



**International
Standard**

ISO 4906

**Tobacco and tobacco products —
Determination of filling power for
preparation of fine-cut smoking
articles — Constant-weight
pressurization**

*Tabac et produits du tabac — Détermination du pouvoir de
remplissage pour la préparation d'objets à fumer en tabac à
rouler — Pressurisation à poids constant*

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Foreword

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This document was prepared by Technical Committee ISO/TC 126, *Tobacco and tobacco products*, Subcommittee SC 1, *Physical and dimensional tests*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The filling power reflects the volume occupied by a unit mass of fine-cut tobacco kept under certain load for a specified duration. It is an important physical characteristics of fine-cut tobacco due to its influence on the fine-cut smoking articles (FCSAs) manufacturing process, final product quality and tobacco utilization. Therefore, there is a necessity to develop an international standard to determine the filling power of fine-cut tobacco. This document fulfils that need.

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Tobacco and tobacco products — Determination of filling power for preparation of fine-cut smoking articles — Constant-weight pressurization

1 Scope

This document specifies a method for the determination of the filling power of the tobacco used for fine-cut tobacco smoking articles.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 6488, *Tobacco and tobacco products — Determination of water content — Karl Fischer method*

ISO 15592-1, *Fine-cut tobacco and smoking articles made from it — Methods of sampling, conditioning and analysis — Part 1: Sampling*

ISO 15592-2, *Fine-cut tobacco and smoking articles made from it — Methods of sampling, conditioning and analysis — Part 2: Atmosphere for conditioning and testing*

ISO 16632, *Tobacco and tobacco products — Determination of water content — Gas-chromatographic method*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 fine-cut tobacco FCT

tobacco produced to be used by consumers for making their own smoking articles

[SOURCE: ISO 15592-1:2001, 3.1]

3.2 fine-cut smoking article FCSA

article, suitable for smoking, produced by combining fine-cut tobacco with a wrapper

[SOURCE: ISO 15592-1:2001, 3.3]

3.3 filling power

measure of the volume occupied by a given mass of fine-cut tobacco when a given pressure is applied

[SOURCE: ISO 15592-3:2022, 3.1.17]

3.4

laboratory fine-cut tobacco sample

sample of *fine-cut tobacco* (3.1) intended for laboratory inspection or testing and which is representative of the gross sample or the sub-period sample.

[SOURCE: ISO 15592-3:2022, 3.1.10]

3.5

test sample

fine-cut tobacco (3.1) for test taken from the *laboratory fine-cut tobacco sample* (3.4) and which are representative of the laboratory fine-cut tobacco sample

[SOURCE: ISO 15592-3:2022, 3.1.13, modified — "laboratory fine-cut smoking articles" was replaced by "laboratory fine-cut tobacco sample"]

3.6

test portion

fine-cut tobacco (3.1) for a single determination and which is taken at random from the *test sample* (3.5)

[SOURCE: ISO 15592-3:2022, 3.1.14, modified — "fine-cut smoking articles" was replaced by "fine-cut tobacco"]

4 Principle

Place a certain mass of fine-cut tobacco in a measuring cylinder and determine the volume of the fine-cut tobacco after it has been exposed to a certain pressure (load) for a defined time.

5 Apparatus

5.1 Filling power tester, for fine-cut tobacco which shall meet the following conditions:

EXAMPLE Borgwaldt DD60A, Borgwaldt (Koerber) D61A2 and Zhengzhou GaTech Instruments Co., Ltd. YGD560¹⁾

5.1.1 measuring cylinder: cylindrical with smooth and clean inner wall, having inner diameter (60,0 ± 0,1) mm and height not less than 100 mm;

5.1.2 measuring/loading head: cylindrical with smooth and clean surface, having internal diameter from (55,0 ± 0,1) mm to (57,0 ± 0,1) mm and capable of applying uniform load on the test sample placed in the measuring cylinder (5.1.1);

5.1.3 lowering speed until measuring head touches the sample: (19 ± 1) mm/s;

5.1.4 height sensor: capable of measuring the column height of the sample, accurate to 0,01 mm and a repeated measurement error of not more than 0,03 mm;

5.1.5 loading timer: with an accuracy of ±0,5 s, resolution of 1 s or better, and be able to meet the requirements of (30,0 ± 0,5) s (see 7.3);

5.1.6 load to apply pressure: 20 N.

5.2 Balance: with a resolution of 0,01 g or better.

1) Borgwaldt DD60A, Borgwaldt (Koerber) D61A2 and Zhengzhou GaTech Instruments Co., Ltd. YGD560 are examples of suitable products available commercially. This information is provided for the convenience of this document and does not constitute an endorsement by ISO of the product name.

5.3 Height gauge block: for the calibration of the height sensor, with a height known to an accuracy of 0,01 mm or better.

6 Sampling and sample processing

6.1 Sampling shall be carried out according to ISO 15592-1.

6.2 The laboratory fine-cut tobacco sample shall not be less than 500 g, and shall be conditioned according to ISO 15592-2 before testing.

6.3 Water content (as a mass fraction) of the conditioned sample shall be determined in accordance with ISO 6488 or ISO 16632.

6.4 Spread out the conditioned sample as a square of about (40 × 40) cm and divide the sample evenly into four parts by the diagonals of the square, take two opposite parts, and then the two parts chosen shall be further reduced by repeating the process once to obtain the test sample.

6.5 The test sample shall be stored in the conditioning atmosphere or packed in sealed container for storing in the test atmosphere.

7 Testing procedure

7.1 The test atmosphere shall conform to the requirements of ISO 15592-2.

7.2 Switch on the power supply of the tester (5.1), calibrate the height sensor (5.1.4) using the height gauge block (5.3).

7.3 Set the loading time to 30,0 s.

7.4 Weigh out a test portion (10,0 ~ 15,0) g accurately to the nearest 0,01 g from the test sample (6.4), transfer it in the measuring cylinder (5.1.1) and spread the top layer evenly.

7.5 Lower (5.1.3) the measuring head (5.1.2) onto the sample in the measuring cylinder (5.1.1) till the head just touches the sample. Then the load is applied for 30 s.

7.6 Record the resultant height of the compressed sample column using the height sensor (5.1.4) immediately at the end of the loading time.

7.7 Remove the test portion from the measuring cylinder.

7.8 Repeat steps from 7.4 to 7.7 for testing other four test portions from the same test sample (7.4).

8 Calculation of filling power

8.1 The filling power obtained from a single determination is calculated by Formula (1).

$$P_F = \frac{\pi r^2 h}{m} \quad (1)$$

where

- P_F is filling power, in cm³/g;
- r is radius inside the measuring cylinder, in cm;
- h is height of the sample column after loading, in cm;
- m is mass of the sample, in g.

The individual results from the five determinations are reported to 0,01 cm³/g.

8.2 The final result is the arithmetic average of five determinations and is calculated according to [Formula \(2\)](#).

$$\overline{P_F} = \sum_{i=1}^5 P_{F,i} / 5 \quad (2)$$

where

- $\overline{P_F}$ is the arithmetic average of five determinations of filling power in cm³/g;
- $P_{F,i}$ is the filling power from a single determination in cm³/g.

The average filling power is reported to 0,01 cm³/g.

8.3 Coefficient of variation is calculated by [Formula \(3\)](#).

$$CV(\%) = \left\{ \frac{\left[\sum_{i=1}^5 (P_{F,i} - \overline{P_F})^2 / 4 \right]^{\frac{1}{2}}}{\overline{P_F}} \right\} \times 100 \quad (3)$$

The CV is reported to 0,1 %.

9 Repeatability and reproducibility

A collaborative study was conducted in 2022 involving 11 laboratories and 3 types of fine-cut tobacco samples, including non-expanded tobacco (A), expanded tobacco (B) and mixture of expanded and non-expanded tobacco (C). All samples were a blend of fire-cured, air-cured and flue-cured tobaccos. Data analysis for the three fine-cut tobacco samples gave estimates for the repeatability limit r and the reproducibility limit R as shown in [Table 1](#). The statistical evaluation was performed according to ISO 5725-5 without eliminating any outlying data.

Table 1 — Results overview of filling power

Sample	Mean cm ³ /g	Number of labs	r	R	r %	R %
A	3,52	11	0,053	0,232	1,5	6,6
B	5,03	11	0,080	0,236	1,6	4,7
C	4,42	11	0,080	0,261	1,8	5,9

10 Test report

The test report shall include the following:

- Identification of the sample as received;
- Date of test;
- Test atmosphere (relative humidity in %, temperature in °C);
- Water content of conditioned sample (expressed as mass fraction);
- Size of measuring head
- Average, maximum, minimum, coefficient of variation and number of the determinations of filling power.

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