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**Standard test method for assessing the  
ignition propensity of cigarettes**

*Méthode d'essai normalisée pour évaluer le potentiel incendiaire des  
cigarettes*

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Published in Switzerland

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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 2.

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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12863 was prepared by Technical Committee ISO/TC 92, *Fire safety*, Subcommittee SC 1, *Fire initiation and growth*.

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## Introduction

A very common initiating event in a fatal fire is the dropping of a cigarette onto a bed or piece of upholstered furniture. The burning cigarette heats the furnishing materials to the point where smouldering combustion begins, perhaps followed by a transition to flaming combustion. Since limiting the frequency of ignitions is a principal approach to reducing fire loss, it is desirable to establish a test method for the propensity of a cigarette to ignite soft furnishings.

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# Standard test method for assessing the ignition propensity of cigarettes

**WARNING — This International Standard involves the use of combustible materials that are exposed to ignition sources. The burning materials emit toxic combustion products. The user shall take proper precautions to avoid thermal injury and inhalation of combustion products. The user shall ensure that all burning has ceased before safely discarding test materials.**

## 1 Scope

This International Standard provides a standard assessment of the capability of a cigarette, positioned on one of three standard substrates, to extinguish or to generate sufficient heat to continue burning, and thus potentially cause ignition of bedding or upholstered furniture. This International Standard is applicable to factory-made cigarettes that burn along the length of a tobacco column. This is a performance-based standard; it does not prescribe any design features of the cigarette that might lead to improved or degraded performance in the test method. The output of this method has been correlated with the potential for cigarettes to ignite upholstered furniture.

## 2 Normative references

The following referenced documents are indispensable for the application 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.

ASTM E2187, *Standard Test Method for Measuring the Ignition Strength of Cigarettes*

ISO 8243, *Cigarettes — Sampling*

ISO 13943, *Fire safety — Vocabulary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13943 and the following apply.

### 3.1

#### **determination**

single measurement involving a lit cigarette placed on a selected substrate

### 3.2

#### **full-length burn**

outcome of a determination in which the cigarette continues to burn to or past the front plane of the tipping paper (filter tip cigarettes) or past the tips of the metal pins for non-filter tip cigarettes

### 3.3

#### **no full-length burn**

outcome of a determination in which the cigarette ceases to burn before reaching the front plane of the tipping paper (filter tip cigarettes) or the tips of the metal pins for non-filter tip cigarettes

3.4

**substrate (for cigarette testing)**

horizontal surface consisting of layers of filter paper on which a test cigarette is placed for testing

3.5

**test**

set of 40 determinations

**4 General principle**

This test method measures the probability that a cigarette, placed on a heat absorbing substrate, will generate sufficient heat to maintain burning of the tobacco column and potentially initiate a fire. Each determination consists of placing a lit cigarette on one of three standard substrates (3, 10, or 15 layers of filter paper). Observation is made of whether or not the cigarette continues to burn nominally the length of the tobacco column, as defined in this International Standard. Forty determinations (comprising a test) are performed to obtain the relative probability that the cigarette will continue burning despite heat abstraction by the substrate.

**5 Apparatus**

**5.1 General description**

An apparatus consists of a holder for the filter paper substrate, a metal rim to compress the layers of filter paper, a clear enclosure to protect the test specimens from air currents, and associated accessories, as defined in this clause. The materials of construction shall meet occupational health and safety requirements. The apparatus shall be placed under a fume hood to minimize the exposure of personnel to combustion products. Technical drawings of the test chamber are provided in Annex A.

**5.2 Test and conditioning environment**

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**5.2.1 General**

Cigarettes and filter paper shall be conditioned in one of the two ways described in 5.2.2 and 5.2.3.

**5.2.2 Conditioning room**

An environmental conditioning room shall be maintained which provides an area adequate for conditioning both cigarettes and filter paper specimens. This room shall be capable of maintaining a relative humidity of  $(55 \pm 5) \%$  and a temperature of  $(23 \pm 3) ^\circ\text{C}$  and shall be continuously monitored. The room in which the tests are conducted, which may also be the conditioning room, shall be maintained within the same temperature and relative humidity ranges.

NOTE These conditioning requirements are consistent with those used for fire safety testing. Other types of testing can require different conditioning requirements.

**5.2.3 Conditioning box**

Alternatively, cigarettes and filter paper shall be stored in a box of sufficient size to hold the needed quantities of filter paper and cigarettes. The interior of the box shall be maintained at the same temperature and relative humidity conditions as in 5.2.2 and shall be continuously monitored. A tray containing a saturated solution of sodium bromide (NaBr) in water will provide the appropriate relative humidity when the box temperature is as prescribed. The box shall be located convenient to the test chamber such that test materials shall not be exposed to a non-conditioned environment for more than 5 min between their removal from the box and the beginning of a determination.

### 5.3 Test chamber

A rectangular test chamber with a chimney that can be placed under an exhaust hood (5.8) shall be constructed of clear, rigid material that allows observation of the entire determination.

NOTE Clear polymethylmethacrylate (PMMA) has been found suitable for this purpose.

The inside dimensions of the test chamber shall be: height  $(340 \pm 25)$  mm, width  $(292 \pm 6)$  mm and depth  $(394 \pm 6)$  mm. The full front panel of the chamber shall be hinged, with a latch to effect positive closure. The top of the chamber shall have a flattop cylindrical chimney of height  $(165 \pm 13)$  mm and inside diameter  $(152 \pm 6)$  mm. The chimney shall be centred on the chamber top and sealed to the chamber top panel. A sheet of rigid material shall be used to cover the chimney when required in the test procedure (Clause 9). The chamber shall be supported on four feet, located near each corner, each approximately 15 mm in height. Technical drawings of the test chamber are provided in Annex A.

### 5.4 Substrate holder

A cylindrical support for the layers of circular filter paper shall be made of rigid material.

NOTE Clear polymethylmethacrylate (PMMA) has been found suitable for this purpose.

The outer diameter of the substrate holder shall be  $(165 \pm 1)$  mm, the inner diameter shall be  $(127 \pm 1)$  mm, and the height shall be  $(50 \pm 1)$  mm. A recess in the top,  $(10 \pm 2,5)$  mm deep, shall expand the inner diameter to  $(152 \pm 1)$  mm. Three or four legs shall raise the bottom of the holder approximately  $(20 \pm 1)$  mm above the chamber floor. Technical drawings of the holder are provided in Annex A.

### 5.5 Metal rim

A circular metal rim, made of brass with a density of  $(8\,550 \pm 150)$  kg·m<sup>-3</sup> or other, equally dense material shall be used to hold the sheets of filter paper flat against each other. The outside diameter of the rim shall be  $(150 \pm 1)$  mm and shall not exceed the inner diameter of the recess in the substrate holder. The inner diameter shall be  $(130 \pm 2)$  mm. The thickness shall be  $(6,4 \pm 1)$  mm. The mass shall be between 235 g and 295 g. The rim surfaces shall be flat and smooth. A pair of parallel metal pins, each approximately 1 mm in diameter and whose inner distance is  $(8,1 \pm 0,5)$  mm apart, shall be located  $(3,2 \pm 0,05)$  mm from the bottom of the rim and shall protrude  $(17 \pm 1)$  mm toward the centre of the rim. The pins shall be spaced to prevent the non-ignited end of a conventional 25 mm circumference cigarette from rolling, but without pressuring the cigarette. If cigarettes of significantly different diameter are to be tested, other pairs of pins, appropriately spaced, shall be inserted into the rim. Technical drawings of the rim are provided in Annex A. Information on the placement of additional pins is provided in Annex B.

### 5.6 Cigarette holder

A holder shall be used to support the lit cigarette in a horizontal position in the test chamber prior to placement of the cigarette onto the substrate. The holder shall not clamp the cigarette or stress it in any other manner, nor shall it contact the cigarette within 30 mm of its lit end.

### 5.7 Cigarette ignition system

A system consisting of an air draw component and an ignition source shall be used to ignite the test cigarettes. The cigarette shall be supported in a horizontal position. A butane gas lighter capable of producing a stable, luminous flame or a hot element igniter shall be used for lighting the cigarette. The air flow and the draw time through the cigarette shall be sufficient to light the cigarette and continue the combustion to within  $\pm 1$  mm of the mark 5 mm from the original tip of the cigarette.

## 5.8 Exhaust hood

A chemical or canopy hood shall be used for removing combustion products from the test room. Air flow through the hood shall be sufficient to remove cigarette and substrate combustion products while not being high enough to influence the combustion processes in the test chamber(s). (See 6.3.)

## 6 Verification of test equipment

### 6.1 Frequency of verification

Verification of equipment shall be carried out as noted below and at any time when equipment or test conditions indicate that evaluation and re-calibration are necessary. The time intervals for verifications stated in this method shall be considered to be the minimum.

### 6.2 Examination for chamber leakage

The test chamber shall be checked before use to minimize air leakage so that the smoke plume from a cigarette rises undisturbed during testing. Door seals shall be checked visually to ensure that they are closed flush against the chamber's side wall and the latching device secures the door tightly. All construction seams shall be inspected to ensure they are airtight and no cracks shall be visible on any surface of the test chamber.

### 6.3 Stability of chamber atmosphere

The stability of the air inside the test chamber shall be determined by placing a lit cigarette in the test position on three or more layers of filter paper, then closing the chamber door. Air movement in the chamber shall be observed to ensure that smoke being emitted by the cigarette is rising vertically and is not showing turbulence within nominally 150 mm above the lit end of the cigarette. This operation shall be conducted prior to use on each day of testing.

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If turbulence is noted, then:

- a) the test chamber shall be checked for leaks;
- b) the test chamber locations shall be evaluated for excess air flow in the laboratory;
- c) the air flow of the exhaust system shall be evaluated as the source of the disturbance.

All sources of the turbulence shall be corrected prior to starting testing.

### 6.4 Humidity and temperature sensors

It shall be assured that the humidity and temperature sensors used to record environmental conditions in the test room, and the conditioning room or conditioning box are operating with the required accuracy. Temperature and humidity shall be validated by using sensors calibrated with a traceable standard. This shall be performed at least weekly unless otherwise prescribed.

**NOTE** An inaccurate sensor might lead to the rejection of all test data since the last verification of accuracy. One way to lessen this possibility is the use of two independent sensors for temperature and two independent sensors for relative humidity.

## 6.5 Test performance verification

A laboratory shall verify the performance of the total test system and operator, using a monitor test piece (cigarette) whose ignition propensity has been established using this International Standard or ASTM E2187<sup>1)</sup>.

NOTE The frequency of performance verification is determined by the quality control program implemented by the laboratory and also determined by any requirements imposed by e.g. clients and/or regulatory authorities. When the verification is sufficiently frequent and the analytical process is stable, all the test results between two valid verifications are assumed to be valid. By contrast, test results obtained during a period that begins with a valid check result and ends with a non-valid check result are regarded as non-valid, pending the outcome of further investigation. Thus, the frequency of verification is balanced between the magnitude of potentially lost data and the resources expended for verification.

## 7 Test specimens and standard substrate assemblies

### 7.1 Handling

Cigarette test specimens and filter paper substrates are sensitive to contamination and shall be handled to avoid any contamination. Test cigarettes shall be handled only by the last nominal 25 mm of the end of the cigarette that is not to be lit. The circular sheets of filter paper shall not be handled in the vicinity where the cigarette will contact the paper during a determination. In all cases, the materials shall be handled with dry hands only.

NOTE The use of clean, dry, non-powdered surgical gloves can mitigate incidental contamination of the test materials while maintaining operator dexterity.

### 7.2 Cigarettes

#### 7.2.1 Cigarette sampling

For each type of cigarette to be tested, the test specimens shall be representative of a population of cigarettes manufactured for sale. The sampling procedure shall be consistent with one of the methods for sampling, i.e. at the point of sale or at the factory, described in ISO 8243.

#### 7.2.2 Care in handling and storage

Cigarette test specimens shall be protected from physical or environmental damage while in handling and storage. It is important that the specimens not be crushed or deformed in any manner. Measures shall be taken to ensure that the specimens are not contaminated while in storage and they shall be protected from degradation by insects. If the specimens are to be stored by the testing laboratory for more than one week, they shall be placed in a freezer at 0 °C to –20 °C reserved for the sole protection of cigarette specimens to minimize the risk of contamination, deformation, or degradation.

#### 7.2.3 Markings

Prior to testing, cigarette test specimens shall be marked, using a soft graphite pencil or other marking device, (5 ± 1) mm and (15 ± 1) mm from the end of the cigarette that will be lit. These marks are used to establish the start (see 9.6) and completion (see 9.11) of a uniform pre-burn period, respectively. Therefore, the marks shall be placed such that they are visible during the test procedure, such as on the cigarette paper seam. Neither the marking of the cigarette nor the mark itself shall distort the cigarette or puncture the cigarette paper.

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1) Standard Reference Material 1082, a standardized cigarette that can be obtained from the (U.S.) National Institute of Standards and Technology, has been widely used for this purpose. Information regarding SRM 1082 can be found at: [https://www-s.nist.gov/srmors/view\\_detail.cfm?srn=1082](https://www-s.nist.gov/srmors/view_detail.cfm?srn=1082). This information is provided for the convenience of users of this document and does not constitute an endorsement by ISO.