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Standard Specification for Asbestos Roving[1]

This standard is issued under the fixed designation D375/D375M; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

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

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 **Warning—**Breathing of asbestos dust is hazardous. Asbestos and asbestos products present demonstrated health risks for users and for those with whom they come into contact. In addition to other precautions, when working with asbestos-cement products, minimize the dust that results. For information on the safe use of chrysoltile asbestos, refer to "Safe Use of Chrysotile Asbestos: A Manual on Preventive and Control Measures."[2]

1.4 The following safety hazards caveat pertains only to the test methods, 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. For specific safety hazard warning, see 1.3.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D76 Specification for Tensile Testing Machines for Textiles
D123 Terminology Relating to Textiles
D861 Practice for Use of the Tex System to Designate Linear Density of Fibers, Yarn Intermediates, and Yarns
D1118 Test Method for Magnetic Rating of Asbestos Fiber and Asbestos Textiles
D1918 Test Method for Asbestos Content of Asbestos Textiles
D2100 Specification for Asbestos Textiles Used for Electrical Insulating Purposes
D2260 Tables of Conversion Factors and Equivalent Yarn Numbers Measured in Various Numbering Systems
D2946 Terminology for Asbestos and Asbestos–Cement Products

3. Terminology

3.1 For definitions of other textile terms used in this specification, refer to Terminology D123. For asbestos terms, refer to Terminology D2946.

3.2 *Definitions:*

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

3.2.2 *asbestos roving, n*—an assemblage of carded asbestos, with or without other fibers, rubbed into a single strand without twist.

3.2.3 *asbestos roving construction number, n*—a system designed to show the construction, namely, the cut of the single roving and whether reinforcements are present.

3.2.3.1 *Discussion*—Rovings up to 9-cut, inclusive, have 3-digit construction numbers: the first digit indicates the cut, the second digit, the number of plies (always 1), and the third digit, the number of reinforcements. Rovings of 10-cut and

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[2] Available from The Asbestos Institute, http://www.chrysotile.com/en/sr_use/manual.htm.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

over have 4-digit construction numbers; the first 2 digits indicate the cut, the third digit, the number of plies (always 1), and the fourth digit, the number of reinforcements.

Rovings containing reinforcements are designated by the roving construction number followed by the description of the reinforcing strand.

Examples:

No. 1010 roving 10-cut, no reinforcement
No. 1011 roving 10-cut, 1 reinforcement (as specified)

When wire is the reinforcement, the cut indicates the linear density of asbestos roving only (mass of the wire not included). When the reinforcement is other than wire, the cut indicates the linear density of the complete assembly.

3.2.4 *atmosphere for testing asbestos textiles, n*—air maintained at a relative humidity of 50 ± 2 % at 21 ± 1°C.

3.2.5 *cut, n*—in asbestos, the number of 201.6 lengths per kilogram [100-yd lengths per pound] 453.6 g [7000 grains] of asbestos roving.

3.2.5.1 *Discussion*—The term "cut" represents a length-per-unit-mass unit, and is derived by cutting (dividing) 7000 grains (453.6 g) by the mass of 10 yd in grains or the mass of 201.6 m in kilograms of a single roving. The number of such units expresses the number of the cut, and when multiplied by 100, indicates the nominal yards per pound.

Example 1—If 5 30-m skeins of single roving, or 150 m, weight 45.2 g, then 201.6 m weigh 60.7 g.

Cut = 1 kg/60.7 g
= 16.47, or 16.47-cut, which is 16 cut on the light side; and 16× 201.6 = 3226 m/kg, nominal.

Example 2—If five 30-yd skeins of single roving, or 150 yd, weigh 637.5 grains, then 100 yd weigh 425 grains.

Cut = 7000/425
= 16.47, or 16.47-cut, which is 16-cut on the light side; and 16× 100 = 1600 yd/lb, nominal.

The term "cut" as applied to asbestos may be defined differently in countries other than the USA.

3.2.6 *reinforced asbestos roving, n*—asbestos roving containing a reinforcement of one or more strands of other fibers or wire.

4. Classification and Grade

4.1 Classes of asbestos roving are based on their structural components as follows:

4.1.1 *Class A*—Roving consisting of asbestos fiber or asbestos and other staple fiber(s).

4.1.2 *Class C*—Asbestos roving containing organic reinforcing strand(s) as specified in 6.2.

4.1.3 *Class D*—Asbestos roving containing nonmetallic inorganic reinforcing strand(s) as specified in 6.3.

4.1.4 *Class E*—Asbestos roving containing a combination of the reinforcing strands used in Classes C through D.

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

4.3 *Electrical Insulation Classification:*

4.3.1 Asbestos roving as made for the electrical industry is furnished in three types, classifed on the basis of magnetic rating determinations, determined by Test Method D1118, as follows:

TABLE 1 Grades of Asbestos Roving

Grade	Asbestos Content, mass %
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

4.3.2 *Type II (Magnetic Rating 0.75 Maximum)* is intended only for special applications where the asbestos is of primary importance as electrical insulation used on magnet wire and when used primarily as a dielectric.

4.3.3 *Type IV (Magnetic Rating 2.00 Maximum)* is intended for use where the asbestos is of secondary importance as electrical insulation and where it is applied in combination with other materials of comparably higher dielectric strength, as in the construction of heat and flame resistant electrical insulating walls over unit conductors of electric cables.

4.3.4 *Type VI (Magnetic Rating 4.00 Maximum)* is intended for use where the asbestos is of minor importance as a dielectric, as in the construction of filler or heat and flame resistant walls of electric cables or when used as a lining for control enclosures subject to exposure to electric arcs (arc chutes).

5. Ordering Information

5.1 Asbestos roving is normally purchased on the basis of roving construction number, class, type, and grade (see 16.1).

6. Materials and Manufacture

6.1 *Fibers*—Asbestos roving shall be uniformly carded from a specified blend of staple fibers.

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

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

7. Chemical Composition

7.1 *Reinforcements*—The chemical properties of the reinforcements shall meet the specifications for such materials as agreed upon by the purchaser and the seller.

7.2 *Asbestos Content*—The asbestos content of the particular grade specified shall be within the limits in Table 1.

8. Physical Properties

8.1 *Reinforcements*—Physical properties of the reinforcements shall meet the specifications for such materials as agreed upon by the purchaser and the seller.

8.2 *Electromagnetic Properties*—Roving to be used for electrical insulating purposes shall conform to the requirements of Specification D2100.

9. Mechanical Properties

9.1 *Tensile (Breaking) Strength*—The tensile strength (breaking load) of asbestos roving shall be as agreed upon by the buyer and the seller.

10. Dimensions, Mass, and Permissible Variations

10.1 *Roving Number (Cut)*—The linear density in metres per kilogram [or yards per pound] of single asbestos roving shall conform to the limits in Table 2.

11. Sampling

11.1 Take five sample packages at random from each lot of 400 to 500 kg [800 to 1000 lb], or fraction thereof, preferably from more than two containers (cases) of roving.

12. Specimen Preparation

12.1 Condition all samples in the atmosphere for testing asbestos textiles (see 3.2.4) for a minimum of 4 h, or until a specimen of the sample shows no progressive change in mass of more than 0.1 % after an exposure of 0.5 h.

13. Test Methods

ROVING NUMBER (CUT)

13.1 *Scope*—This test method covers the determination of the cut number of asbestos roving.

13.2 *Significance and Use*—The cut is the dimension of asbestos roving that is of primary importance since it indicates its specific length per unit mass. It is used to establish the suitability of a roving for a particular application.

13.3 *Hazards*—**Warning—**see 1.3.

13.4 *Procedure:*

TABLE 2 Requirements for Length per Unit Mass of Standard Asbestos Roving

Cut Number	Nominal Length per Unit Mass		Permissible Variation in Average Length per Unit Mass			
					in a 30-m [30-yd] skein	
	m/kg	yd/lb[A]	m/kg	yd/lb[A]	m/kg	yd/lb
5-cut	1000	500	±81	±40	±150	±75
6-cut	1200	600	±97	±48	±180	±90
7-cut	1400	700	±113	±56	±210	±150
8-cut	1600	800	±129	±64	±240	±120
9-cut	1800	900	±145	±72	±270	±135
10-cut	2000	1000	±161	±80	±300	±150
12-cut	2400	1200	±194	±96	±360	±180
14-cut	2800	1400	±230	±112	±420	±210
16-cut	3200	1600	±260	±128	±480	±240
18-cut	3600	1800	±290	±144	±540	±270
20-cut	4000	2000	±320	±160	±600	±300
22-cut	4400	2200	±350	±176	±670	±330
24-cut	4800	2400	±390	±192	±730	±360
26-cut	5200	2600	±420	±208	±790	±390
28-cut	5600	2800	±450	±224	±850	±420
30-cut	6000	3000	±480	±240	±910	±450
35-cut	7100	3500	±560	±280	±1100	±525
40-cut	8100	4000	±650	±320	±1200	±600
45-cut	9100	4500	±730	±360	±1400	±675
50-cut	10100	5000	±810	±400	±1500	±750

[A] To determine tex numbers, divide 496050 by yards-per-pound. A tex unit is equal to the mass in grams of 1 km of yarn. See Tables D2260 and Practice D861.

13.4.1 Determine the linear density of plain or reinforced asbestos roving as directed in 13.4.2 and 13.4.4. Calculate the roving number as in 3.3.1.

13.4.2 *Nonreinforced Roving*—Determine the linear density of conditioned nonreinforced roving as follows: Cut four 1 ± 0.01-m [1± 0.01-yd] lengths from each of the five packages. Combine and weigh the specimen of 20 m [20 yd] to the nearest 0.5 g and calculate the number of metres per kilogram [yards per pound] using Eq 1:

$$Y = 20/W$$
$$\text{or} \quad [Y = (20)/W] \tag{1}$$

where:

Y = metres per kilogram [yards per pound], and
W = mass of the 20-m [20-yd] specimen in kilograms [pounds].

13.4.3 Repeat the procedure in 13.4.2 on four additional 20-m [20-yd] specimens taken from the same five packages. Calculate the average metres per kilogram [yards per pound] of the five specimens.

13.4.4 *Reinforced Rovings*—Reinforcing strands are to be included in the mass of the roving in determining the linear density. Calculate the metres per kilogram [yards per pound] as directed in 13.4.2.

13.4.5 Repeat the procedure in 13.4.4 on four additional 20-m [20-yd] specimens taken from the same five packages. Calculate the average metres per kilogram [yards per pound] of the five specimens.

13.4.6 *Metallic Reinforced Roving*—Metallic reinforcing strands are not to be included in the mass of the roving in determining the linear density. Prepare the 20-m [20-yd] specimen as directed in 13.4.2 and weigh to the nearest 0.5 g. Separate and weigh the total metallic reinforcement to the nearest 0.5 g. Calculate the number of metres per kilogram [yards per pound] using Eq 2:

$$Y = 20/(M - R)$$
$$\text{or} \quad [Y = 20/M - R] \tag{2}$$

where:

Y = metres per kilogram [yards per pound],
M = total mass of the 20-m [20-yd] specimen in kilograms [pound], and
R = mass of metallic reinforcement in kilograms [pound].

13.4.7 Repeat the procedure in 13.4.6 on four additional 20-m [20-yd] specimens taken from the same five packages. Calculate the average metres per kilogram [yards per pound] of the five specimens.

13.5 *Precision and Bias*—See Section 14.

TENSILE (BREAKING) STRENGTH (BREAKING LOAD)

13.6 *Scope*—This test method covers the determination of the tensile (breaking) strength (or breaking load) of asbestos roving.

13.7 *Significance and Use*—The tensile strength determination provides an evaluation of the degree to which individual fibers in the roving are meshed together and a measure of the

cohesive strength of the roving. It may be used to determine the suitability of reinforced roving for specific applications.

13.8 *Apparatus*—See 13.10.1.1.

13.9 *Hazards*—Refer to 13.3.

13.10 *Procedure:*

13.10.1 *Nonreinforced Roving*—It is not industry practice to conduct tensile (breaking) strength tests on this material.

13.10.1.1 *Apparatus*—Use a constant-rate-of traverse-type tensile testing machine conforming to Specification D76. The tensile testing machine should have a range within which the calibration of the load-indicating device is accurate within ±1.0 % and the breaking load can be read with a precision of ±2.0 %. Set the full-scale load of the tensile testing machine so that the estimated load to rupture the specimen falls between 30 and 80 % of full scale.

13.10.1.2 *Reinforced Roving*—Make all tests on conditioned single strands in the standard atmosphere for testing asbestos. Determine the tensile strength (breaking load) of each conditioned single strand on a single strand testing machine of proper capacity with the clamps set 250 mm [10 in.] apart and at a pulling speed of 300± 10 mm [12 ± 0.5 in.]/min. Take three specimens from each package selected as directed in Section 11, and report the average tensile breaking load per package. Take care to avoid loss of twist in reinforcing strands during the test. Use a holding device of the drum or capstan type. Discard the results from all specimens which break within 12 mm [0.5 in.] of the contact points.

13.10.1.3 Calculate the average breaking load of all specimens tested.

13.11 *Precision and Bias*—See Section 14.

13.12 *Asbestos Content*—Determine the asbestos content as directed in Test Method D1918.

13.13 *Electromagnetic Properties*—Determine the magnetic rating of yarn to be used for electrical insulation as directed in Test Method D1118.

14. Precision and Bias

14.1 *Interlaboratory Test Data*[4]—An interlaboratory test was run in 1973 in which randomly drawn samples of one material were tested in each of five laboratories. Each laboratory used one operator who tested five specimens. The components of variance expressed as standard deviations were calculated to be the values in Table 3.

TABLE 3 Components of Variance, Units as Indicated for Properties Listed, as Standard Deviations

Properties	Single-Operator Precision	Between-Laboratory Precision
Roving number, m/kg [yd/lb]	0.32 [0.16]	...
Tensile breaking strength, N [lbf]	0.99 [0.11]	4.0 [0.90]

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D13-1059.

14.2 *Precision*—For the components of variance in Table 3, 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 4.

TABLE 4 Critical Differences for the Conditions Noted and the Units Indicated[A]

Properties	Number of Observations	Single-Operator Precision (Repeatability)	Interlaboratory (Reproducibility)
Roving number, m/kg [yd/lb]	1	0.89 [0.44]	0.89 [0.44]
	2	0.62 [0.31]	0.62 [0.31]
	5	0.40 [0.20]	0.40 [0.20]
	10	0.28 [0.14]	0.28 [0.14]
Breaking strength, N [lbf]	1	1.38 [0.31]	1.73 [0.39]
	2	0.98 [0.22]	1.47 [0.33]
	5	0.62 [0.14]	1.25 [0.28]
	10	0.44 [0.10]	1.20 [0.27]

[A] The critical differences were calculated using $t = 1.960$, which is based on infinite degrees of freedom.

NOTE 1—The tabulated values of the critical differences 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 randomized specimens from one sample of the material tested.

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 D375 for determining those properties have no known bias and are usually accepted in commerce.

15. Rejection and Rehearing

15.1 The purchaser 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 tolerance for all characteristics specified in Sections 6 to 10, then consider the lot a valid delivery.

15.2.2 If the test results for one or more characteristics do not conform to the tolerance, 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 tolerances in the first test, and average the results of the first and second samples as if all results were from one test of double the original number of specimens. If the new average(s) conform(s) to the specified tolerances, consider the lot a valid delivery.

15.2.3 If the test results obtained as directed in 15.2.2 do not conform to the specified tolerances, consider the lot a nonvalid delivery.

16. Packaging

16.1 Asbestos roving is wound on paper cones and tubes of various sizes in accordance with customer requirements.

17. Keywords

17.1 asbestos; asbestos roving; classification; roving; testing