



Designation: **D4332–14** **D4332 – 22**

## Standard Practice for Conditioning Containers, Packages, or Packaging Components for Testing<sup>1</sup>

This standard is issued under the fixed designation D4332; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

### 1. Scope

1.1 This practice provides for standard and special conditioning and testing atmospheres that may be used to simulate particular field conditions that a container, package, or packaging component may encounter during its life or testing cycle.

1.2 This practice describes procedures for conditioning these containers, packages, or packaging components so that they approach or reach equilibrium with the atmosphere to which they may be exposed. This standard is commonly used for conditioning when conducting transit simulation tests.

1.3 Practice **D685** should be used as the relevant conditioning standard when quantification of box compression strength at standard atmosphere conditions is required.

1.4 *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.*

1.5 *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:<sup>2</sup>

**D685** Practice for Conditioning Paper and Paper Products for Testing

**D996** Terminology of Packaging and Distribution Environments

~~**E41D1968** Terminology Relating to Conditioning Paper and Paper Products (Withdrawn 2019)~~

**E171** Practice for Conditioning and Testing Flexible Barrier Packaging

**E337** Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)

**F2825** Practice for Climatic Stressing of Packaging Systems for Single Parcel Delivery

### 3. Terminology

3.1 Terms and definitions used in this practice may be found in Terminology **D996**, Terminology ~~**E41D1968**~~, or Specification **E171**.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee **D10** on Packaging and is the direct responsibility of Subcommittee **D10.21** on Shipping Containers and Systems - Application of Performance Test Methods.

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<sup>2</sup> 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.

#### 4. Significance and Use

4.1 Many materials from which containers and packages are made, especially cellulosic materials, undergo changes in physical properties as the temperature and the relative humidity (RH) to which they are exposed are varied. Therefore, the package should be placed and kept in a specified atmosphere for a length of time such that subsequent measurements of physical properties will be meaningful and reproducible.

4.2 The conditions described in this practice are either historically accepted standard conditions or special laboratory conditions chosen to represent particular phases of the distribution environment. These special conditions do not necessarily duplicate actual field conditions, but tend to simulate them and have effects on packages and materials which may be related to their field performance.

#### 5. Atmospheric Conditions

5.1 *Preconditioning Atmosphere*—~~20~~20 °C to ~~40~~40 °C (~~68~~68 °F to ~~104~~104 °F) and ~~10~~10 % to 35 % relative humidity.

5.2 *Standard Conditioning Atmosphere*—~~23 ± 1~~23 ± 1 °C (~~73.4 ± 2~~73.4 ± 2 °F) and ~~50~~23 °C ± 1 °C (~~73.4 ± 2~~73.4 ± 2 °F) and ~~50~~50 % ± 2 % relative humidity.

NOTE 1—Average values must fall within these limits. Short-term fluctuations and measurement limitations may cause individual measurements to vary up to ~~±2~~±2 °C (~~±3.6~~±3.6 °F) ± 2 °C (~~±3.6~~±3.6 °F) and ±5 % relative humidity without significant impairment of test precision.

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5.3 *Environmental Conditioning Atmosphere*—The environmental conditions shown in **Table 1** may be selected when appropriate (also see Practice **F2825**). Environmental conditioning atmospheres can be used for testing packages with high moisture sensitivity and for testing packages with limited or no moisture sensitivity.

NOTE 2—In the absence of a specific requirement for a particular atmospheric condition, use the conditioning atmosphere given in 5.2.

NOTE 3—Conditioning at the desert condition (see **Table 1**) at a constant temperature of  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ )  $60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ) may have effects on some materials that do not relate to effects of cyclical field conditions.

5.4 The measurement of temperature and relative humidity of the conditioning atmosphere shall be made as close to the specimen being exposed as is possible. (See Test Method **E337** for a detailed description of methods.) The temperature and relative humidity indicated at the control point, may not be representative of conditions elsewhere in the conditioned space due to local effects or deficiency in air circulation. Tolerances at the controller usually must be smaller than those at the specimen.

## 6. Apparatus

6.1 *Room (or Cabinet)* of such size that sample containers or packages may be individually exposed to circulating air at the temperature and relative humidity chosen.

6.1.1 *Control Apparatus* capable of maintaining the room at the required atmospheric conditions within the tolerance limits.

6.2 *Hygrometer*—The instrument used to indicate the relative humidity should have a minimum resolution of 0.5 % RH and be accurate to  $\pm 2$  % relative humidity. A psychrometer may be used either for direct measurement of relative humidity or for checking the hygrometer (see Test Method **E337**).

6.3 *Thermometer*—Any temperature-measuring device may be used provided it can accurately indicate the temperature to within  $0.1^{\circ}\text{C}$  or  $0.2^{\circ}\text{F}$ . The dry-bulb thermometer of the psychrometer may be used either for direct measurement or for checking the temperature-indicating device. It has a resolution of  $0.1^{\circ}\text{C}$  ( $0.2^{\circ}\text{F}$ ) and an accuracy of  $\pm 1^{\circ}\text{C}$  ( $\pm 2^{\circ}\text{F}$ ). Psychrometer thermometers must be graduated and correct to  $0.1^{\circ}\text{C}$  or closer and carefully matched to each other to give the required accuracy and repeatability in the measurement of relative humidity.

## 7. Procedure

7.1 Obtain containers, packages, or packaging components in quantity in accordance with the standard governing the test to be performed. Fiberboard containers (and containers fabricated from other materials that are affected by changes in humidities greater than 40 %) may require preconditioning (see Method **D685**).

7.2 Containers or packages that are sealed with aqueous adhesives should have all seals made sufficiently prior to preconditioning or conditioning so that the water in the adhesive will not be a factor in preconditioning or conditioning of the package.

7.3 Place the container, package, or packaging component within the conditioning chamber and expose it to the required conditions for an amount of time specified in the particular test procedure. If no time period is specified, a period of at least 72 h, or that time required to reach equilibrium (which may be shorter or longer in duration than 72 h), is recommended. The container, package, or packaging component shall be supported in a manner such that all surfaces have free access to the conditioning

**TABLE 1 Environmental Conditions**

Environmental Condition	Temperature, $^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	Relative Humidity, %
Cryogenic	$-55 \pm 3$ ( $-67 \pm 6$ )	...
Extreme cold	$-30 \pm 2$ ( $-22 \pm 4$ )	...
Frozen food storage	$-18 \pm 2$ ( $0 \pm 4$ )	...
Refrigerated storage	$5 \pm 2$ ( $41 \pm 4$ )	$85 \pm 5$
Temperate high humidity	$20 \pm 2$ ( $68 \pm 4$ )	$90 \pm 5$
Tropical	$40 \pm 2$ ( $104 \pm 4$ )	$90 \pm 5$
Desert	$60 \pm 2$ ( $140 \pm 4$ )	$15 \pm 5$