



Standard Specification for Pressboard for Electrical Insulating Purposes¹

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1. Scope

1.1 This specification covers pressboard for electrical insulating purposes, manufactured from kraft, cotton, or kraft and cotton pulps. This board is intended for dielectrical or structural purposes in transformers and other electrical apparatus.

1.2 Electrical insulating boards are most commonly referred to (and will be referred to herein) as pressboard. Other terms used for pressboard include transformer board, fuller board, and presspan.

1.3 This specification covers pressboard having a nominal thickness of 0.030 to 0.315 in. (0.8 to 8.0 mm). For thinner material refer to Specification D 1305.

1.4 The maximum thickness available will differ with the type and the manufacturer. The maximum sheet size will differ with the thickness, type, and manufacturer.

1.5 Pressboard shall normally be plied wet without pasting. Unless specified by the purchaser, this specification does not include pressboard comprised of two or more sheets that have been laminated together using an adhesive.

NOTE 1—The materials described in this specification are similar to corresponding types of pressboard described in IEC Specification 641-3, Sheet 1, Types B.0.1, B.2.1, B.2.3, B.3.1, and B.3.3.

2. Referenced Documents

2.1 ASTM Standards:

D 1305 Specification for Electrical Insulating Paper and Paperboard—Sulfate (Kraft) Layer Type²

D 1711 Terminology Relating to Electrical Insulation²

D 3394 Test Methods for Sampling and Testing Electrical Insulating Board³

2.2 IEC Standards-Publication:

641-3, Specification for Pressboard and Presspaper for Electrical Purposes—Part 3⁴

3. Terminology

3.1 Definitions:

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 D09.19 on Dielectric Sheet and Roll Products.

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² Annual Book of ASTM Standards, Vol 10.01.

³ Annual Book of ASTM Standards, Vol 10.02.

⁴ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

3.1.1 For definitions of terms used in this specification refer to Terminology D 1711.

3.1.2 *calendered pressboard, n*—pressboard produced by drying without restraint and then calendering between steel rolls to obtain the desired thickness and density.

3.1.3 *cotton pulp, n*—cellulose fibers normally obtained by pulping of new cotton garment cuttings.

3.1.3.1 *Discussion*—Included in cotton pulp is pulp called cotton-linter pulp which is derived from cotton fibers adhered to cotton seed but separated from cotton seed subsequent to ginning.

3.1.4 *kraft pulp, n (unbleached sulfate pulp)*—cellulose fibers normally obtained from softwood (coniferous) trees using the sulfate kraft process of cooking.

3.1.5 *precompressed pressboard, n*—pressboard produced by press-drying between heated platens to obtain desired thickness and density.

4. Classification

4.1 This specification covers the following three types of pressboard:

4.1.1 *Type 1*—High-purity calendered pressboard.

4.1.2 *Type 2*—Normal-purity calendered pressboard.

4.1.3 *Type 3*—Precompressed pressboard.

5. Ordering Information

5.1 Orders for material furnished under this specification shall include:

5.1.1 Name of material,

5.1.2 Grade of pressboard (selected from Table 1),

5.1.3 Quantity (weight or number of sheets),

5.1.4 Dimensions (thickness, width, length), and

5.1.5 Additions or exceptions to the specification and supplementary requirements, if required, such as thermally upgraded material.

6. Materials and Manufacture

6.1 The pressboard will be manufactured from unbleached kraft pulp, cotton pulp, or a combination of unbleached kraft pulp and cotton pulp.

6.2 The proportion of cotton pulp, by weight, will be as specified in Table 1.

6.3 Cotton pulp in trace quantities in kraft pulp grades is permitted. Kraft pulp in trace quantities in cotton pulp grades is permitted.

TABLE 1 Classification of Pressboard

<i>Type 1—High-Purity Calendered Pressboard</i>		
Grade 1.1	kraft	
<i>Type 2—Normal-Purity Calendered Pressboard</i>		
Grade 2.1.1	kraft	low density
Grade 2.2.1	kraft	normal density
Grade 2.3.1	kraft	high density
Grade 2.3.2	50 % kraft/50 % cotton	
<i>Type 3—Precompressed Pressboard</i>		
Grade 3.1.1	kraft	low density
Grade 3.2.1	kraft	normal density
Grade 3.3	50 % kraft/50 % cotton	

6.4 No ingredients other than the cellulose fibers listed in 6.1 or additions listed in 5.1.5 shall be permitted.

7. Property Requirements

7.1 Pressboard shall conform to the requirements listed in Tables 2-4 as applicable.

TABLE 2 Type 1—High-Purity Calendered Pressboard

		Grade Number 1.1.1
Apparent density (Procedure A):		
0.030 to 0.050 in. (0.76 to 1.27 mm)	g/cm ³	1.00 to 1.15
0.051 to 0.090 in. (1.30 to 2.29 mm)	g/cm ³	0.95 to 1.10
0.091 to 0.140 in. (2.32 to 3.65 mm)	g/cm ³	0.90 to 1.05
>0.140 in. (3.56 mm)	g/cm ³	0.90 to 1.05
Thickness:		
0.030 to 0.050 in. (0.76 to 1.27 mm)	% ±	10
0.051 to 0.090 in. (1.30 to 2.29 mm)	% ±	8
0.091 to 0.140 in. (2.32 to 3.65 mm)	% ±	6
>0.140 in. (3.56 mm)	% ±	6
Moisture	%	4.0 to 8.0
Ash	% max	0.75
Aqueous extract conductivity	μS/cm max	20
Chloride content	ppm max	8.0
Tensile strength, machine direction:		
0.030 to 0.050 in. (0.76 to 1.27 mm)	psi (MPa) min	9 000 (62)
0.051 to 0.090 in. (1.30 to 2.29 mm)	psi (MPa) min	8 000 (55)
0.091 to 0.140 in. (2.32 to 3.65 mm)	psi (MPa) min	8 000 (55)
>0.140 in. (3.56 mm)	psi (MPa) min	7 000 (48)
Tensile strength, cross machine direction:		
0.030 to 0.050 in. (0.76 to 1.27 mm)	psi (MPa) min	5 000 (34)
0.051 to 0.090 in. (1.30 to 2.29 mm)	psi (MPa) min	4 500 (31)
0.091 to 0.140 in. (2.32 to 3.65 mm)	psi (MPa) min	4 000 (28)
>0.140 in. (3.56 mm)	psi (MPa) min	3 500 (24)
pH of aqueous extract:		6.0 to 9.0
Dielectric strength in air:		
0.030 to 0.050 in. (0.76 to 1.27 mm)	V/mil (kV/mm) min	225 (9)
0.051 to 0.090 in. (1.30 to 2.29 mm)	V/mil (kV/mm) min	200 (8)
0.091 to 0.140 in. (2.32 to 3.65 mm)	V/mil (kV/mm) min	200 (8)
>0.140 in. (3.56 mm)	V/mil (kV/mm) min	175 (7)
Dielectric strength in oil:		
0.030 to 0.050 in. (0.76 to 1.27 mm)	V/mil (kV/mm) min	—
0.051 to 0.090 in. (1.30 to 2.29 mm)	V/mil (kV/mm) min	—
0.091 to 0.140 in. (2.32 to 3.65 mm)	V/mil (kV/mm) min	—
>0.140 in. (3.56 mm)	V/mil (kV/mm) min	—
Shrinkage:		
Machine direction	% max	0.75
Cross-machine direction	% max	1.25
Compressibility at 3 000 psi (21 MPa), Procedure A	% max	15

NOTE 2—Properties for grades listed in Table 1 but not established in Tables 2-4 are being considered.

8. Workmanship, Finish and Appearance

8.1 The pressboard will have the thickness, density, surface texture, and color as agreed upon between the purchaser and the supplier.

8.2 Sheets shall be of width and length with dimensions within limits agreed upon between the purchaser and the supplier.

8.3 Color will be tan to blue-gray, depending upon the grade of pressboard.

8.4 Types 1 and 2 will have a smooth calendered surface. Type 3 will have a fine-textured finish from the press-dried operation.

8.5 The presence of dirt and other foreign materials is undesirable. The pressboard will be free of dirt, metal particles, and other foreign material.

9. Sampling

9.1 Sample in accordance with Test Methods D 3394.

10. Test Methods

10.1 Test in accordance with the procedures in Test Methods D 3394.

11. Rejection and Rehearing

11.1 If the results of any test performed by the purchaser do not conform to the requirements of this specification, at the option of the manufacturer, the test shall be repeated by the purchaser. Two additional sets of specimens from the batch, lot, or shipment shall be tested. If either of these two additional sets of specimens fails the repeated test, the material may be rejected by the purchaser.

11.2 Since some material properties may change due to storage conditions, failure of material based on initial tests shall be reported to the manufacturer within 60 days of receipt of the material by the purchaser.

12. Product Marking

12.1 No marks shall appear in the individual sheets except as mutually agreed upon between the purchaser and the supplier.

NOTE 3—It is not unusual for manufacturing to mark sheets to identify grain direction, name of manufacturer, and, in some cases, grade. However, these marks should be agreed to by the purchaser.

13. Packaging and Package Marking

13.1 Pressboard shall be packed in waterproof wrapping on skids or in crates, boxes, or cartons so constructed as to protect the pressboard during normal transportation by common (or other) carrier, and in storage.

13.2 Each container shall be marked as specified by the purchaser.

14. Keywords

14.1 ash; board; calendered; chlorides; compressibility; cotton; density; dielectric strength; kraft; moisture; precompressed; pressboard; shrinkage; tensile strength; thickness

TABLE 3 Type 2—Normal-Purity Calendered Pressboard

		Grade Numbers			
		2.1.1	2.2.1	2.3.1	2.3.2
Apparent density (Procedure A):					
0.030 to 0.050 in. (0.76 to 1.27 mm)	g/cm ³	0.90 to 1.05	1.00 to 1.15	1.10 to 1.25	1.00 to 1.20
0.051 to 0.090 in. (1.30 to 2.29 mm)	g/cm ³	0.85 to 1.00	0.95 to 1.10	1.10 to 1.25	1.00 to 1.20
0.091 to 0.140 in. (2.32 to 3.65 mm)	g/cm ³	0.80 to 0.95	0.80 to 0.95	1.05 to 1.20	1.00 to 1.20
>0.140 in. (3.56 mm)	g/cm ³	0.80 to 0.95	0.80 to 0.95	1.05 to 1.20	1.00 to 1.20
Thickness:					
0.030 to 0.050 in. (0.76 to 1.27 mm)	% ±	10	10	10	7.5
0.051 to 0.090 in. (1.30 to 2.29 mm)	% ±	8	8	8	7.5
0.091 to 0.140 in. (2.32 to 3.56 mm)	% ±	6	6	6	5.0
>0.140 in. (3.56 mm)	% ±	6	6	6	5.0
Moisture	%	4.0 to 8.0	4.0 to 8.0	4.0 to 9.0	4.0 to 8.0
Ash	% max	1.0	1.0	1.0	1.0
Aqueous extract conductivity	µS/cm max	30	30	30	70
Tensile strength, machine direction:					
0.030 to 0.050 in. (0.76 to 1.27 mm)	psi (MPa) min	7 000 (48)	9 000 (62)	9 500 (66)	8 000 (55)
0.051 to 0.090 in. (1.30 to 2.29 mm)	psi (MPa) min	6 000 (41)	8 000 (55)	8 500 (59)	8 000 (55)
0.091 to 0.140 in. (2.32 to 3.65 mm)	psi (MPa) min	6 000 (41)	8 000 (55)	8 000 (55)	6 525 (45)
>0.140 in. (3.56 mm)	psi (MPa) min	5 000 (34)	7 000 (48)	7 000 (48)	6 525 (45)
Tensile strength, cross machine direction:					
0.030 to 0.050 in. (0.76 to 1.27 mm)	psi (MPa) min	4 500 (31)	5 000 (34)	5 000 (34)	4 350 (30)
0.051 to 0.090 in. (1.30 to 2.29 mm)	psi (MPa) min	4 000 (28)	4 500 (31)	4 500 (31)	4 350 (30)
0.091 to 0.140 in. (2.32 to 3.65 mm)	psi (MPa) min	3 500 (24)	4 000 (28)	4 000 (28)	3 625 (25)
>0.140 in. (3.56 mm)	psi (MPa) min	3 000 (21)	3 500 (24)	3 500 (24)	3 625 (25)
pH of aqueous extract		6.0 to 9.5	6.0 to 9.5	6.0 to 9.5	6.0 to 9.0
Dielectric strength in air:					
0.030 to 0.050 in. (0.76 to 1.27 mm)	V/mil (kV/mm) min	200 (8)	200 (8)	200 (8)	237 (9.5)
0.051 to 0.090 in. (1.30 to 2.29 mm)	V/mil (kV/mm) min	175 (7)	175 (7)	175 (7)	200 (8.0)
0.091 to 0.140 in. (2.32 to 3.65 mm)	V/mil (kV/mm) min	150 (6)	150 (6)	150 (6)	187 (7.5)
>0.140 in. (3.56 mm)	V/mil (kV/mm) min	150 (6)	150 (6)	150 (6)	187 (7.5)
Dielectric strength in oil:					
0.030 to 0.050 in. (0.76 to 1.27 mm)	V/mil (kV/mm) min	—	700 (28)	—	1 000 (40)
0.051 to 0.090 in. (1.30 to 2.29 mm)	V/mil (kV/mm) min	—	652 (25)	—	750 (30)
0.091 to 0.140 in. (2.32 to 3.65 mm)	V/mil (kV/mm) min	—	550 (22)	—	625 (25)
>0.140 in. (3.56 mm)	V/mil (kV/mm) min	—	500 (20)	—	625 (25)
Shrinkage:					
Machine direction	% max	0.75	0.75	0.75	1.00
Cross machine direction	% max	1.25	1.25	1.00	1.50
Compressibility at 3 000 psi (21 MPa), Procedure A	% max	30	20	15	—

TABLE 4 Type 3—Precompressed Pressboard

		Grade Numbers	
		3.2.1	3.3
Apparent density (Procedure A):			
0.030 to 0.063 in. (0.76 to 1.60 mm)	g/cm ³	1.00 to 1.15	.95 - 1.15
0.064 to 0.118 in. (1.63 to 3.00 mm)	g/cm ³	1.10 to 1.20	1.05 - 1.20
0.119 to 0.236 in. (3.02 to 6.00 mm)	g/cm ³	1.15 to 1.25	1.10 - 1.20
0.237 to 0.315 in. (6.02 to 8.00 mm)	g/cm ³	1.20 to 1.30	1.15 - 1.30
Thickness:			
0.118 in. (3.00 mm)	% ±	10	7.5
0.119 to 0.236 in. (3.02 to 6.00 mm)	% ±	9	5.0
0.237 to 0.315 in. (6.02 to 8.00 mm)	% ±	7	5.0
Moisture	% max	6	6.0
Ash	% max	1.0	1.0
Aqueous extract conductivity	µS/cm max	35	-50
Tensile strength, machine direction:			
0.030 to 0.063 in. (0.76 to 1.60 mm)	psi (MPa) min	14 500 (100)	12 325 (85)
0.064 to 0.118 in. (1.63 to 3.00 mm)	psi (MPa) min	15 250 (105)	13 050 (90)
0.119 to 0.236 in. (3.02 to 6.00 mm)	psi (MPa) min	16 000 (110)	13 050 (90)
0.237 to 0.315 in. (6.02 to 8.00 mm)	psi (MPa) min	16 000 (110)	13 050 (90)
Tensile strength, cross machine direction:			
0.030 to 0.063 in. (0.76 to 1.60 mm)	psi (MPa) min	10 000 (70)	6 525 (45)
0.064 to 0.118 in. (1.63 to 3.00 mm)	psi (MPa) min	11 500 (80)	7 250 (50)
0.119 to 0.236 in. (3.02 to 6.00 mm)	psi (MPa) min	12 250 (85)	7 250 (50)
0.237 to 0.315 in. (6.02 to 8.00 mm)	psi (MPa) min	12 250 (85)	7 250 (50)
pH of aqueous extract		6.0 to 9.0	6.0 - 9.0
Dielectric strength in air:			
0.030 to 0.063 in. (0.76 to 1.60 mm)	V/mil (kV/mm) min	275 (11)	250 (10)
0.064 to 0.118 in. (1.63 to 3.00 mm)	V/mil (kV/mm) min	250 (10)	225 (9)
0.119 to 0.236 in. (3.02 to 6.00 mm)	V/mil (kV/mm) min	225 (9)	200 (8)
0.237 to 0.315 in. (6.02 to 8.00 mm)	V/mil (kV/mm) min	200 (8)	200 (8)
Dielectric strength in oil:			
0.030 to 0.063 in. (0.76 to 1.60 mm)	V/mil (kV/mm) min	800 (32)	1 000 (40)
0.064 to 0.118 in. (1.63 to 3.00 mm)	V/mil (kV/mm) min	650 (26)	875 (35)
0.119 to 0.236 in. (3.02 to 6.00 mm)	V/mil (kV/mm) min	600 (24)	875 (35)
0.237 to 0.315 in. (6.02 to 8.00 mm)	V/mil (kV/mm) min	575 (23)	
Shrinkage:			
Machine direction	% max	0.50	0.50
Cross machine direction	% max	0.70	0.70
Compressibility at 3 000 psi (21 MPa), Procedure A:			
0.030 to 0.063 in. (0.76 to 1.60 mm)	% max	12	11
0.064 to 0.118 in. (1.63 to 3.00 mm)	% max	8	7.5
0.119 to 0.236 in. (3.02 to 6.00 mm)	% max	6	5
0.237 to 0.315 in. (6.02 to 8.00 mm)	% max	5	5

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