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MILITARY SPECIFICATION

PLASTIC MATERIALS, SILICONE RESIN, GLASS FIBER BASE, LOW PRESSURE LAMINATED

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

1. SCOPE

1.1 Scope. This specification covers glass fiber base, silicone resin, low pressure laminated plastic material used for airframe structural parts (including external parts) and other applications.

1.2 Classification. The laminated plastic materials shall be classified by type, as below, and further identified by fabric number or mat as specified in Table I.

Type I - General purpose
Type III- Radar frequency

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards and handbooks. Unless otherwise specified, the following specifications, standards and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the specification form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Engineering Specifications and Standards Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

FSC 9330

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SPECIFICATIONS

MILITARY

MIL-C-9084	-Cloth, Glass, Finished, For Resin Laminates
MIL-P-9400	-Plastic Laminate and Sandwich Construction Parts, Aircraft structural.
MIL-R-25506	-Resin, Silicone, Low Pressure Laminating
MIL-M-43248	-Mats, Reinforcing, Glass Fiber

STANDARDS

MILITARY

MIL-STD-105	-Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	-Marking for Shipment and Storage
MIL-STD-794	-Parts and Equipment, Procedures for Packaging and Packing of

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting 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. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and supplement thereto, if applicable.

American Society for Testing and Materials (ASTM)

ASTM D 570	-Water Absorption of Plastics
ASTM D 635	-Rate of Burning and/or Extent and Time of Burning of Self Supporting Plastics in a Horizontal Position.
ASTM D 638	-Tensile Properties of Plastics
ASTM D 695	-Compressive Properties of Rigid Plastics

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American Society for Testing and Materials (ASTM) - Continued

ASTM D 790	-Flexural Properties of Plastics and Electrical Insulating Materials
ASTM D 792	-Specific Gravity and Density of Plastics By Displacement
ASTM D 2520-77	-Complex Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials at Microwave Frequencies and Temperatures to 1650°C

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

Uniform Classification Committee, Agent

Uniform Freight Classification Rules

(Applications for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

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

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 First article. When specified, a sample shall be subjected to the first article inspection (See 4.3 and 6.2).

3.2 Materials. All materials shall be as specified below. There shall be no deviation from these materials without prior approval of the procuring activity.

3.2.1 Fabric. The glass fabric shall conform to Class 3 of MIL-C-9084.

3.2.2 Mat. When mat laminate is specified, the mat shall conform to MIL-M-43248.

3.2.3 Resin. The resin shall conform to MIL-R-25506, Form A or B. The resin manufacturer's curing instructions shall be followed in the use of catalysts, curing, and post cure cycles except where the fabricator has determined more suitable catalytic systems and curing cycles for a particular application. These systems and cycles shall be fully described in the fabricator's process specification.

3.3 Process specification. A detailed description of the manufacturing and fabricating process and methods of control of manufacturing variables in the form of a titled, numbered, and dated process specification shall be prepared by the prime contractor (6.6.1), or obtained from a

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subcontractor (see 6.6.2) and approved by the prime contractor and submitted for approval to the procuring activity. The process specification shall comply with the requirements of this specification and MIL-P-9400, following that format as closely as possible. The process specification shall be made available by the prime contractor at the commencement of the production of material to which it applies and, thereafter, during the course of production for use by authorized Government inspectors in the facilities of the prime contractor, his subcontractors, or his vendors. It shall also be made available, on request, for review by engineers of the procuring activity. The prime contractor represents that compliance with such process specifications will produce a laminate meeting all the contract requirements. The process specification shall not be changed during production without the approval of the procuring activity. The process specification shall also contain specific identification of all materials employed and specific requirements for resin content, specific gravity, Barcol hardness, allowable defects, reparable defects, nonreparable defects, and method of repairing any reparable defects (3.13). Approval of the fabricator's process specification shall constitute compliance only with minimum acceptable requirements of this specification and does not obviate any additional requirements that may be specified in the contract, drawings, or detail specifications applicable to the procurement.

3.4 Foreign materials. Unless otherwise specified in the contract or order, there shall be no metal, paper or other foreign materials in the finished laminate.

3.4.1 Fillers. Finely divided, inert, organic fillers shall be permitted in mat laminates only.

3.5 Gaps and laps. Unless specifically approved by the procuring activity, there shall be no gaps between pieces of glass fabricated in any lamination. When laps are necessary, they shall be laid up with a lap width of at least 0.5 inch (12.7 mm). No two laps shall be superimposed upon each other in the plastic material.

3.6 Overlays. Unless otherwise specified, the laminated material shall not be made with a gel resin overlay (integrally molded or otherwise), with any thick resin surface, or any other surfacing material.

3.7 Warp or twist. The warp or twist of flat sheet laminates shall not exceed that shown in Table I. Percentage of warp is given in terms of length and width, and percentage of twist is given in terms of dimensions from one corner to the opposite corner.

TABLE I. Warp or twist of flat laminate sheets.

Thickness, inch (mm)	Permissible maximum % variation/36 inch (0.91m) dimension 1/
0.031 (0.787) to under .0625 (1.58)	5.00
0.0625 (1.58) to under 0.125 (3.17)	2.50
0.125 (3.17) to 0.25 (6.35)	1.00
Over 0.25 (6.35) to 0.50 (12.7)	0.50

1/ These values apply to as manufactured sheet sizes, not cut pieces. For any standard sheet size other than 36 inches (0.91 m) refer to 6.7.

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3.8 Physical properties.

3.8.1 As specified properties. The minimum and maximum specific gravity, resin content and minimum barcol hardness requirements shall be as specified by the contractor and become part of the process specification (3.3). Testing shall be in accordance with Table VII.

3.8.2 Flammability. Flammability of the laminate determined as specified in Table IV shall be 0.5 inch (12.7 mm) per minute, maximum.

3.8.3 Water absorption. Water absorption of the laminate when determined as specified in Table IV shall not exceed 0.5 percent.

3.9 Mechanical properties. Mechanical properties shall be in accordance with Tables II and III when tested as specified in Table IV.

3.10 Electrical properties (Type III only). Electrical properties for Type III laminates shall be determined at standard conditions (4.5.1) and after immersion (4.5.5) in accordance with Table IV and 4.6.4. Requirements for both conditions shall be:

Dielectric constant, max - 4.5
loss tangent, max - 0.025

3.11 Dimensions and tolerances.3.11.1 Laminated flat sheets.

3.11.1.1 Thickness. Thickness requirements shall be as specified. Tolerance requirements shall be $\pm 10\%$ up to 0.25 inch (6.35 mm), $\pm 7\%$ for thicknesses greater than 0.25 inch (6.35 mm) to 0.50 inch (12.7 mm) and $\pm 5\%$ for all greater thicknesses.

3.11.1.2 Length and width. Length and width requirements shall be as specified by the procuring activity. Tolerance requirements shall be ± 0.5 inch (12.7 mm).

3.11.2 Laminated parts. All dimensions and tolerances of laminated parts shall be as specified by the drawing, detail specification or the procuring activity.

3.12 Makeup of laminates. The number of plies, fabric number or mat, positioning and direction of the fabric, MIL-R-25506 type resin, and other specific information relating to the makeup of laminated sheets and parts shall be as specified in the appropriate drawings, specifications or the procuring activity.

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TABLE II. Longitudinal mechanical properties of laminated material at Standard and wet conditions 1/

Fabric Number	Commercial MIL-C-9084	Tensile strength ₃ min psi x 10 ³ (MPa) ASTM D 638		Compressive strength ₃ min psi x 10 ³ (MPa) ASTM D 695		Flexural strength ₃ min psi x 10 ³ (MPa) ASTM D 790		Flexural modulus of elasticity, initial, min, psi x 10 ⁶ (GPa)	
		Std. Cond.	Wet Cond.	Std. Cond.	Wet Cond.	Std. Cond.	Wet Cond.	Std. Cond.	Wet Cond.
112 112-150	I IA	30 (207)	27 (186)	17 (117)	15 (103)	35 (241)	30 (207)	2.4 (16.5)	2.2 (15.1)
116 116-150	II IIA	30 (207)	27 (186)	15 (103)	13 (89)	31 (213)	27 (186)	2.4 (16.5)	2.2 (15.1)
128 128-150	IV IVA								
128-75G	IVB	30 (207)	27 (186)	11 (75)	10 (68)	32 (220)	26 (179)	2.4 (16.5)	2.2 (15.1)
162	VI	30 (207)	27 (186)	8 (55)	7 (48)	24 (165)	20 (137)	2.0 (13.7)	1.8 (12.4)
164 164-150	VII VIIA	25 (172)	21 (144)	10 (68)	10 (68)	24 (165)	20 (137)	2.0 (13.7)	1.8 (12.4)
120	III	30 (207)	27 (186)	17 (117)	15 (103)	35 (241)	30 (207)	2.4 (16.5)	2.2 (15.1)
181	VIII								
181-150	VIII								
181-75DE	VIIIA								
182 182-150	VIIIB	30 (207)	27 (186)	18 (124)	15 (103)	35 (241)	28 (193)	2.4 (16.5)	2.2 (15.1)
183	IX IXA	32 (220)	28 (193)	27 (186)	14 (96)	35 (241)	30 (207)	2.4 (16.5)	2.2 (15.1)
184 184-150	X	32 (220)	28 (193)	15 (103)	13 (89)	32 (220)	27 (186)	2.4 (16.5)	2.2 (15.1)
143 143-150	XI XIA	32 (220)	28 (193)	12 (82)	11 (75)	32 (220)	27 (186)	2.4 (16.5)	2.2 (15.1)
MAT	V VA	60 (413)	53 (365)	23 (158)	22 (151)	63 (434)	52 (358)	4.4 (30.3)	4.0 (27.5)
	MIL-M-43248	15 (103)	13 (89)	9 (62)	9 (62)	17 (117)	15 (103)	1.3 (8.9)	1.1 (6.9)

1/ Properties listed are for 0.125 + 0.010 inch (3.17 + 0.25 mm) thick parallel laminated panels, except for mat.

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3.13 Workmanship.

3.13.1 Defects. Defects shall be as specified in MIL-P-9400 and as follows: The laminated sheets and parts shall be uniform, smooth and free from uncured or unbonded areas, gaps, cracks, holes, blisters, resin pockets, resin starvation, tackiness, excess surface resin, laps, wrinkles, delamination, air or gas pockets, patches, porosity or other similar defects.

3.13.1.1 Critical area defects. Critical areas are those which are essential to the serviceability of the part or sheet regarding structure, aerodynamic considerations, and electrical requirements. Critical areas shall be as specified in drawings, specifications, or contracts. When no critical areas are specified, each entire part or sheet shall be considered critical.

3.13.1.2 Allowable defects. Allowable defects shall be fully described in the approved process specification. The defects shall be identified as to type, size, number and spacing. Allowable defects are those which do not affect the serviceability of the item.

3.13.1.3 Repairable defects. Repairable defects shall be fully described in the approved process specification. Repairable defects are those which can be repaired without affecting the serviceability of the item.

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 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 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 shall be classified as follows:

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

4.3 First article inspection. Unless otherwise specified, first article inspection shall consist of all the tests and inspections specified in Table IV. First article instructions for testing and approval are located in 6.2.2.

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TABLE III. Longitudinal mechanical properties of laminated material at elevated temperatures

Fabric Number	Tensile strength, min psi x 10 ³ (MPa) ASTM D 638	Compressive strength, min. psi x 10 ³ (MPa) ASTM D 695	Flexural strength, min. psi x 10 ³ (MPa) ASTM D 790	Flexural modulus of elasticity initial, ⁶ min. psi x 10 ⁶ (GPa) ASTM D 790	Flexural strength, min. psi x 10 ³ (MPa) ASTM D 790	Flexural modulus of elasticity initial, ⁶ min. psi x 10 ⁶ (GPa) ASTM D 790
CMCL	Tested at 260°C (500°F) after 30 minutes at 260°C (500°F)				Tested at 260°C (500°F) after 192 hours at 260°C (500°F)	
112 112-150 I IA	20 (137)	6 (41)	14 (96)	1.66 (11.4)	14 (96)	1.66 (11.4)
116 116-150 II IIA	20 (137)	5 (34)	13 (89)	1.66 (11.4)	13 (89)	1.66 (11.4)
128 128-150 IV IVA						
128-75G IVB	20 (137)	4 (27)	13 (89)	1.66 (11.4)	13 (89)	1.66 (11.4)
162 VI	20 (137)	3 (20)	10 (68)	1.40 (9.6)	10 (68)	1.40 (9.6)
164 164-150 VII VIIA	16 (110)	4 (27)	10 (68)	1.66 (11.4)	10 (68)	1.66 (11.4)
120 III	20 (137)	6 (41)	14 (96)	1.75 (12.0)	14 (96)	1.75 (12.0)
181 181-150 VIII VIIIA						
181-75DE	20 (137)	6 (41)	14 (96)	1.66 (11.4)	14 (96)	1.66 (11.4)
182 182-150 IX IXA	21 (144)	5 (34)	14 (96)	1.66 (11.4)	14 (96)	1.66 (11.4)
183 X	21 (144)	5 (34)	13 (89)	1.66 (11.4)	13 (89)	1.66 (11.4)
184 184-150 XI XIA	21 (144)	4 (27)	13 (89)	1.66 (11.4)	13 (89)	1.66 (11.4)
143 143-150 V VA	40 (275)	8 (55)	25 (172)	3.06 (21.0)	25 (172)	3.06 (21.0)
MAT MIL-M-43248	10 (68)	3 (20)	7 (48)	0.88 (6.0)	7 (48)	0.88 (6.0)

1/ Properties listed are for 0.125 ± 0.010 inch (3.17 ± 0.25 mm) thick parallel laminated panels, except for mat.

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4.3.1 Prior approval. The first article approval procedures need not be repeated for subsequent contracts or orders for different parts. The supplier shall submit the previous first article test results and a certification that materials and processing techniques have not been changed. However, the procuring activity shall have the right to require the performance of any of the tests at any time it is deemed necessary to determine the conformance of the laminate to the requirements of this specification.

4.3.1.1 Contractor Certification. When specified (6.2), the contractor may submit a certificate of compliance for the electrical requirements of 3.10 for type III procurements.

4.3.2 First article sample. The first article sample shall consist of a suitable number of laminate sheets 0.125 ± 0.010 inch (3.17 ± 0.25 mm) thick, having a minimum area of 4 square feet (.35 square meter). When specified, an additional 4 by 8 inch (10 by 20 cm) sample at least 0.75 inch (19.0 mm) thick shall be supplied for electrical tests. The first article sample shall be fabricated from the predominant material specified for the end item, and processed in the equipment intended to produce that item. When specified, the sheets shall be cut to produce the number of specimens required for testing.

TABLE IV First Article Tests.

Property Physical and Mechanical	Requirement Paragraph	Test Method <u>1/</u>	No. of Specimens	Average results reported to nearest <u>2/</u>
<u>TESTED AT STANDARD CONDITIONS (See 4.5.1)</u>				
Specific gravity	3.8.1	D 792	3	0.01 unit
Resin content	3.8.1	4.6.2	3	1%
Barcol hardness	3.8.1	4.6.3	3	1 unit
Flammability	3.8.2	D 635	5	.01 in/min (0.25 mm/min)
Water absorption	3.8.3	D 570 <u>6/</u>	3	0.01%
Tensile strength	Table II	D 638	5	10^3 psi
Compressive strength	Table II	D 695 <u>4/</u>	5	10^3 psi
Flexural strength	Table II	D 790 <u>5/</u>	5	10^3 psi
Initial modulus of elasticity	Table II	D 790 <u>5/</u>	5	10^5 psi
<u>TESTED WET - AFTER IMMERSION (See 4.5.2)</u>				
Tensile strength	Table II	D 638	5	10^3 psi
Compressive strength	Table II	D 695 <u>4/</u>	5	10^3 psi
Flexural strength	Table II	D 790 <u>5/</u>	5	10^3 psi
Initial modulus of elasticity	Table II	D 790 <u>5/</u>	5	10^5 psi

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TABLE IV First Article Tests. (continued)

Property Physical and Mechanical	Requirement Paragraph	Test Method <u>1/</u>	No. of Specimens	Average results reported to nearest <u>2/</u>
<u>TESTED @ 260°C (500°F) - AFTER 1/2 HOUR @ 260°C (500°F) (See 4.5.3.1)</u>				
Tensile strength	Table III	D 638	5	10^3 psi
Compressive strength	Table III	D 695 <u>4/</u>	5	10^3 psi
Flexural strength	Table III	D 790 <u>5/</u>	5	10^5 psi
Initial modulus of elasticity	Table III	D 790 <u>5/</u>	5	10^5 psi
<u>TESTED @ 260°C (500°F) - AFTER 192 HOURS @ 260°C (500°F) (See 4.5.3.2)</u>				
Flexural strength	Table III	D 790 <u>5/</u>	5	10^5 psi
Initial modulus of elasticity	Table III	D 790 <u>5/</u>	5	10^5 psi
<u>ELECTRICAL <u>3/</u></u>				
Dielectric constant	Table IV	D 2520, 4.6.4	3	0.1 unit
Loss tangent	Table IV	D 2520, 4.6.4	3	0.001 unit

1/ Methods other than paragraph numbers are ASTM methods.

2/ Test reports shall include all individual values.

3/ Electrical tests shall be conducted at standard conditions and after immersion (see 4.5.4). Three specimens for each condition.

4/ Compression specimens tested edgewise.

5/ Flexural specimens tested flatwise.

4.3.2.1 Manufacturer's data. Along with the first article sample, the manufacturer shall submit, for approval, the following data:

- a. Two copies of proposed process specification
- b. Certification stating that all materials conform to paragraph 3.2 of this specification.
- c. Two copies of preliminary test report showing the laminates submitted conform to the requirements of this specification. Included shall be the contractor "as determined" values for specific gravity, resin content and barcol hardness.

4.4 Quality conformance.

4.4.1 Lot formation. Unless otherwise specified, a lot shall consist of all the laminated sheets or parts fabricated from the same materials under an approved process specification as part of one contract or order.

4.4.2 Sampling and inspection.

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4.4.2.1 Visual. Prior to the application of any coating or finish, each molded part or sheet shall be visually inspected in accordance with Table V and the approved process specification. Criticality of defects shall be as defined in 3.13 of this specification. Those parts or sheets judged to have critical defects shall be discarded. Reparable defects shall be corrected and re-submitted for inspection. The number, positioning and size of allowable defects shall be as specified in the process specification. Disposition of sheets and parts with excess allowable defects shall be as specified in the process specification.

4.4.2.2 Dimensional. Dimensional examination of sheets and parts shall be in accordance with Table VI. Samples shall be selected in accordance with Inspection Level S-3 of MIL-STD-105. The Acceptable Quality Level (AQL) shall be 2.5 expressed as defects per 100 units. The sample unit for this inspection shall be one sheet or molded part as applicable.

TABLE V. Visual inspection

Examine	Defect
Shape	Not shape specified.
Appearance	Finish not as specified, not uniform.
Make-up	Not laminated as specified. Laminations gap. Overlaps less than 0.5 inch (12.7 mm). Made with resin overlay or thick resin surface.
Warp or twist (flat laminated sheets)	In excess of that specified in 3.7.
Foreign material	Embedded foreign material (other than fibrous glass). Surface dirt, parting material, or other contaminants.
Workmanship	Cracks, scratches, holes, blisters, wrinkles, tacky surface, resin-starved or porous areas, resin pockets, chipped or broken parts. Rough surfaces, rough edges. Sheets delaminated, unbonded, or containing air pockets. Patches except when specifically permitted as allowable defects.

TABLE VI. Dimensional inspection

Examine	Defect
Length or width	Varies by more than 0.5 inch (12.7 mm) or by more than the tolerances indicated in drawings or contract requirements, as applicable.
Thickness	Varies by more than the tolerances indicated in drawings, specifications, or contract requirements. Unless otherwise specified, the thickness-tolerance for sheets in 3.11.1.1 shall apply.

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4.4.2.3 Physical and mechanical inspection. Each lot shall be tested for those characteristics identified in Table VII. The sample unit shall be a sufficient area of 0.125 ± 0.01 inch (3.17 ± 0.25 mm) thick laminate cut from the part or flat sheet whenever possible. As an acceptable alternate, the supplier may furnish a flat sheet prepared from the same material and laminated under the same conditions specified for the part. Failure of the sample to pass all the specified tests shall be cause to reject the lot represented by the sample. When Type III electrical testing is specified, a 0.75 inch (19.0 mm) thick specimen (4.3.2) shall also be included.

TABLE VII. Quality conformance mechanical & physical inspection.

Property	Requirement <u>1/</u>
Specific gravity	3.8.1
Resin content	3.8.1
Barcol hardness	3.8.1
Tensile strength	Table II
Compressive strength (tested wet, after immersion) Tested at 260°C (500°F) after 1/2 hour @ 260°F	Table II
Flexural strength	Table III
Initial modulus of elasticity	Table III

1/ Refer to Table IV for test method and number of specimens to be tested.

4.4.2.4 Packaging. The lot size for this inspection shall be the total number of shipping containers. The sample unit shall be one container fully prepared for shipping just prior to closure. The in-spection level shall be S-2 and the AQL shall be 2.5 defects per 100 units. Inspection shall be in accordance with Table VIII and Section 5 of this specification.

4.5 Test conditions.

4.5.1 Standard conditions. Standard conditions shall be $23^{\circ} \pm 1^{\circ}\text{C}$ ($73.4^{\circ} \pm 2^{\circ}\text{F}$) and 50 ± 4 percent relative humidity. Specimens shall be tested after being conditioned for 96 hours at this temperature and humidity.

4.5.2 Wet conditions. Specimens shall be immersed for 2 hours in boiling distilled water, cooled in water to $23^{\circ} \pm 1^{\circ}\text{C}$ ($73.4^{\circ} \pm 2^{\circ}\text{F}$) and tested immediately upon removal from the water without drying the specimens. For referee testing, specimens shall be immersed in dis-tilled water for 30 days at room temperature, and tested without drying upon removal from the water.

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TABLE VIII. Examination of preparation for delivery

Examine	Defect
Packaging	Not level specified in contract requirements. Not individually wrapped or interleaved, when specified. Packaging material not as specified.
Packing	Not level specified in contract requirements. Arrangement not as specified. Specified pads or liners missing or not as specified. Any nonconforming packing component, component missing, damaged or otherwise defective affecting serviceability. Closure not as specified.
Count	Less than specified or indicated quantity.
Weight	Gross weight exceeds specified requirements.
Markings	Interior or exterior markings (as applicable) omitted, illegible, incorrect, incomplete, or not in accordance with contract requirements.

4.5.3 Elevated temperature conditions.

4.5.3.1 Short term exposure. Specimens shall be placed in a test chamber maintained at $260^{\circ} \pm 2^{\circ}\text{C}$ ($500^{\circ} \pm 5^{\circ}\text{F}$) for 30 minutes and tested immediately at the same temperature.

4.5.3.2 Long term exposure. Specimens shall be conditioned for 192 hours in a circulating air oven maintained at $260^{\circ} \pm 2^{\circ}\text{C}$ ($500^{\circ} \pm 5^{\circ}\text{F}$), transferred to the $260^{\circ} \pm 2^{\circ}\text{C}$ ($500^{\circ} \pm 5^{\circ}\text{F}$) test chamber (4.5.3.1) for 30 minutes then tested at that temperature.

4.5.4 Electrical testing conditions. Specimens shall be tested at standard conditions (4.5.1) and after 24 hour immersion in distilled water at $23^{\circ} \pm 1^{\circ}\text{C}$ ($73.4^{\circ} \pm 2^{\circ}\text{F}$). The immersion specimens shall be removed from the water, surface moisture wiped off, then tested immediately at $23^{\circ} \pm 1^{\circ}\text{C}$ ($73.4^{\circ} \pm 2^{\circ}\text{F}$).

4.6 Test methods.

4.6.1 ASTM methods. ASTM methods of test for molded parts or sheets shall be as specified in Table IV.

4.6.2 Resin content. The resin content shall be determined by Soxhlet extraction using piperidine as the solvent using the following equation:

$$C = \frac{W_1 - W_2}{W_1} \times 100$$

Where: C = percent resin content

W_1 = weight of sample laminate

W_2 = weight of dried residue after extraction

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4.6.3 Barcol hardness. Barcol hardness shall be determined by direct reading on a barcol tester. Barcol tester GYZJ934-1 shall be used (see 6.5).

4.6.4 Electrical tests (Type III, only). Electrical property tests shall be performed by the shunted line wave guide method or resonant cavity technique using a 0.75 inch (19.0 mm) thick laminate specimen (4.3.2.1). The frequency shall be 8,500 to 10,000 MHz (X-band frequency range). The recommended test frequency for this band is 9,375 MHz. If calculations (see 6.4) establish thinner specimens are preferable, the testing activity shall be permitted to abrade or mill the specimens to the desired thickness.

5. PACKAGING

5.1 Preservation - packaging. Preservation-packaging shall be level A or commercial, as specified (see 6.2).

5.1.1 Level A. Unless otherwise specified, packaging shall be in accordance with MIL-STD-794.

5.1.2 Commercial. Packaging shall be in accordance with the manufacturer's commercial practice.

5.2 Packing. Unless otherwise specified, packing shall be level A, B or Commercial in accordance with MIL-STD-794.

5.3 Marking. Interior and exterior containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The laminated plastic material covered by this specification is intended for use in airframe and missile structural parts such as radio and radar antenna housing, fairings, et cetera, and for use in other applications. All exterior airframe and missile plastic parts are considered structural parts.

6.1.1 Non-parallel laminations, vari-directional loading. The mechanical properties specified herein are for parallel laminated glass fabric materials and random layup mat materials. When the materials are used cross laminated or in other layup, or in combinations of layups or materials, the mechanical properties will vary, and for design use may be calculated in accordance with available procedures approved by the procuring activity, or determined empirically. Mechanical properties also may vary with the direction of loading, and may also be calculated with other procedures approved by the procuring activity or determined empirically. However, inspection tests are still to be carried out in accordance with this specification.

6.2 Ordering data.

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6.2.1 Procurement requirements. Procurement documents shall specify the following:

- a. Title, number and date of this specification
- b. Type (see 1.2)
- c. Make-up of laminate. Number of plies and lay-up; and identification of plies as to mat or fabric number under this specification (Table I and 3.12)
- d. Whether electrical tests are required and special electrical requirements when applicable (6.4).
- e. Responsibility for performance of first article inspection (4.3 and 6.2.2)
- f. Drawings, specifications applicable to part or sheet
- g. Level of packaging (see 5.1)

6.2.2 First article. Contracts or orders shall specify the following for first article inspection (see 4.3):

- a. Where first article inspection is to be conducted (contractor's plant, Government or commercial laboratory).
- b. Method of reporting inspection results.
- c. Whether first article inspection is required. Paragraph 4.3.1 establishes procedures for waiving first article.

6.3 Additional test frequencies. In addition to the specified test frequency range for electrical properties (see 4.6.4), other frequencies may be of importance in particular applications and may be specified in contract or order in addition to, or in lieu of the 8,500-10,000 megahertz (x-band) range. Typical frequencies are as follows, including the x-band.

<u>Band</u>	<u>Test Frequency (Mhz)</u>
S	2,880
C	5,400
X	9,375
K ^u	16,500
K ^u	24,500
K _a	35,000

For tests above the K_a band, a possible test frequency is 58,500 mhz, based on available oscillator tubes.

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6.3.1 Specimen thickness. The thickness of specimens required for electrical tests at the frequencies as indicated in 6.4 may be calculated by the following formula:

$$d = \frac{3\lambda_o}{4\sqrt{\epsilon - (\lambda_o/\lambda_c)^2}}$$

Where: d = specimen thickness
 λ_o = free space wavelength
 λ_c = cut-off wavelength of wave guide
 ϵ = approximate dielectric constant of sample

Further information is available in ARTC report "ARTC-4 Electrical Test Procedures for Radomes and Radome Materials (Revised July 1960)", prepared by Aerospace Industries Association of America, Inc., 1725 De Sales Street, Washington, DC 20036.

6.4 Barcol Tester. Information concerning Barcol tester, Model GYZJ934-1, is available from the Barber-Colman Company, Rockford, Illinois.

6.5 Definitions.

6.5.1 Prime contractor. A prime contractor is a contractor fabricating components under direct contract with the Government or subcontracting the fabrication of part or all of such components; or a fabricator supplying parts directly to the Government.

6.5.2 Subcontractor. A subcontractor is a fabricator supplying components to a prime contractor.

6.6 Warp or twist equation. For sizes not specified in Table I, the following equation shall be used to obtain the permissible deviation.

$$\frac{D_x}{D_{36}} = \frac{L_x^2}{(36)^2}$$

Where: D_x = Permissible deviation from straight edge
in inches for the given length.
 D_{36} = Permissible deviation in inches for 36
inch length.
 L_x = The given length in inches.

6.7 Cross reference data. Cross reference of types between this revision and the superseded MIL-P-25518A(ASG) is as follows:

Revision B

Type I
Not included. Use Type III
Type III

Superseded Revision A

Type I
Type II
Type III

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6.8 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodians:

Army-MR
Navy-AS
Air Force-11

Preparing activity:

Navy-AS

(Project No. 9330-0864)

Review activities:

Army-EL, AV, MI
Air Force-99
DLA-GS

User activities:

Army-
Navy-MC, OS, SH
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DOCUMENT IDENTIFIER (Number) AND TITLE	MIL-P-25518B	PLASTIC MATERIALS, SILICONE
	RESIN, GLASS FIBER BASE, LOW PRESSURE	LAMINATED

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

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