



Standard Test Method for Tensile Properties of Plastics¹

This standard is issued under the fixed designation D 638; 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 determination of the tensile properties of unreinforced and reinforced plastics in the form of standard dumbbell-shaped test specimens when tested under defined conditions of pretreatment, temperature, humidity, and testing machine speed.

1.2 This test method can be used for testing materials of any thickness up to 14 mm (0.55 in.). However, for testing specimens in the form of thin sheeting, including film less than 1.0 mm (0.04 in.) in thickness, Test Methods D 882 is the preferred test method. Materials with a thickness greater than 14 mm (0.55 in.) must be reduced by machining.

1.3 This test method includes the option of determining Poisson's ratio at room temperature.

NOTE 1—This test method and ISO 527-1 are technically equivalent.

NOTE 2—This test method is not intended to cover precise physical procedures. It is recognized that the constant rate of crosshead movement type of test leaves much to be desired from a theoretical standpoint, that wide differences may exist between rate of crosshead movement and rate of strain between gage marks on the specimen, and that the testing speeds specified disguise important effects characteristic of materials in the plastic state. Further, it is realized that variations in the thicknesses of test specimens, which are permitted by these procedures, produce variations in the surface-volume ratios of such specimens, and that these variations may influence the test results. Hence, where directly comparable results are desired, all samples should be of equal thickness. Special additional tests should be used where more precise physical data are needed.

NOTE 3—This test method may be used for testing phenolic molded resin or laminated materials. However, where these materials are used as electrical insulation, such materials should be tested in accordance with Test Methods D 229 and Test Method D 651.

NOTE 4—For tensile properties of resin-matrix composites reinforced with oriented continuous or discontinuous high modulus $>20\text{-GPa}$ ($>3.0 \times 10^6\text{-psi}$) fibers, tests shall be made in accordance with Test Method D 3039/D 3039M.

1.4 Test data obtained by this test method are relevant and appropriate for use in engineering design.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *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:

D 229 Test Methods for Rigid Sheet and Plate Materials Used for Electrical Insulation²

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension³

D 618 Practice for Conditioning Plastics for Testing⁴

D 651 Test Method for Tensile Strength of Molded Electrical Insulating Materials⁵

D 882 Test Methods for Tensile Properties of Thin Plastic Sheet⁴

D 883 Terminology Relating to Plastics⁴

D 1822 Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials⁴

D 3039/D 3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials⁶

D 4000 Classification System for Specifying Plastic Materials⁷

D 4066 Specification for Nylon Injection and Extrusion Materials⁷

D 5947 Test Methods for Physical Dimensions of Solid Plastic Specimens⁸

E 4 Practices for Force Verification of Testing Machines⁹

E 83 Practice for Verification and Classification of Extensometers⁹

E 132 Test Method for Poisson's Ratio at Room Temperature⁹

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method¹⁰

2.2 ISO Standard:

² Annual Book of ASTM Standards, Vol 10.01.

³ Annual Book of ASTM Standards, Vol 09.01.

⁴ Annual Book of ASTM Standards, Vol 08.01.

⁵ Discontinued; see 1994 Annual Book of ASTM Standards, Vol 10.01.

⁶ Annual Book of ASTM Standards, Vol 15.03.

⁷ Annual Book of ASTM Standards, Vol 08.02.

⁸ Annual Book of ASTM Standards, Vol 08.03.

⁹ Annual Book of ASTM Standards, Vol 03.01.

¹⁰ Annual Book of ASTM Standards, Vol 14.02.

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D 20.10 on Mechanical Properties.

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

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