Designation: D2343 – 17 (Reapproved 2023)

Standard Test Method for Tensile Properties of Glass Fiber Strands, Yarns, and Rovings Used in Reinforced Plastics[1]

This standard is issued under the fixed designation D2343; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

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 impregnated rod 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. This method is intended for use in quality control and R & D, and is not intended to be used to develop composites design data.

NOTE 1—This method is technically equivalent to the short method described in ISO 9163.

NOTE 2—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 vary with specimen preparation, resin impregnation system, and speed and environment of testing. Consider these factors where precise comparative results are desired.

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

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D618 Practice for Conditioning Plastics for Testing

D883 Terminology Relating to Plastics

E4 Practices for Force Calibration and Verification of Testing Machines

E6 Terminology Relating to Methods of Mechanical Testing

2.2 *ISO Standard:*

ISO 9163 Textile Glass—Rovings—Manufacture of Test Specimens and Determination of Tensile Strength of Impregnated Rovings

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions of terms and symbols relating to this test method appear in Terminologies E6 and D883.

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 shall either be tabbed using glass fiber mat or cardboard and tested with standard grips; or the ends shall be sanded with 240 grit sandpaper or fine emery cloth and tested using rubber faced grips.

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.

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

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[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.

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

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 system 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 failures occur if the elongation of the resin system is less than that of the reinforcement being tested. It is critical to select a resin system that does not lead to premature reinforcement failure. Use of compatible resin system and complete resin impregnation is recommended to avoid invalid failures and misleading results.

5.3 This test method is useful for testing pretreated specimens for which comparative results are desired. Gage length, gripping system, testing speed, and the resin impregnation ratio of the specimen affects the values obtained by this test method.

6. Apparatus

6.1 *Impregnation Apparatus*—An example of an acceptable impregnation apparatus for strands is shown in Fig. 1. 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 (Optional)*—A freely turning spindle with a horizontal axis for holding the yarn spool or roving ball. A spindle allows fiber to be pulled from a yarn bobbin or the outside of a roving package. Alternately, inside payout or drawing of the fiber from the interior of a roving package or forming cake without the use of spindle is possible.

6.1.2 *Tension Regulating System* capable of maintaining the roving or yarn under tension between 0.2 newton and 20 newton.

6.1.3 *Impregnation Tank,* as illustrated in Fig. 2, consisting of a container and a static spreader bar assembly. The tank must have the capability of maintaining the required resin temperature within ±5°C.

NOTE 3—Heating and temperature maintenance may be accomplished by use of a double walled vat, with heating fluid circulating between the walls, or by use of an external heating plate.

6.1.4 *Die,* as illustrated in Fig. 3, made of stainless steel, which gives a defined circular cross-section to the impregnated roving.

6.1.5 *Winding Device and Frame,* for collecting the impregnated roving, which ensures that the fibers are kept under constant tension and places the strands onto the fixture in a manner, which allows separate specimens to be fabricated.

6.2 *Template for Tabbing (Optional)*—A template, as shown in Fig. 4, shall be used to provide proper positioning of end tabs.

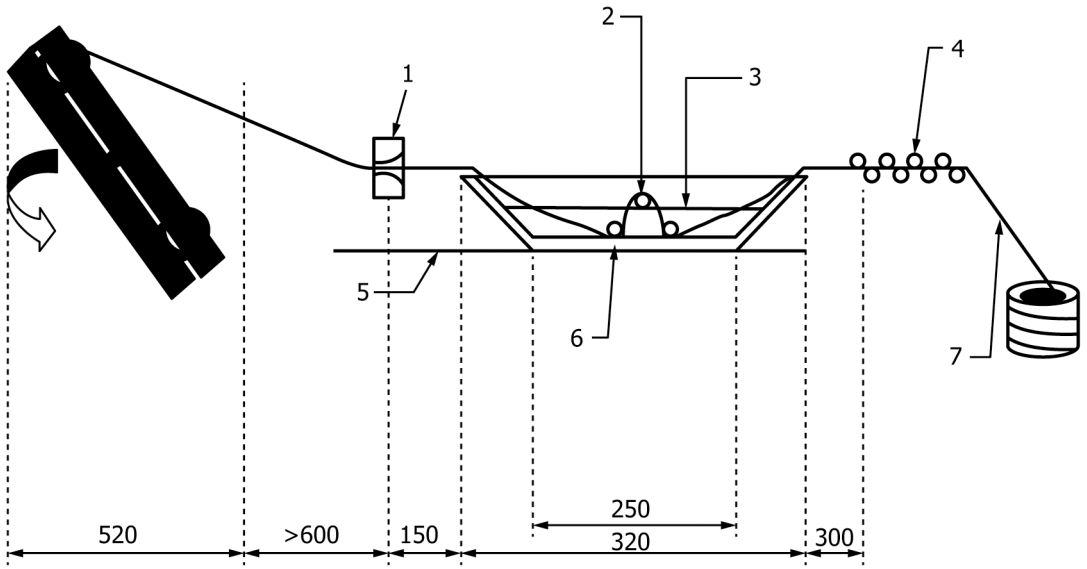
6.3 *Tension Testing Machine*—A testing machine having a constant-rate-of-crosshead movement and comprising essentially the following shall be available:

6.3.1 *Stationary Member,* with one grip.

6.3.2 *Movable Member,* with 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.



1 Die
2 Tensioning Bars
3 Resin Level
4 Tensioning Device
5 Moving Support
6 Impregnation Vat (temperature regulated)
7 Glass Input

FIG. 1 Typical Impregnation Equipment Configuration