



Designation: D 1776 – 04

## Standard Practice for Conditioning and Testing Textiles<sup>1</sup>

This standard is issued under the fixed designation D 1776; 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 approval. A superscript epsilon ( $\epsilon$ ) 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 practice covers the conditioning and testing of textiles in those instances where such conditioning is specified in a test method. Because prior exposure of textiles to high or low humidity may affect the equilibrium moisture pick-up, a procedure also is given for preconditioning the material when specified.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as the standard. Within the text, the inch-pound units are shown in parentheses. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

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:<sup>2</sup>

- D 123 Terminology Relating to Textiles
- D 578 Specification for Glass Fiber Strands
- D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing
- D 885 Test Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns and Cords Made from Man-Made Organic-Base Fibers
- D 1776 Practice for Conditioning Textiles for Testing
- D 4920 Terminology Relating to Moisture in Textiles
- E 337 Test Method for Measuring Humidity With a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperature)

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D13.51 on Conditioning and, Chemical and Thermal Properties.

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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.

#### 2.2 ISO Standard:

ISO 139 Textiles Standard Atmosphere for Conditioning and Testing<sup>3</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *moisture content, n*—that part of the total mass of a material that is absorbed or adsorbed water, expressed as a percentage of the total mass.

3.1.1.1 *Discussion*—The total mass is the original mass comprising the dry substance plus any water present. The word *water* as used in these definitions refers to the compound chemically defined as H<sub>2</sub>O. The terms *water* and *moisture* frequently are used interchangeably in the literature and the trade, but the term *moisture* is sometimes considered to include other volatile material.

3.1.2 *moisture equilibrium, n*—the condition reached by a material when it no longer takes up moisture from, or gives up moisture to, the surrounding atmosphere.

3.1.2.1 *Discussion*—Superficial equilibrium with the film of air in contact with the textile material is reached very rapidly. Moisture equilibrium can be reached in a reasonable time only if the air to which the sample is exposed is in motion. Moisture equilibrium with the air in motion is considered to be realized when successive weighings do not show a progressive change in mass greater than the tolerance established for various textile materials.

3.1.3 *moisture equilibrium, for preconditioning, n*—the moisture condition reached by a sample or specimen after exposure to moving air in the standard atmosphere for preconditioning.

3.1.4 *moisture equilibrium, for testing, n*—the condition reached by a sample or specimen during free exposure to moving air controlled at specified conditions.

3.1.4.1 *Discussion*—For test purposes, moisture equilibrium must be reached by adsorption, starting from a relatively moisture content. Moisture equilibrium for testing is considered as having been reached when the rate of increase in mass of a sample or specimen does not exceed that specified for the material being tested.

<sup>3</sup> Available from American National Standards Institute, 11 W. 42nd Street, 13th Floor, New York, NY 10036.

3.1.5 *precondition, v*—to bring a sample or specimen of a textile to a relatively low moisture content (approximate equilibrium an atmosphere between 5 and 25% relative humidity) prior to conditioning in a controlled atmosphere for testing.

3.1.6 *standard atmosphere for preconditioning textiles, n*—a set of controlled conditions having a temperature not over 50°C (122°F), with respective tolerances of ±1°C (±2°F), and a relative humidity of 5-25% ± 2 % for the selected humidity that drying can be achieved prior to conditioning in the standard atmosphere for testing textiles.

3.1.7 *standard atmosphere for testing textiles, n*—laboratory conditions for testing fibers, yarns, and fabrics in which air temperature and relative humidity are maintained at specific levels with established tolerances. See **Table 1**.

3.1.7.1 *Discussion*—Textile materials are used in a number of specific end use application that frequently require different testing temperatures and relative humidities. Specific conditioning and testing of textiles for end product requirements can be carried out using **Table 1** in Practice **D 1776**.

#### 4. Summary of Practice

4.1 Samples or specimens requiring preconditioning are brought to a relatively low moisture content in a specified atmosphere. Samples or specimens requiring conditioning are brought to moisture equilibrium for testing in the standard atmosphere for testing textiles, or when required, as shown in **Table 1**.

#### 5. Significance and Use

5.1 The conditioning prescribed in this practice is designed to obtain reproducible results on textiles and textile products. Results of tests obtained on these materials under uncontrolled atmosphere conditions may not be comparable with each other. In general, many of the physical properties of textiles and textile products are influenced by relative humidity and temperature in a manner that affects the results of the tests. To make reliable comparisons among different textile materials and products, and among different laboratories, it is necessary to standardize the humidity and temperature conditions to which the textile material or product is subjected prior to, and during, testing.

#### 6. Apparatus

6.1 *Conditioning Room or Chamber, consisting of:*

6.1.1 Equipment for maintaining the standard atmosphere for testing textiles throughout the room or chamber within the

tolerances given in **Table 1** and including facilities for circulating air over all surfaces of the exposed sample or specimen and

6.1.2 Equipment for recording the temperature and relative humidity of the air in the conditioning room or chamber.

6.2 *Psychrometer, Ventilated by Aspiration*, or a similar measuring device, which is accurate to ±1°C (±2°F), for checking the recorded relative humidity, as directed in Test Method **E 337**.

6.3 *Preconditioning Cabinet, Room, or Suitable Container*, equipped with apparatus for maintaining the standard atmosphere for preconditioning throughout the cabinet, room, or other container within the tolerance given in 3.1.6.

6.4 *Balance*, having a sensitivity of one part in 1000 of the mass of the specimen.

6.5 *Multiple Shelf Conditioning Rack*,<sup>4,5</sup> for spreading out samples and specimens.

#### 7. Preparation of Test Apparatus and Calibration

7.1 Set-up procedures for the preconditioning and conditioning room or chamber from different manufacturers may vary. Prepare and verify calibration of the temperature and relative humidity recording devices as directed in the manufacturer's instructions.

7.2 Verify calibration of the temperature and relative humidity recording devices in the testing room as directed in the equipment manufacturer's instructions.

7.2.1 The temperature and relative humidity indicated on the control point or on a recorder located away from the specimen may not be representative of a localized condition at the specimen because of local effects or deficiency in circulation of air that may take place in an enclosure or room. Tolerances at a controller usually must be smaller than those required at the specimen.

<sup>4</sup> Drawings of the passive conditioning rack may be obtained from the American Association of Chemists and Colorists, P. O. Box 12215, Research Triangle Park, NC 27709-2215.

<sup>5</sup> A suitable rapid conditioning system may be constructed in the laboratory. See "Earnest, D. W., 1996, *Advancements in USDA Cotton Classing Facilities, Proceedings 1996*, Beltwide Cotton Conferences, pp. 1651–1654," and "Knowiton, J. I., and Alldredge, R. K., 1994, *A New Method for Accelerating Cotton Sample Conditioning in Cotton Classing Offices, Proceedings 1994*, Beltwide Cotton Conferences, pp. 582–584." Suitable self-contained rapid conditioning units are available from at least two commercial sources.

**TABLE 1 Standard Atmospheres for Testing Various Materials**

Material	Temperature	Relative Humidity %	ASTM Standard
Textiles, general, other than nonwoven, tire cords and glass fiber	21 ± 1°C (70 ± 2°F)	65 ± 2	D 1776
Nonwovens (includes paper)	23 ± 1°C (73.4 ± 1.8°F)	50 ± 2	D 1776
Plastics and electrical insulating materials	23 ± 2°C (73.4 ± 3.6°F)	50 ± 5	D 618
Glass fiber products:			
Plastic applications	23 ± 2°C (73.4 ± 3.6°F)	50 ± 5	D 618
Textile applications	21 ± 1°C (70 ± 2°C)	65 ± 5	D 1776
Tire cords:			
Rayon	24 ± 2°C (75 ± 3.6°F)	55 ± 2	D 885
Polyester, Aramid, Nylon	24 ± 2°C (75 ± 3.6°F)	55 ± 5	D 885