

Air Permeability
ASTM D737-96

Standard Test Method for Air Permeability of Textile Fabrics

What This Test is Used For:

This test method covers the measurement of the air permeability--the rate of air flow passing perpendicularly through a known area under a prescribed air pressure differential between the two surfaces of a material--of textile fabrics and is applicable to most fabrics including woven fabrics, air bag fabrics, blankets, napped fabrics, knitted fabrics, layered fabrics, and pile fabrics. The fabrics may be untreated, heavily sized, coated, resin-treated or otherwise treated. It is generally expressed in SI units as $\text{cm}^3/\text{s}/\text{cm}^2$ and in inch-pound units as $\text{ft}^3/\text{min}/\text{ft}^2$.

Air permeability is an important factor in the performance of such textile materials as gas filter, fabrics for air bags, clothing, mosquito netting, parachutes, sails, tentage, and vacuum cleaners. It can also be used to provide an indication of the breathability of weather-resistant and rainproof fabrics.

Construction factors and finishing techniques can have an effect upon air permeability by causing a change in the length of airflow paths through a fabric. Fabrics with different surface textures on either side can have a different air permeability depending upon the direction of air flow.

For a woven fabric, yarn twist is also important. As twist increase, the yarn diameter and the cover factor are decreased. This increases air permeability. Increasing yarn twist may also allow the more circular, high-density yarns to be packed closely together in a tightly woven structure with reduced air permeability

How the Test Works:

A circle of fabric is clamped into the tester and through the use of a vacuum, the air pressure is made different on one side of the fabric. Airflow will occur from the side with higher air pressure, through the fabric, to the side with the lower air pressure. From this rate of air flow, the air permeability of the fabric is determined.

Scientific Testing Requirements:

When using this equipment for scientific purposes, the fabric must be prepared according to ASTM D1776.

Equipment Needed:

Air permeability testing apparatus
Circular test head with a test area of 5.93 square inches (15.07 cm).
Clamping system to secure test specimens
Pressure gage or manometer
Flowmeter
Cutting dies

Procedure:

Sample Preparation

1. When cutting specimens, avoid wrinkles, folds or creases.
2. Avoid getting oil, water, grease, etc. on the specimens when handling.
3. For the purposes of the lab, each student will test one sample. For scientific testing, 10 samples are used.
4. Use the medium cutting die (sized 4.5 inches/114. cm)
5. Use specimens representing a broad distribution across length and width, preferably along the diagonal of the fabric.

Preparation of Test Apparatus

1. Make all tests in the standard atmosphere for testing textiles.
2. Loosen the clamping system by twisting the top ring counter-clockwise.
3. Position the fabric sample between the top and bottom of the column, ensuring that fabric covers the entire opening. The fabric should be placed right side down.

4. Tighten the clamping system completely.
5. Place coated test specimens with the coated side down (toward the low pressure side) to minimize air edge leakage.

Test Procedure

1. Read and record the individual test results in SI units or in inch-pound units rounded to three significant digits.
2. Ensure that the control valves "A" and "C" on the right are completely closed.
3. Check that the manometer (the glass tube of liquid) indicates zero. Adjust if necessary using the black knob on the top right of the machine to raise and lower the level.
4. Using the foot switch, turn on the vacuum pump (does this have to be held down?)
5. Using the black flowtube switch closer to the center on the left side of the machine, select flow tube number 4.
6. Gradually open "Valve C" (on the right side) until the required pressure is shown on the manometer tube.
7. If the flowtube float has not moved close "Valve C."
8. Select Flowtube number 3.
9. Gradually open "Valve C" (on the right side) until the required pressure is shown on the manometer tube.
10. If the flowtube float has not moved close "Valve C."
11. Select flowtube number 2.
12. Gradually open "Valve A" until the required pressure drop is shown on the manometer.
13. If the float in tube 2 does not rise, close "Valve A."
14. Select flowtube number 1.
15. Gradually open "Valve A" until the required pressure drop is shown on the manometer.
16. Once a range has been established for a particular type of material, the correct flowtube can be selected without going through the sequence.

Results / Calculation:

1. Air Permeability, Individual Specimens: use values read directly from the test instrument in SI units and in inch-pound units rounded to three significant digits.
2. Air Permeability, Average: calculate the average air permeability for the entire laboratory sampling unit.

Report:

1. Report that the air permeability was determined in accordance with Test Method D373.
2. Describe the material or product sampled and the method of sampling used.
3. Report the following information for each sample:
 - a. Air Permeability (both individual and average).
 - b. Pressure differential between the fabric surfaces. (Where is this found?)
 - c. Manufacturer (SDL America, Inc) and model (MO21S Air Permeability Tester) of test instrument
 - d. Any modification of this test method or equipment including changing or adding gaskets.