

TT-L-32A
April 30, 1969
SUPERSEDING
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FEDERAL SPECIFICATION
LACQUER, CELLULOSE NITRATE, GLOSS
FOR AIRCRAFT USE

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

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers a durable, cellulose nitrate gloss lacquer. It provides for an additional type of material suitable for use under AIR POLLUTION REGULATIONS (See 6.4).

1.2 Classification. This specification covers one grade and two types of lacquer.

Type 1 - For use under normal circumstances

Type 2 - For use where AIR POLLUTION REGULATIONS are enforced

1.2.1 Grade and colors. This specification covers one grade of cellulose nitrate lacquer in the following colors, as specified:

Color Name	Color Standard to be employed Fed. Std. No. 595
Clear	-----
Light Blue	15102
Insignia Blue	15044
Light Green	14187
Olive Drab	X14087
Light Yellow	13655
Orange Yellow	13538
Aircraft Cream	13594
International Orange	12197
Insignia Red	11136
Maroon	10049
Insignia White	17875
Aircraft Gray	16473
Engine Gray	16081
Gloss Black	17038
Glossy Sea Blue	15042
Strata Blue	15045

1.2.1.1 The list in 1.2.1 is not restrictive; the lacquer may be procured in any color desired by the activity concerned. When colors other than those listed above are required, the pigmentation and applicable qualitative and quantitative requirements shall conform to those of the nearest matching color contained herein. Where no near matching color exists, the pigments shall be in accordance with the best commercial quality (see 3.1, 3.2, and 3.4.5).

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue 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:

QQ-A-250/5 - Aluminum Alloy Alclad 2024, Plate and Sheet.
TT-B-838 - Butyl Acetate; Normal (For Use in Organic Coatings).
TT-B-846 - Butyl Alcohol; Normal (butanol) (For Use in Organic Coatings).
TT-E-751 - Ethyl Acetate, Technical.
TT-E-776 - Ethylene Glycol Monobutyl Ether (For Use in Organic Coatings).

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Federal Specifications (Cont'd):

TT-M-268	- Methyl Isobutyl Ketone (For Use in Organic Coatings).
TT-M-95	- Naphtha; Aliphatic.
TT-M-350	- Nitrocellulose, Technical (For Use in Organic Coatings).
TT-P-143	- Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing, and Marking of.
TT-P-320	- Pigment, Aluminum; Powder and Paste, Paint.
TT-P-346	- Pigment, Chrome-Yellow and Chrome-Orange, Dry.
TT-P-350	- Pigment, Lampblack - Dry.
TT-P-442	- Pigment, Titanium Dioxide (For Protective Coatings).
TT-S-735	- Standard Test Fluids; Hydrocarbon.
TT-T-266	- Thinner; Dope and Lacquer (Cellulose-Nitrate).
TT-T-548	- Toluene; Technical.

Federal Standards:

Fed. Std. No. 123	- Marking for Domestic Shipment.
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 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, D.C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, Washington.

(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.)

Military Specifications:

MIL-C-8514	- Coating Compound, Metal Pretreatment, Resin-Acid.
MIL-P-8585	- Primer Coating, Zinc Chromate, low-Moisture-Sensitivity.
MIL-A-8625	- Anodic Coatings, for Aluminum and Aluminum Alloys.

Military Standards:

Mil. Std. No. 105	- Sampling Procedures and Tables for Inspection by Attributes.
Mil. Std. No. 129	- Marking for Shipment and Storage.

(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.

National Bureau of Standards Publication:

Research Paper RPl345 (November 1940).

(Application for copies should be addressed to the National Bureau of Standards, Washington, D.C. 20234.)

3. REQUIREMENTS

3.1 Materials. The ingredient materials used in the manufacture of this product shall be of high quality, entirely suitable for the purpose, and shall conform to applicable specifications. Ingredient materials conforming to contractor's specifications may be used, provided the specifications are acceptable to the Government and contain provisions for adequate tests. The use of contractor's specifications will not constitute waiver of Government inspection.

3.2 Toxicity. The manufacturer shall certify that the lacquer contains no substance of known toxicity under normal conditions of usage.

3.3 Composition.

3.3.1 Type 1. The composition shall conform to the percentages, by weight, given in table I.

3.3.2 Type 2. The composition shall conform to the percentages, by weight, given in table I except that the volatile portion shall be as specified in 3.4.4.2.

3.4 Ingredients. All ingredients used in the manufacture of these products shall conform to applicable Government specifications and the requirements of 3.4.1 through 3.4.5.

TABLE I. Composition-percent by weight

Material	Minimum	Maximum
Product:		
Pigmented colors: 1/		
Nonvolatile	40	--
Volatile	--	60
Clear:		
Nonvolatile	30	--
Volatile	--	70
Analysis of volatile portion: 2/ 3/		
Type 1		
Total esters or ketones	35	--
Medium boiling 4/	23	--
Total alcohols	15	22
Medium boiling 4/	6	--
Total hydrocarbons (aromatic) 5/	--	50
Toluene	30	--
Type 2		
See 3.4.4.2		
Analysis of nonvolatile portion: 6/		
Pigment	--	45
Nonvolatile vehicle solids	55	--
Analysis of nonvolatile vehicle solids: 7/		
RS-1/2 sec cellulose nitrate	28	31
Resins	58	62
Plasticizers	10	13

- 1/ For gloss black, insignia blue, sea blue, strata blue, and insignia red, nonvolatile shall be 32 percent minimum, volatile 68 percent maximum.
- 2/ The minimum boiling point of the volatile portion shall be not less than 158°F.
- 3/ Values in this block based on volatile portion = 100 percent.
- 4/ Boiling above 108°C (226°F).
- 5/ Aliphatic hydrocarbons shall not be used.
- 6/ Values in this block based on nonvolatile portion = 100 percent.
- 7/ Values in this block based on nonvolatile vehicle solids = 100 percent.

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3.4.1 Resins. Resins shall be nonoxidizing phthalic alkyls; 43 to 47 percent phthalic anhydride content and 30 to 34 percent coconut-type oil modification. (See 6.3)

3.4.2 Cellulose compounds. The cellulose compounds shall conform to type II of TT-N-350. (See 6.3)

3.4.3 Plasticizers. Chemical plasticizers shall consist of di-isooctyl phthalate or dioctyl phthalate.

3.4.4 Solvents.

3.4.4.1 Type 1. The volatile portion shall not contain benzol, chlorinated solvents, or other substances of similar toxicity under normal conditions of usage. (See 4.6.3)

3.4.4.2 Type 2. In addition to the requirements of 3.4.4.1, the volatile content, for type 2, of the admixed and thinned coating shall consist of a non-photochemically reactive solvent blend. A non-photochemically reactive solvent is any solvent with an aggregate of less than 20 percent of its total volume composed of the chemical compounds classified below and which does not exceed any of the following individual percentage composition limitations, referred to the total volume of solvent:

- (a) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers or ketones having an olefinic or cycloolefinic type of unsaturation: 5 percent;
- (b) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent;
- (c) A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent.

3.4.4.2.1 Thinner. The thinner to be used with the non-photochemically reactive coating, type 2, shall be non-photochemically reactive as defined in 3.4.4.2 and shall be compatible with the system.

3.4.5 Pigments. Pigments shall be as shown in table II and in accordance with all applicable specifications. When pigments listed in table II are not covered by specifications listed in 2.1, they shall be of a high durability established by past usage in comparable lacquer.

TABLE II. Pigmentation

Color Name	Color Number	Pigmentation 1/ 2/
Light Blue	15102	Iron Blue, Titanium Dioxide
Insignia Blue	15044	Iron Blue, Titanium Dioxide, Carbon Black 3/
Light Green	14187	Chrome-Green, Yellow Iron Oxide, Light or Medium Chrome-Yellow, Shading Yellow, Iron Blue, Titanium Dioxide
Olive Drab	X14087	Medium Chrome-Yellow or Orange, Shading Yellow, Pure Iron Oxides (Yellow or Red), Titanium Dioxide, Carbon Black 3/, Iron Blue
Light Yellow	13655	Light Chrome-Yellow (light-fast) 5/
Orange Yellow	13538	Medium Chrome-Yellow (light-fast) 5/
Aircraft Cream	13594	Titanium Dioxide, Pure Iron Oxides, or Chrome-Yellow or Chrome-Orange
International Orange	12197	Molybdate-Orange
Insignia Red	11136	BON Maroon 6/, Molybdate-Orange
Maroon	10049	Pure Iron Oxides, Titanium Dioxide, Carbon Black 3/
Insignia White	17875	Titanium Dioxide 4/
Aircraft Gray	16473	Titanium Dioxide, Carbon Black 3/
Engine Gray	16081	Titanium Dioxide, Yellow Iron Oxide, Carbon Black 3/
Gloss Black	17035	Carbon Black 2/
Glossy Sea Blue	15042	Titanium Dioxide, Carbon Black 3/, and Iron Blue
Strata Blue	15043	Titanium Dioxide, Carbon Black 2/, Iron Blue and Milleri Blue

TABLE II. Pigmentation (Continued)

- 1/ The pigments listed, or any combination thereof, shall be the principal ingredients used in the lacquer to obtain the colors specified. To exactly match the required color, other tinting pigments may be used in an amount which shall not exceed 2 percent of the total weight of pigment, provided such additional pigments have good outdoor durability.
- 2/ Where titanium dioxide is specified, the high chalk-resistant type conforming to TT-P-442 shall be used.
- 3/ Lampblack conforming to TT-P-350 may be used if desired in these colors.
- 4/ This color shall contain no tinting pigment whatsoever.
- 5/ Pigment conforming to TT-P-346 may not be satisfactory. The proprietary light-fast chrome yellows and oranges are satisfactory.
- 6/ Manganese precipitate of Color Index No. 48 Permanent Red; otherwise known as Permanent Red-2B Manganese.

3.5 Qualitative requirements.

3.5.1 Condition in container. The lacquer, in a freshly opened full container, shall show no skinning, curdling, livering or excessive pigment flotation, nor more settling or caking than may be re-dispersed easily, with a paddle, to a uniform and homogeneous condition. (See 4.6.1)

3.5.1.1 Storage stability. The previously unopened packaged product shall meet all the requirements specified herein for a period of one year, except for weather resistance (3.5.14.3), provided that the daily mean temperature of the ambient air at the storage location falls within the range of 35 to 95 degrees Fahrenheit, and the peak ambient air temperature does not exceed 115 degrees.

3.5.2 Odor. The odor of the lacquer, in the container or as an applied film shall not be obnoxious. (See 4.6.1)

3.5.3 Color. The color of the lacquer film shall match the applicable color standard of Fed. Std. No. 595 or as specified by the procuring activity. (See 4.6.1)

3.5.3.1 For Insignia White only. The minimum tristimulus values in table III shall be considered as defining the minimum values for the Insignia White color; in addition, the color shall be characteristic of the pigment and vehicle used. Therefore, brighter or whiter shades than color No. 17875 shall be considered acceptable.

3.5.4 Dilution stability. The lacquer, when reduced and tested as specified in section 4, shall show no curdling, precipitation, or separation of any ingredient. (See 4.6.2)

3.5.5 Working properties. Two coats of the lacquer under test, reduced to spraying consistency and applied to a smooth, vertical, metal surface, shall show good working properties and shall dry to a uniform, smooth surface, free of runs, sags, bubbling, wrinkling, streaking, or other defects. (See 4.6.4)

3.5.6 Self-lifting properties. The second coat of lacquer, over control formula primer conforming to MIL-P-8585 for type 1, or non-photochemically reactive MIL-P-8585 for type 2, shall show no lifting after drying intervals for the first lacquer coat of 4, 7, and 24 hours. (See 4.6.1)

3.5.7 Drying time. The lacquer films, with a total dry film thickness of 1.0 ± 0.2 mils, shall dry hard in not more than 40 minutes under laboratory conditions of temperature and relative humidity specified herein. (See 4.6.1)

3.5.8 Surface appearance. The lacquer, when examined after drying, shall be free from blushing, streaks, blisters, coarse particles, silking, or other irregularities of surface. (See 4.6.4.1)

3.5.9 Print resistance. When tested as specified in section 4, the lacquer under test shall show no permanent print from cheesecloth. (See 4.6.5)

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3.5.10 Primer absorption. Panels, prepared as specified in 4.3.1, shall not show a loss in gloss of more than 5 units when compared with the gloss of an unprimed panel coated with the same lacquer. (See 4.6.6)

3.5.11 Coating anchorage. Lacquer, when tested as specified in section 4, shall cut loose in the form of a ribbon without flaking or separation from the primer. The coating anchorage of the lacquer under test shall be equal to or better than that exhibited by a simultaneously tested control lacquer of the corresponding color. (See 4.6.7)

3.5.12 Baking properties. Lacquer films, baked as specified in section 4, shall show no pronounced color change when compared with the unbaked film. (See 4.6.8)

3.5.13 Flexibility (cold cracking). A panel, prepared as specified in 4.3.1, having a metal thickness of 0.020 inch, shall exhibit no flaking at the bend when subjected to the flexibility (cold cracking) test. Fine cracks shall not be cause for rejection. (See 4.6.9)

3.5.14 Resistance properties.

3.5.14.1 Water resistance. The lacquer film shall withstand immersion in water at room temperature without showing any checking, blistering, or whitening. A slight whitening or dulling which may be removed by light wiping with a soft cloth shall not be cause for rejection. The immersed film shall in all respects be equal to or better than the control lacquer of the corresponding color after immersion under the same conditions. (See 4.6.10)

3.5.14.2 Hydrocarbon resistance. The lacquer film under test shall withstand immersion in hydrocarbon test fluid conforming to TT-S-735, Type III, at room temperature for 4 hours. Immediately after removal, the film shall show no blistering or film failure, except that edge blistering or slight gumming above the liquid level shall not be cause for rejection. Twenty-four hours after removal, the film shall be equal to the film of the control lacquer of corresponding color immersed under the same conditions except that a slight discoloration or dulling shall not be cause for rejection. (See 4.6.11)

3.5.14.3 Weather resistance. Panels which have been weather-exposed in Florida for 12 months as specified in section 4, shall show no greater film deterioration, loss of gloss, or color change at any time during the exposure period than that exhibited by a simultaneously exposed sample of the control lacquer of the corresponding color. The panels shall be examined before and after washing with detergent and water. At the end of 3 months, and at any time thereafter, the test shall be terminated upon evidence of failure of the lacquer under test to meet the requirements of this specification. (See 4.6.12)

3.5.14.4 Anchorage (tape test). When tested as specified in section 4, the lacquer under test shall show no more than a slight widening of the scratch. Not more than 1/8 of an inch is considered acceptable. (See 4.6.12)

3.5.14.5 Resistance to moderately cold exposure. Panels, prepared and tested as specified in section 4, shall show no visible difference when compared with similarly prepared but unexposed panels. (See 4.6.13)

3.5.14.6 Bleeding (For Insignia Red only). Panels, prepared and tested as specified in section 4, shall show no bleeding of the red through the white. (See 4.6.14)

3.5.14.7 Resistance to loss of gloss and color (accelerated weathering). Panels prepared as specified in 4.3.1 and exposed for 336 hours in a weatherometer, shall exhibit no more chalking or color change than that exhibited by a simultaneously exposed control lacquer of the same color. If the material under test is found to be inferior at a shorter exposure period than 336 hours, the test shall be terminated and the material shall be considered unsatisfactory. (See 4.6.16)

3.6 Quantitative requirements. The lacquer shall meet the quantitative requirements specified in tables III and IV.

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TABLE III. Quantitative requirements

Requirements	Minimum	Maximum
Coarse particles (retained on a No. 325 sieve)		
percent by weight of total paint	--	0.1
Fineness of grind	7.0	--
Viscosity (reduced as specified in 4.3.2) determined with a No. 4 Ford cup)(seconds)	--	20
Weight per gallon (pounds):		
Clear lacquer	7.7	--
Gloss Black	7.8	--
Glossy Sea Blue	7.7	--
Insignia Blue	7.7	--
Strata Blue	7.7	--
Insignia Red	7.8	--
All other colors	8.4	--
Specular gloss (60 degrees geometry):		
All colors (except the following)	80	--
Insignia White and Aircraft Gray	75	--
Glossy Sea Blue and Gloss Black	85	--
Directional reflectance,		
Insignia White only:		
A value	84	--
B value	85	--
C value	85	--

TABLE IV. Hiding Power

Color	Dry Film thickness (Maximum inches)	Contrast ratio (Minimum)
Light Blue	0.001	0.98
Insignia Blue	.001	.98
Light Green	.001	.98
Olive Drab	.001	.98
Light Yellow	.001	.86
Orange Yellow	.001	.88
Aircraft Cream	.001	.96
International Orange	.001	.96
Insignia Red	.001	.88
Maroon	.001	.98
Insignia White	.001	.90
Aircraft Gray	.001	.98
Engine Gray	.001	.98
Gloss Black	.001	.98
Glossy Sea Blue	.001	.98
Strata Blue	.001	.98

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3.6.1 Hiding power. The minimum contrast ratio of the lacquer coating, cast on black and white carrara glass at the specified dry film thickness shall conform to the requirements specified in table IV. (See 4.6.15)

3.7 Workmanship. The component ingredients shall be intimately assembled and processed, as required, in accordance with the best practice for the manufacture of high-quality lacquer.

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 as 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 prescribed requirements.

4.2 Classification of tests. The inspection and testing of the lacquer shall be classified as quality conformance tests.

4.3 Test conditions. The laboratory testing conditions shall be in accordance with Fed. Test Method Std. No. 141 and as described herein.

4.3.1 Test panels. Unless otherwise specified herein, all panels used for test purposes shall be aluminum-clad aluminum alloy (Clad 2024) conforming to QQ-A-250/5, anodized in accordance with MIL-A-8625, type I. The panels shall be 0.020 by 3 by 6 inches and shall be finished as follows: Spray with one coat of wash primer, MIL-C-8514, four parts by volume resin component to one part by volume acid accelerator reduced with one part by volume diluent (10 percent butyl alcohol and 90 percent of 95 percent ethyl alcohol) to a dry film thickness of 0.4 to 0.7 mil. Air dry for 2 hours. Unless otherwise specified, panels shall then be sprayed to a dry film thickness of 0.3 to 0.6 mil with the control formula product of MIL-P-8585 (cut 1 volume package to two volumes toluene) when type 1 lacquer is to be tested; when type 2 lacquer is to be tested, the non-photochemically reactive MIL-P-8585 shall be used. Air dry for 2 hours, then apply two spray coats of lacquer under test, reduced as specified in 4.3.2, over the primer films with a 45-minute drying interval between coats. The dry film thickness of the two coats shall be 1.0 ± 0.2 mil. Unless otherwise specified, after application of the lacquer the panels shall be air dried for 18 hours. For the following tests the panels shall be air dried for 2 hours and then force dried for 1 hour at a temperature of 180°F:

- (a) Flexibility
- (b) Water resistance.

For the hydrocarbon test the last coat of lacquer shall air dry 18 hours and then force dry at 220°F for 1 hour. The force dried panels shall be ready for test when cooled to room temperature.

4.3.2 Methods for preparing samples. Samples shall be prepared for testing in accordance with Fed. Test Method Std. No. 141 and as specified herein. All tests shall be conducted with the package lacquer, unless spray application is required. In such cases, for type 1 lacquer, thinning for spray application shall be accomplished by reducing the lacquer with an equal volume of thinner conforming to the following composition:

<u>Ingredients</u>	<u>Percent by weight</u>
Butyl acetate, Fed. Spec. TT-B-838	25
Ethyl acetate, Fed. Spec. TT-E-751	22
Butyl alcohol, Fed. Spec. TT-B-846	10
Toluene, Fed. Spec. TT-T-545	22
Aliphatic naphtha, Fed. Spec. TT-N-95	21

For type 2 lacquer, thinning for spray application shall be accomplished by reducing the lacquer with an equal volume of thinner specified in 3.4.4.2.1.

TABLE V. Type I control lacquer formulations $\frac{1}{14}$ (percent by weight (dry basis))

Color number	Ingredient color	15102 Lz. blue	15044 Maignais blue	14187 Lz. green	14697 Olive drab	13455 Lz. yellow	13538 Orange yellow	13594 Alizarin cream	12197 Mauve- national orange	11134° Maignais red	10045° Maroon	17875 Maignais white	10473 Alizarin gray	10093 Eugene gray	17033 Gloss black	11043° Glossy sea blue	Clear	15045° Zirconia blue
Titanium dioxide 2/ iron blue 3/		16.0 8.0	1.0 14.5		2.2			26.1				26.2	30.0	17.0		0.7		7.7
Chrome green 4/ iron oxide				38.8												4.1		1.1
Iron oxide lansoo yellow																		
5/ cadmium chromo					9.0			7.7						3.0				
Yellow 8/ Red iron					0.0		35.7											
Oxide 7/ Carbon black 3/					0.0						10.0							
Light chrome					1.0						1.5							
Yellow 9/ Molybdate						35.7												2.7
Orange 10/ Millori blue									25.7	9.0								
NON Maroon 11/ Microcellulose										16.1								4.5
1 1/2 second Irayd resin 13/	22.5	25.4	19.7	23.1	19.6	19.6	19.6	20.0	19.6	22.8	25.0	19.3	21.0	23.8	29.0	25.0		30.0
Plastic clear 13/	45.0	50.7	38.0	48.5	38.2	38.2	38.2	38.4	38.2	44.1	44.3	39.0	42.0	45.3	55.0	50.0		60.0
Plastic clear 13/	7.5	8.4	6.5	8.0	6.5	6.5	6.5	6.0	6.5	7.4	8.1	6.5	7.0	7.7	9.4	9.4		10.0

The control lacquer formulations with the specified proprietary raw materials represent products of established outdoor weathering durability. The listing of these proprietary materials is not to be construed as an endorsement thereof or as precluding qualification of lacquers formulated with raw materials from other proprietary sources or other formulations within the compositional framework of tables I and II. Such products may prove equivalent or even superior in performance to the control lacquers. However, the formulations in table V with the specified raw materials listed in table Va should be employed as the comparison standards for outdoor weathering purposes.

through 13/ The corresponding numbers in the first column of table V and Va identify the formulations with the raw materials. These formulations are precise for the polymerization.

name or mutations are precise for the colors indicated. Tying pigments, table II, note 1, may be used to produce colors matching FFD-STD-545 where an asterisk (*) appears in the color number.

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4.3.3 Control lacquers. Satisfactory type 1 control lacquers for weathering have been prepared at a Government laboratory using the ingredients in the exact proportions shown in table V. To complete the formulations, the ratios of the nonvolatile to the volatile, and the composition of the volatile, shall be in strict accordance with table I. (Method of processing is important in securing the specified physical properties; therefore, submission of contractual samples whose compositions conform with the composition of the test lacquer is not a guaranty of acceptability under this specification.)

4.3.3.1 Process. The following process may be used to mix the ingredients for type 1: Add nitrocellulose solution to the required weight of RBH dispersion paste and stir 1/2 hour. Add plasticizer and stir again. Add the methyl isobutyl ketone (TT-M-268) and toluene to the resin solution (Duraplex ND-78), and stir until solution is homogeneous. Add homogeneous solution slowly to the mixed dispersion paste while stirring.

4.4 Quality conformance tests. Quality conformance tests shall consist of all the tests of this Specification, except that weather resistance shall be conducted only when requested by the procuring activity.

TABLE Va. Composition of RBH pastes (percent by weight)

Code No.	Pigment	1/2 second			Plasticizer	Toluene
		nitrocellulose (dry basis)	Ethyl alcohol	Ethyl acetate		
6610 2/	60.0	8.0	3.5	16.0		12.5
6150 3/	20.0	12.0	32.0	36.0		
809 4/	50.0	11.0	4.5	14.0		20.5
208 5/	45.0	9.0	17.2	11.6		17.2
P643E117 6/	50.0	11.0	4.5	14.0		20.5
148 7/	50.0	10.0	4.0	14.5		21.5
6077 8/	8.5	20.0	8.0	25.0		38.5
P643E103 9/	50.0	11.0	4.5	14.0		20.5
P643E116 10/	50.0	10.0	4.5	14.0		21.5
P944E768 11/	20.0	10.0		26.7	3.3	40.0
Duraplex ND78 12/	Manufactured by Rohm and Haas					
Flexol DOP 13/	Manufactured by Union Carbide and Carbon Co.					

2/ through 13/, see footnotes to table V.

4.4.1 The Government reserves the right to rerun any or all tests of this specification at any time within 1 year from the date of manufacture of the lacquer, as attested by the date appearing on the container label. Samples for retests shall be taken from previously unopened containers.

4.4.2 Batch data. Batch production data shall be furnished as required by the procuring activity.

4.4.3 Report of tests. The manufacturer shall submit reports for each batch, showing the results for all the acceptance tests except weather resistance and storage stability when required by the procuring activity. In addition he shall certify that the lacquer will meet the weather resistance and storage stability requirements of this specification.

4.4.3.1 In lieu of reporting analytical results on the breakdown of the nonvolatile and volatile composition of the lacquer, the manufacturer may report such results as "calculated" under the condition that he has carefully described by separate report, attached to manufacturer's test reports, the character and detail of his production methods which in his opinion guarantee that any suitable analysis made by the Government will yield acceptable results.

4.4.4 Examination of product. The lacquer shall be examined for conformance with the requirements of this specification with respect to material and workmanship.

4.5 Sampling.

4.5.1 Sampling for tests. Acceptance test samples consisting of two 1-quart containers of the lacquer shall be selected as required by the procuring activity.

4.5.2 Sampling for inspection of filled containers. Sampling for inspection of filled containers shall be conducted as directed by the procuring activity.

4.5.2.1 For military agencies. A random sample of filled containers shall be selected in accordance with Mil. Std. No. 105 at inspection level I and acceptable quality level of 2.5 percent defective to verify compliance with all stipulations of this specification in regard to fill, closure, marking, and other requirements not involving tests. Each sample filled container shall be examined for defects of construction relative to the container and the closure, for evidence of leakage, and for unsatisfactory markings; each filled container shall also be weighed to determine the volume of contents. The net weight divided by the determined weight per gallon will give the volume. Any container in the sample having one or more defects, or under the required fill, shall be rejected, and if the number of defective containers in any sample exceeds the acceptance number for the specified sampling plan of Mil. Std. No. 105, the lot represented by the sample shall be rejected.

4.5.3 Test and analyses. Tests and analyses to determine conformance with the requirements of section 3 with regard to the compositional properties shall be made on packaged material. Tests for conformance with the remainder of the detail requirements shall be made after reduction of the lacquer in accordance with 4.3.2.

4.6 Test methods. The tests of this specification shall be conducted in accordance with the specified methods as given in Fed. Test Method Std. No. 141, and as described herein.

4.6.1 The tests listed below shall be conducted in accordance with the specified methods as given in Fed. Test Method Std. No. 141, and the panels used shall be prepared as specified in 4.3.1, unless otherwise specified:

Test	Fed. Test Method Std. No. 141 - Method No.
Vehicle Isolation (supercentrifuge)	4032
Volatile and Nonvolatile content (Ordinary laboratory oven)	4041
Pigment content (supercentrifuge)	4022
Phthalic anhydride in resins	7371 and 7024
Nitrocellulose in lacquers	5205
Condition in container	3011
Odor test	4401
Self-lifting test	6252
Drying time (varnishes, lacquers and enamels)	4061
Color of pigmented coatings	4250
Fineness of grind (determined with use of gauge having minimum path length of 4 inches)	4411
Coarse particles and skins in synthetic vehicle enamels, lacquers, and dope	4092
Viscosity (or consistency) of pigmented material - No. 4 Ford Cup	4282
Weight per gallon	4184
Specular gloss	6101
Directional reflectance ^{1/}	6121
Plasticizer	7371

^{1/} Tristimulus values may be obtained using Hunter Reflectometer with three filters, in the manner described in the National Bureau of Standards Research Paper RP 1345 (November 1940) or using the Photovolt Lumetron Reflectometer.

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4.6.2 Dilution stability.

4.6.2.1 Type 1. One volume of lacquer type 1 shall be reduced with two volumes of the following solvent, stirred thoroughly, and placed in a closed container. The mixture shall be observed for evidence of curdling, precipitation, or separation immediately and after 24 hours: (See 3.5.4.)

Ingredients	Percent by Volume
Normal butyl acetate, Fed. Spec. TT-B-838	15
Normal butyl alcohol, Fed. Spec. TT-B-846	15
Toluene, Fed. Spec. TT-T-548	70

4.6.2.2 Type 2. One volume of type 2 lacquer shall be reduced with two volumes of thinner specified in 3.4.4.2.1, stirred thoroughly, and placed in a closed container. The mixture shall be examined immediately and after 24 hours for conformance to 3.5.4.

4.6.3 Solvents. The content of these components shall be determined by method 7360 of Fed. Test Method Std. No. 141. If no applicable method is given, appropriate qualitative tests shall be made on the isolated solvents to ascertain whether or not permissible solvents are used in the formulation.

4.6.4 Working properties. A panel prepared in accordance with 4.3.1 shall be placed in a nearly vertical position and allowed to air dry for 24 hours prior to examination. After air drying for the specified time, the panel shall be examined for defects. (See 3.5.5.)

4.6.4.1 Surface appearance. The film of a panel prepared as specified in 4.3.1, shall be examined visually. (See 3.5.8.)

4.6.5 Print resistance. A panel, prepared as specified in 4.3.1, shall be air dried for 5 hours, and tested in accordance with method 6211 of Fed. Test Method Std. No. 141 wherein a 1 psi pressure shall be applied for 1 hour. The panel shall be examined 2 hours after removal of pressure. (See 3.5.9.)

4.6.6 Primer absorption. Primed and unprimed panels shall be prepared as specified in 4.3.1. The gloss of the primed and unprimed panels shall be tested in accordance with method 6101 of Fed. Test Method Std. No. 141. (See 3.5.10.)

4.6.7 Coating anchorage. Panels, prepared as specified in 4.3.1, shall be tested in accordance with method 6304 of Fed. Test Method Std. No. 141 and examined for flaking or separation from the primer. (See 3.5.11.)

4.6.8 Baking properties. Panels shall be prepared as specified in 4.3.1, except that the panels shall be baked for 48 hours at a temperature of 145 to 154°F. The panels shall then be compared with similarly prepared air-dried panels and examined for color change. (See 3.5.12.)

4.6.9 Flexibility (cold cracking). Panels shall be prepared as specified in 4.3.1, and shall be tested for cold cracking, using a 1/4 inch diameter mandrel in accordance with method 6203 of Fed. Test Method Std. No. 141. The rate of bend shall be 1 to 2 seconds. (See 3.5.13.)

4.6.10 Water resistance. Panels, prepared as specified in 4.3.1, shall be immersed in water in accordance with method 6011 of Fed. Test Method Std. No. 141 for 24 hours at room temperature. Five minutes after removal from the water, the lacquer shall be examined. (See 3.5.14.1.)

4.6.11 Hydrocarbon resistance. Test panels and control panels, prepared as specified in 4.3.1, shall be immersed in hydrocarbon test fluid conforming to TT-S-735, type III, at room temperature for 4 hours. Immediately after removal from the test fluid the panels shall be examined. This examination shall be repeated 24 hours after removal from the fluid. (See 3.5.14.2.)

4.6.12 Anchorage (tape test). Two panels, prepared as specified in 4.3.1, shall be partially immersed in distilled water, at a temperature of $73.5 \pm 2^\circ\text{F}$ for 24 hours. The panels shall then be removed from the water and wiped dry with a soft cloth. Immediately thereafter, two parallel scratches, 1 inch apart, and penetrating to the metal, shall be made with a sharp pointed stylus upon a previously immersed part of each panel. A 1-inch wide strip of masking tape taken from a sample of Minnesota Mining and Manufacturing Company, Code No. 250 masking

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tape not more than 6 months old, shall be applied across each set of scratches, adhesive side down. The tape shall be pressed down with two passes of a 4-1/2 pound rubber-covered roller, approximately 3-1/2 inches in a diameter by 1-3/4 inches in width. The surface of the roller shall have a durometer hardness value within the range of 70 to 80. The tape shall be removed in one abrupt motion and each panel examined for conformance to the anchorage requirements of this specification. The interval from the time of removal of the panels from the water to the time of application of the tape shall be 60 ± 5 seconds. Stripping of the tape from the panel shall be done immediately after application thereof. (See 3.5.14.4)

4.6.13 Resistance to moderately cold exposure. Panels, prepared as specified in 4.3.1, shall be placed under refrigeration at a temperature of $40 \pm 2^\circ\text{F}$, for 19 hours. The exposed panels shall be compared to similarly prepared but unexposed panels. The exposed panels shall exhibit no visible difference when compared to the unexposed panels. (See 3.5.14.5)

4.6.14 Bleeding (for Insignia Red only). Panels, prepared as specified in 4.3.1 and finished with Insignia Red, shall air dry 18 hours. The panels shall be sprayed with two coats of Insignia White and allowed to dry. The dry film thickness of the Insignia White shall be 1.0 ± 0.2 mil. The panels shall be examined for evidence of bleeding of red through the white. (See 3.5.14.6)

4.6.15 Hiding power.

4.6.15.1 Panel preparation. A thoroughly representative portion of the lacquer under test shall be cast on a smooth, flat metal surface, utilizing an 0.008-inch (approximate clearance) doctor blade, in order that a dry film thickness of 1 mil is obtained. The metal panel shall be held firm when the film is cast with the doctor blade. An excess of the coating being tested shall be poured on the metal plate just in front of the film applicator. The plate shall be lowered and the drawdown made immediately, continuing the motion down the plate until the lower end is reached. The film should be homogeneous and free of film irregularities which would affect the overall accuracy of the determination. The lacquer coating shall be dried in a horizontal position for at least 24 hours in a dust-free cabinet. An average of five film-thickness readings shall be taken in the central portion of the coated panel with a suitable filmeter. The doctor blade clearance which gave the desired film thickness shall be utilized in casting the coating on the black and white Carrara glass. The application technique and drying procedure is similar to the one utilized in the preparation of the metal panels. The black Carrara glass shall have a daylight 45° , 0° apparent reflectance of less than 1 percent; the white Carrara glass shall have a daylight 45° , 0° apparent reflectance of 86 ± 2 percent (relative to MgO).

4.6.15.2 Reflectance determination. The reflectance of the coated black and white Carrara glass shall be determined in accordance with method 6121 of Fed. Test Method Std. No. 141 by the Hunter reflecto-meter used with the green filter in the manner described in the National Bureau of Standards Research Paper RP 1345 (November 1940). The reflectance of the film over the black is divided by the reflectance of the film over the white to obtain the contrast ratio. (See 3.6.1)

4.6.16 Resistance to loss of gloss and color (Accelerated weathering). The initial gloss (60 degrees geometry) of panels prepared as specified in 4.3.1 shall be determined in accordance with method 6101 of Fed. Test Method Std. No. 141. The metal shall be of sufficient gauge to withstand subjection to a weatherometer without warping. Panels shall be exposed in accordance with method 6151 of Fed. Test Method Std. No. 141. Panels may be examined at any time before 336-hour exposure. After removal of the panels from the weatherometer, they shall be rinsed in distilled water and allowed to dry without wiping or polishing. The gloss shall then be determined as above. The panels must be a smooth plane or erroneous readings may be obtained. The color change shall be determined by visual means or by any acceptable photometric method. (See 3.5.14.7)

4.6.17 Weather resistance. Panels coated with the lacquer under test and separate panels coated with the control lacquer of corresponding color shall be prepared as specified in 4.3.1. The panels shall be exposed in accordance with method 6161 of Fed. Test Method Std. No. 141 for 1 year in the area of Miami, Florida. Panels shall be examined for gloss as specified in 4.6.1, and color change shall be examined by eye or any acceptable photometric method. (See 3.5.14.8)

4.7 Inspection for packaging and marking. The lacquer material shall be inspected for all the requirements of Section 5.

4.8 Rejection criteria. If a test specimen fails to meet any of the tests required by this specification, the lot represented by the sample shall be rejected.

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5. PREPARATION FOR DELIVERY

5.1 Packaging and Packing. The lacquer, in half-pint, quart, gallon, or five-gallon volume, shall be packaged and packed in accordance with TT-P-143. The level of packaging, A, B, or C, the level of packing, A, B, or C, and the volume of lacquer in the container shall be as specified in the purchase order. (See 6.2.) The volume of the lacquer shall be at least that specified, when determined at 23.0°C (73.4°F).

5.2 Marking. Marking of interior and shipping containers shall be in accordance with Fed. Std. No. 123 for civil agencies, or Mil. Std. No. 129 for military agencies, as specified (see 6.2). In addition, all cans and pails shall bear a printed label showing the date of manufacture and the following special marking:

"THINNING DIRECTIONS: Type 1: For spraying or brushing, reduce as required with thinner conforming to TT-T-266. To alleviate blushing under conditions of high humidity, up to 1 pint of thinner conforming to TT-E-776, depending on weather conditions, may be added to 1 gallon of thinner conforming to TT-T-266."

The information below is intended for the label for clear lacquer package only.

"ALUMINUM LACQUER: Prepare by incorporating 12 ounces of aluminum paste conforming to TT-P-320, type II, class A, in 1 gallon of clear lacquer with the aid of thinner as required. Aluminum powder of comparable fineness, purity, and physical properties may be employed in the production of aluminized finishes. In such instances, where powder is used, the amount of aluminum content shall be the same as the aluminum content of the aluminum paste specified."

For type 2 the manufacturer shall modify the above directions to specify the thinner to be employed.

5.2.2 In addition to the marking specified above, the following caution notice shall appear on each can and container:

"WARNING: FLAMMABLE VAPOR HARMFUL

Use only with adequate ventilation.
Avoid prolonged breathing of vapor.
Avoid prolonged or repeated contact with skin."

6. NOTES

6.1 Intended Use. The cellulose nitrate lacquer conforming to this specification is intended for use as an exterior protective coating for metal surfaces. The lacquer may be applied satisfactorily over primers conforming to MIL-P-8585 or MIL-P-7962. However, type 1 lacquer must be used over the conventional primers and type 2 lacquer must be used over non-photochemically reactive primer. When primer conforming to MIL-P-7962 is used, wash primer conforming to MIL-C-8514 shall be used. The system of MIL-C-8514, MIL-P-8585 and TT-L-32 is recommended. Lacquer should not be applied over bare metal.

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) Selection of applicable level of packaging and packing required (see 5.1).
- (c) Volume of lacquer in the container, in U. S. liquid units, as follows: one half-pint, one quart, one gallon, or five gallons. (A U. S. liquid gallon is 231 cubic inches.)
- (d) Type, color number and name (see 1.2, 1.2.1, 1.2.1.1, and 3.4.5).
- (e) For type 2, special thinners shall be procured for use with the particular manufacturer's product.
- (f) Size of the containers in which the lacquer is to be furnished.
- (g) Whether for use by civil or military agencies.

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6.3 The solvent for the resin used for type 2 shall be such that the final lacquer formulation will have a solvent content which is non-photochemically reactive. (See 3.4.1 and 3.4.2)

6.4 Type 2 lacquer should be specified for use in areas with regulations controlling the emission of solvents into the atmosphere.

MILITARY CUSTODIANS:

Army - MR, MU
Navy - AS
Air Force - 84, 85
DSA - IS

User Activity:

Army - AV

Preparing Activity:

Navy - AS

CIVIL AGENCY INTEREST:

GSA-PSS

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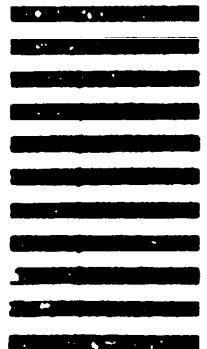
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