

MIL-L-46159A (OR)
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 SUPERSEDING
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MILITARY SPECIFICATION

LACQUER, ACRYLIC, LOW REFLECTIVE

This specification is approved for use by the Army Materials and Mechanics Research Center, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers two types of low reflective acrylic lacquer for aircraft and is suitable for use under air pollution regulations.

1.2 Classification. Lacquer covered by this specification shall be of the following types, as specified:

- Type I - Spray application.
- Type II - Pressurized dispenser application.

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 this specification to the extent specified herein:

SPECIFICATIONS

Federal

QQ-A-250/3	-Aluminum Alloy Alclad 2024, Plate and Sheet.
TT-B-1325	-Beads (glass spheres); Retro-Reflective.
TT-P-458	-Pigment, Yellow-Iron-Oxide; Hydrated, Synthetic, Dry.
TT-S-735	-Standard Test Fluids, Hydrocarbon.
TT-T-291	-Thinner-Paint, Volatile Spirits Petroleum Spirits.
CCC-C-458	-Cloth, Flannel, Cotton.
FFP-P-1892	-Paint, Varnish, Lacquer, and Related Materials, Packaging, Packing, and Marking of.
FFP-T-60	-Tape: Packaging, Waterproof.

FSC 8010

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Army Materials and Mechanics Research Center, Watertown, MA 02172 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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Military

MIL-L-2104	-Lubricating Oil, Internal Combustion Engine, Tactical Service.
MIL-C-3341	-Chemical Conversion Coatings on Aluminum and Aluminum Alloys.
MIL-C-851A	-Coating Compound, Metal Pretreatment, Resin-Acid.
MIL-P-13328	-Primer (Wash), Pretreatment, Blue (Formula No. 117-B for Metals).
MIL-C-22751	-Coating System, Epoxy-Polyamide, Chemical and Solvent Resistant; Process for Application of.
MIL-P-23377	-Primer Coating, Epoxy-Polyamide, Chemical and Solvent Resistant.
MIL-C-81706	-Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys.

STANDARDS

Federal

FED. TEST METHOD STD. No. 141.	-Paint, Varnish, Lacquer, and Related Materials; Methods of Inspection, Sampling, and Testing.
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PUBLICATIONS

Air Force Manual

AFM 71-4 (TM 38-250; NAVSUP Pub 505; DSAM 4145.3; MCO P4030.19) - Packaging and Materials Handling: Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft.

(Copies of specification, standards, 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 documents form 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.

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D 362 -Consistency of Paints Using the Stormer Viscosimeter.
- D 1014 -Conducting Exterior Exposure Tests of Paints On Steel.
- D 1200 -Viscosity of Paints, Varnishes and Lacquers by Ford Viscosity Cup.
- D 1210. -Fineness of Dispersion of Pigment-Vehicle System.
- D 1296 -Odor of Volatile Solvents and Diluents.
- D 1308 -Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- D 1364 -Water in Volatile Solvents (Fischer Reagent Titration Method).
- D 1644 -Standard Methods of Test for Nonvolatile Content Of Varnishes.
- D 2698 -Determination of the Pigment Content of Solvent-Type Paints by High-Speed Centrifuging.
- E 167 -Goniophotometry of Reflecting Objects and Materials.

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

SOUTHERN CALIFORNIA - AIR POLLUTION DISTRICT

Rule 442 - Use of Solvents. .

(Application for copies should be addressed to Southern California - Air Pollution Control District, 9420 Talstar Avenue El Monte, CA.91731).

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI Z129.1 - Hazardous Industrial Chemicals, Precautionary Labeling of.

(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018).

NATIONAL BUREAU OF STANDARDS (NBS)

NBS Standard No. 316

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20502).

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

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3. REQUIREMENTS

3.1 Qualification. The lacquer furnished under this specification shall be a product which is qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 6.4). Any change in the formulation of a qualified product will necessitate its qualification. The material supplied under the contract shall be identical, within manufacturing tolerances, to the product receiving qualification.

3.2 Color. The color of the lacquer shall be Aircraft Green or Black and shall match the color chips furnished by this agency when tested as in 4.4.4 (see 6.4).

3.3 Composition.

3.3.1 Pigment. The hiding pigments for Aircraft Green shall be yellow iron oxide, red iron oxide, carbon black, and black iron oxide; for black the hiding pigment shall be carbon black. Hiding pigments shall be chemically pure and free from extenders. Small amounts of other shading pigments may be used when necessary to match the color, provided these pigments have good color permanence. Extender pigments shall be a combination of crystalline and diatomaceous silica and shall not exceed the amount specified in Table III. Glass beads for black shall conform to TT-3-1323, Type I, Grade B, and shall not exceed the amount specified in Table III. The infrared spectrum of the pigment when tested as in 4.4.7.2 shall closely match the spectrum of Figure 1 and shall show no additional absorption bands.

3.3.2 Vehicle.

3.3.2.1 Nonvolatile vehicle. The nonvolatile vehicle shall conform to the requirements of Table I when analyzed as in 4.4. The infrared spectrum of the nonvolatile vehicle when tested as in 4.4.5 shall closely match the spectrum of Figure 2.

Table I. Nonvolatile vehicle

Material	Percent by weight	
	Minimum	Maximum
Acrylic resins ¹	94	96
Plasticizer ²	4	6

¹ A one-to-one blend, by weight of a methyl methacrylate polymer and a methyl methacrylate copolymer (see 6.5).

² Butyl benzyl phthalate.

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3.3.2.2 Volatile vehicle. The volatile portion of the lacquer shall consist of the solvents in Table II. When Type I is analyzed in accordance with 4.4 the volatile portion of the lacquer shall conform to the requirements of Table II.

Table II Quantitative Requirements of Volatile Portion ^{1/}

Material	Percent By Weight	
	Minimum	Maximum
Anhydrous Ethanol	—	25
Esters	19	—
Methyl Ethyl Ketone	14	—
Aliphatic Hydrocarbons (Exempt Type)	—	9
Cellulosolve Acetate	—	17
Toluene	—	19

- ^{1/}
- (a) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethyl benzene: 8 percent maximum.
 - (b) Ethyl benzene and toluene: 20 percent maximum.
 - (c) Total of a + b: 20 percent maximum.

3.3.3 Propellant (Type II). The propellant shall be a hydrocarbon or blend of hydrocarbons and/or halogenated hydrocarbon (s) as required to assure that the lacquer conforms to the requirements as specified herein. Vinyl chloride shall not be used in these products.

3.4 Dispenser (Type II)

3.4.1 Container. Container shall be a nominal 16 ounce commercial type metal pressure container, generally known as an aerosol container, of construction as to assure acceptance of the finished package by common carriers operating in interstate commerce. The capacity of the container shall be sufficient to contain the specified solids content of the lacquer with outage in accordance with generally recognized safe commercial practice.

3.4.2 Dispensing valve. The dispensing valve shall have a spray head which can be removed without releasing pressure from the aerosol. The valve shall have a metering orifice accessible to cleaning with a common pin after removal of the spray head. The removable spray head shall contain orifices of such dimensions as to produce spraying properties as required in 3.6.5.2. The lower end of the dip tube shall have a maximum clearance of 1/8 inch from the bottom ring of the can after storage for 1 week in the product. (This allows for swelling of the tube).

3.4.3 Agitator. Each dispenser shall contain one spherical agitator either 3/8, 5/8, or 3/4 inch in diameter or the equivalent volume in smaller spheres, or one to more rivets of irregularly shaped form made of materials chemically nonreactive to mild acids or bases. For example a glass marble or plated steel ball or balls.

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3.4.4 Cover cap. The valve shall be protected from accidental functioning and damage by a rigid fitting metal cover cap which shall be removable and replaceable.

3.4.4.1 The color of the cover cap shall be an approximate match to the color of the lacquer.

3.4.5 Unless otherwise specified, Type II aerosol containers shall meet the requirements of Paragraph 9-7C of Air Force Manual 71-4 for air shipment of materials.

3.5 Quantitative requirements. The lacquer shall conform to the requirements in Table III when tested as in 4.4.

Table III Quantitative Requirements

	Requirements	
	Minimum	Maximum
Total Solids		
Aircraft Green		
Type I, percent by weight of lacquer	46	—
Type II, weight in grams of solid net contents	35	—
Black		
Type I, percent by weight of lacquer	45	—
Type II, weight in grams of solid net contents	35	—
Pigment		
Aircraft Green		
Type I, percent by weight of lacquer	25	—
Type II, percent by weight of nonvolatiles	54	57
Black		
Type I, percent by weight of lacquer	25	—
Type II, percent by weight of nonvolatiles	55	58
Extender pigment, percent by weight of total pigment		
Aircraft Green	—	70
Black - Extender Pigment	—	63
Glass Beads	19	20
Vehicle Solids		
Aircraft Green		
Type I, percent by weight of lacquer	21	—
Type II, percent by weight of nonvolatiles	45	48

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Table III. Quantitative Requirements (Cont'd)

	Requirements	
	Minimum	Maximum
Black		
Type I, percent by weight of lacquer	20	—
Type II, percent by weight of nonvolatile	44	47
Water, percent by weight of lacquer	—	1.0
Coarse particles and skins, percent by weight of pigment	—	1.0
Hiding power (contrast ratio)	0.98	—
60 degree specular gloss	—	0.5
85 degree specular gloss (sheen)	—	0.5
Infrared reflectance, percent	—	7
Specular reflectance, Black	Table IV	
Viscosity (Type I)		
Package, Krebs Stormer shearing rate - 200 rpm	82	92
Reduced, No.4 Ford cup, seconds	10	20
Fineness of grind		
Hegman	—	0
ASTM, Microns	100	—
Drying time, air-drying dry hard, minutes	—	40
Pressure (Type II) psig at 75° F.	35	45

Table IV. Specular Reflectance for Black

Incident Angle Degrees	Viewing Angle Degrees	Reflectance Maximum
20	45	2.60
10	45	2.70
0	45	2.95
-10	45	3.20
-20	45	3.60
-30	45	4.20
-40	45	5.25
-45	45	5.80
-50	45	6.50
-55	45	7.30
-60	45	8.25
-70	45	10.50

3.6 Qualitative performance.3.6.1 Condition in container.

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3.6.1.1 Type I. The lacquer, tested in 4.4.15.1, shall be free from grits, seeds, skinning, or livering in a freshly opened fill container and shall show no more pigment settling or caking than can be easily and completely reincorporated to a smooth homogeneous state.

3.6.1.2 Type II. When tested as in 4.4.15.2, the lacquer shall be easily redispersed and shall meet the requirements of 3.6.5.2.

3.6.2 Storage stability.

3.6.2.1 Type I. The lacquer shall show no skinning, livering, curdling, hard caking, or tough gummy sediment when tested as in 4.4.16.1. It shall remix readily to a smooth homogeneous state and meet all other requirements of this specification.

3.6.2.2 Type II. When tested as in 4.4.16.2, the aerosol shall meet all requirements of this specification.

3.6.3 Accelerated storage stability (Type II). When tested as in 4.4.17, the lacquer shall conform to the requirements of 3.6.1.2.

3.6.4 Odor. The odor of the wet lacquer and of the film at any interval of drying shall not be obnoxious or objectionable.

3.6.5 Spraying properties.

3.6.5.1 Type I. The lacquer, tested as in 4.4.18.1, shall spray satisfactorily in all respects and shall show no running, sagging, stracking, or blushing. The dried film shall show no dusting, mottling, or color separation, and shall present a uniform lusterless finish free from seeds.

3.6.5.2 Type II. When tested as in 4.4.18.2, the dispenser shall deliver a spray of normal particle size. Overspray shall not be excessive. The spray pattern shall be such as to deposit a uniform coating on a smooth vertical surface. The film shall dry free of grit, seeds, streaks, orange peel, sags, or any surface irregularity. The color shall acceptably match the standard color chip.

3.6.6 Valve operation (Type II). When tested as in 4.4.19, the valve shall operate without excessive finger pressure. It shall close immediately without sputtering or interruption. The valve shall not clog nor collect heavy deposits around the orifices.

3.6.7 Coating anchorage. A film of lacquer tested as in 4.4.20, shall cut loose in the form of a ribbon with outflaking or separation from the primer.

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3.6.8 Adhesion tape test. A film of lacquer tested as in 4.4.21, shall show no removal beyond 1/16 inch on either side of the score line.

3.6.9 Resistance to heat. A film lacquer tested as in 4.4.22, shall show no increase in gloss, sheen, or excessive color change from a panel prepared at the same time but not exposed.

3.6.10 Polish resistance. A film of lacquer tested as in 4.4.23, shall have maximum 60 and 85 degree specular gloss of 5.

3.6.11 Water resistance. A film of lacquer tested as in 4.4.24, shall show no wrinkling or blistering immediately after removal of the panel from the water. The lacquer shall be no more than slightly affected when examined 2 hours after removal. After 24 hours air drying, the portion of the panel which was immersed shall be almost indistinguishable with regard to hardness, color, and gloss from a panel prepared at the time but not immersed.

3.6.12 Hydrocarbon resistance. A film of lacquer tested as in 4.4.25, shall show no wrinkling or blistering immediately after removal of the panel from the fluid. The lacquer shall be no more than slightly affected when examined 2 hours after removal. After 24 hours air-drying, the portion of the panel which was immersed shall be almost indistinguishable with regard to hardness, color, and gloss from a panel prepared at the same time but not immersed.

3.6.13 Lubricating oil resistance. A film of lacquer tested as in 4.4.26, shall show no 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. After 24 hours air drying, the portion of the panel which was immersed shall be almost indistinguishable with regard to hardness, color, and gloss from a panel prepared at the same time but not immersed.

3.6.14 Weather resistance. A film of lacquer tested as in 4.4.27, shall show no checking, cracking, or appreciable film deterioration. There shall be no more than light chalking (No. 6 Method 6411 of FED. TEST METHOD STD. No. 141). The film shall show no excessive change in value or chroma and no change in hue. After removal of any chalking which has occurred, the original color shall be substantially restored and the washed area shall show no more than slight fading or darkening.

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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 the prescribed requirements.

4.2 Sampling, inspection, and testing. Unless otherwise specified, sampling, inspection, and testing shall be in accordance with Section 1000 of FED. TEST METHOD STD. No. 141.

4.3 Classification of tests. Testing under this specification shall be for the purpose of:

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

4.3.1 Qualification testing shall consist of tests for all requirements specified in Section 3 (see 6.4).

4.3.2 Acceptance tests shall normally consist of tests for all requirements specified in Section 3 with the exception of storage stability in a full container (see 3.6.2) and weather resistance (see 3.6.14).

4.4. Test methods.

4.4.1 Test conditions. The routine and reference test conditions shall be in accordance with Section 7 of FED. TEST METHOD STD. No. 141 except as otherwise specified herein.

4.4.2 Test panels. Except as otherwise specified, all panels used for test purposes shall be aluminum-clad aluminum alloy conforming to QQ-A-250/5. The panels shall be 0.020 by 3 by 6 inches in size, and treated with materials conforming to MIL-C-81706 to produce coatings conforming to MIL-C-5541 and finished as follows: Spray panels with one cross-coat of epoxy-polyamide primer; MIL-P-23377, and air-dry for 3 hours; dry film thickness shall be 0.6 to 0.8 mil. Apply one cross-coat of the Lacquer under test to a total dry film thickness of 1.4 to 1.7 mils. Unless otherwise specified, air-dry panels for 1 week before testing.

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4.4.3..The following tests shall be conducted in accordance with applicable methods of FED. TEST METHOD STD. No. 141 or as hereinafter specified. The right is reserved to make any additional tests deemed necessary to determine that the lacquer meets the requirements of this specification.

Table V Index

Tests	Test Method		Paragraph of this specification giving further references	Paragraph of this specification giving requirements
	Applicable method in FED. TEST METHOD STD. No. 141	Applicable ASTM TEST METHOD		
Color	4250	—	4.4.4	3.2
Resins, acrylic	—	—	4.4.5	3.3.2.1
Plasticizer	7371	—	—	3.3.2.1
Solvent	7360	—	—	3.3.2.2
Total Solids				
Type I	—	D 1644	—	Table III
Type II	—	—	4.4.6.4	Table III
Pigment Content				
Type I	—	D 2698	—	Table III, 3.3.1
Type II	—	—	4.4.6.2	Table III, 3.3.1
Vehicle Solids				
Type I	—	D2698, D1644	—	Table III
Type II	—	—	4.4.6.3	Table III
Extender Pigment, Total	5271	—	4.4.7.1	Table III
Extender Pigment, Analysis	—	—	4.4.7.2	Table III
Water	—	D1364	—	Table III
Coarse particles and skins	4092	—	—	Table III
Hiding power (contrast ratio)	4122	—	4.4.8	Table III
60 degree specular gloss	6101	—	4.4.9	Table III
85 degree specular gloss (sheen)	6103	—	4.4.10	Table III
Infrared reflectance percent	6242	—	4.4.11	Table III
Specular Reflectance Black	—	E 167	4.4.12	Table III, IV

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Table V. Index (Cont'd)

Tests	Test Method		Paragraph of this specification giving further references	Paragraph of this specification giving requirements
	Applicable method in FED. TEST METHOD STD. No. 141	Applicable Method		
Viscosity (Type I)	---	---	---	Table III
Package	---	D 562	---	Table III
Reduced	---	D 1200	4.4.13	Table III
Fineness of grind	---	D 1210	---	Table III
Drying time	3061	---	---	Table III
Dry hard	3061	---	---	Table III
Pressure, Type II	---	---	4.4.14	Table III
Condition in Container				
Type I	3011	---	4.4.15.1	3.6.1.1
Type II	---	---	4.4.15.2	3.6.1.2
Storage Stability				
Type I	3022	---	4.4.16.1	3.6.2.1
Type II	3022	---	4.4.16.2	3.6.2.2
Accelerated stability (Type II)	---	---	4.4.17	3.6.3
Odor	---	D 1296	---	3.6.4
Spraying Properties				
Type I	4131, 2131	---	4.4.18.1	3.6.5.1
Type II	---	---	4.4.18.2	3.6.5.2
Valve operation	---	---	4.4.19	3.6.6
Coating anchorage	6304	---	4.4.20	3.6.7
Adhesion tape test	---	---	4.4.21	3.6.8
Resistance to heat	---	---	4.4.22	3.6.9
Polish resistance	---	---	4.4.23	3.6.10
Water resistance	---	D1308	4.4.24	3.6.11
		Sec. 3.4		
Hydrocarbon resistance	---	D1308	4.4.25	3.6.12
Lubricating oil resistance	---	Sec. 3.4	4.4.26	3.6.13
Weather resistance	---	D1014	4.4.27	3.6.14

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4.4.4 Color. In accordance with Method 4250 of FED. TEST METHOD STD. No. 141, compare the specified color with the film of lacquer on white car-rara glass prepared for the hiding power test and observe for compliance with 3.2. Spray Type II to full hiding on a Black and White Morast card and observe for compliance with 3.2.

4.4.5 Vehicle analysis. Determine the infrared spectrum of the iso-lated vehicle by vacuum oven drying a film of the vehicle for 30 minutes on a rock salt plate. Compare the spectrum with that of Figure 2 for compliance with 3.3.2.

4.4.6 Analysis of Type II.

4.4.6.1 Total nonvolatile. Remove the cap, spray nozzle, and paper label from the aerosol pressure can and clean the sides of the can. Weigh on a balance of sufficient capacity having a minimum sensitivity of 0.05 gram. Shake thoroughly for a minimum of 15 minutes. As soon as possible after agitation, spray to clear dip tube and valve, then remove 1 to 5 grams with the appropriate sampling device as illustrated in Figure 4 and 5. The sampler in Figure 4 is for use on cans having a recessed outlet; those with protruding outlets require the device shown in Figure 5. Support the sample can at a 45 degree angle, attach the sampler with the perforated ventholes held in a topside position, then press down with the valve or rod quickly and firmly for approximately 1 second. Disengage the sampling device and rinse the contents into a weighed beaker with acetone. If a small amount of the paint spills onto the sample can, rinse that portion also into the beaker. Evaporate the sample in a water bath under a gentle stream of air to low volume then transfer to an oven at 105°C for 1 hour. Cool the beaker in a desiccator and weigh. Re-weigh the aerosol can and calculate the percent total nonvolatile. Repeat for a duplicate determination.

Total nonvolatile

$$\% = \frac{\text{Gain in weight of the beaker} \times 100}{\text{Loss in weight from the sample can}}$$

Use to calculate total solids in 4.4.6.4.

4.4.6.2 Percent pigment. Repeat the procedure followed in 4.4.6.1, substituting weighed centrifuge tubes for beakers and withdrawing 5 to 10 gram samples. Extract three times in a centrifuge using acetone as solvent. Dry and weigh the centrifuge tubes and calculate the percent pigment. Check for compliance with Table III.

$$\% \text{ Total Pigment} = \frac{\text{Grams of pigment} \times 100}{\text{Weight of sample} \times \frac{\% \text{ total nonvolatile}}{100}}$$

Collect the supernatant liquid and reduce the volume to a workable level using a steam bath or other suitable method. Save for vehicle analysis, 4.4.5.

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4.4.6.3 Vehicle solids. Determine the percent of vehicle solids using the result obtained in the total pigment determination. Check for compliance with Table III.

$$Z \text{ vehicle solids} = 100 - X \text{ total pigment}$$

4.4.6.4 Total solids (Type II). Chill the aerosol can with the remaining sample from 4.4.6 in the freezing compartment of a refrigerator for an hour or longer and puncture the bottom of the can with a can opener. Drain out the sample and rinse with acetone until clean. Dry with a current of air or in an oven and weigh the empty can. Subtract this weight from the first weight recorded in the total solids determination (4.4.6.1) and calculate the total net contents in grams. Determine the total solids content in grams using Z total nonvolatile from 4.4.6.1. Check for compliance with Table III.

4.4.7 Extender pigment.

4.4.7.1 Total extender pigment content. Determine matter insoluble in acid in the extracted pigment by Method 5271 of FED. TEST METHOD STD. No. 141.

4.4.7.2 Extender pigment analysis. The infrared spectrum of a potassium bromide disc of the pigment prepared from approximately 1 mg of pigment and 200 mg of potassium bromide shall show the extender to be composed of only crystalline and diatomaceous silica. It will closely match the spectrum illustrated in Figure 1 and will show no additional absorption bands.

4.4.8 Hiding power (contrast ratio). Determine the contrast ratio in accordance with Method 4122 of FED. TEST METHOD STD. No. 141. Use a film applicator that will deposit a 3-inch-wide film with a dry film thickness of 0.0020 inch maximum. Air-dry the lacquer for at least 24 hours, determine the reflectance and verify the film thickness in the area in which the reflectance was measured. Calculate the contrast ratio and check for compliance with the requirements of Table III.

4.4.9 60 degree specular gloss. Draw down the lacquer using a 0.003 inch (0.006 inch gap clearance) film applicator. Test as in Method 6101 of FED. TEST METHOD STD. No. 141 for compliance with Table III.

4.4.10 85 degree specular gloss (sheen). Draw down the lacquer using a 0.003 inch (0.006 inch gap clearance) film applicator. Test as in Method 6103 of FED. TEST METHOD STD. No. 141 for compliance with Table III.

4.4.11 Infrared reflectance. Determine infrared reflectance in accordance with Method 6242 of FED. TEST METHOD STD. No. 141 on the white carbara glass panel prepared for the hiding power test (see 4.4.9). Observe for compliance with Table III using a Wratten 87 filter.

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4.4.12 Specular Reflectance for Black. Prepare two panels as in 4.4.2 and allow to air dry 48 hours. Determine the goniophotometric reflectance in accordance with ASTM Method E167 except paragraphs 5.3.1 and 6.1 shall be changed as follows:

5.3.1 For nonrecording instruments take readings using the green filter at each 10 degree interval from +20 to -70 degrees and also the -45 and -55 degree incident angles.

6.1 Calculate the average sample reading (R_i) for each specimen at each incident angle. Calculate a factor (F_s) by dividing the 0-45 degree reflectance standard value in percent by the value the goniophotometer was adjusted to read for the reference standard. The goniophotometric data (G_d) for each incident angle is calculated by multiplying the average sample reading (R_i) by the reference standard factor (F_s).

Check the values for compliance with Table IV.

4.4.13 Viscosity (reduced). Reduce 1 part by volume of lacquer with 1-1/2 parts by volume of thinner conforming to Table VI. Test as in Method 4282 of FED. TEST METHOD STD. No. 141. Check for compliance with Table III.

Table VI Exempt Thinner

Ingredient	Percent by Volume
n-Butyl Acetate	25
Anhydrous Ethanol	26
Aliphatic Hydrocarbons (Exempt Type)	27
Toluene	18
Butyl Cellosolve	4

4.4.14 Pressure (Type II). Determine the pressure of the system at the outer orifice for compliance with Table III using a standard type pressure gage fitted with a suitable adaptor. Condition the aerosol container for 3 hours in a water bath at $75 \pm 2^\circ\text{F}$ before testing.

4.4.15 Condition in container.

4.4.15.1 Type I. Determine package condition for acceptance testing in accordance with Method 3011 of FED. TEST METHOD STD. No. 141. For qualification testing, determine pigment settling or caking as follows: Proceed as in Method 3011 of FED. TEST METHOD STD. 141, but do not stir. Baseal and then agitate the can for 3 minutes on a paint shaker^{1/}. On re-examination of the contents, the disclosure of any gel bodies or dispersed pigment indicates unsatisfactory settling properties. Observe for compliance with 3.6.1.1.

^{1/}An apparatus of this type, powered by 1/4-hp motor, operates at a rate of 1350 shakes per minute, and is manufactured by Red Devil Tools, Irvington, N.J.

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4.4.15.2 Type II. Shake the aerosol container until the agitator moves freely inside of can and mix contents thoroughly. Spray the lacquer as in 4.4.15.2 and check for compliance with 3.6.1.2.

4.4.16 Storage stability.

4.4.16.1 Type I. In accordance with Method 3022 of FED. TEST METHOD STD. No. 141, allow a full standard quart can of the packaged lacquer to stand undisturbed for 1 year and then examine the contents. Evaluate pigment settling or caking as in 4.4.15, but agitate the can for 5 minutes on the paint shaker prior to re-examination. Determine viscosity and make other applicable tests for compliance with 3.6.2.1.

4.4.16.2 Type II. In accordance with Method 3022 of FED. TEST METHOD STD. No. 141, allow an aerosol container of the lacquer to stand undisturbed for 6 months, then examine for compliance with 3.6.2.2.

4.4.17 Accelerated storage stability (Type II). Place an aerosol container of the lacquer in a water bath maintained at $120^{\circ} \pm 50^{\circ}$ for 14 days. At the end of this period, remove, cool to room temperature and examine for compliance with 3.6.3.

4.4.18 Spraying properties.

4.4.18.1 Type I. Reduce the lacquer as in 4.4.13 and spray one coat to a total dry film thickness between 0.0015 and 0.002 inch. Allow the panel to air-dry for 24 hours in a nearly vertical position and examine for compliance with 3.6.3.1.

4.4.18.2 Type II. Spray the lacquer on a steel panel set at an angle of approximately 15 degrees from the vertical by holding the dispenser in an upright parallel position to the panel at a distance of 10 to 12 inches. With the valve fully open move the dispenser horizontally from one side of the panel to the other. Spray in overlapping horizontal strokes from the top to the bottom of the panel. Apply two thin coats (each coat between 0.0004 and 0.0006 inch dry film thickness) one after the other. The second coat shall be applied by spraying vertically in overlapping strokes. After application of the second coat, place the panel in a vertical position, allow to dry 30 minutes, and examine for compliance with 3.6.3.2.

4.4.19 Valve operation (Type II). Spray from the dispenser with the valve fully open for 15 seconds, once per day, on any 7 days over a period of 10 days and observe for compliance with 3.6.6.

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4.4.20 Coating anchorage. Panels prepared as in 4.4.2 shall be air-dried for 48 hours and then tested in accordance with Method 6304 of FED. TEST METHOD STD. No. 141 for compliance with 3.6.7.

4.4.21 Adhesion tape test. Prepare two panels as in 4.4.2. Air-dry for 72 hours and partially immerse for 24 hours in distilled water, at a temperature of $23^{\circ} \pm 1.1^{\circ}\text{C}$ ($73.5^{\circ} \pm 2^{\circ}\text{F}$), in accordance with Method 6011 of FED. TEST METHOD STD. No. 141. Remove from water and wipe dry with a soft cloth. Score a line through to the metal across the width of the previously immersed film using a sharp pointed knife. The film shall then be taped perpendicular to and across the score line with waterproof, pressure-sensitive adhesive tape (3/4 inch wide) conforming to PFP-T-60, Type IV. 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. Allow 10 seconds for the test area to return to room temperature. Grasp a free end of the tape and at a rapid speed, strip it from the specimen by pulling the tape back upon itself at 180 degrees. Observe the specimen for compliance with 3.6.8.

4.4.22 Resistance to heat. Panels prepared as in 4.4.2, shall be heated in a circulating oven at $176^{\circ} \pm 2^{\circ}\text{C}$ ($350^{\circ} \pm 4^{\circ}\text{F}$) for 24 hours and examined for compliance with 3.6.9.

4.4.23 Polish resistance.

4.4.23.1 Test apparatus. The apparatus^{3/} shall consist of an electrically operated straight line, reciprocating washability and abrasion machine with an abrasion boat attachment. The abrasion boat shall approximate 3-1/2 by 2-1/8 inches at the base and weigh 4-1/2 pounds including added weights. The abrasion boat shall have a spindle located at each end to retain the roll of polishing cloth and a vertical pin by which it is attached to the driving cord. A roll of 5.0 ounce flannel cloth, 1-3/4 inches wide, conforming to CCC-C-458, Type I, shall be attached to the spindles for this test. The length of the stroke shall approximate 13 inches. The speed shall approximate 37 cycles (74 strokes) per minute.

4.4.23.2 Polishing medium. The polishing medium shall consist of the following by weight:

50 parts synthetic yellow iron oxide (TI-P-458, Type III, or NBS Standard No. 316).

100 parts SAE-10 engine oil conforming to MIL-L-2104.

^{2/} A roller of this type is available from the Pressure Sensitive Tape Council, 1201 Waukegan Road, Glenview, Illinois 60025.

^{3/} An apparatus of this type powered by a 1/2-hp explosion-proof motor, is manufactured by the Gardner Laboratories, Inc., Bethesda, Maryland.

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4.4.23.3 Test procedure.

4.4.23.3.1 Draw down a 2 inch wide film of lacquer with a 0.003 inch (0.006 inch gap clearance) doctor blade on a 6 by 17 inch glass panel prepared and cleaned as in Method 2021 of FED TEST METHOD STD. No. 141. Air-dry the specimen for 72 hours and then apply a 0.002 inch film of the polishing medium over the lacquer area of the test specimen.

4.4.23.3.2 Condition the flannel cloth by drawing down a 2 inch wide film of the polishing medium with a 0.002 inch (0.004 inch gap clearance) doctor blade on a 6 by 17 inch glass panel. Clamp the glass panel on the abrasion apparatus so the film is centered with the polishing stroke, and run the apparatus for 10 cycles (20 strokes). Use a new flannel cloth for each test.

4.4.23.3.3 Remove the glass panel used to condition the flannel cloth and replace with the specimen test panel from 4.4.23.3.1. Run the apparatus for 100 cycles (200 strokes). Remove the panel, rinse with enamel thinner conforming to TT-I-291, Grade 1 and wash with a soft sponge or cloth using yellow laundry soap and water. Dry thoroughly, determine gloss and sheen of the area in the center of the panel by Methods 6101 and 6103 of FED. TEST METHOD STD. No. 141, and check for compliance with 3.6.10.

4.4.24 Water resistance. Panels, prepared as in 4.4.2 shall be immersed in distilled water in accordance with ASTM Method D1308, Sec. 5.4 for 24 hours at room temperature. After removal from water, the lacquer shall be examined for compliance with 3.6.11.

4.4.25 Hydrocarbon resistance. Panels prepared as in 4.4.2 shall be immersed in test fluid conforming to type III of TT-g-735 at room temperature, for 4 hours, in accordance with ASTM Method D1308, Sec. 5.4. After removal from the fluid examine for compliance with 3.6.12.

4.4.26 Lubricating oil resistance. Panels prepared as in 4.4.2 shall be immersed in diester lubricating oil composed of 95 percent di-2-ethyl-hexyl sebacate, and 5 percent tricresyl phosphate at a temperature of $127^{\circ} \pm 2^{\circ}\text{C}$ ($260^{\circ} \pm 4^{\circ}\text{F}$) for 20 hours followed by 2 hours at $162^{\circ} \pm 2^{\circ}\text{C}$ ($323^{\circ} \pm 4^{\circ}\text{F}$). The film shall be cleaned immediately after removal with detergent and water, mineral spirits, or aliphatic naphtha. Four hours after removal, the panels shall be examined for compliance with 3.6.13.

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4.4.27 Weather resistance. Prepare two 4 x 12 inch test panels as in 4.4.2. Air-dry for 1 week and place on outdoor exposure for 18 months at an angle of 45 degrees south in the climate of Washington, D.C. in accordance with ASTM Method D 1014. At the conclusion of the exposure period test the panels for compliance with 3.6.14.

4.5 Inspection of packaging. Packaging inspection shall be in accordance with the quality assurance provisions of documents referenced herein in Section 5.

5. PACKAGING.

5.1 Packing. The lacquer shall be furnished in 16-ounce pressurized dispensers, 1-quart, 1-gallon, 5-gallon or 55-gallon containers as specified (see 6.2). Packaging and packing shall be in accordance with PPP-P-1892. Packaging shall be Level A or C and packing shall be Level A, B or C as specified (see 6.2).

5.2 Marking (Type I). The containers shall be marked in accordance with PPP-P-1892. In addition, each container shall be legibly marked with the following instructions for use:

INSTRUCTIONS FOR USE:

This lacquer should be applied over epoxy primer, MIL-P-23377, with or without pretreatment coating, MIL-C-8514 or MIL-P-15328. The primer MIL-P-23377, shall be mixed and applied in accordance with MIL-C-22751. A cross-coat of primer, 0.6 to 0.9 mil dry-film thickness, shall be applied and allowed to dry 2 or 3 hours before the application of the topcoat lacquer at 1.4 to 1.7 mils dry film thickness.

Thinning directions: For spray application the manufacturer shall include on the label, thinning recommendations and solvent blend.

5.2.2 Type II. Each aerosol container shall be conspicuously labeled per ANSI Z129.1 to indicate the toxicity, flammability, and reactivity. The marking shall include this warning: CAUTION. Flammable liquid. No smoking. During application avoid skin contact and inhalation of vapors. If lacquer gets in eyes, flush with copious amounts of water and seek medical attention. Do not apply without adequate ventilation. Do not ingest.

6. NOTES

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6.1 Intended use. The lacquer is intended to provide a nonspecular surface for aircraft. It is also formulated for resistance to diester lubricating oil. The lacquer is intended for spray application over epoxy polyamide type primer, MIL-P-23377.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type required (see 1.2).
- (c) Size of container required (see Section 5).
- (d) Level of packaging and packing required (see Section 5).

6.3 The lacquer covered by this specification should be purchased by volume, the unit being 1 U. S. liquid gallon of 231 cubic inches at 20°C (68°F).

6.4 Qualification. With respect to product 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 the contractors is called to this requirement, and manufacturers are urged to arrange to have the product 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 Organic and Chemical Coatings Research Group, Lab 9000, DRYFS-70, USA Mobility Equipment and Development Command, Fort Belvoir, Virginia 22060. Color chips and information pertaining to qualification of products may be obtained from that activity.

6.5 The following acrylic resins when blended one-to-one on a solids basis (see Table I) have produced lacquers conforming to this specification.

Material	Percent Solids	Polymer Properties	
		T _g ° C	Tukon Hardness KHN
Methyl Methacrylate Copolymer	100	105	21-22
Methyl Methacrylate Copolymer	100	60	15-16

6.6 The following pigment combination has produced an Aircraft Green lacquer conforming to this specification. However, the Government assumes no responsibility for the acceptance of a product claimed to be manufactured under the identical pigmentation.

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AIRCRAFT GREEN PIGMENTATION

Yellow Iron Oxide	14.9 lbs.
Red Iron Oxide	2.0 lbs.
Black Iron Oxide	7.8 lbs.
Carbon Black	5.1 lbs.
Crystalline Silica	48.2 lbs.
Diatomaceous Silica	20.6 lbs.
Organo Montmorillonite	<u>1.4 lbs.</u>
	100.0 lbs.

Custodian:

Army - MR

Review activity:

Army - AV

User activity:

Army - ME

Preparing activity:

Army - MR

Project No. 8010-A107

HTL-L-46159A (REV)

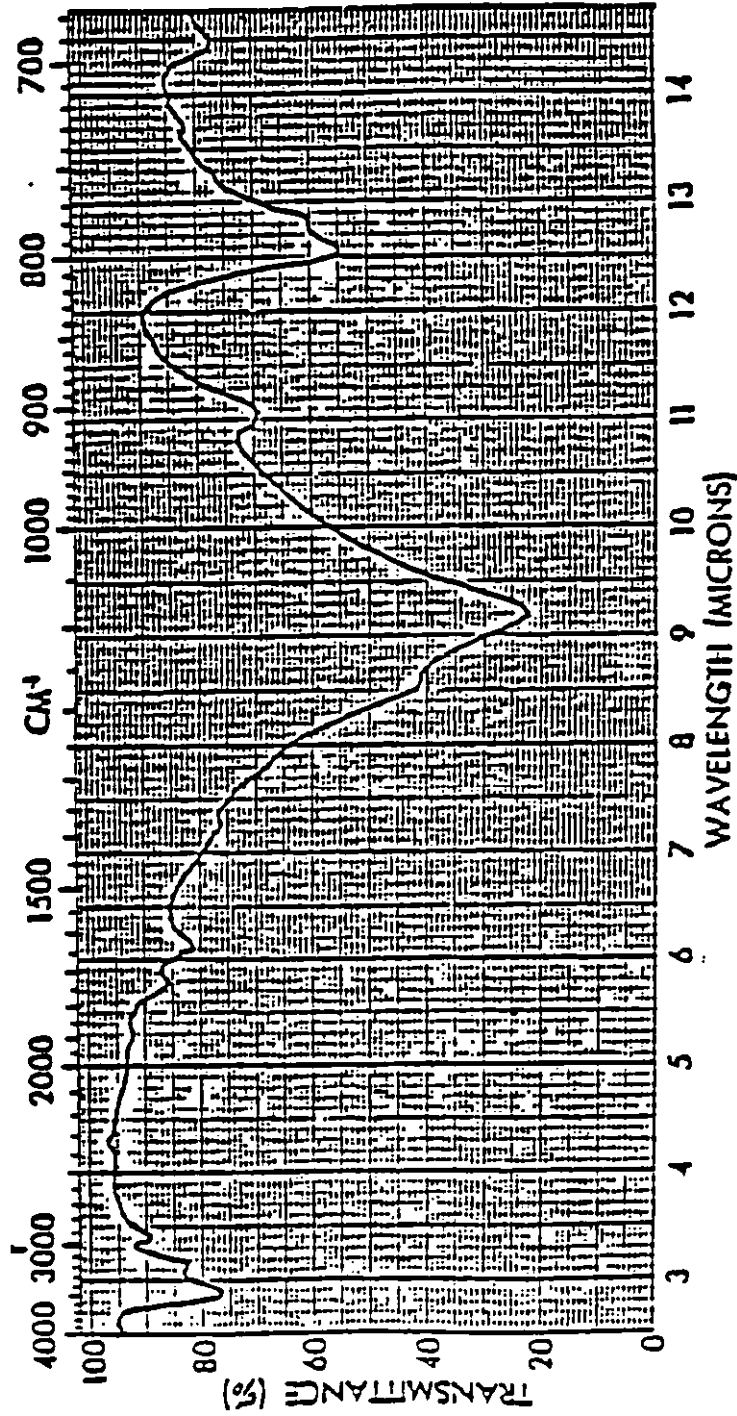


FIGURE 1

Infrared Spectrum of Pigment

X-314b

MIL-L-46159A (CR)

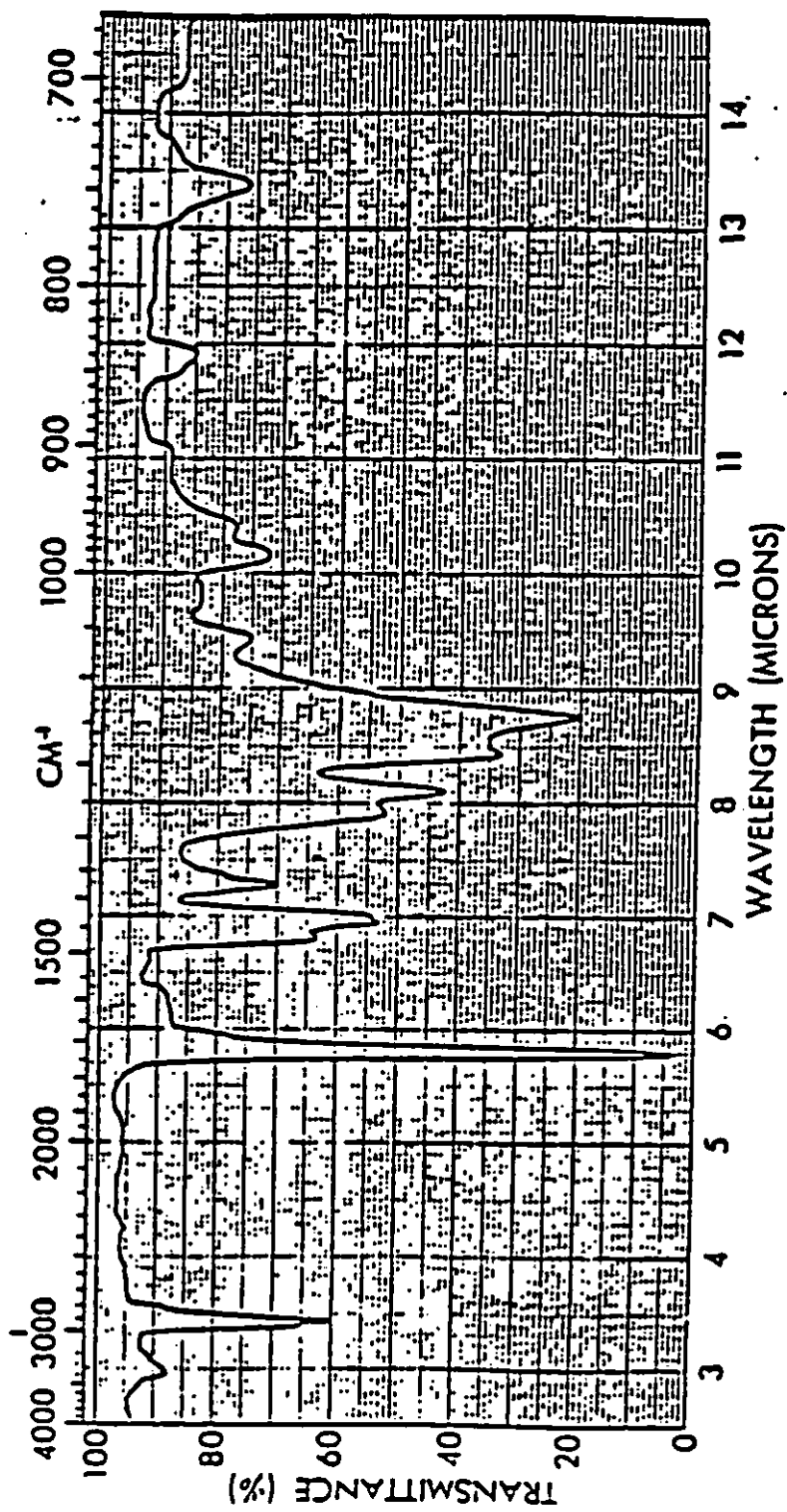


FIGURE 2

Infrared Spectrum of Nonvolatile Vehicle

X-3145

MIL-L-46159A (MR)

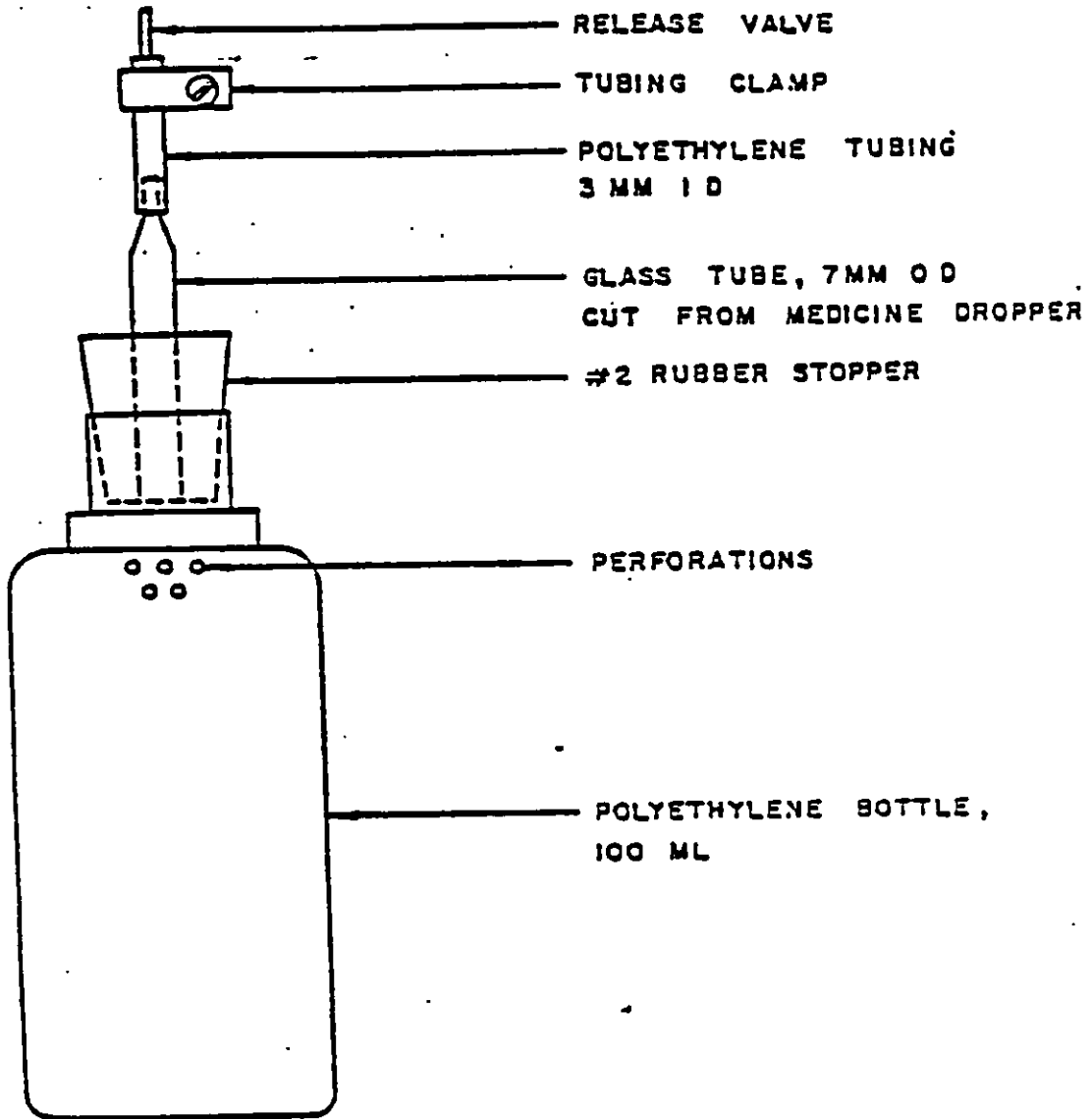


FIGURE 3. SAMPLING DEVICES FOR CANS
HAVING RECESSED OUTLETS

X-3145

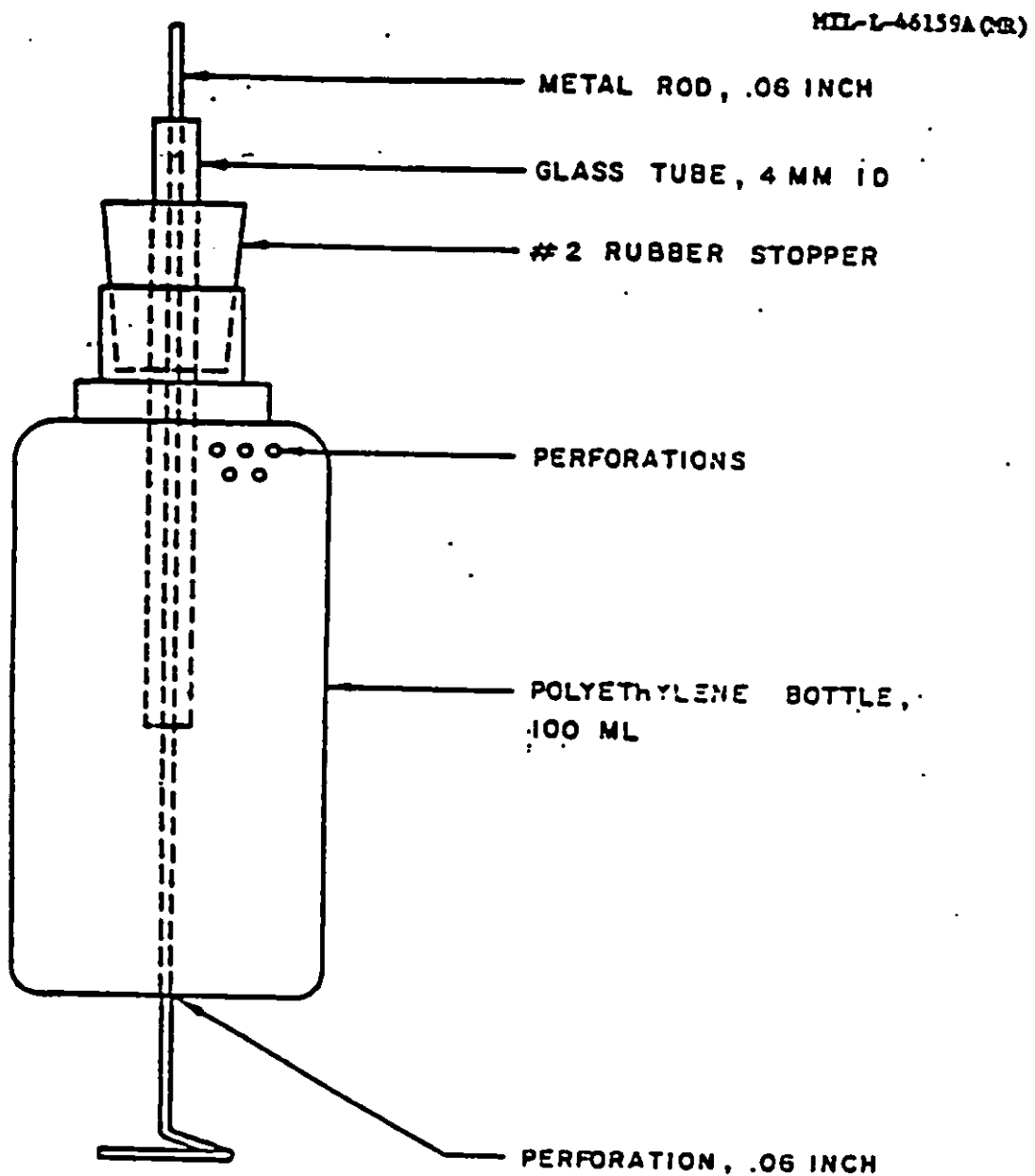


FIGURE 4. SAMPLING DEVICES FOR CANS
HAVING PROTRUDING OUTLETS

X-3147

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
3b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
5. PROBLEM AREAS		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify): _____	
6. PROBLEM AREAS			
a. Paragraph Number and Wordings			
b. Recommended Wordings			
c. Reason/Justification for Recommendations			
7. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		7b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
7c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		7d. DATE OF SUBMISSION (YYMMDD)	

(TO DETACH THIS FOR F ALONG THIS LINE.)