

MIL-P-2160CA(Wep)
26 October 1962

Superseding
MIL-P-21600(Wep)
21 August 1958

MILITARY SPECIFICATION

PAINT SYSTEM, FLUORESCENT, REMOVABLE, FOR AIRCRAFT APPLICATION

This specification has been approved by the
Bureau of Naval Weapons, Department of the Navy.

1. SCOPE

1.1 Scope.-- This specification covers the requirements for a high visibility, durable, exterior fluorescent paint system consisting of a pigmented fluorescent paint with a clear protective overcoating containing a weathering stabilizer. This paint system is capable of being removed without softening the permanent undercoats.

1.2 Classification.-- This specification covers one grade of fluorescent paint system to be furnished in the following colors, as specified (See 6.4).

<u>Color No.</u>	<u>Color Name</u>
633	Fluorescent red-orange
634	Fluorescent yellow-orange

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

SPECIFICATIONS

Federal

QQ-A-362	Aluminum Alloy Plate and Sheet, AlClad 2024
TT-N-97	Naphtha; Petroleum, Aromatic (for Use in Organic Coatings)
TT-P-143	Paint, Varnish, Lacquer, and Related Materials; General Spec- ification for Packaging, Packing and Marking

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TT-T-291	Thinner, Paint, Volatile Mineral Spirits
TT-T-548	Toluol (for Use in Organic Coatings)
TT-X-916	Xylene (for Use in Organic Coatings)
LLL-O-358	Oil; Pine

Military

MIL-P-6884	Paint, Temporary Identification
MIL-P-7962	Primer, Lacquer Type; Corrosion-Inhibiting, Fast Drying (for Spray Application Over Pretreatment Coating)
MIL-C-8514	Coating, Pretreatment, Smooth Finish, Spray Type
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-C-18687	Cleaning Compound, Aircraft Surface
MIL-L-19537	Lacquer; Acrylic Nitrocellulose, Gloss (for Aircraft Use)
MIL-T-19544	Thinner; Acrylic-Nitrocellulose Lacquer
MIL-R-21972	Remover, Fluorescent Paint (Water-Rinsable Type)
MIL-C-22543	Cleaning Compound, Water-Emulsion

STANDARDS

Federal

Federal Test Method Standard No. 141	Paint, Varnish, Lacquer and Related Materials; Methods of Inspection, Sampling and Testing
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Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage

(When requesting any of the applicable documents, refer to both title and number. All requests should be made via the cognizant Government inspector. Copies of this specification and other unclassified specifications and drawings required by contractors in connection with specific procurement functions should be obtained upon application to the Commanding Officer, Naval Supply Depot (Code CDS), 5801 Tabor Avenue, Philadelphia 20, Pennsylvania. All other documents should be obtained from the procuring activity or as directed by the contracting officer.)

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3. REQUIREMENTS

3.1 Qualification.— The paint furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable qualified products list.

3.2 Material.— The ingredients used in the manufacture of this product shall conform to the applicable Government specifications. Ingredient materials conforming to contractor's specifications may be used provided that prior approval is obtained from the Government laboratory specified in 6.7. The use of contractors' specifications will not constitute waiver of Government inspection.

3.3 Toxicity.— The manufacturer shall certify that the fluorescent paint system contains no substance of known toxicity under normal conditions of usage.

3.4 Composition.— The composition of the fluorescent paint and the clear overlay shall be in accordance with Table I.

TABLE I

COMPOSITION

Property	Pigmented Paint (Percent by Weight)	Clear Overlay (Percent by Weight)
Volatile	40 max.	64 max.
Nonvolatile	52 min.	36 min.
Substituted dihydroxy benzophenone ^{1/} (percent of total solids)		2 min.

^{1/} A maximum of 10 percent (based on total solids) of this stabilizer may be included in the pigmented coating.

3.4.1 Volatile.— The volatile portion of the pigmented coating shall be aliphatic and aromatic hydrocarbons. The volatile portion of the clear overcoat shall be aromatic. Benzol shall not be present in either the pigmented coating or the clear overcoat.

3.4.2 Vehicle.— The resin in the vehicle of the pigmented coating shall be a good grade of mineral spirits soluble polybutylmethacrylate. The resin portion of the clear overcoat shall be a high grade, unmodified acrylic which shall be soluble in aromatic hydrocarbons and shall contain no ketones, cellosolve acetate or aliphatic hydrocarbons.

3.4.3 Pigment.— The pigment shall consist of a powdered resin which contains fluorescent dye (s).

3.5 Physical properties.

3.5.1 Fineness of grind.— Fineness of grind of the pigmented paint shall be a minimum of 5.

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3.5.2 Drying time.-- When tested as specified in 4.5.2, separate films of pigmented paint and clear overcoating shall both dry hard within one hour. When the clear overcoating is drawn down over the pigmented film, the system shall dry hard and exhibit no tack (to touch) within 3 hours and shall dry tack free within 4 hours when tested with a Zapon Tack Tester.

3.5.3 Color (spectrophotometric).-- After drying for 24 hours, the color values of the red-orange and yellow-orange paint systems shall be in accordance with the respective "Before Exposure" values specified in Tables II and III.

3.5.4 Accelerated weathering.-- After exposure in the weatherometer for 300 hours (See 4.5.4), the red-orange or yellow-orange paint systems (See 4.4), shall meet the respective requirements specified in Tables II and III and there shall be no evidence of deterioration of the film properties (loss of intercoat adhesion, cracking, flaking, peeling, etc.).

3.5.5 Weather resistance.-- The red-orange system (See 4.4) when exposed in southern Florida for 120,000 Langley units or the yellow-orange system (See 4.4) when exposed in southern Florida for 90,000 units, shall meet the respective requirements specified in Tables II and III and there shall be no evidence of deterioration of the film properties (loss of intercoat adhesion, cracking, flaking, peeling, etc.).

3.6 Qualitative requirements.

3.6.1 Condition in container.-- The packaged paint, pigmented and clear, shall pour freely without stirring. There shall be no traces of grit, coarse particles, or separation of pigments, nor shall there be settling which cannot be readily redispersed with a paddle to a uniform and homogeneous state.

3.6.2 Storage stability.-- The pigmented and clear materials, when stored in full, closed containers for 1 year at 70° - 90°F, shall meet all the requirements of this specification.

3.6.3 Working properties.-- When the unstrained pigmented or clear paint is reduced for spraying (naphtha, II-N-97, Type I, Grade B for the pigmented paint and toluene or xylene for the clear), there shall be no evidence of separation and the paint (pigmented or clear) shall show good working properties and shall dry to a uniform smooth surface free of runs, sags, bubbling, wrinkling, streaking, or other defects. When the clear is applied by spray over the pigmented coating, the complete fluorescent system shall be uniformly smooth and free of the above noted defects (a 1-mil film of clear is applied over a 3-mil film of pigmented coating after the latter has air-dried 4 hours).

3.6.4 Odor.-- The odor of the pigmented or clear coating, wet or dry, shall not be objectionable and shall be characteristic of the solvents specified.

TABLE II
COLOR LIMITS BEFORE AND AFTER WEATHERING FOR RED ORANGE ✓

Exposure	Dominant Wave Length (millimicrons)		Excitation Purity % Min	Luminance Factor % Min	Peak "Reflectance" Compared to MgCO ₃ % Min
	Min	Max			
Before Exposure	610	614	98	31	195
Weatherometer - 300 hrs. 4/	607	614	95	31 (min) 37 (max)	175
Florida Exposure (120,000 Langley Units)	603	614	93	31 (min) 42 (max)	160

TABLE III
COLOR LIMITS BEFORE AND AFTER WEATHERING FOR YELLOW ORANGE ✓

Exposure	Dominant Wave Length (millimicrons)		Excitation Purity % Min	Luminance Factor % Min	Peak "Reflectance" Compared to MgCO ₃ % Min
	Min	Max			
Before Exposure	602	606	98	47	215
Weatherometer - 300 hrs. 4/	599	606	97	46 (min) 58 (max)	185
Florida Exposure (90,000 Langley Units)	595	606	94	48 (min) 58 (max)	160

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Notes to Tables II and III

- 1/ In accordance with the Selected Ordinate Method described in Section IV, which is abstracted from the "Handbook of Colorimetry" - Hardy, Arthur C., Color Measurement Laboratory, Massachusetts Institute of Technology, 1936.
- 2/ This value is to be the highest reflectance obtained in the wavelength range of 624-630 millimicrons.
- 3/ This value is to be the highest reflectance obtained in the wavelength range of 607-620 millimicrons.
- 4/ Values based on weatherometer performance in accordance with the procedure in "Accelerated Weathering" in Section 4.

3.6.5 Reduced viscosity. - Upon reducing 3 volumes of the pigmented paint with 2 volumes of aromatic naphtha (TT-N-97, Type I, Grade B) the viscosity shall be not more than 24 seconds (#4 Ford Cup). Upon reducing one volume of the clear coating with one volume of toluol (TT-T-548), the viscosity shall be not more than 15 seconds (#4 Ford Cup).

3.6.6 Solvent resistance. - The clear coating shall not be affected by mineral spirits when tested as specified in 4.5.7.

3.6.7 Dilution stability. - There shall be no evidence of incompatibility when one volume of the pigmented paint is reduced with one volume of aromatic naphtha (TT-N-97, Type I, Grade B) and when one volume of the clear coating is reduced with one volume of toluol or xylene. Examination of the reduced coatings shall be made after one hour.

3.6.8 Appearance (clear coating). - A flow-out of the clear coating as received on a glass panel shall be clear and show no evidence of incompatibility (See 4.5.8).

3.6.9 Adhesion (knife test). - The red-orange and yellow-orange paint systems (See 4.4) shall show satisfactory adhesion and shall ribbon without flaking or chipping when tested in accordance with 4.5.1.

3.6.10 Removability. - The fluorescent paint system shall be removable (both before and after the required Florida exposure) with the remover listed in Table IV without impairment of more than slight staining of the lacquer substrate. (Note that the remover listed in Table IV is the formula listed in MIL-R-21972(Aer), Amendment 1).

3.6.11 Anchorage (tape test). - When tested as specified in 4.5.10, the fluorescent paint system shall show satisfactory adhesion to the lacquer base coat.

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TABLE IV
FORMULA FOR REMOVER

Ingredients	Percent by Weight
Xylene	56.3
Triton X-102 (Rohm and Haas Co.)	3.4
Pine Oil (LLL-O-358, Class B)	2.6
Cyclohexanol (Dow Chemical Co.)	2.6
Butyl Cellosolve (Mono-n-Butyl Ether of Ethylene Glycol)	1.7
Isopropyl Alcohol (99%)	0.4
Water (Distilled)	17.8
Sodium Chromate	0.2
Corn Starch	15.0
Compounding Procedure - The ingredients shall be added in the order listed above accompanied by constant stirring at a moderate speed. Small portions at a time shall be added and each portion shall be thoroughly dispersed before another is added. After dispersing the final ingredient, the mixture shall be stirred for an additional five minutes.	

3.6.12 Lifting test. - When tested as directed in 4.5.11, the fluorescent coating under test shall exhibit no film defects such as lifting or cracking when applied over the white test paint.

3.6.13 Workmanship. - The component ingredients of the pigmented and clear coatings shall be intimately assembled and processed in accordance with the best practice for the manufacture of high quality coatings.

4. QUALITY ASSURANCE PROVISIONS

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

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4.2 Classification of tests.- The inspection and testing of the paint shall be classified as follows:

(a) Qualification tests: Qualification tests are those tests accomplished on samples submitted for qualification as a satisfactory product.

(b) Acceptance tests: Acceptance tests are those tests accomplished on material submitted for acceptance under contract.

4.2.1 Qualification tests.

4.2.1.1 Sampling instructions.- Qualification test samples shall consist of three 1-quart containers of the fluorescent pigmented paint and three 1-quart containers of clear overcoat. The sample paints shall be selected in accordance with Federal Test Method Standard No. 141, Method 1031, and shall be forwarded to the Supply Officer, Naval Air Material Center, Philadelphia 12, Pa., Attention: Director, Aeronautical Materials Laboratory. The samples shall be plainly identified by securely attached durable tags marked with the following information:

Samples for Qualification tests
PAINT, FLUORESCENT, REMOVABLE, FOR AIRCRAFT USE
Manufacturer's name and formula number
Submitted by (name of manufacturer) (date) for
Qualification tests in accordance with the
requirements of Specification MIL-P-21600A(Wep)
(date) under authorization (reference letter
authorizing the test)

4.2.1.2 Report of tests.- The manufacturer shall submit reports of his qualification product in accordance with the requirements of Federal Test Method Standard No. 141, showing results of all the tests specified herein, except Weather Resistance and Storage Stability. Regarding the composition of the paint, the manufacturer may report such results as "calculated" provided in his opinion, analysis made by the Government will yield the same results.

4.2.1.3 Tests.- The Qualification tests of the paint shall consist of all the tests of this specification.

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4.2.2 Acceptance tests.- Acceptance tests shall consist of all the tests of this specification except Storage Stability, and Weather Exposure.

4.2.2.1 Acceptance testing.- Acceptance testing shall be conducted in accordance with Method 1031.1 of Federal Test Method Standard No. 141.

4.2.2.2 Examination of product.- Paint shall be examined to determine conformance with this specification with respect to material and workmanship.

4.2.2.3 Sampling for inspection of filled containers.- A sample of filled containers shall be taken at random in accordance with Military Standard MIL-STD-105 at inspection level I and acceptable quality level equals 2.5 percent defective to verify compliance with the specification in regard to fill, closure, marking and other requirements not involving tests.

4.3 Test conditions.- The laboratory testing conditions shall be in accordance with Federal Test Method Standard No. 141 and as described herein.

4.4 Test panels.- Except as otherwise specified herein, all panels used for test purposes shall be aluminum-clad aluminum alloy conforming to Specification QQ-A-362, anodized in accordance with Specification MIL-A-8625, Type I. 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, Specification MIL-C-8514(Aer), to a dry film thickness of 0.0002 to 0.0004 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 0.0005 inch of control formula product of primer conforming to Specification MIL-P-7962, and air-dried for 30 minutes. Two spray coats of control formula white MIL-L-19537(Aer) lacquer shall then be applied over the primer with a 30 minute drying interval between coats. The total dry film thickness of the two coats of lacquer shall be 0.001 ± 0.0002 inch. After application of the lacquer, the panels shall be air-dried for 2 hours and force-dried for one hour at a temperature of 82°C (180°F). The pigmented fluorescent paint shall be reduced to a #4 Ford Cup viscosity

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of 20-22 seconds with thinner conforming to TT-N-97, Type I, Grade B. Three coats of pigmented fluorescent paint shall be sprayed to a total dry film thickness of .0028 to .0032 inch allowing a 30 minute air drying interval between coats. Prior to overcoating with the clear, the fluorescent paint shall air dry 18 hours. The clear overcoat shall be reduced with toluene conforming to Specification TT-T-548 to a #4 Ford Cup viscosity of 14-16 seconds, and applied in two wet coats to a dry thickness of .0009 to .0011, allowing a 30 minute air dry interval between coats. The panels shall be air dried 72 hours before testing.

4.5 Test methods.— The tests of this specification shall be conducted in accordance with the specified methods of Federal Test Method Standard No. 141 and as described herein.

4.5.1 The following tests shall be conducted in accordance with the specified methods as given in Federal Test Method Standard No. 141.

Test	Method No. Federal Test Method Std. No. 141
Volatile and nonvolatile content ✓	4041
Fineness of grind	4411
Condition in container	3011
Odor	4401
Viscosity	4282
Working properties	4541
Dilution stability	4203
Adhesion (Knife test)	6304

✓ An approximately equal weight of tricresyl phosphate shall be thoroughly mixed with the sample in the solids cup when conducting this determination for both the pigmented and clear coatings.

4.5.2 Drying time.— When tested separately or as a system, the pigmented and clear coatings shall be drawn-down over clean plate glasses with 0.008 inch and 0.005 inch clearance blades, respectively. When tested as a system, the clear shall be drawn-down perpendicular to the pigmented film after the latter has air dried 4 hours. Dry-hard and Tack-free requirements are described in Fed. Std. No. 141, Method 4061. The Zapon Tack Tester is described in Physical and Chemical examination of paints, etc., Gardner & Sward, Eleventh Edition, 1950, p. 155. The tester shall be used with a 1-lb. weight over an interval of 1 minute.

4.5.3 Color (spectrophotometric).— The painted specimen prepared as in 4.4 is illuminated directly with light having the spectral quality of C I E Source "C". Source "C" is composed of a tungsten lamp operated at 2848°K in conjunction with a filter. The filter consists of a layer one centimeter thick of each of two solutions contained in separate glass cells.

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Solution 1 has the following compositions:

Copper sulphate	($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$)	3.412 g
Mannite	($\text{C}_6\text{H}_8(\text{OH})_6$)	3.412 g
Pyridine	($\text{C}_5\text{H}_5\text{N}$)	30.1 ml
Distilled water	to make	1000.0 ml

Solution 2 has the following compositions:

Cobalt ammonium sulphate ($\text{CoSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 5\text{H}_2\text{O}$) 30.580g

Copper sulphate	($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$)	22.520 g
Sulphuric acid	(Density 1.835)	10.0 ml
Distilled water	to make	1000.0 ml

The light emitted and reflected by the sample is picked off at an angle of approximately 45° . The Beckman Model DU spectrophotometer or equivalent is used as the instrument for obtaining the spectral data. The use of a lucite rod (1 inch in diameter and 1 inch long) to transmit the light to the spectrophotometer is optional.

A magnesium carbonate block (resurfaced until comparison with a vitrolite standard at 400 millimicrons reaches a reproducible minimum value) is used as a reference standard.

Measurements are made at thirty wavelength points as the ratio expressed as percent of the energy reflected from the painted sample compared to the energy reflected from the block of magnesium carbonate.

The wavelengths (millimicrons) used are as follows:

422.2	450.1	477.7	541.4	572.5	600.8
432.0	455.9	489.5	544.3	577.4	610.9
435.5	461.2	495.2	551.8	584.8	624.2
438.6	462.0	515.2	561.9	588.7	627.3
444.4	468.7	529.8	564.1	599.6	645.9

The measurements at 435.5, 461.2, 544.3, 564.1, 577.4, 588.7, 599.6, 610.9, 624.2, and 645.9 millimicrons are added together and are multiplied by a factor of 0.098. This is known as X. This is one of the three tristimulus values.

The measurements at 489.5, 515.2, 529.8, 541.4, 551.8, 561.9, 572.5, 584.8, 600.8, and 627.3 millimicrons are added together and are multiplied by a factor of 0.100. This is known as Y. This is the second of the three tristimulus values. It is also known as the Luminance Factor.

The measurements at 422.2, 432.0, 438.6, 444.4, 450.1, 455.9, 462.0, 468.7, 477.7 and 495.2 millimicrons are added together and are multiplied by 0.118. This is known as Z. This is the third tristimulus value.

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When X, Y and Z have been determined the trichromatic coefficient, x, y, z can be calculated from the following expressions:

$$x = \frac{X}{X + Y + Z} \quad y = \frac{Y}{X + Y + Z} \quad z = \frac{Z}{X + Y + Z}$$

The trichromatic coefficients are used to determine dominant wavelength and (excitation) purity by consulting diagrams in Handbook of Colorimetry by Hardy. Each point x, y is found on some wavelength line, while the relative distance of the point from the Source C point corresponds to the excitation purity.

The blue sensitive phototube (where there is a choice) should be used to make all the measurements.

A slit width of 0.1 mm is preferred, but, if necessary, a maximum half-intensity band width of 50 Angstrom units will be permitted.

The selected ordinate method of determining tristimulus value is used. A sample calculated sheet follows:

	R^C (%)		(X)	(Y)	(Z)
422.2	_____	z			_____
430.0	_____	z			_____
435.5	_____	x	_____		
438.6	_____	z			_____
444.4	_____	z			_____
450.1	_____	z			_____
455.9	_____	z			_____
461.2	_____	x	_____		
462.0	_____	z			_____
468.7	_____	z			_____
477.7	_____	z			_____
489.5	_____	y		_____	
495.2	_____	z			_____
515.2	_____	y		_____	
529.8	_____	y		_____	
541.4	_____	y		_____	
544.3	_____	x	_____		
551.8	_____	y		_____	
561.9	_____	y		_____	
564.1	_____	x	_____		
572.5	_____	y		_____	
577.4	_____	x	_____		
584.8	_____	y		_____	
588.7	_____	x	_____		

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			(X)	(Y)	(Z)
599.6		x			
600.8		y			
610.9		x			
624.2		x			
627.3		y			
645.9		x			
		Sum.			
	Multiplier		(.098)	(.100)	(.118)
			X	Y	Z
	Tristimulus Value				
X + Y + Z =	Luminance Factor			Y =	
	Purity			=	
$\frac{X}{X + Y + Z}$ =	Dominant Wave Length, mu			=	
$\frac{Y}{X + Y + Z}$ =	Peak Reflectance				

4.5.4 Accelerated weathering.- The weathering machine used shall be an Atlas XW type open arc Weatherometer operated in accordance with Method 6151 of Federal Test Method Standard No. 141 with the following exceptions:

(a) Successively replace 1 of the 8 Correx D glass filters every 250 hours, rather than replace all 8 filters after 2000 hours or when discolored.

(b) An alternate 20 minute wet and dry cycle shall be used.

(c) The impurities in the water used shall be less than 6 parts per million calculated as NaCl.

4.5.5 Weather resistance.- Weather resistance panels prepared as specified in 4.4 shall be exposed in Southern Florida in accordance with Method 6161 of Federal Test Method Standard No. 141. The exposure period shall be as specified in 3.5.5. Upon any evidence of failure of the paint system, the test shall be immediately terminated.

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4.5.6 Storage stability.-- Filled, closed containers of the pigmented and clear materials shall be stored under warehouse conditions at a temperature of 70° to 90°F. for one year. At the end of the storage period, the containers shall be opened and the materials tested for conformance to the requirements of this specification.

4.5.7 Solvent resistance.-- A panel of the clear overcoat prepared as specified in 4.5.2 shall be air-dried for 72 hours and then partially immersed in mineral spirits (IT-T-291) for 15 minutes. The panel shall then be removed and allowed to recover for 30 minutes and then examined for film irregularities.

4.5.8 Appearance.-- The clear overcoat shall be flowed out on a glass panel and allowed to drain for 15 minutes. The film shall then be examined for conformity with the requirements.

4.5.9 Removability - Panels shall be prepared as specified in 4.4 except that the finish system shall be force dried for 24 hours at 180°F. The panel shall be placed on a rack so that the six-inch dimension forms a 60° angle with the horizontal. Approximately 20 mls of the thoroughly mixed remover (see Table IV) shall be poured on the painted area at a constant rate taking 30 to 35 seconds for the pouring procedure. Allow the remover to act on the coating for 5 minutes. The panel shall be removed from the rack and placed on a clean, dry horizontal surface for scrubbing. The brush used for the scrubbing operation shall be a dry brush, having a block (metal or wood) measuring 1/2 by 1-1/2 by 3-1/2 inches with brush stock of 59 appropriately staggered tufts, each tuft of 50 ± 5 straight 0.091 inch diameter nylon fibers extending 5/8 inch beyond the block. The scrubbing brush shall be weighted with a 5-pound weight and shall be passed over the remover coated areas 10 times with the 1-1/2 inch edges of the brush blocks facing the direction of brushing motion. The panels shall be rinsed under tap water for 1 minute. Place panels on rack and repeat entire operation again. The above test shall be repeated on panels which have been subjected to the required Florida exposure (See 3.5.5).

4.5.10 Anchorage (tape test).-- Duplicate panels prepared as in 4.4 shall be tested as directed in Method 6301 of Federal Test Method Standard No. 141 except that the panels shall be immersed in water for 16 hours.

4.5.11 Lifting test.-- For this test, panels shall be prepared similar to paragraph 4.4 except that the white test paint of Table V shall be applied (2 passes to a total dry film thickness of 1.0 ± 0.3 mil, 1/2 hour air-dry between passes) over the force-dried MIL-L-19537 lacquer. After an air-dry of 2 hours, the white test paint shall be overcoated with the fluorescent paint under test. This coating shall be applied in 3 passes (approximately 1 mil per pass) to a total dry film thickness of 3.0 ± 0.2 mil, 1/2 hour air-dry between passes. At no time, either during application or after a sufficient air-dry, shall the fluorescent coating exhibit cracking, lifting, sagging, or any other film defects.

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TABLE V

WHITE TEST PAINT FORMULA

Ingredients (1)	Weight (grams)	Source of Ingredients
Titanium Dioxide	400	Spec. TT-T-425, Type III
Silica	120	Johns-Manville, Celite 281
Magnesium Silicate	280	Whitaker, Clarke & Daniels SF Talc 399
Polybutylmethacrylate	1336	Acryloid F-10 (40% Solids in a mixture of 9 parts by volume of mineral spirits to 1 part by volume of aromatic naphtha) Rohm & Haas Co., or equivalent
Aromatic Naphtha	370	Spec. TT-N-97, Type I, Grade R
Note (1): The above materials shall be ground for 24 hours in a 1-gallon capacity pebble mill previously filled to about 1/3 of its capacity with approximately 1/2 inch diameter white flint pebbles.		

5. PREPARATION FOR DELIVERY

5.1 Application.— For direct purchases by or direct shipments to the Government, the packaging, packing and marking for shipment shall be in accordance with Specification TT-P-143 and as specified in paragraph 5.2.

5.2 Marking.— Marking of containers shall be in accordance with the provisions of MIL-STD-129. In addition, individual containers shall bear a printed label (with a clear weatherproof overcoating) showing the following information:

Specification MIL-P-21600A(Wep)
 Color or clear overcoating
 Manufacturer's name and batch number
 Date manufactured (month and year)

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The following shall appear on pails of the pigmented coating:

"Directions for Use of Fluorescent Paint

The application instructions are given in Process Specification MIL-P-21698A(Wep) - See this specification for detailed application instructions. Apply over a suitable white undercoating as specified therein.

Thinning Directions for Fluorescent Coating

Thin fluorescent coating to spray consistency by adding approximately 1 volume of naphtha, Specification TT-N-97, Type I, Grade B, to 2 volumes of fluorescent paint (a #4 Ford Cup viscosity of 20-22 seconds).

Application of Fluorescent Coating

Apply approximately 3 mil of paint (.003 inch). Normally 3 wet coats will achieve this thickness. Avoid too thick a coating which will reduce brightness and too thin a coating will reduce its fluorescence life.

Air-Dry for Fluorescent Coating

One-half hour between coats and 4 hours between last coat of fluorescent paint and the first coat of "clear overcoating." Remove overspray by light wiping with a clean tack rag before applying subsequent coats and after last coat of fluorescent paint has been applied.

CAUTION

1. The "clear overcoating" must be used over the fluorescent paint, since it extends the life of the fluorescent paint considerably.
2. Use only clean mixing and spraying equipment. Contaminated equipment will greatly reduce the fluorescent properties of the paint. Use the "clear overcoating" specific for the fluorescent paint. Do not substitute other "clears."
3. Do not use fluorescent coating in areas subject to spillage of aircraft fluids such as fuels and lubricants.
4. Always strain fluorescent coating before using to insure a smooth film free of particles.
5. Fluorescent system cannot be applied over white or non-white MIL-E-7729 or MIL-E-5556 enamel's because of poor adhesion."

The following shall appear on the pails of the "Clear Overcoating":

"Use.- This coating must be used directly over the fluorescent coating. Failure to employ it will greatly reduce the fluorescent life of the coating.

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Thinning Directions.- Thin "clear overcoating" to spray consistency by adding approximately 1 volume of toluene or 1 volume of xylene to 1 volume of package material (a #4 Ford Cup viscosity of 15 seconds).

Application Requirements.- After staining the thinned clear coating through a fine paint strainer, apply approximately 1 mil (.001 inch). Normally, this thickness can be achieved by applying a thin wet coat which is allowed to "set up." This is followed by a full wet coat. If feasible, coating should be permitted to dry at least 24 hours before aircraft is flown to avoid dirt pickup."

6. NOTES

6.1 Intended use.- The paint system conforming to this specification is intended for use as a high visibility finish which can be removed readily with a remover without impairing the underlying permanent protective finish. Fluorescent finishes gradually fade and lose brightness with exposure to sunlight for long periods.

6.2 Solvent sensitivity.- This material is attacked by most solvents, greases, and oils. Placement on aircraft should avoid areas subject to contact with these solvents.

6.3 Cleaning.- Cleaning materials containing organic solvents should not be employed. Use water solutions of Specification MIL-C-18687(Aer) detergent.

6.4 Ordering data.- The material should be purchased by volume, the unit a U. S. Gallon (231 cubic inches at 15.5°C (60°F)). Material shall be procured as a kit in units of one gallon for pigmented and 1/2 gallon for clear. Procurement documents should state the color number and name, the size of the containers in which the paint is to be furnished, and level of packaging and packing required (See Section 5).

6.5 Manufacturing information.

6.5.1 A satisfactory product meeting all requirements of this specification has been made in a Government laboratory, in accordance with the following procedures and formulas outlined in Tables VI and VII. All grinding equipment should be absolutely clean since contamination detracts significantly from the fluorescence.

6.6 Air Force - Navy aircraft color standards.- Air Force - Navy Aircraft Color Standards may be obtained upon application to the Director, Aeronautical Materials Laboratory, Naval Air Material Center, Philadelphia 12, Pennsylvania. Visual matching cannot be relied on for fluorescent colors. These should be checked by spectrophotometric methods for conformance with specification requirements.

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TABLE VI

FLUORESCENT PAINT

Ingredients	Percent by Weight
(1) Fluorescent Pigment	35
(2) Acrylic Resin (40% solution in aliphatic hydrocarbons)	46
(3) Toluene	18
(4) Weathering stabilizer (dihydroxy substituted benzophenone)	1

Method I: Add (1) and (2) to a porcelain pebble mill charged with clean white porcelain pebbles. Dissolve (4) in (3) and add portion of this solution to Mill base to give proper consistency. Grind to required fineness, discharge mill. Add remainder of stabilizer toluene mixture to grind for short time and discharge contents and add to original mill base.

Method II: Grind (1) and (2) on roll mill until sufficiently ground. Dissolve (4) in (3) and add to roll mill base.

TABLE VII

CLEAR OVERCOAT

Ingredients	Percent by Weight
(1) Acrylic Resin (40% solution in toluol)	92
(2) Weathering stabilizer (dihydroxy substituted benzophenone)	2
(3) Toluol	6

While stirring (1), add (2) in small increments. Continue stirring until clear solution is obtained. Discharge contents and rinse container with (3).

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6.7 Provisions for qualification.- With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose 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 Chief, Bureau of Naval Weapons, Department of the Navy, Washington 25, D. C.; however, information pertaining to qualification may be obtained from the Director, Aeronautical Materials Laboratory, Naval Air Material Center, Philadelphia 12, Pennsylvania.

6.7.1 It is to be understood that upon receipt of the letter of authorization, samples shall be furnished at no cost to the Government and that the manufacturer shall pay the transportation charges to and from the designated point where tests are to be made. In the case of failure of the sample or samples submitted, consideration will be given to the request of the manufacturer for additional tests only after it has been clearly shown that changes have been made in the product which the Government considers sufficient to warrant additional tests.

NOTICE: When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.