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An American National Standard

Standard Test Method for Tensile Properties of Plastics (Metric)¹

This standard is issued under the fixed designation D 638M; 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.

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 10 mm. However, for testing specimens in the form of thin sheeting, including film less than 1.0 mm, Test Methods D 882 is the preferred test method. Materials with a thickness greater than 10 mm 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 527-1966 are technically equivalent.

NOTE 2—This test method is the companion to inch-pound Test Method D 638.

NOTE 3—This test method may be used for testing phenolic resin molded 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—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 5—For tensile properties of resin-matrix composites reinforced with oriented continuous or discontinuous high modulus >20 GPa fibers, tests shall be made in accordance with Test Method D 3039/D 3039M.

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

1.5 *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.*

¹ This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.10 on Mechanical Properties.

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2. Referenced Documents

2.1 ASTM Standards:

- D 229 Test Methods for Rigid Sheet and Plate Materials Used for Electrical Insulation²
 - D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing³
 - D 638 Test Method for Tensile Properties of Plastics³
 - D 651 Test Method for Tensile Strength of Molded Electrical Insulating Materials⁴
 - D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting³
 - D 883 Terminology Relating to Plastics³
 - D 3039/D 3039M Test Method for Tensile Properties of Polymer Matrix Composite Materials⁵
 - D 4000 Classification System for Specifying Plastic Materials⁶
 - D 4066 Specification for Nylon Injection and Extrusion Materials⁶
 - E 4 Practices for Load Verification of Testing Machines⁷
 - E 83 Practice for Verification and Classification of Extensometers⁷
 - E 132 Test Method for Poisson's Ratio at Room Temperature⁷
- #### 2.2 ISO Standard:
- ISO 527-1966 Determination of Tensile Properties⁸

3. Terminology

3.1 **Definitions**—Definitions of terms applying to this test method appear in Terminology D 883 and Annex A1.

4. Significance and Use

4.1 This test method is designed to produce tensile property data for the control and specification of plastic materials. These data are also useful for qualitative characterization purposes and for research and development. For many materials, there may be 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 in Classification D 4000 lists the ASTM materials standards that currently exist.

² Annual Book of ASTM Standards, Vol 10.01.

³ Annual Book of ASTM Standards, Vol 08.01.

⁴ Discontinued—See 1991 Annual Book of ASTM Standards, Vol 10.01.

⁵ Annual Book of ASTM Standards, Vol 15.03.

⁶ Annual Book of ASTM Standards, Vol 08.02.

⁷ Annual Book of ASTM Standards, Vol 03.01.

⁸ Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.