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(See 6.5)

MILITARY SPECIFICATION

CLOTH, GLASS, FINISHED, FOR RESIN LAMINATES

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

1. SCOPE

1.1 Scope. This specification covers woven glass cloth that has been suitably finished for further fabrication into glass fabric base resin laminates and sandwich materials.

1.2 Classification. The cloth shall be of the types shown in Table I and of the following classes:

Class 1 - For polyester laminates
Class 2 - For epoxy laminates
Class 3 - For silicone laminates
Class 4 - For phenolic laminates

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

PPP-P-1133	Packaging and Packing of Synthetic Fiber Fabrics

Military

MIL-Y-1140	Yarn, Cord, Sleeving, Cloth, and Tape - Glass
MIL-R-7575	Resin, Polyester, Low-pressure Laminating

FSC 8305

SPECIFICATIONS

Military (Continued)

MIL-R-9299	Resin, Phenolic, Laminating
MIL-R-9300	Resin, Epoxy, Low-pressure Laminating
MIL-R-25506	Resin, Silicone, Low-pressure Laminating

STANDARDS

Federal

FED-STD-191	Textile Test Methods
FED-STD-406	Plastic, Methods of Testing

Military

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

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

3. REQUIREMENTS

3.1 Material. The cloth shall be manufactured from continuous filament glass yarns in accordance with Table I.

3.2 Construction and physical properties. The construction and physical properties of the finished cloth shall conform to the requirements listed in Table I when tested as specified in 4.2.3.

3.2.1 Width. Unless otherwise specified (6.2), the width of the finished cloth shall be 38 inches, inclusive of the selvages, and the width tolerance shall be -0.25 inch to +0.50 inch.

3.3 Finish. The finish shall be such as to produce the characteristics required of finished glass cloth in this specification, including the required performance characteristics when the finished cloth is made into a laminate with a laminating resin appropriate for the respective class (1.2) of the finished cloth; that is, with polyester resin for Class 1 cloth, epoxy resin for Class 2 cloth, silicone resin for Class 3 cloth, and phenolic resin for Class 4 cloth. The finish may comprise only a suitable cleaning operation to remove the processing oils and binders

TABLE I

CONSTRUCTION AND PHYSICAL PROPERTIES OF FINISHED CLOTH

Type	Commercial Designation 1/	Weave	Yarns per inch (min)		Yarn Construction 2/ 3/		Thickness (inch)		Weight (oz/sq yd)		
			Warp	Filling	Warp	Filling	Min	Max	Min	Nom 1/	Max
I	112	Plain	39	38	450-1/2 ECD	450-1/2 ECD	0.0030	0.0050	1.94	2.06	2.18
I A	112-150	Plain	39	38	450-1/2 ECD	150-1/0 ECG	0.0030	0.0050	2.44	2.60	2.76
II	116	Plain	59	57	450-1/2 ECD	450-1/2 ECD	0.0035	0.0055	2.89	3.07	3.25
II A	116-150	Plain	59	51	450-1/2 ECD	150-1/0 ECG	0.0035	0.0055	3.40	3.62	3.84
III	120	4-counter (crowfoot) satin	59	57	450-1/2 ECD	450-1/2 ECD	0.0035	0.0055	2.89	3.07	3.25
IV	128	Plain	41	31	225-1/3 ECE	225-1/3 ECE	0.0065	0.0085	5.42	5.77	6.12
IV A	128-150	Plain	41	31	150-1/2 ECG	150-1/2 ECG	0.0065	0.0085	5.42	5.77	6.12
IV B	128-75G	Plain	41	31	75-1/0 ECG	75-1/0 ECG	0.0060	0.0085	5.42	5.77	6.12
V	143	4-harness (crowfoot) satin	48	29	225-3/2 ECE	450-1/2 ECD	0.0080	0.0120	8.08	8.60	9.12
V A	143-150	4-harness (crowfoot) satin	48	29	150-2/2 ECG	450-1/2 ECD	0.0080	0.0120	8.08	8.60	9.12
VI	162	Plain	27	15	225-2/5 ECE	225-2/5 ECE	0.0140	0.0190	10.90	11.60	12.30
VII	164	Plain	19	17	225-4/3 ECE	225-4/3 ECE	0.0140	0.0180	11.37	12.10	12.83
VII A	164-150	Plain	19	17	150-4/2 ECG	150-4/2 ECG	0.0150	0.0190	11.37	12.10	12.83
VIII	181	5-counter, 8-harness satin	56	53	225-1/3 ECE	225-1/3 ECE	0.0080	0.0120	8.13	8.65	9.17
VIII A	181-150	5-counter, 8-harness satin	56	53	150-1/2 ECG	150-1/2 ECG	0.0080	0.0120	8.13	8.65	9.17
VIII B	181-75DE	5-counter, 8-harness satin	56	53	75-1/0 ECDE	75-1/0 ECDE	0.0080	0.0120	8.13	8.65	9.17
IX	182	5-counter, 8-harness satin	59	55	225-2/2 ECE	225-2/2 ECE	0.0120	0.0150	11.37	12.10	12.83
IX A	182-150	5-counter, 8-harness satin	59	55	150-1/3 ECG	150-1/3 ECG	0.0120	0.0150	12.78	13.60	14.42
X	183	5-counter, 8-harness satin	53	47	225-3/2 ECE	225-3/2 ECE	0.0170	0.0210	15.13	16.10	17.07
XI	184	5-counter, 8-harness satin	41	35	225-4/3 ECE	225-4/3 ECE	0.0240	0.0330	22.84	24.30	25.76
XI A	184-150	5-counter, 8-harness satin	41	35	150-4/2 ECG	150-4/2 ECG	0.0240	0.0330	22.84	24.30	25.76
XII	1000-150	Plain	15	13	150-4/2 ECG	150-4/2 ECG	0.0120	0.0160	9.02	9.60	10.18
XII A	1000-75	Plain	15	13	75-2/2 ECK	75-2/2 ECK	0.0120	0.0160	9.02	9.60	10.18
XIII	1044-150	Plain	13	13	150-4/4 ECG	150-4/4 ECG	0.0200	0.0250	16.73	17.80	18.87
XIII A	1044-75	Plain	13	13	75-2/4 ECK	75-2/4 ECK	0.0200	0.0250	16.73	17.80	18.87

Notes: 1/ Commercial designations and nominal weights per square yard are shown for information only and are not requirements. Commercial designations for a given type may vary with different suppliers.

2/ Terminology for yarn construction is in accordance with MIL-Y-1140 but the requirements of MIL-Y-1140 for yarn breaking strengths are not applicable. NOTE: The nominal average diameter of DE filaments (not listed in MIL-Y-1140) is 0.00025 inch.

3/ Yarns conforming to specified construction except for smaller-than-specified filament diameter are acceptable (e.g., 75-1/0 ECDE yarns are acceptable for Type IV B cloth in lieu of 75-1/0 ECG yarns).

present in the greige cloth, provided such a finish furnishes adequate compatibility with the applicable resin; or it may comprise a cleaning operation with subsequent application of additional materials (e.g., resin-coupling agents, fabric conditioners) to the cleaned cloth. The finish used shall be identified (3.7) by the finished cloth supplier's designation. Supplementing of the supplier's designation by a chemical characterization on the same label (e.g., "a chromium complex finish", "an amino silane finish") is recommended but is not required.

3.4 Color. The color of the finished cloth shall be uniform and shall be characteristic of the applied finish. When specified in the contract or order (6.2), the warp direction of the finished cloth shall be marked by colored direction-indicator yarns running warpwise in the cloth. Color and spacing of the indicator yarns, when specified, shall be prescribed in the ordering data (6.2), but the preferred color is blue and the preferred spacing is 6 inches between colored yarns.

3.5 Properties after lamination.

3.5.1 Mechanical properties. Laminates based on the finished cloth, when prepared in accordance with 4.2.4.3.1 and tested for mechanical properties in accordance with 4.2.4.5, shall conform to the requirements of Table II for longitudinal tensile properties and of Table III for longitudinal flexural properties of the applicable type and class of cloth.

3.5.2 Electrical properties. Unless otherwise specified (6.2), laminates prepared in accordance with 4.2.4.3.2 from Classes 1, 2, or 3 finished cloth and tested for electrical properties in accordance with 4.2.4.5 and 4.2.4.5.1 shall conform to the requirements of Table IV. There shall be no electrical requirements for laminates made from Class 4 finished cloth.

3.6 Length of rolls. Unless otherwise specified (6.2), the total length of cloth in each roll shall be 250 ±25 yards for Types I through IV B, 125 ±25 yards for Types V through IX A, also Types XII and XII A, and 65 ±15 yards for Types X through XI A, also Types XIII and XIII A. Unless otherwise specified (6.2), the maximum number of pieces in any roll shall be three and the minimum length of any piece shall be 15 yards.

3.7 Identification of product. Each roll of cloth shall be marked for identification in accordance with PPP-P-1133. Each roll shall also bear a ticket or label showing the identification of the finish which has been applied to the fabric (3.3).

3.8 Workmanship. The finished cloth shall be clean and evenly woven and shall conform to the quality of product established by this specification. Defects, if present, shall not exceed the limits specified herein.

TABLE II

LONGITUDINAL TENSILE STRENGTH OF LAMINATES 1/

Base Cloth		Tensile Strength (Thousands of psi) (Minimum Average)							
		Class 1 (polyester)		Class 2 (epoxy)		Class 3 (silicone)		Class 4 (phenolic)	
Type	Commercial Designation	Standard Conditions	Wet Condition	Standard Conditions	Wet Condition	Standard Conditions	Wet Condition	Standard Conditions	Wet Condition
I	112	40	38	47	45	30	27	48	46
I A	112-150	40	38	47	45	30	27	48	46
II	116	40	38	47	45	30	27	48	46
II A	116-150	40	38	47	45	30	27	48	46
III	120	40	38	47	45	30	27	48	46
IV	128	40	38	47	45	30	27	48	46
IV A	128-150	40	38	47	45	30	27	48	46
IV C	128-75G	40	38	47	45	30	27	48	46
V	143	80	75	90	85	60	53	96	90
V A	143-150	80	75	90	85	60	53	96	90
VI	162	40	38	47	45	30	27	48	46
VII	164	33	30	39	35	25	21	40	36
VII A	164-150	33	30	39	35	25	21	40	36
VIII	181	40	38	48	45	30	27	40	38
VIII A	181-150	40	38	48	45	30	27	40	38
VIII B	181-75DE	40	38	48	45	30	27	40	38
IX	182	43	40	50	47	32	28	52	48
IX A	182-150	43	40	50	47	32	28	52	48
X	183	43	40	50	47	32	28	52	48
XI	184	43	40	50	47	32	28	52	48
XI A	184-150	43	40	50	47	32	28	52	48
XII	1000-150	33	30	39	35	25	21	40	36
XII A	1000-75	33	30	39	35	25	21	40	36
XIII	1044-150	33	30	39	35	25	21	40	36
XIII A	1044-75	33	30	39	35	25	21	40	36

1/ The longitudinal direction of the laminate is parallel to the warp direction of the base cloth.

TABLE III

LONGITUDINAL FLEXURAL STRENGTH OF LAMINATES 1/

Base Cloth		Flexural Strength (Thousands of psi) (Minimum Average)							
		Class 1 (polyester)		Class 2 (epoxy)		Class 3 (silicone)		Class 4 (phenolic)	
Type	Commercial Designation	Standard Conditions	Wet Condition	Standard Conditions	Wet Condition	Standard Conditions	Wet Condition	Standard Conditions	Wet Conditions
I	112	50	45	70	65	35	30	60	54
I A	112-150	50	45	70	65	35	30	60	54
II	116	45	40	63	58	32	27	54	48
II A	116-150	45	40	63	58	32	27	54	48
III	120	50	45	70	65	35	30	60	54
IV	128	45	39	63	58	32	26	54	47
IV A	128-150	45	39	63	58	32	26	54	47
IV B	128-75G	45	39	63	58	32	26	54	47
V	143	90	78	115	110	63	52	108	94
V A	143-150	90	78	115	110	63	52	108	94
VI	162	35	30	49	45	25	20	42	36
VII	164	35	30	49	45	25	20	42	36
VII A	164-150	35	30	49	45	25	20	42	36
VIII	181	50	45	75	65	35	30	50	45
VIII A	181-150	50	45	75	65	35	30	50	45
VIII B	181-75DE	50	45	75	65	35	30	50	45
IX	182	50	45	70	65	35	30	60	54
IX A	182-150	50	45	70	65	35	30	60	54
X	183	45	40	63	58	32	27	54	48
XI	184	45	40	63	58	32	27	54	48
XI A	184-150	45	40	63	58	32	27	54	48
XII	1000-150	40	30	56	43	28	20	48	36
XII A	1000-75	40	30	56	43	28	20	48	36
XIII	1044-150	40	30	56	43	28	20	48	36
XIII A	1044-75	40	30	56	43	28	20	48	36

1/ The longitudinal direction of the laminate is parallel to the warp direction of the base fabric.

TABLE IV

ELECTRICAL REQUIREMENTS OF LAMINATES 1/

Characteristic	Class 1 (polyester)		Class 2 (epoxy)		Class 3 (silicone)	
	Standard Conditions	Immersion Conditions	Standard Conditions	Immersion Conditions	Standard Conditions	Immersion Conditions
At 1 megacycle/sec ("radio frequency")						
Dielectric constant (max ave)	4.4	4.6	4.4	4.6	4.2	4.2
Loss tangent (max ave)	0.045	0.055	0.045	0.055	0.030	0.030
At 8,500 to 10,000 megacycles/sec ("radar frequency") 2/						
Dielectric constant (max ave)	4.2	4.4	4.6	4.6	4.5	4.5
Loss tangent (max ave)	0.020	0.025	0.020	0.025	0.025	0.025

1/ There are no electrical requirements for Class 4 finished glass cloth.

2/ "X-band" frequency range. The recommended test frequency for this band is 9,375 megacycles per second.

4. QUALITY CONFORMANCE PROVISIONS

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

4.2 Quality conformance inspection. All inspection of the product under this specification shall be classified as quality conformance inspection. Quality conformance inspection shall include the following:

(a) Examination of rolls (4.2.2).

(b) Tests of finished glass cloth (4.2.3).

(c) Tests of resin laminate (4.2.4).

4.2.1 Sampling for quality conformance inspection. Sampling for quality conformance inspection shall be in accordance with MIL-STD-105 and as specified herein.

4.2.1.1 Lot. For sampling purposes, a lot shall consist of all the finished glass cloth of one type and class subjected to inspection at one time.

4.2.1.2 Unit of product. The unit of product for determining lot size and also the unit of product for sampling shall be as specified in the individual examination or test.

4.2.2 Examination of rolls. The examination of rolls shall consist of over-all examination (4.2.2.1), length examination (4.2.2.2), and yard-by-yard examination (4.2.2.3).

4.2.2.1 Over-all examination. The unit of product for determining lot size for this examination shall be one linear yard and the sample unit shall be one roll. The number of sample units (rolls) selected for examination shall be as shown in Table V. The sample rolls shall be examined for the defects listed in Table VI and each defect shall be counted once in each roll in which it is observed. The maximum acceptable number of defects (acceptance number) shall be as shown in Table V.

TABLE V

SAMPLE SIZE AND ACCEPTANCE NUMBER FOR OVER-ALL AND LENGTH EXAMINATIONS

Lot Size (Yards)	Sample Size (Rolls)	Acceptable Number of Defects in Samples (Max)
Up to 1,300 1/	3	0
1,301 to 3,200	5	0
3,201 to 8,000	7	0
8,001 to 22,000	10	0
22,001 to 110,000	15	1
110,001 and over	25	1

1/ If the lot contains fewer than 3 rolls, each roll of the lot shall be examined.

TABLE VI

OVER-ALL DEFECTS IN ROLLS
Over-all uncleanliness
Objectionable odor (Odor of chemicals commonly used in finishing compounds shall not be regarded as objectionable)
Color not characteristic of the applied finish
Cloth brittle or fused throughout
Uneven weaving throughout clearly visible

4.2.2.2 Length examination. In this examination, the unit of product for determining lot size shall be one linear yard and the sample unit shall be one roll. The number of rolls selected for examination shall be as shown in Table V. Every piece in each of the sample rolls shall be examined for gross length. Any piece found to be shorter than is marked on the piece ticket, or any roll found to contain more than the permitted maximum number of pieces (3 maximum, unless otherwise specified in the ordering data), or any piece less than the permitted minimum length (15 yards minimum, unless otherwise specified in the ordering data) shall be considered a defect with regard to length. The maximum number of length defects shall be as shown in Table V, but, in addition, the lot shall be unacceptable if the total of the actual gross lengths of pieces in the sample rolls is less than the total of the gross lengths marked on the piece tickets.

4.2.2.3 Yard-by-yard examination. The unit of product for determining lot size for this examination shall be one linear yard and the sample unit shall also be one linear yard. The defects listed in Table VII shall be counted regardless of their proximity to each other, except where two or more defects represent a single local condition of the fabric, in which case only the more serious defect shall be counted. A continuous defect shall be counted as one defect for each warpwise yard or fraction thereof in which it occurs. The inspection level shall be Level II of MIL-STD-105 and the Acceptable Quality Level (AQL) shall be 2.5 major defects and 10.0 total defects per 100 units (yards). The number of rolls from which the sample is selected shall be in accordance with Table V and an approximately equal number of sample units (yards) shall be examined from each roll selected.

4.2.3 Tests of finished glass cloth. For this test, the sample unit and the unit of product for determining lot size shall be one linear yard, full width of the cloth. The sample size shall be in accordance with Table VIII and each sample unit shall be subjected to all the tests of Table IX. The lot shall be unacceptable if one or more units fail to meet any of the specified tests.

TABLE VII

CLASSIFICATION OF DEFECTS IN YARD-BY-YARD EXAMINATION

Defect	Description	Major	Minor
Bias or bowed filling	Distorted from horizontal by more than 3 inches for 38-inch width and proportionately for other widths		X
Baggy, ridgy, or wavy cloth	Clearly visible 1/	X	
Hole, cut, or tear	3 or more yarns ruptured at adjoining points	X	
Spots, streaks, or stains	Clearly visible 2 inches or more in combined directions 1/	X	
	Clearly visible less than 2 inches but greater than 1/4 inch in combined directions 1/		X
Tender or weak spot	Clearly visible 2 inches or more in combined directions 1/	X	
	Clearly visible less than 2 inches but greater than 1/4 inch in combined directions 1/		X
Smash	Any	X	
Broken or missing ends or picks	3 or more contiguous regardless of length or 2 contiguous more than 36 inches in length	X	
	2 contiguous less than 36 inches in length		X
Floats and skips	2 inches or more in combined warp and fill directions	X	
	Less than 2 inches in combined warp and fill directions		X
Coarse or light filling	Over 1/2 inch in width		X

TABLE VII (Continued)

Defect	Description	Major	Minor
Selvage defects	Curled or folded under		X
Crease	Hard embedded and folded over on self	X	
Uneven finish	Thin areas where finishing compound is missing or insufficient, clearly visible 1/	X	
Brittle or fused area	Any	X	
Width	Exceeding specified tolerance (3.2.1)		X

1/ "Clearly visible" at normal inspection distance (approximately 3 feet).

TABLE VIII

SAMPLE SIZE FOR TESTS OF FINISHED GLASS CLOTH

Lot Size (Yards)	Sample Size (Yards)
Up to 800	2
801 to 22,000	3
22,001 and over	5

TABLE IX

TEST METHODS FOR FINISHED GLASS CLOTH

Characteristic	Requirement Reference	Test Method (FED-STD-191 method nos. except as noted)	No. of determinations per sample unit
Thickness	Table I	5030	5
Weight	Table I	5041	5
Yarns per inch	Table I	5050	5

TABLE IX (Continued)

Characteristic	Requirement Reference	Test Method (FED-STD-191 method nos. except as noted)	No. of determinations per sample unit
Weave 1/	Table I	Visual	1
Yarn ply	Table I	Visual	1
Yarn size 2/	Table I	Commercial	1

1/ Including color direction - indicator yarns where specified (3.4).

2/ Supplier's certificate of compliance will be acceptable with respect to this requirement.

4.2.4 Tests of resin laminate.

4.2.4.1 Certification. Unless otherwise specified in the ordering data (6.2), the test requirements for mechanical properties (3.5.1), electrical properties (3.5.2), or both mechanical and electrical properties of the laminate may be satisfied by the supplier's certificate of conformity to these requirements supported by certified test data showing that cloth finished by the same supplier, of identical type, class, and finish, has previously been subjected to and has passed the applicable tests for laminate properties under this specification.

4.2.4.2 Sampling for laminate tests. Except as provided by waiver of electrical requirements (3.5.2) or certification of laminate properties (4.2.4.1), a sample unit of sufficient size for fabricating laminates in accordance with 4.2.4.3 for tests in accordance with 4.2.4.4 and 4.2.4.5 shall be taken from each 10,000 yards or fraction thereof of finished glass cloth in the inspection lot.

4.2.4.3 Preparation of laminate sample.

4.2.4.3.1 Laminate for mechanical tests. The laminate for mechanical (tensile and flexural) tests shall be fabricated in the form of two or more flat sheets at least 12 inches long by 12 inches wide and 0.125 ±.010 inch thick, employing a parallel layup of the glass cloth. The brand of laminating resin employed shall be at the option of the supplier of the finished cloth unless otherwise specified in the ordering data (6.2), except that it shall be in accordance with the following:

Finished cloth	Laminating resin
Class 1	Polyester conforming to MIL-R-7575
Class 2	Epoxy conforming to MIL-R-9300
Class 3	Silicone conforming to MIL-R-25506
Class 4	Phenolic conforming to MIL-R-9299

The laminate shall be laid up and fully cured in accordance with the resin manufacturer's instruction sheet at a laminating pressure not exceeding 30 psi for Classes 1, 2, and 3 and 300 psi for Class 4. The sample shall be so prepared as to be essentially void free and representative of the best quality workmanship and shall have a resin content by weight that will produce a laminate with optimum properties.

4.2.4.3.2 Laminate for electrical tests. The laminate for electrical tests at 1 megacycle per second, when required, shall be prepared in accordance with 4.2.4.3.1. The laminate for electrical tests at 8500 to 10,000 megacycles per second, when required, shall be a panel 4 inches wide by 8 inches long by the thickness which has been determined as optimum for the test (4.2.4.5.1). When the optimum thickness is uncertain, the panel shall be made at least 0.75 inch thick. The glass cloth base, resin content, specific gravity, finish, and other physical characteristics of this sample shall be the same as those of the laminate fabricated in accordance with 4.2.4.3.1 and the fabricating procedure shall follow as closely as possible the procedure of 4.2.4.3.1.

4.2.4.4 Laminate test conditions.

4.2.4.4.1 Standard conditions. Standard conditions shall be 23 ±1° C (73.4 ±1.8° F) and 50 ±4 percent relative humidity. Specimens shall be tested after being conditioned for 96 hours at this temperature and humidity.

4.2.4.4.2 Wet condition (for mechanical tests). Wet conditioning shall be a 2-hour immersion of the specimen in boiling distilled water. The specimens shall then be cooled in water to 23 ±1° C and shall be tested wet at that temperature immediately after removal from the water. In case of any question as to the validity of the test results, additional specimens shall be soaked for 30 days in distilled water at room temperature and then tested wet immediately after removal from the water. Results determined under the latter condition shall be final. If the cure temperature of the laminate is 100° C (212° F) or less, the 30-day soak at room temperature shall be mandatory for wet conditioning.

4.2.4.4.3 Immersion conditioning (for electrical tests). The specimens shall be immersed in distilled water at 23 ±1° C for 24 hours. The specimen shall

then be removed from the water, the surface moisture shall be wiped off, and the tests shall be conducted immediately at 23 ±1° C.

4.2.4.5 Laminate test methods. Tests of the resin laminates shall be made in accordance with Table X, except that the tests of electrical properties are not applicable to Class 4 materials (3.5.2). The Acceptable Quality Level shall be zero defective sample units. (No sample unit shall fail to meet the required average value for any applicable laminate characteristic.)

4.2.4.5.1 Electrical tests at 8500 to 10,000 megacycles per second. The electrical properties tests of the laminates in this frequency range shall be performed by the shorted line waveguide method or resonant cavity technique (6.6), using the laminate sample described in 4.2.4.3.2. A test frequency of 9,375 megacycles per second is recommended. If a specimen thinner than the prepared laminate of 4.2.4.3.2 is preferred for the test, it is permissible to abrade or otherwise mill the laminate to the optimum thickness.

4.3 Inspection of preparation for delivery. An examination shall be made in accordance with the provisions of PPP-P-1133 to determine compliance with the packaging, packing, and marking requirements in Section 5 of this specification.

4.4 Rejection criteria. If a sample of finished glass cloth fails to meet the Acceptable Quality Level (AQL) prescribed for any part of the quality conformance inspection of product in this specification, or if the preparation-for-delivery sample contains more defects than are permitted by the AQL prescribed in PPP-P-1133, the lot of finished cloth represented by the sample shall be rejected. Disposition of rejected lots shall be in accordance with MIL-STD-105.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be Level A or C as specified (6.2). Cloth of one type and class only shall be put up in rolls and packaged in accordance with the applicable requirements of PPP-P-1133, except that the means used on the rolls of cloth to restrain the rolls from unwinding shall be limited to types which will not damage the glass cloth.

5.2 Packing. Packing shall be Level A, B, or C as specified (6.2). Cloth of one type and class only shall be packed in accordance with the requirements of PPP-P-1133 for the applicable level.

5.3 Marking. Marking shall be in accordance with 3.7 and the requirements of PPP-P-1133.

TABLE X

TESTS OF RESIN LAMINATES 1/

Characteristic	Requirement Reference	Test Method (FED-STD-406 method nos. except as noted)	No. of determinations per sample unit
Longitudinal tensile strength			
Standard conditions (4.2.4.4.1)	Table II	1011 2/	5
Wet condition (4.2.4.4.2)	Table II	1011 2/	5
Longitudinal flexural strength			
Standard conditions (4.2.4.4.1)	Table III	1031 3/	5
Wet condition (4.2.4.4.2)	Table III	1031 3/	5
Dielectric constant at 1 megacycle/sec			
Standard conditions (4.2.4.4.1)	Table IV	4021	3
Immersion conditions (4.2.4.4.3)	Table IV	4021	3
Loss tangent at 1 megacycle/sec			
Standard conditions (4.2.4.4.1)	Table IV	4021	3
Immersion conditions (4.2.4.4.3)	Table IV	4021	3
Dielectric constant at 8500 to 10,000 megacycles/sec			
Standard conditions (4.2.4.4.1)	Table IV	(See 4.2.4.5.1)	3
Immersion conditions (4.2.4.4.3)	Table IV	(See 4.2.4.5.1)	3
Loss tangent at 8500 to 10,000 megacycles/sec			
Standard conditions (4.2.4.4.1)	Table IV	(See 4.2.4.5.1)	3
Immersion conditions (4.2.4.4.3)	Table IV	(See 4.2.4.5.1)	3

1/ Tests of electrical properties (Dielectric constant, loss tangent) are not applicable to Class 4 material.

2/ Tensile specimens to be Type II of Method 1011.

3/ Flexural specimens to be 1 by 4 inches in size. Specimens are to be tested flatwise.

6. NOTES

6.1 Intended use. The fabrics covered by this specification are intended for use in fabricating resin laminates and plastic sandwich materials for structural parts, radio and radar antenna housings, fairings, and other applications.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.

(b) Quantity of cloth required.

(c) Type and class of cloth required (1.2).

(d) Exceptions, if any, to the optional provisions of this specification, including:

(1) Required cloth width and tolerances if other than specified in 3.2.1.

(2) Requirement for direction-indicator yarns (3.4) if applicable, including color and spacing of the indicator yarns.

(3) Applicable waivers, if any, of the electrical requirements of 3.5.2 (Classes 1, 2, and 3 only) (see 6.3).

(4) Applicable roll length and piece requirements if other than specified in 3.6.

(5) Laminate tests, if any, for which performance is required and for which certification (4.2.4.1) will not be acceptable (see 6.4).

(6) Required brand of resin for preparing laminate test samples if other than the cloth supplier's option (4.2.4.3.1).

(e) Levels of packaging and packing required (5.1, 5.2).

6.3 Applicability of electrical requirements (Classes 1, 2, and 3 only). When finished cloth of this specification is being procured solely for fabricating nonelectrical laminates or nonelectrical sandwich materials, waiver of the electrical properties requirements (3.5.2) of the specification is not normally objectionable. Also, if electrical applications are to involve only "radio frequency" materials (test frequency, 1 megacycle per second), waiver of the requirements for properties at

8500 to 10,000 megacycles per second is not normally objectionable. However, where the finished cloth may be issued, as from stock, for miscellaneous uses which may include "radio frequency" and "radar frequency" applications, complete adherence to the 3.5.2 requirements in procurement is indicated. Government agencies submitting purchase requisitions or departmental item requirements estimates to a central procurement facility and desiring waiver of any electrical requirements of 3.5.2 should so indicate in the requisition or requirements estimate.

6.4 Certification of laminate characteristics. Government agencies submitting purchase requisitions or departmental item requirements estimates to a central procurement facility and desiring performance of any or all of the laminate tests of 4.2.4 in lieu of certification (4.2.4.1) should specify in the requisition or requirements estimate which test or tests should be performed and which may be satisfied by certification. It should be recognized that the laminate tests of this specification are sufficiently costly that quality control by performance of the tests on a procurement lot basis rather than by certification may result in significantly increased unit cost, extended delivery time, or even unavailability of material, especially for small procurement lots of the finished cloth.

6.5 Supersession data. Issues of MIL-C-9084 previous to the present revision covered only finished cloth for use in polyester resin laminates. The finished cloth of previous issues of this specification are, therefore, included in Class 1 of this revision. Classes 2, 3, and 4 of this revision were not included in previous issues of the specification.

6.6 Source document. Further information on tests of laminate at 8500 to 10,000 megacycles per second 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 DeSales Street, Washington, D. C. 20036.

6.7 Marginal indicia. Because of the extensive degree of revision in this issue of the specification, no attempt has been made to indicate by marginal indicia where changes (additions, modifications, corrections, deletions) from the previous issue were made. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of relationship to the last previous issue.

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