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Tissue paper and tissue products —

Part 6: Determination of grammage

Papier tissue et produits tissue —

Partie 6: Détermination du grammage

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Contents

Page

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by the European Committee Standardization (CEN) Technical Committee CEN/TC 172, *Pulp, paper and board*, in collaboration with ISO Technical Committee TC 6, *Paper, board and pulps*, Subcommittee SC 2, *Test methods and quality specifications for paper and board*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 12625-6:2005), which has been technically revised with the following changes:

a) a new subclause, 8.3, has been added;

b) formulae were added to clarify Clause 10;

c) in Annex A, the precision data has been updated;

d) this document has been editorially updated.

A list of all parts in the ISO 12625 series can be found on the ISO website.

Tissue paper and tissue products —

Part 6:
Determination of grammage

1 Scope

This document specifies a test method for the determination of grammage of tissue paper and tissue products.

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 186, *Paper and board — Sampling to determine average quality*

ISO 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

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:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
grammage
g
mass of a unit area of tissue paper or tissue product as determined by the procedure in this document

Note 1 to entry: Grammage is expressed in grams per square metre (g/m^2).

4 Principle

The mass and area of a test piece or test pieces of either a tissue paper or a tissue product is measured and the grammage is calculated as the mass per unit area of the test pieces taken. For finished paper products, the grammage may also be calculated from the mass and area of a specified number of the finished tissue product items. Precision data are available in Annex A.

5 Apparatus

5.1 General

The balance shall be placed on a horizontal surface free from externally induced vibrations.

5.2 Cutting device

The cutting device shall be capable of repeatedly cleanly cutting test pieces of the same nominal size, whose area falls within ±1,0 % of a known area. This shall be checked frequently by measurement and, provided that the above accuracy is attained, the mean area obtained in these checks shall be used for calculating grammage.

With certain types of tissue paper and tissue product, it will be found, after carrying out this determination of area, that test pieces cannot be cut with the accuracy just defined. In such instances, the area of every test piece shall be determined individually.

5.3 Balance

The device to determine the balance shall have a measuring accuracy of 0,001 g.

5.4 Length measurement device

The length measurement device shall be a ruler, an electronic digital ruler, a scanner or any other device with a minimum measuring accuracy of 0,5 mm.

6 Sampling

If the tests are being made to evaluate a lot, the sample shall be selected in accordance with ISO 186.

If the tests are being made on another type of sample, make sure that all specimens taken are representative of the sample. Each test piece shall be free from perforations and faults not normally inherent in the tissue.

7 Conditioning

Condition the samples according to ISO 187 and keep them in the standard atmosphere throughout the test.

Conditioning shall be done prior to the preparation of test pieces.

8 Preparation of test pieces

8.1 General

Test pieces shall be free from areas containing creases, dirt or visible damage. Test pieces shall be made of either areas cut from specimens of tissue paper or tissue products (see 8.2), or made of whole finished products (see 8.3).

8.2 Cutting of the test pieces

8.2.1 General

In the case where test pieces are cut from specimens of tissue paper or tissue products, the test sheet or stack of superimposed test sheets can be placed between two supporting sheets of paper, such as office copy paper, in order to obtain test pieces with clean cut edges and dimensions of the accuracy specified.

8.2.2 Size of test pieces

Since tissue paper and tissue products vary greatly in dimensions, it is only possible to give general guidance regarding the dimension of the test piece or test pieces.

The minimum area of an individual test piece shall be at least 100 cm^2. One test piece may, if necessary, be composed of several smaller pieces.

8.2.3 Number of test pieces

Using the cutting device (5.2), cut at least 10 test pieces. The mass of a minimum area of 1 000 cm^2 shall be determined, and convenient larger areas shall be taken in compliance with the provisions of this document.

8.3 Uncut finished products

8.3.1 General

In the case where test pieces are composed of finished tissue products, test pieces shall lie unfolded and flat with no tension applied.

If a scanner is used for this measurement, ensure that the scanner-cover is sufficient in size to cause the item to lie flat.

If a ruler is used, it shall be of dimensions larger than the test piece.

8.3.2 Size of test pieces

Since tissue paper and tissue products vary greatly in dimensions, it is only possible to give general guidance regarding the dimension of the test piece or test pieces.

Using a measuring device (5.4) as described, the minimum area of an individual test piece shall be at least 100 cm^2. One test piece may, if necessary, be composed of several smaller pieces.

8.3.3 Number of test pieces

The minimum number of test pieces shall be 10. The mass of a minimum area of 1 000 cm^2 shall be determined, and convenient larger areas shall be taken in compliance with the provisions of this document.

The 10 or more test pieces (finished product items) shall be selected from the sample in a random manner so as to represent variation in size and mass of the finished product item present in the sample. In any case, sequential finished product units shall never be tested, except in cases where the sample is very limited in quantity.

9 Procedure

9.1 Determination of the mass of the test pieces

Determine the mass of each test piece on the balance (5.3) to the nearest 0,001 g.

It is recommended, especially when dealing with small test pieces, that touching the test pieces with bare hands is avoided.

If the standard deviation is not needed, the total mass of all 10 or more test pieces may be determined by weighing all test pieces together.

Any deviation from the procedure described above shall be explicitly mentioned in the test report.

9.2 Determination of the area of the test pieces

9.2.1 When test pieces have been cut to specified dimensions as described in 8.2, determine the area of each individual test piece.

9.2.2 For the determination of grammage on finished paper products, the total area shall be measured to an accuracy of better than 1 % using a measuring device (5.4) as described.

When the test pieces are measured, they shall lie unfolded and flat with no tension applied.

If a scanner is used for this measurement, closing the scan cover is usually sufficient to cause the item to lie flat. Likewise, placing a steel rule along the edge is usually sufficient. Where a digital ruler is used, the finished product should be flattened using a flat piece of plastic approximately 4 mm thick, of dimensions larger than the test piece, or a similar flattening means.

9.2.3 Any deviation from the procedure described above shall be explicitly mentioned in the test report.

10 Calculation

10.1 General

Calculate the grammage to three significant figures for each test piece using Formula (1):

$$g = \frac{m}{A} \times 10^6 \tag{1}$$

where

g is the grammage of the test piece, in grams per square metre;

m is the mass of the test piece, in grams;

A is the area of the test piece, in square millimetres.

10.2 Mean and standard deviation of grammage

Calculate the mean grammage of the sample and express it to three significant figures using Formula (2):

$$\bar{g} = \frac{\sum_{i=1}^{n} g_i}{n} \tag{2}$$

where

$\bar{g}$ is the mean grammage of the sample, in grams per square metre;

g_i is the grammage of the test piece, *i*, in grams per square metre;

n is the number of the test pieces.

Calculate the standard deviation and express it to two significant figures using Formula (3):

$$s = \sqrt{\frac{\sum_{i=1}^{n} (g_i - \bar{g})^2}{n-1}} \tag{3}$$

where

$\bar{g}$ is the mean grammage of the sample, in grams per square metre;

g_i is the grammage of the test piece, *i*, in grams per square metre;

n is the number of test pieces;

s is the sample standard deviation.

If test pieces are weighed together, calculate the grammage using Formula (4):

$$g_i = \frac{\sum_{i=1}^{n} m_i}{n \times A} \times 10^6 \tag{4}$$

where

g_i is the grammage of the test piece, *i*, in grams per square metre;

n is the number of test pieces;

m is the mass of the test piece in grams;

A is the area of each test piece, in square millimetres, where test piece areas are exactly equal (see 5.4).

11 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 12625-6;

b) the date and place of testing;

c) the description and identification of the sample, such as the product category and dimensions under test;

d) the grammage, in grams per square metre, rounded to the first decimal place, number of single values, standard deviation reported to two significant figures and coefficient of variation, reported to two significant figures;

e) whether the test pieces are weighed together or not (if they are weighed together, the standard deviation and coefficient of variation cannot be calculated);

f) any deviation from this document and any other circumstances that may have affected the test results;

g) the conditioning atmosphere used.

Annex A
(informative)

Precision

A.1 General

In March 2015, an international round-robin was performed with eight tissue papers and tissue products by eight different laboratories according to this document. Three of the assessed converted products were measured with both methods described in this document (determination on cut test pieces and uncut test pieces).

The results are presented in Table A.1 to Table A.4.

The calculations were made according to ISO/TR 24498[4] and TAPPI T 1200 sp-07[5].

The repeatability standard deviation reported in Table A.1 is the "pooled" repeatability standard deviation, that is, the standard deviation is calculated as the root-mean-square of the standard deviations of the participating laboratories. This differs from the conventional definition of repeatability in ISO 5725-1[2].

The repeatability and reproducibility limits reported are estimates of the maximum difference which should be expected in 19 of 20 instances, when comparing two test results for material similar to those described under similar test conditions. These estimates may not be valid for different materials or different test conditions.

NOTE 1 The repeatability standard deviation and the within-laboratory standard deviation are identical. However, the reproducibility standard deviation is not the same as between-laboratories standard deviation. The reproducibility standard deviation includes both the between-laboratories standard deviation and the standard deviation within a laboratory, viz.:

$$s^2_{repeatability} = s^2_{within\,lab}$$

but

$$s^2_{reproducibility} = s^2_{within\,lab} + s^2_{between\,lab}$$

NOTE 2 $2{,}77 = 1{,}96\ \sqrt{2}$, provided that the test results have a normal distribution and that the standard deviation, s, is based on a large number of tests.

A.2 Measurement on cut test pieces

Half of the participating laboratories used manual cutters and half used automated punches.

Table A.1 — Estimation of repeatability on cut test pieces

Sample	Number of laboratories	Mean basis weight g/m²	Repeatability standard deviation s_r g/m²	Coefficient of variation $C_{V,r}$ %	Repeatability limit r g/m²
toilet-4-ply virgin	8	62,9	0,49	0,78	1,4
hanky-3-ply virgin	8	61,8	0,37	0,59	1,0
base sheet 1 ply virgin	8	17,6	0,36	2,0	1,0
towel-2-ply virgin	8	41,6	0,33	0,80	0,92
hanky-4-ply virgin	8	58,2	0,53	0,91	1,5
toilet-2-ply virgin	7[a]	38,7	0,41	1,1	1,1
napkin-3-ply virgin	8	49,7	0,59	1,2	1,6
toilet-3-ply recycled	7[a]	48,9	0,36	0,75	1,0

[a] One outlier.

Table A.2 — Estimation of reproducibility on cut test pieces

Sample	Number of laboratories	Mean basis weight g/m²	Reproducibility standard deviation s_R g/m²	Coefficient of variation $C_{V,R}$ %	Reproducibility limit R g/m²
toilet-4-ply virgin	8	62,9	0,66	1,1	1,8
hanky-3-ply virgin	8	61,8	0,62	1,0	1,7
base sheet 1 ply virgin	8	17,6	0,45	2,6	1,3
towel-2-ply virgin	8	41,6	0,42	1,0	1,2
hanky-4-ply virgin	8	58,2	0,75	1,3	2,1
toilet-2-ply virgin	7[a]	38,7	0,41	1,1	1,1
napkin-3-ply virgin	8	49,7	0,60	1,2	1,7
toilet-3-ply recycled	7[a]	48,9	0,39	0,80	1,1

[a] One outlier.

A.3 Measurement on uncut test pieces

Three finished products have been assessed with the two procedures. In Table A.3 and Table A4, test pieces are made of the unfolded finished products.