



Designation: D3499 – 11

Standard Test Method for Toughness of Wood-Based Structural Panels¹

This standard is issued under the fixed designation D3499; 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 for toughness of wood-based structural panels covers the determination of energy necessary to cause failure by impact loading of a beam specimen which is simply supported and loaded at midspan. Wood-based structural panels in use include plywood, waferboard, oriented strand board, and composites of veneer and of wood-based layers.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D143 Test Methods for Small Clear Specimens of Timber

D2395 Test Methods for Specific Gravity of Wood and Wood-Based Materials

D4442 Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials

3. Significance and Use

3.1 The failure of wood-based materials with impact loads is sometimes an important criteria in design considerations. In addition, some effects on the mechanical properties of wood, such as decay, are best evaluated by measuring its toughness. This test method serves to evaluate the toughness of structural panel products while Methods D143 can be used to measure the toughness of solid clear wood specimens.

¹ This test method is under the jurisdiction of ASTM Committee D07 on Wood and is the direct responsibility of Subcommittee D07.03 on Panel Products.

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² 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.

4. Apparatus

4.1 The toughness testing machine (Note 1) shall consist of a frame supporting a pendulum, being so arranged that a measured amount of the energy from the fall of the pendulum may be applied to a test specimen. The pendulum shall consist of a bar to which is fastened a weight adjustable to different positions and shall carry at its upper end a drum or pulley whose center provides the axis of rotation. The force shall be applied to the specimen by means of a flexible steel cable passing over the drum. A stationary graduated scale or dial and a vernier operated by the moving drum shall be provided for reading the angles through which the pendulum swings. The machine shall be adjusted before test so that the pendulum hangs truly vertical and adjusted to correct for friction. The cable shall be adjusted so that the load is applied to the specimen when the pendulum swings to within approximately 15° of the vertical so as to produce complete failure by the time the downward swing is completed.

NOTE 1—The set-up shown in Fig. 1 has been found to give satisfactory results.

5. Test Specimen

5.1 The toughness test specimen to be used in conjunction with the Forest Products Laboratory toughness testing machine shall be 5/8 in. (16 mm) in width for material less than 5/8 in. (16 mm) in thickness, and the thickness of the specimen shall be equal to that of the material. For material more than 5/8 in. (16 mm) in thickness, the width shall be equal to the thickness of the material, thus making the specimen square in cross section. The length shall be determined from the thickness of the material in accordance with Table 1. The actual cross-sectional dimensions, and the specimen and span length shall be measured to an accuracy of not less than $\pm 0.3\%$ or 0.001 in. (0.02 mm) whichever is larger.

6. Control of Moisture

6.1 Panel specimens to be tested at specific moisture contents or after reaching equilibrium moisture content at specific temperature and relative humidity conditions shall be conditioned to approximate constant weight in controlled atmospheric conditions. For approximating moisture conditions of panels used under dry conditions, a relative humidity of $65 \pm 2\%$ at a temperature of $68 \pm 6^\circ\text{F}$ ($20 \pm 3^\circ\text{C}$) is recommended.