

NOT MEASUREMENT SENSITIVE

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30 APRIL 1993
SUPERSEDING
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MILITARY SPECIFICATION

COATING, ELASTOMERIC, POLYURETHANE, RAIN-EROSION

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

1. SCOPE

1.1 Scope. This specification establishes the requirements for rain-erosion coatings for exterior aircraft structures. This coating limits the content of lead to 0.06 percent by weight. Additionally, the coating has a maximum volatile organic compound (VOC) content of 420 grams/liter (g/l).

1.2 Classification. The coating shall be furnished in the following colors, as specified (see 6.2b): FED-STD-595 color number 36375 (gray), or 37038 (black).

1.3 Part numbers. Part numbers, for cataloging purposes, may be assigned in accordance with 6.7.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS), and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Warfare Center Aircraft Division Lakehurst, Systems Requirements Department, Code SR3, Lakehurst, NJ 08733-5100, 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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SPECIFICATIONS

FEDERAL

L-P-383	Plastic Material, Polyester Resin, Glass Fiber Base, Low Pressure Laminated
QQ-A-250/5	Aluminum Alloy Alclad 2024, Plate and Sheet
PPP-P-1892	Paint, Varnish, Lacquer, and Related Materials; Packaging, Packing and Marking of

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MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4, JP-5 and JP-5/JP-8 ST
MIL-R-7705	Radomes, General Specification for
MIL-C-8514	Coating Compound, Metal Pretreatment, Resin - Acid
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-P-23377	Primer Coatings: Epoxy, Chemical and Solvent Resistant
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Number O-156
MIL-P-25421	Plastic Materials, Glass Fiber Base - Epoxy Resin, Low Pressure Laminated
MIL-R-81294	Remover, Paint, Epoxy, Polysulfide and Polyurethane Systems
MIL-T-81772	Thinner, Aircraft Coating
MIL-H-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft, Metric, NATO Code Number H-537
MIL-C-83286	Coating, Urethane, Aliphatic Isocyanate, for Aerospace Applications
MIL-C-85285	Coating: Polyurethane, High Solids
MIL-P-85582	Primer Coatings: Epoxy, Waterborne

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STANDARDS

FEDERAL

- FED-STD-141 Paint, Varnish, Lacquer and Related Materials;
Methods of Inspection, Sampling and Testing
- FED-STD-313 Material Safety Data, Transportation Data and
Disposal Data for Hazardous Materials Furnished
to Government Activities
- FED-STD-595 Colors Used in Government Procurement

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from DODSSP - Customer Service, Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.1.2 Other government documents. The following other government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

CODE OF FEDERAL REGULATIONS (CFR)

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

- 29 CFR 1910.1200 Occupational Safety and Health Standards -
Hazard Communications

DEPARTMENT OF TRANSPORTATION

- 49 CFR 171-178 Transportation of Explosives and other
Dangerous Articles by Land and Water

(Application for copies of the Code of Federal Regulations (CFR) should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents that are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z129.1 American National Standard for the Precautionary Labeling of Hazardous Industrial Chemicals

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D522	Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
ASTM D1210	Standard Test Method for Fineness of Dispersion of Pigment - Vehicle Systems
ASTM D1640	Standard Test Method for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature
ASTM D1729	Standard Practice for Visual Evaluation of Color Differences of Opaque Materials
ASTM D2196	Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer
ASTM D2370	Standard Test Method for Tensile Properties of Organic Coatings
ASTM D3335	Standard Test Method for Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy
ASTM D3432	Standard Test Method for Unreacted Toluene Diisocyanates in Urethane Prepolymers and Coating Solutions by Gas Chromatography
ASTM D3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM G26	Standard Practice for Operating Light Exposure Apparatus (Xenon - Arc Type) with and without water for Exposure of Nonmetallic Materials

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

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents may also be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

3.1 Qualification. The coatings furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list (QPL) at the time of the award of contract (see 4.3 and 6.3). Any change in the formulation of a qualified product will necessitate its requalification. The material supplied under contract shall be identical, within manufacturing tolerances, to the product receiving qualification.

3.2 Material. Materials specified herein shall be of such a quality as to produce products conforming to the requirements of this specification.

3.3 Toxicity. The manufacturer shall certify that the materials furnished under this specification have no adverse affect on the health of personnel when used for its intended purpose and under the precautions of 5.2.1 through 5.2.1.2. A Material Safety Data Sheet (MSDS) shall be prepared and submitted in accordance with FED-STD-313. The MSDS shall also meet the requirements of 29 CFR 1910.1200. One copy of the completed MSDS shall accompany the samples being submitted to the qualifying activity for testing (see 4.3.2). Questions pertinent to the effect of these coatings on the health of personnel when used for its intended purpose shall be referred by the procuring activity to the appropriate medical service who will act as adviser to the procuring activity (see 4.3.2 and 6.6). 6.8 and 6.8.1 contain additional information on polyurethane coatings and personnel protective methods when handling these coatings. When tested in accordance with table VII, no component of the rain-erosion coating shall contain more than 0.06 percent by weight of lead compounds.

3.4 Composition. The rain-erosion coating shall be a two-component system consisting of Component A, a polyurethane elastomeric base component, and Component B, a ketimine or other amine type curing agent. They shall be mixed in the ratio specified by the manufacturer.

3.4.1 Volatile content. The maximum volatile organic compound (VOC) content of the rain-erosion coating shall be 420 g/l when tested in accordance with table VII, . Halogenated solvents (such as 1,1,1-trichloroethane) shall not be used in the formulation of this product.

3.5 Component quantitative requirements.

3.5.1 Component A. The vehicle in Component A shall be composed of polyurethane prepolymers that meet the requirements in table I. The pigmented portion shall meet the requirements in table I when tested as specified in table VII and 4.6.1.

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TABLE I. Component A requirements.

Characteristic	Requirement
Pigment (based on nonvolatile) (maximum)	6 percent by weight
Resin (based on nonvolatile) (maximum)	94 percent by weight
Fineness of grind, PC (mixed topcoat) (minimum)	6
Free toluene diisocyanate (maximum) (pigmented component)	0.4 percent by weight

3.5.2 Component B curing agent. The curing agent, a ketimine or other amine, shall be a clear, amber colored solution.

3.6 Physical properties - liquid.

3.6.1 Viscosity. The steady-state viscosity of the admixed coating shall be not greater than 4000 centipoise (cP) when tested in accordance with table VII and 4.6.2.

3.6.2 Pot life. When maintained in a full, closed container, in accordance with 4.6.3, the pot life of the admixed coating shall be a minimum of two hours at a temperature of $73.5^{\circ} \pm 2^{\circ}\text{F}$ ($23^{\circ} \pm 1.1^{\circ}\text{C}$) and relative humidity (RH) of 50 ± 10 percent. After exposure to these conditions, the admixed coating shall show no signs of gelation or an increase in viscosity of more than 50 percent, and be capable of being spray applied to a smooth, uniform coating, in accordance with 3.7.1.

3.6.3 Component properties.

3.6.3.1 Condition in container. All components of the rain-erosion coating shall be uniform, homogeneous, and free of skins, lumps, gels, or coarse particles. There shall be no separation of ingredients which cannot be readily dispersed to a smooth, homogeneous mixture. The coating containers shall exhibit no evidence of excessive pressure or be deformed by gassing.

3.6.3.2 Storage stability. The individual components shall be capable of being stored in their original, unopened containers for a minimum of six months at 90°F (32°C), in accordance with table VII.

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3.6.3.3 Accelerated storage stability. Component A shall be exposed as specified in 4.6.4. The container shall not develop excessive internal pressure, capable of causing it to swell. Additionally, the contained material shall be free of lumps, skins, gels, or particulate matter, either suspended in solution or settled on the inner surface of the container. When stirred with a paddle, the contained material shall be a smooth, homogeneous mixture.

3.7 Film properties.

3.7.1 Surface appearance and color. The test coating, applied to aluminum test panels in accordance with 4.5.1 and 4.5.2.1, shall be free of pinholes, cracks, bubbles, or other film irregularities when visually examined under 10x magnification. Slight after-tack is permissible. Additionally, when tested in accordance with table VII, the color of the cured test coating shall be a good visual match with the specified (see 6.2b) color chip of FED-STD-595.

3.7.2 Drying time. The test coating, applied to test panels in accordance with 4.5.1 and 4.5.2.1 shall dry hard within six hours when tested in accordance with table VII.

3.7.3 Free-film strength. The free-film strength of the test coating shall be in accordance with table II when prepared in accordance with 4.6.5 and tested in accordance with table VII.

TABLE II. Free-film strength.

Characteristic	Requirement
Tensile strength (minimum)	1000 psi
Elongation-at-break (minimum)	350 percent

3.7.4 Peel adhesion. The minimum peel adhesion of the applied test coating shall be 4 pounds per inch (lbs/in) of width, when tested in accordance with 4.6.6. Breakage of the film, without peeling from the panel, at values less than 4 lbs/in shall be permissible.

3.7.5 Low-temperature flexibility. The test coating, applied to test panels in accordance with 4.5.1 and 4.5.2.1, shall show no evidence of cracking or loss of adhesion when tested in accordance with 4.6.7.

3.7.6 Strippability. The test coating shall be capable of being completely stripped through to the substrate when processed as specified in 4.6.8.

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3.8 Resistance properties.

3.8.1 Water resistance. The test coating, applied to test panels in accordance with 4.5.1 and 4.5.2.1, shall show no evidence of checking or visible color change when tested in accordance with 4.6.9.

3.8.2 Fuel resistance. The test coating, applied to four test panels in accordance with 4.5.1 and 4.5.2.1, shall be separately immersed in fuels conforming to MIL-T-5624, Grades JP-4 and JP-5/JP-8 ST respectively, shall show no evidence of blistering, checking, visible color change or other defects in accordance with 4.6.10.

3.8.3 Fluid resistance. The test coating, applied to six test panels in accordance with 4.5.1 and 4.5.2.1 shall withstand immersion for 4 hours at room temperature (about 70° - 77°F (21° - 25°C)) in lubricating oil conforming to MIL-L-23699 and hydraulic fluid conforming to MIL-H-83282, in accordance with 4.6.11. Four hours after removal, the film shall exhibit no blistering, softening, dark staining or other defects.

3.8.4 Rain-erosion resistance. The coating, tested in accordance with 4.6.12, shall possess a minimum of 30 minutes erosion-time at a dry-film thickness of 12 - 14 mils (304 - 356 microns (μm)).

3.8.5 Accelerated weather resistance. The test coating, applied to two test panels in accordance with 4.5.1 and 4.5.2.1 and exposed to accelerated weathering for 500 hours in accordance with 4.6.13, shall exhibit no cracking, checking, embrittlement, or loss of adhesion.

3.8.6 Hydrolytic stability. The test coating, applied to two test panels in accordance with 4.5.1 and 4.5.2.1, shall exhibit no softening or loss of adhesion when tested in accordance with 4.6.14.

3.8.7 Electrical transmission. The test coating, applied to test panels in accordance with 4.6.15.1 and tested in accordance with 4.6.15.2 through 4.6.15.5, shall possess the requirements specified in table III.

TABLE III. Electrical transmission.

Characteristic	Requirement	
	After 7 day cure at 75° ± 5°F (24° ± 3°C) and RH of 50 ± 10%	After 7 day cure plus 7 days at 100°F (38°C) and RH of 90%
Electrical transmission (minimum)	90%	85%

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3.9 Working properties.

3.9.1 Application. The coatings shall be capable of being applied by brushing or spraying to plastic laminates, composites and aluminum alloy substrates. The material shall be mixed in accordance with the manufacturer's instructions. It shall achieve a minimum dry-film thickness of 2 mils (51 μm) per pass.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the government to accept defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.2.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in the test method document or the applicable paragraph(s) of this specification.

4.3 Qualification inspection. Qualification inspection shall consist of all examinations and tests specified in table IV.

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TABLE IV. Qualification inspection.

Inspection	Requirement paragraph	Test method paragraph
Visual examination	---	4.4.3
Lead content	3.3	4.6
Volatile content	3.4	4.6
Pigment	3.5.1	4.6, 4.6.1
Viscosity	3.6.1	4.6.2
Pot life	3.6.2	4.6.3
Condition in container	3.6.3.1	---
Storage stability	3.6.3.2	4.6
Accelerated storage stability	3.6.3.3	4.6.4
Surface appearance	3.7.1	---
Color	3.7.1	4.6
Drying time	3.7.2	4.6
Free-film strength	3.7.3	4.6.5
Peel adhesion	3.7.4	4.6.6
Low temperature flexibility	3.7.5	4.6.7
Strippability	3.7.6	4.6.8
Water resistance	3.8.1	4.6.9
Fuel resistance	3.8.2	4.6.10
Fluid resistance	3.8.3	4.6.11
Rain erosion resistance	3.8.4	4.6.12
Accelerated weather resistance	3.8.5	4.6.13
Hydrolytic stability	3.8.6	4.6.14
Electrical transmission	3.8.7	4.6.15
Application	3.9.1	---

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4.3.1 Qualification samples. Qualification test samples shall consist of a minimum of three quarts in each color (gray and black). The material shall be furnished in containers of the type to be used in filling contract orders. Samples shall be identified as follows and forwarded to the laboratory designated in the letter of authorization (see 6.3).

- Qualification test samples
- Specification MIL-C-85322B (Gray or Black) (as applicable)
- Coating, Elastomeric, Polyurethane, Rain-Erosion
- Manufacturer's name and product number
- Submitted by (name and date) for qualification testing in accordance with authorization (reference authorizing letter)

4.3.2 Test report. In addition to the qualification test samples, the manufacturer shall furnish a test report showing that the material satisfactorily conforms to the requirements of this specification. The manufacturer shall furnish to the contracting activity the toxicological data and formulation description required to evaluate the safety of the material for the proposed use through the submission of a Material Safety Data Sheet (see 3.3).

4.3.3 Retention of qualification. In order to retain qualification of a product approved for listing on the QPL, the manufacturer shall verify by certification to the qualifying activity that the manufacturer's product(s) comply with the requirements of this specification. The time of periodic verification by certification shall be in two-year intervals from the date of original qualification and shall be initiated by the preparing activity. The government reserves the right to re-examine the qualified product whenever deemed necessary to determine that the product continues to meet any or all of the specification requirements.

4.4 Quality conformance inspection.

4.4.1 Lot and batch. A lot shall consist of all the coating of the same color, manufactured at one-time from one batch, forming part of one contract, and submitted for acceptance. A batch shall consist of all coating material manufactured during one continuous operation and forming part of one contract or order for delivery. Material sampling shall be made from each lot and/or batch.

4.4.2 Physical property testing. The quality conformance inspection shall consist of the requirements and tests of 3.6.1, 3.6.2, 3.6.3.1, 3.7.1, 3.7.2, 3.7.4, and 3.7.5. The examinations and tests shall be made prior to delivery to the procuring activity. The government reserves the right to conduct tests for storage stability and weather resistance or to conduct any or all tests of this specification at any time within six months from the date of manufacture of the coating as attested by the date appearing on the container's label. Samples for test shall be taken from previously unopened containers.

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4.4.3 Visual inspection of filled containers. Samples selected at random for examination in accordance with 4.4.2 shall be examined for proper filling and weight.

4.4.4 Examination of packaging, packing and marking. An examination shall be made to determine that packaging, packing and marking comply with the requirements of section 5 of this specification. Defects shall be scored in accordance with table V. Shipping containers fully prepared for delivery that have not been palletized shall be examined for defects of closure. The samples for this examination shall be selected at random in accordance with MIL-STD-105, inspection level S-2 and acceptable quality level (AQL) of 4.0.

TABLE V. List of defects for packaging, packing and marking.

Examine	Defect
Packaging	Container not as specified, closures not accomplished by specified or required methods or materials. Leakage or seepage of contents.
Packing	Non-conforming component, component missing, damaged or otherwise defective. Bulged or distorted container.
Markings	Data, including directions for use, omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements.

4.4.5 Examination for palletization. An examination shall be made to determine that palletization complies with the requirements of section 5 of this specification. Defects shall be scored in accordance with table VI. The samples for this examination shall be selected at random in accordance with MIL-STD-105, inspection level S-1 and AQL of 6.5.

TABLE VI. List of defects for palletization.

Examine	Defect
Finished dimension	Length, width or height exceeds specified maximum requirement.
Palletization	Not as specified. Pallet pattern not as specified. Interlocking of loads not as specified. Load not bonded with required straps as specified.
Weight	Exceeds maximum load limits
Marking	Omitted, incorrect, illegible, or improper size, location, sequence or method of application.

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4.5 Test panels.

4.5.1 Aluminum test panels. Test panels for all tests, with the exception of free-film strength (3.7.3 and 4.6.5), peel adhesion (3.7.4.1 and 4.6.6), strippability (3.7.6 and 4.6.8), rain-erosion resistance (3.8.4 and 4.6.12), and electrical transmission (3.8.7 and 4.6.15), shall conform to QQ-A-250/5, and anodized in accordance with MIL-A-8625, Type I. Test panels dimensions shall be 3.0 by 6.0 by 0.020 inch (in.) (76.2 by 152.4 by 0.51 millimeters (mm)). The primer coating and test coat shall be applied in accordance with 4.5.2.1 and 4.5.2.3.

4.5.1.1 Glass fiber base laminate panels. Test panels for the peel adhesion (3.7.4.1 and 4.6.6) and strippability (3.7.6 and 4.6.8) test shall conform to any type and fabric number of MIL-P-25421. The test panels shall be flat, dense, representative of high quality plastic laminate structure of low void content. Test panel dimensions shall be 3.0 by 6.0 by approximately 0.04 in. (76.2 by 152.4 by approximately 1.0 mm).

4.5.2 Coating application.

4.5.2.1 Aluminum test panels. Primer coating, conforming to MIL-P-23377 or MIL-P-85582, shall be applied to the aluminum test panels to a dry film thickness of 0.6 to 0.9 mils (15.25 to 22.86 μm). The primer coating shall be permitted to dry for 60 minutes prior to application of the test coating. The test coating shall be applied in accordance with 4.5.2.3.

4.5.2.2 Vinyl and glass fiber base panel preparation. Two test panels conforming to 4.5.1.1 shall be lightly sanded with 180 to 240 grit abrasive paper to remove the glossy finish. After sanding, the test panels shall be wiped with a clean cloth saturated with solvent to remove dust and contamination. A 3.0 by 3.0 in. (76 by 76 mm) section of the test panel shall be covered with vinyl or TEDLAR film of an approximate thickness of 0.002 in. (0.051 mm). The vinyl or TEDLAR film shall be secured to the test panel by pressure sensitive cellulose tape, $\frac{1}{2}$ in. (12.7 mm) in width or both ends. The vinyl or TEDLAR film shall be secured by the tape at the exposed glass fiber surface. Wash primer conforming to MIL-C-8514 shall be applied to the test panels, covering the glass fiber base, the TEDLAR or vinyl film, and the cellulose tape. The wash primer shall be applied to a dry-film thickness of 0.3 to 0.5 mils (7.6 to 12.7 μm) and be permitted to dry for 60 minutes. The test coating shall then be applied over the wash primer in accordance with 4.5.2.3 and allowed to cure for four days. After this period, the TEDLAR or vinyl film and the cellulose tape shall be carefully removed. The panels shall be cured for a total of 168 hours.

4.5.2.3 Test coating application. The coating shall be applied to a dry-film thickness of 12 to 14 mils (305 to 356 μm). The rate of application shall be 2 mils (51 μm) per pass. The minimum cure time prior to testing shall be seven days.

4.6 Test methods. The tests of this specification shall be conducted in accordance with table VII and paragraphs 4.6.1 through 4.6.15.5. The test panels used shall be prepared as specified in 4.5 through 4.5.2.3. Ingredient material submitted shall be tested to determine compliance with the applicable specification. Unless otherwise specified herein, all tests shall be conducted at a temperature of $73^{\circ} \pm 5^{\circ}\text{F}$ ($228^{\circ} \pm 2.8^{\circ}\text{C}$) and RH of $50 \pm 10\%$.

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TABLE VII. Test methods.

Requirements paragraph	Test	FED-STD-141 Test Method Number	ASTM Method Number
3.3	Lead content		D3335
3.4.1	Volatile organic compound (VOC) content		D3960
3.5.1	Free toluene diisocyanate of prepolymer		D3432
3.5.1	Resin solids	4051	
3.5.1	Fineness of grind		D1210
3.5.1	Total pigment	4021	
3.6.1	Viscosity		D2196 <u>1/</u>
3.6.3.2	Storage stability	3022	
3.7.1	Color		D1729
3.7.2	Drying time		D1640
3.7.3	Free-film strength		D2370
3.7.5	Low-temperature flexibility		D522 <u>2/</u>
3.8.5	Accelerated weathering		G26

1/ Method A

2/ Method B

4.6.1. Total pigment. The percentage of pigment in Component A is found using Method 4021 of FED-STD-141 with the following exceptions:

- a. The extraction mixture shall be acetone (A.C.S. reagent grade).
- b. The solids shall be dried in a vacuum oven at $221^{\circ} \pm 3.6^{\circ}\text{F}$ ($105^{\circ} \pm 2^{\circ}\text{C}$) and no more than 10 mm Hg for two hours.

4.6.2 Viscosity. Allow the admixed coating to stand undisturbed for 30 minutes. The viscosity shall be tested in accordance with ASTM D2196, method A, using a Brookfield viscometer (Model LVT, Spindle #2, 30 RPM), or equivalent. Readings shall be made when a steady-state of the coating is achieved.

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4.6.3 Pot life. The admixed coating shall be stored in a full, closed container for two hours at $73.5^{\circ} \pm 2^{\circ}\text{F}$ ($23^{\circ} \pm 1^{\circ}\text{C}$) and RH of 50 ± 10 percent. After this period, the coating shall be examined for conformance to 3.6.2.

4.6.4 Accelerated storage stability. Unopened containers of component A (pigmented) shall be subjected to a minimum of four days of accelerated storage at $120^{\circ} \pm 5^{\circ}\text{F}$ ($49^{\circ} \pm 3^{\circ}\text{C}$). At the end of the four day storage period, the containers shall be visually inspected for swelling and gassing. The containers shall then be opened and inspected for conformance to 3.6.3.3.

4.6.5 Free-film strength. The coating shall be applied to two sheets of vinyl or TEDLAR film with dimensions of 8.0 by 10.0 in. (203 by 254 mm) in accordance with 4.5.2.2. After curing for four days, the coated films shall be placed in lukewarm water and the free-films of the coating separated. After blotting with paper towels, the films shall be cured and tested in accordance with ASTM D2370 for conformance to 3.7.3.

4.6.6 Peel adhesion. Two test panels, conforming to 4.5.1.1, shall be prepared in accordance with 4.5.2.2 and then immersed in water for four hours. Four parallel razor blade cuts shall be made through to the fiberglass, crossing the nonadhered and adhered coating section and placed at $\frac{1}{4}$ in. (6.5 mm), $1\text{-}\frac{1}{4}$ in. (31.75 mm), $1\text{-}\frac{3}{4}$ in. (44.5 mm), and $2\text{-}\frac{1}{4}$ in. (69.9 mm) from the edge of the test panel. A 1.0 in. (25.4 mm) free strip of test coating shall be folded back over the adhered coating and the uncoated panel and the free strip of coating shall be placed in the jaws of a Scott Tensile Tester, or equivalent, to provide a 180° pull at a rate of 2.0 inches per minute (51 mm per minute). The peel adhesion strength shall conform to 3.7.4.

4.6.7 Low-temperature flexibility. Two test panels, prepared in accordance with 4.5.1 and 4.5.2.1, shall be conditioned for a minimum of 60 minutes at $-60^{\circ} \pm 5^{\circ}\text{F}$ ($-51^{\circ} \pm 3^{\circ}\text{C}$) and, while at that temperature, bent 180° over a $\frac{1}{4}$ in. (6.4 mm) mandrel, in accordance with ASTM D522, method B, "Cylindrical Mandrel Test". The test panels shall be examined immediately after bending for evidence of failure, then conditioned at $70^{\circ} \pm 5^{\circ}\text{F}$ ($21^{\circ} \pm 3^{\circ}\text{C}$), and reexamined for conformance to 3.7.5.

4.6.8 Strippability. Wash primer conforming to MIL-C-8514 shall be applied to a dry film thickness of 0.3 to 0.5 mils (8 to 13 μm) to test panels conforming to 4.5.1.1 and be permitted to dry for 60 minutes. The test coating shall then be applied over the wash primer in accordance with 4.5.2.3. Chemical stripper, conforming to MIL-R-81294, Type IV, shall be applied to the test coating on the test panels and allowed to stand about 15 minutes or until blistering and lifting of the test coating occurs. The softened coating shall then be removed with a plastic scraper. Reapply stripper to remove any residual primer or test coating. Rub the test panel surface with a clean cloth saturated with methyl-ethyl-ketone (MEK) to clean the coating residue from the test panel. The panel shall then be examined for conformance to 3.7.6.

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4.6.9 Water resistance. Two test panels shall be prepared in accordance with 4.5.1 and 4.5.2.1, with the exception that the test coating shall be permitted to air-dry for 2 to 10 hours. The test coating shall then be topcoated with 2.0 ± 0.3 mils ($51 \pm 7 \mu\text{m}$) of coating conforming to MIL-C-83286 or MIL-C-85285 and cured for 7 days. The test panels shall then be immersed in distilled water for 4 days at a temperature of $120^\circ \pm 5^\circ\text{F}$ ($49^\circ \pm 2.8^\circ\text{C}$). After removal from the distilled water, the coating shall be examined for conformance to 3.8.1.

4.6.10 Fuel resistance. Four test panels, prepared in accordance with 4.5.1 and 4.5.2.1, shall be separately immersed in fuels conforming to MIL-T-5624, grades JP-4 and JP-5/JP-8 ST, (two test panels in each grade) for a period of four hours at $70^\circ \pm 10^\circ\text{F}$ ($21^\circ \pm 5^\circ\text{C}$) and RH of 50 percent. After this period, the test panels shall be removed from the fuels and visually examined for conformance to 3.8.2.

4.6.11 Fluid resistance. Six test panels, prepared in accordance with 4.5.1 and 4.5.2.1, shall be immersed separately (three test panels in each fluid) in the following fluids for 4 hours: lubricating oil, conforming to MIL-L-23699; hydraulic fluid conforming to MIL-H-83282. Four hours after removal, the test panels shall be visually examined for conformance to 3.8.3.

4.6.12 Rain-erosion resistance. Four round disks, each with a diameter of 1.0 in. (25.4 mm) and a thickness of 3/16 in. (5 mm) and cut from a glass fiber base laminate conforming to any type and fabric number of MIL-P-25421, shall be used for testing each color (gray and black). The test panels shall be coated in accordance with 4.5.2.2 and 4.5.2.3. Each coated disk shall be mounted in a horizontal whirling-arm tester, at the end of the rotating arm so that the disk is perpendicular to the direction of travel. A water ring, mounted above the rotating blade, shall be used to simulate a natural rainfall of 1/2 inch per hour and 2.0 mm droplet size. The test shall be run at 500 miles/hour (800 kilometers/hour) at the sample's center. Determine the average time in which the 4 specimens of the same color and type have eroded through to the substrate (see 3.8.4).

4.6.13 Accelerated weather resistance. Two test panels, prepared in accordance with 4.5.1 and 4.5.2.1, shall be exposed for 500 hours in a 6000 watt Xenon-arc weatherometer (Atlas Electric Devices Company, or equivalent) that is cycling between 102 minutes of light only and 18 minutes of light and waterspray. Coatings shall be examined for conformance to 3.8.5. The following conditions shall apply when tested in accordance with to ASTM G26, Type BH:

Black body temperature in cabinet:	$140^\circ \pm 5^\circ\text{F}$ ($60^\circ \pm 3^\circ\text{C}$)
Relative humidity in cabinet:	50 ± 5 percent
Intensity of Xenon-arc:	0.3 - 0.4 watts/meter ² at 340 nm

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4.6.14 Hydrolytic stability. Two test panels shall be prepared in accordance with 4.5.1 and 4.5.2.1. The test panels shall be stored at $200^{\circ} \pm 5^{\circ}\text{F}$ ($93^{\circ} \pm 3^{\circ}\text{C}$) and RH of 95 percent for four days. The test panels shall be stored coated side up on the tray in a glass desiccator jar after this four day storage. The desiccator shall contain a glycerin (22 percent by weight) in water solution in the bottom, which shall produce a relative humidity of 95 percent at the test temperature. The desiccator shall then be closed and inserted into an air circulating oven maintained at $200^{\circ} \pm 5^{\circ}\text{F}$ ($93^{\circ} \pm 3^{\circ}\text{C}$). At the end of the exposure period, inspect the panels visually and check for softening of the film by pushing a thumbnail or spatula over the film, in accordance with 3.8.6.

4.6.15 Electrical transmission.

4.6.15.1 Test panels. Two test panels shall be fabricated from 16 layers of number 181E fiberglass and polyester resin conforming to L-P-383. The fiberglass to polyester ratio shall be 62 to 38 parts by weight. The laminate shall be dense, of low void content, and representative of a high quality laminate fabrication. Test panel dimensions shall be approximately 24.0 by 34 by 0.17 ± 0.01 in. (610 by 864 by 4.19 ± 0.03 mm). The dielectric constant of the laminate shall be 4.20 ± 0.05 . One panel shall be lightly sanded with 180 to 240 grit abrasive paper, wiped with solvent, and then coated with wash primer conforming to MIL-C-8514 to a dry film thickness of 0.3 to 0.5 mils (8 to 13 μm). The wash primer shall be permitted to dry for 60 minutes prior to application of the test coating, in accordance with 4.5.2.3. One panel shall be used as the control and remain uncoated.

4.6.15.2 Sequence of testing. The sequence of testing the panels shall be as follows:

- a. Coated test panels for electrical transmission testing shall be cured in accordance with 4.6.15.1.
- b. One uncoated control panel and one coated panel shall be tested as specified below. The uncoated and coated test panels shall be conditioned at a temperature of $100^{\circ} \pm 5^{\circ}\text{F}$ ($38^{\circ} \pm 3^{\circ}\text{C}$) and RH $90 \pm 5\%$ for seven days and then tested as specified below.

4.6.15.3 Transmission test equipment. Test equipment performance requirements for flat panel samples shall meet the transmission efficiency test of MIL-R-7705.

4.6.15.4 Test procedure. The test shall be conducted at a frequency of 9.375 gigahertz (GHz). The test sample shall be clamped at the approximate midpoint between the horns at a 60° incident angle. The horns shall be adjusted so that polarization is horizontal. The incident angle shall be varied slightly on either side of 60° to maximize power transmission. Minimum and maximum power transmission shall be determined through a 3/8-in (9.5 mm) lateral movement of the test panel and averaged. The average of the two values shall be considered the power transmission.

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4.6.15.5 Test data and computation. The test data shall be converted to percent transmission using the following formula:

$$\text{percent transmission} = \frac{T2 \text{ sample}}{T2 \text{ blank}} \times 100$$

Where T2 sample = power transmission of coated panel

T2 blank = power transmission of uncoated panel

5. PACKAGING

5.1 Packaging and packing. The coatings shall be packaged and packed in accordance with PPP-P-1892. The level of packaging shall be A or C and the level of packing shall be A, B, or C as specified (see 6.2). The size of the containers shall be either 1 quart, 1 gallon or 5 gallons. The coating shall be supplied in a kit, packaged as a unit, consisting of two or more containers of the same colored "Component A" (resin portion) and one can of "Component B" (curing agent).

5.2 Marking and labeling. In addition to the marking specified in PPP-P-1892, individual containers shall bear a printed label showing the following nomenclature and information as applicable:

- Component Identification (as applicable)
 - Component A - Pigmented polyurethane resin component
 - Component B - Curing agent component
- Specification MIL-C-85322B, (Gray or Black), (as applicable)
- Manufacturer's name and product number
- Date of manufacture by month and year
- Batch number
- Net contents
- Mixing instructions for application

All unit and shipping containers of toxic and hazardous chemicals and materials shall also be labeled in accordance with the applicable laws, statutes, regulations or ordinances, including Federal, state and municipal requirements. In addition, unit and shipping containers, including unit containers that serve as shipping containers such as pails and drums, shall be marked with the applicable precautionary information detailed in ANSI Z129.1.

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5.2.1 Precautionary markings.

5.2.1.1 Container. In addition to the labeling specified in 49 CFR 171-178, the following shall appear on each component container of every kit, and on each exterior shipping container:

CAUTION

THIS COATING MATERIAL IS TOXIC AND FLAMMABLE AND SHALL NOT BE USED IN CONFINED AREAS WHERE THERE ARE OPEN FLAMES, ARCING EQUIPMENT, HOT SURFACES, OR WHERE SMOKING IS PERMITTED.

USE ONLY WITH ADEQUATE VENTILATION.

AVOID BREATHING OF VAPOR.

DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES AND/OR SKIN WITH PLENTY OF WATER. FOR EYES, GET MEDICAL ATTENTION.

5.2.1.2 Kit enclosure. The following precautionary information shall be included, on a sheet, with each kit:

Precautions:

1. Open Component A (pigmented) carefully. Some outgassing may be evident. Do not open any container that is bulged or deformed. Discard any container that is bulged or deformed.
2. All spray equipment shall be adequately grounded. Clean equipment thoroughly after each use with thinner conforming to MIL-T-81772, Type I.
3. Mix only the number of kits that can be used within two hours. Keep containers closed when not in use.
4. Wear protective clothing, creams, gloves and goggles while spraying.
5. An air-line respirator is recommended for spraying operations. If it is not available, protective masks containing an organic-vapor cartridge respirator should be used.
6. Do not contaminate Components A or B with alcohol or water.
7. Keep containers closed when not in use. Both components are moisture sensitive.
8. Wash hands immediately after use.

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5.2.1.2 Lid (Component A only). Each lid of Component A material shall bear a red printed label with the following information:

- USE CAUTION
- OPEN SLOWLY

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The material covered by this specification is intended as a rain-erosion coating for aircraft radomes and leading edges.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Color number and name (see 1.2).
- c. Issue of DODISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.1 and 2.2).
- d. Including quantity and size of containers (see 5.1).
- e. Level of packaging and packing (see 5.1).
- f. Special markings (see 5.2)
- g. Toxicological data requirements (see 3.3 and 4.3.2).
- h. FAR clauses 23.303 and 52.223-3.
- i. Specify if palletization is required.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in the Qualified Products List, QPL-85322, whether or not such products have actually been so listed by that date. The attention of contractors is called to these requirements, and manufacturers are urged 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 purchase orders for the products covered by this specification. The activity responsible for the QPL is the Commander, Naval Air Systems Command, Department of the Navy, Washington, DC 20361; Information pertaining to qualification of products may be obtained from the Commander, Naval Air Warfare Center - Aircraft Division, Code 6062, Warminster, PA 18974. In the event that the material covered by this specification and furnished under contract fails to perform satisfactorily, approval of such a product will be subject to immediate withdrawal from the QPL.

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6.4 Subject term (keyword) listing.

Flammable
 Flexible
 Material Safety Data Sheets (MSDS)
 Polyurethane
 Qualified products list (QPL)
 Rain-erosion coating
 Sulfuric acid

6.5 Moisture. The polyurethane components should be kept dry. The presence of moisture degrades the quality of the paint. Packaging of the materials should be done in a dry atmosphere. Solvents for the resins should be examined for evidence of contamination before they are incorporated, even though they are of urethane grade. Urethane grade solvents or thinners may become contaminated with water in tank cars or storage tanks. The purchase of urethane grade solvents or thinners is no guarantee that excessive moisture is not present. It is therefore recommended that all users check for moisture contamination. The following suggested method may be used to determine the presence of water: add one drop of aluminum secondary butoxide to 100 ml of the solvent in a stoppered flask and shake. An appreciable amount of turbidity indicates the presence of water. The pigments used in the topcoats must be absolutely dry before being incorporated into the resin solution. If not, the package stability will suffer.

6.6 Material Safety Data Sheets (MSDS). A material safety data sheets (MSDS) must be completed in accordance with 3.3. Contracting officers must identify those activities requiring copies of the completed MSDS, in accordance with 3.3 and 4.3.2. The government mailing addresses for submission of MSDS's are listed in FED-STD-313.

6.7 Part number assignments. Part numbers may be coded as follows:

<u>M85322B</u>	-	<u>XX</u>	-	<u>XXXX</u>
Specification identifier		Color designator (see 6.7.1)		Kit size designator (see 6.7.2)

6.7.1 Color designator. The type and color designation in the part number assignment is to be as follows:

Color	Designator
Gray	GY
Black	BK

6.7.2 Kit size designator. The kit size designation in the part number assignment is to be as follows:

Kit size	Designator
1 quart (0.94 liter)	001Q
1 gallon (3.79 liter)	001G
5 gallon (18.93 liter)	005G

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6.8 Toxicity of polyurethane coatings. Some free isocyanate is released during the mixing and application of multi-component polyurethane coatings. Released free isocyanates can produce a significant irritation to the skin, eyes, and respiratory tract. Personnel exposed to free isocyanates may develop an allergic pulmonary sensitization, particularly if there is an inhalation of the vapor and mist produced during spray application. This sensitization may cause an asthmatic reaction with wheezing, dyspnea, and cough. Once sensitized, further exposure cannot be tolerated. For this reason, there is a restriction on the issuance and use of this material. Personnel exposed to free isocyanates on a regular basis should receive a periodic medical exam that includes a chest roentgenograph (X-ray), pulmonary function tests, and an evaluation of any respiratory disease or history of allergy. Periodic testing of pulmonary functions may aid in detecting the onset of pulmonary sensitization.

6.8.1 Personnel protective methods. Eye protection and appropriate clothing to prevent repeated or prolonged skin contact should be worn while applying material that contains free isocyanates. Additional information pertaining to protective equipment and other necessary precautions should be available from the coating application facility's Occupational Safety and Health office.

6.9 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - ME
Air Force - 11

Preparing activity:
Navy - AS
(Project No. 8010-0516)

Review activities:
Army - AV, ME

User activities:
Navy - MC

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of 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.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER

MIL-C-85322B

2. DOCUMENT DATE (YYMMDD)

930430

3. DOCUMENT TITLE

COATING, ELASTOMERIC, POLYURETHANE, RAIN EROSION

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (Include Zip Code)

d. TELEPHONE (Include Area Code)

(1) Commercial

(2) AUTOVON
(if applicable)

7. DATE SUBMITTED
(YYMMDD)

8. PREPARING ACTIVITY

a. NAME COMMANDING OFFICER, NAVAL AIR
WARFARE CENTER AIRCRAFT DIVISION LAKEHURST
SYSTEMS REQUIREMENTS DEPARTMENT

b. TELEPHONE (Include Area Code)

(1) Commercial

(908) 323-7488

(2) AUTOVON

624-7488

c. ADDRESS (Include Zip Code)

CODE SR3
LAKEHURST, NJ 08733-5100

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

Defense Quality and Standardization Office
5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466
Telephone (703) 756-2340 AUTOVON 289-2340