INTERNATIONAL STANDARD

ISO 2965

Second edition
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Materials used as cigarette papers, filter plug wrap and filter joining paper, including materials having an oriented permeable zone — Determination of air permeability

Matériaux utilisés comme papier à cigarettes, pour le gainage des filtres et comme papier manchette, y compris les matériaux possédant une zone perméable orientée — Détermination de la perméabilité à l'air

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 2965 was prepared by Technical Committee ISO/TC 126, *Tobacco and tobacco products*, Subcommittee SC 1, *Physical and dimensional tests*.

This second edition cancels and replaces the first edition (ISO 2965:1979), which has been technically revised.

Annexes A and B form an integral part of this International Standard. Annexes C to E are for information only.

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Introduction

Measurements of air permeability of materials used as cigarette papers have been made for many years. The methods have required development and change because of the changing nature of the paper products and changes in the magnitude of their air permeability.

This method has been developed with the technical resources of CORESTA (Cooperative Centre for Research Relative to Tobacco).

Materials used as cigarette papers, filter plug wrap and filter joining paper, including materials having an oriented permeable zone — Determination of air permeability

1 Scope

This International Standard specifies a method for the determination of air permeability (AP).

It is applicable to materials used as cigarette papers, filter plug wrap and filter joining paper, including materials having an oriented permeable zone, where the measured permeability is in excess of 10 $cm^3 \cdot (min^{-1} \cdot cm^{-2})$ at 1 kPa.

NOTE — For an estimate of the air permeability of materials outside the scope of this International Standard, see note in 5.1 and note 3 in 7.5.1.

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 3402:1991, *Tobacco and tobacco products — Atmosphere for conditioning and testing.*

ISO 187:1990, *Paper board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples.*

3 Definitions

For the purposes of this International Standard the following definitions apply.

3.1
air permeability (AP)
flow of air ($cm^3 \cdot min^{-1}$) passing through 1 cm^2 surface of the test piece at a measuring pressure of 1,00 kPa

NOTE — The air permeability units are $cm^3 \cdot (min^{-1} \cdot cm^{-2})$ at 1 kPa.

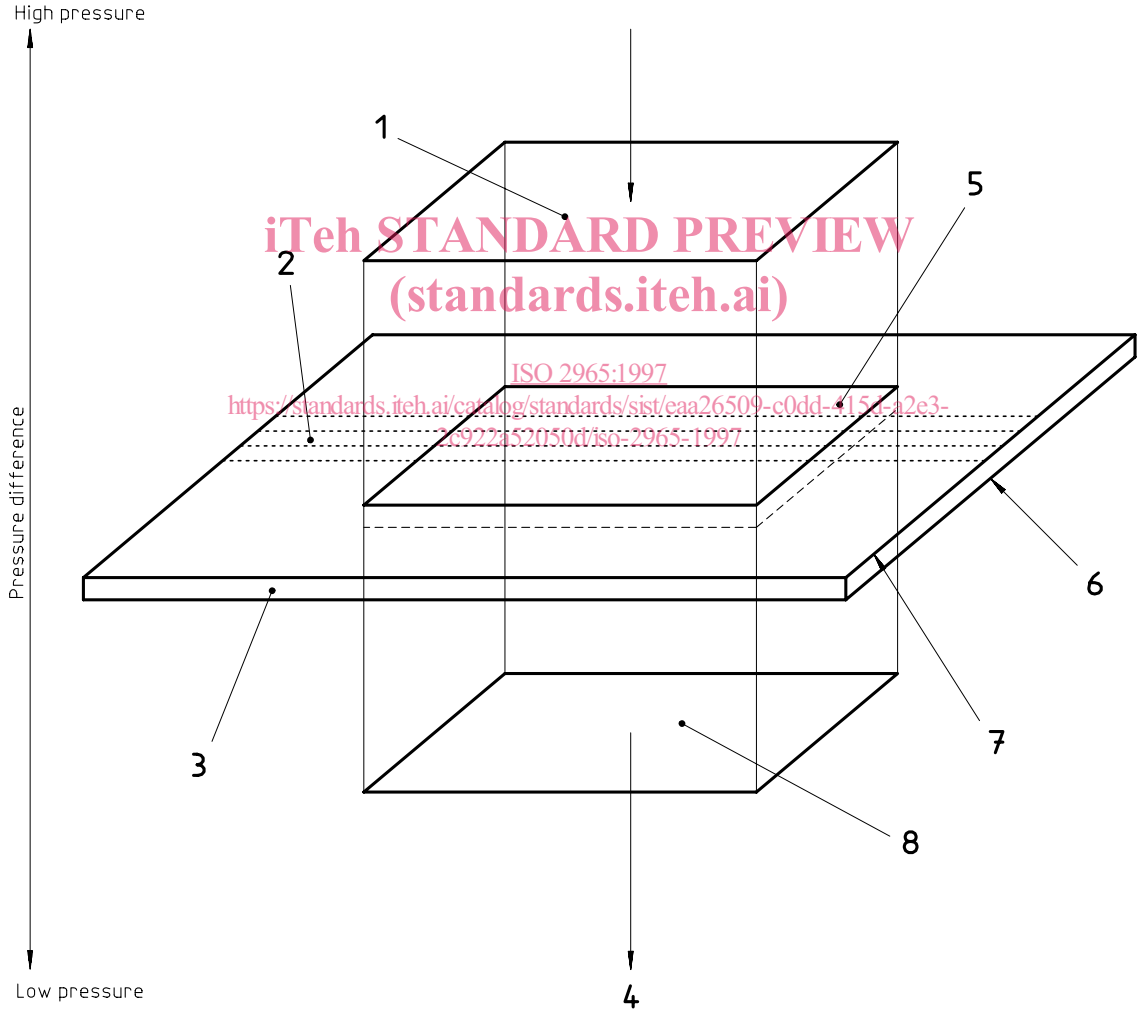
3.2
measuring pressure
difference in pressure across the two faces of the test piece during the measurement

3.3
leakage
air flow unintentionally aspirated from the surrounding atmosphere or escaping into it through the sealing surface of the test piece holder and elsewhere

4 Principle

A test piece is held in a suitable device. A pressure difference is applied across the test piece. The resultant flow of air through the test piece is measured.

The principle of measurement is illustrated in figure 1.



1 Air stream
2 Perforated zone (if present)
3 Test piece
4 Direction of air flow
5 Test surface of area 2 cm^2
6 Inner surface
7 Outer surface
8 Air stream

Figure 1 — Principle of measurement

The air flow through the test piece may be produced by applying a positive or negative pressure to one side of the test piece. The direction of air flow through the test piece shall be that which would occur when the sample is used in the finished product, where known, i.e. from the outside face towards the inside face.

NOTES

1 If the air flow is produced by a positive pressure, the apparatus used should incorporate a filter which protects the test sample from contamination by oil, water and particles.

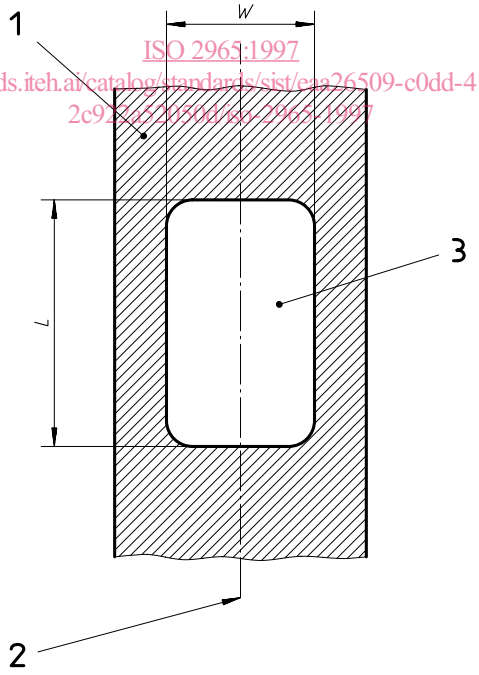
2 With certain materials, the flow through the test piece may exhibit a non-linear relationship with applied pressure drop. Thus the air flow through the test piece is determined at two pressure differences to establish whether the flow/pressure relationship across the paper is linear or non-linear. If it is non-linear a second measurement of air flow is recorded at 0,25 kPa to characterize the material fully.

3 Depending upon whether the volumetric air flow rate is measured up-stream or down-stream of the test piece, a difference of approximately 1 % of the flow rate can exist either side of the theoretical value at the centre of the test piece.

5 Apparatus

5.1 Test piece holder for clamping the test piece, free from leaks, with a rectangular surface area of 2,00 cm^2 ± 0,02 cm^2 with corner radii not greater than 0,1 cm. The long side (*L*) shall have a length of 2,000 cm ± 0,005 cm (see figure 2).

NOTE — An estimate of the air permeability of speciality papers, outside the scope of this International Standard, may be required. In this case, specialized test piece holders with different surface areas may be necessary.



1 Test piece

2 Centreline of test piece

3 Measurement surface area of test piece holder

W is the width of test surface

L is the long side of test surface (see 5.1)

5.2 Pneumatic controller, to produce an air flow at a given but adjustable pressure difference between the two mating faces of the test piece holder.

5.3 Pressure gauge, suitable for measuring pressure differences to at least 0,001 kPa, having a relative error of no more than 2 % of the measured value within the measuring range.

5.4 Flow meter, suitable for measuring the air flow with an relative error not greater than 5 % of the measured value within the measuring range.

5.5 Conditioning enclosure, capable of maintaining the conditions given in ISO 187 (but see 7.2).

6 Sampling

Take a sample which is representative, on a statistical basis, of the population to be characterized.

Samples shall be free of visible defects and creases which may impair measurement performance.

7 Procedure

7.1 Leak check of the test piece holder

Follow the procedure given in annex A. Perform a leak check daily, prior to use.

Air leaks between the mating faces of the test piece holder shall not be greater than 2,0 $cm^3 \cdot min^{-1}$.

NOTE — Some users require determination of the effect of surface leakage through particular papers which contribute to the measured flow. In this case if a value for leakage, with the test piece in place, is required the procedure given in annex C may be used. This should be determined and referred to in the test report.

7.2 Preparation of test pieces

Select at random from the sample, taken in accordance with clause 6, the number of test pieces required for the test plus an additional three test pieces to be used as described in 7.5.1, note 3.

If necessary make the test pieces suitable for testing (cut to the required dimensions, eliminate folds, seams, etc.).

Condition the test pieces, prior to measurement, in a conditioning enclosure set at 23° C ± 1 °C and 50 % ± 2 % relative humidity (RH) in accordance with ISO 187. Samples shall be held such that the conditioning air has free access to all their surfaces.

IMPORTANT — In laboratories unable to use the conditions given in ISO 187, the conditions 22 °C ± 1 °C and 60 % ± 2 % RH given in ISO 3402 may be used. In these cases a note shall be included with the test report.

NOTE — Complete sample bobbins, where it is not possible to expose all surfaces to the conditioning atmosphere, may require an extended period of conditioning. The time required should be determined by practice and experience.

The period of time for conditioning is not given in this International Standard but the period of time retained should be reported with the results.

7.3 Calibration

Calibrate the instrument using the calibration standards and procedure referred to in annex B.

7.4 Insertion of a test piece

All papers shall be placed in the test piece holder so that the measuring air will travel from the outside face towards the inside face of the paper as it is applied in the construction of the finished product, where this is known.

The positioning of the test pieces in the test piece holder is illustrated in figure 1 (see clause 4).

7.4.1 Materials with uniformly distributed permeability

Place in such a way that, if possible, the centre of the smaller dimension (*W*) of the test surface is at the centre of the width of the test piece (see figure 2).

7.4.2 Materials with a narrow and oriented permeable zone

The permeable zone shall be oriented along, and parallel to, the direction of the 20 mm length of the test surface (see figure 3).

The edges of the permeable zone shall not be less than 1 mm from the edges of the test surface. Ideally the test piece should extend over each edge of the test surface by at least 3 mm. If for technical reasons this cannot be achieved (i.e. the specimen under study is less than 16 mm total width or the permeable zone is less than 4 mm from one edge of the sample), this shall be referred to in the test report.

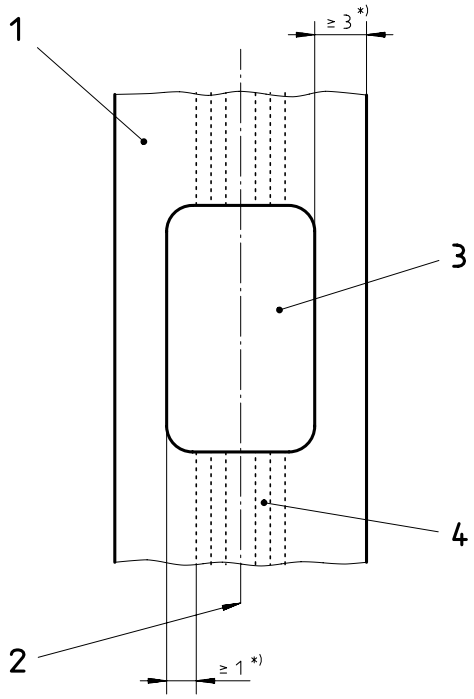
7.5 Measurement

7.5.1 General

Insert a test piece into the test piece holder. Establish an approximate pressure difference within the range 1,0 kPa ± 0,05 kPa across the two faces of the test piece. Accurately record this pressure and the corresponding flow rate.

NOTE 1 The permeability of test pieces can vary throughout their length. For this International Standard the mean value of 10 individual measurements is used to determine the value of air permeability of a test piece. In practice, laboratories often take a different number of measurements depending upon the application of the measurement.

Dimensions in millimetres



*) See 7.4.2

1 Test piece

2 Centreline of test piece

3 Oriented permeable zone

4 Measurement surface area of test piece holder

Figure 3 — Positioning of test pieces for materials with a narrow and oriented permeable zone

Proceed in the same way with all the test pieces. The results are normalized as given in clause 8.

NOTE 2 If it is required further to characterize the material because it is believed that the flow/pressure relationship is non-linear, perform the following test for air flow rate/pressure relationships on three additional test pieces.

Set up, in turn, pressure differences of 0,25 kPa and 1,00 kPa across the test material, without moving the test material. Record the corresponding air flow rates Q_1 and Q_2 ($cm^3 \cdot min^{-1}$) across the test material respectively. Calculate the ratio Y by the equation:

$$Y = \frac{Q_1}{Q_2} \times \frac{1,0}{0,25}$$

Repeat the above procedure on two other test pieces and calculate the mean of the three values obtained for the value Y Y does not deviate by more than 2 % from the value 1,00 (in practice if it is not greater than 1,02), the air flow rate/pressure relationship is **linear**. Otherwise the relationship is referred to as **non-linear**.

If the test material has been shown to have non-linear air flow rate/pressure characteristics, the measurement of air flow rate at a single pressure difference is considered inadequate to characterize the material. The flow rate may be determined using the second pressure difference of 0,25 kPa.

Further information is given in annex D.

NOTE 3 Materials that exhibit a linear characteristic and have a permeability of less than 10 $cm^3 \cdot (min^{-1} \cdot cm^{-2})$ at 1 kPa may be re-measured in order to obtain an estimate of permeability using :

- a test piece holder with a single larger test surface area;

- a test piece holder containing multiple areas that perform simultaneous measurements of the standard single 2,00 cm^2 rectangular test surface area, each with dimensions described in 5.1 ;

- a pressure drop of 2,0 kPa.

In this case, the method gives only the estimation of permeability.

7.5.2 Measurement of strips

Make ten consecutive measurements with a minimum distance of 20 mm between measurements.

7.5.3 **Measurement of spills** (papers recovered from manufactured products)

Make ten measurements comprising single measurements on each of ten spills. Ensure that the overlap seam is not included in the test surface.

8 Expression of results

The determination of the value of air permeability shall be the mean value from the individual measurements; see 7.5.2 and 7.5.3.

NOTE — If a measuring head with multiple test surfaces is used as described in 7.5.1, note 3, it should be understood that the measurement obtained is already an average of the number of test surfaces used in the measuring head. In addition, care has to be taken in the interpretation of *r* and *R* when using these measuring heads.

The air permeability, AP, is expressed in cubic centimetres per minute per square centimetre measured at 1 kPa. Using a test surface of area 2 cm^2, it is given by the equation:

$$AP = \frac{Q}{2}$$

where

AP is the numerical value of the air permeability, in $cm^3 \cdot (min^{-1} \cdot cm^{-2})$ at 1 kPa;

Q is the numerical value of the air flow, in cubic centimetres per minute, passing through the test piece.

In practice, Q is not measured at precisely 1 kPa and a normalization procedure to correct to 1 kPa is required. In addition, other measuring heads, with areas not 2 cm^2 may have been used (see 7.5.1, note 3) and a correction for this is then also required.

The general equation is as follows :

$$AP = \frac{Q}{A} \times \frac{p}{\Delta p}$$