PD ISO/TS 3550-3:2015

BSI Standards Publication

Cigarettes — Determination of loss of tobacco from the ends

Part 3: Method using a vibro-bench

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National foreword

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Cigarettes — Determination of loss of tobacco from the ends —

Part 3: Method using a vibro-bench

Cigarettes — Détermination de la perte de tabac par les extrémités — Partie 3: Méthode utilisant une plateforme vibrante

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Foreword

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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*.

ISO 3550 consists of the following parts, under the general title *Cigarettes — Determination of loss of tobacco from the ends*:

— *Part 1: Method using a rotating cylindrical cage*

— *Part 2: Method using a rotating cubic box (sismelatophore)*

— *Part 3: Method using a vibro-bench* [Technical Specification]

Introduction

The loss of tobacco from cigarette ends, which particularly affects short strands, is a nuisance for the industry, as well as for the consumer.

From this standpoint, the greater a cigarette's resistance to loss from its end, the higher its quality.

The devices available for measuring such loss of tobacco are based on the principle of mechanically vibrating cigarettes in a cigarette-containing tester.

ISO 3550–1 and ISO 3550–2 describe two particular types of device. The first, described in ISO 3550-1, comprises a rotating cylindrical cage through which tobacco is allowed to fall into a weighing vessel. The second, described in ISO 3550-2, uses a cubic box rotating around its main diagonal axis.

A third method, based on use of a vibro-bench, vibrating along the horizontal direction is described in this part of ISO 3550.

The first system (ISO 3550-1) principally permits determination of losses undergone by the cigarette during the manufacturing and packaging processes, while the second method (ISO 3550-2) can be used to estimate tobacco losses undergone throughout the distribution network and in the smoker's pocket.

The third method (ISO/TS 3550-3) is applicable to the determination of tobacco losses that the cigarette is likely to undergo throughout its lifecycle.

The three methods were designed for different application fields by using different simulation test devices with completely distinct mechanical structures, so the physical meanings of results given with three methods are different.

The absolute mean values between the three methods are not comparable and these methods cannot be substituted for one another, although there can be some correlation between them. Therefore, these methods are not mutually exclusive.

Cigarettes — Determination of loss of tobacco from the ends —

Part 3: Method using a vibro-bench

1 Scope

This part of ISO 3550, as Technical Specification, specifies a method for the determination of loss of tobacco from cigarette ends using a vibro-bench.

This method applies to the determination of loss of tobacco from cigarette ends in manufacturing site, throughout the distribution network and also while in the smoker's pocket.

NOTE Two other methods for the determination of loss of tobacco from the ends, using a rotating cylindrical cage and a cubic rotating box (sismelatophore), are described in ISO 3550-1 and ISO 3550-2, respectively.

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 2971, *Cigarettes and filter rods — Determination of nominal diameter — Method using a non-contact optical measuring apparatus*

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

ISO 8243, *Cigarettes — Sampling*

3 Principle

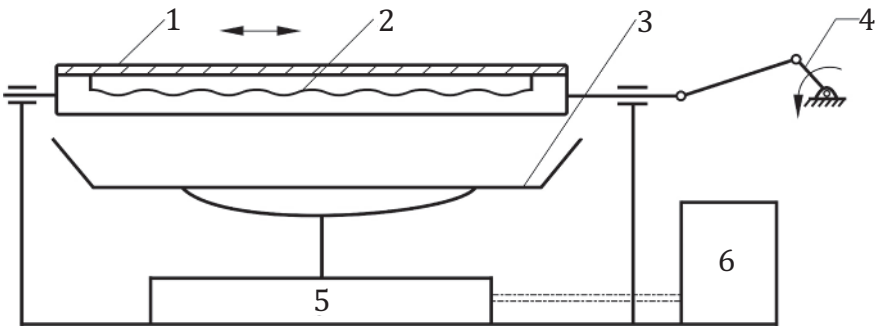
A test portion of a given number of cigarettes is placed in a vibro-bench, the longitudinal vertical section of which conforms to a cosine function. During the test, the vibro-bench reciprocates along the horizontal direction and the cigarettes vibrate inside the bench. The amount of tobacco that falls out from the open end(s) of the cigarettes is determined gravimetrically.

4 Apparatus

4.1 Conditioning chamber, capable of controlling the enclosed atmosphere in accordance with the requirements of ISO 3402.

4.2 Cigarette ends loss test unit, complying with the following requirements:

a) main part of the test unit shall consist of a vibro-bench, an actuating device, an analytical balance, control unit etc. See Figure 1 for a schematic diagram of the test unit;

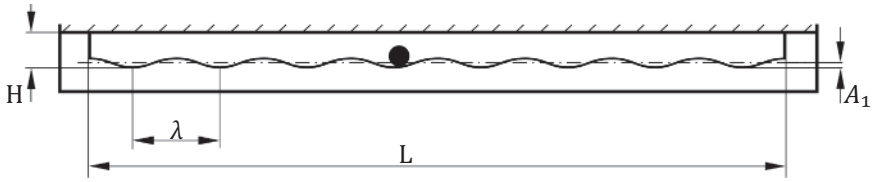


Key

1 cover
2 vibro-bench
3 tray
4 actuating device
5 analytical balance
6 control unit

Figure 1 — Schematic diagram of a tester

b) longitudinal vertical section of the vibro-bench is shown in Figure 2;



Key

L length of the vibro-bench, being equal to (208,0 ± 1,0) mm
H distance between the cover and the trough of the cosine function, being equal to (13,0 ± 0,5) mm

Figure 2 — Longitudinal vertical section of the vibro-bench

c) the longitudinal vertical section of the vibro-bench shall conform to a cosine function which is shown in Formula (1):

$$y = A_1 \cos \frac{2\pi}{\lambda} x \tag{1}$$

where

A_1 is the amplitude of the cosine function, being equal to (1,3 ± 0,1) mm;

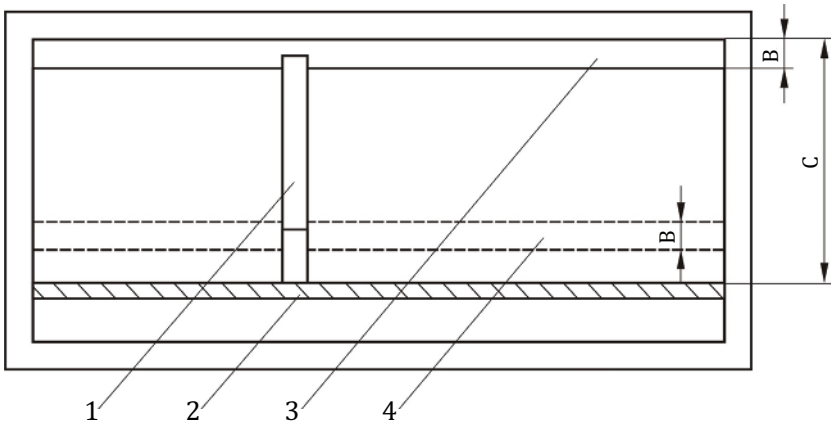
λ is the wavelength (the distance between each trough), being equal to (26,0 ± 0,2) mm;

x is the abscissa of the centreline of the waveform;

y is the ordinate corresponding to x;

d) vibro-bench is made of stainless steel with mirror polish surface;

e) top view of the vibro-bench is shown in Figure 3;



Key

1 cigarette
2 adjustable endplate
3 gap D
4 gap E (if present)
B gap width
C test area

Figure 3 — Top view of the vibro-bench

For plain cigarettes, the gap E of the same width shall be set at the opposite end of the gap D in test area.

B denotes the width of the gap, being equal to (10,0 ± 1,0) mm.

C denotes the effective width of the vibro-bench, being equal to the length of cigarette plus (5,0 ± 1,0) mm.

f) the vibro-bench reciprocates with the vibration frequency of (300 ± 1) times per minute, i.e. 5 Hz, and the vibration amplitude of (19,5 ± 0,5) mm. The vibro-bench will stop automatically when the specified number of vibrations is reached. For normal testing, the number of vibrations of (600 ± 1) is specified;

g) the tobacco which has fallen out of the cigarette ends is collected in the collection tray attached to the analytical weighing balance kept under the vibro-bench (see Figure 1). The tobacco thus collected is weighed accurately to 0,001 g after the vibration experiment is completed and results are stored in the control unit through a communication interface.

4.3 Device for the measurement of the diameter of the cigarettes, in accordance with ISO 2971.

4.4 Ruler with graduations in millimetres, to an accuracy of 0,5 mm.

4.5 Counting trays (optional), for filling a defined number of cigarettes for use as the test portion. The dimensions of the tray depend on the number of cigarettes in the test portion which, in turn, depends on the diameter. Annex B shows an example of a counting tray.

NOTE A counting tray is a useful device for selecting a defined number of cigarettes in a time-saving and error-free manner. The dimensions of the counting tray depend on the number of cigarettes and their diameter. The example given in Annex B is a counting tray for 20 cigarettes of 7,8 mm in diameter.

5 Sampling

Carry out sampling in accordance with appropriate procedures given in ISO 8243 where applicable or, by another procedure relevant to the purpose of the test. In the latter case, a reference to, or details of, the sampling procedure used shall be given in the test report, as appropriate.

6 Procedure

6.1 Conditioning of test sample

Place the test sample in the conditioning chamber (4.1) and condition the sample in accordance with ISO 3402.

6.2 Test portion

Select the number of cigarettes according to the measured diameter as specified in Table 1.

Table 1 — The number of cigarettes for one test portion

Diameter of the cigarettes tested (mm)	**Number of cigarettes for one test portion**
4,88 < D ≤ 5,03	31
5,03 < D ≤ 5,20	30
5,20 < D ≤ 5,37	29
5,37 < D ≤ 5,57	28
5,57 < D ≤ 5,77	27
5,77 < D ≤ 6,00	26
6,00 < D ≤ 6,24	25
6,24 < D ≤ 6,50	24
6,50 < D ≤ 6,78	23
6,78 < D ≤ 7,09	22
7,09 < D ≤ 7,42	21
7,42 < D ≤ 7,80	20
7,80 < D ≤ 8,21	19
8,21 < D ≤ 8,66	18
8,66 < D ≤ 9,17	17
9,17 < D ≤ 9,75	16
NOTE The analysis for calculation of the number of cigarettes is shown in Annex A.	

6.3 Determination

6.3.1 Testing to be carried out in the test atmosphere specified in ISO 3402.

6.3.2 Determine the mean length (l) of the cigarettes in the test portion using the ruler (4.4), set the adjustable end plate to give a distance (C) between the end faces of l + (5 ± 1) mm.

6.3.3 Determine the mean diameter (D) of the cigarettes to be tested to the nearest 0,001 mm in accordance with ISO 2971.

6.3.4 Place the test portion into the vibro-bench, the arrangement of which is shown in Figure 3.

6.3.5 Cover the vibro-bench, start the tester to carry out the test.

6.3.6 Once the vibro-bench stops after vibrating for (600 ± 1) times, weigh the tobacco collected in the collection tray attached to the analytical balance to the nearest 0,001 g.

6.3.7 Discard the tested cigarettes and tobacco collected in the collection tray.

6.3.8 The control unit calculates, displays, and prints the results.

7 Calculation of specific tobacco fallout values

7.1 End-related tobacco fallout

The mass of the end-related tobacco fallout, m_{LOE}, in milligrams per open end, is given by Formula (2):

$$m_{LOE} = \frac{m_L}{q \cdot q_{OE}} \tag{2}$$

where

m_L is the mass of fallout, in milligrams, related to the test portion;

q is the number of cigarettes in the test portion;

q_{OE} is the number of open ends per cigarettes.

NOTE q_{OE} is equal to 1 for filter cigarettes and 2 for plain cigarettes.

7.2 Area-related tobacco fallout

The mass of the area-related tobacco fallout, m_{LOA}, in milligrams per square centimetre of open end, is given by Formula (3):

$$m_{LOA} = \frac{m_L}{q \cdot A \cdot q_{OE}} \tag{3}$$

where

m_L is the mass of fallout, in milligrams, related to the test portion;

A is the area, in square centimetres, of one open end, to the nearest 0,01 cm^2;

q is the number of cigarettes in the test portion;

q_{OE} is the number of open ends per cigarettes.

NOTE q_{OE} is equal to 1 for filter cigarettes and 2 for plain cigarettes.

8 Test report

The test report shall include the following information:

— all information necessary for the complete identification of the tested sample(s);

— characteristic data of cigarettes (length, diameter, number of open ends);

— method and date of sampling;

— date of testing;

— number of cigarettes in the test sample;

— vibration frequency, amplitude, and times [if they differ from those specified in 4.2 f)];

— water content;

— number of single measuring results;

— mean value for the single measuring results;

— minimum and maximum value of single measuring results;

— standard deviation for the single measuring results if their number is >3;

— coefficient of variation for the single measuring results if their number is >3.

It shall also mention any operating conditions not specified in this part of ISO 3550, as well as any circumstances which might have influenced the results.

Annex A
(informative)

Analysis for the calculation of the number of cigarettes

The numbers of cigarettes (q) for the different diameters (D) were calculated from Formula (A.1):

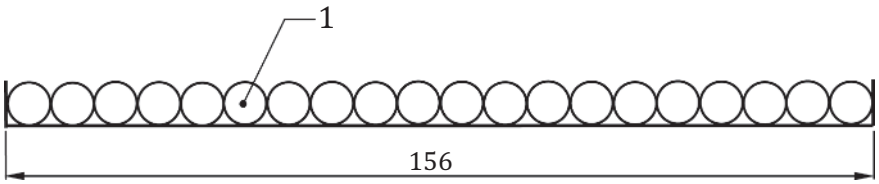
$$q = \mathrm{INT}\left(6\lambda / \mathrm{D}\right) \tag{A.1}$$

Formula (A.1) was obtained when the length of six times the wavelength was fully filled with a single layer of cigarettes. Take this number (q) as the number of cigarettes for one test portion. The calculated number was rounded down to the nearest integer.

Annex B
(informative)

Example of counting tray

Dimensions in millimetres



Key

1 20 cigarettes of 7,8 mm Ø

Figure B.1 — Diagram of counting tray

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