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An American National Standard

Standard Specification for Woven Glass Fabrics for Electrical Insulation[1]

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1. Scope

1.1 This specification applies to straight-cut (as opposed to bias-cut) plain weave greige (unfinished) glass fabric produced from continuous-filament yarns and suitable for use in the production of coated or treated fabric for electrical insulating purposes.

1.2 Excluded from this specification are woven glass fabric tapes and fabrics intended for use primarily in laminated constructions.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards:*

D 123 Terminology Relating to Textiles[2]
D 578 Specification for Glass Fiber Strands[2]
D 1711 Terminology Relating to Electrical Insulation[3]
D 1777 Test Method for Thickness of Textile Materials[2]
D 1931 Specification for Fully Cured Silicone Rubber-Coated Glass Fabric and Tapes for Electrical Insulation[3]
D 3636 Practice for Sampling and Judging Quality of Solid Electrical Insulating Materials[4]
D 3773 Test Methods for Length of Woven Fabrics[4]
D 3774 Test Methods for Width of Woven Fabrics[4]
D 3775 Test Method for Fabric Count of Woven Fabric[4]
D 3776 Test Methods for Mass per Unit Area (Weight) of Fabric[4]
D 4029 Specification for Finished Woven Glass Fabrics[4]
D 4963 Test Method for Ignition Loss of Glass Strands and Fabrics[4]
D 5035 Test Method for Breaking Strength and Elongation of Textile Fabrics (Strip Method)[4]

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions employed herein are as indicated in Terminology D 123, except as further defined herein.

3.1.2 For definitions of terms relating to electrical insulation refer to Terminology D 1711.

4. Ordering Information

4.1 Orders for material covered by this specification shall include the width and length of each roll ordered.

5. Materials and Manufacture

5.1 *Construction and Mechanical Properties*—The fabrics shall meet the requirements of Table 1.

6. Composition

6.1 Yarns used in the preparation of these fabrics shall conform to the requirements for Types ECD, ECE, and ECG yarns as described in Specification D 578.

7. Dimensions, Weights, and Permissible Variations

7.1 *Width*—The width of the fabric, measured outside the selvedge, shall not vary from that specified in the purchase agreement by more than ±0.5 in. (±13 mm).

7.2 *Roll Length*:

7.2.1 The measured length of a roll of fabric shall be within 10 % of the nominal length shown in Table 1 except that 10 % of the total length shipped may be on rolls of less than the standard roll length but in no case shall the length of such rolls be less than 30 % of the nominal lengths shown under Table 1.

7.2.2 The measured length of a roll shall be not less than 98 % of the length declared for each roll as shipped.

7.3 *Sizing*:

7.3.1 The fabric shall contain no lubricants or sizing other than those normally used in the weaving of greige fabric.

7.3.2 The average amount of sizing in the fabric shall not be more than 4.5 weight %, except for Styles 104 and 1610, where it shall not be more than 6.0 weight % when determined in accordance with the Organic Content section of Test Method D 4963.

NOTE 1—Experience indicates that where coated fabric must meet stringent wet dielectric strength requirements, as for example in Specification D 1931, a maximum size content of 2.6 weight % shall be required.

8. Workmanship, Finish, and Appearance

8.1 *Determination of Nonconforming Rolls*:

[1] This specification is under the jurisdiction of ASTM Committee D-9 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.07 on Flexible and Rigid Insulating Materials.

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[2] *Annual Book of ASTM Standards*, Vol 07.01.

[3] *Annual Book of ASTM Standards*, Vol 10.01.

[4] *Annual Book of ASTM Standards*, Vol 07.02.

TABLE 1 Fabric Construction and Mechanical Properties

Style No.	Yarns, Warp, and Filler	Nominal Warp and Filler[A]		Nominal Thickness[B]		Nominal Weight[C]		Min Avg Breaking Strength/Unit Width[D]				Nominal Roll Length	
								Warp		Filler			
		threads/in.	threads/cm	mils	mm	lb/yard^2	g/m^2	lbf/in.	kN/m	lbf/in.	kN/m	yards	m
104	ECD 900-1/0 W ECD 1800-1/0 F	60 by 52	23.6 by 20.5	1.2	0.030	0.036	20.0	40	7.0	15	2.6	500 or 600	450 or 550
107	ECD 900-1/2 W ECD 900-1/0 F	60 by 35	23.6 by 13.8	1.7	0.043	0.066	35.0	70	12.3	20	3.5	600 or 625	550 or 570
108	ECD 900/1/2	60 by 47	23.6 by 18.5	2.0	0.051	0.089	48.0	70	12.3	40	7.0	600 or 625	550 or 570
112	ECD 450-1/2	40 by 39	15.7 by 15.4	3.2	0.081	0.131	71.0	82	14.4	80	14.0	500	450
1610[E]	ECG 150-1/0	32 by 28	12.6 by 11.0	3.8	0.097	0.153	83.0	115	20.1	100	17.5	500 or 525	450 or 480
116	ECD 450-1/2	60 by 58	23.6 by 22.8	3.5	0.089	0.198	107	125	21.9	120	21.0	350 or 400	320 or 370
125	ECD 450-2/2	36 by 34	14.2 by 13.4	5.0	0.127	0.234	127	150	26.3	140	24.5	250	230
127	ECD 450-3/2	43 by 32	16.5 by 12.6	7.5	0.191	0.375	203	250	43.8	200	35.0	250 or 300	230 or 275
141[F]	ECE 225-2/3	32 by 21	12.6 by 8.3	11.0	0.279	0.547	297	400	70.1	290	50.8	125	115
162	ECE 225-2/5	28 by 16	11.0 by 6.3	15.0	0.381	0.738	400	450	78.8	350	61.3	125	115
1080	ECD 450-1/0	60 by 47	23.6 by 18.5	2.0	0.051	0.089	48.5	70	12.3	40	7.0	1250	1140
1125	ECD 450-1/2 W ECG 150-1/0 F	40 by 39	15.7 by 15.4	3.5	0.089	0.164	89	90	15.8	130	22.8	1000	900
1165	ECD 450-1/2 W ECG 150-1/0 F	60 by 52	23.6 by 20.5	4.2	0.107	0.232	125	125	21.9	140	24.5	1000	900
1677	ECDE-150-1/0 W ECDE-150-1/0 F	40 by 40	15.7 by 15.7	4.5	0.114	0.200	109	140	24.5	130	22.8	1000	900
7628	ECG 75-1/0 W ECG 75-1/0 F	42 by 32	16.5 by 12.6	7.0	0.178	0.371	201	250	44	200	35	750	685
1675	ECDE 150-1/0 W ECDE 150-1/0 F	40 by 32	16.5 by 12.6	4.3	0.109	0.178	96.5	140	24.5	95	16.6	1000	900

[A] Tolerance on thread count is ± 2 ends or picks/in. for both warp and filler thread.

[B] Tolerance on average thickness is ±10 % of nominal, except for Styles 104 and 116 where the average thickness is from 0.95 to 1.15 mils (0.024 to 0.029 mm) inclusive, and 3.4 to 4.3 mils (0.086 to 0.104 mm) inclusive, respectively. Tolerance on individual thickness is ± 15 % of nominal, except for Styles 104 and 116 where individual thickness is from 0.9 to 1.2 mils (0.023 to 0.0305 mm) inclusive, and 3.2 to 4.3 mils (0.081 to 0.109 mm) inclusive, respectively.

[C] Tolerance on average weight is ±10 % of nominal when determined in accordance with Test Methods D 3776.

[D] Values for breaking strength apply to specimens 1 in. (25.4 mm) wide. Specimens of widths different than this may give substantially different values of breaking strength.

[E] This style is commonly referred to as an open-weave glass fabric.

[F] Either ECE 225-2/3 or ECE 225-3/2 may be used.

8.1.1 At any time prior to its use, any sample roll in the lot that contains one or more of the following characteristics shall be considered a nonconforming roll:

8.1.1.1 Tight selvedges,

8.1.1.2 Loose selvedges,

8.1.1.3 Bagginess,

8.1.1.4 Continuous wrinkles or creases,

8.1.1.5 Uncleanliness or general dirtiness,

8.1.1.6 Continuous excessively fuzzy or hairy surface, as caused by broken filaments,

8.1.1.7 Lint (continuous occurrence of loose tufts of fibers), or

8.1.1.8 Color (pronounced departure from normal color of greige goods).

8.1.2 Any sample roll in the lot in which any one of the warp or filling nonconformances noted in 8.1.2.1-8.1.2.17 occurs repeatedly throughout the entire roll shall be considered a nonconforming roll.

8.1.2.1 Cut or broken selvedges (curl, cut, or broken condition of selvedge),

8.1.2.2 Bias or bowed filling (distorted from horizontal by more than 2 in. (50 mm), 38 in. (1 m), and proportionately for all other widths),

8.1.2.3 Broken picks (a pick missing from a portion of the width),

8.1.2.4 Dirt spots (clearly visible grease, oil, or dirt on fabric),

8.1.2.5 Ends out (void caused by a missing warp yarn),

8.1.2.6 Floats (places where warp or filler yarns extend over ends 2 in. (50 mm) or more in combined directions with which they should be interlaced).

8.1.2.7 Gouts (foreign matter, dirt or lint, woven into the fabric),

8.1.2.8 Knots (yarns tied together producing overhanging threads),

8.1.2.9 Loops or kinks (double-back yarn),

8.1.2.10 Loose picks (a single filling yarn woven under insufficient tension),

8.1.2.11 Mispicks (picks not properly interlaced),

8.1.2.12 Mixed yarn (yarn differing from that normally being used in the fabric).

8.1.2.13 Pull-ins (extra thread extending only a part of the way across the fabric),

8.1.2.14 Set-marks (fillingwise band containing more or less than the normal number of picks),

8.1.2.15 Slugs (abruptly thickened place in yarns),

8.1.2.16 Thin spots (an open streak of variable length parallel to warp or filling), or

8.1.2.17 Printed markings (any printed markings, except at the very end of the roll).

8.1.3 Any sample roll in which the nonconformances noted in 8.1.2.1-8.1.2.17 and in Table 2 (Note 4) result in more than 40 demerit points/100 lineal yards based on a 38-in. (1-m) width (45 demerit points/100 lineal metres based on a 1-m (38-in.) width) when rated according to Table 2 shall be considered a nonconforming roll.

TABLE 2 Nonconformance Ratings

NOTE 1—No 1 yard (1 m) shall be penalized more than 4 points.

NOTE 2—A combination of both warp and filling nonconformances occurring in 1 yard (1 m) shall not be penalized more than 4 points total in any 1 yard (1 m).

NOTE 3—The number of demerit points allowable, 40 points per 100 lineal yard of 38-in. width (45 points per 100 linear metres of 1-m width) shall be increased or decreased in proportion to the width of the roll.

NOTE 4—In the case of holes, smashes, or tight picks, assign 4 demerit points for each occurrence.

Nonconformance Length, in. (mm) (Warp or Filler, or Both)	Demerits
Less than 6 in. (150 mm)	1 point
6⅛ to 12 in. (160 to 300 mm)	2 points
12½ to 18 in. (310 to 450 mm)	3 points
18⅛ to 36 in. (460 to 920 mm)	4 points

9. Sampling

9.1 A lot is defined as including all of a particular style of fabric received in a shipment at one time.

9.2 The number of rolls constituting a sample from each lot shall be determined in accordance with Practice D 3636 using Inspection Level II.

10. Test Methods

10.1 *Construction and Mechanical Properties*—Tests to determine conformance with the construction, dimension, and mechanical properties of Table 1 and sizing content (organic content) shall be made in accordance with the following test methods:

10.1.1 *Width* - Test Methods D 3774 Option A.

10.1.2 *Roll Length* - Test Methods D 3773.

10.1.3 *Sizing* - Test Method D 4963.

10.1.4 *Thread Count* - Test Method D 3775.

10.1.5 *Thickness* - Test Method D 1777 Option 1.

10.1.6 *Weight* - Test Methods D 3776 Option A.

10.1.7 *Breaking Strength* - Test Method D 5035.

10.2 For workmanship, finish, and appearance see the instructions in Specification D 4029.

11. Inspection

11.1 Due to the fragile nature of glass fabric in the raw state, rewinding and handling for inspection purposes shall be done in such a manner as not to incur physical damage or distortion to the fabric. This is particularly applicable to the thin styles of high thread-count construction.

12. Rejection

12.1 The purchaser reserves the right to reject any part of the shipment not conforming to the requirements for packing and marking as specified in Section 13.

12.2 The failure of a sample roll to conform to the requirements of Table 1 shall be counted as only one roll failure.

12.3 The classification of any roll as nonconforming in accordance with Section 8, shall be counted as only one roll failure.

12.4 The failure of 60 % or more of the sample rolls tested in accordance with Section 8 for nonconforming rolls shall constitute cause for rejection of the entire lot without further tests.

13. Packaging and Package Marking

13.1 Fabric rolls shall be packaged in such a manner that normal handling during shipment will not result in telescoping of the roll or in circumferential end dents. No more than one roll shall be packed in a single container.

13.2 In addition to denoting the fragile nature of its contents, each container shall contain the following information on at least one end of the outside package:

13.2.1 Manufacturer's identification,

13.2.2 Manufacturer's lot and roll number,

13.2.3 Style of fabric,

13.2.4 Length,

13.2.5 Width, and

13.2.6 Net weight of fabric.

14. Keywords

14.1 electrical insulation; greige glass fabric; woven glass fabric