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

*Tabac et produits du tabac — Résistance au tirage des cigarettes et
perte de charge des bâtonnets-filtres — Conditions normalisées et
mesurage*

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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Test conditions	2
4.1 Test conditions common to cigarettes and filter rods.....	2
4.1.1 General.....	2
4.1.2 Air flow.....	2
4.1.3 Position.....	3
4.2 Conditions particular to cigarettes — Insertion of the test piece.....	3
4.3 Conditions particular to filter rods — Encapsulation.....	3
5 Instrument calibration	3
6 Procedure	3
6.1 Conditions common to vacuum and pressure instruments.....	3
6.2 Conditions particular to vacuum instruments.....	3
6.3 Conditions particular to pressure instruments (for filter rods only).....	4
7 Expression of results	4
8 Precision	4
8.1 Interlaboratory test.....	4
8.2 Repeatability.....	4
8.3 Reproducibility.....	5
9 Test report	5
Annex A (normative) Calibration of pressure drop transfer standards	6
Annex B (informative) Results of an interlaboratory trial	14
Annex C (informative) Comparison of draw resistance or pressure drop measurement: Critical flow orifice instruments versus constant mass flow instruments	18
Bibliography	20

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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 126, *Tobacco and tobacco products*, Subcommittee SC 1, *Physical and dimensional tests*.

This fifth edition cancels and replaces the fourth edition (ISO 6565:2011), which has been technically revised.

Introduction

The draw resistance of cigarettes or the pressure drop of filter rods is a widespread and important concept both for product quality specifications and for analytical determinations by mechanical smoking.

Different procedures and apparatus are currently available for this determination. It has so far not been possible to standardize the complete description of the equipment to be used and the detailed procedure. Nevertheless, it has been possible to obtain broad consensus on the definitions to be adopted and the conditions that allow comparable determinations of this characteristic to be made. In order to achieve this, one of the main requirements is the use of transfer standards for the calibration of instruments (see Annex A).

In this International Standard, the results are given in pascals (Pa). For information, they are also given in millimetres water gauge (mmWG).

The values given previously in mmWG are converted into Pa using the following correction factor:

— 1 mmWG = 9,806 7 Pa

For practical use, the values have been rounded.

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

1 Scope

This International Standard describes a method for the measurement of the draw resistance of cigarettes and pressure drop of filter rods, and specifies the standard conditions applicable to such measurements.

It is applicable to cigarettes, filter rods, and, by extension, to cylindrical tobacco products similar to cigarettes.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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.

3.1

pressure drop

Δp

static pressure difference between the two ends of

- a test piece completely encapsulated in a measuring device such that no air can pass through the outer membrane (or wrapping),
- a pneumatic circuit, or
- a *pressure drop transfer standard* (3.6)

when it is traversed by an air flow under steady conditions in which the measured volumetric flow, under standard conditions, at the *output end* (3.4) is 17,5 ml/s, as defined in ISO 3402

Note 1 to entry: This is expressed in pascals (Pa) (or in mmWG).

3.2

draw resistance

Δp_D

negative pressure which has to be applied to the *output end* (3.4), under test conditions (see ISO 3402), in order to sustain a volumetric flow of 17,5 ml/s, exiting at the output end, when the cigarette is encapsulated in a measurement device to a depth of approximately 9 mm, as defined in ISO 3308

Note 1 to entry: Any ventilation zones and the tobacco rod are exposed to the atmosphere.

Note 2 to entry: The concept of draw resistance can also be subjectively judged when a cigarette is smoked by a consumer/taste panel. Under such circumstances, draw resistance is not measured objectively because the conditions of the formal definition are not met.

3.3

input end

<cigarettes> end of the test piece intended to be lit

3.4

output end

end opposite from the *input end* (3.3)

3.5

standard direction of flow

direction from the *input end* (3.3) to the *output end* (3.4)

Note 1 to entry: In the case of a filter rod, the *input end* (3.3) and the *output end* (3.4) are defined by the direction of flow.

3.6

pressure drop transfer standard

transfer standard for *pressure drop* (3.1) measurement systems which is calibrated under standard ambient conditions and used under local ambient conditions

Note 1 to entry: The form and properties of suitable transfer standards are given in Annex A.

3.7

dummy standard

device with the same shape and similar form to a *pressure drop transfer standard* (3.6), for use in leak testing of calibration apparatus

Note 1 to entry: A suitable dummy standard consists of a pressure drop transfer standard or a smooth metal tube of similar dimensions.

3.8

reference standard

pressure drop transfer standard (3.6) against which other pressure drop transfer standards are compared

Note 1 to entry: Such a reference standard is generally reserved for this purpose and is not used for the routine calibration of pressure drop measuring instruments.

3.9

monitor reference standard

reference standard (3.8) used to confirm the correctness of calibration of an instrument or measurement system

Note 1 to entry: See A.4.2.3.4.

4 Test conditions

4.1 Test conditions common to cigarettes and filter rods

4.1.1 General

The test conditions shall be constant and in agreement with the conditions under which the calibration was performed (see Clause 5).

NOTE The use of transfer standards for calibration enables measurements to be made under test conditions outside those described by ISO 3402.

4.1.2 Air flow

The air flow shall be from the input end in the standard direction of flow (see 3.5).

4.1.3 Position

The position of the test piece may be either horizontal or vertical, but products with cavities containing loose-fill material shall be positioned vertically.

4.2 Conditions particular to cigarettes — Insertion of the test piece

The output end of the test piece shall be inserted into a measurement device encapsulated to a depth of approximately 9 mm.

NOTE The intention is to achieve a good seal while not occluding any ventilation holes.

4.3 Conditions particular to filter rods — Encapsulation

The test piece shall be completely encapsulated in a measuring device so that no air can pass through the filter rod wrapping.

5 Instrument calibration

The instrument shall be calibrated before normal testing using transfer standards. This shall be done at least once per day. The calibration shall be carried out in accordance with the instrument manufacturer's instructions.

The instrument shall be recalibrated if the atmospheric conditions change by more than 2 °C for temperature, or by more than 5 % for relative humidity.

Each calibration of the instrument shall be recorded for later reference.

NOTE 1 To obtain the best accuracy, calibrate the instrument as close as possible to its full-scale deflection or at the maximum point of the range of values of the products to be tested.

To check for air leaks that might have occurred during the calibration and to check the linearity of the measuring system, at least one intermediate value pressure drop standard should be used in order to obtain a mid-scale value.

NOTE 2 In addition to the mid-scale value, a calibration check can be made with a pressure drop standard that has a nominal pressure drop value close to the draw resistance or pressure drop of the test pieces to be measured.

6 Procedure

6.1 Conditions common to vacuum and pressure instruments

Record details of the instrument type and configuration, including measurement settling time, if this can be determined (see 6.2 and 6.3).

Insert the test piece (either manually or automatically) into the measuring device of the instrument. Read the value of the draw resistance or pressure drop and record it.

6.2 Conditions particular to vacuum instruments

Before reading the draw resistance or pressure drop, leave the test piece in the measuring device until the reading is steady.

NOTE Practice has shown that a settling time of 4 s to 6 s is normally sufficient.

6.3 Conditions particular to pressure instruments (for filter rods only)

Determine the required settling time depending on the draw resistance of the test piece and the type of instrument. The reading for pressure drop shall be recorded at a constant time after the insertion of the test piece.

For the particular conditions described in 6.2 and 6.3, practice has shown that for low draw resistance or pressure drop, i.e. below 2 000 Pa (or about 200 mmWG), a settling time of 2 s to 3 s is sufficient, while for higher draw resistances or pressure drop, i.e. above 4 000 Pa (or about 400 mmWG), a settling time of 4 s to 6 s is required.

7 Expression of results

The expression of the laboratory results depends on the purpose for which the data are required and the level of laboratory precision.

Express the results as follows:

- individual draw resistance or pressure drop of a test piece, rounded to the nearest 10 Pa (or to the nearest 1 mmWG);
- average and standard deviation of the draw resistance or pressure drop of a sample, rounded to the nearest 1 Pa (or to the nearest 0,1 mmWG).

8 Precision

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8.1 Interlaboratory test

Details of an interlaboratory test on the precision of the method are summarized in Annex B. The values derived from this interlaboratory test might not be applicable to values and matrices other than those given.

8.2 Repeatability

The absolute difference between two independent single results, obtained using the same method on identical test material in the same laboratory by the same operator using the same equipment within a short interval of time will, in not more than 5 % of cases, be greater than the values given in Table 1 for cigarettes and Table 2 for filter rods.

Table 1 — Cigarettes

Repeatability limit, r	
Pa	mmWG
$r = 23$	$r = 2,3$

Table 2 — Filter rods

Repeatability limit, r	
Pa	mmWG
$r = 0,007 \times m\Delta p$	$r = 0,007 \times m\Delta p$
NOTE $m\Delta p$ is the mean value of the pressure drop Δp , expressed in pascals (Pa) (or in mmWG).	

8.3 Reproducibility

The absolute difference between two single test results, obtained using the same method on identical test material in different laboratories with different operators using different equipment will, in not more than 5 % of cases, be greater than the values given in [Table 3](#) for cigarettes and [Table 4](#) for filter rods.

Table 3 — Cigarettes

Reproducibility limit, R	
Pa	mmWG
$R = 57$	$R = 5,8$

Table 4 — Filter rods

Reproducibility limit, R	
Pa	mmWG
$R = 0,023 \times m\Delta p$	$R = 0,023 \times m\Delta p$
NOTE $m\Delta p$ is the mean value of the pressure drop Δp , expressed in pascals (Pa) (or in mmWG).	

9 Test report

The test report shall show the method, instrument, and instrument configuration used.

It shall also mention any operating conditions not specified in this International Standard or regarded as optional, as well as any circumstances that might have influenced the results.

The test report shall include all details required for the complete identification of the sample and the results obtained.

It shall mention, in particular, the following information:

- the product name or identification;
- the date of sampling;
- the date of test;
- the type of instrument used, instrument configuration, or settling time;
- the results;
- the total number of test pieces tested;
- the room temperature in degrees Celsius (°C) during testing;
- the relative humidity in percentage (RH %) during testing;
- the atmospheric pressure.