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Textiles — Determination of the permeability of fabrics to air

Textiles — Détermination de la perméabilité à l'air des étoffes

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9237 was prepared by Technical Committee ISO/TC 38, *Textiles*.

Annexes A and B of this International Standard are for information only.

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Textiles — Determination of the permeability of fabrics to air

1 Scope

This International Standard describes a method for measuring the permeability of fabrics to air and is applicable to most types of fabrics, including industrial fabrics for technical purposes, nonwovens and made-up textile articles that are permeable to air.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 48:1994, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD).*

ISO 139:1973, *Textiles — Standard atmospheres for conditioning and testing.*

ISO 10012-1:1992, *Quality assurance requirements for measuring equipment — Part 1: Metrological confirmation system for measuring equipment.*

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 air permeability: Velocity of an air flow passing perpendicularly through a test specimen under specified conditions of test area, pressure drop and time.

4 Principle

The rate of flow of air passing perpendicularly through a given area of fabric is measured at a given pressure difference across the fabric test area over a given time period.

5 Sampling

Select samples either in accordance with the procedure laid down in the material specification for the fabric, or as agreed between the interested parties.

In the absence of specification, follow the example of sampling given in annex B.

6 Atmospheres for conditioning and testing

The atmospheres for preconditioning, conditioning and testing shall be as specified in ISO 139.

7 Apparatus

Metrological confirmation of the test apparatus shall be carried out in accordance with ISO 10012-1.

7.1 Circular specimen holder, with an orifice allowing the test to be carried out on an area of 5 cm^2, 20 cm^2, 50 cm^2 or 100 cm^2.

The tolerance on the test area shall not exceed $\pm$ 0,5 %.

NOTE 1 Adequate support of the test specimen, particularly for large test surfaces, is recommended.

7.2 Means for clamping, to secure the specimen without distortion.

NOTE 2 Care should be taken to prevent leakage of air

around the edges of the test specimen. Alternatively the leakage may be measured separately and subtracted from the test results.

7.3 Guard ring device, to prevent leakage, for optional use in conjunction with the clamping means (7.2), (see A.2.1).

7.4 Pressure gauge or **manometer**, connected to the test head to indicate a pressure drop across the specimen test area of 50 Pa, 100 Pa, 200 Pa or 500 Pa, with an accuracy of at least 2 %.

7.5 Means for drawing a steady flow of air at controlled temperature and humidity through the specimen holder and for adjusting the flowrate to produce a pressure drop across the specimen of between 50 Pa and 500 Pa.

7.6 Flowmeter, volumetric counter or **measuring aperture**, indicating the rate of air flow in cubic decimetres per minute (litres per minute) with an accuracy of at least ± 2 %.

NOTE 3 Flowmeters or volumetric counters measuring the rate of air flow in cubic centimetres per second (or other suitable units) may be used if the required accuracy of at least ± 2 % is maintained.

8 Conditioning of samples and test conditions

Prior to test the samples shall be conditioned and the test performed in the standard atmosphere for testing (see clause 6).

Recommended conditions for the test are:

test surface area: 20 cm^2;

pressure drop: 100 Pa for apparel fabrics;

pressure drop: 200 Pa for industrial fabrics.

In cases where these pressure drops cannot be achieved or are not appropriate, an alternative pressure drop of 50 Pa or 500 Pa may be used and/or an alternative test area of 5 cm^2, 50 cm^2 or 100 cm^2 may be chosen, if agreed between the interested parties.

NOTE 4 For comparison of results it is recommended to perform the test with the same test area and pressure drop.

9 Test procedure

NOTE 5 Advice on checking calibration and conducting the test is given in annex A.

Mount the test specimen in the circular specimen holder (7.1) with sufficient tension to eliminate wrinkles, if any, taking care that the fabric is not distorted in its own plane. Avoid selvedges and areas with creases or folded places. For fabrics for which the air permeability may be different between the two faces of the fabric, specify in the test report [see 11 a) 2)] which face was tested. Clamp specimens coated on one side with the coating towards the lower pressure side to prevent air leakage.

Start the suction fan or other means (7.5) to force the air through the test specimen and adjust the flow of air gradually till a pressure drop, as recommended above, is achieved across the test area of the fabric. Record the air flow (see 7.6) after at least 1 min or until steady conditions are achieved.

NOTE 6 Some devices, e.g. volumetric counters, may need a volume of air flow of about 10 dm^3 to assure the required accuracy.

Repeat the test at different locations on the sample at least 10 times under the same conditions.

10 Calculation and expression of results

10.1 Calculate the arithmetic mean of the individual readings and the coefficient of variation (to the nearest 0,1 %), stating the 95 % confidence interval.

10.2 Calculate the air permeability, R, expressed in millimetres per second, using the equation

$$R = \frac{\bar{q}_V}{A} \times 167$$

where

$\bar{q}_V$ is the arithmetic mean flowrate of air, in cubic decimetres per minute (litres per minute);

A is the area of fabric under test, in square centimetres;

167 is the conversion factor from cubic decimetres (or litres) per minute per square centimetre to millimetres per second.

10.3 For open fabrics and nonwovens, the air permeability R may be expressed in metres per second using the equation

$$R = \frac{\bar{q}_V}{A} \times 0{,}167$$

where $\bar{q}_V$ and A are as defined in 10.2.

10.4 Express the 95 % confidence interval in the units specified in 10.2 or 10.3, rounding the result R to 2 % of the value obtained in 10.2 or 10.3.

11 Test report

The test report shall include the following information:

a) general information:

   1) the number and year of publication of this International Standard, i.e. ISO 9237:1995, and the date of test;

   2) all information necessary for complete identification of the sample tested and, if required, indication of the direction of air flow through the fabric;

   3) test surface area used, in square centimetres;

   4) pressure drop used, in pascals;

   5) number of specimens tested;

   6) the conditioning and testing atmospheres used;

   7) any deviation from the procedure specified.

b) test results:

   1) mean air permeability $\bar{R}$, in millimetres per second or metres per second, as applicable;

   2) coefficient of variation, in percent;

   3) 95 % confidence interval, in millimetres per second or metres per second, as applicable.

Annex A
(informative)

Advice on checking the calibration and conducting the test

A.1 Checking the apparatus and calibration

It is advisable to check the calibration and the proper functioning of the apparatus weekly if in constant use, prior to testing if used infrequently, and after the apparatus has been moved or repaired. The calibration of the apparatus should be checked periodically against a primary reference standard, at intervals of no greater than 12 months.

The calibration of the pressure gauge (7.4) should also be checked periodically.

A calibration check plate with test aperture of known air permeability at given pressure drop should be used for checking the calibration. Ensure the reproducibility of the exact position of the check plate in the circular specimen holder (7.1) to avoid any air leakage.

Means for checking the calibration recommended for specific types of apparatus should be used in accordance with the specification of the apparatus and the required accuracy of the test.

A.2 Conducting the test

A.2.1 Edge leakage may be prevented by means of an annular guard ring (7.3). The pressure drop acrosss the guard ring is measured by a separate pressure gauge or manometer (7.4); the air drawn through the guard ring should not pass through the flowmeter (7.6). The pressure drops across the test and the guard ring surfaces are equalized, so that no air can pass edgewise either to or from the test surfaces.

If the measuring device is not equipped with a guard ring, the rate of edge leakage can be determined by covering the sample with a rubber plate of the same size as the sample. Rubber plates 1 mm to 2 mm thick, having a hardness of 65 IRHD to 70 IRHD when tested in accordance with ISO 48, have been found to be suitable.

A.2.2 Clamps on the fabric surface should be faced with a suitable grade of rubber (see 7.2). Gaskets 2,5 mm thick and having a hardness of 65 IRHD to 70 IRHD when tested in accordance with ISO 48 have been found to be suitable.

A.2.3 Care should be taken when clamping the specimen to ensure that it is not distorted or stretched.

Annex B
(informative)

Suggested sampling procedure

B.1 Preparation of bulk sample (number of pieces from a shipment or lot)

To prepare the bulk sample, take at random from the shipment or lot at least the appropriate number of pieces shown in table B.1. Ensure that no piece that shows signs of damage or dampness incurred during transit is included in the bulk sample.

B.2 Preparation of laboratory samples

From each piece comprising the bulk sample, cut (from a position chosen at random but at least 3 m from an end of the piece) a laboratory sample of length at least 1 m and of full width. Ensure that areas that are creased or that have a visible fault are not included in a laboratory sample.

Table B.1 — Bulk sample

Number of pieces in shipment or lot	Minimum number of pieces in bulk sample
$\leqslant 3$	1
4 to 10	2
11 to 30	3
31 to 75	4
$\geqslant 76$	5

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