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Standard Practice for Climatic Stressing of Packaging Systems for Single Parcel Delivery[1]

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1. Scope

1.1 This practice provides a uniform basis for evaluating, in a laboratory, the ability of a packaging system to withstand a range of climatic stresses that a packaging system may be exposed to during distribution throughout the world and still provide the product protection from damage or alteration.

1.2 This practice is designed as conditioning prior to testing for overnight or two-day delivery systems of a single parcel packaging system or as a standalone test for climatic stressing of packaging systems.

1.3 This practice does not cover refrigerated, frozen food storage, or cryogenic storage conditions. Only the climatic environments encountered in various regions of the world are covered by this practice.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D996 Terminology of Packaging and Distribution Environments

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

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

F17 Terminology Relating to Flexible Barrier Packaging

2.2 *ISO Standard:*[3]

ISO 2233 Packaging—Complete, Filled Transport Packages: Conditioning for Testing

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions used in this practice, see Terminologies D996 and F17.

3.1.2 *climatic stressing*—exposing packaging system test samples to conditions of temperature and humidity for a specified period of time which would simulate expected conditions seen in the defined storage and distribution system.

4. Summary of Practice

4.1 Products shipped through the distribution environment, regardless of mode of transportation, encounter various climatic and physical environments as they pass through different parts of the world at various times of the year. This practice is designed to provide guidance when establishing the climatic stresses imparted to packaging systems using expected climatic conditions and durations that they can encounter in distribution in order to evaluate its ability to provide protection to the package contents or devices.

5. Significance and Use

5.1 This practice provides a method for conditioning packaging systems using climatic conditions that occur in actual distribution. The recommended exposure levels are based on available information on shipping, handling and storage environments, current industry practices, and published studies. They are not absolute extremes, but recorded daily averages in cold and hot climates of the world.

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.

[1] This practice is under the jurisdiction of ASTM Committee F02 on Flexible Barrier Packaging and is the direct responsibility of Subcommittee F02.50 on Package Design and Development.

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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, http://www.ansi.org.

TABLE 1 Climatic Conditions

NOTE 1—The time between each condition should be documented in the test plan. It can be determined by the user. It may be as little as no time between conditions (worst case) or up to several hours depending on factors as distribution environment data, test facility capacities and test schedules. If the anticipated time between exposures will exceed one hour, a controlled storage condition such as 23 ± 5°C and 50 ± 10 % relative humidity (RH) should be considered.

Condition	Description	Temperature	Relative Humidity	Exposure Time
1	Cold	–20 ± 3°C	not specified	4 h +30 min/–0†
2	Controlled Room Conditions	23 ± 5°C	50 ± 10 %	See Note above
3	Hot/Dry	50 ± 3°C	25 ± 5 %	4 h +30 min/–0†
4	Controlled Room Conditions	23 ± 5°C	50 ± 10 %	See Note above
5	Warm/Humid	30 ± 3°C	90 ± 5 %	4 h +30 min/–0†
6	Controlled Room Conditions	23 ± 5°C	50 ± 10 %	See Note above

†Editorially corrected.

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 ±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°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 *Define Packaging System*—Describe the packaging system in terms of size, weight, and materials of construction and establish the unit of test (shipping box, multipack, pallet load, and so forth).

7.2 Identify the various modes and durations of transportation that will be used to store and distribute the products to customers. For example, the product will be delivered to its destination via truck and air over a two-day transit period.

7.3 When used as a standalone test, predetermine the acceptance criteria.

7.4 Write a test plan using the sequence, conditions and exposure times cited in Table 1. If data is available for the user's distribution environment indicating different conditions and exposure times, they should be used.

NOTE 1—Exposing packaging system materials to warm/humid climatic stresses first may cause the materials to absorb moisture that may remain with the materials throughout the remaining exposures.

7.5 Conditions and exposure times may be based on known storage and distribution systems and conditions.

7.6 *Test Specimen:*

7.6.1 Test specimens should consist of representative packaging systems, including actual contents or devices. Contents with blemishes or minor defects may be used if the defective component is not to be studied and if the defect is documented in the report. Simulated contents are also acceptable as long as they duplicate the load characteristics of the actual contents.

7.6.2 Care must be taken to ensure that no degradation has occurred to both the packaging system and the contents prior to initiating the climatic stress exposure. This is particularly important in situations where the samples are shipped to a remote test site.

7.7 Perform climatic conditioning per the plan.

7.8 Continue with the packaging system performance test or evaluate the results of the conditioning against any predetermined acceptance criteria when performing a standalone test.

8. Climatic Conditions

8.1 The conditions listed in Table 1 are based on industry experience, global climate, time products spend in distribution systems and guidance from Practice D4332 and ISO 2233.

9. Report

9.1 The report shall include the following:

9.1.1 Temperature, relative humidity, and time of exposure.

9.1.1.1 Preconditioning atmosphere and time of exposure when used.

9.1.2 Statement of compliance with this procedure.

9.1.3 Variations from this procedure, including the testing temperature and relative humidity, if different from the conditioning atmosphere, the time elapsed, and so forth.

9.1.4 When used as a standalone test, whether the acceptance criteria have been met and the nature of noncompliance.

10. Precision and Bias

10.1 A statement of precision and bias is not applicable to this practice.

11. Keywords

11.1 desert; distribution environment; freeze; handling; packaging systems; shipping; storage conditions; transit; tropical

BIBLIOGRAPHY

(1) Ritter, S., "How Hot? How Wet? How High?",Valley Labs, Boulder CO, ISTA Con 2001 Conference.

(2) Kipp , B. and Russell, P., "European Express Shipping/Drop/Impact Study", International Safe Transit Association Dimensions 06 Conference.

(3) Cowland, R., "Global Thermal Profile Development", International Safe Transit Association Dimensions 07 Conference.

(4) "Climates of the World," published by the US Department of Commerce and National Oceanic and Atmospheric Administration (NOAA).