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MILITARY SPECIFICATION

COATING SYSTEM, POLYURETHANE, NON-YELLOWING, WHITE, RAIN EROSION RESISTANT, THERMALLY REFLECTIVE

This specification is approved for use by Materials Laboratory, Air Force Wright Aeronautical Laboratories, Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for one type of thermally reflective non-yellowing white rain erosion resistant polyurethane coating system for glass fabric reinforced plastic laminates and other plastic parts used for exterior surfaces of aircraft and missiles.

1.2 Classification. The coating systems shall be of the following classes:

Class 1 - General Use
Class 2 - Limited Use

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of this 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

PPP-P-1892 Paint, Varnish, Lacquer, and Related Materials, Packaging, Packing and Marking of

Beneficial comments (recommendation, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Materials Laboratory, AFWAL/MLSA, WPAFB, OH 45433 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 8010

TT-S-735	Standard Test Fluids; Hydrocarbon

MILITARY

MIL-P-5425	Plastic, Arcylic, Heat Resistant
MIL-R-7705	Radomes, General Specification For
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-R-25134	Remover, Paint and Lacquer, Solvent Type
MIL-P-25421	Plastic Materials; Glass Fiber-Epoxy Resin Low Pressure Laminated

STANDARDS

FEDERAL

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

(Copies of specifications, standards, drawings, and publication required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D2267	Method of Test for Aromatics in Light Naphthas, Reformates, and Gasolines by Gas Chromatography

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

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

Federal Hazardous Substances Labeling Act

(Application for copies should be addressed to the U. S. Department of Health, Education and Welfare, Food and Drug Administration, Washington, D. C. 20203.)

3. REQUIREMENTS

3.1 Qualification. The coating materials furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3).

3.2 Materials. The coating materials shall be either an aliphatic or cycloaliphatic isocyanate polyurethane prepolymer and shall be a chemically curing composition of such ingredients to produce high quality non-yellowing rain erosion resistant coatings. The mix ratio of components, if applicable, shall be as specified by the manufacturer and 3.5.1.

3.2.1 Toxic products and formulations. The materials shall have no adverse effect on the health of personnel when used for their intended purpose with adequate environmental controls and safety equipment. Questions pertinent to this effect shall be referred by the procuring activity to the appropriate department medical service who will act as an advisor to the procuring agency.

3.3 Components.

3.3.1 Class 1. Unless otherwise specified, the Class 1 coating system shall consist of the following: primer plus activator; non-yellowing aliphatic or cycloaliphatic isocyanate polyurethane prepolymer solution which may be moisture curable and accelerated by a catalyst or may be reacted with a curing agent; and a diluent solvent to be used in the application of the coating. Class 1 coatings shall be applied by a brush or spray techniques. The solvents contained in Class 1 coatings are photochemically reactive. (See 6.4)

3.3.2 Class 2. Unless otherwise specified the Class 2 coating system shall consist of the following: primer plus activator; aliphatic or cycloaliphatic isocyanate base polyurethane prepolymer which may be moisture curable and accelerated by a catalyst or may be reacted with a curing agent; and a diluent solvent to be used in the application of the coating. Class 2 coatings shall be applied by brushing or spray techniques. All solvents and diluents contained in and furnished with the Class 2 coating shall be nonphotochemically reactive. (See 6.5)

3.3.3 Solvent. The diluting and spraying solvents for Class 2 coatings shall be nonphotochemically reactive and shall be compatible with the coating materials. (See 6.4)

3.3.4 Nonphotochemically reactive solvent. The nonphotochemically reactive solvent ingredient of Class 2 materials shall not exceed any one of the following percentage composition limitations with reference to the total volume of the solvent when tested as specified in 4.7.3:

a. A combination of hydrocarbons, alcohols, aldehydes, esters, ethers or ketones having an olefinic or cycloolifinic type unsaturation: 5 percent.

b. A combination of aromatic compounds with 8 or more carbon atoms to the molecule, except ethylbenzene: 8 percent.

c. A combination of ethylbenzene, ketones, having branched hydrocarbon structures, trichlorethylene or toluene: 20 percent.

3.4 Quantitative requirements. The quantitative requirements of the coatings shall be as specified in Table I.

3.4.1 Free aliphatic isocyanate. The free aliphatic isocyanatic content of either the mixed components or single component moisture cure coating systems shall be not greater than 1 percent. When the prepolymer contains an aliphatic isocyanate, the free isocyanate content shall be determined by a test mentod approved by the issuing activity.

3.4.2 Free cycloaliphatic isocyanate. The free cycloaliphatic isocyanate content of either the mixed components or single component moisture cure coating systems shall not be greater than 1 percent. When the prepolymer contains cycloaliphatic methylene bis (4-cyclohexylene isocyanate), the free isocyanate content shall be determined in accordance with Appendix. When the prepolymer is based on any cycloaliphatic isocyanate other than methylene bis (4-cyclohexylene isocyanate), the issuing activity shall be consulted for appropriate analytical procedures for determination of free isocyanate.

3.5 Component requirements.

3.5.1 Mixing. Components of Class 1 and 2 coatings shall be individually mixed in accordance with the manufacturer's instructions. The resulting individual mixtures shall be smooth, homogeneous materials free from lumps, gelling, seeding, separation or other objectionable characteristics.

TABLE I. Quantative requirements.

Class 1 and Class 2 Coatings

Material	Nonvolatile Solids Content, Percent By Weight	Weight Per Gallon, Pounds	Viscosity, Centipoises		Flash Point °C
	Minimum	Minimum	Minimum	Maximum	Minimum
Primer (mixed components, if applicable)	10.0	7.0	50	250	21
Class 1 and 2 aliphatic and cycloaliphatic polyurethane prepolymer	45	8.0	100	800	10

3.5.2 Odor. The odor of the wet coatings shall not be obnoxious when tested as specified in 4.7.

3.5.3 Color. Class 1 and 2 base coatings and/or topcoatings shall be pigmented white. The color shall be sufficiently intense to completely hide the surface and provide the thermal reflectance properties specified herein.

3.5.4 Accelerated storage stability. Class 1 and 2 coating shall be subjected to 4 days of accelerated storage in accordance with 4.7.7. At the end of the 4-day storage period the component materials shall be free of lumps, skins and gels, and shall disperse readily to a smooth homogeneous mixture.

3.5.5 Storage stability. The previously unopened packaged components of Class 1 and 2 coatings components, including the primer and primer accelerator, shall meet all the requirements specified herein after a storage period of one year, provided that the daily mean temperature of the ambient conditions at the storage locations falls within the range of 70° to 100°F (21° to 38°C) (see 4.7.8).

3.5.6 Pot life. Class 1 and 2 base coating and topcoating solutions shall have a minimum pot life of 4 hours after catalyzation. At the end of the 4-hour period, the coatings shall show no signs of lumping, seeding, separation, or an increase in viscosity of more than 20 percent from the initial viscosity when tested in accordance with 4.7.9 and Table 1.

3.5.7 Application and drying time. The coatings shall be applied in accordance with the manufacturer's instructions to a total dry film thickness of 12 to 14 mils. The total application time, including intervals between coatings shall not exceed 8 hours and the tack free drying time shall not exceed 10 hours after final application of the coatings when tested in accordance with 4.7.10.

3.5.7.1 Rate-of-cure. The rate-of-cure of the coatings shall have a maximum set-to-touch or recoat time of one hour. The manufacturer shall furnish instructions for catalyzing or accelerating the polyurethane base materials for a temperature range from 65° to 95°F (18° to 35°C) and a relative humidity range from 40 to 75 percent when tested in accordance with 4.7.10.

3.5.8 Curing time. Class 1 and 2 coatings shall be fully cured within 5 days and shall be free of pinholes, cracks, bubbles, or other film irregularities when tested in accordance with 4.7.11.

3.5.9 Peel strength. Class 1 and 2 coatings shall have a peel strength of not less than 6 pounds per inch when tested in accordance with 4.7.12.

3.5.10 Flexibility. A film of the coating shall show no cracking or loss of adhesion in the bend area when tested in accordance with 4.7.15.

3.5.11 Fluid immersion resistance. When tested as specified in 4.7, panels prepared in accordance with 4.6 and coated in accordance with 4.6.1 and exposed to fluids as specified below shall show no pigment leaching, loss of adhesion, blistering or discoloration. Panels shall be inspected immediately upon removal from the test fluid for any observable defects. The exposed panels shall then be cleaned and all specified tests performed within an hour after removal from the test fluids. Cleaning of the panels shall be by wiping with lint free paper towling or with lint free cloth.

a. Distilled water resistance. Distilled water at ambient conditions ($24^{o}C \pm 1^{o}C$) for 24 hours.

b. Hydrocarbon resistance. Type III fluid of TT-S-735 for a period of 1 hour at standard conditions.

3.5.12 Rain erosion resistance. Class 1 and 2 coatings shall have a minimum average erosion resistance of 100 minutes when tested as specified in 4.7.16.

3.5.13 Electrical transmission. Class 1 and 2 coatings shall have a minimum electrical transmission of 90 or 95 percent, when tested as specified in 4.7.18.

3.5.14 Thermal reflectivity. The coating shall be exposed to a total fluence of 60 at flux rate of 30 cal/cm^2-sec without burning or charring when tested in accordance with 4.7.22. Discoloration is permitted.

3.5.15 Weather resistance. Class 1 and 2 coatings, when exposed to outdoor weathering for 6 months, shall show no film deterioration such as checking, chalking, cracking, embrittlement, loss of adhesion or loss of resiliency. After weathering, the coatings shall meet the erosion resistance requirements as specified in Table II.

3.5.16 Strippability. Newly applied, fully cured and weathered Class 1 and Class 2 coatings shall be strippable when tested in accordance with 4.7.21.

TABLE II. Rain erosion resistance and electrical transmission requirements.

Class 1 and Class 2 Coatings.

Property	After drying and normal 5 day cure	After normal cure and aging 7 days at 95% RH and 38° ± 2°C (100°F ± 2°F)	After normal cure and aging 24 hours at 108° ± 2°C (225° ± 5°F)	After normal cure and 6 months exterior weathering
Rain erosion resistance (erosion through 12 to 14 mils of erosion coating at 500 MPH and 1 inch/hour rainfall, time in minutes, minimum) Class 1 and Class 2	100	100	100	100
Electrical transmission Class 1 1/ and Class 2 1/	95	90	-	95
Uncoated control panel	87	84	-	87

1/ The percentage of electrical transmission of a panel coated with either a Class 1 or 2 coating is equal to 100 times the electrical transmission of the coated panel divided by the electrical transmission of the uncoated control panel.

3.5.17 Repairability. The cured coatings shall be repairable by the same procedure specified by the manufacturer for orignial application.

3.5.18 Age. The age of the coatings shall be not more than 12 months from the date of manufacturer to the date of use.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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

a. Qualification inspection (see 4.3)

b. Quality conformance inspection (see 4.4)

4.3 Qualification inspection. Qualification tests shall consist of all of the tests specified in 4.7 except the test for inspection of filled containers.

4.3.1 Qualification samples. Unless otherwise specified, qualification test samples shall consist of the following materials and test panels:

a. Materials

Primer (for Class 1 and 2)	1 pint (for each class)
Primer activator	Quantity specified by manufacturer
Polyurethane prepolymer solutions	1 gallon (for each class)

a. Materials (Cont'd)

Catalyst	Quantity specified by manufacturer
Diluent	2 quarts minimum (for each class) Solvent must be urethane grade.

b. Test panels.

Uncoated airfoils (see 4.7.16)	18 (for each class)
Coated void-free laminate panels (see 4.7.18)	2 (for each class)
Uncoated void-free control panels (see 4.7.18)	1
Coated void-free panels (see 4.7.22)	1 (for each class)

The samples shall be plainly identified and forwarded to the qualifying activity or as otherwise directed in the letter of authorization from the qualifying activity (see 6.3). The identification shall include the manufacturer's production code or compound number.

4.3.2 Test report. Qualification samples shall be accompanied by a certified test report showing results of all tests required by this specification except the test for inspection of filled containers .

4.3.3 Instruction sheet. The manufacturer shall forward 3 copies of the instruction sheet detailing mixing, thinning, application and curing procedures for his material with all qualification samples submitted for approval. Qualification approval of the manufacturer's coating system shall also constitute approval of the applicable instruction sheets. The instruction sheets shall not be changed in any way without specific approval of the qualifying activity.

4.4 Quality conformance inspection. Quality conformance inspection for acceptance of individual lots shall consist of sampling and tests as specified herein.

4.4.1 Sampling.

4.4.1.1 Lot. A lot shall consist of all coating materials of the same type and class manufactured at one time and offered for delivery at one time.

4.4.1.2 Samples. One gallon samples shall be selected from each lot and subjected to the following tests:

a. Novolatile (solids) content (see 4.7)

b. Viscosity (see Table I)

c. Condition in container (see 4.7.6)

d. Accelerated storage (see 4.7.7)

e. Peel strength (see (4.7.12)

4.5 Test conditions. Standard laboratory test conditions shall be $24^{\circ} \pm 2^{\circ}C$ with a relative humidity of 50 ± 2 percent. All component materials shall be conditioned for at least 24 hours at this temperature and relative humidity before being tested or used in the preparation of test panels. Except as otherwise specified herein, all physical tests on the coating materials or test films thereof shall be made under these conditions in an atmosphere that is dust free.

4.6 Test panels. Unless otherwise specified, test panels shall be flat, glass fiber base laminate conforming to any type and fabric number of MIL-P-25421. Except as otherwise specified, panels shall be 3 inches wide, 8 inches long, and 1/8 inch thick. The glass laminate panels shall be of low void content, dense and representative of high quality plastic laminate structures. They shall be lightly sanded with 320 grit abrasive paper to remove the glossy finish and wiped clean with a solvent such as xylene or methyl isobutyl ketone before applying any primer or coating materials.

4.6.1 Coating of panels. Except as otherwise specified herein, test panels shall be coated as follows:

Class 1 and 2 - 1 to 2 mils of primer and 12 to 14 mils of rain erosion resistant coating applied in accordance with manufacturers instructions.

4.7 Test methods. Test methods shall be as specified in Table III and 4.7.1 through 4.7.22.

Table III. Test methods.

Characteristic	Requirement Reference	Test Method (FTMS No. 141)
Nonvolatile (solids) content	Table I	4041 or 4042
Flash point	Table I	4291
Weight per gallon, pounds	Table I	4148
Viscosity, Centipoises	Table I	4287
Odor	3.5.2	4401

4.7.1 Toxicological data and formulations. The supplier shall furnish the toxicological data and formulations required to evaluate the safety of the material for the proposed use.

4.7.2 Urethane-base prepolymers (free diisocyanate content). The free diisocyanate content of Class 1 and 2 coatings shall be determined in accordance with Appendix or as otherwise directed by the qualifying activity.

4.7.3 Nonphotochemically reactive solvent. The nonphotochemically reactive volatile content shall be determined by the use of a gas chromatograph or other suitable device in accordance with ASTM-D-2267.

4.7.4 Mixing. A 1-quart sample of each of the pigmented base resins of Class 1 and 2 coatings shall be vigorously mixed by hand. The complete mixing shall be accomplished in a maximum of 5 minutes. After the mixture appears homogeneous or at the end of the 5-minute period, whichever occurs first, the material shall be allowed to stand for 1 minute, then poured slowly into another container. The coating shall be observed during pouring and the residue remaining in the mixing container visually observed for conformance to 3.5.1. When a catalyst is added to the coatings the mixture shall be agitated on a commercial type paint shaker instead of by hand for a minimum of 5 minutes prior to application.

4.7.5 Color. The amount of white pigment shall be such that as the coating is applied the surface becomes increasingly white with each successive coat. When the specified coating thickness has been obtained, the color shall be sufficiently intense to completely hide the surface and provide the thermal reflectivity as specified herein.

4.7.6 Condition in container. Component materials of each container shall be tested in accordance with Federal Test Method Standard No. 141, Method 3011.

4.7.7 Accelerated storage. The component materials for Class 1 and 2 coating systems shall be stored (uncatalyzed) at a temperature of 120° ± 2°F (49° ± 2°C) for 4 days. After this storage period, the materials shall be examined for conformance to 3.5.4.

4.7.8 Storage stability. The component materials for Class 1 and 2 coating systems shall be aged for 12 months. After this storage period, full closed containers of the primer and rain erosion resistant coatings shall be capable of meeting the requirements of this specification.

4.7.9 Pot life. A 1-quart sample of the Class 1 and 2 coatings shall be mixed as specified in 4.7.4 and stored in closed containers for 4 hours at standard conditions. At the end of the storage period, the coatings shall be visually examined and a viscosity measurement made as specified in 4.7.

4.7.10 Drying (tack-free) time. Class 1 and 2 coatings shall be applied in accordance with the manufacturer's instructions to two test panels as specified in 4.6. At the end of the rated tack-free time (not to exceed 10 hours), a polyethylene film 1 inch wide, 6 inches long, and 0.004 ± 0.002 inch thick shall be pressed with a 1-ounce weight (approximately 2 square inches) onto each of the coated test panels. The polyethylene film shall then be progressively withdrawn at right angles to the surface of the coating. The time at which there is no evidence of removal of the coating by adherence to the polyethylene film shall be considered the tack-free time.

4.7.11 Curing time. Class 1 and 2 coatings shall be applied in accordance with the manufacturer's instructions and cured for 5 days at 24°C and 50 percent relative humidity to determine conformance to 3.5.8.

4.7.12 Peel Strength. Three panels as specified in 4.6 shall be coated with primer on one half of one side. Twelve to 14 mils of rain erosion resistant coating is then applied to the entire side of each panel and air-dried at standard conditions for 5 days. At the end of the 5-day period, two 1-inch wide strips shall be cut, lengthwise, through the coating to the panel and extended the full length of the panel. A 1-inch coating strip over the unprimed area shall be peeled back to the primer and clamped in one jaw of a suitable tension testing machine and the matching end of the test panel clamped in the other jaw to provide a 180-degree pull. The jaw separation rate shall be 2 inches per minute. The results shall be the numerical average of the peak loads. If the coating separates cohesively and does not separate from the panel surface, the peel strength shall be reported as greater than the measured value.

4.7.13 Water resistance. Three coated panels of each class of coating shall be prepared as specified in 4.5.1 and cured as specified in 4.7.11. The panels shall then be immersed in distilled water for 24 hours at standard conditions. At the end of the 24 hours immersion period, the specimens shall be removed from the water and visually examined for conformance to 3.5.11. The specimens shall then be subjected to the peel strength test to determine conformance to 3.5.9.

4.7.14 Aromatic fuel resistance. Three coated panels of each class of coating shall be prepared as specified in 4.6.1 and cured as specified in 4.7.11. The panels shall then be immersed in hydrocarbon test fluid conforming to type III of TT-S-735 at standard conditions for 1 hour. At the end of the 1 hour period, the specimens shall be removed from the fluid and visually examined for conformance to 3.5.11. The specimens shall then be subjected to the peel strength test to determine conformance to 3.5.9.

4.7.15 Flexibility. Three 3-inch by 4-inch by 0.020-inch 2024-T0 aluminum test panels, anodized according to type II of MIL-A-8625, shall be coated with 12 to 14 mils of the erosion resistant coating and cured as specified in 4.7.11. The coated panels shall then be conditioned for 1 hour at -65°F and while at that temperature bent 180 degrees over a 1/4 - inch cylinderical mandrel in accordance with method 6221 of Federal Test Method Standard No 141. The panels shall be visually examined immediately after bending for evidence of failure, then conditioned at 24°C ± 1°C (75° ± 2°F) and again examined for conformance to 3.5.10.

4.7.16 Rain erosion resistance.

4.7.16.1 Test panels. Eighteen airfoil shaped panels shall be used for testing each class coating. The specimens shall be in accordance with Figure 1 and shall be of low void content, dense and representative of high quality plastic laminate structures. A 12 to 14 mils thick coating shall be applied to the airfoil shapes in accordance with 4.6.1, cured as specified in 4.7.11 and tested as follows: six of the airfoil shapes shall be tested immediately; six panels shall be subjected to outdoor weathering as specified in 4.7.19; and six panels shall be aged for 24 hours in a circulating air oven 108° ± 2°C (225° ± 5°F).

4.7.16.2 Test procedures. Six coated airfoil shapes, exposed as specified in 4.7.16.1, shall be mounted on a suitable diameter 2-bladed propeller (0.0025 chord) in such a manner that 1 end of each panel extends to near the tip of each 0° pitch propeller blade. The propeller should be mounted horizontally and driven by a variable speed motor designed to permit testing at the center of the specimens at selected speeds. A suitable water ring, mounted above the rotating blade, shall be used to simulate a natural rainfall of 1 inch per hour at a 2 millimeter droplet size. The test shall be run at 500 miles per hour and shall conform to Table II. Failure is determined as the average time at which six specimens have eroded through to the substrate.

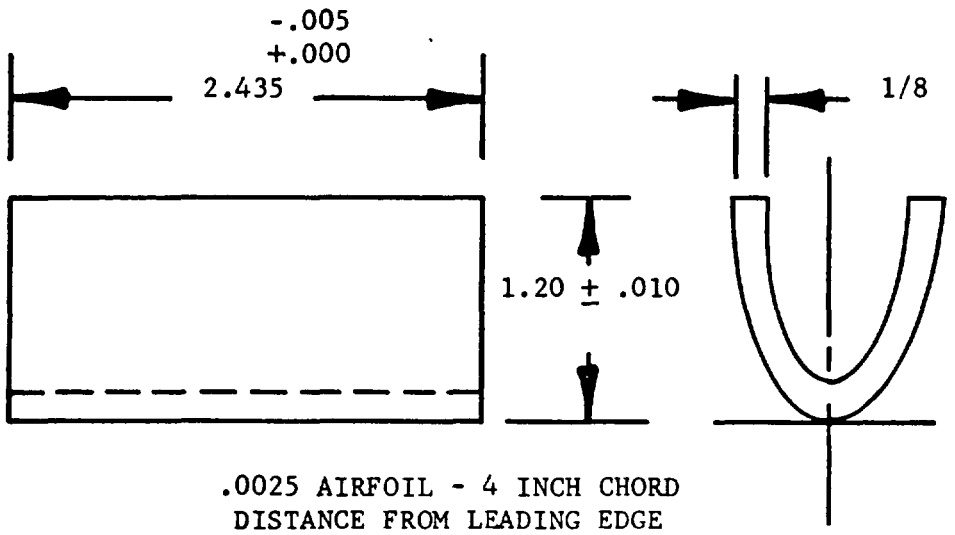
4.7.17 Sequence of testing. The sequence of testing the panels shall be as follows:

a. All panels shall be cured as specified in 4.7.11.

b. The uncoated control panel and 2 coated panels shall be tested as specified in 4.7.18 and 4.7.19 immediately after curing.

c. The panels specified in b. above shall be exposed to a temperature of 38° ± 2°C (100° ± 5°F) and a relative humidity of 95 percent for 7 days then tested as specified in 4.7.18.

d. The control panel and 2 coated panels shall be subjected to outdoor weathering as specified in 4.7.20. The 2 panels shall then be tested as specified in 4.7.18.



.0025 AIRFOIL - 4 INCH CHORD
DISTANCE FROM LEADING EDGE

% CHORD	ORDINATE (Y)	ABSCISSA (X)
.00	.00	.000
1.25	.05	.158
2.50	.10	.218
5.00	.20	.296
7.50	.30	.350
10.00	.40	.390
15.00	.60	.446
20.00	.80	.478
25.00	1.00	.485
30.00	1.20	.500

OUTER DIMENSIONS OF 1/8 INCH SPECIMEN

DIMENSIONS IN INCHES

MATERIAL - EPOXY-GLASS FIBER LAMINATE CONFORMING TO MIL-P-25421

FIGURE 1. Rain erosion test specimen.

4.7.18 Electrical transmission.

4.7.18.1 Test panels. Except for size, 5 test panels as specified in 4.6 and coated on 1 side only as specified in 4.6.1, shall be tested for conformance to Table II. The panels shall be 24 inches by 24 inches by 0.050 to 0.055 inch thick. Two of the panels are for Class 1 coating, 2 for Class 2 coating and 1 panel shall remain uncoated for use as a control panel.

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

4.7.18.3 Test procedures. The electrical transmission test procedure for flat panel samples shall be in accordance with MIL-R-7705 and as specified herein.

4.7.18.4 Microwave power frequency. The cured panels shall be subjected to one way microwave power measurements at incidence angles from -30 to +30 degrees, using paralled and perpendicular polarization of the incident energy. The microwave power transmission test shall be conducted at a frequency of 9.375 gigahertiz (GHZ).

4.7.18.5 Sample test plane. The test sample shall be clamped perpendicular to and at the approximate midpoint between the horns. The center of the sample will be coincident with the centerline of the horn.

4.7.18.6 Sample supporting structure. The sample supporting structure for holding the test sample in a perpendicular position between the horns shall be a wood clamp extending across the entire length of the bottom edge of the sample. The clamp shall not cover more than a one-inch border of the panel edge. The wood clamp shall be covered with absorbing material if it causes interference.

4.7.18.7 Angular displacement turn table. The test sample shall be mounted on a turn table with provisions for moving the panel through 0 to 70 degrees and for lateral movement of a minimum of one inch reproducibly. Readings shall be taken in maximum increments of 10 degrees and each 0.1 inch setting for angles up to 30 degrees.

4.7.19 Weather resistance. The panels shall be as specified in 4.6 except the size shall be 24 inches by 24 inches by 0.050 to 0.055 inch thick. Panels shall be exposed to outdoor weathering for 6 months and tested in accordance with Federal Test Method Standard No. 141, method 6160 at an approximate 45° south latitude.

4.7.20 Pot life. The base resin of Class 1 and 2 coatings shall be mixed with the catalyst or activator at standard conditions. The coatings shall have a minimum usable pot life of 4 hours when stored in a closed container. At the end of the 4-hour storage period, the coatings shall conform to 3.5.6.

4.7.21 Strippability. Two panels, one for each class, shall be as specified in 4.6 except the panel size shall be 24 inches by 24 inches by 0.050 to 0.055 inch thick. The panels shall be conditioned in the sequence specified in 4.7.17b and 4.7.17d. The stripper shall conform to MIL-R-25134. Apply the stripper to the panels with a brush. After the stripper has been in contact with the coating systems for 20 minutes, remove the residue with clean water by holding the panel under a tap water source. Inspect the panel for complete removal of the coatings, including primer, to determine conformance to 3.5.16.

4.7.22 Thermal flash resistance. Test panels 4 inches by 4.5 inches by 0.125 inches as specified in 4.6 shall be coated with the paint system. The coating shall be cured at standard conditions for five days prior to testing. When tested as follows the coating shall meet the requirements of 3.5.14. The coating shall be exposed to a quartz lamp radiation source with a spectral quality representative of 2200°K (3500°C) black body radiation. Operational characteristics of the apparatus shall consist of a pre-set irradiance level, precise regulation including a sensing radiometer and a pressurized lamp housing to avoid overheating and contamination by pyrolysis gases.

4.7.23 Packaging, packing, and marking. The coatings shall be inspected for compliance with section 5.

5. PACKAGING

5.1 Packaging, packing, and marking. The coatings shall be packaged, packed, and marked in accordance with PPP-P-1892 and as specified herein. Preservation and packaging shall be level A or C, as specified (see 6.2); packing shall be level A, B, or C as specified (see 6.2).

5.1.1 Packaging. The coatings shall be packaged in 1-gallon or 5-gallon containers. The components of the type I coating shall be packaged in separate companion containers; the primer in one and the primer activator in the other; the rain erosion resistant coating in one container and the catalyst in the other. The quanity of rain erosion resistant coating furnished shall be 1 full gallon plus catalyst or 1 full 5-gallon container plus catalyst. The quantity of primer shall be sufficient to primer coat an area equivalent to the area coverage of the base coating.

5.1.2 Packing. Packing for Class 1 and 2 coatings shall be 1 container each of primer, primer activator, rain erosion resistant coating, catalyst and thinner or solvent. The thinner for the 1-gallon size coatings shall be packed in the same unit.

5.1.3 Marking. In addition to the marking specified in PPP-P-1892, each container of the coating shall show the following precautionary marking; DO NOT STORE AT TEMPERATURES ABOVE 100°F. Each 1-gallon can and 5-gallon container shall be labeled as specified in 5.1.3.1.

5.1.3.1 Labeling. The following labeling in compliance with the provisions of the Federal Hazardous Substances Labeling Act shall appear on all containers:

CAUTION: THIS COATING MATERIAL IS 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 PROLONGED OR REPEATED BREATHING OF VAPOR.
DON"T GET IN EYES, ON SKIN, ON CLOTHING.
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES: FOR EYES, GET MEDICAL ATTENTION.

5.1.4 Mixing and application instructions. The supplier shall include mixing and application instructions with each package of the coatings.

6. NOTES

6.1 Intended use. Class 1 and 2 coatings are intended for exterior laminated plastic parts of high-speed aircraft and missiles for protection from rain erosion and thermal energy while the air vehicle is in flight. These coatings cannot be used on radomes and other plastic parts that have a requirement for protection against static electrical charges because they are not electrically conductive.

6.2 Ordering date. Procurement documents should specify:

a. Title, number and date of this specification.

b. Class.

c. Type and size of container.

d. Selection of applicable levels of packaging and packing (see section 5).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by the date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Air Force Wright Aeronautical Laboratories, Materials Laboratory, ATTN: AFWAL/MLSA, Wright-Patterson Air Force Base, Ohio 45433 and information pertaining to qualification of products may be obtained from the activity.

6.4 Photochemically reactive solvents. The Class 1 coating should be used in areas where Air Pollution Regulations do not control the emission of certain solvents into the atmosphere. However, the Class 1 coating can be used where solvent recovery systems are in operation or where the amount of the coating used will not result in solvent emissions exceeding the allowable amount for the specific geographical area.

6.5 Nonphotochemically reactive solvents. The Class 2 coating should be used in areas where Air Pollution Regulations control the emission of solvents into the atmosphere.

Custodian:

Air Force - 11

Preparing activity:

Air Force - 11

Project No. 8010-F039

APPENDIX

DETERMINATION OF FREE METHYLENE BIS (4-CYCLOHEXYLENE ISOCYANATE) MONOMER BY GEL PERMEATION CHROMATOGRAPHY

10. SCOPE

Gel Permeation Chromatography (GPC) is used to determine the amount of unreacted Methylene bis (4-Cyclohexylene Isocyanate) in urethane prepolymer formulations.

20. PRINCIPLE

1 c.c. of 1% solution of sample in tetrahydrofuran (THF) is injected into the GPC instrument. The area under the peak due to the monomer measured and this value is converted to concentration of monomer with the aid of a calibration curve.

30. EQUIPMENT AND REAGENTS

30.1 Gel Permeation Chromatograph, Water Model 100 or equivalent.

30.2 Styragel packed columns, type B (Waters) 3/8" x 4'

1	300° A pore size
1	700° A pore size
1	1000° A pore size
1	2000°-5000° A pore size
1	Reference Column

30.3 Differential Refractometer Detector.

30.4 Fisher T-397 Tetrahydrofuran.

30.5 Graduated Cylinders, 100 ml.

30.6 Centrifuge tubes, 100 ml., conical tips.

30.7 Analytical balance.

30.8 Centrifuge capable of handling 100 ml. tubes.

30.9 Beakers 150 ml.

40. PROCEDURE

Instrumental Conditions

Flow rate thru sample columns	1 ml per minute
Chart Speed	10 mins. per inch
Oven Temperature	30 ^{o} C
Refractometer Temperature	40° C
Span Selector	4X

Standardization

40.1 Prepare five standard samples by spiking a sample of Prepolymer (having a low concentration of monomer) with weighed amounts of monomer to give a series with 0% to 10% monomer. Run them through the GPC instruments.

40.2 Measure the areas under the peaks due to monomer.

40.3 Plot the areas vs % monomer added. The intercept will be the percent monomer in the original coating sample, and when subtracted from the other standards, should result in a calibration curve which intercepts through the origin. (See figure 1.)

ANALYTICAL PROCEDURE

40.4 Weight accurately about 0.80 grams of sample and dissolve in 60 ml of THF. Add THF in an amount to give a 1% (weight/volume) concentration of sample.

40.5 Transfer to centrifuge tube and cover top with aluminum foil to prevent loss of THF. Centrifuge for 15-20 minutes to precipitate Tio_2 pigment. (Note - unpigmented samples need not be centrifuged).

40.6 When solution is clear of pigment, inject GPC instrument and record curve.

50. CALCULATIONS

Measure area under peak due to monomer. Interpolate percent free monomer from calibration curve.

Reference: N.D.Kornbau, D.C.Ziegler, ANAL.CHEM.42, 1291 (1970).

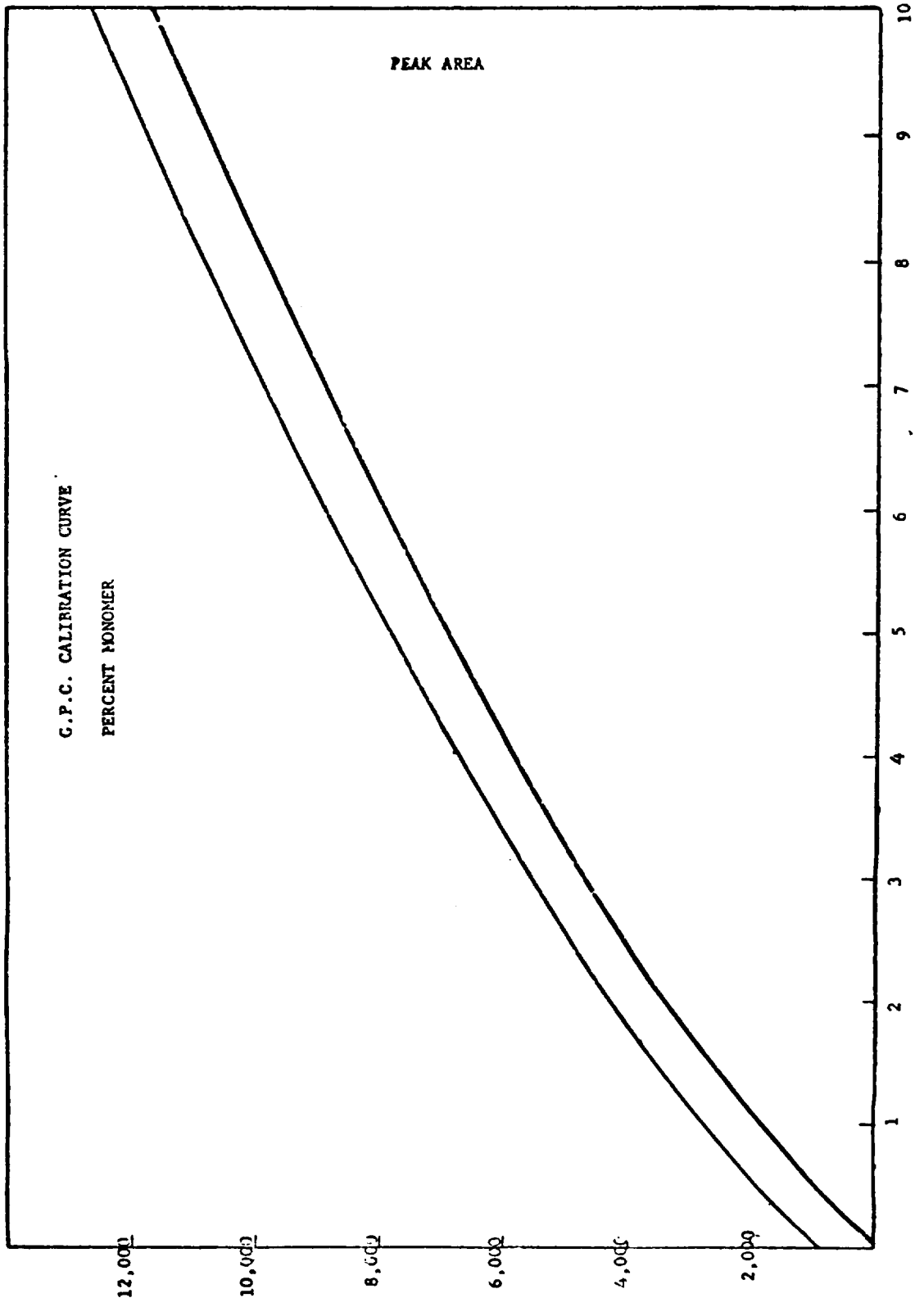


FIGURE 1. Calibration curve.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

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

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wo-ding:

c. Reason/Rationale for Recommendation:

6. REMARKS

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

b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional

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

8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

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