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Water Vapor Transmission of Textiles

Developed in 2015 by AATCC Committee RA63; editorially revised 2016, reaffirmed and editorially revised 2017.

Foreword

This test method is similar in concept to other "upright cup" methods; however, it was developed specifically to evaluate comfort of vapor permeable textiles used in outdoor products. The temperature differential between the heated bath and the ambient air creates a driving force to promote water vapor transmission. This driving force is likely greater than in actual use, but it serves as an effective condition to differentiate materials by their water vapor transmission performance. Measuring water vapor transmission through test fabric as a percentage of transmission through control paper improves precision of the results, even with small fluctuations in test time or temperature. The control paper can also serve as a verification tool to ensure consistent results.

1. Purpose and Scope

1.1 This test method is used to determine the relative rate of water vapor transmission of textiles.

2. Principle

2.1 Test and control specimens are attached to water-filled canning jars where the fabric replaces the flat lid. The jars are weighed and suspended in a water bath at 54°C (129°F) for 24 h. The amount of water vapor that passes through the specimens is determined by re-weighing each jar at the end of the 24 h test and subtracting from the original weights. Vapor transmission through test specimens is reported as a percentage of the average loss through control specimens. Vapor transmission may also be reported in units of g/m^2/24 h.

3. Terminology

3.1 **control paper,** n.—a standard filter paper able to transmit a consistent volume of water vapor under controlled conditions.

3.2 **moisture management,** n.—*for liquid moisture management testing*, the engineered or inherent transport of aqueous liquids such as perspiration or water (relates to comfort) and includes both liquid and vapor forms of water.

3.3 **water vapor transmission rate,** n.—the steady water vapor flow in unit time through unit area of a body, normal to specific parallel surfaces, under specific conditions of temperature and humidity at each surface. [ASTM C168 (see 14.1)].

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations.All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices (GLP) should be followed. Wear safety glasses in all laboratory area.

5. Uses and Limitations

5.1 This test method may not be applicable to materials that depend on direct contact with water for vapor transmission.

6. Apparatus

6.1 Water bath with a thermostat that can be set to maintain a water bath temperature of 54 ± 2°C (129 ± 5°F) (see 15.1).

6.2 A 11 or 12 gauge stainless steel plate with a minimum of seven 88.3 mm (3.5-in.) diam holes. The plate must be stiff enough to suspend jars slightly above the bottom of the bath. The plate will also cover the water bath to minimize evaporation.

6.3 Wide-mouth pint (nominal 16 oz) canning jars, or other glass jars with nominal 83 mm (3.25 in) diam opening and 121 mm (4.75 in.) inside depth, to fill all holes in the stainless steel plate.

6.4 Canning jar bands, or other means of securing specimens over jar mouths.

6.5 Balance, accurate to ± 0.1 g (± 0.001 oz).

6.6 Distilled water.

6.7 Timer.

6.8 Thermometer suitable for measuring water temperature at 54 ± 2°C (129 ± 5°F).

6.9 AATCC vapor transmission control paper (see 15.2), three sheets.

7. Specimens

7.1 All specimens should be cut at least 100 ± 5 mm (4 ± 0.2 in.) away from the selvage. If testing garments, cut specimens at least 100 ± 5 mm (4 ± 0.2 in.) from all seams and stitching.

7.2 Take specimens such that each contains different warp yarns or wales and different fill yarns or courses.

7.3 Cut four specimens approximately 108 mm (4.5 in.) in diam. Specimens should be large enough to cover the jar opening and be secured by the band, but exact size and shape are not critical to the test.

7.4 Control specimens are pre-cut filter paper (see 6.9).

8. Conditioning

8.1 Prior to testing, precondition and condition all specimens and control papers as directed in ASTM D1776, Conditioning Textile for Testing (see 15.3). Condition each specimen for at least 4 h in an atmosphere of 21 ± 2°C (70 ± 4°F) and 65 ± 5% RH by laying each specimen separately on a screen or perforated shelf of a conditioning rack. Use the standard textile conditions for the control paper as well as textile specimens

8.2 Perform all tests in the standard atmosphere for textile testing, 21 ± 2°C (70 ± 4°F) and 65 ± 5% RH.

8.3 Tests should be performed in still air, with a maximum air flow of 0.1 m/s (0.33 ft/s). Greater air flow will result in higher values for vapor transmission.

9. Preparation of Apparatus and Specimens

9.1 Clean and dry the canning jars.

9.2 Number each jar. The number must remain legible after wetting.

9.3 Fill the water bath approximately three quarters full with distilled water. Cover with the metal plate.

9.4 Heat and maintain the water bath at 54 ± 2°C (129 ± 5°F).

9.5 Place the first jar on the balance and tare. Add 390 ± 1 g (13.76 ± 0.04 oz) distilled water to the tared jar.

9.6 Repeat for a total of seven jars (three control, four test).

9.6.1 If multiple samples are being tested simultaneously, only one set of control jars is required.

9.7 Place one control specimen, face up, over the opening of jar number "1" and secure with a band.

9.8 Repeat for jars numbered "2" and "3."

9.9 Place test specimens from a sample over the openings of jars numbered "4" through "7," face side up, and secure with jar bands (see Fig. 1).

9.9.1 If multiple samples are being tested simultaneously, secure specimens from the second sample on jars numbered "8" through "11." Continue to secure all specimens, keeping specimens from each

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