



Designation: D 4332 – 99

Standard Practice for Conditioning Containers, Packages, or Packaging Components for Testing¹

This standard is issued under the fixed designation D 4332; 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 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 may reach equilibrium with the atmosphere to which they may be exposed.

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.*

2. Referenced Documents

2.1 ASTM Standards:

D 685 Practice for Conditioning Paper and Paper Products for Testing²

D 996 Terminology of Packaging and Distribution Environments²

E 41 Terminology Relating to Conditioning³

E 171 Specification for Standard Atmospheres for Conditioning and Testing Materials²

E 337 Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)⁴

2.2 ISO Standard:

2233 Packaging—Complete, Filled Transport Packages: Conditioning for Testing⁵

3. Terminology

3.1 Terms and definitions used in this practice may be found in Terminology D 996, Terminology E 41, or Specification E 171.

¹ This practice is under the jurisdiction of ASTM Committee D-10 on Packaging and is the direct responsibility of Subcommittee D10.23 on Natural Environment Test Methods.

Current edition approved Oct. 10, 1999. Published December 1999. Originally published as D 4332 – 84. Last previous edition D 4332 – 89 (1994) ^{ϵ 1}.

² *Annual Book of ASTM Standards*, Vol 15.09.

³ *Annual Book of ASTM Standards*, Vol 14.02.

⁴ *Annual Book of ASTM Standards*, Vol 11.03.

⁵ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

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 to 40°C (68 to 104°F) and 10 to 35 % relative humidity.

5.2 *Standard Conditioning Atmosphere*—23 $\pm$ 1°C (73.4 $\pm$ 2°F) and 50 $\pm$ 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 $\pm$ 2°C ($\pm$ 3.6°F) and $\pm$ 5 % relative humidity without significant impairment of test precision.

NOTE 2—The standard conditioning in the United States is different than in many other countries that use the ISO 2233 preferred conditions (G) of 20°C (68°F) and 65 % relative humidity. See Fig. 1.

5.3 *Special Atmospheres*—The special standard atmospheric conditions shown in Table 1 may be selected when appropriate.

NOTE 3—Temperature and humidity tolerances of $\pm$ 1°C ($\pm$ 1.8°F) and $\pm$ 2 % relative humidity are desirable but not always attainable.

NOTE 4—In the absence of a specific requirement for a particular atmospheric condition, use the conditioning atmosphere given in 5.2.

NOTE 5—Conditioning at the desert condition (Table 1) at a constant temperature of 60°C (140°F) may have effects on some materials that do not relate to effects of cyclical field conditions.

5.3.1 Preferred atmospheres approved by ISO, but not required in this practice are shown in Table 2.

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 E 337 for a detailed description of methods.) The temperature and

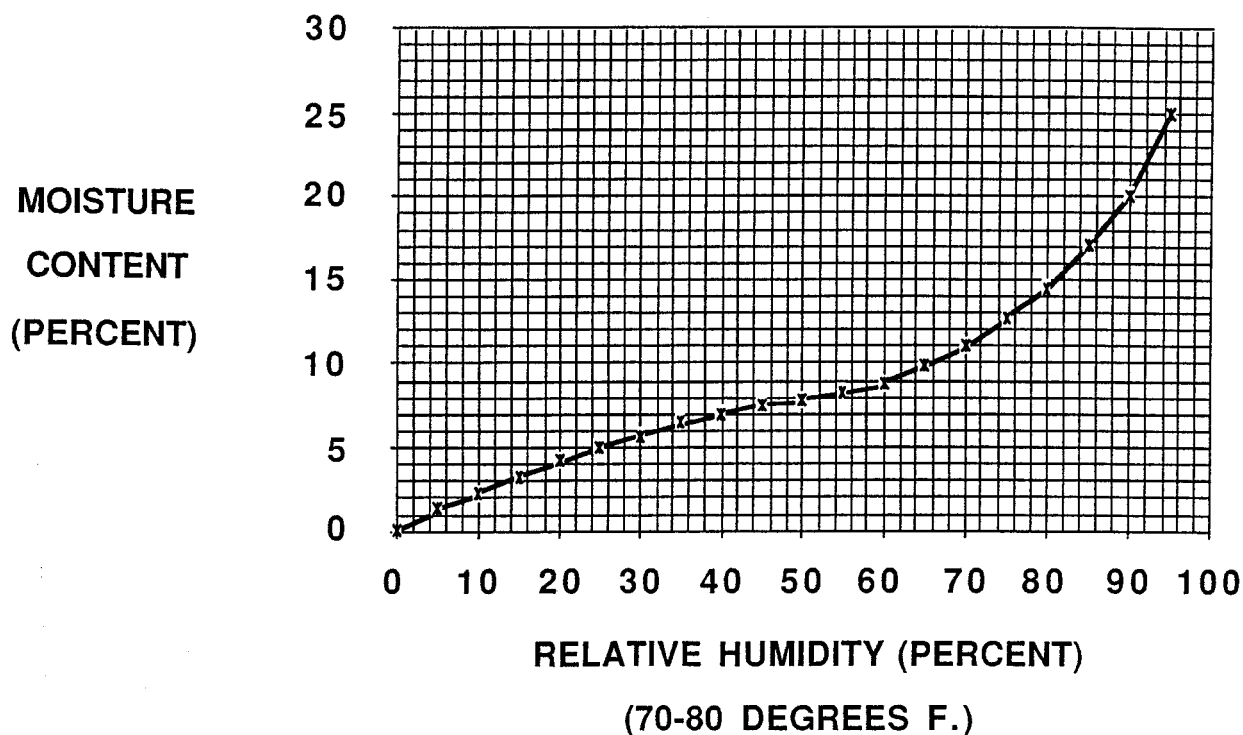


FIG. 1 Moisture Content Versus Relative Humidity (Approximate)

TABLE 1 Special Atmospheres

Environment (ISO 2233 Condition)	Temperature, °C (°F)	Relative Humidity, %
Cryogenic (A)	-55 ± 3 (-67 ± 6)	...
Frozen food storage (C)	-18 ± 2 (0 ± 4)	...
Refrigerated storage (D)	5 ± 2 (41 ± 4)	85 ± 5
Temperate high humidity (F)	20 ± 2 (68 ± 4)	90 ± 5
Tropical (L)	40 ± 2 (104 ± 4)	90 ± 5
Desert	60 ± 2 (140 ± 4)	15 ± 2

TABLE 2 Preferred Atmospheres Listed in ISO 2233

Condition	Temperature, °C (°F)	Relative Humidity, %
B	-35 ± 3 (-49 ± 6)	not specified
E	20 ± 2 (68 ± 4)	65
H	27 ± 2 (81 ± 4)	65
J	30 ± 2 (86 ± 4)	90
K	40 ± 3 (104 ± 6)	uncontrolled
M	55 ± 2 (131 ± 4)	30

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 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 E 337).

6.3 *Thermometer*—Any temperature-measuring device may be used provided it can accurately indicate the temperature to within 0.1°C or 0.2°F . The dry-bulb thermometer of the psychrometer may be used either for direct measurement or for checking the temperature-indicating device.

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 D 685).

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 required to reach equilibrium is recommended. The container, package, or packaging component shall be supported in a manner such that all surfaces have free access to the conditioning atmosphere. Heavier packages may be placed on a pallet or other device that should allow for as much exposure of the surface bottom to the conditioning atmosphere as is possible, so long as the device does not cause a permanent change in the box or affect the final test result.