Designation: D732 – 10

Standard Test Method for Shear Strength of Plastics by Punch Tool[1]

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 U.S. Department of Defense.

1. Scope*

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

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 *Definitions:*

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 the use of 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 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) does not interpret as indicating the shear strength value so obtained is solely a material property, independent of thickness.

4.2 For many materials, 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.

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 ±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.).

[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.

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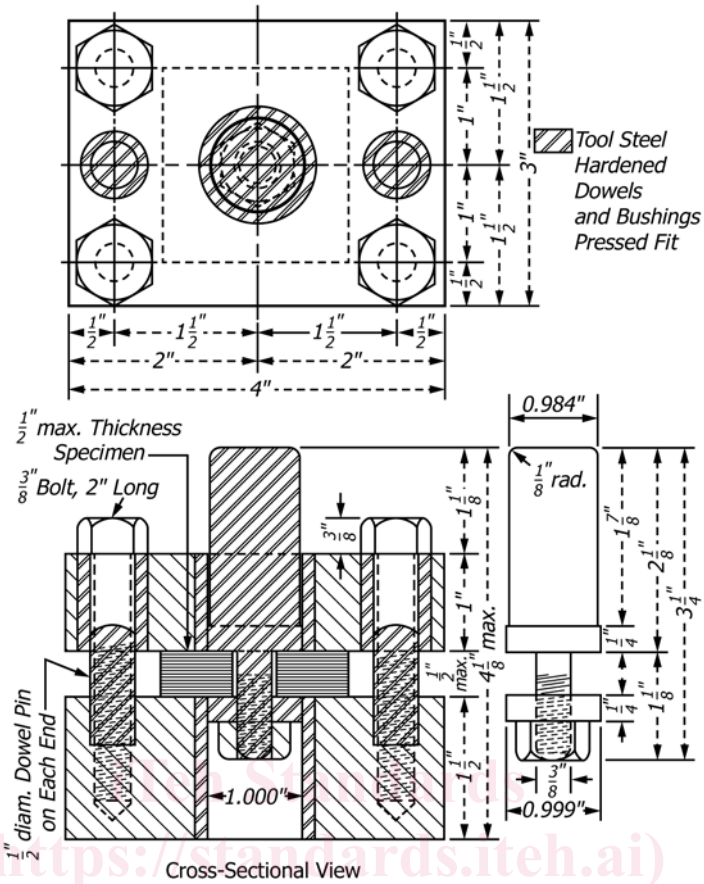
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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



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

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 is limited from 1.27 and 12.7 mm (0.050 and 0.500 in.). The upper and lower surfaces shall be parallel to each other and reasonably flat. A hole approximately 11 mm (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 *Pre-Test Conditioning*—Condition the test specimens in accordance with Procedure A of Practice D618 unless otherwise specified by contract or the relevant ASTM material specification. Conditioning time is specified as a minimum. Temperature and humidity tolerances shall be in accordance with Section 7 of Practice D618 unless specified differently by contract or material specification.

7.2 *Test Conditions*—Conduct the tests at the same temperature and humidity used for conditioning with tolerances in accordance with Section 7 of Practice D618 unless otherwise specified by contract or the relevant ASTM material specification.

8. Procedure

8.1 Measure the thickness of each test specimen to the nearest 0.025 mm (0.001 in.) at a minimum of three points on a circle approximately 12.7 mm (0.500 in.) from its center. Average the readings and record as the specimen thickness.

8.2 Place the specimen over the 9.5-mm (3⁄8-in.) threaded pin of the punch and fasten it in place by securing the washer and nut tightly.

8.3 Center the specimen and punch on the support fixture and complete the assembly of the clamping fixture being sure to tighten the bolts securely.

8.4 Load the test specimen at a crosshead speed of 1.25 mm (0.05 in.)/min. The tolerances shall be 1.3 ± 0.3 mm (0.050 ± 0.010 in.)/min.

8.5 Push the punch far enough through the specimen so that the sheared section clears the specimen proper. The specimen will then be adjacent to the necked-down portion of the punch, and it can then be readily removed from the tool.