



Designation: D 4028 – 96 (Reapproved 2002)

Standard Specification for Solar Screening Woven from Vinyl-Coated Fiber Glass Yarn¹

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1. Scope

1.1 This specification covers the requirements for vinyl-coated fiber glass solar screening, and should help users recognize the characteristics of acceptable vinyl-coated fiber glass solar screening. This specification is limited in application to vinyl-coated fiber glass solar screening that is produced with a ribbed pattern woven in the warp direction. The applicability of this specification to vinyl-coated fiber glass type solar screening of a non-rib, a double rib (ribs in both warp and filling direction), or a filling rib construction is not known.

1.2 This specification shows the definitions, general requirements, and physical requirements for commercial standard vinyl-coated fiber glass solar screening designed and woven for installation in any dwelling, building, or structure for the purpose of providing a significant reduction in solar heat gain, while providing outward view and interior light. Solar screening provides a structure that has insect-restraining capabilities equivalent to standard insect screening.

NOTE 1—For information on standard insect screening, see Specification D 3656.

1.3 This specification shows the values in both SI units and inch-pound units. “SI” is the technically correct name for the system of metric units known as the International System of Units. “Inch-pound units” is the technically correct name for customary units used in the United States. The values stated in either SI units or in other units shall be regarded separately as standard. The values expressed in each system may not be exact equivalents; therefore, each system must be used independently of the other without combining in any way.

1.4 The following precautionary caveat pertains only to the test method portion, Sections 8-21 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.*

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

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2. Referenced Documents

2.1 ASTM Standards:²

- D 76 Specification for Tensile Testing Machines for Textiles
 - D 123 Terminology Relating to Textiles
 - D 578 Specification for Glass Fiber Strands
 - D 883 Terminology Relating to Plastics
 - D 1776 Practice for Conditioning Textiles for Testing
 - D 3374 Specification for Vinyl-Coated Glass Yarns
 - D 3656 Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Fiber Yarn
 - D 3773 Test Methods for Length of Woven Fabric
 - D 3774 Test Method for Width of Woven Fabric
 - D 3775 Test Method for Fabric Count of Woven Fabric
 - D 3776 Test Methods for Mass per Unit Area (Weight) of Fabric
 - D 4909 Test Method for Color Stability of Vinyl-Coated Glass Textiles to Accelerated Weathering
 - D 4912 Test Method for Fabric Stability of Vinyl-Coated Glass Yarn Insect Screening and Louver Cloth
 - D 4963 Test Method for Ignition Loss of Glass Strands and Fabrics
 - D 5035 Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
 - E 171 Specification for Standard Atmospheres for Conditioning and Testing Flexible Barrier Materials
- #### 2.2 AATCC Standard:³
- Evaluating Procedure 1, Grey Scale for Color Change.
- #### 2.3 ANSI ASHRAE Standard:⁴
- Standard 74-1988, Method of Measuring Solar-Optical Properties of Materials
- #### 2.4 Federal Test Method Standards:⁵
- No. 191, Method 5872, Effect of High Temperature on Cloth Blocking, Textile Test Methods

² 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.

³ Available from American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

⁴ Available from American Society of Heating, Refrigeration, and Air-Conditioning Engineers, 1791 Tullie Circle N.E., Atlanta, GA 30329.

⁵ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.



No. 191, Method 5903, Flame Resistance of Cloth, Vertical, Textile Test Methods

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

2.5 *Military Standard*.³

MIL-STD-105D Sampling Procedures and Tables for Inspection by Attributes

3. Terminology

3.1 Definitions:

3.1.1 *acceptable quality level (AQL or P1)*—in acceptance sampling the maximum fraction of nonconforming items at which the process average can be considered satisfactory; the process average at which the risk of rejection is called the producer's risk.

3.1.2 *atmosphere for testing textiles, n—for glass*, air maintained at a relative humidity of at least 48 % and no greater than 67 %, and at a temperature of at least 20°C (68°F) and no greater than 25°C (77°F).

3.1.2.1 *Discussion*—Glass textiles are used in various products such as reinforced plastics, mat-like material, tire cords, electrical insulation, etc. Each of these materials require different testing atmospheres. It is the intent of this wide spread in testing atmosphere to allow testing of glass textiles in respective laboratories where end product test atmosphere requirements differ. The test atmospheres for respective products should be controlled as specified in Specification E 171. It is the opinion of Subcommittee D13.18 that the physical properties cited in respective specifications would not be affected by the range selected. In any event, the test atmosphere should be stated in the report.

3.1.3 *fabric stability, n—in vinyl coated glass screening and louver cloth*, the property denoting the ability to resist movement of yarn segments in one direction over yarn segments in the opposite direction.

3.1.3.1 *Discussion*—The movement of the yarns may be a result of weak bonds between crossing yarns as the coating is fused during manufacture.

3.1.4 *mesh, n—in coated glass yarn fabrics*, the number of warp yarns or ends per linear 25.4 mm (1 in.) followed by the number of filling yarns or picks per linear 25.4 mm (1 in.).

3.1.5 *shading coefficient, n*—the ratio of the solar heat gain through a glazing system under a specific set of conditions to

the solar gain through a single light of double-strength sheet glass under the same conditions.

3.1.5.1 *Discussion*—This definition is from the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) Handbook of Fundamentals.

3.1.6 *solar screening, n—of coated fiber glass yarn solar screening*, a woven fabric that imparts a shielding or protection from light, heat, wind, and insects without excessive alteration or impairment of visual viewing, and that has a mesh in excess of 12 by 12 with a rib pattern in the warp direction formed by the weaving of two or more contiguous yarns with a minimum of space between such yarns followed by space equivalent to the width of one or more of the yarns in the rib.

3.1.7 For definitions of other textile terms used in this method refer to Terminology D 123.

3.1.8 For definitions of plastic terms used in this method refer to Terminology D 883.

4. General Requirements

4.1 Material:

4.1.1 *Workmanship*—All commercial standard vinyl-coated glass yarn solar screening shall be made of high grade material with good workmanship and meet the yarn requirements specified in Specification D 3374. Products shall be free of any defects that might affect serviceability or appearance, except those permitted in footnote C of Table 1. The quality acceptance levels will be determined by agreement between the purchaser and the supplier.

4.1.2 *Plasticizers*—The material used to coat or impregnate the fibrous glass 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.

4.1.2.1 *Optional Plasticizer*—At the supplier's option, plasticizers other than phosphates and phthalates may be used provided the color is not affected and the coating compound is treated with solubilized copper 8 quinolinolate which is listed as inhibitor (e) in Federal Standard CCC-D-950. The amount of fungicide shall be based on the nonvolatile content of the coating. The coating compound shall be chemically analyzed for copper 8 quinolinolate content in accordance with Federal Standard CCC-D-950.

TABLE 1 Defects^A

Bias or bowed filling – distortion at any point 13 mm (½ in.) or more from horizontal	Scalloped selvage
Broken or missing end or pick	Slack, or tight selvage
Curled (doubled, rolled, or folded) selvage	Smash
Cut, hole, or tear	Splice – more than one in 929 cm ² (1 ft ²)
Damaged selvage extending into body of screening	Splice – more than 25 mm (1 in.) in length
Double picks	Splice – not well made or showing loose ends exceeding 25 mm (1 in.) in length
Floats	Spot, stain, streak, or mottled ^B
Hitch-back, open place, or slippage	Tight end or pick – causing waviness or ridge
Jerked-in filling, slough-off, or kinky filling	Uncoated yarns ^C
Knots	Warp streaks or filling bar
Offshade ^B	Wrong draw

^A For definitions of terms used in this table, refer to Terminology D 123.

^B At normal inspection distance, approximately 1 m (1 yd).

^C Single ends or picks unevenly coated and giving the appearance of a streak, or light-colored, but coated yarn, shall not be scored as a defect when examined at normal inspection distance of approximately 1 m (1 yd).



4.1.3 *Color*—For colors listed in Table 2, the maximum and minimum shade limits shall be defined by color designations listed in Federal Standard 595A as agreed upon between the purchaser and the supplier.

4.1.4 *Selva*—Vinyl-coated glass screening may be supplied with or without selvages as agreed between the purchaser and supplier.

4.1.5 *Yarn Splices*—Vinyl-coated glass yarn splices shall be permitted provided they show no tails and do not exceed 25 mm (1 in.) in length. Yarn splices in the solar screening shall not exceed 15 per standard 30 m (100 ft) roll, and no more than one splice shall occur in any 9.30 cm² (1 ft²) of product.

4.2 *Put-Up*—Vinyl-coated glass yarn solar screening shall be put-up on rolls and in containers whose dimensions shall be agreed upon between the purchaser and the supplier.

5. Physical Requirements

5.1 *Appearance*—Unless otherwise agreed upon between the purchaser and the supplier, a roll shall be defective if it contains one or more defects from the list in Table 1, and the lot shall be unacceptable if the number of defective sample rolls exceeds the acceptance number in Table 6. Table 6 is based on an acceptable quality level (AQL) of 4 % defective rolls.

5.2 *Mesh*—The standard average mesh shall be approximately even-spaced as specified in Table 2, ± 0.5 mesh per 25.4 mm (1 in.) in the non-rib direction and ± 2 mesh in the rib direction. There are no tolerance requirements within 13 mm (0.5 in.) of the selva.

5.3 *Roll Length*—Each roll of solar screening complying with Specification D 4028 shall contain not less than 30 linear m (100 linear ft), and shall contain not more than two pieces per roll with no piece less than 3 linear m (10 linear ft).

5.3.1 The lot shall be unacceptable if the total of the actual gross lengths of rolls in the sample is less than the total of the gross lengths marked on the roll tickets.

5.4 *Width*—The standard average roll width shall be as specified in Table 2 ± 7 or -0 mm (± 0.25 or -0 in.).

5.5 *Mass per Unit Area*—The minimum average mass per unit area for each class shall be as specified in Table 3.

5.6 *Ignition Loss*—The average ignition loss shall equal or exceed the value specified in Table 3.

5.7 *Breaking Strength*—The average breaking strength shall equal or exceed the value specified in Table 3.

5.8 *Fabric Stability*—The yarns shall be bonded at the contact or cross-over points to give sufficient fabric stability to the finished product to equal or exceed the applicable average force values specified in Table 3.

TABLE 3 Properties—Sample Average

Properties	Mesh 53 by 16	Mesh 54 by 16	Mesh 54 by 18
Mass per unit area, min:			
g/m ²	246	246	246
oz/yd ²	7.25	7.25	7.25
Ignition loss, min, %	50	50	50
Breaking strength, min:			
Warp N	400	400	400
lbf	90	90	90
Fill N	155	155	155
lbf	35	35	35
Fabric stability, min:			
Warp N	67	67	89
lbf	15	15	20
Fill N	67	67	89
lbf	15	15	20
Shading coefficient, max	0.36	0.36	0.36

5.9 *Shading Coefficient*—The average shading coefficient shall equal or be less than the value specified in Table 3.

5.10 *Flame Resistance*—There shall be no propagation of flame along any specimen for longer than 10 s after removal of flame source, and no single specimen may propagate flame along its entire length in any time increment.

5.11 *Blocking Resistance*—The surfaces of the solar screening shall not adhere or exhibit blocking in excess of Scale No. 1.

5.12 *Color Stability to Accelerated Weathering*—The change from the original color after 480 h of accelerated weathering exposure shall be no greater than Step 3 of the AATCC Gray Scale for evaluating change in color.

5.12.1 The change from the original color after 960 h of accelerated weathering exposure shall be no greater than Step 2 of the AATCC Gray Scale.

5.12.2 Exposure periods and acceptable changes for colors other than the colors as listed in Table 2 shall be as agreed upon between the purchaser and the supplier.

6. Sampling Inspection and Number of Specimens

6.1 *Lot Size*—A lot shall consist of each shipment of a single solar screening having the same color and mesh, unless otherwise agreed upon between the purchaser and the supplier. The lot size shall be designated in linear units of metres (feet).

6.2 *Lot Sample*—As a lot sample for acceptance testing, take the number of rolls of solar screening directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider rolls of solar screening to be the primary sampling unit. In the absence of such an agreement, take the number of rolls specified in Table 4.

TABLE 2 Generally Available Mesh, Widths, and Colors

Product	Nominal Yarn Diameter		Standard Constructions (Mesh)		Standard Minimum Widths		Colors
	μm	in.	Warp	Fill	cm	in.	
Fiber glass solar screening	292	0.0115	53	16	46, 51, 56, 61, 66, 71,	18, 20, 22, 24, 26, 28,	bronze
	330	0.0130	54	16	76, 81, 86, 91, 96, 102,	30, 32, 34, 36, 38, 40,	charcoal
			54	18	107, 112, 117, 122,	42, 44, 46, 48, 54, 60,	gray
					137, 152, 168, 183,	66, 72, 78, 84	
					198, 213		