



Designation: D 2343 – 95

Standard Test Method for Tensile Properties of Glass Fiber Strands, Yarns, and Rovings Used in Reinforced Plastics¹

This standard is issued under the fixed designation D 2343; 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 test method covers the determination of the comparative tensile properties of glass fiber strands, yarns, and rovings in the form of straight standard test specimens when tested under defined conditions of pretreatment, temperature, humidity, and tension testing machine speed. This test method is applicable to continuous filament, glass fiber materials that have been coated with a resin compatible sizing.

NOTE 1—There is no known ISO equivalent to this test method.

NOTE 2—This test method was originally developed as a quality control test for glass fiber. It should not be used to develop composites design data. Consult Test Method D 638, Test Method D 3039/D 3039M, or the materials specification for development of composite design properties.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

NOTE 3—Prime consideration should be given to the use of a polymeric binder that produces specimens that yield the highest consistent values for the glass fiber material under test. Tensile properties may vary with specimen preparation, resin impregnation system, and speed and environment of testing. Consequently, where precise comparative results are desired, these factors must be carefully controlled.

1.3 *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 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing²
- D 638 Test Method for Tensile Properties of Plastics²
- D 3039/D3039M Test Method for Tensile Properties of

Fiber-Resin Composites³

E 4 Practices for Force Verification of Testing Machines⁴

E 6 Terminology Relating to Methods of Mechanical Testing⁴

3. Terminology

3.1 Definitions:

3.1.1 Definitions of terms and symbols relating to this test method appear in Terminology E 6 and the Appendix to Test Method D 638.

4. Summary of Test Method

4.1 This test method consists of impregnating glass fiber strands, yarns, or rovings with a suitable polymeric binder material and loading the resulting test specimens to failure in a tension testing machine having a constant-rate-of-crosshead movement. The cross sectional area is determined from skeins of glass fiber taken before and after each set of test specimens. After impregnation and curing, the specimens are tested in accordance with the procedure outlined in 4.1.1.

4.1.1 *Procedure*—The test specimen is cut to a specified length and tested using rubber-faced grips, 240 grit sandpaper, fine emery cloth, or combination thereof.

5. Significance and Use

5.1 Tensile properties determined by this test method are of value for identifying and characterizing materials for control and specification purposes as well as for providing data for research and development studies.

5.2 This test method is intended for use in testing resin-compatible sized glass fiber materials that have been designed specifically for use with certain generic types of plastics. The use of a resin impregnant that is compatible with the reinforcement material under test produces results that are most representative of the actual strength that is available in the material when used as intended in an end item. Premature reinforcement failure may occur if the elongation of the resin system is less than that of the reinforcement being tested. Misleading results may be obtained when glass fiber materials are tested dry or when a noncompatible resin impregnant is used.

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.18 on Reinforced Thermosetting Plastics.

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Changes incorporated since the last revision of this test method are designed to improve reproducibility by giving more specific instructions on the sample preparation procedures.

² *Annual Book of ASTM Standards*, Vol 08.01.

³ *Annual Book of ASTM Standards*, Vol 15.03.

⁴ *Annual Book of ASTM Standards*, Vol 03.01.

5.3 This test method is useful for testing pretreated specimens for which comparative results are desired. The reproducibility of test results is good when precise control is maintained over all test conditions. Values obtained by this test method may be affected by gage length, gripping system, testing speed, and the resin impregnation ratio of the specimen.

6. Apparatus

6.1 *Impregnation Apparatus*—An example of an acceptable impregnation apparatus for strands is shown in Fig. 1, and for rovings and yarns in Fig. 2. Minor modifications to the apparatus are acceptable providing consistent samples are produced. The apparatus shall consist essentially of the following:

6.1.1 *Free Wheeling Spindle*—A freely turning spindle with a horizontal axis for holding the yarn spool or roving ball. A spindle is not required for testing strands because the material is pulled over the end from the outside or the inside of the forming cake.

6.1.2 *Guide Eye and Pulley*—A ceramic guide eye, 25 mm (1.0 in.) in diameter, and a freewheeling pulley, 20 mm (0.8 in.) minimum groove diameter, to guide the material as illustrated in Fig. 3.

6.1.3 *Impregnation Tank*, as illustrated in Fig. 3 and Fig. 4, consisting of a container and a static spreader bar assembly having at least three bars, each a minimum of 8 mm ($\frac{5}{16}$ in.) diameter, made of a corrosion-resistant material.

6.1.4 *Winding Fixture*—A typical winding fixture for glass fiber strands and yarns is shown in Fig. 5, and for rovings in Fig. 6.

6.2 *Cutting Gage*—A typical cutting gage is shown in Fig. 7. This tool eliminates the need for measuring the specimens manually.

6.3 *Tension Testing Machine*—A testing machine having a constant-rate-of-crosshead movement and comprising essentially the following shall be available:

6.3.1 *Stationary Member*, carrying one grip.

6.3.2 *Movable Member*, carrying a second grip.

6.3.3 *Grips*—Grips for holding the test specimen between the fixed and the movable member shall be of the self-aligning type (that is, they shall be attached to the fixed and movable members in such a manner that they will move freely into alignment as soon as any load is applied). The long axis of the test specimens will then coincide with the direction of the applied pull through the center line of the grip assembly.

NOTE 4—Air-actuated grips have been found advantageous and are recommended for use in this test method.

6.3.4 *Jaws*—A set of removable jaws to match the required grips shall be used for clamping the test specimens. One of the faces of the jaws should be adjustable to compensate for thickness of the specimen ends, so that the tension force may be lined up with the center of the jaw. Rubber-faced jaws, 25 by 102 mm (1.0 by 4.0 in.), shall be used for gripping specimens. If slippage of the test specimens is observed, 240 grit sandpaper strips may be used to improve gripping. The sandpaper should be replaced when it has lost its grittiness, or after every 30 to 50 breaks.

6.3.5 *Drive Mechanism*—A drive mechanism capable of imparting a uniform controllable speed to the movable member of the apparatus.

6.3.6 *Load Indicator*—A suitable load-indicating mechanism capable of showing the total tensile load carried by the test specimen when held by the grips shall be used. This mechanism shall be essentially free of inertial lag at the specified rate of testing and shall indicate the load with an accuracy of at least $\pm 1\%$ of the indicated load value. The accuracy of the testing machine shall be verifiable in accordance with Practices E 4.

6.3.7 *Deflection-Measuring Device and Recorder*—A suitable instrument for measuring deflection (extensometer) and a suitable mechanism for recording this deflection shall be provided. It is desirable that this instrument and recorder automatically record this deflection as a function of the load on the test specimen.

6.4 *Balance, Analytical.*

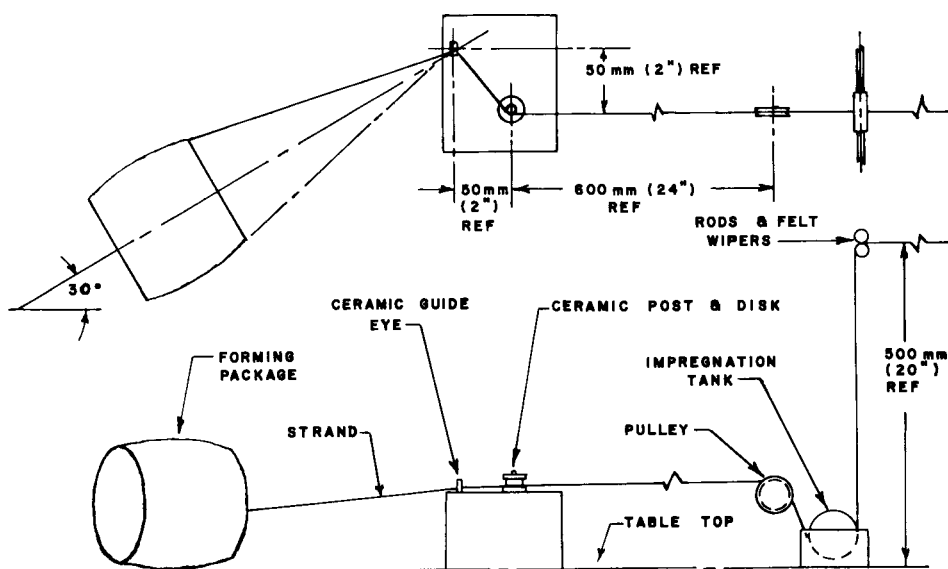


FIG. 1 Typical Impregnating Apparatus for Strands