INTERNATIONAL STANDARD

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Cigarettes — Determination of ventilation — Definitions and measurement principles

Cigarettes — Détermination du taux de ventilation — Définitions et principes de mesurage

Reference number
ISO 9512:2002(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 9512 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 9512:1993), which has been technically revised.

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

This corrected version of ISO 9512:2002 incorporates the following corrections. Figures 1 b) and d) have been corrected and a few minor editorial changes have been made.

Cigarettes — Determination of ventilation — Definitions and measurement principles

1 Scope

This International Standard specifies a method for the determination of ventilation which is applicable to cigarettes.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3308, *Routine analytical cigarette-smoking machine — Definitions and standard conditions*

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

ISO 6565, *Tobacco and tobacco products — Draw resistance of cigarettes and pressure drop of filter rods — Standard conditions and measurement*

3 Terms and definitions

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

3.1
ventilation
aspiration of atmospheric air into an unlit cigarette other than through its front area

NOTE Dilution is the effect of ventilation on the smoke concentration.

3.2
front area
that end of a cigarette which is intended to be lit

3.3
total airflow
100 % of the volumetric airflow leaving the mouth end of an unlit cigarette which is encapsulated in a measurement device having an insertion depth as defined in ISO 3308

NOTE Under standard test conditions, the total airflow, Q, is 17,5 ml/s.

3.4
generator for total airflow
device to maintain a constant total airflow at the exit of the mouth end of a cigarette when encapsulated in a measurement head having an insertion depth as defined in ISO 3308

3.5
ventilation airflow
volumetric airflow entering an unlit cigarette other than through the front area of the cigarette

NOTE The ventilation airflow is standardized to the negative pressure at the mouth end of the cigarette, created by the draw resistance of the cigarette when encapsulated in a measurement device having an insertion depth as defined in ISO 3308.

3.6
total ventilation
total amount of lateral air entering the cigarette (other than through its front area) when encapsulated in a measurement device having an insertion depth as defined in ISO 3308

3.7
degree of ventilation
ratio, expressed as a percentage, of the ventilation airflow to the total airflow

See Figures 1 b), 1 c) and 1 d).

3.8
components of total ventilation
that air entering through the cigarette paper, and through the materials comprising and attaching the filter to the tobacco rod, contributing to total ventilation

See Figures 1 b), 1 c) and 1 d).

3.9
filter ventilation
that air entering the cigarette through the filter joining paper (tipping paper) between the covered part of the mouth end and the beginning of the tobacco rod

See Figure 1 b).

3.10
paper ventilation
that air entering the cigarette through the envelope covering the whole length of the tobacco rod

See Figure 1 b).

3.11
butt ventilation
that air entering the cigarette between the covered part of the mouth end of the cigarette and the position defined by the butt length appropriate to the cigarette

See Figure 1 c).

3.12
burnable tobacco rod ventilation
that air entering the cigarette through its paper between the position defined by the butt length appropriate to the cigarette and the end of the cigarette which would be lit

See Figure 1 c).

3.13
tipping-paper ventilation
that air entering the cigarette through the filter joining paper (tipping paper) between the covered part of the mouth end and the tobacco rod end of the tipping paper

See Figure 1 d).

3.14
cigarette-paper ventilation
air entering the cigarette through the cigarette paper between the end of the cigarette which would be lit and the mouth end of the tipping paper

See Figure 1 d).

4 Principle

Air is drawn, at a constant flow rate, in the standard smoking direction through an unlit cigarette. The individual components of ventilation are measured separately. The degrees of ventilation are obtained by calculation.

5 Standard conditions

5.1 Prior to measurement, the cigarettes shall be conditioned in an atmosphere as specified in ISO 3402.

5.2 Ventilation measurements shall be made on unlit cigarettes in accordance with the test atmosphere as specified in ISO 3402.

5.3 The direction of airflow in the cigarette shall be that which would occur when the cigarette is smoked.

6 Requirements for apparatus

6.1 The apparatus used shall allow separate assessment of the ventilation components shown in Figure 1.

6.2 The cigarettes shall be held in the measurement head by an encapsulation device, with an encapsulation depth as defined by ISO 3308.

6.3 Seals used to hold the cigarette and partition ventilation measurement regions shall be sized and positioned appropriately to the dimensions of the product under test to minimise any systematic influence on measured parameters. See Figure 2.

6.4 The measuring pressure surrounding the cigarette contained in the measurement head, other than at the front end and the mouth end enclosed in the holding seal, shall not be more than 20 Pa lower than that of the testing atmosphere when the total airflow is applied.

NOTE Experiments conducted during the development of this method show that the measured ventilation flows reduce proportionally to increased pressure drop of the apparatus' ventilation measurement path.

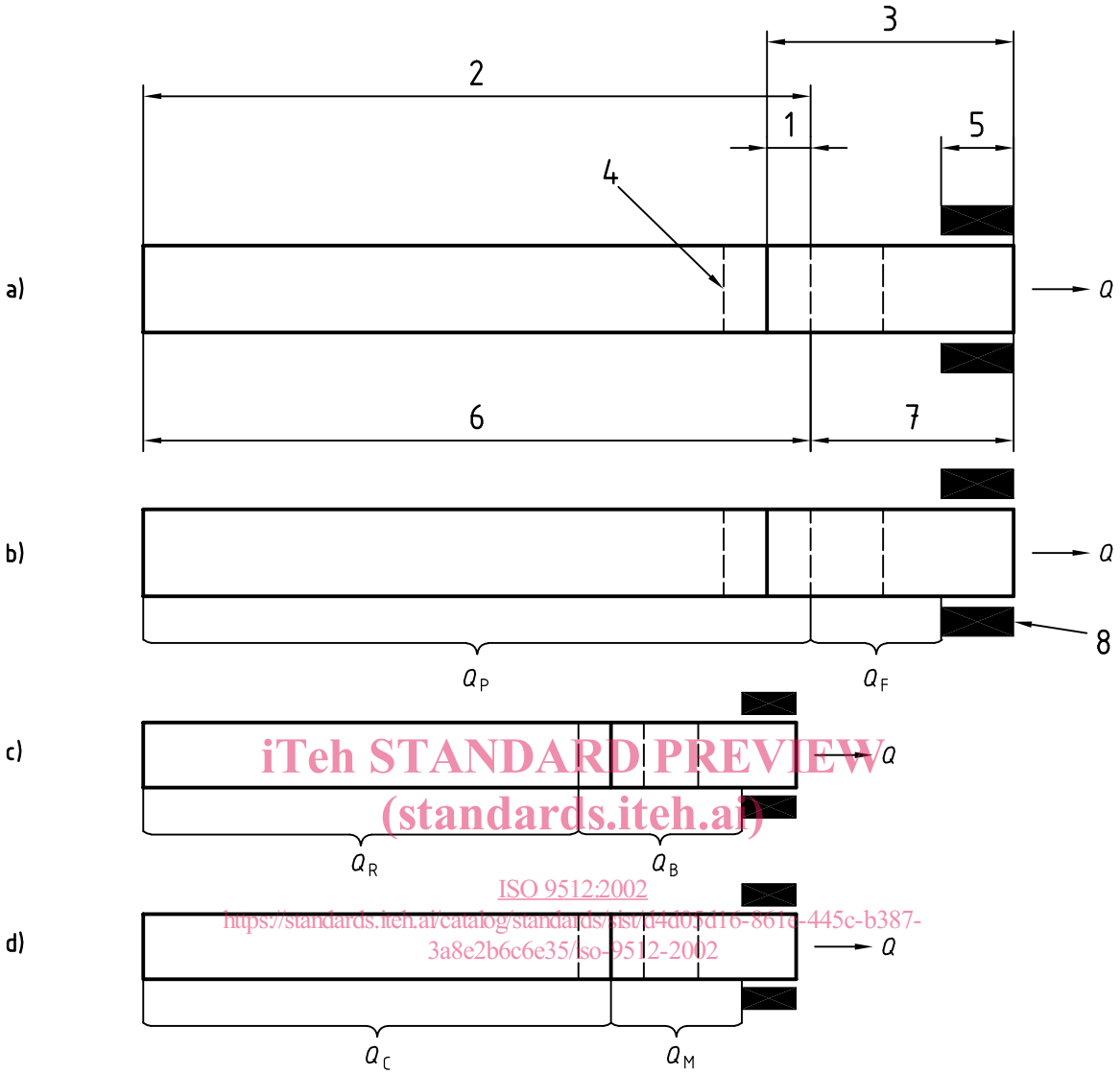
6.5 A generator for total airflow shall be used to establish the measurement conditions.

Deviations from the total airflow shall not exceed ± 0,10 ml/s.

NOTE A critical flow orifice (CFO) is normally used to establish a constant total airflow for vacuum-based measurement systems.

6.6 The device used for measurement of ventilation airflows shall have no intrinsic effect on the volumetric airflow measurement.

See Figure 2.



Key

1 Overlap
2 Cigarette paper
3 Tipping paper
4 Butt mark
5 Standard depth of encapsulation (ISO 3308)
6 Tobacco rod
7 Filter
8 Encapsulation device

Total airflow, Q = 17,5 ml/s

Degree of filter ventilation, $V_F = \frac{Q_F}{Q} \times 100\ \%$

Degree of paper ventilation, $V_P = \frac{Q_P}{Q} \times 100\ \%$

Degree of total ventilation, $V = V_F + V_P = \frac{Q_F + Q_P}{Q} \times 100\ \%$

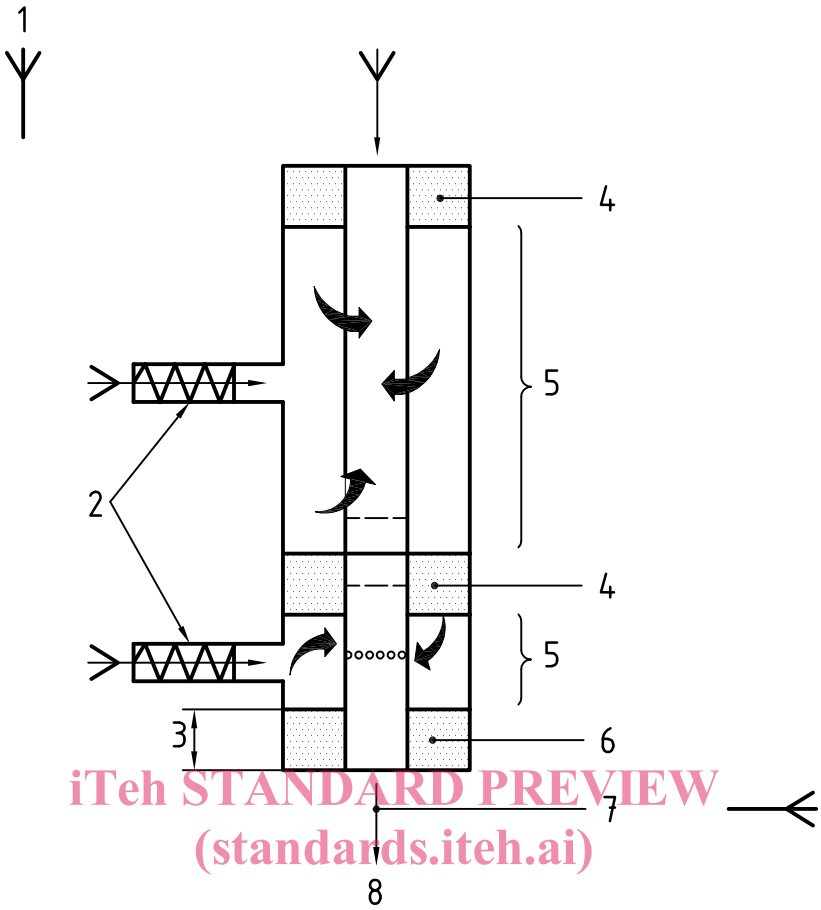
Degree of burnable tobacco rod ventilation, $V_R = \frac{Q_R}{Q} \times 100\ \%$

Degree of butt ventilation, $V_B = \frac{Q_B}{Q} \times 100\ \%$

Degree of cigarette paper ventilation, $V_C = \frac{Q_C}{Q} \times 100\ \%$

Degree of tipping paper ventilation, $V_M = \frac{Q_M}{Q} \times 100\ \%$

Figure 1 — Different degrees of ventilation



Key

1	Test atmosphere conforming to ISO 3402	5	Ventilation chamber
2	Ventilation flow measurement devices	6	Fixed holding seal
3	Encapsulation depth conforming to ISO 3308	7	Device to measure cigarette draw resistance
4	Adjustable partitioning seals	8	Total airflow

Figure 2 — Schematic for ventilation flow measurement

7 Sampling

A sample shall be taken 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.

8 Checking of apparatus

The measurement device shall be calibrated in accordance with the manufacturer's recommendations, ensuring the device is leakfree prior to implementing or checking calibration.

9 Procedure

9.1 Conditioning of test cigarettes

Condition the cigarette sample selected for the test as specified in 5.1.

9.2 Calibration

Calibrate the measurement device using calibration standards and calibration procedure in accordance with annex B.

NOTE Any calibration needs to span the range of values expected from the test sample required on the products to be measured.

9.3 Measurement

Ensure that the measurement apparatus has been adjusted to suit the dimensions of the cigarette to be tested.

Insert the cigarette samples to be tested into the measurement head and use the apparatus in accordance with the manufacturer's instructions.

Record the ventilation measurement parameters.

10 Expression of results

The reported value of any ventilation measurements shall be the mean value of individual measurements, expressed as a percentage of total airflow.

The results shall be expressed as follows:

a) individual values shall be expressed to at least one decimal place;

b) mean values shall be expressed to the first decimal place (0,05 is rounded to 0,1);

c) the standard deviation shall be expressed to the first decimal place (0,05 is rounded to 0,1).

11 Precision

The precision of this method has been estimated by selecting five cigarette product types having nominal filter ventilation values which span the normal range of measurement. The results are given in annex E.

12 Test report

The test report shall include the number of cigarette samples and all necessary information for the complete identification of the samples.

The test report shall specify the method used, the result(s) obtained and any outlying cases. It shall also mention any operating details not specified in this International Standard or regarded as optional, together with details of any deviations from this International Standard.

In the test report, some additional information such as name of the laboratory in which the test has been performed, the name of the operator and the date of the test should be given.

Annex A
(normative)

Calibration of ventilation standards

A.1 Calibration of ventilation standards

Ventilation standards are used to calibrate measuring instruments for the determination of the components of the total ventilation of cigarettes.

Ventilation standards have ventilation values allowing calibration of the measurement apparatus in the mid-range measurements.

Ventilation standards have defined pressure drop values, which may be used to calibrate measurement instruments for the draw resistance of cigarettes within the target range of measurement.

A.2 Essential properties of ventilation standards

A.2.1 Ventilation standards should be made of an inert material which is unaffected by use or ageing.

A.2.2 Standards should closely resemble the physical size and shape of a cigarette.

A.2.3 Ventilation standards shall have defined and repeatable values of

— tipping ventilation, and

— pressure drop with tipping ventilation zones open (ΔP_o),

when a suction source, having a total airflow of 17,5 ml/s is applied to the outlet of the standard.

A.2.4 The following parameters may be added:

— paper ventilation;

— pressure drop with tipping ventilation zones closed (ΔP_c);

— pressure drop with tipping and paper ventilation zones closed (ΔP_e).

A.2.5 The airflow through the ventilation standard shall be laminar. The ventilation standard shall have repeatable measurement characteristics and shall be largely unaffected by changing atmospheric conditions.

A.2.6 Ventilation standards shall be inscribed with a unique ID having a certificate of calibration giving traceable values of tipping ventilation and pressure drop with tipping ventilation zones open. Additional parameters may be included.

The level of uncertainty of calibration of the ventilation standards shall not exceed 1,5 % absolute.

A.2.7 The certificate of calibration shall state the actual atmospheric pressure, temperature and relative humidity of the laboratory testing atmosphere during calibration.