Designation: D4762 – 18

Standard Guide for Testing Polymer Matrix Composite Materials[1]

This standard is issued under the fixed designation D4762; 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 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 nonstandard 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.*

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

[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.

Current edition approved June 1, 2018. Published August 2018. Originally approved in 1988. Last previous edition approved in 2016 as D4762 – 16. DOI: 10.1520/D4762-18.

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

[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 ±45° 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 Tg) 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 Bearing/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 "Flatwise" 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 Substrate

D7565/D7565M Test Method for Determining Tensile Properties of Fiber Reinforced Polymer Matrix Composites Used for Strengthening of Civil Structures
D7615/D7615M Practice for Open-Hole Fatigue Response of Polymer Matrix Composite Laminates
D7616/D7616M Test Method for Determining Apparent Overlap Splice Shear Strength Properties of Wet Lay-Up Fiber-Reinforced Polymer Matrix Composites Used for Strengthening Civil Structures
D7617/D7617M Test Method for Transverse Shear Strength of Fiber-reinforced Polymer Matrix Composite Bars
D7705/D7705M Test Method for Alkali Resistance of Fiber Reinforced Polymer (FRP) Matrix Composite Bars used in Concrete Construction
D7750 Test Method for Cure Behavior of Thermosetting Resins by Dynamic Mechanical Procedures using an Encapsulated Specimen Rheometer
D7766/D7766M Practice for Damage Resistance Testing of Sandwich Constructions
D7905/D7905M Test Method for Determination of the Mode II Interlaminar Fracture Toughness of Unidirectional Fiber-Reinforced Polymer Matrix Composites
D7913/D7913M Test Method for Bond Strength of Fiber-Reinforced Polymer Matrix Composite Bars to Concrete by Pullout Testing
D7914/D7914M Test Method for Strength of Fiber Reinforced Polymer (FRP) Bent Bars in Bend Locations
D7956/D7956M Practice for Compressive Testing of Thin Damaged Laminates Using a Sandwich Long Beam Flexure Specimen
D7957/D7957M Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement
D7958/D7958M Test Method for Evaluation of Performance for FRP Composite Bonded to Concrete Substrate using Beam Test
D8066/D8066M Practice Unnotched Compression Testing of Polymer Matrix Composite Laminates
D8067/D8067M Test Method for In-Plane Shear Properties of Sandwich Panels Using a Picture Frame Fixture
D8101/D8101M Test Method for Measuring the Penetration Resistance of Composite Materials to Impact by a Blunt Projectile
D8131/D8131M Practice for Tensile Properties of Tapered and Stepped Joints of Polymer Matrix Composite Laminates
D8132/D8132M Test Method for Determination of Prepreg Impregnation by Permeability Measurement
F1645/F1645M Test Method for Water Migration in Honeycomb Core Materials

2.1.2 *Standards of Committee D20 on Plastics*

C581 Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service
D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents
D570 Test Method for Water Absorption of Plastics
D618 Practice for Conditioning Plastics for Testing
D638 Test Method for Tensile Properties of Plastics
D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
D671 Test Method for Flexural Fatigue of Plastics by Constant-Amplitude-of-Force (Withdrawn 2002)[4]
D695 Test Method for Compressive Properties of Rigid Plastics
D696 Test Method for Coefficient of Linear Thermal Expansion of Plastics Between −30°C and 30°C with a Vitreous Silica Dilatometer
D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
D953 Test Method for Bearing Strength of Plastics
D1505 Test Method for Density of Plastics by the Density-Gradient Technique
D1822 Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials
D2471 Practice for Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins (Withdrawn 2008)[4]
D2583 Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
D2584 Test Method for Ignition Loss of Cured Reinforced Resins
D2734 Test Methods for Void Content of Reinforced Plastics
D2990 Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
D3418 Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry
D3846 Test Method for In-Plane Shear Strength of Reinforced Plastics
D4065 Practice for Plastics: Dynamic Mechanical Properties: Determination and Report of Procedures
D4473 Test Method for Plastics: Dynamic Mechanical Properties: Cure Behavior
D5083 Test Method for Tensile Properties of Reinforced Thermosetting Plastics Using Straight-Sided Specimens
D6272 Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials by Four-Point Bending

2.1.3 *Standards of Other ASTM Committees*

E228 Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer
E289 Test Method for Linear Thermal Expansion of Rigid Solids with Interferometry
E1269 Test Method for Determining Specific Heat Capacity by Differential Scanning Calorimetry
E1461 Test Method for Thermal Diffusivity by the Flash Method
E1922 Test Method for Translaminar Fracture Toughness of Laminated and Pultruded Polymer Matrix Composite Materials

[4] The last approved version of this historical standard is referenced on www.astm.org.