Designation: D 3374 – 99

# Standard Specification for Vinyl-Coated Glass Yarns[1]

This standard is issued under the fixed designation D 3374; 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 vinyl-coated glass yarns. These yarns are manufactured in two basic classes. These classes have been established that when properly woven into screening, satisfactory strength, durability, and insect protection are obtained. The two classes are as follows:

1.1.1 *Class 1*—Nominal thickness 0.292 mm (0.0115 in.).

1.1.2 *Class 2*—Nominal thickness 0.330 mm (0.0130 in.).

1.2 The values stated in either SI 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 this specification.

1.3 The following precautionary statement pertains only to the test method portions, Sections 12–21, of 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[2]

D 578 Specification for Glass Fiber Strands[2]

D 885 Test Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made From Man-Made Organic-Base Fibers[2]

D 1776 Practice for Conditioning and Testing Textiles[2]

D 1907 Test Method for Yarn Number by the Skein Method[2]

D 2256 Test Method for Tensile Properties of Yarns by the Single-Strand Method[2]

D 4329 Practice for Fluorescent UV Exposure of Plastics[3]

D 4909 Test Method for Color Stability of Vinyl-Coated Glass Textiles to Accelerated Weathering[4]

D 4963 Test Method for Ignition Loss of Glass Strands and Fabrics[5]

2.2 *ANSI/ASQC Standards:*

ANSI/ASQC Z1.4 Sampling Procedures for Inspection by Attributes[6]

ANSI/ASQC Z1.9 Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming[6]

2.3 *Federal Standard:*

CCC-D-950 Specification, Dyeing and After Treating Processes for Cotton Cloths[7]

2.4 *AATCC Standard:*

Evaluation Procedure 1, Gray Scale for Color Change[8]

## 3. Terminology

3.1 *Definitions:*

3.1.1 *moisture equilibrium, n*—the condition reached by a material when it no longer takes up moisture from, or gives up moisture to, the surrounding atmosphere.

3.1.2 *vinyl-coated glass yarn, n*—glass continuous filament yarn, coated with a pigment and plasticized vinyl chloride resin.

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

## 4. Sampling and Number of Specimens

4.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of yarn packages directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider yarn packages to be the primary sampling unit. In the absence of such agreement, proceed as follows:

4.1.1 *Yarn Number, Ignition Loss, and Strength*—Take the number of yarn packages specified in ANSI/ASQZ Z1.9 using the count of yarn packages in the lot as a measure of the lot size.

4.1.2 *Color and Workmanship*—Take the number of yarn packages specified in ANSI/ASQZ Z1.4 using the count of yarn packages in the lot as a measure of the lot size.

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[1] This specification is under the jurisdiction of ASTM Committee D-13 on Textiles and is the direct responsibility of Subcommittee D13.18 on Glass Fiber and Its Products.

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

[3] *Annual Book of ASTM Standards*, Vol 08.03.

[4] Discontinued— See 1995 *Annual Book of ASTM Standards*, Vol 07.02.

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

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

[7] Available from General Services Administration, Specification and Consumer Information Distribution Section (WFSIS), Washington Navy Yard, Bldg. 197, Washington, DC 20407.

[8] Available from American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

***A Summary of Changes section appears at the end of this standard.**

4.1.3 *Color Stability to Accelerated Weathering*—Use the yarn packages taken as a lot sample for strength, and yarn number as the lot sample for color stability to accelerated weathering.

NOTE 1—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability between shipping cartons, yarn packages, yarn within a shipping carton, and test specimens from a yarn package to produce a sampling plan with meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

4.2 *Laboratory Sample*—As a laboratory sample for acceptance testing, proceed as follows:

4.2.1 *Yarn Number, Ignition Loss, Strength, Color, and Workmanship*—Use the lot sampling units as laboratory sampling units.

4.2.2 *Color Stability to Accelerated Weathering and Low-Temperature Flexibility*—Use every fifth yarn package in the lot sample for strength, and yarn number as the laboratory sampling units. For small lots, take at least one yarn package as a laboratory sampling unit.

4.3 *Test Specimens*—Proceed as follows:

4.3.1 *Yarn Number, Ignition Loss, and Strength*—Take the number of specimens per laboratory sampling unit specified in the applicable test method. Evaluate the results of testing using ANSI/ASQ Z1.9, Inspection Level IV, normal inspection, and an acceptable quality level of 1.5 %.

4.3.2 *Color and Workmanship*—Use the yarn packages in the lot sample as the specimens. Evaluate the results of inspecting the specimens using ANSI/ASQZ Z1.4, Inspection Level II, normal inspection, and an acceptable quality level of 1.5 %.

4.3.3 *Color Stability to Accelerated Weathering*—Take the number of specimens per laboratory sampling unit specified in the test methods.

## REQUIREMENTS

### 5. Material

5.1 *Input Yarn*—The yarn shall be glass continuous filament glass yarn which meets the requirements of Specification D 578 for the applicable yarn construction.

5.2 *Plastic Coating*—The material used to coat or impregnate the glass continuous filament yarn shall be a compound of polymerized or copolymerized vinyl chloride resin, plasticized with phosphate or phthalate ester plasticizers exclusively, pigmented and stabilized to meet the requirements herein.

5.2.1 *Optional Plasticizer*—As agreed upon between the purchaser and the supplier, pasticizers other than phosphates and phthalates may be used.

### 6. Put-Up

6.1 The vinyl-coated glass yarn shall be put up on packages or tubes, and in containers whose dimensions shall be agreed upon between the purchaser and the supplier.

### 7. Yarn Number, Ignition Loss, and Breaking Strength

7.1 The requirements of yarn number, ignition loss, and breaking strength are specified in Table 1.

**TABLE 1 Physical Property Requirements**[A]

| Classification | Yarn Number, text (yd/lb) | | | Ignition Loss, | Breaking Strength, min, N (lbf) | |
|---|---|---|---|---|---|---|
| | min | nominal | max | min,% | Conditioned | Wet |
| Class 1 | 99 (5000) | 91 (5450) | 84 (5900) | 58 | 17.8 (4.0) | 15.6 (3.5) |
| Class 2 | 160 (3100) | 136 (3650) | 118 (4200) | 53 | 28.9 (6.5) | 24.5 (5.5) |

[A] Nominal values are supplied for information only.

### 8. Color

8.1 Samples shall be a commercial match to color standards agreed upon between the purchaser and the supplier.

NOTE 2—Gray and charcoal are considered standard colors. They are in general use and demand and are the most readily available. Other colors are usually available on a made-to-order basis.

### 9. Workmanship

9.1 As agreed upon between the purchaser and the supplier, the following defects shall be considered cause for rejection of the yarn package in which they occur:

9.1.1 Uncoated or partially coated sections of yarn.

9.1.2 Slubs, large lumps, or coating irregularities of such degree as to adversely affect weaveability of the yarn or cause excessive rejects of the final product. Small irregularities that represent inherent characteristics of the coating are permitted.

9.1.3 Yarns that have been bruised, cut, or mashed.

9.1.4 Splices exceeding 25 mm (1 in.) in length or having unbonded or fused ends.

9.1.5 Any defect affecting the free unhampered unwinding of yarn or affecting the secure holding of yarn winds on the package.

### 10. Color Stability to Accelerated Weathering

10.1 When tested as specified in Section 18, the observed color change after 480 h shall be no greater than Step 3 on the gray scale and after 960 h shall be no greater than Step 2 on the gray scale.

10.2 When agreed upon between the purchaser and the supplier, other exposure periods and other gray scale ratings may be acceptable.

## TEST METHODS

### 11. Conditioning

11.1 Condition the laboratory samples without preconditioning for a period of at least 5 h in the atmosphere for testing glass textiles as directed in Practice D 1776, unless otherwise specified.

NOTE 3—In any event, 24 h is considered ample exposure time to bring the samples to moisture equilibrium.

### 12. Material

12.1 Upon prior agreement, the purchaser may accept the supplier's certification that the materials comply with the requirements of Section 5. In the absence of such an agreement compliance will be tested using Specification D 578 and Fed. Std. CCC-D-950.

### 13. Put-Up

13.1 Verify that the yarn packages and shipping containers conform to agreement by inspection in the purchaser's plant.

## 14. Yarn Number

14.1 Determine the yarn number as directed in Test Method D 1907. Report the yarn number as metres per kilogram (yards per pound). Test one specimen having a skein length of 27.5 m (30 yd) per laboratory sampling unit.

NOTE 4—Tex (metres per kilogram) is equal to 496 055 divided by the yards per pound.

14.2 See Annex A1 for information on precision and bias.

## 15. Ignition Loss

15.1 Determine the ignition loss as directed in Test Method D 4963 using one 27.5-m (30-yd) skein of vinyl-coated glass yarn from each laboratory sampling unit.

NOTE 5—An estimation of ignition loss can be obtained by subtracting input yardage from control yarn yardage.

## 16. Breaking Strength

16.1 Test the breaking strength as directed in Test Method D 2256. A constant rate of extension (CRE) tester is recommended with pneumatic type clamps with fixed nubbing surfaces which are integral with one of the clamping surfaces. The snubbing surfaces may be circular with a diameter of not less than 12.5 mm (0.5 in.) or may be semi-involute.

16.2 Test five specimens per laboratory sampling unit using each of the following procedures:

16.2.1 Use Option 1A for conditioned single-strand strength. Preconditioning is not required.

16.2.2 Use Option 2A for wet single-strand strength. Immerse for 24 h in distilled water containing no wetting agents.

16.3 See Annex A1 for information on precision and bias.

## 17. Color and Workmanship

17.1 Examine each yarn package in the laboratory sample for visual appearance of its outer surface. Reject any yarn package having defects defined in Section 9 or whose color is not a commercial match to the color standard.

## 18. Color Stability to Accelerated Weathering

18.1 Determine the color stability to accelerated weathering as directed in Test Method D 4329, Cycle A, using one appropriate size specimen for a total exposure of 480 h and one appropriate size specimen for a total exposure of 960 h for each laboratory roll to be tested.

18.1.1 Rate the specimens for color change after exposure in accordance with AATCC Evaluation Procedure 1.

## CONFORMANCE AND INDEXING

## 19. Conformance

19.1 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 19.2.

19.2 In the absence of a control chart or sequential sampling plan, proceed as directed in 19.2.1-19.2.3.

19.2.1 If the test results for a lot conform to the requirements for all characteristics listed in Sections 5–11 and Table 1, the lot shall be considered acceptable.

19.2.2 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.

19.2.3 If the test results obtained as directed in 19.2.2 do not conform to the specified requirements, the lot shall be considered unacceptable.

## 20. Keywords

20.1 appearance; breaking strength; color; colorfastness; flexibility; ignition loss; thickness; vinyl-coated glass yarns; yarn number

## ANNEX

**(Mandatory Information)**

## A1. INTERLABORATORY TEST DATA FOR PRECISION AND BIAS FOR BREAKING STRENGTH, THICKNESS, AND YARN NUMBER

A1.1 *Summary*—In 95 out of 100 cases when comparing two averages, the differences should not exceed the amounts shown in Table A1.1 for the respective number of determinations when all of the determinations are taken by the same well-trained operator using the same piece of test equipment and specimens randomly drawn from the same sample of material but tested at different times. Larger differences are likely to occur under all other conditions.

**TABLE A1.1 Observed Critical Differences**

| Property Name | Percent of Average | | Observations Per Average |
|---|---|---|---|
| | Class 1 | Class 2 | |
| Breaking strength | 3.7 | 3.1 | 5 |
| Yarn number | 2.8 | 1.0 | 2 |

A1.1.1 Larger differences are likely to occur under all other conditions. The test methods specified for breaking strength, and yarn number have no bias since the true value of breaking strength, and yarn number can only be defined in a specific test method. Sections A1.2-A1.4 explain the basis for this summary

and for evaluations made under other conditions.

A1.2 *Interlaboratory Test Data*[9]—An interlaboratory test was run in 1986 in which randomly drawn specimens of a Class 1 vinyl-coated glass yarn and a Class 2 vinyl-coated glass yarn were tested in each of four laboratories. Each laboratory used two operators, each of whom tested the number of specimens shown in A1.1 for each material at different times. The components of variance expressed as coefficients of variation are listed in Table A1.2.

NOTE A1.1—The square roots of the components of variance are being reported to express the variability as percent of the average rather than as the square of that unit of measure.

A1.3 *Precision*—For the components of variance reported in Table A1.2, 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 A1.3.

NOTE A1.2—Since the interlaboratory test included only four laboratories, estimates of between-laboratory precision should be used with special caution.

NOTE A1.3—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 any two specific laboratories, the amount of statistical bias, if any, between them must be established, with each comparison based on recent data obtained on specimens taken from a lot of material of the type being evaluated and nearly homogeneous as possible and then randomly assigned in equal numbers to the two laboratories.

A1.4 The test methods specified for breaking strength and yarn number produce test values that can be defined only in terms of a test method. There is no independent referee method by which bias may be determined. These test methods for breaking strength and yarn number have no known bias.

[9] ASTM Research Report No. D-13-1078. A copy is available on loan from ASTM Headquarters.

**TABLE A1.2 Coefficients of Variation, Vinyl-Coated Glass Yarns, Percent of Average**

| Property and Material | Single-Operator Component | Within-Laboratory Component | Between-Laboratory Component |
|---|---|---|---|
| *Breaking Strength:* | | | |
| Class 1, | | | |
| Single-material | 3.02 | 0.0 | 3.92 |
| Multi-material | 3.86 | 0.0 | 3.98 |
| Class 2, | | | |
| Single-material | 2.51 | 0.71 | 2.09 |
| Multi-material | 2.69 | 0.71 | 2.09 |
| *Yarn Number:* | | | |
| Class 1, | | | |
| Single-material | 1.45 | 0.0 | 0.64 |
| Multi-material | 2.63 | 0.0 | 0.85 |
| Class 2, | | | |
| Single-material | 0.53 | 0.39 | 1.02 |
| Multi-material | 0.53 | 0.39 | 1.02 |

**TABLE A1.3 Critical Differences for the Conditions Noted, Vinyl-Coated Glass Yarns, 95 % Probability Level, Percent of Average**

| Property and Number of Observations in Each Average | Single-Operator Precision | Within-Laboratory Precision | Between-Laboratory Precision |
|---|---|---|---|
| Class 1, Single-Material Comparisons | | | |
| Breaking Strength | | | |
| 1 | 8.4 | 8.4 | 13.7 |
| 2 | 5.9 | 5.9 | 12.4 |
| 5 | 3.7 | 3.7 | 11.5 |
| 10 | 2.6 | 2.6 | 11.2 |
| Yarn Number | | | |
| 1 | 4.0 | 4.0 | 4.4 |
| 2 | 2.8 | 2.8 | 3.4 |
| 5 | 1.8 | 1.8 | 2.5 |
| 10 | 1.3 | 1.3 | 2.2 |
| Class 1, Multi-Material Comparisons | | | |
| Breaking Strength | | | |
| 1 | 8.7 | 8.7 | 14.0 |
| 2 | 6.4 | 6.4 | 12.7 |
| 5 | 4.4 | 4.4 | 11.9 |
| 10 | 3.5 | 3.5 | 11.6 |
| Yarn Number | | | |
| 1 | 5.2 | 5.2 | 5.7 |
| 2 | 4.3 | 4.3 | 4.9 |
| 5 | 3.7 | 3.7 | 4.4 |
| 10 | 3.5 | 3.5 | 4.2 |
| Class 2, Single-Material Comparisons | | | |
| Breaking Strength | | | |
| 1 | 6.9 | 7.2 | 9.3 |
| 2 | 4.9 | 5.3 | 7.9 |
| 5 | 3.1 | 3.7 | 6.9 |
| 10 | 2.2 | 3.0 | 6.5 |
| Yarn Number | | | |
| 1 | 1.5 | 1.8 | 3.4 |
| 2 | 1.0 | 1.5 | 3.2 |
| 5 | 0.7 | 1.3 | 3.1 |
| 40 | 0.5 | 1.2 | 3.1 |
| Class 2, Multi-Material Comparisons | | | |
| Breaking Strength | | | |
| 1 | 7.0 | 7.2 | 9.3 |
| 2 | 4.9 | 5.3 | 7.9 |
| 5 | 3.1 | 3.7 | 6.9 |
| 10 | 2.3 | 3.0 | 6.5 |
| Yarn Number | | | |
| 1 | 1.5 | 1.8 | 3.4 |
| 2 | 1.0 | 1.5 | 3.2 |
| 5 | 0.7 | 1.3 | 3.1 |
| 10 | 0.5 | 1.2 | 3.1 |

## SUMMARY OF CHANGES

Committee D-13 has identified the location of selected changes to this standard since the last issue (D 3374–94) that may impact the use of this standard.

*D 3374–94:*

(*1*) Updated instructions (1.2) for use of SI units.

(*2*) Changed conditioning reference to D 1776.

(*3*) Changed MIL-SPEC references to ANSI/ASQC references.

(*4*) Deleted sections on yarn thickness and low-temperature flexibility.