



Standard Specification for Coated Glass Fabrics Used for Electrical Insulation¹

This standard is issued under the fixed designation D3949; 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 woven glass fabric coated with fully cured oleoresinous varnish, epoxy resin, polyurethane resin, or polyester resin. Excluded are coated polyester-glass fabric and glass fabric coated with silicone resins and silicone elastomers.

1.2 It is recognized that several properties, notably breaking strength and dielectric strength, are related to the style of base fabric used for any particular thickness. This specification has been developed for materials using fabrics woven from relatively coarse-filament yarns and in some cases from relatively open-weave constructions, and property values are frequently somewhat lower than if finer filament yarns or closer weave constructions were used. The user is therefore alerted that significantly higher levels of performance test values may be obtained through the use of these latter types of alternate base constructions.

1.3 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 ASTM Standards:²

- D902 Test Methods for Flexible Resin-Coated Glass Fabrics and Glass Fabric Tapes Used for Electrical Insulation
- D1711 Terminology Relating to Electrical Insulation
- D1830 Test Method for Thermal Endurance of Flexible Sheet Materials Used for Electrical Insulation by the Curved Electrode Method
- D2518 Specification for Woven Glass Fabrics for Electrical Insulation
- D3636 Practice for Sampling and Judging Quality of Solid Electrical Insulating Materials

¹ This specification is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.07 on Flexible and Rigid Insulating Materials.

Current edition approved Nov. 1, 2004. Published November 2004. Originally approved in 1980. Last previous edition approved in 1994 as D3949 – 94. DOI: 10.1520/D3949-99R04.

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. Terminology

3.1 *Definitions:* For definitions of terms used in this specification refer to Terminology D1711.

4. Classification

4.1 The materials of this specification are identified according to the type of coating applied, as follows:

- 4.1.1 *Type 1*—Black oleoresinous varnish,
- 4.1.2 *Type 2*—Yellow oleoresinous varnish,
- 4.1.3 *Type 3*—Epoxy resin,
- 4.1.4 *Type 4*—Polyurethane (isocyanate) resin, and
- 4.1.5 *Type 5*—Polyester resin.

5. Ordering Information

5.1 Orders for material covered by this specification shall include the following:

- 5.1.1 Type of coating,
- 5.1.2 Nature of finish, if any (waxy, greasy, dry, oily, mica-dusted, and so forth),
- 5.1.3 Color of coating (oleoresinous only),
- 5.1.4 Nominal coated thickness and base fabric thickness,
- 5.1.5 Put-up,
 - 5.1.5.1 *Full-Width Rolls*—core size, trimmed or untrimmed, length and width,
 - 5.1.5.2 *Sheets*—length and width,
 - 5.1.5.3 *Tapes*—core size, length, width,
- 5.1.6 Number of units per package,
- 5.1.7 Type of packaging (sealed unit packages, carton size, pallet size), and
- 5.1.8 Marking on unit packages and cartons.

6. Materials and Manufacture

6.1 *Materials*—The base fabric for all thicknesses shall be woven from continuous-filament yarns and shall be in conformance with the requirements of Specification D2518.

6.2 *Splices*—The material shall not be spliced unless agreed upon by the purchaser and seller. If it is necessary to splice rolls, splices shall occur not more than once in each 100 yd (92 m) or less, except that rolls having a length of 10 yd (9 m) or less shall contain no splices. Sheet materials shall contain no splices.

7. Electrical and Mechanical Requirements

7.1 The electrical and mechanical requirements shall be in accordance with the values shown in **Tables 1-3**.

8. Dimensional Requirements

8.1 *Thickness* shall be in accordance with the values shown in **Table 4**.

8.2 *Width*—Individual measurements on all samples selected shall not vary from the nominal by more than $\pm 1/32$ in. (0.8 mm) for widths up to 1 in. (25 mm) and by more than $\pm 1/16$ in. (1.6 mm) for widths 1 in. and over. Rolls trimmed to 36 in. or 1 m shall not be less than that amount. Sheets shall be within $\pm 1/8$ in. (3.2 mm) of the nominal width and length specified.

8.3 *Length*—The length in yards or metres per roll shall not be less than specified.

9. Workmanship and Appearance

9.1 *Visual Nonconformities*—The material shall be free from the following nonconformities to the extent specified in **12.4**:

- 9.1.1 Weave distortion in base fabric,
- 9.1.2 Wrinkles, creases, tears,
- 9.1.3 Dirt in coating,
- 9.1.4 Nonuniform application of coating (runs, drains, wrinkles, uncoated spots),
- 9.1.5 Poor adhesion of coating to fabric,
- 9.1.6 Roughness caused by broken glass filaments, gels in coating,
- 9.1.7 Unevenly wound rolls,
- 9.1.8 Ragged cut edges of rolls,
- 9.1.9 Collapsed cores, and
- 9.1.10 Unmarked splices, open splices.

10. Oil Resistance

10.1 The coated film shall show no evidence of blistering, disintegration in the oil, or removal by the blotter used in the test. The oil shall not become turbid. Thickness measurements are not required, since there are no specifications for this property.

NOTE 1—Slight swelling of the coated film in that portion of the material located between the yarns sometimes occurs, particularly with freshly coated Type 1 material. This is evidenced by a regularity in the spacing of the effect and can be differentiated from true blistering, which occurs randomly over the surface of the test specimens.

TABLE 1 Breaking Strength Requirements

Base Fabric Thickness, in. (mm)	Breaking Strength, warp, lbf/in. (kN/m)
0.002 (.051)	70 (12.2)
0.003 (0.08)	100 (17.5)
0.004 (0.10)	130 (22.8)
0.005 (0.13)	150 (26.2)
0.007 (0.18)	220 (38.6)
0.010 (0.25)	300 (52.6)
0.015 (0.38)	350 (61.3)

11. Temperature Classification

11.1 The materials covered by this specification shall not have a temperature index less than that specified as follows when tested in accordance with Test Method **D1830** using a life criterion of 20 000 h:

Types 1 and 2	130
Types 3 and 4	155
Type 5	180

NOTE 2—In the case of materials for special applications, some of the preceding types may have temperature indices below those stated, or may have life values less than 20 000 h. Use of these materials shall be agreed upon between the purchaser and the seller.

11.2 The seller shall, at the request of the purchaser, provide a thermal life graph (Arrhenius plot) showing the nominal temperature indices of the types of materials purchased.

12. Sampling

12.1 *Lot Definition*—Refer to Terminology Section of Practice **D3636**.

12.2 *Unit of Sample*—The unit of sample shall be the unit of product (rolls or sheets).

12.3 *Sampling the Lot*—Randomly select, to the nearest integral package, a number of packages equal to \sqrt{N} from each lot, where N is the total number of packages in the shipment. These shall constitute the source of the unit sampling in **12.4** and **12.5**.

12.4 *Sampling for Visual and Dimensional Examination*—Select a random sample of rolls or sheets from material of **12.3** in accordance with Inspection Level I of Practice **D3636**. Acceptance shall be determined in accordance with **11.1** and **Table 4** on the basis of AQL = 2.5. Take as the test sample 5 yd (4.5 m) from each sampled roll or sheet.

12.5 *Sampling for Performance Tests*—Select a random sample of rolls or sheets from the material of **12.3** in accordance with Inspection Level S-2 of Practice **D3636**. Take an amount corresponding to about 0.5 yd² (0.3 m²) from each sampled roll or sheet.

13. Tests and Retests

13.1 If the results of any test to determine conformance with **7.1** and **10.1** do not conform to the requirements prescribed in this specification, make two additional tests on different specimens of the same sample. If either of these additional tests fail, or if the average of all tests computed including the retests fail, the lot of material shall be subject to rejection. Notice of failure of the material based on tests made shall be reported to the supplier within 3 weeks after receipt of the material by the purchaser.

14. Test Methods

14.1 Use the methods described in Test Methods **D902** to determine compliance with this specification, unless otherwise agreed upon between the purchaser and the seller.

15. Preparation for Delivery

15.1 Unless otherwise agreed upon between the purchaser and the seller, the following shall be considered standard procedure for finishing, packaging, and marking: