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Standard Guide for Testing Polymer Matrix Composite Materials¹

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1. Scope

1.1 This guide summarizes the application of ASTM standard test methods (and other supporting standards) to continuous-fiber reinforced polymer matrix composite materials. The most commonly used or most applicable ASTM standards are included, emphasizing use of standards of Committee D30 on Composite Materials.

1.2 This guide does not cover all possible standards that could apply to polymer matrix composites and restricts discussion to the documented scope. Commonly used but non-standard industry extensions of test method scopes, such as application of static test methods to fatigue testing, are not discussed. A more complete summary of general composite testing standards, including non-ASTM test methods, is included in the Composite Materials Handbook (CMH-17).² Additional specific recommendations for testing textile (fabric, braided) composites are contained in Guide D6856.

1.3 This guide does not specify a system of measurement; the systems specified within each of the referenced standards shall apply as appropriate. Note that the referenced standards of ASTM Committee D30 are either SI-only or combined-unit standards with SI units listed first.

1.4 *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.*

1.5 *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.*

¹ This guide is under the jurisdiction of ASTM Committee D30 on Composite Materials and is the direct responsibility of Subcommittee D30.01 on Editorial and Resource Standards.

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² Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

2. Referenced Documents

2.1 ASTM Standards:³

- 2.1.1 *Standards of Committee D30 on Composite Materials*
 - C271/C271M Test Method for Density of Sandwich Core Materials
 - C272/C272M Test Method for Water Absorption of Core Materials for Sandwich Constructions
 - C273/C273M Test Method for Shear Properties of Sandwich Core Materials
 - C297/C297M Test Method for Flatwise Tensile Strength of Sandwich Constructions
 - C363/C363M Test Method for Node Tensile Strength of Honeycomb Core Materials
 - C364/C364M Test Method for Edgewise Compressive Strength of Sandwich Constructions
 - C365/C365M Test Method for Flatwise Compressive Properties of Sandwich Cores
 - C366/C366M Test Methods for Measurement of Thickness of Sandwich Cores
 - C393/C393M Test Method for Core Shear Properties of Sandwich Constructions by Beam Flexure
 - C394/C394M Test Method for Shear Fatigue of Sandwich Core Materials
 - C480/C480M Test Method for Flexure Creep of Sandwich Constructions
 - C481 Test Method for Laboratory Aging of Sandwich Constructions
 - C613 Test Method for Constituent Content of Composite Prepreg by Soxhlet Extraction
 - D2344/D2344M Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
 - D3039/D3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials
 - D3171 Test Methods for Constituent Content of Composite Materials
 - D3410/D3410M Test Method for Compressive Properties of Polymer Matrix Composite Materials with Unsupported Gage Section by Shear Loading
 - D3479/D3479M Test Method for Tension-Tension Fatigue

³ 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.

- of Polymer Matrix Composite Materials
- D3518/D3518M** Test Method for In-Plane Shear Response of Polymer Matrix Composite Materials by Tensile Test of a $\pm 45^\circ$ Laminate
- D3529** Test Methods for Constituent Content of Composite Prepreg
- D3530** Test Method for Volatiles Content of Composite Material Prepreg
- D3531/D3531M** Test Method for Resin Flow of Carbon Fiber-Epoxy Prepreg
- D3532/D3532M** Test Method for Gel Time of Carbon Fiber-Epoxy Prepreg
- D3800** Test Method for Density of High-Modulus Fibers
- D3878** Terminology for Composite Materials
- D4018** Test Methods for Properties of Continuous Filament Carbon and Graphite Fiber Tows
- D4102** Test Method for Thermal Oxidative Resistance of Carbon Fibers
- D4255/D4255M** Test Method for In-Plane Shear Properties of Polymer Matrix Composite Materials by the Rail Shear Method
- D5229/D5229M** Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials
- D5379/D5379M** Test Method for Shear Properties of Composite Materials by the V-Notched Beam Method
- D5448/D5448M** Test Method for Inplane Shear Properties of Hoop Wound Polymer Matrix Composite Cylinders
- D5449/D5449M** Test Method for Transverse Compressive Properties of Hoop Wound Polymer Matrix Composite Cylinders
- D5450/D5450M** Test Method for Transverse Tensile Properties of Hoop Wound Polymer Matrix Composite Cylinders
- D5467/D5467M** Test Method for Compressive Properties of Unidirectional Polymer Matrix Composite Materials Using a Sandwich Beam
- D5528** Test Method for Mode I Interlaminar Fracture Toughness of Unidirectional Fiber-Reinforced Polymer Matrix Composites
- D5687/D5687M** Guide for Preparation of Flat Composite Panels with Processing Guidelines for Specimen Preparation
- D5766/D5766M** Test Method for Open-Hole Tensile Strength of Polymer Matrix Composite Laminates
- D5961/D5961M** Test Method for Bearing Response of Polymer Matrix Composite Laminates
- D6115** Test Method for Mode I Fatigue Delamination Growth Onset of Unidirectional Fiber-Reinforced Polymer Matrix Composites
- D6264/D6264M** Test Method for Measuring the Damage Resistance of a Fiber-Reinforced Polymer-Matrix Composite to a Concentrated Quasi-Static Indentation Force
- D6415/D6415M** Test Method for Measuring the Curved Beam Strength of a Fiber-Reinforced Polymer-Matrix Composite
- D6416/D6416M** Test Method for Two-Dimensional Flexural Properties of Simply Supported Sandwich Composite Plates Subjected to a Distributed Load
- D6484/D6484M** Test Method for Open-Hole Compressive Strength of Polymer Matrix Composite Laminates
- D6507** Practice for Fiber Reinforcement Orientation Codes for Composite Materials
- D6641/D6641M** Test Method for Compressive Properties of Polymer Matrix Composite Materials Using a Combined Loading Compression (CLC) Test Fixture
- D6671/D6671M** Test Method for Mixed Mode I-Mode II Interlaminar Fracture Toughness of Unidirectional Fiber Reinforced Polymer Matrix Composites
- D6742/D6742M** Practice for Filled-Hole Tension and Compression Testing of Polymer Matrix Composite Laminates
- D6772/D6772M** Test Method for Dimensional Stability of Sandwich Core Materials
- D6790/D6790M** Test Method for Determining Poisson's Ratio of Honeycomb Cores
- D6856** Guide for Testing Fabric-Reinforced "Textile" Composite Materials
- D6873/D6873M** Practice for Bearing Fatigue Response of Polymer Matrix Composite Laminates
- D7028** Test Method for Glass Transition Temperature (DMA T_g) of Polymer Matrix Composites by Dynamic Mechanical Analysis (DMA)
- D7078/D7078M** Test Method for Shear Properties of Composite Materials by V-Notched Rail Shear Method
- D7136/D7136M** Test Method for Measuring the Damage Resistance of a Fiber-Reinforced Polymer Matrix Composite to a Drop-Weight Impact Event
- D7137/D7137M** Test Method for Compressive Residual Strength Properties of Damaged Polymer Matrix Composite Plates
- D7205/D7205M** Test Method for Tensile Properties of Fiber Reinforced Polymer Matrix Composite Bars
- D7248/D7248M** Test Method for High Bearing - Low Bypass Interaction Response of Polymer Matrix Composite Laminates Using 2-Fastener Specimens
- D7249/D7249M** Test Method for Facesheet Properties of Sandwich Constructions by Long Beam Flexure
- D7250/D7250M** Practice for Determining Sandwich Beam Flexural and Shear Stiffness
- D7264/D7264M** Test Method for Flexural Properties of Polymer Matrix Composite Materials
- D7291/D7291M** Test Method for Through-Thickness "Flat-wise" Tensile Strength and Elastic Modulus of a Fiber-Reinforced Polymer Matrix Composite Material
- D7332/D7332M** Test Method for Measuring the Fastener Pull-Through Resistance of a Fiber-Reinforced Polymer Matrix Composite
- D7336/D7336M** Test Method for Static Energy Absorption Properties of Honeycomb Sandwich Core Materials
- D7337/D7337M** Test Method for Tensile Creep Rupture of Fiber Reinforced Polymer Matrix Composite Bars
- D7522/D7522M** Test Method for Pull-Off Strength for FRP Laminate Systems Bonded to Concrete or Masonry Substrates