



Designation: ~~D732-02~~ Designation: D732 - 09

Standard Test Method for Shear Strength of Plastics by Punch Tool¹

This standard is issued under the fixed designation D732; 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 covers the punch-type of shear test and is intended for use in determining the shear strength of test specimens of organic plastics in the form of sheets and molded disks in thicknesses from 1.27 to 12.7 mm (0.050 to 0.500 in.).~~

1.1 This test method covers the procedure for determining the shear strength of composite materials in the form of sheets, plates, and molded shapes in thicknesses from 1.27 to 12.7 mm (0.050 to 0.500 in.).

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—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*²

D618 Practice for Conditioning Plastics for Testing

D4000 Classification System for Specifying Plastic Materials

D4066 Classification System for Nylon Injection and Extrusion Materials (PA)

E4 Practices for Force Verification of Testing Machines

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definition:*

3.1.1 *shear strength*—the maximum load required to shear the specimen in such a manner that the moving portion of the load fixture has completely cleared the stationary portion, divided by the sheared area. It is expressed in megapascals (or pounds-force per square inch) based on the area of the sheared edge or edges.

4. Significance and Use

4.1 Shear strength obtained by ~~a tool~~ the use of the punch-type punch-type tooling is one of the recognized methods of comparing materials, or obtaining data for engineering design purposes, or both. However, it must be recognized that for end-use applications there ~~may are likely to~~ be many factors not taken into account in this test method, such as stress-concentrating geometries and rates of shear, which can profoundly affect the measured shear strength. Moreover, the fact that the shear strength is calculated by dividing the load by the area of the sheared edge (punch circumference X specimen thickness) ~~should does not be interpreted interpret~~ as indicating ~~that~~ the shear strength value so obtained is solely a material property, independent of thickness.

4.2 For many materials, ~~there may be~~ it is possible that there is a specification that requires the use of this test method, but with some procedural modifications that take precedence when adhering to the specification. Therefore, it is advisable to refer to that material specification before using this test method. Table 1 of Classification System D4000 lists the ASTM materials standards that currently exist.

¹ This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.10 on Mechanical Properties. Current edition approved April 10, 2002. Published June 2002. Originally published as D732-43T. Last previous edition D732-99. DOI: 10.1520/D0732-02. Current edition approved Oct. 15, 2009. Published November 2009. Originally approved in 1943. Last previous edition approved in 2002 as D732-02. DOI: 10.1520/D0732-09.

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.

*A Summary of Changes section appears at the end of this standard.

5. Apparatus

5.1 *Testing Machine*—Any suitable testing machine of the constant-rate-of-crosshead movement type. The testing machine shall be equipped with the necessary drive mechanism for imparting to the crosshead a uniform, controlled velocity with respect to the base. The testing machine shall also be equipped with a load-indicating mechanism capable of showing the total compressive load carried by the test specimen. This mechanism shall be essentially free from inertia-lag at the specified rate of testing and shall indicate the load with an accuracy of $\pm 1\%$ of the indicated value or better. The accuracy of the testing machine shall be verified in accordance with Practices E4.

5.2 *Shear Tool*—A shear tool of the punch type which is so constructed that the specimen is rigidly clamped both to the stationary block and movable block so that it cannot be deflected during the test. A suitable form of shear tool is shown in Fig. 1.

5.3 *Micrometers*—Suitable micrometers for measuring the thickness of the test specimen to an incremental discrimination of at least 0.025 mm (0.001 in.).

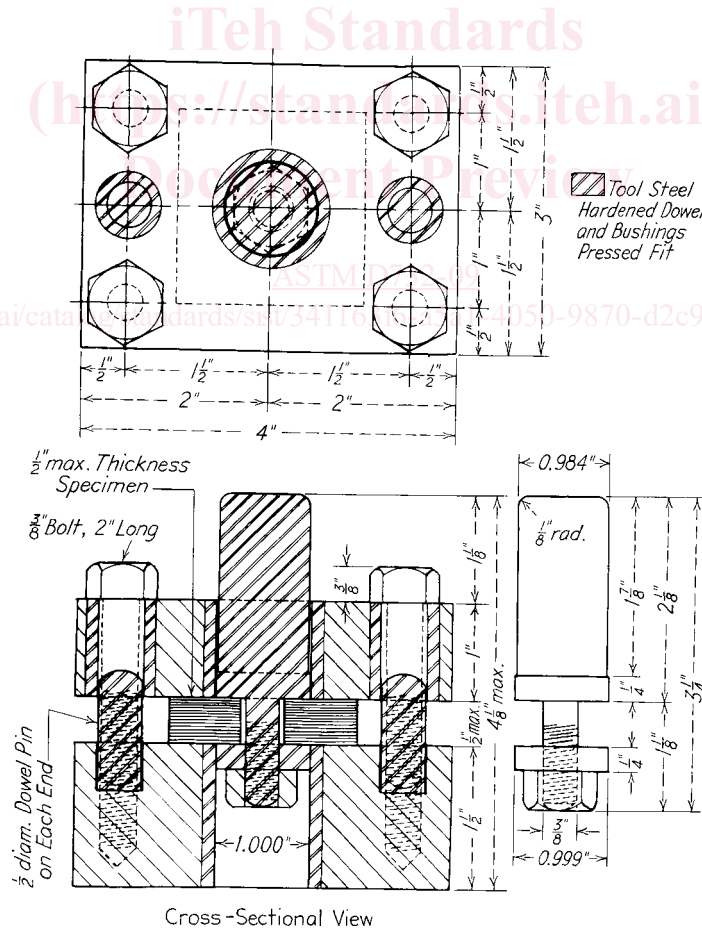
6. Test Specimen

6.1 The specimen shall consist of a 50-mm (2-in.) square or a 50-mm (2-in.) diameter disk cut from sheet material or molded into this form. The thickness of the specimen may be limited from 1.27 to 12.7 mm (0.050 to 0.500 in.). The upper and lower surfaces shall be parallel to each other and reasonably flat. A hole approximately 11 mm ($\frac{7}{16}$ in.) in diameter shall be drilled through the specimen at its center.

6.2 A minimum of five specimens of each sample material shall be tested. If fewer than five specimens are tested, the report shall reflect that results are based on a modified version of the standard.

7. Conditioning

7.1 *Conditioning*—Pre-Test 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 40 h prior to test in accordance with Procedure A of Practice D618 unless otherwise specified by contract



NOTE 1—In case of difficulty in obtaining hardened dowels and bushings, the entire shear tool may be made from a fairly good grade of steel, eliminating all of the bushings shown. The actual working surfaces will wear faster than when hardened tool steel is used. When they show signs of appreciable wear, the shear tool can then be bored out to take either hardened or unhardened bushings, depending upon which are available.

FIG. 1 Punch-Type Shear Tool for Testing Specimens 0.127 to 12.7 mm (0.050 to 0.500 in.) in Thickness