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Test Method for Water Resistance: Hydrostatic Pressure Using a Restraint

Developed in 2017 by AATCC Committee RA63; reaffirmed and editorially revised 2019. Related to ISO 811.

1. Purpose and Scope

1.1 This test method measures the resistance of a fabric to the penetration of water under hydrostatic pressure while restrained by an acrylic plate. It is applicable to all types of fabrics, including those treated with a water resistant or water repellent finish.

1.2 Water resistance depends on the repellency of the fibers and yarns, as well as the fabric construction.

1.3 The results obtained by this method may not be the same as the results obtained by the AATCC methods for resistance to rain or water spray. Results may not be the same as those obtained by hydrostatic water resistance testing *without* a restraint.

2. Principle

2.1 One surface of the test specimen is subjected to a hydrostatic pressure, increasing at a constant rate, until three points of leakage appear on its other surface. The water may be applied from above or below the test specimen.

2.2 This test method is the same as AATCC TM127, Test Method for Water Resistance: Hydrostatic Pressure except a restraint is used to prevent deformation of the fabric.

3. Terminology

3.1 **hydrostatic pressure,** n.—the force distributed over an area exerted by water.

3.2 **water resistance,** n.—*of fabric*, the characteristic to resist wetting and penetration by water.

3.3 **water repellency,** n.—*in textiles*, the characteristic of fiber, yarn, or fabric to resist wetting.

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 should be followed. Wear safety glasses in all laboratory areas.

4.2 Manufacturer's safety recommendations should be followed when operating laboratory testing equipment.

5. Apparatus and Materials (see 11.1)

5.1 Hydrostatic Tester.

5.1.1 Option 1, Hydrostatic Pressure Tester (see 11.2).

5.1.2 Option 2, Hydrostatic Head Tester (see 11.3).

5.2 Water, distilled or de-ionized.

5.3 Restraint: 200 × 200 ± 10 mm, made of 6.0 ± 0.5 mm thick clear cast acrylic. Other restraint materials may be used with the agreement of all parties.

5.4 Paper towel: single ply, with no finish, 200 × 200 ± 10 mm, a color that will exhibit a color change when wet.

6. Test Specimens

6.1 A minimum of three fabric specimens should be taken diagonally across the width of the fabric to be representative of the material. Cut specimens at least 200 × 200 mm to allow proper clamping.

6.2 Handle the specimens as little as possible and avoid folding or contaminating the area to be tested.

6.3 Condition the test specimens at 21 ± 2°C (70 ± 4°F) and 65 ± 5% RH for at least 4 h before testing.

6.4 The surface of the fabric to be exposed to water must be specified because different results may be obtained on the face and the back. Identify that surface on a corner of each specimen.

7. Procedure

7.1 Verify the water in contact with the test specimen is regulated at 21 ± 2°C (70 ± 4°F) (see 11.4).

7.2 Dry the clamping surface.

7.3 Position the specimen with the surface to be tested facing the water (see 11.6). Place the paper towel on the side of the fabric not facing the water, then place the restraint so the paper towel is sandwiched between the fabric and restraint.

7.4 Clamp the fabric, paper and restraint assembly in place (see 11.5). Clamp slowly to avoid a sudden increase in pressure that may affect results.

7.5 Operation.

7.5.1 Option 1—Hydrostatic Pressure Tester. Turn on the motor, press the lever to raise the overflow device at the rate of 10 mm/s, and close the air vent as soon as water flows from it.

7.5.2 Option 2—Hydrostatic Head Tester. Select the gradient of 60 mbar/min, press the start button (see 11.6).

7.6 Disregarding water droplets that appear within approximately 3 mm of the specimen clamping ring, record the hydrostatic pressure at the moment water droplets penetrate the fabric in three different places. Droplets will be visible as darkened spots on the paper towel (see 11.7).

8. Calculation

8.1 Calculate the average hydrostatic pressure for each sample.

9. Report

9.1 Results for each specimen and the average for each sample.

9.2 The material and the side tested.

9.3 Water temperature and type.

9.4 Gradient (rate of increasing water pressure).

9.5 Tester option used.

9.6 Any modification to the method.

10. Precision and Bias

10.1 *Precision*.

10.1.1 In 2017, a single-laboratory study was completed with two fabrics (see Table I). Fabric A was a bottom-weight woven twill with a durable water-repellent finish. Fabric D was a 43-g/m^2 nonwoven material constructed of spunbond olefin fiber.

10.1.2 Analysis of the data yielded critical differences shown in Table II. Differences between two averages of (n) specimens, for the appropriate precision parameter, should reach or exceed the table value to be statistically significant at

Table I—Precision Study Results (mm water)

Fabric	*n*	Mean	St Dev
A	7	433.7	14.8
D	8	563.6	57.7

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