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Tissue paper and tissue products —

Part 12: **Determination of tensile strength of perforated lines — Calculation of perforation efficiency**

Papier tissue et produits tissues —

Partie 12: Détermination de la résistance à la rupture par traction de perforations — Calcul de l'efficacité des perforations

ICS 85.060

ISO/CEN PARALLEL ENQUIRY

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Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

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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.

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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 12625-12 was prepared by European Committee for Standardization (CEN) Technical Committee CEN/TC 172 *Pulp, paper and board* in collaboration with Technical Committee ISO/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).

ISO 12625 consists of the following parts, under the general title Tissue paper and tissue products:

— *Part 1: General guidance on terms;*

— *Part 3: Determination of thickness, bulking thickness and apparent bulk density;*

— *Part 4: Determination of tensile strength, stretch at break and tensile energy absorption;*

— *Part 5: Determination of wet tensile strength;*

— *Part 6: Determination of grammage;*

— *Part 7: Determination of optical properties;*

— *Part 8: Water-absorption time and water-absorption capacity; basket-immersion test method;*

— *Part 9: Determination of ball burst strength;*

— *Part 10: Determination of demand water absorption rate and –capacity; controlled hydraulic pressure;*

— *Part 12: Determination of tensile strength of perforated lines — Calculation of perforation efficiency.*

Introduction

Tissue papers such as toilet paper and kitchen towel are often pre-cut. They are used after separation of two consecutive sheets.

Papermakers must know the efficiency of the perforations performed.

Perforation strength shall be enough to ensure the product cohesion, but not too high to enable an easy separation of sheets.

Regarding the type of tissue product, forces may be applied perpendicular to the perforation lines, or in the direction of the perforation lines.

This International Standard has been prepared by harmonising those Standards applicable to tissue paper and tissue products currently in use. It specifies a procedure to determine perforation efficiency based on the method developed in ISO 12625-4 for the determination of the tensile strength of tissue paper and tissue products.

Tissue paper and tissue products —

Part 12:
Determination of tensile strength of perforated lines — Calculation of perforation efficiency

1 Scope

This part of ISO 12625 specifies a test method for the determination of tensile strength of perforated lines of tissue paper. It uses a tensile-testing apparatus operating with a constant rate of elongation.

The calculation of perforation efficiency is also specified in this document.

It is expressly stated that the detection of impurities and contraries in tissue paper and tissue products should be applied according to ISO 15755.

For the determination of moisture content in tissue paper and tissue products, ISO 287 should be applied.

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.

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*

ISO 536, *Paper and board — Determination of grammage*

ISO 1924-2, *Paper and board — Determination of tensile properties — Part 2: Constant rate of elongation method (20 mm/min)*

ISO 7500-1, *Metallic materials — Verification of uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

ISO 12625-1, *Tissue paper and tissue products — Part 1: General guidance on terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12625-1 and the following apply.

3.1
tensile strength
maximum tensile force per unit width that a test piece will withstand before breaking in a tensile test

3.2
perforation efficiency
difference between tensile strength performed on a non perforated test piece and a perforated test piece of the same sample, divided by the tensile strength determined on a non perforated test piece, expressed as a percentage

4 Principle

A perforated test piece of tissue paper or tissue product, of given dimensions, is stretched to break in machine direction at a constant rate of elongation using a tensile-testing apparatus that measures and records the tensile force as a function of the elongation of the test piece.

From the recorded data, the tensile strength is calculated.

In order to determine perforation efficiency, measurements are performed both on perforated tissue paper and on non perforated tissue product.

5 Apparatus

5.1 Tensile-testing apparatus

The tensile-testing apparatus shall be in accordance with ISO 1924-2. It is capable of stretching a test piece of tissue paper or tissue product of given dimensions, at a constant rate of elongation of (50 ± 2) mm/min, and recording the tensile force as a function of elongation on a strip chart recorder or any equivalent device.

The elongation shall be recorded to an accuracy of ± 0,1 mm. The measurement of the elongation shall start at a tension of (5 ± 1) N/m.

The force-measuring system shall measure loads with an accuracy of ± 1 % of the reading or ± 0,05 N, whichever is the greater. It shall be calibrated and verified in accordance with the requirements of ISO 7500-1.

5.1.1 Means for measuring the area of the force elongation curve

The tensile-testing apparatus shall provide a means for measuring the area between the force-elongation curve and the elongation axis, to an accuracy of ± 2 % of the true value. Most modern tensile testers are equipped with an electronic or electro-mechanical integrator that can be used for this purpose. The area may also be determined from a graphical output of the data on chart paper using a planimeter.

5.1.2 Tensile-tester clamps

The tensile-testing apparatus shall have two clamps of at least 50 mm in width. Each clamp shall be designed to grip the test piece firmly, but without damage, along a straight line across the full width of the test piece (the clamping line) and shall have means for adjusting the clamping force.

The clamps should preferably grip the test piece between a cylindrical and a flat surface, with the plane of the test piece tangential to the cylindrical surface. Other types of clamps may be used if it can be ensured that the test piece does not slip or suffer any damage during the test.

During the test, the clamping lines shall be parallel to each other. They shall also be perpendicular to the direction of the applied tensile force and to the long dimension of the test piece.

The distance between the clamping lines (the test span length) shall be (100 ± 1) mm. In cases where the distance between perforations on the finished products is less than 100 mm and it is not possible to obtain a test piece of 150 mm in length (as required in 7.2) containing only one perforation line, a test span length of (50 ± 1) mm shall be used.

5.2 Cutting device

The cutting device shall meet the requirements of ISO 536 and shall produce test pieces (50,0 ± 0,5) mm wide, with undamaged, straight, smooth and parallel edges.

6 Conditioning

Condition the samples in a standard atmosphere at (23 ± 1) °C and (50 ± 2) % relative humidity according to ISO 187, unless otherwise agreed between the parties concerned.

7 Preparation of test pieces

7.1 General

The sample shall be selected in accordance with ISO 186.

Condition the samples as required in Clause 6 prior to cutting the test pieces, and keep them in the standard atmosphere throughout the test.

7.2 Dimensions

7.2.1 Non perforated test pieces

Non perforated test pieces shall be (50 ± 0,5) mm in width and at least 150 mm in length, excluding perforations and faults. With the exception of tissue paper or tissue products having an embossed pattern all over or over part of the surface, the test pieces shall be free of creases, kinks, wrinkles, folds or other thickness variations.

Test pieces shall be cut with their length in the machine direction.

7.2.2 Perforated test pieces

Each perforated test piece shall be (50 ± 0,5) mm in width and at least 150 mm in length, excluding faults. With the exception of tissue paper or tissue products having an embossed pattern all over or over part of the surface, the test pieces shall be free of creases, kinks, wrinkles, folds or other thickness variations.

Test pieces shall be cut with their length in the machine direction.

Perforation lines shall be located in the middle of the length of the test pieces.

The number of tie bars shall carefully be kept constant for all the considered test pieces.

7.3 Number of test pieces

Take 20 specimens for each sample of tissue paper or tissue products as follows:

Strips of four sheets long are taken, and then the first and the fourth sheet have to be removed, leaving two sheets connected by the perforation line for testing.

From ten specimens, cut ten test pieces in the machine direction, excluding perforation line, and from ten specimens, cut ten test pieces in the machine direction with perforation line in the middle making a total of 20 test pieces from each sample of tissue paper or tissue product. Should, in isolated cases, the requisite number of ten test pieces in each condition not be available, test at least ten test pieces (five for each condition) from the available specimens.

NOTE Care should be taken not to handle the final specimens in any way that might decrease the perforation tensile strength (by stretching or breaking any of the perforations).

8 Procedure

8.1 Non perforated test pieces

Ensure that the tensile-testing apparatus is calibrated and check the zero position of the recording device.

Place the non perforated test piece in the clamps so that any observable slack is eliminated, but the test piece is not placed under any significant strain (see Figure 1).

Do not touch the test area of the test piece between the clamps with the fingers. Align and tightly clamp the test piece and carry out the test.

Test ten test pieces from each sample (7.3).

The elongation rate between the clamps shall be kept constant at (50 ± 2) mm/min (see 5.1).

Record all readings, except for test pieces that break within 5 mm from the clamping line. The latter case shall be subject to the following provision:

If more than 20 % of the test pieces cut from a particular specimen break within 5 mm from the clamping line, reject all the readings obtained for that specimen. Inspect the apparatus for conformity with the specifications and take the appropriate remedial measures.

8.2 Perforated test pieces

Ensure that the tensile-testing apparatus is calibrated and check the zero position of the recording device.

Place the perforated test piece in the clamps so that any observable slack is eliminated, but the test piece is not placed under any significant strain. Perforation line shall be (50 ± 5) mm from the upper clamp (see Figure 2).

Do not touch the test area of the test piece between the clamps with the fingers. Align and tightly clamp the test piece and carry out the test.

NOTE Any deviation from the vertical line would induce a decrease in the measured strength of the peforated test pieces, and thus a greater calculated perforation efficiency than the true one.

Test ten test pieces from each sample (7.3).

The elongation rate between the clamps shall be kept constant at (50 ± 2) mm/min (see 5.1).

Record all readings.