ADOPTION NOTICE

SAE-AMS-C-83231, "COATINGS, POLYURETHANE, RAIN EROSION RESISTANT FOR EXTERIOR AIRCRAFT AND MISSILE PLASTIC PARTS", was adopted on 24-SEP-99 for use by the Department of Defense (DoD). Proposed changes by DoD activities must be submitted to the DoD Adopting Activity: ASC/ENOI, Building 560, 2530 Loop Road West, Wright-Patterson AFB, OH 45433-7101. Copies of this document may be purchased from the Society of Automotive Engineers 400 Commonwealth Drive Warrendale, Pennsylvania, United States, 15096-0001. http://www.sae.org/

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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-C-83231

Issued SEP 1999

Submitted for recognition as an American National Standard

Coatings, Polyurethane, Rain Erosion Resistant for Exterior Aircraft and Missile Plastic Parts

1. SCOPE:

1.1 Scope:

This specification covers the requirements for two classes and two types of rain erosion resistant coatings. This specification has been prepared as a direct replacement for the Military Specification MIL-C-83231A Notice 1.

1.2 Application:

These products have been used for protecting glass fabric reinforced plastic laminates and other plastic parts used for exterior surfaces of aircraft and missiles, but usage is not limited to such applications. (See 8.1)

1.3 Classification:

The coatings shall be of the following classes, types and compositions as specified. (See 6.1.)

Class A	Polyurethane prepolymers which are not dependent on moisture or high relative humidity for curing (see 6.4).
Type I	Rain erosion resistant coating.
Type II	Antistatic rain erosion resistant coating.
Composition G	General use.
Composition L	Limited use.
Class B	Polyurethane prepolymers which are dependent on moisture or high relative humidity for curing (see 6.4).
Type I	Rain erosion resistant coating.
Type II	Antistatic rain erosion resistant coating.
Composition G	General use.
Composition L	Limited use.

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1.4 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The issue of the following documents in effect on the date of the purchase order form a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 93	Flash Point by Pensky-Martin Closed Cup Tester
ASTM D 1014	Conducting Exterior Exposure Tests of Paints on Steel
ASTM D 1296	Odor of Volatile Solvents and Diluents
ASTM D 1475	Density of Paint, Varnish, Lacquer and Related Products
ASTM D 1644	Non-Volatile Content of Varnishes
ASTM D 2196	Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer
ASTM D 2369	Volatile Content of Coatings
ASTM D 4420	Aromatics in Finished Gasoline by Gas Chromatography

2.2 U.S. Government Publications:

Available from DODSSP Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

TT-S-735	Standard Test Fluids; Hydrocarbon
PPP-P-1892	Paint Varnish, Lacquer and Related Materials: Packaging, Packing and Marking of
MIL-P-5425	Plastic Sheet, Acrylic, Heat Resistant
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 Based-Epoxy Resin Low Pressure Laminated
FED-STD-141	Paint, Varnish, Lacquer, and Related Materials; Methods of Inspection. Sampling and Testing
	U.S. Air Force 535 Free Diisocyanate Test Method
HUD	Federal Hazardous Substances Labeling Act
49CFR 171-178	Department of Transportation (DOT) Regulations for the Transportation of Explosives and Other Dangerous Articles by Land and Water

2.3 State Regulations Publications:

Available from the California Air Pollution Control District, 434 South San Pedro Street, Los Angeles, CA 90013.

Rule 102 Photochemically Reactive Solvents,

3. TECHNICAL REQUIREMENTS:

3.1 Qualification:

The coatings materials furnished under this specification shall be products which are qualified for listing on the applicable qualified products listed at the time set for opening of bids (see 4.3 and 8.3). Qualified contractors shall certify that the products offered conform to the requirements specified in 3.5.5.

3.2 Materials:

The coating material shall be of a polyurethane type formulated from a chemically curing composition of such ingredients as may be necessary to produce high quality materials. The coating materials shall cure completely at standard conditions. The Class A coatings shall contain only cycloaliphatic or Aliphatic isocyanate (see 8.4).

3.2.1 Toxic products and formulations: The material shall have no adverse effect on the health of personnel when used for its intended purpose and applied in approved facilities with the use of approved 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 A, Types I and II, Compositions G and L: The Class A coatings shall be a polyurethane prepolymer vehicle which can be polymerized with a curing agent at standard conditions without dependence on moisture or high relative humidity. Unless otherwise specified, class A, type I coating components shall be individually packaged and furnished as a kit. The kit shall consist of the following: a primer plus primer activator; polyurethane prepolymer vehicle plus the curing agent; and a thinning solvent. For class A, type II coatings, an anti-static film shall be applied to the surface of the type I coating. The class A, type II coating kit shall consist of all the components required for the class A, type I kit plus the antistatic polyurethane prepolymer vehicle and the curing agent. Class A coatings shall be applied by spray or brush techniques. All solvents and thinners contained in and furnished with class A, composition G coatings shall be nonphotochemically reactive. The solvents and thinners contained in and furnished with class A, composition L coatings are photochemically reactive (see 8.5).

3.3.2 Class B, Types I and II, compositions G and L: The class B coatings shall be moisture curing polyurethane prepolymers, of which the polymerization may be accelerated by a catalyst. The class B coatings can be polymerized at standard temperature conditions but are dependent on moisture or high relative humidity. The polymerization rate can be accelerated by the use of a catalyst. Unless otherwise specified, class B, type I coating components shall be individually packaged and furnished as a kit. The kit shall consist of the following: a primer plus primer activator: polyurethane prepolymer vehicle plus a catalyst when applicable; and a thinning solvent. For class B, type II coatings, an antistatic film shall be applied to the surface of type I coating. The class B, typed II coating kit shall consist of all the components required for the class B, type I kit plus the antistatic polyurethane vehicle and the catalyst when applicable. Class B coatings shall be applied by brush or spray techniques. All solvents and thinners contained in and furnished with class B, composition G coatings shall be non-photochemically reactive. The solvents and thinners contained in and furnished with class B, composition L coatings are photochemically reactive (see 8.5).

3.3.3 Solvents: The solvents and thinners for classes A and B, types I and II, composition G coatings shall be nonphotochemically reactive and shall be compatible with the coating materials.

3.3.4 Nonphotochemically reactive solvent: A nonphotochemically reactive solvent is any solvent with an aggregate of less than 20 percent of its total volume composed of the chemical compounds classified below or which does not exceed any of the following individual percentage composition limitations with reference to the total volume of solvent (see 8.5).

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

b. A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethyl benzene: 8 percent.

c. A combination of ethylbenzene, ketones having hydrocarbon structures, trichloroethylene or toluene: 25 percent.

d. Total (a) + (b) + (c): 20 percent maximum.

e. Ethylene glycol monoethyl ether acetate: 25 percent minimum.

3.4 Quantitative Requirements:

The quantitative requirements of the coatings shall be as specified in Table 1.

TABLE 1 - Quantitative Requirements - Classes I and II

Component	Nonvolatile (Solids Content) % by Weight, min	Density, kg/L (lb/gal)	Viscosity, Centipoises	Flash Point °C (°F), min
Primer (Mixed components, if applicable)	10.0	0.839 (7.0)	100-400	10 (50)
CLASS A				
Type I, Compositions, G & L Polyurethane Prepolymer	40	0.899 (7.5)	250-500	10 (50)
Type II, Compositions G & L Polyurethane Prepolymer	40	0.899 (7.5)	250-500	10 (50)
Antistatic Polyurethane Prepolymer	50	0.899 (7.5)	900-1500	10 (50)
CLASS B				
Type I, Compositions G & L Polyurethane Prepolymer	45	0.959 (8.0)	130-500	10 (50)
Type II, Compositions G & L Polyurethane Prepolymer	45	0.959 (8.0)	130-400	10 (50)
Antistatic Polyurethane Prepolymer	35	0.899 (7.5)	900-1500	10 (50)

3.4.1 Polyurethane prepolymers (free diisocyanate content): The free diisocyanate content of the polyurethane prepolymers for classes A and B, types I and II coatings shall be not greater than 1 percent when tested as specified in 4.7.2 and Appendix.

3.5 Qualitative Requirements:

3.5.1 Mixing: Components of classes A and B, types I and II coatings shall be individually mixed in accordance with the manufacturers instructions. The resulting individual mixtures shall be smooth, homogeneous materials free from lumps, gelling, seeding, separation or other objectional characteristics.

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: Classes A and B coatings shall be tinted black. The color shall be sufficiently intense when the specified film thickness is applied that the surface is completely hidden.

3.5.4 Accelerated storage stability: Classes A and B coatings shall be subjected to 4 days of accelerated storage. 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 when tested in accordance with 4.7.7.

3.5.5 Shelf storage life: When stored as specified in 4.7.8, classes A and B coatings shall meet all the requirements of this specification except that the minimum viscosity in Table 1 shall not have decreased by more than 10 percent from the specified value and the maximum viscosity in Table 1 shall not have increased by more than 10 percent above the specified value.

3.5.6 Pot life: Classes A and B coatings shall have a minimum pot life of 4 hours at standard conditions. 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.

3.5.7 Application and drying time: The class A and B coatings shall be applied in accordance with the manufacturer's instructions to a total dry film thickness of 0.31 to 0.36 mm (0.012 to 0.014 inch) (12 to 14 mils). The total application time, including priming and intervals between coatings shall not exceed 8 hours. The tack free drying time for class A coatings shall not exceed 4 hours after application of the final coating when tested in accordance with 4.7.10. The tack free drying time for class B coatings shall not exceed 10 hours after application of the final coat when tested in accordance with 4.7.10.

3.5.7.1 Rate-of-cure: The rate-of-cure of the classes A and B coatings shall have a maximum set-to-touch or recoat time of one hour. For class B materials, the manufacturer shall furnish instructions for catalyzing or accelerating the polyurethane prepolymer materials for a temperature range from 10 to 35°C (65 to 95°F) and a relative humidity range from 40 percent to 75 percent.

3.5.8 Curing time: Class A coatings shall be fully cured within 5 days and shall be free of pinholes, cracks, bubbles or other film irregularities. Class B coatings shall be fully cured within 10 days and shall be free of pinholes, cracks, bubbles, or other film irregularities.

3.5.9 Peel strength: Class A coatings shall have a peel strength of not less than 1126 N/m (7 pounds per inch) and class B coating shall have a peel strength of not less than 1751 N/m (10 pounds per inch) when tested in accordance with 4.7.12.

3.5.10 Flexibility: Films of the coatings shall show no cracking or loss of adhesion in the bend area when tested in accordance with 4.7.12.

3.5.11 Water and aromatic fuel resistance: After immersion in water and fuels, the coatings shall show no evidence of blistering, swelling, checking, or visible color change. After immersion, the peel strength shall not decrease to less than 7 pounds per inch when tested in accordance with 4.7.13 and 4.7.14.

3.5.12 Rain erosion resistance: Class A types I and II coatings, and class B types I and II coatings shall not erode through a 0.31 to 0.36 mm (0.012 to 0.014 inch) (12 to 14 mils) thick coating when tested as specified in 4.7.16 and Table 3.

3.5.13 Electrical transmission: Class A types I and II coatings and class B types I and II coatings shall have a minimum electrical transmission of 85, 90 or 95 percent when tested as specified in 4.7.18 and Table 3.

3.5.14 Surface resistivity: The surface resistivity of the class A, type II coating shall be not less than 0.5 megohms nor more than 15 megohms per square when tested as specified in 4.7.19 and Table 3.

3.5.15 Weather resistance: Class A, types I and II coatings and class B, types I and II coatings, when exposed to outdoor weathering for 6 months shall show no film deterioration such as chalking, checking, cracking, embrittlement, loss of adhesion, or loss of resiliency. After weathering, the coatings shall meet the surface resistivity requirements as specified in 3.5.14.

3.5.16 Strippability: Newly applied, fully cured and weathered Class A, types I and II and class B, types I and II coatings shall be easily strippable when tested as specified in 4.7.22.

3.5.17 Repairability: The cured coatings shall be repairable as specified by the manufacturer.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

The manufacturer of the coating compound shall supply all samples for manufacturer's tests and shall be responsible for the performance of all required tests. Purchaser reserves the right to sample and perform any confirmatory testing deemed necessary to ensure that the coating compound conforms to the requirements of this specification.

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 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 types I and II)	0.5 L or 1 pint (for each class and each type)
Primer activator	Quantity specified by manufacturer
Polyurethane prepolymer	3.8 L or 1 gallon (for each class and each type)
Catalyst	Quantity specified by manufacturer
Antistatic coating (for type II)	1 L or 1 quart for each class
Antistatic catalyst (for type II)	Quantity specified by manufacturer
Diluent	3.8 L or 1 gallon (for each class and each type)

4.3.1 (Continued):

b. Test panels

Uncoated airfoils (see 4.7.16)	18 (for each class and each type)
Coated void-free laminate panels (see 4.7.18)	5 (2 for type I, classes A and B) (3 for type II, classes A and B)
Uncoated void-free control panels (see 4.7.18)	1
Coated void-free panels (see 4.7.22)	1 (for each class and type)

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.

4.3.2.1 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: 3.8 L or one gallon samples shall be selected from each lot and subjected to the following tests:

a. Nonvolatile (solids) content (see 4.7).
b. Viscosity (see 4.7).
c. Condition in container (see 4.7.6).
d. Accelerated storage (see 4.7.7).
e. Peel strength (see 4.7.12).
f. Surface resistivity (type II system only) (see 4.7.19).

4.5 Test conditions:

Standard laboratory test: conditions shall be 24°C ± 1 (75°F ± 2) 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 material 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 75 x 200 x 3.2 mm (3 x 8 x 0.125 inch). 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 material.

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

Classes A and B

Type I - 0.025 to 0.05 mm (0.001 to 0.002 inch) (1 to 2 mils) of primer and 10 to 12 mils of rain erosion resistant coating (0.25 to 0.30 mm) was omitted.

Classes A and B

Type II - 0.025 to 0.05 mm (0.001 to 0.002 inch) (1 to 2 mils) of primer, plus 0.23 to 0.28 mm (0.009 to 0.011 inch) (9 to 11 mils) of rain erosion resistant coatings, plus 0.025 to 0.05 mm (0.001 to 0.002 inch) (1 to 2 mils) of antistatic coating.

4.7 Test methods:

Test methods shall be as specified in Table 2 and 4.7.1 through 4.7.22.

TABLE 2 - Test Methods

Characteristics	Requirement Reference	Test Method (ASTM)
Nonvolatile (solids) content	Table 1	D2369
Flash point	Table 1	D93
Density	Table 1	D1475
Viscosity	Table 1	D2196
Odor	3.5.2	D1296

4.7.1 Toxicological data and formulations: The contractor 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 B, types I and II coatings shall be determined in accordance with U.S. Air Force Bulletin 535. The free diisocyanate content of class A, types I and II shall be determined in accordance with the Appendix.

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-liter or 1-quart sample of each of the tinted base resins of classes A and B, types I and II 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 black tint contained in the base resin component of the classes A and B, types I and II materials shall be such that as the coatings are applied the surface becomes increasingly darker with each successive coat. When the specified coating thickness has been obtained, the color shall be sufficiently intense to completely hide the surface.

4.7.6 Condition in container: Component materials of each container shall be tested in accordance with FED-STD-141, method 3011.

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

4.7.8 Shelf storage life: The separate components of classes A and B, types I and II coating systems shall be stored in original unopened containers for a period of one year from the date of manufacture at a temperature of 24°C ± 2 (75°F ± 5) and 50 ± 5 percent relative humidity. After this storage period, the coating systems shall be capable of meeting the requirements of this specification.

4.7.9 Pot life: A 1-liter or 1-quart sample of the classes A and B, types I and II coatings shall be mixed as specified in 4.7.3 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: Classes A and B, types I and II coatings shall be applied in accordance with the manufacturer's instructions to two each test panels for each class and type of coating material as specified in 4.6. At the end of the rated tack free time (not to exceed 4 hours for the class A coatings or 10 hours for the class B coatings), a polyethylene film 2.54 cm (1 inch) wide, 15.24 cm (6 inches) long, and 0.010 cm ± 0.005 (0.001 inch) thick shall be pressed with a 28.3 gram (1-ounce) weight (approximately 12.9 square centimeters) 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: Classes A and B, types I and II coatings shall be applied in accordance with the manufacturer's instructions. The class A, types I and II coatings shall be cured for 5 days at 24°C (75°F) and 50 percent relative humidity to determine conformance to 3.5.8. The class B, types I and II coatings shall be cured for 10 days at 24°C (75°F) and 50 percent relative humidity to determine conformance to 3.5.8.

4.7.12 Peel strength: For each class and type coating, 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 as specified in 4.7.11. At the end of the curing period, two 2.54 cm (1-inch) wide strips shall be cut, lengthwise, through the coating to the panel and extended the full length of the panel. A 2.54 cm (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 5 cm (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 and type 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 distilled water for 24 hours at standard conditions. At the end of the 24-hour 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 of 3.5.9 to determine conformance to 3.5.11.

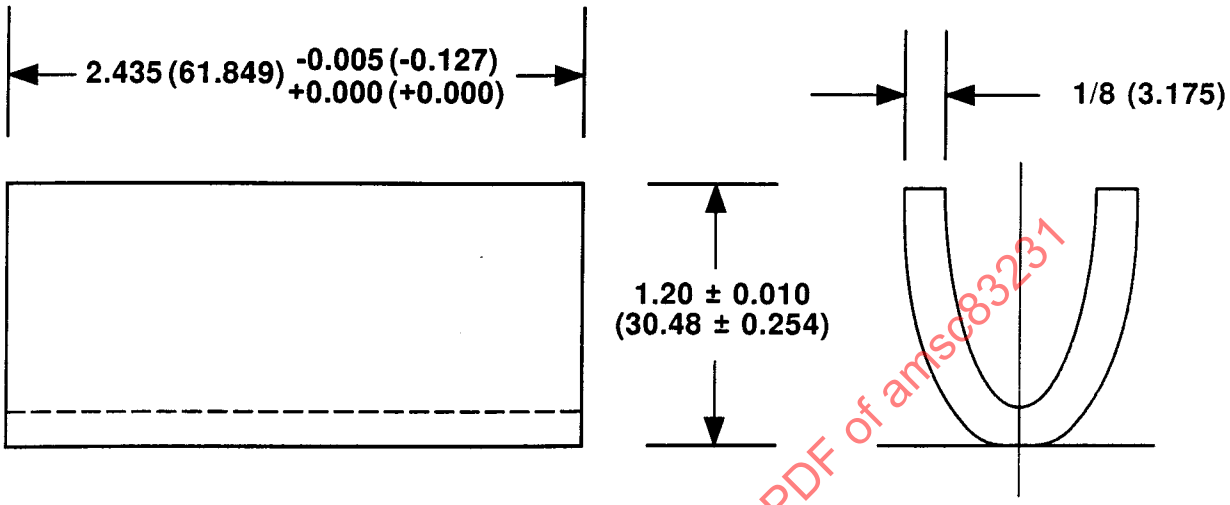
4.7.14 Aromatic fuel resistance: Three coated panels of each class and type coating shall be prepared as specified in 4.6.1 and cured as specified in 4.7.11. The panels shall then be immersed in hydrocarbon test fluid conforming to TT-S-735 Type III at standard conditions for 1 hour. At the end of the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

4.7.15 Flexibility: Three 7.62 x 10.16 x 0.050 cm (3 x 4 x 0.020 inch) 2024-T3 aluminum test panels anodized according to MIL-A-8625 Type II shall be coated with 0.31 to 0.36 mm (0.012 to 0.014 inch) (12 to 14 mils) of the coating systems and cured as specified in 4.7.11. The coated panels shall then be conditioned for 1 hour at -54°C (-65°F) and while at that temperature bent 180 degrees over a 0.317 cm (1/8-inch) conical mandrel in accordance with method 6223 of FED-STD-141. The panels shall be visually examined immediately after bending for evidence of failure, then conditioned at 24°C (75°F ± 2), 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 and type 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 0.31 to 0.36 mm (0.012 to 0.014 inch) (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 4.7.20; and six panels shall be aged for 24 hours in a circulating air-oven 107°C ± 2 (225°F ± 5).

4.7.16.2 Test procedure: 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 25.4 mm/h (1 inch per hour) at a 2 millimeter droplet size. The test shall be run at 805 km/h (500 miles per hour) and shall conform to Table 3. Failure is determined as the average time at which six specimens have eroded through to the substrate.



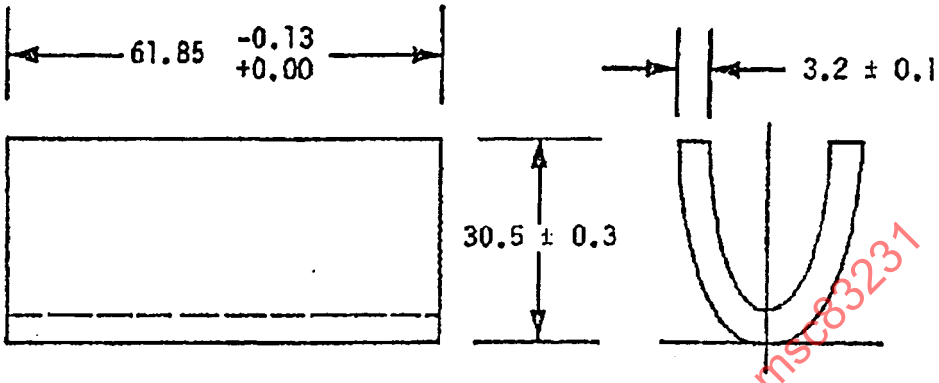
0.0025 AIRFOIL - 4 INCH (101.6 MILLIMETERS) CHORD
DISTANCE FROM LEADING EDGE

% CHORD	ORDINATE (Y)	ABSCISSA (X)
0.00	0.00	0.000
1.25	0.05	0.158
2.50	0.10	0.218
5.00	0.20	0.296
7.50	0.30	0.350
10.00	0.40	0.390
15.00	0.60	0.446
20.00	0.80	0.478
25.00	1.00	0.485
30.00	1.20	0.500

OUTER DIMENSIONS OF 1/8 INCH SPECIMEN

DIMENSIONS IN INCHES

FIGURE 1a - Rain Erosion Test Specimen



0.064 AIRFOIL - 100 mm CHORD
DISTANCE FROM LEADING EDGE

% CHORD	ORDINATE (Y)	ABSCISSA (X)
0.00	0.00	0.000
1.25	1.27	4.013
2.50	2.54	5.537
5.00	5.08	7.518
7.50	7.62	8.890
10.00	10.16	9.906
15.00	15.24	11.33
20.00	20.32	12.14
25.00	25.40	12.32
30.00	30.48	12.70

OUTER DIMENSIONS OF 3 mm SPECIMEN

DIMENSIONS IN MILLIMETERS

FIGURE 1b - Rain Erosion Test Specimen (SI)

TABLE 3 - Rain-Erosion Resistance, Electrical Transmission and Surface Resistivity
(Types I and II)

Property	After Drying & Normal Cure (See 3.5.8)	After Normal Cure and Aging 7 Days at 95% RH and 38 °C ± 2 (100 °F ± 2)	After Normal Cure & Outdoor Weathering	After Normal Cure & Aging 24 hours at 107 °C ± 2 (225 °F ± 5)	Exposure at -54°C (-65°F) for 6 hours
Rain erosion resistance (Erosion through 0.31 to 0.36 mm (0.012 to 0.014 inch (12 to 14 mils) at 805 km/h (500 mph) and 25.4 mm/h (1 inch/h) rainfall, time in minutes, minimum					
Class A, Type I	180		180	180	
Class A, Type II	150		150	150	
Class B, Type I	120		120	120	
Class B, Type II	100		100	100	
Electrical transmission (Two coated panels required for each coating, percent, minimum)					
Classes A & B, Type I 1/	95	90	95		
Classes A & B, Type II 1/	90	85	90		
One uncoated control panel	87	84	87		
Surface resistivity (in megohms per square)					
Classes A & B, Type II only	0.5 to 15	0.5 to 15	0.5 to 15	0.5 to 15	0.5 to 15

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

4.7.17 Sequence of testing: The sequence of testing the panels for classes A and B, types I and II coatings 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°C ± 2 (100°F ± 5) and a relative humidity of 95 percent for 7 days then tested as specified in 4.7.18. Additional testing as specified in 4.7.19 shall be conducted on the type II coated panels.

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 and for type II coatings additional testing as specified in 4.7.19.

e. One each panel coated with the type II coatings shall be maintained at a temperature of -54°C (-65°F) for 4 hours and tested as specified in 4.7.19. The same panels shall then be aged in a circulating air-oven for 24 hours at 107°C ± 2 (225°F ± 5) and again tested as specified in 4.7.19.

4.7.18 Electrical transmission:

4.7.18.1 Test panels: Except for size, 6 test panels as specified in 4.6.1 and coated on 1 side only as specified in 4.6.1, shall be tested for conformance to Table 3. The panels shall be 61 x 61 x 0.127 cm to 0.140 cm (24 x 24 x 0.050 inches to 0.055 inch) thick. Two of the panels are for type I coating, 3 for type II and 1 panel shall remain uncoated for use as a control panel.

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

4.7.18.3 Test procedure: 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 parallel and perpendicular polarization of the incident energy. The microwave power transmission test shall be conducted a frequency of 9.375 gigahertz (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 approximate midpoint between the horns. The center of the sample will be coincident with the centerline of the horns.

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 turntable: The test sample shall be mounted on a turntable with provisions for moving the panel through 0 to 70 degrees and for lateral movement of a minimum of 2.54 cm (1 inch) reproducibly. Reading shall be taken in maximum increments of 10 degrees and each 0.25 cm (0.1 inch) setting for angles up to 30 degrees.

4.7.18.8 Test data and compution: The test data shall be converted to and reported as percent transmission using the equation listed below:

$$\frac{T^2 \text{sample}}{T^2 \text{blank}} \times 100 = \% \text{ transmission}$$

Where T^2 sample = power transmission of coated panel
T^2 blank = power transmission of uncoated panel.

4.7.19 Surface resistivity (type II only): Test for surface resistivity shall be in accordance with Table 3.

4.7.19.1 Equipment: The equipment used for the surface resistivity test shall be as specified in Figures 2 and 3; two 1.20 cm (3/8 inch) wire spring loaded electrodes having a pressure capacity of 1.36 to 2.27 kilograms (kg) (3 to 5 pounds) shall be as specified in Figure 3. Use a 500-volt megohmmeter to measure accurately the range of 0 to 1000 megohms. The acrylic plastic panel shall conform to MIL-P-5425 and shall have a pattern of 12 holes 1.27 cm (1/2 inch) in diameter, drilled in three rows of 4 holes spaced 15.24 cm (6 inches) apart, center to center. The first hole shall start at a point 7.62 cm (3 inches) from the side edge and 15.24 cm (6 inches) from the top edge. This template shall be used as a means of spacing the electrodes at equal distance for the resistivity readings.

4.7.19.2 Test panels: The panels shall be as specified in 4.6 except the size shall be 61 cm by 61 cm by 0.127 cm to 0.140 cm (24 inches by 24 inches by 0.50 to 0.055 inch) thick. The panels shall be coated as specified in 4.6 and cured as specified in 4.7.11.

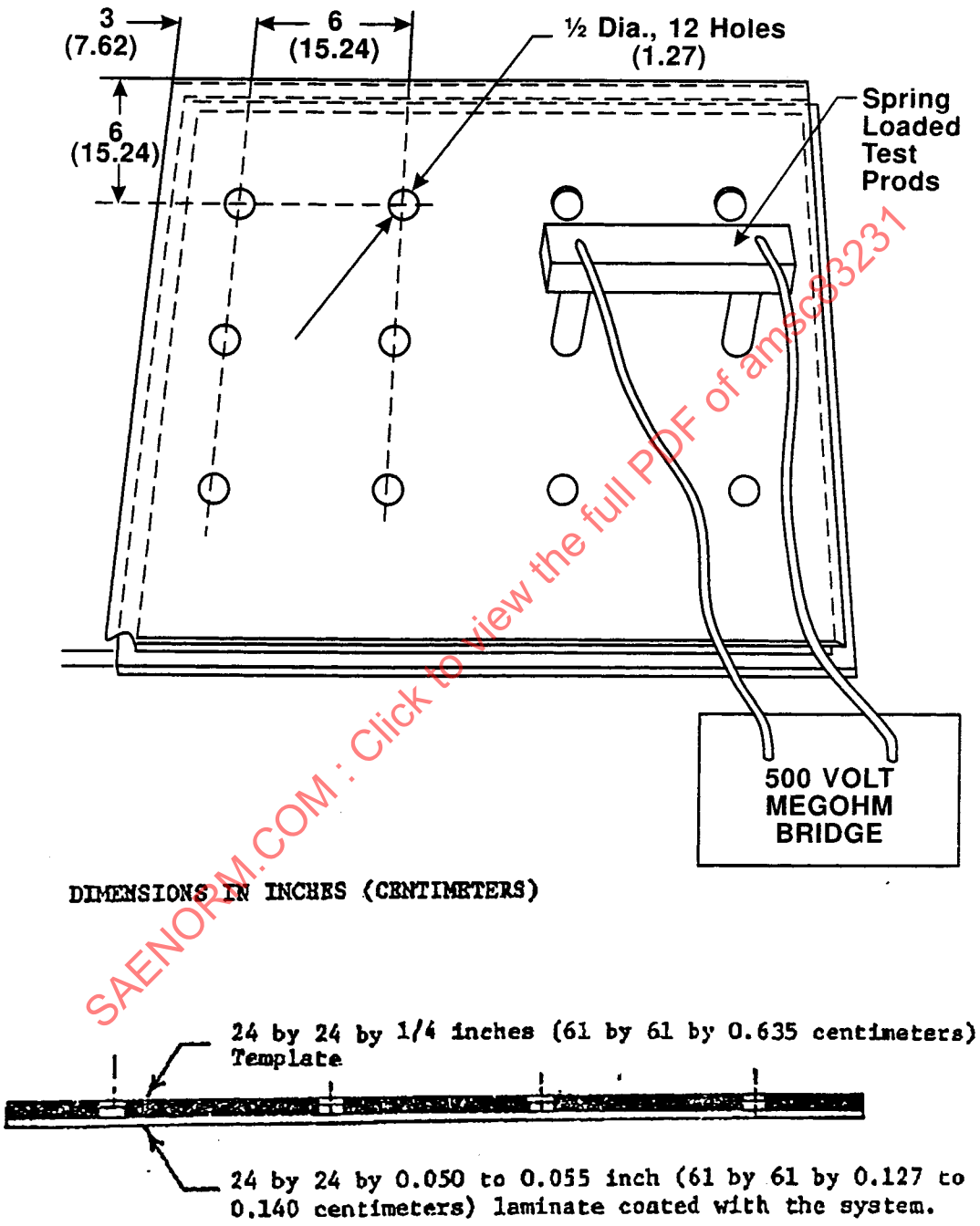


FIGURE 2 - Apparatus Used for Surface Resistivity

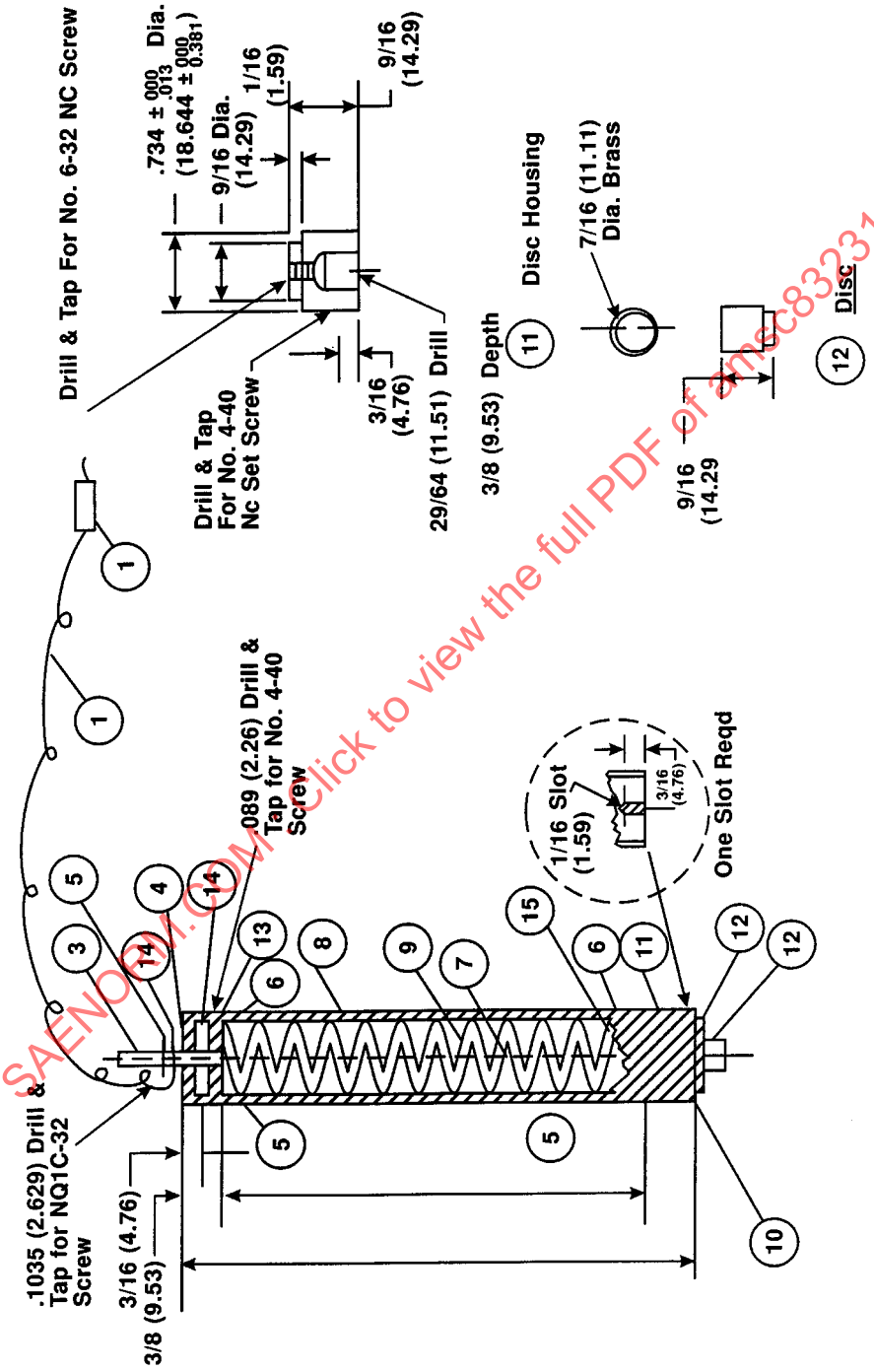
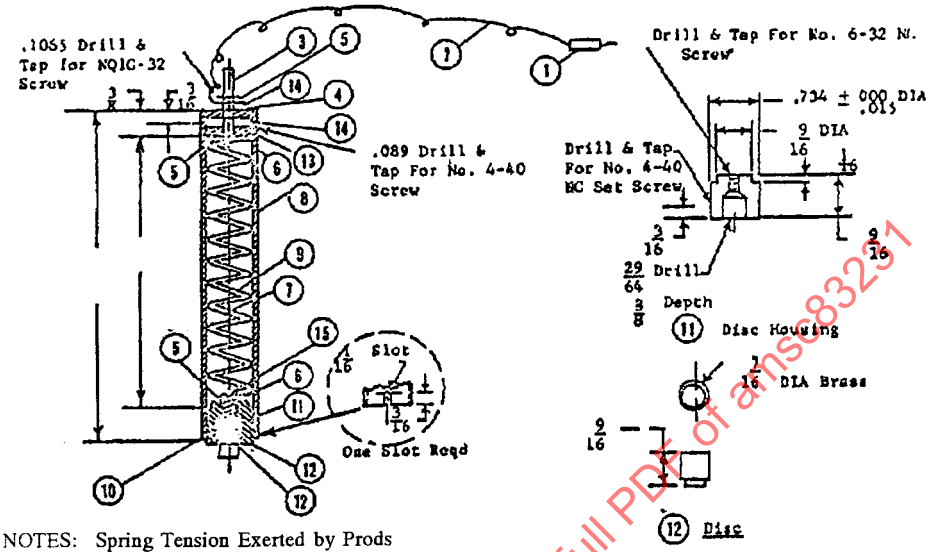


FIGURE 3a



NOTES: Spring Tension Exerted by Prods
WHEN: They are Pressed to Their
LIMIT: Is 3 to 5 lb.
Bend Terminal Lug No. 5 Around Bolt
Head to Clear Spring
Shorten Wire No. 7 to Allow Disc
Housing to Extend Maximum of 1/16 Beyond Tube.
DIMENSIONS IN INCHES

Part No.	No. Reqd	MATERIAL DESCRIPTION	SIZE
1	2	Instrument Lead	As Required
2	2	Rubber Covered Lead Wire	As Required
3	2	Round Head Mach Screw	No. 6-32 NCX1-1/8 Long
4	4	Hex Nut	No. 6-32 NC
5	6	Terminal Lug Shakeproof	2106-6
6	4	Internal Type Lock Washer	For No. 6-32 MC Screw
7	2	Pig Tail Wire	.035 DIA X5-1/2 Long
8	2	Phenolic Tubing	7/80.D X 3/41.DX5-5/16 Long
9	2	Compression Spring	.063 GA 11/16 O.D.X4/12 Long
0	2	Socket Head Set Screw	No. 4-40 NC X1/8 Long
11	2	Disc Housing	Brass - 3/4 Rod Stock X 9/16 Long
12	2	Brass Disc	7/16 DIA X 9/16
13	2	Phenolic Red Rod	3/4 DIA X 9/16
14	4	Flathead Mach Screw	No. 4-40 NC X 1/4 Long
15	2	Roundhead Mach Screw	No. 6-40 NC X 1/4 Long

FIGURE 3b - Spring Loaded Prods.

12	2	Brass Disc	7/16 DIA X 9/16
13	2	Phenolic Red	3/4 DIA X 9/16
14	4	Flathead Mach Screw	No. 4-40 NC X 1/4 Long
15	2	Roundhead Mach Screw	No. 6-40 NC X 1/4 Long

FIGURE 3c - Spring Loaded Prods.

4.7.19.3 Measurement procedure: The template shall be placed over an individual panel which has been exposed to the conditions as specified in 4.7.17. The two electrodes with their wire leads connected to the 500-volt megohmeter shall be placed to coincide with two holes of the template. All readings shall be taken with a uniform pressure of 1.36 to 2.27 kg (3 to 5 pounds) on the electrodes. Seventeen different readings shall be taken between holes of the template and averaged. After 1 hour, a repeat 17 readings shall be taken and averaged.

4.7.20 Weather resistance: The panels shall be as specified in 4.6 except the size shall be 61 cm by 61 cm by 0.127 cm to 0.140 cm (24 inches by 24 inches by 0.050 to 0.055) thick. Panels shall be exposed to outdoor weathering for 6 months and tested in accordance with ASTM D 1014 at an approximate 45 degree south latitude.

4.7.21 Pot life: The tinted base resin of classes A and B types I and II and the type II antistatic coatings shall be mixed with the catalyst 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.

4.7.22 Strippability: Four panels, one for each class and type, shall be as specified in 4.6 except the size shall be 61 cm by 61 cm by 0.127 cm to 0.14 cm (24 inches by 24 inches by 0.050 to 0.055 inch) thick. Panels shall be tested in the sequence specified in 4.7.17. The stripper used shall conform to MIL-R-25134. Apply the stripper to the panels by brushing. After the stripper has been in contact with the coatings system for 15 minutes, remove the residues with a gentle stream of tap water. Inspect the panel for complete removal of the coatings, including primer, to determine conformance to 3.5.16.

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

5. PREPARATION FOR DELIVERY:

5.1 Preservation-packaging:

Preservation-packaging shall be level A or C, as specified (see 8.2).

5.1.1 Packaging: The coatings shall be packaged in 3.8 liters or 19.0 liters (1-gallon or 5-gallon) containers. The components of the classes A and B, type I coatings shall be packaged in separate companion containers; the primer in one and the primer activator in the other; the rain erosion resistant coating in the one container and the catalyst in the other. The quantity of rain erosion coating furnished shall be 3.8 liters (1 full gallon) plus catalyst or 19.0 liters (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. The primer shall be furnished in completely filled containers. The components of the classes A & B, type II coatings shall be packaged as specified for type I and additional separate companion containers for the antistatic coating and catalyst. The quantity of antistatic coating shall be 0.95 liters (1 full quart) plus catalyst for the 3.8 liters (1-gallon) container and 3.8 liters (1 full gallon) of antistatic coating plus catalyst for the 19.0 liters (5 gallon) container.