

MIL-L-19538C

11 May 1970

SUPERSEDING

MIL-L-19538B(ASG)

21 June 1963

MILITARY SPECIFICATION

LACQUER: ACRYLIC NITROCELLULOSE, CAMOUFLAGE (FOR AIRCRAFT USE)

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

* 1.1 Scope - This specification covers the requirements for acrylic-nitrocellulose camouflage lacquer for metal surfaces which is particularly formulated for resistance to diester lubricating oil. The lacquer is primarily intended for spray application. This specification provides two classes, one of which is suitable for use under Air Pollution Regulations.

* 1.2 Classification - This specification covers one grade and two classes of acrylic-nitrocellulose lacquer:

Class 1 - For use where Air Pollution Regulations do not apply.

Class 2 - For use where Air Pollution Regulations are in force.

* 1.2.1 Colors - This specification covers one grade of acrylic-nitrocellulose lacquer in the following colors, as specified:

<u>FED-STD-595</u> <u>Color No.</u>	<u>ANA Bull. No. 157</u> <u>Color No.</u>	<u>Color name</u>
37875	---	Insignia white
37038	---	Black
35044	---	Insignia blue
35042	---	Non-specular sea blue
34151	---	Interior green
X 34087	---	Olive drab
33538	---	Orange yellow
31136	---	Bright red
36440	---	Light gull gray
36231	---	Dark gull gray

FSC 8010

MIL-L-19538C

FED-STD-595	ANA Bull. No. 157	
<u>Color No.</u>	<u>Color No.</u>	<u>Color name</u>
26081	---	Seaplane gray
27875	---	Semi-gloss insignia white
---	627	Field green

- * 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.

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.

SPECIFICATIONS

Federal

QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet
TT-E-776	Ethylene Glycol Monobutyl Ether (for Use in Organic Coatings)
TT-M-261	Methyl-Ethyl-Ketone (for Use in Organic Coatings)
TT-M-268	Methyl Isobutyl Ketone (for Use in Organic Coatings)
TT-P-143	Paint, Varnish, Lacquer, and Related Materials; General Specification for Packaging, Packing and Marking of
TT-P-343	Pigment, Carbon-Black, Dry
TT-P-346	Pigment, Chrome-Yellow and Chrome-Orange, Dry
TT-P-347	Pigment, Chromium-Oxide-Green, Dry
TT-P-350	Pigment, Lampblack, Dry

SPECIFICATIONS

Federal (Continued)

TT-P-355	Pigment, Copper-Phthalocyanine-Blue, Dry
TT-P-375	Pigment, Indian Red and Bright Red (Iron Oxide, Dry)
TT-P-385	Pigment, Iron-Blue, Dry
TT-P-410	Pigment, Molybdate Orange
TT-P-442	Pigment, Titanium-Dioxide (for Protective Coatings)
TT-P-458	Pigment, Yellow-Iron-Oxide; Hydrated, Synthetic, Dry
TT-S-735	Standard Test Fluids, Hydrocarbon
TT-T-548	Toluene; Technical
TT-X-916	Xylene (for Use in Organic Coatings)

Military

MIL-N-5538	Nitrocellulose, Technical, for Use in Organic Coatings
MIL-P-7962	Primer Coating, Cellulose-Nitrate Modified Alkyd Type, Corrosion-Inhibiting, Fast-Drying (for Spray Application Over Pretreatment Coatings)
MIL-C-8514	Coating Compound, Metal-Pretreatment, Resin-Acid
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-A-15197	Antimony Sulfide (Pigment) (Paint Ingredient)
MIL-T-19544	Thinner; Acrylic-Nitrocellulose Lacquer
MIL-P-23377	Primer Coating, Epoxy Polyamide, Chemical and Solvent Resistant

STANDARDS

Federal

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

MIL- L-19538C

STANDARDS

Federal (Continued)

FED-STD-595 Colors

Military

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

PUBLICATIONS

Air Force-Navy Aeronautical Bulletin

No. 157 Colors, List of Standard Aircraft Camouflage

(Copies of specifications, standards, drawings, and publications required by suppliers 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 document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply:

National Bureau of Standards Publication

RP 1345 Multi-purpose Photoelectric Reflectometer
(Nov. 1940)

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.)

3. REQUIREMENTS

3.1 Material - The ingredients used in the manufacture of this product shall conform to applicable Government specifications. Ingredient materials conforming to contractor's specifications may be used provided prior approval is obtained from the procuring activity. The use of contractors' specifications will not constitute waiver of Government inspection.

* 3.2 Toxicity - The material shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the procuring activity to the appropriate department medical service who will act as an advisor to the procuring activity.

- * 3.3 **Composition** - Both Class 1 and Class 2 lacquers shall be formulated in accordance with Tables I, II, III, and IV, with the following exceptions; Class 2 formulation with respect to the volatile content shall be modified in accordance with 3.4.5.2. For colors in the 7- to 15-gloss range, equivalent extenders from sources of supply other than those mentioned in Table IV may be used. However, it is not permissible to vary the Table IV ratio of silica to magnesium silicate. For materials in other gloss ranges, any siliceous extenders may be used in whatever ratio is found necessary, subject to the restrictions of 3.4.4. The composition shall conform to the following percentage, by weight, as given in Table I for Class 1; for Class 2 see 3.4.5.2. Pigments shall be in accordance with Table II, as specified for the individual colors except that pigments and extenders for field green, color No. 627, shall be formulated in the ratios specified in Table V.

TABLE I

COMPOSITION - PERCENT BY WEIGHT
(for Class 2 volatile content refer to 3.4.5.2)

Material	Minimum	Maximum
Volatile	--	60
Nonvolatile <u>1/</u>	40	--
Volatile content <u>2/</u>		
Total ketones <u>3/</u>	57	--
Medium boiling <u>4/</u>	28.5	--
Total alcohols	--	6
Toluene <u>5/</u>	--	39
Nonvolatile content		
Pigment	--	45
Vehicle solids	55	--
Vehicle solids content	All colors	
	Percent minimum	Percent maximum
Nitrocellulose compounds	23	26
Resins	54	57
Plasticizers	19	21

- 1/ For black, the nonvolatile content shall be 37 percent minimum.
2/ The minimum boiling point of volatile portion shall be not less than 75° C (168° F).
3/ Slight changes in the tolerance of the solvents will be permitted, along with a substitution of small amounts of comparable boiling range solvents for the ketones, to provide for the use of pigments in the form of dispersion pastes.
4/ Boiling above 114° C (237° F).
5/ Aliphatic hydrocarbons shall not be used.

3.4 Ingredients - All ingredients used in the manufacture of these products shall conform to the following.

3.4.1 Resin -

- * 3.4.1.1 Class 1 - The resin shall be a copolymer of methyl methacrylate and other acrylic esters, with the methyl methacrylate portion being the major part of the copolymer. The viscosity (40 percent solution in toluene) shall be 480 to 640 centipoises at 30° C (86° F).
- * 3.4.1.2 Class 2 - For Class 2 the resin shall be as defined in 3.4.1.1, except that the viscosity (40 percent in toluene) shall be for identification purposes only (see 6.3).

3.4.2 Cellulose compounds - The cellulose compounds shall conform to Type II of MIL-N-5538 (see 6.3).

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

3.4.4 Flatting pigment - The flatting pigment shall not exceed that required to produce the specified gloss values. Based on the total pigment content, the flatting pigments shall not exceed 85 percent for black, and 50 percent for each of the other colors. The flatting pigments shall be siliceous matter. Calcium sulfate and metallic soaps are prohibited except that metallic soaps may be used as an aid to grinding in an amount not to exceed 1 percent of the total pigments. Flatting pigments other than the above will be permitted only upon submission to the procuring activity of evidence of satisfactory weather resistance of materials so formulated.

* 3.4.5 Solvents -

- * 3.4.5.1 Class 1 - Only those solvents, in the ratios indicated, which are specified in Table I, shall be used in the manufacture of the product. The finished lacquer shall be capable of being thinned for use with thinner conforming to MIL-T-19544.
- * 3.4.5.2 Class 2 - The volatile content 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 or which does not exceed any of the following individual percentage composition limitations, referred to the total volume of solvent. The minimum boiling point of the solvent blend shall be 75° C (168° F).

- (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.

* 3.4.5.2.1 Thinner - The thinner to be used with the non-photochemically reactive lacquer shall be non-photochemically reactive as defined in 3.4.5 and shall be compatible with the lacquer. It shall contain no less than 5 percent ethylene glycol monobutyl ether.

3.4.6 Pigments - Pigments shall be as shown in Table II. When pigments in Table II are not covered by Government specifications they shall conform to the requirements of 3.1 and shall be of high durability established by past usage in a comparable lacquer.

TABLE II

PIGMENTATION 1/ 2/

FED-STD-595 Color No.	ANA Bull. No. 157 Color No.	Color	Pigmentation (except flatting pigments)
37875	---	Insignia white	Titanium dioxide (TT-P-442) 3/
37038	---	Black	Carbon black (TT-P-343) (TT-P-350) 4/
35044	---	Insignia blue	Iron blue (TT-P-385), titanium dioxide and carbon black 4/
35042	---	Non-specular sea blue	Iron blue, titanium dioxide and carbon black 4/
34151	---	Interior green	Chrome yellow 5/ or chrome orange (TT-P-346) 5/, titanium dioxide, shading yellow, yellow iron oxide (TT-P-458) and chrome oxide green (TT-P-347)

TABLE II (Continued)

FED-STD-595 Color No.	ANA Bull. No. 157 Color No.	Color	Pigmentation (except flatting pigments)
X34087	---	Olive drab	Phthalocyanine blue (TT-P-355), iron blue, chrome yellow <u>5</u> /, or chrome orange <u>5</u> /, chrome oxide green, titanium dioxide, pure iron oxide, molybdate orange, shading yellow
33538	---	Orange yellow	Chrome yellow <u>5</u> /, chrome orange <u>5</u> /, or molybdate orange (TT-P-410)
31136	---	Bright red	Bon red <u>6</u> /, molybdate orange (TT-P-375)
36440	---	Light gull gray	Titanium dioxide and carbon black <u>4</u> /
36231	---	Dark gull gray	Titanium dioxide and carbon black <u>4</u> /
26081	---	Seaplane gray	Titanium dioxide and carbon black <u>4</u> /
27875	---	Semigloss insignia white	Titanium dioxide <u>3</u> /
---	627	Field green	Medium chrome yellow, phthalocyanine blue and antimony sulfide (MIL-A-15197)

- 1/ The pigments listed in Table II, or any combination thereof, shall be the principal ingredients used in the lacquer to obtain the colors specified. Except for the colors marked with footnote 3/, other tinting pigments may be used as ingredients, in an amount which shall not exceed 2 percent of the total weight of pigment, provided these additional tinting pigments have proven good outdoor durability. The pigments shall be sufficiently insoluble to prevent leaching during immersion (see 3.5.15).
- 2/ Where titanium dioxide is specified, the chalk-resisting type conforming to type III of TT-P-442 shall be used.
- 3/ These colors shall contain no tinting pigments whatsoever.
- 4/ Lampblack may be used in these colors.
- 5/ Pigments conforming to TT-P-346 may be unsatisfactory. The proprietary lightfast chrome yellows and oranges are satisfactory, however.

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 grit, skinning, curdling, livering or excessive pigment flotation, and shall show no more settling or caking than may be easily redispersed with a paddle to a uniform and homogeneous condition (see 4.6.1).

3.5.1.1 Storage stability - The lacquer, stored in a full, closed container for one year at 21° to 32° C (70° to 90° F) shall pass all the tests specified (see 4.6.2).

3.5.2 Odor - The odor of the lacquer, wet or dry, shall not be obnoxious. An air-dried film shall retain no residual odor 48 hours after application (see 4.6.1).

* 3.5.3 Color - The color of the lacquer film after drying 24 hours shall match the applicable FED-STD-595 or ANA Bulletin No. 157 color numbers specified in Table II, or as specified, see 1.2.1.1, (see 4.6.1). For field green only, the film shall be within the spectrophotometric limits specified in Figure 1, when tested as specified in 4.6.1.1.

3.5.4 Working properties - Two coats of lacquer under test reduced to spray consistency and applied on 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 4.6.3).

3.5.5 Self-lifting properties - After application of the second coat of the lacquer, there shall be no evidence of lifting in the system when tested as specified in 4.6.18.

3.5.6 Drying time - The lacquer, applied to a total film thickness of 1.0 ±0.2 mil, shall dry hard in not more than 40 minutes under laboratory conditions of temperature and relative humidity specified (see 4.6.1).

3.5.7 Surface appearance - The lacquer film, after drying, shall be free from blushing, streaks, blisters, coarse particles, silking, or other irregularities of surface (see 4.6.4).

3.5.8 Print resistance - The lacquer under test shall show no permanent print from cheesecloth (see 4.6.5).

3.5.9 Primer absorption - The lacquer under test shall show no tendency to sink into the control formula primer, or impair the adhesion of the primer to metal when tested as specified herein. The lacquer shall not develop embrittlement through a combination with the primer when compared with the same lacquer applied to a panel without primer (see 4.6.6).

3.5.10 Coating anchorage - Lacquer film 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).

3.5.11 Baking properties - Lacquer films, baked as specified in Section 4, shall show no pronounced color change as compared with the unbaked film (see 4.6.8).

3.5.12 Flexibility (cold cracking) - The lacquer film shall exhibit no flaking at the bend when subjected to the cold cracking test. Fine cracks shall not be cause for rejection (see 4.6.9).

3.5.13 Infrared reflectance (applicable only to olive drab) - Olive drab shall show a minimum infrared reflectance of 28 percent, a maximum infrared reflectance of 55 percent (see 4.6.10).

3.5.14 Polishing test - The polished lacquer film shall not exhibit an increase in gloss value greater than three times the initial gloss value (see 4.6.11).

3.5.15 Resistance properties -

3.5.15.1 Water resistance - The lacquer film shall withstand immersion in water at room temperature for 24 hours 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. The water shall not be discolored by extraction of leachable matter from the paint film (see 4.6.12).

3.5.15.2 Hydrocarbon resistance - The lacquer film shall withstand immersion in hydrocarbon test fluid conforming to Type III of TT-S-735, at room temperature for 4 hours. Immediately after removal, the film shall show no blistering or film failure, except that slight gumming above the liquid level shall not be cause for rejection. Twenty-four hours after removal, the film shall, in all respects, be equal to or better than 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. The test fluid shall not be discolored by extraction of leachable matter from the paint film (see 4.6.13).

3.5.15.3 Lubricating oil resistance - When tested as specified in 4.6.14, the lacquer film shall withstand immersion in synthetic diester lubricating oil for a period of 2 hours at a temperature of $121 \pm 2^\circ \text{C}$ ($250 \pm 4^\circ \text{F}$) without showing any blistering, film softening or other film failure, except that slight gumming above the liquid level shall not be cause for rejection. Slight discoloration will be permitted. Twenty-four hours after removal, the film shall, in all respects, be equal to or better than the film of a similarly prepared control formula lacquer of corresponding color which has been similarly immersed in the synthetic diester lubricating oil. The oil shall not be discolored by extraction of leachable matter from the paint film.

3.5.15.4 Weather resistance - Panels which have been weather exposed for one year in Florida shall show no greater film deterioration, loss of adhesion, chalking, 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 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 conform to this specification (see 4.6.17).

3.5.15.5 Anchorage (tape test) - The lacquer film under test shall show no more removal from the primer, nor removal of the entire system from the panel, than that exhibited by a simultaneously tested sample of the control lacquer of the corresponding color (see 4.6.15).

3.6 Quantitative requirements - The camouflage lacquer shall conform to the quantitative requirements specified in Table III.

TABLE III

QUANTITATIVE REQUIREMENTS

Requirements	Minimum	Maximum
Coarse particles (retained on a No. 325 sieve) percent by weight of total lacquer (see 4.6.1)	--	0.1
Fineness of grind (see 4.6.1)	6	--
Viscosity (reduced as specified in 4.3.2) (determined with a No. 4 Ford cup) (seconds) (see 4.6.1)	--	20
Weight per gallon (pounds) (see 4.6.1)		
Black	7.4	--
All other colors	8.0	--

TABLE III (Continued)

Requirements	Minimum	Maximum
Specular gloss (60 degrees geometry) (see 4.6.1)	--	10
Insignia white	--	10
Black	--	10
Insignia blue	--	10
Non-specular sea blue	--	10
Interior green	12	19
Olive drab	--	10
Orange yellow	--	10
Bright red	--	10
Light gull gray	7	15
Dark gull gray	--	10
Seaplane gray	7	15
Semigloss insignia white	40	55
Field green	--	5
Hiding power (dry film thickness 1 mil) (contrast ratio) (percent) (see 4.6.16)	83	--
Insignia white	88	--
Semigloss insignia white	80	--
Orange yellow	88	--
Bright red	98	--
All other colors		
Color (by photoelectric tristimulus) ^{1/}		
Insignia white and semigloss insignia white only	82	--
B value	84	--
A value	84	--
G value		

^{1/} Tristimulus values may be obtained using Hunter reflectometer with three filters, or equivalent (see 4.6.1).

3.7 Workmanship - The component ingredients shall be intimately assembled and processed 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 supplies and services conform to prescribed requirements.

- * 4.2 Classification of tests - All the tests required for the testing of lacquer are classified as quality conformance tests, except the Storage Stability test and Weathering test.

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

- * 4.3.1 Test panels - Except as otherwise specified herein, all panels used for test purposes shall be aluminum-clad aluminum alloy conforming to QQ-A-250/5, anodized in accordance with Type I of MIL-A-8625. The panels shall be 0.020 by 3 by 6 inches in size, and shall be finished as follows: Spray one coat of wash primer conforming to MIL-C-8514 to a dry film thickness of 0.0002 to 0.0003 inch and air-dry for 30 minutes. The test panels with the wash primer applied shall then be sprayed with a dry film thickness of 0.0003 to 0.0004 inch of control formula primer conforming to MIL-P-7962, normal type for Class 1 lacquer and non-photochemically reactive type when testing Class 2 lacquer. The panels shall then be air-dried for 30 minutes. Unless otherwise specified, two spray coats of lacquer under test shall then be applied over the primer with a 45-minute drying interval between coats. Lacquer under test shall be prepared as specified in 4.3.2. The total dry film thickness of the two coats of lacquer shall be 0.001 \pm 0.0002 inch. Unless otherwise specified after application of the lacquer, the panels shall be air-dried for 24 hours. For the following tests, the panels shall be air-dried for 2 hours and force dried for 1 hour at a temperature of 82° C (180° F).

- (a) Flexibility (cold cracking) (4.6.9)
- (b) Water resistance (4.6.12)
- (c) Hydrocarbon resistance (4.6.13)
- (d) Lubricating oil resistance (4.6.14)

- * 4.3.2 Methods for preparing lacquer 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 application is required. In such cases, thinning for spray application shall be accomplished by reducing the lacquer with an equal volume of thinner conforming to the following compositions:

(a) For Class 1

<u>Ingredients</u>	<u>Percent by weight</u>
Methyl isobutyl ketone (TT-M-268)	45
Toluene (TT-T-548)	45
Ethylene glycol monobutyl ether (TT-E-776)	5
Xylene (TT-X-916)	5

(b) For Class 2 - Thinning for spray application shall be accomplished by reducing the lacquer with an equal volume of thinner specified in 3.4.5.2.

* 4.3.3 Control formula lacquer - Control formula lacquer shall be used with both classes of lacquer under test. The control formula lacquer of Table IV is for light gull gray color. When testing for outdoor weathering, the control formula must be the same color approximately as the color of the material under tests. Lacquer made in other colors shall be formulated from the raw materials specified in Table IV, except for the pigments which shall be in accordance with Table II (except for field green). Field green pigmentation shall be as specified in 4.3.3.1. All control lacquers shall conform to this specification.

4.3.3.1 Field green - Field green pigmentation for control lacquer shall be as specified in Table V.

4.4 Batch data - Batch production data shall be furnished in accordance with Method 1031 of Fed. Test Method Std. No. 141.

4.4.1 Report of tests - The manufacturer shall submit test reports to the Government representative in accordance with Method 1031 of Fed. Test Method Std. No. 141, for each batch, showing the results of all tests specified herein, except weather resistance (4.6.17) and storage stability (4.6.2). Each ingredient material shall be identified with the name of its manufacturer and that manufacturer's trade name and formula number.

4.4.1.1 In lieu of reporting analytical results on the breakdown of the non-volatile and volatile composition of the lacquer, the manufacturer may report 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.

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

TABLE IV 1/CONTROL LACQUER - LIGHT GULL GRAY 2/

Ingredients	Percent by weight
Titanium dioxide <u>3/</u>	12.55
Silica <u>4/</u>	1.13
Magnesium silicate <u>5/</u>	3.17
Acrylic resin <u>6/</u>	32.00
Diethyl phthalate	4.65
1/2 second nitrocellulose (70 percent in ethyl alcohol)	8.31
Toluene	2.79
Methyl isobutyl ketone	17.70
Methyl ethyl ketone (TT-M-261)	17.70

Grind the ingredients of Table IV in a porcelain or stone-lined pebble mill for 24 hours.

1/ The Table IV formulation with the specified proprietary raw materials represents a product of established outdoor weathering durability. The listing of these proprietary materials is not to be construed as an endorsement thereof or as precluding lacquers formulated with raw materials from other proprietary sources or other formulation within the compositional framework of Tables I and II. Such products may prove equivalent or even superior in performance to the test lacquer. However, the Table IV formulation should be employed as the comparison standard, for control purposes. Control lacquers in colors other than light gull gray should be prepared in accordance with 4.3.3.

2/ Tint to proper color with RBH No. 6077 black dispersion.

3/ Dupont R610.

4/ Johns Manville Celite 266.

5/ Whitaker, Clarke and Daniels SF Talc 399.

6/ Rohm and Haas Acryloid B-82 (40 percent in Toluene).

TABLE V

FIELD GREEN CONTROL LACQUER PIGMENTATION 1/, 2/

Ingredients	Percent by weight
Medium chrome yellow <u>3/</u>	34.5
Phthalocyanine blue <u>4/</u>	1.8
Antimony sulfide <u>5/</u>	13.7
Silica <u>6/</u>	15.8
Magnesium silicate <u>7/</u>	34.2

1/ The Table V formulation with the specified proprietary raw materials represents a product of established color match. The listing of these proprietary materials is not to be construed as an endorsement thereof or as precluding pigments 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 test pigments. However, the Table V formulation should be employed as the comparison standard for control purposes.

2/ For production purposes, the pigments and extenders may not be in exactly the same proportions of Table V, since mass tone and tinting strength of the pigments may vary slightly among different batches. These pigments shall be the sole prime pigments. No tinting pigments are permissible. However, flattening pigments are required to achieve the required gloss.

3/ Imperial X 1810.

4/ Dupont BT284D.

5/ Rare Metals Products Co., precipitated grade No. 1 (MIL-A-15197).

6/ Johns Manville Celite No. 266.

7/ Whitaker, Clarke and Daniels SF Talc 399.

4.4.3 Sampling -

4.4.3.1 Sampling for tests - Samples shall be selected as required by Fed. Test Method Std. No. 141, Method 1031.

4.4.3.2 Sampling for visual inspection of filled containers - A random sample of filled containers shall be selected in accordance with MIL-STD-105 at Inspection Level I and Acceptable Quality Level of 2.5 percent defective to verify all requirements of this specification in regard to fill, closure, packaging, packing, marking, workmanship, and other requirements not involving tests.

4.4.3.3 Resubmitted inspection lots - Paragraph titled "Resubmitted lots" of MIL-STD-105 shall apply, except that a resubmitted inspection lot shall be inspected, using tightened inspection. For visual examination, where the original acceptance number was zero, a sample size represented by the next higher sample size code letter shall be chosen.

* 4.5 The Government reserves the right to rerun any or all tests of this specification at any time within one year from the date of manufacture of the lacquer as attested by the date appearing on the container's label. Samples for retest shall be taken from previously unopened containers.

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

* 4.6.1 The following tests shall be conducted in accordance with the specified methods of Fed. Test Method Std. No. 141. Panels shall be prepared as specified in 4.3.1.

Test	Fed. Test Method Std. No. 141 Method No.
Pigment content (supercentrifuge)	4022
Volatile and nonvolatile content	4041
Vehicle solids	4052
Condition in container	3011
Coarse particles	4092
Viscosity (No. 4 Ford cup)	4282
Weight per gallon	4184
Drying time	4061
Odor	4401
Specular gloss	6101
Color	4250
Color (photoelectric tristimulus) (white only)	4252
Fineness of grind (determined with use of gage having minimum path length of 4 inches)	4411
Non-photochemically reactive solvents	7360

4.6.1.1 Field green color - The reflectance of the panel within the range of 400 and 850 millimicrons, when measured on a General Electric Recording Spectrophotometer, or equal, shall fall between the two dotted curves of Figure 1.

4.6.2 Storage stability - A full, closed container of lacquer shall be stored under warehouse conditions at a temperature of 21° to 32° C (70° to 90° F) for one year, at the end of which time it shall be opened and inspected and tested for conformance to this specification, except for weather resistance (see 3.5.1.1).

4.6.3 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 3.5.4).

4.6.4 Surface appearance - The film on a panel prepared as specified in 4.3.1 shall be examined under a magnification of 10 to 15 diameters (see 3.5.7).

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 4 hours after removal of pressure (see 3.5.8).

4.6.6 Primer absorption - Panels shall be prepared as specified in 4.3.1 along with panels prepared without the undercoats. The adhesion of the primed and unprimed panels shall be tested as specified in 4.6.7 (see 3.5.9).

4.6.7 Coating anchorage - A panel prepared as specified in 4.3.1 shall be air-dried for 48 hours and then tested in accordance with Method 5304 of Fed. Test Method Std. No. 141 (see 3.5.10).

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 63° to 68° C (145° to 154° F). The panels shall then be examined for color change (see 3.5.11).

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 6223 of Fed. Test Method Std. No. 141. The rate of bend shall be 2 seconds (see 3.5.12).

4.6.10 Infrared reflectance - The test for infrared reflectance shall be conducted in accordance with Method 6242 of Fed. Test Method Std. No. 141 (see 3.5.13).

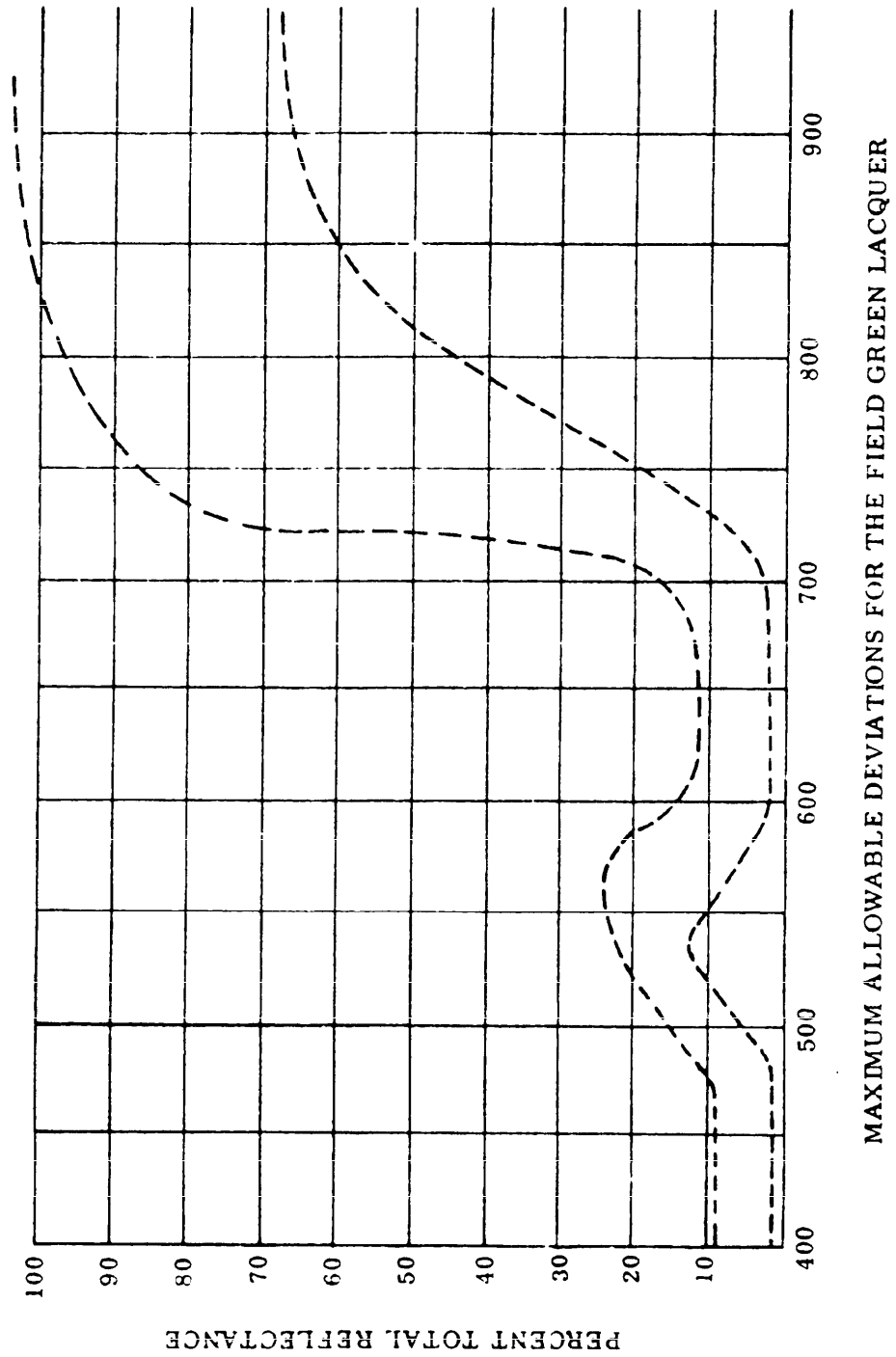


FIGURE 1. WAVE LENGTH IN MILLIMICRONS

4.6.11 Polishing test - A panel prepared as specified in 4.3.1 shall be allowed to air-dry 48 hours and then be polished by rubbing lengthwise with a pair of unbleached cotton cloth with a thread count of approximately 115 by 55 and a weight of approximately 6 ounces per square yard. Thirty brisk strokes with a normal force of approximately 2 pounds shall be executed. The gloss shall be determined before and after polishing (see 3.5.14).

4.6.12 Water resistance - Panels, prepared as specified in 4.3.1, shall be immersed in distilled water in accordance with Method 6011 of Fed. Test Method Std. No. 141 for 24 hours at room temperature. Five minutes after removal from water, the lacquer shall be examined (see 3.5.15.1).

4.6.13 Hydrocarbon resistance - Panels shall be prepared as specified in 4.3.1. The panels shall then be immersed in test fluid conforming to Type III of TT-S-735, at room temperature, for 4 hours, in accordance with Method 6011 of Fed. Test Method Std. No. 141. The film shall be examined immediately after removal and 24 hours after removal from the fluid (see 3.5.15.2).

* 4.6.14 Lubricating oil resistance - Panels shall be prepared as specified in 4.3.1. The panels shall then be immersed in diester lubricating oil composed of 95 percent di-2-ethyl-hexyl sebacate, and 5 percent tricresyl phosphate at a temperature of $121 \pm 2^{\circ} \text{C}$ ($250 \pm 4^{\circ} \text{F}$) for a period of 2 hours. The film shall be cleaned immediately after removal with detergent and water, mineral spirits, or aliphatic naphtha. Twenty-four hours after removal, the panels shall be compared (see 3.5.15.3).

Note: di-2-ethyl-hexyl sebacate may be obtained as Rohm and Haas "Plexol 201".

4.6.15 Anchorage (tape test) - Four 3 by 6 inch anodized aluminum-clad aluminum-alloy panels conforming to QQ-A-362 shall be cleaned carefully with solvent. Panels shall be prepared as specified in 4.3.1. Two of the panels shall then be coated with two coats of the lacquer under test, and the remaining two panels with two coats of control lacquer of corresponding color. After application of the second coat of lacquer, the panels shall be air-dried for 72 hours. All four panels shall then be partially immersed in distilled water, at a temperature of $23 \pm 1.1^{\circ} \text{C}$ ($73.5 \pm 2^{\circ} \text{F}$), 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 stylus upon a previously immersed part of each panel. A 1-inch-wide strip of masking tape, taken from a fresh sample of Minnesota Mining and Manufacturing Company Code No. 250 masking tape, or equal, 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 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 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 tape from panel shall be done immediately after application thereof (see 3.5.15.5).

4.6.16 Hiding power -

4.6.16.1 Panel preparation - A representative portion of the lacquer under test shall be cast on a smooth flat metal surface utilizing a suitable doctor blade so that a dry film thickness of 1 mil is obtained. The metal plate 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 a central portion of the coated panel with a suitable film meter. The doctor blade clearance which gave the desired film thickness shall be utilized in casting the coating on 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-degree, 0-degree apparent reflectance of less than 1 percent; the white Carrara glass shall have a daylight 45-degree, 0-degree apparent reflectance of 86 ± 2 percent (relative to MgO).

4.6.16.2 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. The Hunter reflectometer used with the green filter in the manner described in the National Bureau of Standards Research Paper RP 1345 (November 1940), meets these requirements as does the Photovolt Lumetron Reflectometer. 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 Table III).

4.6.17 Weather resistance - Panels, 5 by 16 inches, shall be prepared as specified in 4.3.1. Panels shall be prepared for exposure with the lacquer under test and separate panels shall be prepared with the control lacquer of the corresponding color. The panels shall be exposed in accordance with Method 6161 of Fed. Test Method Std. No. 141 for 1 year in the vicinity of Miami, Florida (see 3.5.15.4).

4.6.18 Self-lifting properties - Three panels shall be prepared in accordance with 4.3.1. The first coat of the lacquer under test applied to the three panels shall be allowed to dry for 1/2, 1, and 2 hours, respectively. After application of the second coat of lacquer, there shall be no evidence of lifting in the system (see 3.5.5).

MIL-L-19538C

4.7 Rejection and retest - Rejection and retest provisions shall be in accordance with Section 1000 of Fed. Test Method Std. No. 141.

5. PREPARATION FOR DELIVERY

* 5.1 Packaging and packing - For direct purchases by or direct shipments to the Government, the packaging, packing, and marking for shipment shall be in accordance with TT-P-143 and as specified in 5.2. The level of packaging shall be as specified (see 6.2).

* 5.2 Marking and labeling - In addition to the marking required by TT-P-143, individual cans or containers shall bear a label showing the following information:

"PRIMING COATS: Use only over the following systems:

- A. A system consisting of MIL-C-8514 wash primer plus MIL-P-7962 lacquer primer; conventional lacquer primer under Class 1 lacquer and non-photochemically reactive primer under Class 2 lacquer.
- B. The epoxy-polyamide primer MIL-P-23377; Class 1 epoxy primer under Class 1 lacquer and Class 2 epoxy primer under Class 2 lacquer."

"WARNING: Do not use non-photochemically reactive coatings with conventional coatings."

"THINNING DIRECTIONS: Class 1 - For spraying or brushing, reduce as required with thinner conforming to MIL-T-19544. Class 2 - Non-photochemically reactive lacquer shall be thinned in accordance with the manufacturer's instructions."

"WARNING: Avoid contaminating infrared-reflecting colors with other paints. To preserve infrared reflectance, use only clean mixing paddles, containers, and other equipment for thinning or application. (Applicable to olive drab color only.)"

6. NOTES

* 6.1 Intended use - The acrylic-nitrocellulose camouflage lacquer conforming to this specification is intended for use as a general purpose exterior coating for metal surfaces and is particularly formulated for resistance to diester lubricating oil. Acrylic-nitrocellulose camouflage lacquer is intended to be used only over a system consisting of wash primer (pretreatment coating), MIL-C-8514, and lacquer type primer, MIL-P-7962; Class 1 lacquer should be used only with conventional primers, and Class 2 lacquer should be used only with non-photochemically reactive primers.

- * 6.1.1 The acrylic-nitrocellulose camouflage lacquer does not show good adhesion when applied over zinc-chromate primer covered by MIL-P-8585; however, the acrylic lacquer exhibits excellent adhesion to cellulose nitrate camouflage lacquer conforming to TT-I-20.

- * 6.2 Ordering data - Procurement documents should specify:
- (a) Title, number, and date of this specification.
 - (b) Class, color number and name (see 1.2)
 - (c) Size of container for lacquer. The lacquer should be purchased by volume, the unit being a US gallon (231 cubic inches) at 15.5° C (60° F).
 - (d) Levels of packaging and packing required (see Section 5).

- * 6.3 The solvent for the resin used for Class 2 shall be such that the final lacquer formulation will have a solvent content which is non-photochemically reactive (see 3.4.1.2 and 3.4.2).

6.4 Changes from previous issue - The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Army - MR
Navy - AS
Air Force - 84

Preparing activity:

Navy - AS
Project No. 8010-0684

Review activities:

Army - MR, MU
Navy - AS
Air Force - 84

User activity:

Navy - OS, SH, MC

NOTICE - Review/user information is current as of date of this document. For future coordination of changes to this document, draft circulation should be based on the information in the current Federal Supply Classification Listing of DOD Standardization Documents.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS (Street, City, State, ZIP Code)

4. TYPE OF ORGANIZATION (Mark one)

☐

VENDOR

☐

USER

☐

MANUFACTURER

☐

OTHER (Specify):

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

b. WORK TELEPHONE NUMBER (Include Area Code) - Optional

c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 12503 WASHINGTON D C

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

WEAPONS ENGINEERING STANDARDIZATION OFFICE (CODE X)
NAVAL AIR ENGINEERING CENTER
PHILADELPHIA, PENNSYLVANIA 19112

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES