INTERNATIONAL STANDARD

ISO 3550-1

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Cigarettes — Determination of loss of tobacco from the ends —

Part 1:
Method using a rotating cylindrical cage

Cigarettes — Détermination de la perte de tabac par les extrémités —

Partie 1: Méthode utilisant une cage rotative cylindrique à barreaux

Reference number
ISO 3550-1:1997(E)

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.

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.

International Standard ISO 3550-1 was prepared by Technical Committee 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)*

Annex A forms an integral part of this part of ISO 3550. Annexes B and C are for information only.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

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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 ends, the higher its quality.

The measuring devices available are based on the rotation of a cigarette-containing device. This International Standard describes two particular types of device. The first, described in this part of ISO 3550, 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 about its main diagonal axis.

The first system principally permits determination of losses undergone by the cigarette during the manufacturing and packaging processes, and the second one losses undergone throughout the distribution network and in the smoker's pocket.

The two methods are not mutually exclusive and other acceptable methods exist which are based upon slightly different types of device.

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Cigarettes — Determination of loss of tobacco from the ends —

Part 1:
Method using a rotating cylindrical cage

1 Scope

This part of ISO 3550 specifies a method for the determination of loss of tobacco from cigarette ends using a rotating cylindrical cage.

It applies mainly to cigarettes sampled on the manufacturing site, before or after packaging.

NOTE — A method for the determination of loss of tobacco from the ends, using a cubic rotating box (sismelatophore), is described in ISO 3550-2.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 3550. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 3550 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2971:—[1], *Cigarettes and filters rods — Determination of nominal diameter — Method using the laser beam measuring device.*

ISO 3402:1991, *Tobacco and tobacco products — Atmosphere for conditioning and testing.*

ISO 6488:—[2], *Tobacco — Determination of water content — Karl Fischer method.*

ISO 8243:1991, *Cigarettes — Sampling.*

3 Principle

A test portion of a given number of cigarettes is placed in a cylinder (cage) of elliptical cross section, which is formed of closely spaced parallel rods. During the test the cage rotates around its horizontally positioned longitudinal axis and the cigarettes tumble in the cage.

The amount of tobacco fallout from the open ends of the cigarettes is determined.

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1 To be published. (Revision of ISO 2971:1987)
2 To be published. (Revision of ISO 6488:1981)

The test conditions depend on the size and shape of the cage, the diameter and the spacing of the rods, the rotational speed of the cage, the number of revolutions per test, and the number of cigarettes per test portion which in turn depends on the diameter of the cigarettes.

As a first result of the test, the mass m_L of tobacco falling from the test portion is determined. From this mass and the physical dimensions of the test cigarette, the loss of tobacco per open end and per unit cross-section of open end is determined.

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 tester, complying with the following requirements.

a) The main part of the tester shall consist of a cage having an elliptical cross section formed from a number of round stainless-steel rods. The spacing between adjacent rods shall be smaller than the diameter of the cigarettes to be tested but wide enough for any strands of tobacco lost from the test portion during a test to fall through. The positioning of the rods and their spacing shall be as detailed in annex A.

b) Bearings shall be provided at the centre point of each elliptical end face to enable the cage to be held horizontally and allowing it be rotated about its longitudinal axis.

c) To permit tests to be carried out simultaneously on more than one test portion or on test portions from different samples, the cage may be equipped with one or more dividers along its length so as to create several test compartments.

d) Each test compartment shall be equipped with one movable end plate in addition to its fixed end face, so that the effective length of the compartment can be adjusted to match the length of the cigarettes under test.

e) Each test compartment shall be provided with means of opening to allow for loading and unloading of its test portion and with a removable pan arranged beneath it to collect all of the tobacco which falls out from the ends of the cigarettes during the test.

f) The tester shall be equipped with a drive system capable of rotating the cage and its contents at a rotational speed of 90 r/min ± 1 r/min. The drive system shall be controlled by a preset counter that stops the rotation of the cage automatically when the specified number of revolutions is reached. For normal testing, 270 revolutions is specified.

See figure 1 for a schematic diagram of a tester.

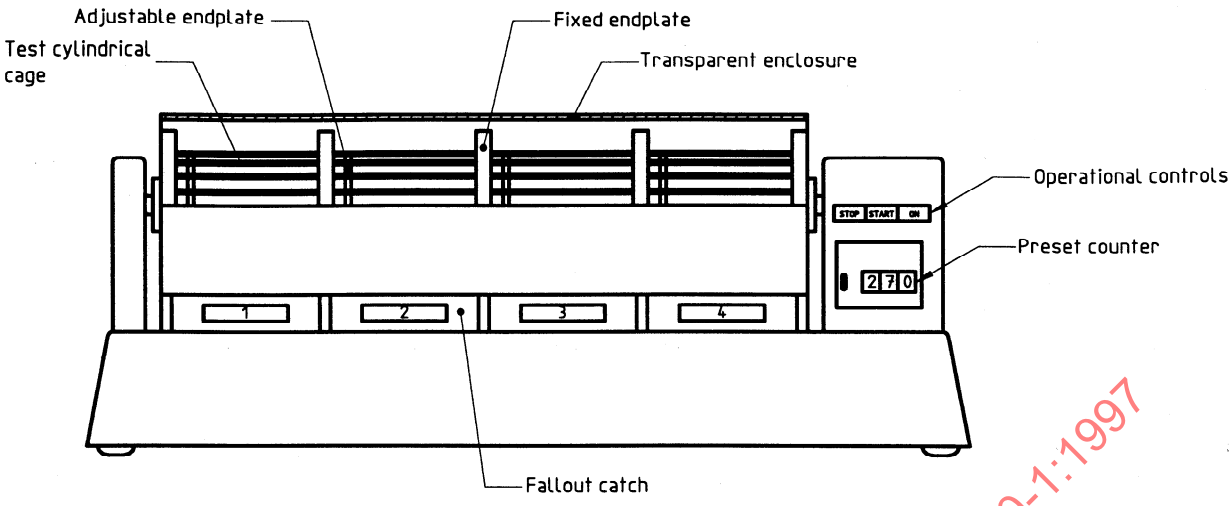

Figure 1 — Practical tester layout

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

4.4 Analytical balance, capable of weighing to an accuracy of ± 0,000 1 g.

4.5 Ruler, with graduations in millimetres.

4.6 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 C 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 C is a counting tray for 50 cigarettes of 8,0 mm diameter.

5 Sampling

Carry out sampling in accordance with one of the procedures given in ISO 8243 where applicable or, if not, by a procedure relevant to the aim of the test. In the latter case, an appropriate reference to, or details of, the sampling procedure used shall be given in the test report.

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 Determination of water content

Take a test portion from the test sample conditioned as specified in 6.1 and determine the water content in accordance with ISO 6488.

NOTE — Although the water content is not used when calculating the loss of tobacco from cigarette ends, it may affect the results considerably. The water content should, therefore, be determined and reported.

6.3 Preparation for the test

6.3.1 Determine the mean diameter of the cigarettes to be tested to the nearest 0,01 mm in accordance with ISO 2971 and also their mean length (l), to the nearest 0,5 mm using the ruler (4.5).

6.3.2 As the test portion, select from the conditioned test sample the number of cigarettes specified in table 1 for the measured diameter.

6.3.3 Set the adjustable end plate(s) of the test compartment(s) to give a distance between the end faces of $l + (5 \pm 1)$ mm.

6.3.4 Check that the fallout pans are clean and weigh them to the nearest 0,001 g.

6.4 Determination

6.4.1 Operate in the test atmosphere specified in ISO 3402.

6.4.2 Taking care to avoid damage to the cigarettes, transfer the test portion(s) to the test compartment(s).

6.4.3 Close the test compartment(s) and the cover of the tester, reset the counter and start the test.

6.4.4 Once the drive stops after 270 revolutions, remove the fallout pans and weigh them again to the nearest 0,001 g. Calculate the fallout quantity for each test portion. Discard the cigarettes tested.

6.4.5 Repeat the test 5 to 10 times depending on the accuracy desired.

Table 1

Diameter of the cigarettes tested (mm)	Number of cigarettes for one test portion
5,00	128
5,10	123
5,20	118
5,30	114
5,40	110
5,50	106
5,60	102
5,70	98
5,80	95
5,90	92
6,00	89
6,10	86
6,20	83
6,30	80
6,40	78
6,50	76
6,60	73
6,70	71
6,80	69
6,90	67
7,00	65
7,10	63
7,20	61
7,30	60
7,40	58
7,50	57
7,60	55
7,70	54
7,80	52
7,90	51
8,00	50
8,10	48
8,20	47
8,30	46
8,40	45
8,50	44
8,60	43
8,70	42
8,80	41
8,90	40
9,00	39

NOTE — See in annex B the regression analysis for calculation of the number of cigarettes.

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

$$m_{LOE} = \frac{m_L}{q.q_{OE}}$$

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

$$m_{LOA} = \frac{m_L}{q.A.q_{OE}}$$

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 cm²;

q is the number of cigarettes in the test portion;

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

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 ;
- rotation speed and number of revolutions [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 may have influenced the results.

Annex A
(normative)

Criteria for cigarette ends loss tester

A.1 Rotation speed

The rotational speed [see 4.2 f)] of the test cage is specified to be 90 r/min ± 1 r/min.
If a different rotation speed is used, it shall be stated in the test report.

A.2 Number of revolutions

The number of revolutions per test [see 4.2 f)] is specified to be 270.
If a different number of revolutions is used, it shall be stated in the test report.

A.3 Test cage

The test cage is formed by 44 rods of stainless steel with a diameter of 3 mm ± 0,05 mm.
The centres of the rods are located on an ellipse that satisfies the following function, shown in figure A.1:

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

where

a = 54,0 mm
b = 36,5 mm

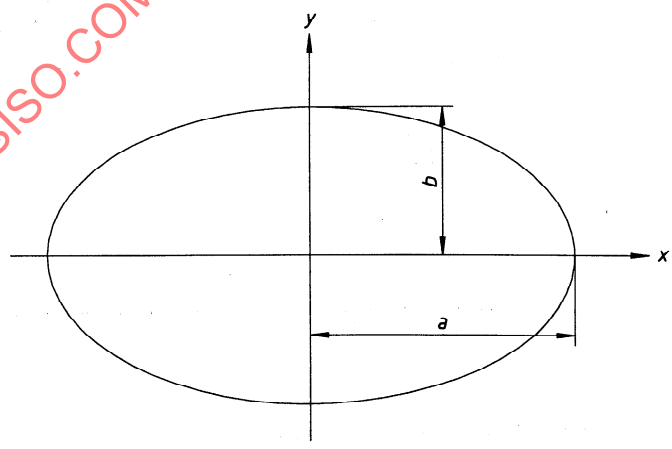

Figure A.1

The clearance between the rods is 3,5 mm.

The theoretical location of the centre of the rods is identified by the cartesian coordinates X_n and Y_n as given in table A.1 and shown in figure A.2.

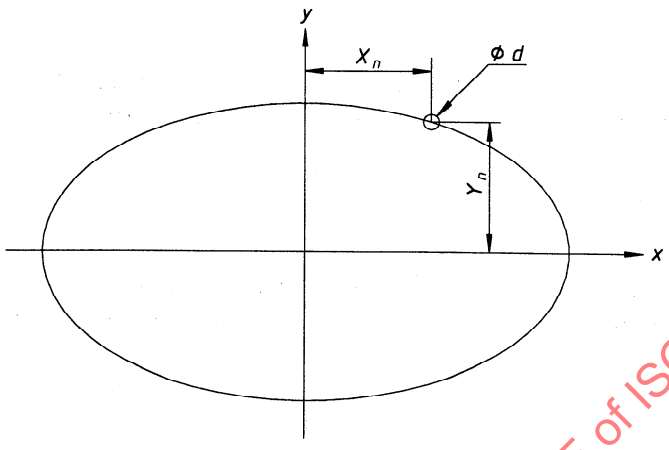

Figure A.2

Table A.1 — Theoretical rod positions

n	$\pm X_n$ mm	$\pm Y_n$ mm
1	3,258	36,434
2	9,752	35,900
3	16,178	34,824
4	22,484	33,186
5	28,607	30,957
6	34,463	28,100
7	39,937	24,567
8	44,869	20,309
9	49,030	15,295
10	52,116	9,556
11	53,784	3,258

In practice, the deviation from these points shall not exceed 0,3 mm.