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**Tissue paper and tissue products**

**Part 5:**

**Determination of wet tensile strength**

*Papier tissu et produits en tissu*

*Partie 5: Détermination de la résistance à la rupture par traction à l'état humide*

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ISO 12625-5:2005

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 12625-5 was prepared by the 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).

This first edition cancels and replaces EN 12625-5:1999 which has been technically revised.

With regard to EN 12625-5:1999, the following changes have been made:

- a) addition of information concerning the precision of the test method;
- b) editorial updating.

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*

# Tissue paper and tissue products

## Part 5: Determination of wet tensile strength

### 1 Scope

This part of ISO 12625 specifies a test method for the determination of the wet tensile strength of tissue paper and tissue products after soaking with water, using a tensile-strength-testing apparatus operating with a constant rate of elongation.

Currently, two types of tensile-strength testers are commercially available, one where the test piece is positioned vertically and, for the other, horizontally. This part of ISO 12625 applies for both. For vertical tensile-strength testers, a device which is held in the lower grip of the tensile-strength tester, called a Finch Cup, is used to achieve the wetting. For horizontal tensile-strength testers, the soaking device is placed between the clamps.

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.

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### 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 1924-2, *Paper and board — Determination of tensile properties — Part 2: Constant rate of elongation method*

ISO 7500-1, *Metallic materials — Verification of static 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*

ISO 12625-4, *Tissue paper and tissue products — Part 4: Determination of tensile strength, stretch at break and tensile energy absorption*

### 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 wet tensile strength**  
maximum tensile force per unit width that a test piece soaked with water will withstand before breaking in a tensile test

NOTE The wet tensile strength is expressed in newtons per metre.

**3.2 wet-tensile-strength retention**  
ratio, expressed as a percentage, of the tensile strength of the wet test piece to the tensile strength of the same test piece in the dry, conditioned state

### 4 Principle

A test piece of tissue paper or tissue product of given dimensions, soaked in water for a given period of time under specified conditions, is stretched (elongated) to break at a constant rate of elongation, using a tensile-strength-testing apparatus that measures and records the tensile force as a function of the elongation of the test piece.

The test can be carried out by a vertical or a horizontal tensile-strength tester.

In order to wet the test pieces for a vertical tensile-strength tester, a device, called a Finch Cup, which is held to the lower clamp, is used; while for a horizontal tensile-strength tester, a soaking cup is inserted between the clamps.

From the wet tensile strength and the tensile strength of the same sample in the dry conditioned state, the wet-tensile-strength retention can be calculated.

### 5 Apparatus

#### 5.1 Vertical tensile-strength tester

##### 5.1.1 Tensile-strength-testing apparatus

Tensile-strength-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  $(50 \pm 2)$  mm/min, and recording the tensile force as a function of elongation on a strip chart recorder or any equivalent device.

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

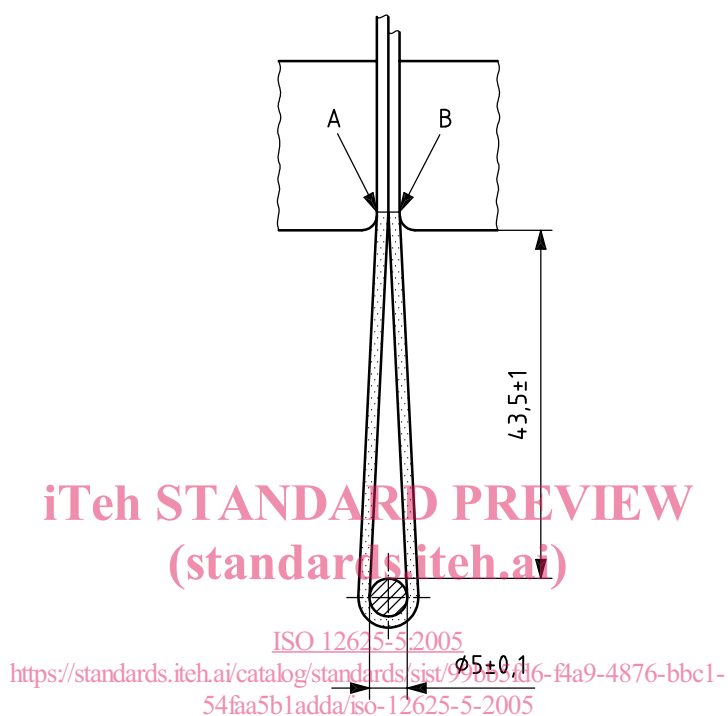
##### 5.1.2 Tensile-tester clamps

The tensile-strength-testing apparatus (5.1.1) shall have an upper clamp with a minimum of 50 mm width, for holding both ends of the test piece firmly and without slippage. To avoid damaging the test pieces, the clamp surfaces that touch the pieces should be smooth and have rounded edges, i.e. free from burrs. The lower clamp shall be designed to grip the Finch Cup soaking device (5.1.3) firmly. The clamps shall have means for adjusting the clamping force.

During the test, the upper clamping line and the Finch Cup soaking device rod (5.1.3) shall be parallel to each other. They shall also be perpendicular to the direction of the applied tensile force and to the length axis of the test piece.

The test span length, which is defined as the distance between the clamping line and the top surface line of the cylindrical rod of the Finch Cup soaking device, shall be adjustable to  $\pm 1$  mm (see Figure 1).

Dimensions in millimetres



**Key**

$\overline{AB}$  =  $(100 \pm 2)$  mm  
= total span length

$\frac{\overline{AB}}{2}$  =  $(50 \pm 1)$  mm  
= test span length

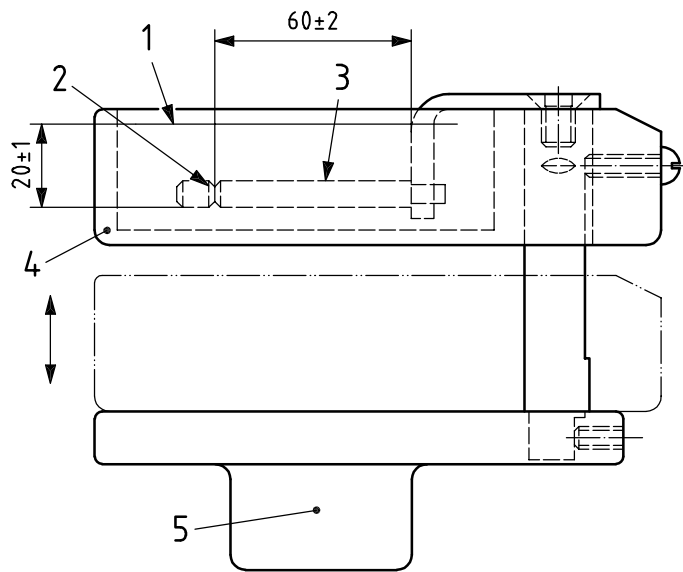
**Figure 1 — Positioning of a test piece**

### 5.1.3 Finch Cup soaking device

A Finch Cup soaking device (see Figure 2) consists of a support system that holds a horizontal cylindrical rod of  $(5 \pm 0,1)$  mm diameter, and approximately 60 mm length, and a water container.

The water container shall be constructed such that it can be moved vertically and locked in a raised position. In the locked raised position, the water in the container shall completely surround the cylindrical rod, which is thereby immersed in the liquid to a depth of  $(20 \pm 1)$  mm, as indicated in the example of Figure 2.

Projecting downwards, from the bottom of the device, is a rigid metal tongue by means of which the device can be held in the lower clamp of the tensile-strength-testing apparatus.



- Key**
- 1 liquid level mark
  - 2 positioning groove
  - 3 rod,  $d (5 \pm 0,1)$  mm
  - 4 water container (movable)
  - 5 tongue

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**Figure 2 — Finch Cup soaking device (example)**

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**5.2 Horizontal tensile-strength tester**

**5.2.1 Tensile-strength-testing apparatus**

The tensile-strength-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  $(50 \pm 2)$  mm/min, and recording the tensile force as a function of elongation.

The force-measuring system shall measure loads with an accuracy of  $\pm 1\%$  of the reading or  $\pm 0,1$  N, whichever is the greater. It shall be calibrated and verified to confirm the requirements according to ISO 7500-1.

**5.2.2 Tensile-tester clamps**

The tensile-strength tester shall have two clamps for holding the test piece. Each clamp shall be designed to grip the test piece firmly along a straight line across the full width of the test piece, without causing any damage, and shall have means for adjusting the clamping force. The table between the clamps must be removable.

During the test, the clamping lines shall be parallel to each other within an angle of  $1^\circ$ . The clamping lines shall be perpendicular to the direction of the applied tensile force and to the longest dimension of the test piece, to the same level of accuracy.

The distance between the clamping lines, i.e. the test span, shall be adjustable to  $(100,0 \pm 0,5)$  mm.



### 5.2.3 Soaking vessel

The soaking vessel can be inserted between the clamps of the tensile-strength tester (5.2.2), as shown in Figure 3.

The soaking vessel may be equipped with a device that, between the measurements, will adjust the water to a constant level.

### 5.3 Cutting device

The cutting device is capable of repeatedly cutting test pieces ( $50,0 \pm 0,5$ ) mm wide and at least 150 mm in length, with undamaged, straight, smooth and parallel edges.

## 6 Conditioning

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

## 7 Preparation

### 7.1 General

The sample shall be selected in accordance with ISO 186.

Condition the specimens in accordance with ISO 187 and keep them in the conditioning atmosphere throughout the test.

Handling of wet samples must be avoided.

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#### 7.1.1 Rapid ageing (curing)

The wet strength of tissue paper is frequently enhanced by addition of a wet strength agent. A rapid ageing with heat, also called curing, is frequently used to develop the maximum wet strength that a tissue paper or tissue product will achieve after a period of natural ageing at ambient conditions which may vary from a few days to several weeks, based on the wet strength agent used.

The decision of whether or not to use rapid ageing will be determined by the user of this part of ISO 12625, based upon the information about the tissue paper or tissue product sample being tested. Rapid ageing is not a requirement of this part of ISO 12625, but is an allowed option.

There is no rule for determining whether to rapid age or not, but the following principles are generally applied.

**7.1.1.1** Production test pieces which have not left the manufacturing environment, are generally rapid aged. To rapid age a tissue paper or tissue product, it is recommended to heat in air at  $(80 \pm 2)$  °C for 30 min. After heating, condition the test piece in a standard atmosphere at  $(23 \pm 1)$  °C and  $(50 \pm 2)$  % relative humidity for at least 1 h prior to testing.

For production inspections where data must be available quickly, rapid ageing conditions of  $(105 \pm 2)$  °C for 15 min may be used.

**7.1.1.2** Test pieces which have been delivered into the marketing chain, and especially those available for sale to the ultimate consumer, are generally not aged.

It must be understood that the wet strength of test pieces after rapid ageing may be different than that which will be experienced by the end user of the product.