



## Standard Specification for Woven Asbestos Cloth<sup>1</sup>

This standard is issued under the fixed designation D 1571; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers woven asbestos cloth having a minimum of 75 % asbestos fiber by weight, excluding the mass of other inorganic reinforcing strands which may be present.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 The following safety caveat pertains only to the test methods portion, Section 13, described in this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- D 123 Terminology Relating to Textiles<sup>2</sup>
- D 299 Specification for Asbestos Yarns<sup>3</sup>
- D 1682 Test Methods for Breaking Load and Elongation of Textile Fabrics<sup>4</sup>
- D 1777 Method for Measuring Thickness of Textile Materials<sup>2</sup>
- D 1910 Methods of Test for Construction Characteristics of Woven Fabrics<sup>5</sup>
- D 1918 Test Method for Asbestos Content of Asbestos Textiles<sup>3</sup>
- D 2100 Specification for Asbestos Textiles Used for Electrical Insulating Purposes<sup>3</sup>
- D 2946 Terminology Relating to Asbestos<sup>3</sup>
- D 3774 Test Methods for Width of Woven Fabric<sup>6</sup>
- D 3775 Test Method for Fabric Count of Woven Fabric<sup>6</sup>
- D 3776 Test Method for Mass Per Unit Area (Weight) of Woven Fabric<sup>6</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C-17 on Fiber-Reinforced Cement Products and is the direct responsibility of Subcommittee C17.03 on Asbestos-Cement Sheet Products and Accessories.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 07.01.

<sup>3</sup> Annual Book of ASTM Standards, Vol 04.05.

<sup>4</sup> Discontinued, see 1991 Annual Book of ASTM Standards, Vol 07.01.

<sup>5</sup> Discontinued, see 1981 Annual Book of ASTM Standards, Part 32.

<sup>6</sup> Annual Book of ASTM Standards, Vol 07.02.

### 3. Terminology

3.1 For definitions of other textile terms used in this specification, refer to Terminology D 123. For asbestos terms, refer to Terminology D 2946.

#### 3.2 Definitions:

3.2.1 *asbestos textile, n*—hydrous magnesium silicate serpentine mineral designated as chrysotile and having the empirical formula  $Mg_3Si_2O_5(OH)_4$ .

### 4. Classification

4.1 The classes of asbestos cloth are based on the nature of the yarns from which they are woven.

4.1.1 *Class A*—Cloth constructed of asbestos yarns containing no reinforcing strands.

4.1.2 *Class B*—Cloth constructed of asbestos yarns containing wire reinforcement.

4.1.3 *Class C*—Cloth constructed of asbestos yarns containing organic reinforcing strands.

4.1.4 *Class D*—Cloth constructed of asbestos yarns containing nonmetallic inorganic reinforcing strands.

4.1.5 *Class E*—Cloth constructed of two or more of the yarns used in cloth Classes A through D.

4.2 *Grades*—The grades of asbestos cloth are based on the percentage of asbestos content by mass as stated in Table 1.

#### 4.3 Styles:

4.3.1 The style designation employed by the ATI uses both a numerical and alphabetical classification. In metallic cloths, the first two digits denote the weight per square yard expressed in ounces. The letter “M” indicates that the fabric is made with metallic or wire-inserted yarns, and the final digit or digits indicate the cut number of the yarns employed. In plain or non-metallic cloths, the meaning of each numerical designation is the same as that used in the metallic cloth classification. The alphabetical letter designates the weave used. The letter “P” stands for plain weave, “H” indicates a herringbone construction, and “T” denotes a twill.

4.3.2 Typical styles of non-metallic asbestos cloths are presented in Table 2.

4.3.3 Typical styles of metallic (wire-inserted) asbestos cloths are presented in Table 3.

### 5. Ordering Information

5.1 Woven asbestos cloth is normally purchased on the basis of class, grade, weave, style, mass per unit area (weight),

**TABLE 1 Grades of Woven Asbestos Tape**

Grade	Asbestos Content, weight percent
Commercial	75 up to but excluding 80
Underwriters	80 up to but excluding 85
A	85 up to but excluding 90
AA	90 up to but excluding 95
AAA	95 up to but excluding 99
AAAA	99 to 100 inclusive

thickness, and width as specified in the order. Asbestos cloth is normally furnished in rolls of 50 or 100 m (50 or 100 yd).

## 6. Materials and Manufacture

6.1 *Yarn*—Asbestos cloth shall be uniformly woven from a specified grade of asbestos yarn with or without reinforcement.

6.2 *Wire Reinforcement*—The wire reinforcement may be brass, copper, zinc, nickel, nichrome, inconel, monel, or other metal or alloy as specified in the order.

6.3 *Organic Reinforcement*—The organic reinforcements may be cotton, nylon, rayon or other spun or filament yarn(s) as specified in the order.

6.4 *Inorganic Reinforcement*—The inorganic reinforcement may be glass, or other ceramic or vitreous spun or filament yarn(s) as specified in the order.

## 7. Chemical Composition

7.1 *Asbestos Content*—The asbestos content of the particular grade specified shall conform to the limits stated in Table 1.

## 8. Physical Properties

8.1 *Electromagnetic Properties*—Cloth to be used for electrical insulating purposes shall conform to the requirements in Specification D 2100.

## 9. Mechanical Properties

9.1 *Tensile (Breaking) Strength*—The breaking strength (breaking load) of asbestos cloth shall be as agreed upon between the purchaser and the seller.

## 10. Dimensions, Mass, and Permissible Variations

10.1 *Width*—The width of asbestos cloth shall be within the following limits:

Nominal Width	Permissible Limits
Up to and including 1 m (40 in.)	±12 mm (0.5 in.)
Over 1 m (40 in.) up to and including 1.5 m (60 in.)	±19 mm (0.75 in.)
Over 1.5 m (60 in.)	±25 mm (1.00 in.)

### 10.2 Thickness:

10.2.1 The thickness of asbestos cloth shall be within the following limits:

Nominal Thickness	Permissible Limits
1.25 mm (0.050 in.) and under	±0.12 mm (0.005 in.)
Over 1.25 mm (0.050 in.)	+0.25 mm (0.010 in.) -0.12 mm (0.005 in.)

10.2.2 The thicknesses of single-ply cloths range from approximately 0.4 to 2.5 mm (0.015 in. to 0.100 in.). Fabrics up to 40 mm (1.5 in.) in thickness can be woven in multi-ply construction.

10.3 *Mass per Unit Area (Weight)*—The mass per unit area (weight) of asbestos cloth shall be within ±7 % of the specified mass.

10.4 *Fabric Count*—The warp ends or filling picks shall be within the following limits:

Ends or Picks per Unit Length	Permissible Limits
500 or less/mm (20 or less/in.)	±1 end or pick/25 mm (1 in.)
More than 500 mm (20/in.)	±5 % of the specified count

10.5 *Yarn Number (Cut)*—The yarn number (cut) shall be as specified and shall conform to the requirements stated in Specification D 299.

## 11. Sampling

11.1 From each lot of cloth, take a lot sample in a random manner to be representative of the lot in accordance with the schedule in Table 4. Cut a specimen from each sample roll, each specimen to be the full width of the roll and at least 0.5 m (0.5 yd) long. The specimen may be taken from the cut end of the roll.

## 12. Specimen Preparation

12.1 Condition all specimens (without preconditioning) for a period of 4 h, or until the specimen shows no progressive change in mass of more than 0.1% after an exposure of 0.5 h, in an atmosphere having a relative humidity of  $50 \pm 2\%$  at  $21 \pm 1.1^\circ\text{C}$ .

## 13. Test Methods

### 13.1 Mensuration:

13.1.1 *Scope*—This test method covers the determination of the width, thickness, mass per unit area (weight), fabric count, and yarn number (cut) of woven asbestos cloth.

13.1.2 *Significance and Use*—The mensurations and dimensions of woven asbestos cloth are of prime importance in characterizing woven asbestos cloth. These dimensions are necessary (though not sufficient) to establish the cloth's suitability for specific applications.

13.1.3 *Hazards*—When cutting or handling asbestos textile products or components, avoid creating dust or wear a respiratory protector. Frequent prolonged respiration of excessive airborne concentrations of asbestos may cause serious bodily harm.

### 13.1.4 Procedure:

13.1.4.1 *Width*—Measure the width of the cloth, either on the full roll or on a short specimen from each sample roll, as directed in Methods D 1910.

13.1.4.2 *Thickness*—Measure the thickness of the cloth as directed in Method D 1777. Use a gage of the deadweight type equipped with a dial graduated to read directly to 0.025 mm (0.001 in.), and having a circular presser foot with a diameter of  $9.5 \pm 0.025$  mm ( $0.375 \pm 0.001$  in.). The presser foot and moving parts connected therewith shall be weighted so as to apply a total load of  $170 \pm 3$  g ( $6 \pm 0.1$  oz), equivalent in pressure to 23.4 kPa (3.4 psi) to the specimen. Make ten thickness measurements on a specimen from each sample roll. Make no measurement within 75 mm (3 in.) of any edge of the specimen, and distribute the places of measurement approximately uniformly over the specimen. Report the calculated average of all measurements as the average thickness of the lot.

13.1.4.3 *Mass per Unit Area (Weight)*—From each sample roll, cut a specimen not less than 0.5 m (0.5 yd) in length and across the full width of the cloth, measuring the length and

**TABLE 2 Weight and Construction of Typical Plain (Non-Metallic) Asbestos Cloths**

Mass Per Unit Area		ATI Style No. <sup>A</sup>	Construction						Tensile Strength <sup>B</sup>			
kg/m <sup>2</sup> ± 7 %	Weight lb/sq yd ± 7 %		Number of Ends per		Number of Picks per		Warp Yarn Number	Fill Yarn Number	Warp		Fill	
			cm	in.	cm	in.			N	lbf	N	lbf
0.27	0.50	8P26	8	20	6	14	2610	2610	130	30	110	25
0.35	0.65	10P24	8	21	9	22	2410	2410	180	40	200	45
0.38	0.70	11P20	8	21	7	17	2010	2010	180	40	130	30
0.41	0.75	12P18	8	21	7	17	1810	1810	180	40	130	30
0.49	0.90	14P17	8	21	7	19	1710	1710	240	55	220	50
0.52	0.95	15P26	6	15	6	14	2620	2620	200	45	180	40
0.56	1.05	17P10	8	20	6	15	1010	1710	290	65	180	40
0.56	1.05	17P24	6	16	6	15	2420	2420	240	55	220	50
0.60	1.10	18P10G	5	13	4	9	1010	1010	400	90	310	70
0.65	1.20	19H20	14	35	11	27	2010	2010	440	100	330	75
0.68	1.25	20P28	11	27	5	13	2820	2820	360	80	180	40
0.71	1.30	21P10	3	8	3	8	1020	1020	200	45	180	40
0.71	1.30	21P16	5	12	6	15	1620	1620	240	55	310	70
0.76	1.40	22P10G	7	18	4	9	1010	1010	560	125	310	70
0.76	1.40	22P16	7	19	4	10	1620	1620	360	80	180	40
0.76	1.40	22P22	9	24	5	12	2220	2220	330	75	160	35
0.79	1.45	23P18	7	17	6	14	1820	1820	240	55	220	50
0.81	1.50	24P10	4	9	4	9	1020	1020	220	50	200	45
0.90	1.65	26P10	4	10	4	10	1020	1020	240	55	220	50
0.90	1.65	26P12	5	13	5	13	1220	1220	290	65	270	60
0.90	1.65	26P14	6	14	6	14	1420	1420	330	75	310	70
0.95	1.75	28P16	9	24	4	10	1620	1620	510	115	220	50
0.98	1.80	29P10	6	16	4	10	1020	1010	400	90	130	30
0.98	1.80	29P14	8	20	4	10	1420	1420	420	95	180	40
1.06	1.95	31P12	4	10	4	11	1020	1230	240	55	440	10
1.08	2.00	32P12	7	18	4	9	1220	1220	400	90	180	0
1.14	2.10	34P10	6	16	4	9	1020	1020	400	90	200	40
1.22	2.25	36P8	6	16	2	6	820	820	440	100	180	45
1.22	2.25	36P10	7	18	4	9	1020	1020	560	125	220	40
1.23	2.27	37P10	7	18	4	10	1020	1120	600	135	240	50
1.27	2.35	38P12	8	20	5	12	1220	1220	470	105	240	55
1.4	2.50	40P10	8	20	4	10	1020	1020	600	135	240	55
1.4	2.50	40P14	11	28	6	14	1420	1420	710	160	310	55
1.6	3.00	48P10	7	18	4	9	1030	1020	800	180	240	70
1.6	3.00	48T12	12	30	4	10	1220	1220	760	170	220	55
1.8	3.30	53T12	14	36	5	12	1220	1220	800	180	240	50
2.0	3.70	59T12	16	40	6	14	1220	1220	...	...	...	55
2.3	4.20	67P10DC	12	30	6	14	1020	1020	...	...	...	...
2.6	4.75	76P10DC	15	37	6	16	1020	1020	...	...	...	...
2.8	5.25	84P10DC	16	40	6	15	1020	820	...	...	...	...
3.0	5.50	88P10DC	16	40	5	13.5	1020	1030	...	...	...	...

<sup>A</sup> The letter "P" in Style Number indicates Plain Cloth. "H" indicates Herringbone Construction. "T" indicates Twill.

<sup>B</sup> Minimum average of 5 tests, grab method, according to Specification D 1682.

width of the specimen to the nearest 2.5 mm (0.1 in.) in at least three places, using a steel tape or rigid rule. Make sure that the specimen is free from tension, wrinkles, and folds. Weigh the specimen to the nearest 5 g (0.01 lb). Using the average length and average width, calculate the mass per square metre or square yard.

13.1.4.4 Report the calculated mass of each sample in kilograms per square metre or pounds per square yard.

13.2 *Fabric Count*—Determine the fabric count (warp yarn ends per 25 mm (1 in.) and filling yarn picks per 25 mm (1 in.)) on one or more specimens for each sample roll taken for test as directed in Test Methods D 3774, D 3775, and D 3776.

13.2.1 Report the number of ends per 25 mm (1 in.) counted to the nearest individual warp yarn and the picks per 13.2 calculated to the nearest filling yarn.

13.2.2 *Precision and Bias*—Refer to Section 14.

13.3 *Asbestos Content*:

13.3.1 Determine the asbestos content on one or more specimens from each sample roll as directed in Test Method D 1918.

13.3.2 Report the average asbestos content as directed in Test Method D 1918.

13.4 *Tensile (Breaking) Strength (Breaking Load)*:

13.4.1 Determine the breaking strength by the Grab Method as directed in Test Method D 1682. Make five tests on the warp specimens and eight tests on the filling specimens from each sample roll.

13.4.2 Report the average breaking load for specimens cut in each direction, for all specimens giving acceptable breaks.

## 14. Precision and Bias

14.1 *Interlaboratory Test Data*<sup>7</sup>—An interlaboratory test was run in 1974 in which randomly drawn samples of three materials were tested in four laboratories. One operator in each laboratory tested five specimens of each material. The components of variance expressed as standard deviations were calculated to be the values listed in Table 5.

<sup>7</sup> ASTM Research Report RR: D-13-1048 is available on loan from ASTM Headquarters, 1916 Race St., Philadelphia, PA 19103.

**TABLE 3 Construction of Typical Metallic (Wire-Inserted) Asbestos Cloths**

Mass per Unit Area		ATI Style No. <sup>A</sup>	Construction					
kg/m <sup>2</sup> ± 7 %	Weight lb/sq yd ± 7 %		Number of Ends per		Number of Picks per		Warp Yarn Number	Fill Yarn Number
			cm	in.	cm	in.		
1.08	2.00	32M8	6	14	6	14	811	811
1.08	2.00	32M12	7	19	4	9	1221	1211
1.17	2.15	35M10	7	18	3	8	1021	1011
1.22	2.25	36M10	7	18	3	8	1021	1011
1.25	2.30	37M12	7	18	3	8	1221	1221
1.32	2.44	39M10	7	18	4	9	1021	1021
1.36	2.50	40M10	7	17	3	8	1021	1021
1.36	2.50	40M10	5	12	3	7.5	1022	1022
1.36	2.50	40M12	7	18	3	8	1021	1221
1.49	2.75	44M8	6	14	4	10	822	821
1.49	2.75	44M9	7	17	3	8	921	921
1.49	2.75	44M10	7	18	4	9	1021	1021
1.49	2.75	44M10	6	14	3	8	1022	1022
1.52	2.80	45M12	7	18	4	9	1021	1221
1.57	2.90	46M10	7	19	4	10	1021	1021
1.65	3.00	48M8	6	16	4	10	822	821
1.65	3.00	48M10	7	18	4	9	1022	1021
1.79	3.25	52M10	8	20	4	10	1021	1021
1.89	3.45	55M8	6	16	3	7	822	822
1.89	3.45	55M10	7	18	4	9	1022	1022
1.9	3.50	56M10	7	18	4	9	1022	1022
2.2	4.00	64M10	9	22	4	10	1022	1022
2.3	4.25	68M10	6	16	3	8	1032	1032
3.4	6.25	100M12	18	45	6	15	1221	1221
3.9	7.00	112M10	14	35	5	12.5	1022	1022

<sup>A</sup>The Letter "M" in Style Number indicates Metallic Cloth.

**TABLE 4 Lot Sample**

Number of Rolls in Lot or Shipment	Number of Rolls to be Taken for Test
1	1
2 to 8	2
9 to 15	3
16 to 40	4
41 to 65	5
66 rolls and over	10 % of shipment rounded off to the next higher integer

**TABLE 5 Components of Variance for the Mensuration Test Method, Presented in Terms of Standard Deviations**

Properties Measured	Units	Single-Operator Precision (Repeatability)	Interlaboratory (Reproducibility)
Width	mm	2.012	2.093
	(in.)	(0.792)	(0.0824)
Thickness	mm	0.035	0.033
	(in.)	(0.0014)	(0.0013)
Fabric Count			
Warp	number	0.3003	0.0439
Filling	number	0.2427	0.2032
Tensile (Breaking) Strength (Breaking Load)			
Warp	N	49	21.5
	(lbf)	(11.02)	(4.83)
Filling	N	23	19.8
	(lbf)	(5.21)	(4.45)
Mass per Unit Area (Weight)	g/m <sup>2</sup>	12.10	0.0000
	(lb/yd <sup>2</sup> )	(0.0224)	(0.0000)

14.2 *Critical Differences*—For the components of variance, two averages of observed values should be considered significantly different at the 95 % probability level if the difference equals or exceeds the critical differences listed in Table 6.

NOTE 1—The tabulated value of the critical differences and confidence limits should be considered to be a general statement, particularly with

respect to between-laboratory precision. Before a meaningful statement can be made about two specific laboratories, the amount of statistical bias, if any, between them must be established, with each comparison being based on recent data obtained on specimens randomly drawn from one sample of the material to be evaluated.

14.3 *Bias*—The true value of the properties listed in Table 3 and Table 4 can only be defined in terms of specific test methods. Within these limitations, the procedures in Specification D 1571 for determining those properties have no known bias and are usually accepted in commerce.

## 15. Rejection and Rehearing

15.1 The buyer and the seller may agree on a procedure to establish conformance, including control charts furnished by the seller, a sequential sampling plan, or the double-sampling plan outlined in 15.2.

15.2 In the absence of a control chart or sequential sampling plan, proceed as directed in 15.2.1 through 15.2.3.

15.2.1 If the test results for the lot conform to the requirements for all characteristics listed in 7.1 through 10.5, the lot shall be considered acceptable.

15.2.2 If the test results for one or more characteristics do not conform to the requirements, take a new laboratory sample from either the original lot sample or a new lot sample. Test the new sample for the characteristic(s) that did not conform to the requirements in the first test and average the results of the first and second samples as if they were one test of double the original number of specimens. If the new average(s) conform(s) to the specified requirements, the lot shall be considered acceptable.

15.2.3 If the test results obtained as directed in 15.2.2 do not conform to the specified requirements, the lot shall be considered unacceptable.

**TABLE 6 Critical Differences for the Mensuration Test Conditions Noted<sup>A</sup>**

Properties Measured	Units	Number of Observations	Single-Operator Precision (Repeatability)	Interlaboratory (Reproducibility)	
Width	mm	1	5.575	8.044	
		4	2.779	6.436	
		8	1.971	6.126	
	(in.)	1	(0.2195)	(0.3167)	
		4	(0.1097)	(0.2534)	
		8	(0.0776)	(0.2412)	
Thickness	mm	1	0.099	0.135	
		4	0.048	0.104	
		8	0.036	0.099	
	(in.)	1	(0.0039)	(0.0053)	
		4	(0.0019)	(0.0041)	
		8	(0.0014)	(0.0039)	
Fabric Count Warp	number	1	0.83	0.84	
		4	0.42	0.43	
		8	0.29	0.32	
Filling	number	1	0.67	0.88	
		4	0.34	0.66	
		8	0.24	0.61	
Tensile (Breaking) Strength (Breaking Load)	Warp	N	1	135.85	148.35
			4	67.92	90.34
			8	48.04	76.51
		(lbf)	1	(30.54)	(33.35)
			4	(15.27)	(20.31)
			8	(10.80)	(17.20)
	Filling	N	1	64.23	84.47
			4	32.12	63.57
			8	22.73	59.38
		(lbf)	1	(14.44)	(18.99)
			4	(7.22)	(14.29)
			8	(5.11)	(13.35)
Mass per Unit Area (Weight)	g/m <sup>2</sup>	1	33.7	33.7	
		4	16.8	16.8	
		8	11.9	11.7	
	(lb/yd <sup>2</sup> )	1	(0.0621)	(0.0621)	
		4	(0.0310)	(0.0310)	
		8	(0.0219)	(0.0219)	

<sup>A</sup>The critical differences were calculated using  $\tau = 1.960$ , which is based on infinite degrees of freedom.

## 16. Packaging

16.1 Asbestos cloth is normally supplied in rolls of 50 or 100 linear m (50 or 100 linear yd). Other lengths may be ordered.

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## 17. Keywords

17.1 asbestos; cloth; testing; woven asbestos cloth