



Standard Test Method for In-Plane Shear Properties of Polymer Matrix Composite Materials by the Rail Shear Method¹

This standard is issued under the fixed designation D 4255/D 4255M; 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 Department of Defense.

1. Scope

1.1 This test method determines the in-plane shear properties of high-modulus fiber-reinforced composite materials by either of two procedures. In Procedure A, laminates clamped between two pairs of loading rails are tested. When loaded in tension the rails introduce shear forces in the specimen. In Procedure B, laminates clamped on opposite edges with a tensile or compressive load applied to a third pair of rails in the center are tested.

1.2 Application of this test method is limited to continuous-fiber or discontinuous-fiber-reinforced polymer matrix composites in the following material forms:

1.2.1 Laminates composed only of unidirectional fibrous laminae, with the fiber direction oriented either parallel or perpendicular to the fixture rails.

1.2.2 Laminates composed only of woven fabric filamentary laminae with the warp direction oriented either parallel or perpendicular to the fixture rails.

1.2.3 Laminates of balanced and symmetric construction, with the 0° direction oriented either parallel or perpendicular to the fixture rails.

1.2.4 Short-fiber-reinforced composites with a majority of the fibers being randomly distributed.

NOTE 1—Additional test methods for determining in-plane shear properties of polymer matrix composites may be found in Test Methods D 5379/D 5379M and D 5448/D 5448M, and Practice D 3518/D 3518M.

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.*

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text the inch-pounds 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 standard.

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 Constituent Content of Composite Materials⁴

D 3518/D 3518M Practice for In-Plane Shear Stress-Strain Response of Unidirectional Polymer Matrix Composite Materials by Tensile Test of ±45° Laminate⁴

D 3878 Terminology for Composite Materials⁴

D 5229/D 5229M Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials⁴

D 5379/D 5379M Test Method for Shear Properties of Composite Materials by the V-Notched Beam Method⁴

D 5448/D 5448M Test Method for In-Plane Shear 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 a Measure of Quality for 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

¹ This test method is under the jurisdiction of ASTM Committee D30 on Composite Materials 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.

⁵ Annual Book of ASTM Standards, Vol 03.01.

⁶ Annual Book of ASTM Standards, Vol 14.02.