
International Standard



5636/2

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Paper and board — Determination of air permeance (medium range) — Part 2 : Schopper method

Papier et carton — Détermination de la perméabilité à l'air (valeur moyenne) — Partie 2 : Méthode Schopper

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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 developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5636/2 was developed by Technical Committee ISO/TC 6, *Paper, board and pulps*, and was circulated to the member bodies in March 1983.

It has been approved by the member bodies of the following countries :

Austria	Hungary	South Africa, Rep. of
Belgium	India	Spain
Brazil	Iran	Sweden
Bulgaria	Italy	Switzerland
Canada	Kenya	Tanzania
China	Korea, Rep. of	Turkey
Czechoslovakia	Netherlands	United Kingdom
Egypt, Arab Rep. of	Norway	USA
Finland	Poland	USSR
Germany, F.R.	Romania	Venezuela

No member body expressed disapproval of the document.

Paper and board — Determination of air permeance (medium range) —

Part 2 : Schopper method

0 Introduction

This International Standard specifies methods of measuring the rate of flow of air through unit area of a sheet of paper or board, under unit pressure difference. The measurements may be made with any apparatus which complies with the specifications given in this International Standard.

ISO 5636/1 specifies basic requirements for the apparatus and general operating procedures. Other parts specify detailed requirements and operating procedures applicable to specific types of apparatus.

1 Scope

This part of ISO 5636 specifies the method of determining the air permeance of paper and board in the medium air permeance range using the Schopper apparatus.

2 Field of application

The method is applicable to papers and boards having air permeances between 1×10^{-2} and $1 \times 10^2 \mu\text{m}/(\text{Pa}\cdot\text{s})$. The method is unsuitable for rough surfaced papers and boards, such as creped and corrugated papers, which cannot be securely clamped to avoid leakage.

3 References

ISO 186, *Paper and board — Sampling for testing*.

ISO 187, *Paper and board — Conditioning of samples*.

ISO 5636/1, *Paper and board — Determination of air permeance (medium range) — Part 1 : General method*.

4 Definition

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

air permeance : The mean flow of air through unit area under unit pressure difference in unit time, under specified conditions.

It is expressed in micrometres per pascal second
[$1 \text{ ml}/(\text{m}^2\cdot\text{Pa}\cdot\text{s}) = 1 \mu\text{m}/(\text{Pa}\cdot\text{s})$].

5 Principle

Clamping a test piece between two airtight circular gaskets of known dimensions, with the absolute air pressure on one side of the test area of the test piece equivalent to atmospheric pressure and the difference in pressure between the two sides of the test piece maintained at a small but substantially constant value during the test. Determination of the flow of air through the test area in a specified time.

6 Apparatus

6.1 Air permeance apparatus.

The apparatus consists of a clamping device which shall ensure a test area of the test piece of $10,0 \pm 0,2 \text{ cm}^2$. One side of the clamping device shall be open to the conditioned atmosphere of the testing laboratory and the other shall be connected to the remainder of the apparatus which shall maintain a small constant pressure difference on the test area and which shall be capable of accurately measuring the displaced volume of air. The clamping device uses special gaskets of low elasticity in order to prevent significant change in the test area of the test piece.

The difference in pressure between the two sides of the test area of the test piece during testing is adjustable so that the following two pressure differences (Δp) can be maintained with the specified accuracy :

$$\Delta p \text{ (I)} = 1,00 \pm 0,01 \text{ kPa}$$

$$\Delta p \text{ (II)} = 2,50 \pm 0,01 \text{ kPa}$$

The measuring accuracy for the volume of air passing through the test area shall be :

$$\pm 1 \text{ ml for volumes less than or equal to } 100 \text{ ml;}$$

$$\pm 5 \text{ ml for volumes greater than } 100 \text{ ml.}$$

The maximum measurable volume of air shall be 1 000 ml.

6.2 Timing device : accurate to 0,1 s.

7 Sampling

Sampling shall be carried out in accordance with ISO 186.

8 Conditioning

Conditioning shall be carried out in accordance with ISO 187.

9 Preparation of test pieces

The part of the test piece which will become the test area shall not be handled during preparation and testing.

Not less than ten test pieces shall be cut and their two surfaces identified, for example top side and wire side. The minimum size of the test piece shall be such that the test piece protrudes noticeably in all directions from the clamping unit and provides the test area specified in clause 6. The test area shall be free from folds, wrinkles, holes, watermarks, or defects normally not inherent in the paper or board.

10 Procedure

10.1 Test atmosphere

Testing shall be carried out under the same atmospheric conditions used to condition the test pieces (see clause 8).

10.2 Checking

Test the apparatus for air leakage as specified in the annex. If excessive leakage is detected, replace any defective tubing or gaskets in the apparatus.

10.3 Determination

Place the apparatus on a level surface free from vibration.

Clamp the test piece in the apparatus and within 30 s adjust the pressure difference to $1,00 \pm 0,01$ kPa. Immediately after this, begin the measurement of the volume of air passing through the test piece. By reference to table 1, select the correct test duration for determining the air permeance. The different test durations are selected in such a way that the reading error for the test result is not greater than 2,5 %. The air permeance of the side to be tested shall be measured using five test pieces. A separate test area shall be used for each measurement. Five test pieces shall be tested from the other side.

Table 1 — Test duration when using a constant pressure difference of $1,00 \pm 0,01$ kPa

Air flow ml/s	Test duration s	Measured volume ml
0,13 to 0,33	300	40 to 100
0,33 to 0,83	120	40 to 100
0,83 to 1,67	60	50 to 100
1,67 to 5,0	120	200 to 600
5,0 to 10,0	60	300 to 600
10,0 to 20,0	30	300 to 600
20,0 to 40,0	15	300 to 600

For papers and boards of higher density, if the air flow is less than the minimum given in table 1, the constant pressure difference may be increased to $2,50 \pm 0,01$ kPa and the test duration given in table 2 shall be used. The air permeance of the side to be tested shall be measured using five test pieces. A separate test area shall be used for each measurement. Five test pieces shall be tested from the other side.

Table 2 — Test duration when using a constant pressure difference of $2,50 \pm 0,01$ kPa

Air flow $\mu\text{l/s}$	Test duration s	Measured volume ml
17 to 33	3 000	50 to 100
33 to 67	1 500	50 to 100
67 to 167	600	40 to 100
greater than 167	240	greater than 40

If boards having a thickness greater than 0,3 mm are to be tested, it may be advisable to seal their edges outside the clamping area in order to prevent the passage of air through the material outside the test area. If this is done, care must be taken not to affect the test area.

11 Expression of results

11.1 Calculation of air permeance (P)

The air permeance (P) of each test piece, in micrometres per pascal second, is given by the formula

- a) if the pressure difference was 1,00 kPa :

$$\frac{V}{t}$$

- b) if the pressure difference was 2,50 kPa :

$$\frac{0,4 V}{t}$$

where, in each case, V/t is the rate of flow of air, expressed in millilitres per second, passing through the test piece.

11.2 Arithmetic mean

Calculate the arithmetic mean of the air permeance, in micrometres per pascal second, to three significant figures.

If there is evidence of a significant difference between the results for each direction of air flow through the test piece, calculate a separate arithmetic mean for each.

11.3 Standard deviation

Calculate the standard deviation or coefficient of variation of the air permeance for all replicate test results to two significant figures.

12 Precision

12.1 Repeatability

A repeatability of 6,4 % was obtained for Schopper air permeance results from a series of tests.

The difference between the two single test results found on identical test material by one operator using the same apparatus within a short time interval will exceed this repeatability on average not more than once in twenty instances in the normal and correct operation of the method.

12.2 Reproducibility

A reproducibility of 18,8 % was obtained for Schopper air permeance results from a series of tests.

The difference between two single and independent results found by two operators working in different laboratories on identical test material will exceed this reproducibility on average not more than once in twenty instances in the normal and correct operation of the method.

13 Test report

The test report shall include the following information :

- a) a reference to this part of ISO 5636;
- b) the date and place of testing;
- c) all the information necessary for the complete identification of the sample;
- d) the type of instrument used;
- e) the temperature and relative humidity during the test;
- f) the number of test pieces tested;
- g) the pressure difference used, in kilopascals;
- h) the test duration, in seconds;
- j) the arithmetic mean or means (see 11.2);
- k) the standard deviation or coefficient of variation (see 11.3);
- m) any deviation from the procedure specified.

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Annex

Checking air leakage

(This annex forms part of the Standard.)

Clamp a thin sheet of smooth, rigid, impermeable metal or plastics material in the apparatus.

When determined by the procedure specified in 10.2, the leakage shall not exceed 1,0 ml in 1 h.

If the air permeance of the samples being tested is high, then a higher leakage rate may be allowable; for example, for samples having an air flow greater than 100 ml during the test duration, a leakage rate of 5 ml or less in 1 h would not significantly affect the results obtained.

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