Designation: D 1621 – 04

Standard Test Method for Compressive Properties Of Rigid Cellular Plastics[1]

This standard is issued under the fixed designation D 1621; 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 describes a procedure for determining the compressive properties of rigid cellular materials, particularly expanded plastics.

1.2 The values stated in SI units are to be regarded as the standard. The values in brackets 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—This test method and ISO 844 are technically equivalent.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 618 Practice for Conditioning Plastics for Testing

E 4 Practices for Force Verification of Testing Machines

E 83 Practice for Verification and Classification of Extensometer Systems

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

2.2 *ISO Standard:*

ISO 844 Cellular Plastics—Compression Test of Rigid Materials[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *compliance*—the displacement difference between test machine drive system displacement values and actual specimen displacement.

3.1.2 *compliance correction*—an analytical method of modifying test instrument displacement values to eliminate the amount of that measurement attributed to test instrument compliance.

3.1.3 *compressive deformation*—the decrease in length produced in the gage length of the test specimen by a compressive load expressed in units of length.

3.1.4 *compressive strain*—the dimensionless ratio of compressive deformation to the gage length of the test specimen or the change in length per unit of original length along the longitudinal axis.

3.1.5 *compressive strength*—the stress at the yield point if a yield point occurs before 10 % deformation (as in Fig. 1a) or, in the absence of such a yield point, the stress at 10 % deformation (as in Fig. 1b).

3.1.6 *compressive stress (nominal)*—the compressive load per unit area of minimum original cross section within the gage boundaries, carried by the test specimen at any given moment, expressed in force per unit area.

3.1.7 *compressive stress-strain diagram*—a diagram in which values of compressive stress are plotted as ordinates against corresponding values of compressive strain as abscissas.

3.1.8 *compressive yield point*—the first point on the stress-strain diagram at which an increase in strain occurs without an increase in stress.

3.1.9 *deflectometer*—a specialized extensometer used for sensing of extension or motion, usually without reference to a specified gage length.

3.1.10 *displacement*—compression platen movement after the platens contact the specimen, expressed in millimetres or inches.

3.1.11 *gage length*—the initial measured thickness of the test specimen expressed in units of length.

3.1.12 *modulus of elasticity*—the ratio of stress (nominal) to corresponding strain below the proportional limit of a material expressed in force per unit area based on the minimum initial cross-sectional area.

[1] This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.22 on Cellular Plastics.

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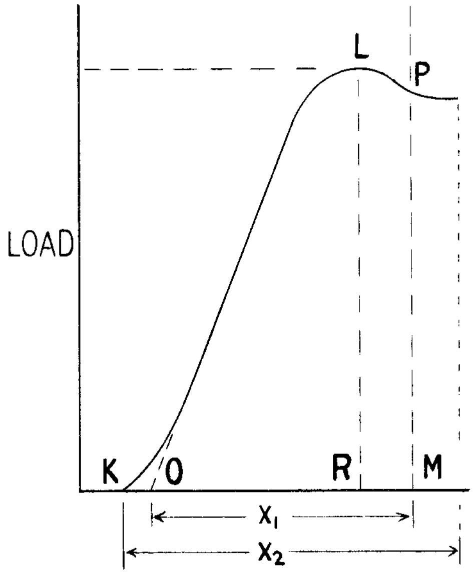
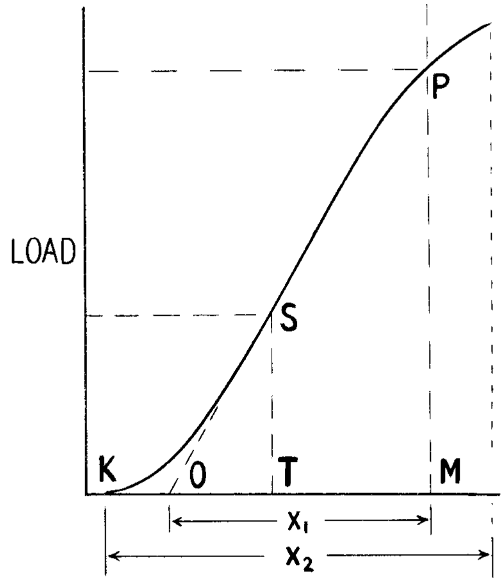
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

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





X_1 = 10 % CORE DEFORMATION
X_2 = DEFLECTION (APPROXIMATELY 13 %)

FIG. 1 a Compressive Strength (See 3.1.5 and Section 9)

FIG. 1 b Compressive Strength (See 3.1.5 and Section 9)

3.1.13 *proportional limit*—the greatest stress that a material is capable of sustaining without any deviation from proportionality of stress-to-strain (Hooke's law) expressed in force per unit area.

4. Significance and Use

4.1 This test method provides information regarding the behavior of cellular materials under compressive loads. Test data is obtained, and from a complete load-deformation curve it is possible to compute the compressive stress at any load (such as compressive stress at proportional-limit load or compressive strength at maximum load) and to compute the effective modulus of elasticity.

4.2 Compression tests provide a standard method of obtaining data for research and development, quality control, acceptance or rejection under specifications, and special purposes. The tests cannot be considered significant for engineering design in applications differing widely from the load - time scale of the standard test. Such applications require additional tests such as impact, creep, and fatigue.

4.3 Before proceeding with this test method, reference shall be made to the specification of the material being tested. Any test specimen preparation, conditioning, dimensions, or testing parameters, or a combination thereof, covered in the materials specification shall take precedence over those mentioned in this test method. If there are no material specifications, then the default conditions apply.

5. Apparatus

5.1 *Testing Machine*—A testing instrument that includes both a stationary and movable member and includes a drive system for imparting to the movable member (crosshead), a uniform, controlled velocity with respect to the stationary member (base). The testing machine shall also include the following:

5.1.1 *Load Measurement System*—A load measurement system capable of accurately recording the compressive load imparted to the test specimen. The system shall be indicate the load with an accuracy of ±1 % of the measured value or better. The accuracy of the load measurement system shall be verified in accordance with Practices E 4.

5.2 *Compression Platens*—Two flat plates, one attached to the stationary base of the testing instrument and the other attached to the moving crosshead to deliver the load to the test specimen. These plates shall be larger than the specimen loading surface to ensure that the specimen loading is uniform. It is recommended that one platen incorporate a spherical seating mechanism to compensate for non-parallelism in the specimen's loading surfaces or non-parallelism in the base and crosshead of the testing instrument.

5.3 *Displacement Measurement System*—A displacement measurement system capable of accurately recording the compressive deformation of the test specimen during testing to an accuracy of ±1 % of the measured value or better. This measurement is made through use of the test machine crosshead drive system or using a direct measurement of compression platen displacement.

5.3.1 *Direct Compression Platen Displacement*—This system shall employ a deflectometer that directly reads the distant between the upper and lower compression platens. The accuracy of the displacement measurement transducer shall be verified in accordance with Practices E 83 and shall be classified as a Class C or better.

5.3.2 *Test Machine Crosshead Drive System*—This system shall employ the position output from the crosshead drive system as a indicator of compression platen displacement. This method is only appropriate when it is demonstrated that the effects of drive system compliance result in displacement errors of less than 1 % of the measurement or if appropriate