



Designation: D 5448/D 5448M – 93

Standard Test Method for Inplane Shear Properties of Hoop Wound Polymer Matrix Composite Cylinders¹

This standard is issued under the fixed designation D 5448/D 5448M; 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 determines the inplane shear properties of wound polymer matrix composites reinforced by high-modulus continuous fibers. It describes testing of hoop wound (90°) cylinders in torsion for determination of inplane shear properties.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text the inch-pound units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the test method.

1.3 *This standard does not purport to address all of the safety problems, 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 792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement²
- D 883 Terminology Relating to Plastics²
- D 2584 Test Method for Ignition Loss of Cured Reinforced Resins³
- D 2734 Test Method for Void Content of Reinforced Plastics³
- D 3171 Test Method for Fiber Content of Resin-Matrix Composites by Matrix Digestion⁴
- D 3878 Terminology Relating to High-Modulus Reinforcing Fibers and Their Composites⁴
- D 5229/D 5229M Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials⁴
- D 5449/D 5449M Test Method for Transverse Compressive

Properties of Hoop Wound Polymer Matrix Composite Cylinders⁴

D 5450/D 5450M Test Method for Transverse Tensile Properties of Hoop Wound Polymer Matrix Composite Cylinders⁴

E 4 Practices for Force Verification of Testing Machines⁵

E 6 Terminology Relating to Methods of Mechanical Testing⁵

E 111 Test Method for Young's Modulus, Tangent Modulus, and Chord Modulus⁵

E 122 Practice for Choice of Sample Size to Estimate the Average Quality of a Lot or Process⁶

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods⁶

E 251 Test Methods for Performance Characteristics of Metallic Bonded Resistance Strain Gages⁵

E 456 Terminology Relating to Quality and Statistics⁶

E 691 Practice for Conducting and Interlaboratory Study to Determine the Precision of a Test Method⁶

E 1237 Guide for Installing Bonded Resistance Strain Gages⁵

3. Terminology

3.1 *Definitions*—Terminology D 3878 defines terms relating to high-modulus fibers and their composites. Terminology D 883 defines terms relating to plastics. Terminology E 6 defines terms relating to mechanical testing. Terminology E 456 and Practice E 177 define terms relating to statistics. In the event of a conflict between terms, Terminology D 3878 shall have precedence over other standards.

3.2 *Description of Terms Specific to This Standard:*⁷

3.2.1 *hoop wound, n*—a winding of a cylindrical component where the filaments are circumferentially oriented.

3.2.2 *inplane shear modulus, G_{12} [MT^{-1} T^{-2}], n* —the elastic shear modulus of a unidirectional material in the plane defined by axes parallel and perpendicular to the reinforcing fibers.

⁵ Annual Book of ASTM Standards, Vol 03.01.

⁶ Annual Book of ASTM Standards, Vol 14.02.

⁷ If the term represents a physical quantity, its analytical dimensions are stated immediately following the term (or letter symbol) in fundamental dimension form, using the following ASTM standard symbology for fundamental dimensions, shown within square brackets: [M] for mass, [L] for length, [T] for time, [θ] for thermodynamic temperature, and [nd] for nondimensional quantities. Use of these symbols is restricted to analytical dimensions when used with square brackets, as the symbols may have other definitions when used without the brackets.

¹ This test method is under the jurisdiction of ASTM Committee D-30 on High Modulus Fibers and Their Composites and is the direct responsibility of Subcommittee D30.04 on Lamina and Laminate Test Methods.

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² Annual Book of ASTM Standards, Vol 08.01.

³ Annual Book of ASTM Standards, Vol 08.02.

⁴ Annual Book of ASTM Standards, Vol 15.03.