



Standard Specification for Glass Fiber Cord and Sewing Thread¹

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1. Scope

1.1 This specification covers the requirements for continuous glass filament sewing thread; and continuous filament cord, untreated and neoprene treated.

1.2 This specification is intended to assist ultimate users by designating the types of these products that are typical in the industry.

1.3 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 nonconformance with the standard.

1.4 *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 76 Specification for Tensile Testing Machines for Textiles²
- D 123 Terminology Relating to Textiles²
- D 204 Test Methods for Sewing Threads²
- D 578 Specification for Glass Fiber Strands²
- D 1423 Test Method for Twist in Yarns by the Direct-Counting Method²
- D 1776 Practice for Conditioning Textiles for Testing²
- D 1907 Test Method for Yarn Number by the Skein Method²
- D 2256 Test Method for Tensile Properties of Yarns by the Single-Strand Method²
- D 4963 Test Method for Ignition Loss of Glass Strands and Fabrics³

2.2 ANSI Standard:

ANSI/ASQC Z1.4 Sampling Procedures for Inspection by Attributes⁴

3. Terminology

3.1 Definitions:

3.1.1 *cord, n—of glass fiber*, a strand made by combining multiple ends of filament stands, including cabled yarns, primarily for structural application.

3.1.2 *neoprene treated, n, adj—in glass fiber*, a descriptive term for the application of polychloroprene rubber compound to improve the stability, knot holding properties, and abrasion resistance of the cord.

3.1.3 *sewing thread, n*—a flexible, small diameter yarn or strand, usually treated with a surface coating, lubricant, or both, intended to be used to stitch one or more pieces of material or an object to a material.

3.1.4 *twist balance, n—in glass fiber cord and sewing thread*, the relationship of primary and final twist to each other and to the cord size such that residual torsional effects are nullified.

3.1.5 *untreated, n, adj*—a descriptive term for glass fiber yarns having no applied chemicals or coatings, other than the minimal lubricant or binder used to control intra-fiber abrasion.

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

4. Designation of Construction

4.1 The yarn designations of fiber glass cords and sewing threads are specified as directed in Specification D 578 except that for the cords either the letter “U” or the letter “N” is added to the last segment of the designation.

4.1.1 Cord designations may include a type number that describes the relative diameter of the cords and treatment. The first character of this designation is a numeral from 1 to 10 that indicates the relative diameter of the cord to other cords, that is, 2 is larger than 1, 3 is larger than 2, etc. The second character of this designation is the letter “U” or the letter “N”. The “U” indicates that the cord is untreated, and the “N” indicates that the cord is neoprene treated. The type number for cord is included in Tables 1 and 2 to show its relationship to designation.

4.1.2 Sewing thread construction includes a type number that describes a manufacturer’s code and the size. The second

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

³ *Annual Book of ASTM Standards*, Vol 07.02.

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

TABLE 1 Physical Properties of Typical Continuous Filament Glass Cords, Untreated

Type ^A	Designation		Nominal Yarn Number		Breaking Strength, min		Nominal Yarn Diameter	
	tex	inch-pound units	tex	yd/lb	N	lbf	mm	in.
1U	EC9 33 2 × 2U	ECG 150 2/2U	137	3620	44	10	0.25	0.010
2U	EC9 33 4 × 5U	ECG 150 4/5U	710	700	249	56	0.66	0.026
3U	EC9 33 4 × 8U	ECG 150 4/8U	1165	425	418	94	0.86	0.034
4U	EC9 33 4 × 16U	ECG 150 4/16U	2400	210	827	186	1.32	0.02
5U	EC9 33 4 × 10 × 3U	ECG 150 4/10/3U	4700	105	1277	287	1.93	0.06
6U	EC9 33 4 × 12 × 3U	ECG 150 4/12/3U	5500	90	1401	315	2.11	0.083
7U	EC9 33 4 × 12 × 4U	ECG 150 4/12/4U	7400	67	1601	360	2.41	0.095
8U	EC9 33 4 × 24 × 3U	ECG 150 4/24/3U	11000	45	2571	578	3.02	0.119
10U	EC9 33 4 × 36 × 3U	ECG 150 4/36/3U	17100	29	3363	756	3.78	0.149

^A Commercial designation.

TABLE 2 Physical Properties of Typical Continuous Filament Glass Cords, Treated

Type ^A	Designation		Nominal Yarn Number		Breaking Strength, min		Nominal Yarn Diameter	
	tex	inch-pound units	tex	yd/lb	N	lbf	mm	in.
1N	EC9 33 2 × 2N	ECG 150 2/2N	153	3240	53	12	0.27	0.0105
2N	EC9 33 4 × 5N	ECG 150 4/5N	775	638	285	64	0.81	0.032
3N	EC9 33 4 × 8N	ECG 150 4/8N	1280	387	449	101	0.99	0.039
4N	EC9 33 4 × 16N	ECG 150 4/16N	2600	193	867	195	1.57	0.062
5N	EC9 33 4 × 10 × 3N	ECG 150 4/10/3N	5100	98	1290	290	2.13	0.084
6N	EC9 33 4 × 12 × 3N	ECG 150 4/12/3N	5900	84	1379	310	2.39	0.094
7N	EC9 33 4 × 12 × 4N	ECG 150 4/12/4N	8100	61	1512	340	2.79	0.110
8N	EC9 33 4 × 24 × 3N	ECG 150 4/24/3N	11800	42	2473	556	3.25	0.128
10N	EC9 33 4 × 36 × 3N	ECG 150 4/36/3N	18400	27	2998	674	4.19	0.165

^A Commercial designation.

character is a numeral and indicates the relative diameter of the sewing threads, that is, 4 is larger than 2, 6 is larger than 4, etc. This type number for sewing thread is included in Table 3 to show its relationship to designation.

REQUIREMENTS

5. Material

5.1 The fiber shall be electrical grade, free of any free alkali metal oxides, such as soda or potash, and foreign particles, dirt, and other impurities.

6. Designation

6.1 The nominal designation of fiber glass cords listed in Table 1 or Table 2 shall conform to the requirements of Table 1 or Table 2. The nominal designation of fiber glass sewing threads listed in Table 3 shall conform to the requirements of Table 3. The nominal designations of other fiber glass cords or sewing threads shall be agreed upon between the purchaser and the supplier. The requirements of the individual elements of the designation are specified in Sections 7-9.

7. Filament Diameter

7.1 The nominal filament diameter of fiber glass cords shall be designated by the letter designation “G”. The nominal

filament diameter of fiber glass sewing threads shall be designated by the letter designation “B” to “DE”, as applicable. The numerical values associated with letter designations are specified in Specification D 578. The average filament diameter for the yarns in the cord or sewing thread shall conform to Specification D 578 for the specified filament diameter.

NOTE 1—Because of the application of fiber glass sewing threads, it is desirable to utilize somewhat finer filament sizes.

8. Yarn Number

8.1 Since the yarn number in the designation does not include size, the nominal yarn number for strands including size is stated separately for strands listed in Table 1, Table 2, or Table 3. For strands not listed in those tables, the nominal yarn number including size shall be agreed upon between the purchaser and the supplier. The average yarn number for the lot shall be within the interval: nominal yarn number $\pm 10\%$ of the nominal yarn number.

9. Strand Construction

9.1 For strands listed in Table 1, Table 2, or Table 3, the strand construction shall conform to the requirements of Table 1, Table 2, or Table 3. For strands not listed in Table 1, Table 2, or Table 3, the strand construction shall be agreed upon

TABLE 3 Physical Properties of Typical Continuous Filament Glass Sewing Threads

Type ^A	Designation		Nominal Yarn Number		Breaking Strength, min		Nominal Yarn Diameter	
	tex	inch-pound units	tex	yd/lb	N	lbf	mm	in.
B-4	EC3.5 33 1 × 2	ECB 150 1/4	140	3550	58	13	0.36	0.014
B-6	EC3.5 33 2 × 3	ECB 150 2/3	213	2330	89	20	0.43	0.017
B-8	EC3.5 33 2 × 4	ECB 150 2/4	287	1730	111	25	0.51	0.020
T-12	EC6 33 1 × 4	ECDE 150 1/4	140	3550	58	13	0.36	0.014
T-18	EC6 33 2 × 4	ECDE 150 2/3	213	2330	89	20	0.43	0.017
T-24	EC6 33 2 × 4	ECDE 150 2/4	287	1730	111	25	0.51	0.020

^A Commercial designation.

between the purchaser and the supplier.

10. Direction of Twist

10.1 For fiber glass cords the primary twist shall be “Z” twist and the final twist shall be “S” twist unless otherwise agreed upon between the purchaser and the seller. For fiber glass sewing threads the primary twist shall be “S” twist and the final twist shall be “Z” twist unless otherwise agreed upon between the purchaser and the supplier.

11. Twist Level

11.1 The nominal twist of fiber glass cords and sewing threads shall be agreed upon between the purchaser and the supplier. The tolerances for the primary twist and for the final twist shall conform to Table 4.

12. Breaking Strength

12.1 The minimum breaking strength for fiber glass cords listed in Table 1 or Table 2 shall conform to the requirements of Table 1 or Table 2. The minimum breaking strength of fiber glass sewing thread listed in Table 3 shall conform to the requirements of Table 3. The minimum breaking strength of other fiber glass cords or sewing threads shall be agreed upon between the purchaser and the supplier. No individual break shall be less than the specified minimum breaking strength.

13. Yarn Diameter

13.1 The nominal yarn diameter for some generally available fiber glass cords are listed in Table 1 or Table 2, and the nominal yarn diameter for some generally available fiber glass sewing threads are listed in Table 3. The nominal yarn diameters are included for information only and are not considered a cause for rejection unless otherwise agreed upon, as when specified in an applicable material specification. In that case, the yarn diameter tolerances shall be agreed upon between the purchaser and the supplier.

14. Twist Balance

14.1 The average twist balance shall not exceed one half of the complete rotation.

15. Ignition Loss

15.1 The nominal organic content of sewing threads and untreated cords shall be not less than 1.3 % and no more than

2.0 % unless otherwise agreed upon between the purchaser and the seller. The nominal organic content of neoprene-treated cords shall be no less than 4.0 % unless otherwise agreed upon between the purchaser and the supplier.

16. Visual Appearance

16.1 The cord or sewing thread shall be generally uniform in quality and condition, clean, smooth, and free of foreign particles and defects detrimental to appearance or performance.

16.2 The cord or sewing thread in the laboratory sample for the visual appearance shall be examined for the defects listed in Table 1, and the acceptable quality levels (AQLs) shall be 1.5 total (major and minor combined) defects per hundred units unless otherwise agreed upon between the purchaser and the supplier.

17. Put-Up

17.1 Glass fiber cord or sewing thread shall be wound on tubes, spools, or cones as agreed upon between the purchaser and the seller. The seller may use his standard practice unless otherwise agreed upon between the purchaser and the supplier.

18. Packaging

18.1 Each tube, spool, or cone, put-up as specified, shall be packaged to afford adequate protection against physical damage during shipment from the supply source to the receiving activity. The supplier may use his standard practice when it meets this requirement.

19. Marking

19.1 Each package shall be marked to show the following information unless specified otherwise by the purchaser and the supplier. Characters shall be of such size as to be clearly legible and shall not be obliterated by normal handling:

- Product, Type Cord or Sewing Thread,
as applicable
- Construction
- Treatment
- Size
- Glass, Type “E” Glass
- Lot Number
- Number of Units
- Purchase Order Number

SAMPLING AND CONDITIONING

20. Sampling

20.1 *Lot Size*—A lot is defined as a single shipment of a single type of cord or sewing thread. A lot may constitute all or part of a single customer order.

20.2 *Lot Sample*—As a lot sample, take at random the number of tubes, spools, cones, or other yarn holding units specified in ANSI/ASQC Z1.4 and a single sampling plan.

20.3 *Laboratory Sample*—As a laboratory sample, take the following samples:

20.3.1 For visual appearance of the outer surface of packages, the tubes, spools, cones, or other yarn holding units in the lot sample serve as the laboratory sample.

20.3.2 For other properties, take at random from the packages in the lot sample the number of packages specified in Table 5.

TABLE 4 Twist Tolerances

	Tolerances
Turns per Centimetre:	
From zero to 0.4, incl	±0.1 turn per centimetre
Over 0.4 and up to and including 4.0	±0.2 turn per centimetre
Over 4	±5.0 % of the specified average twist
Turns per Metre:	
From zero to 40, incl	±10 turns per metre
Over 40 and up to and including 400	±20 turns per metre
Over 400	±5.0 % of the specified average twist
Turns per Inch:	
From zero to 1, incl	±0.25 turn per inch
Over 1 and up to and including 10	±0.5 turn per inch
Over 10	± 5.0 % of the specified average twist

TABLE 5 Visual Examination of Cord and Sewing Thread

Examine	Defect
Appearance and workmanship	any cut finish, other than as specified spot or stain ^A embedded foreign matter ^A
Put-up	any defect affecting the free unhampered unwinding of yarn or affecting the secure holding of yarn winds on the package not put-up on spool specified

^A Clearly visible at normal inspection distance of approximately 1 m (3 ft).

20.4 *Test Specimens*—For package appearance, the packages in the lot sample serve as test specimens. For other properties, take skeins from the outside of each package in the laboratory sample as a source of test specimens required in the respective test methods in this specification after first discarding a minimum of 110 m (120 yd) from the very outside of the package.

21. Condition

21.1 Condition the laboratory samples for a period of at least 5 h in the atmosphere as specified in Practice D 1776. Test under the same conditions. Preconditioning is not required.

NOTE 2—Glass textiles are normally tested in either the atmosphere specified for textiles or for plastics depending on their end use.

TEST METHODS

22. Material

22.1 Accept the supplier's certification that the material is of the correct classification as specified in Specification D 578. Verify that the fiber is continuous filament during testing for strand construction as directed in Section 25. Determine the freedom from detrimental impurities during the inspection for cord or sewing thread appearances as directed in Section 32.

23. Filament Diameter

23.1 Determine the filament diameter as directed in Specification D 578, using 50 individual filaments from one yarn specimen from each of the tubes, spools, or cones in the laboratory sample.

24. Yarn Number

24.1 Calculate the size-free yarn number as directed in Specification D 578, using one test specimen from each of the tubes, spools, or cones in the laboratory sample and a skein length of 10 m (12 yd) for cord and 110 m (120 yd) for sewing thread.

24.2 Calculate the yarn number with size using Eq 1:

$$\text{Yarn number (corrected)} = \text{yarn number} (100 + S) / 100 \quad (1)$$

where:

S = ignition loss, %.

25. Strand Construction

25.1 Verify the number of single strands and the number of plied or cabled strands on one test specimen from each of the tubes, spools, or cones in the laboratory sample while determining the twist direction or twist level.

26. Direction of Twist

26.1 Verify the direction of twist in each strand in the cord or sewing thread as directed in Test Method D 1423 using a sample of one test specimen from each of the tubes, spools, or cones in the laboratory sample.

27. Twist Level

27.1 Determine the twist level of each strand in the cord or sewing thread as directed in Test Method D 1423, using one test specimen from each of the tubes, spools, or cones in the laboratory sample.

28. Breaking Strength

28.1 Determine the breaking strength as directed in Specification D 578, using five test specimens from each of the tubes, spools, or cones in the laboratory sample.

29. Yarn Diameter

29.1 Determine the yarn diameter in accordance with Test Methods D 204.

30. Twist Balance, Sewing Thread

30.1 Determine the sewing thread twist balance using the procedure described in Test Methods D 204, except remove and discard approximately 9 m (10 yd) from the side of the package prior to test.

31. Ignition Loss

31.1 Determine the ignition loss as directed in Test Method D 4963 using one test specimen from the tubes, spools, or cones in the laboratory sample and with each test specimen 10 m (12 yd) long for cord and 110 m (120 yd) long for sewing thread.

32. Visual Appearance

32.1 Examine each tube, spool, or cone in the laboratory sample for visual appearance obtained as directed in 20.3.1. Reject any tube, spool, or cone having an unsatisfactory put-up as defined in Table 5 or having more than the permitted number of defects listed in Table 5 for appearance and workmanship defects. Based on the sample size and the acceptable quality level, accept or reject the lot as directed in ANSI/ASQC Z1.4. for single sampling plans for normal inspection.

33. Put-Up

33.1 The evaluation of put-up is part of the evaluation for visual appearance in 32.1.

CONFORMANCE AND INDEXING

34. Conformance

34.1 The purchaser and the supplier may agree on a procedure to establish conformance, including control charts furnished by the supplier, a sequential sampling plan, or double-sampling plan outlined in 34.2.

34.2 In the absence of a control chart or sequential sampling plan, proceed as directed in 34.2.1-34.2.3.

34.2.1 If the test results for a lot conform to the requirements for all characteristics listed in Sections 5-19, and Tables 1-3 and Tables 5 and 6, the lot shall be considered acceptable.

TABLE 6 Letter Designation for Typical Diameters of Glass Fibers in Cord and Sewing Thread

Filament Size Letter Symbol	End Use	Range for Filament Diameter Average	
		μm^A	in.
B	sewing thread	3.25 to 3.99	0.00013 to 0.000159
DE	sewing thread	5.50 to 6.49	0.00023 to 0.000269
G	cord	8.50 to 9.49	0.00035 to 0.000399

^A The micrometres stated are not direct equivalents of inches but are consistent for inch-pound and SI filament size descriptions commonly used in the industry.

34.2.2 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.

34.2.3 If the test results obtained as directed in 34.2.2 do not conform to the specified requirements, the lot shall be considered unacceptable.

35. Keywords

35.1 appearance; construction; designation; diameter; glass cords; glass sewing threads; ignition loss; length per unit mass; organic content; yarn number

SUMMARY OF CHANGES

The following are changes since the last revision:

- (1) Updated instructions for use of SI units.
- (2) Changed conditioning reference to Practice D 1776.
- (3) Deleted reference to MIL-STD 105D. Added reference to ANSI/ASQC Z1.4.

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