



Designation: ~~D3846—02~~ Designation: D 3846 – 08

## Standard Test Method for In-Plane Shear Strength of Reinforced Plastics<sup>1</sup>

This standard is issued under the fixed designation D 3846; 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 ( $\epsilon$ ) 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 covers the determination of the in-plane shear strength of reinforced thermosetting plastics in flat sheet form in thicknesses ranging from 2.54 to 6.60 mm (0.100 to 0.260 in.).~~

1.1 This test method covers the determination of the in-plane shear strength of reinforced thermosetting plastics in flat sheet form in thicknesses ranging from 2.54 to 6.60 mm (0.100 to 0.260 in.). This protocol is not for reinforced pultruded thermoset products, which may use Test Method D 2344/D 2344M.

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

NOTE 1—This standard has no known ISO equivalent.

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

D 618 Practice for Conditioning Plastics for Testing

D 695 Test Method for Compressive Properties of Rigid Plastics

D2344 2344/D 2344M Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

E 4 Practices for Force Verification of Testing Machines

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

### 3. Terminology

3.1 *Definitions:*

3.1.1 *in-plane shear strength*—the shear strength at rupture in which the plane of fracture is located along the longitudinal axis of the specimen between two centrally located notches machined halfway through its thickness on opposing faces.<sup>46-08</sup>

### 4. Summary of Test Method

4.1 In-plane shear strength, as determined by this test method, is measured by applying a compressive load to a notched specimen of uniform width. The specimen is loaded edgewise in a supporting jig of the same description as that referenced in Test Method D 695 for testing thin specimens. A schematic of the specimen used for this test and the supporting jig is shown in Fig. 1. Failure of the specimen occurs in *shear* between two centrally located notches machined halfway through its thickness and spaced a fixed distance apart on opposing faces.

### 5. Significance and Use

5.1 Shear tests of various kinds are widely used in the reinforced plastics industry to assess the strength of the reinforcement-to-resin bond in polyester-, vinyl ester-, and epoxy-resin composites. In addition to their importance for the generation of data for research and development, quality control, and specification purposes, such tests are of fundamental value to the fibrous reinforcement industry, since they can be used to assess the potential of new sizing systems for the surface treatment of glass fibers.

<sup>1</sup> 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.

Current edition approved March 10, 2002. Published May 2002. Originally published as D3846–79. Last previous edition D3846–94.

Current edition approved May 1, 2008. Published June 2008. Originally approved in 1979. Last previous edition approved in 2002 as D 3846 - 02.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* Vol 08.01, 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.

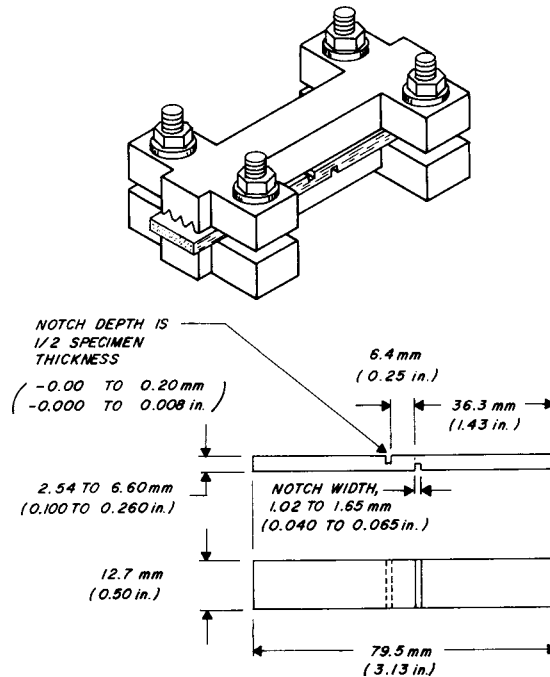


FIG. 1 Specimen and Loading Jig for In-Plane Shear Test

5.2 This test method is useful for establishing the shear strength of laminates or other reinforced plastics having randomly dispersed fiber reinforcement. While the test also lends itself to parallel-fiber reinforced plastics, it has been designed to accommodate nonparallel-fiber reinforced materials that cannot be tested satisfactorily by the short-beam procedure described in Test Method D 2344.

## 6. Apparatus

6.1 *Testing Machine*—Any suitable testing machine capable of control of constant-rate-of-crosshead movement and comprising essentially the following:

6.1.1 *Drive Mechanism*—A drive mechanism for imparting to the movable member a uniform, controlled velocity with respect to the stationary member, as required in 10.3.

6.1.2 *Load Indicator*—A load-indicating mechanism capable of showing the total compressive load carried by the test specimen. The mechanism shall be essentially free of inertial lag at the specified rate of testing and shall indicate the load with an accuracy of  $\pm 1\%$  of the maximum indicated value of the test (load). The accuracy of the testing machine shall be verified at least once a year in accordance with Practices E 4.

6.1.3 *Compression Tool*—A compression tool for applying the load to the test specimen, such as those shown in Figs. 1 and 2 of Test Method D 695.

6.1.4 *Supporting Jig*—A supporting jig, shown schematically in Fig. 1, and conforming to the dimensions of that shown in Fig. 4 of Test Method D 695.

6.1.5 *Micrometers*—Suitable micrometers, reading to 0.025 mm (0.001 in.) for measuring the width and thickness of the specimens, as well as the depth of, and distance between, the notches.

6.1.6 *Torque Wrench*—A suitable torque wrench for tightening the nuts of the supporting jig of 6.1.4 to the torque prescribed in 10.2.

## 7. Test Specimens

7.1 *Configuration*—Test specimens shall conform to the shape and dimensions given in Fig. 1. The edges of the specimens shall be smooth, but not rounded or beveled.

7.2 *Preparation*—Two parallel cuts, one on each opposite face of the specimen and 6.4 mm (0.25 in.) apart, shall be sawed across the entire width of the specimen and centrally located along its length. The width and depth of notch shall conform to the dimensions shown in Fig. 1. For laminated materials, the notch shall be of sufficient depth to sever the center ply of the reinforcement, located midway between the two faces of the laminate.

7.3 *Number*—Five specimens shall be tested whenever isotropic materials are under test. When testing material that is suspected or known to be anisotropic, ten specimens (five normal to and five parallel with the principal axis of anisotropy) shall be tested.

## 8. Conditioning

8.1 *Conditioning*—Condition the test specimens at  $23 \pm 2^\circ\text{C}$  ( $73.4 \pm 3.6^\circ\text{F}$ ) and  $50 \pm 5\%$  relative humidity for not less than