



Designation: D2221 – 01 (Reapproved 2021)

Standard Test Method for Creep Properties of Package Cushioning Materials¹

This standard is issued under the fixed designation D2221; 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 determination of creep properties of package cushioning materials. It is applicable to materials available in bulk, sheet, or molded form used for the cushioning of articles during storage, handling, and shipment.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing

E105 Guide for Probability Sampling of Materials

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

¹ This test method is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.13 on Interior Packaging.

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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.

3.1.1 *creep, n*—the deformation of a material occurring with time and due to an externally applied constant stress. For cushioning materials specifically, it may be defined as the change in thickness of a cushion under static compressive load over a period of time.

3.1.2 *permanent set, n*—the permanent change in thickness of an unloaded cushion as a result of an applied compressive load for any given time interval and any given unloaded recovery time period.

4. Summary of Test Method

4.1 The test apparatus consists of a suitable testing device having a base plate and a guided movable platen which can be loaded with weights. The loaded movable platen is placed on a cushion to simulate static compressive loading of cushioning material in actual packaging. By measuring the change in thickness of the loaded cushion with time, creep properties of the cushioning material can be obtained.

5. Significance and Use

5.1 This test method determines the extent and nature of cushion thickness change under static load. Creep data obtained by this test method are applicable to the cushion under the conditions of the particular test and are not necessarily the same as obtained in a complete pack in actual packaging environments. Data may be affected by magnitude of static load, specimen area, shape, and thickness, by varying ambient conditions of temperature, humidity, by friction in the movable platen guide system, and by actual cushion thickness. Vibration in the vicinity of the test fixtures may also influence data results.

6. Apparatus

6.1 *Movable, Guided Platen*, capable of being weighted to achieve the desired loading along with a base to support the sample throughout the duration of the test. Two such assemblies are shown in Fig. 1 and Fig. 2.

6.2 *Static Load Box Fixture* (Fig. 1), consisting of a movable guided platen and an outer box that shall act as the guide and the base plate for supporting the sample.

6.2.1 *Base Plate (Outer Box)*, may be constructed of $\frac{3}{4}$ in. (19.0 mm) minimum white pine and fabricated to reduce