
**Materials used as cigarette papers,
filter plug wrap and filter joining
paper, including materials having a
discrete or oriented permeable zone
and materials with bands of differing
permeability — Determination of air
permeability**

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

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

This fourth edition cancels and replaces the third edition (ISO 2965:2009), which has been technically revised. The main changes compared to the previous edition are as follows.

- Use of a 0,30 cm² test piece holder has been allowed for measurement of small paper areas.
- [Formula \(E.3\)](#) has been corrected.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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 Cooperation Centre for Scientific Research Relative to Tobacco (CORESTA).

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Materials used as cigarette papers, filter plug wrap and filter joining paper, including materials having a discrete or oriented permeable zone and materials with bands of differing permeability — Determination of air permeability

1 Scope

This document 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 or discrete permeable zones where the measured permeability is in excess of $10 \text{ cm}^3 \cdot (\text{min}^{-1} \cdot \text{cm}^{-2})$ at 1 kPa. In addition, it is applicable to banded cigarette papers, with bands of a width of at least 4 mm.

NOTE For an estimate of the air permeability of materials outside the scope of this document, see Note 3 in [5.1.2](#) and [7.6.1.4](#).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 3402, *Tobacco and tobacco products — Atmosphere for conditioning and testing*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

air permeability

AP

air flow, measured in cubic centimetres per minute, passing through 1 cm^2 surface of the test piece at a measuring pressure ([3.2](#)) of 1,00 kPa

Note 1 to entry: The air permeability units are $\text{cm}^3 \cdot (\text{min}^{-1} \cdot \text{cm}^{-2})$ at 1 kPa.

3.2

measuring pressure

difference in pressure between 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

**3.4
paper with uniformly distributed permeability
standard paper**

paper with natural *air permeability* (3.1) only

**3.5
paper with oriented permeable zone**

paper that has a continuous zone of higher *air permeability* (3.1) obtained through perforation

**3.6
paper with discrete permeable zone**

paper that has higher *air permeability* (3.1) obtained through perforation in discrete areas

**3.7
banded paper**

paper with bands of different *air permeability* (3.1)

Note 1 to entry: Papers of this type normally have bands with permeability significantly lower than that of the base paper.

**3.8
special paper**

paper with modified *air permeability* (3.1)

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Note 1 to entry: Papers of this type include those defined in 3.5, 3.6 and 3.7.

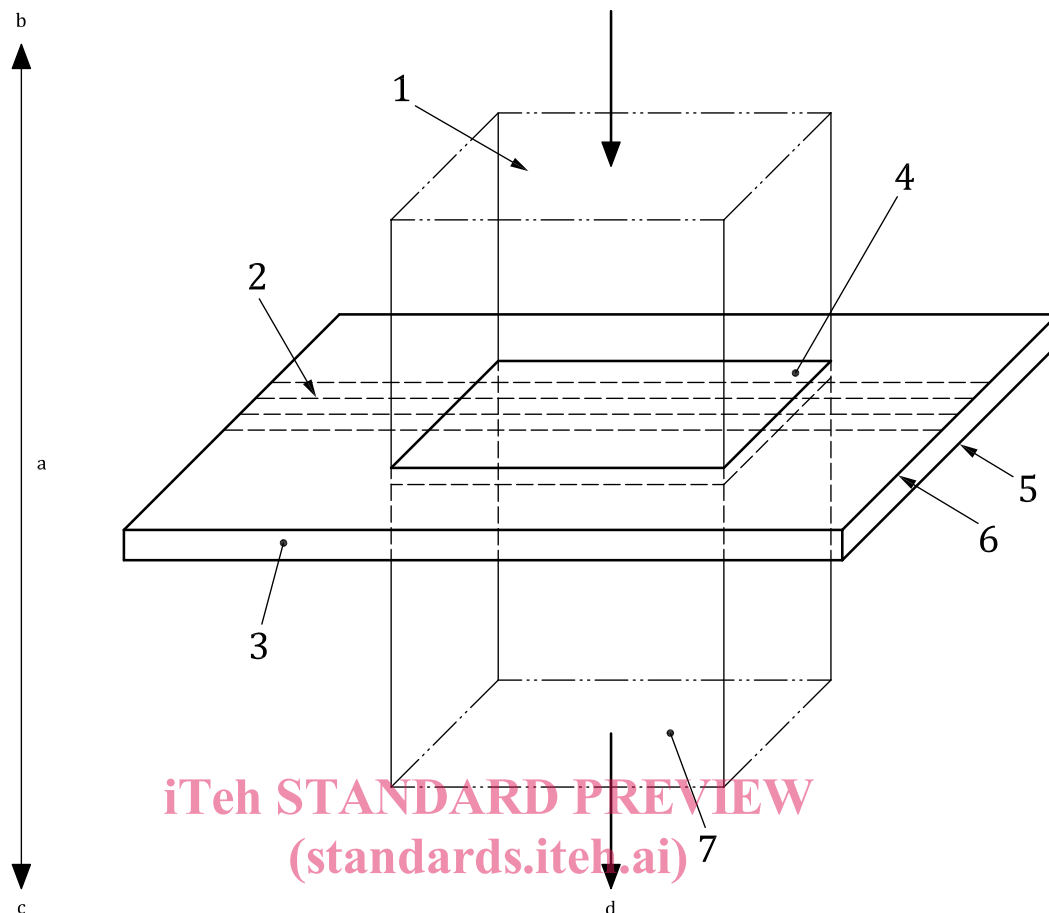
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4 Principle

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

The principle of measurement is illustrated in [Figure 1](#).



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Key

- | | | | |
|---|------------------------------|---|------------------------|
| 1 | air flow | 5 | inner surface |
| 2 | perforated zone (if present) | 6 | outer surface |
| 3 | test piece | 7 | air flow |
| 4 | test surface | | |
| a | Measuring pressure. | c | Low pressure. |
| b | High pressure. | d | Direction of air flow. |

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.

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.

NOTE 1 With certain materials, the air flow through the test piece can exhibit a nonlinear relationship with the applied measuring pressure. Thus, the air flow through the test piece is determined at two different measuring pressures to establish whether the air flow/measuring pressure relationship across the paper is linear or nonlinear. If it is nonlinear, a second measurement of air flow is recorded at a measuring pressure of 0,25 kPa to fully characterize the material.

NOTE 2 Depending upon whether the air flow is measured up-stream or down-stream of the test piece, a difference of approximately 1 % of the air flow 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.

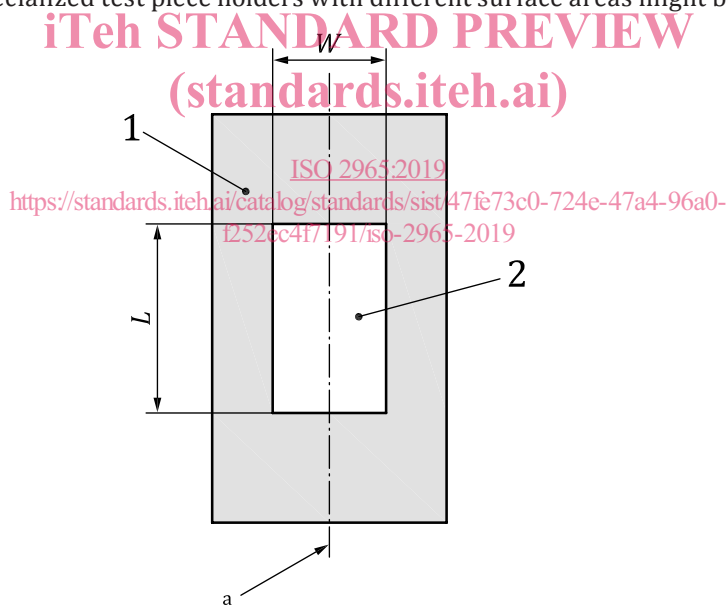
5.1.1 For papers with uniformly distributed permeability and those with oriented or discrete permeable zones: the test piece holder has a rectangular surface area of $2,00 \text{ cm}^2 \pm 0,02 \text{ cm}^2$ with corner radii no greater than 0,1 cm. The long side, L , shall have a length of $2,000 \text{ cm} \pm 0,005 \text{ cm}$ (see [Figure 2](#)).

5.1.2 For bands of differing permeability and small areas of uniform permeability: the test piece holder has a rectangular surface area of $0,30 \text{ cm}^2 \pm 0,01 \text{ cm}^2$. The short side shall have a length of $2,00 \text{ mm} \pm 0,05 \text{ mm}$ [see [7.5.6](#) and [Figure 3 d](#)]. This test piece holder shall be used for the measurement of the air permeability of bands or if the area to be tested cannot be measured with the test piece holder provided in [5.1.1](#) while keeping the required minimum distances to paper edges or areas of different permeability provided in [7.5.2](#) to [7.5.6](#). In all other cases the $2,00 \text{ cm}^2$ test piece holder ([5.1.1](#)) shall be used.

NOTE 1 The positioning of the test piece holder on the test piece differs for different types of papers (see [7.5](#) and [Figures 2](#) and [3](#)).

NOTE 2 Small test piece areas, requiring the use of the $0,30 \text{ cm}^2$ test piece holder, can occur for the measurement of the air permeability for cigarette papers or papers taken from cigarettes with a circumference of less than 16 mm.

NOTE 3 An estimate of the air permeability of other speciality papers, outside the scope of this document, can be required. In this case, specialized test piece holders with different surface areas might be necessary.



Key

- 1 test piece
- 2 test surface of test piece holder
- L long side of the test surface (see [5.1.1](#))
- W width of the test surface
- a Centreline of test piece.

Figure 2 — Positioning of test pieces for materials with uniformly distributed permeability

5.2 **Pneumatic controller**, to produce an air flow at a given but adjustable measuring pressure.

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 a relative error no 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 [7.3](#)).

6 Sampling

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

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

7 Procedure

7.1 General

Since the air flow/measuring pressure relationship of many papers is not linear, this procedure should be followed closely to allow proper comparison of results. If it is necessary to deviate from this procedure in any way (for example, to use a non-standard size of test piece holder or to modify the positioning of the test piece holder, due to sample dimensions), then this shall be noted in the test report [see [7.5](#) and [Clause 10 d](#)].

7.2 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 $2,0 \text{ cm}^3 \cdot \text{min}^{-1}$.

Some users require determination of the effect of surface leakage through particular papers that 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.

7.3 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 [7.6.1.3](#).

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 in accordance with ISO 187. Samples shall be held such that the conditioning air has free access to all their surfaces.

In laboratories unable to use the conditions given in ISO 187, the conditions given in ISO 3402 may be used. In this case, a note shall be included with the test report.

Complete sample bobbins, where it is not possible to expose all surfaces to the conditioning atmosphere, might 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 document but the period of time retained should be reported with the results.

7.4 Calibration

Calibrate the instrument using the calibration standards and procedure referred to in [Annex B](#).

7.5 Insertion of a test piece

7.5.1 General

All papers shall be placed in the test piece holder so that the measuring air will flow 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 [Figures 2](#) and [3](#) (see also [5.1](#)).

When the minimum distances to paper edges, edges of permeable zones or areas of different air permeability cannot be kept with the 2,00 cm² test piece holder, the 0,30 cm² test piece holder of [5.1.2](#) shall be used and the minimum distances as provided in [7.5.2](#) to [7.5.6](#) shall apply. If even for the 0,30 cm² test piece holder these minimum distances cannot be kept for technical reasons, this shall be referred to in the test report.

7.5.2 Materials with uniformly distributed permeability

Place the test piece 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](#)).

7.5.3 Materials with a narrow and oriented permeable zone

The permeable zone shall be oriented along, and parallel to, the direction of the 2 cm length of the test surface [see [Figure 3 a](#)].

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.

7.5.4 Materials with an extended and oriented permeable zone

The test piece shall be placed so that the test surface covers the maximum possible width of the permeable zone [see [Figure 3 b](#)].

Ideally, the dimension L of the test surface shall extend at least 1 mm outside the edges of the permeable zone and the sample should extend over each edge of the test surface by at least 3 mm. Where this cannot be achieved (for example, due to sample dimensions), this shall be referred to in the test report.

7.5.5 Materials with discrete permeable zones

The test piece shall be oriented to expose the greatest possible number of the permeable zones within the measurement surface area of the test piece holder [see [Figure 3 c](#)].

Ideally, the 2 cm dimension of the test surface shall extend at least 1 mm outside the edges of the permeable zones and the sample should extend over each edge of the test surface by at least 3 mm. Where this cannot be achieved (for example, due to sample dimensions), this shall be referred to in the test report.

7.5.6 Materials with bands of different air permeability

For measurement of the permeability of the bands, a 0,30 cm² test piece holder shall be used.