



Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics¹

This standard is issued under the fixed designation D 2990; 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 These test methods cover the determination of tensile and compressive creep and creep-rupture of plastics under specified environmental conditions (see 3.1.3).

1.2 While these test methods outline the use of three-point loading for measurement of creep in flexure, four-point loading (which is used less frequently) can also be used with the equipment and principles as outlined in Test Methods D 790.

1.3 For measurements of creep-rupture, tension is the preferred stress mode because for some ductile plastics rupture does not occur in flexure or compression.

1.4 Test data obtained by these test methods 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 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.* A specific warning statement is given in 6.8.2.

2. Referenced Documents

2.1 ASTM Standards:

D 543 Test Method for Resistance of Plastics to Chemical Reagents²

D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing²

D 621 Test Methods for Deformation of Plastics Under Load²

D 638 Test Method for Tensile Properties of Plastics²

D 695 Test Method for Compressive Properties of Rigid Plastics²

D 790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials²

D 1822 Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials²

D 2236 Test Method for Dynamic Mechanical Properties of Plastics by Means of a Torsional Pendulum³

D 4000 Classification System for Specifying Plastic Materials⁴

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *creep modulus*—the ratio of initial applied stress to creep strain.

3.1.2 *creep strain*—the total strain, at any given time, produced by the applied stress during a creep test.

3.1.2.1 *Discussion*—The term creep, as used in this test method, reflects current plastics engineering usage. In scientific practice, creep is often defined to be the nonelastic portion of strain. However, this definition is not applicable to existing engineering formulas. Plastics have a wide spectrum of retardation times, and elastic portions of strain cannot be separated in practice from nonelastic. Therefore, wherever “strain” is mentioned in these test methods, it refers to the sum of elastic strain plus the additional strain with time.

3.1.3 *deformation*—a change in shape, size or position of a test specimen as a result of compression, deflection, or extension:

3.1.4 *compression*—in a compressive creep test, the decrease in length produced in the gage length of a test specimen.

3.1.5 *deflection*—in a flexural creep test, the change in mid-span position of a test specimen.

3.1.6 *extension*—in a tensile creep test, the increase in length produced in the gage length of a test specimen.

3.1.7 *slenderness ratio*—the ratio of the length of a column of uniform cross section to its least radius of gyration. For specimens of uniform rectangular cross section, the radius of gyration is 0.289 times the smaller cross-sectional dimension. For specimens of uniform circular cross section, the radius of gyration is 0.250 times the diameter.

3.1.8 *stress*—for tensile or compressive creep, the ratio of the applied load to the initial cross-sectional area. For flexural

¹ These test methods are under the jurisdiction of ASTM Committee D-20 on Plastics and are the direct responsibility of Subcommittee D20.10 on Mechanical Properties.

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² *Annual Book of ASTM Standards*, Vol 08.01.

³ Discontinued, see 1984 *Annual Book of ASTM Standards*, Vol 08.02.

⁴ *Annual Book of ASTM Standards*, Vol 08.02.