



SLOVENSKI STANDARD

SIST ISO 3781:2013

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Nadomešča:
SIST ISO 3781:1996

Papir, karton in lepenka - Ugotavljanje utržne jakosti v mokrem

Paper and board -- Determination of tensile strength after immersion in water

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Papier et carton -- Détermination de la résistance à la traction après immersion dans l'eau
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ICS:

85.060 Papir, karton in lepenka Paper and board

SIST ISO 3781:2013 **en**

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INTERNATIONAL STANDARD

**ISO
3781**

Third edition
2011-09-01

Paper and board — Determination of tensile strength after immersion in water

*Papier et carton — Détermination de la résistance à la traction après
immersion dans l'eau*

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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 3781 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps*, Subcommittee SC 2, *Test methods and quality specifications for paper and board*.

This third edition cancels and replaces the second edition (ISO 3781:1983), of which it constitutes a minor revision. It is no longer applicable to tissue paper or tissue products, which are covered by ISO 12625-5. In addition, precision data have been added.

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Paper and board — Determination of tensile strength after immersion in water

1 Scope

This International Standard specifies a test method for the determination of the wet tensile strength of paper or board after its immersion in water for a specified period.

In principle, the method is applicable to both paper and board, provided an appropriate soaking time is agreed between the interested parties.

This International Standard is not applicable to tissue paper and tissue products or other lightweight, highly absorbent paper which is difficult to handle or of low strength when wet (see ISO 12625-5^[1]).

NOTE The tensile strength testing is performed using an apparatus operating at a constant rate of elongation of 20 mm/min, as per ISO 1924-2, or 100 mm/min, as per ISO 1924-3. Therefore, depending on which method is chosen, only one or the other of those International Standards is needed for performing the test.

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 (20 mm/min)*

ISO 1924-3, *Paper and board — Determination of tensile properties — Part 3: Constant rate of elongation method (100 mm/min)*

ISO 14487, *Pulps — Standard water for physical testing*

3 Terms and definitions

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

[ISO 12625-5:2005, definition 3.1]

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NOTE It is expressed in kilonewtons per metre.

3.2 wet tensile strength retention
ratio of the tensile strength of a wet test piece to that of another test piece from the same sample in the dry, conditioned state

NOTE 1 It is expressed as a percentage.

NOTE 2 Adapted from ISO 12625-5:2005, definition 3.2.

4 Principle

Immersion in water, for an appropriate period of time, of a test piece of the paper or board being tested, and determination of its wet tensile strength.

From the wet tensile strength and the tensile strength in the dry, conditioned state, the wet tensile strength retention is calculated.

5 Apparatus

5.1 Tensile strength testing apparatus, complying with ISO 1924-2 or ISO 1924-3 for dry tensile strength testing.

5.2 Water for soaking: distilled or deionized water as specified in ISO 14487, having the temperature specified for conditioning in ISO 187.

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6 Sampling

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If the tests are made to evaluate a lot, select the sample in accordance with ISO 186. If the tests are made on another type of sample, ensure that the test pieces taken are representative of the sample received.

7 Conditioning

For testing of dry tensile strength and for tests which involve soaking for less than 1 h, the specimen and the test pieces shall be conditioned in accordance with ISO 187. Conditioning is not necessary for tests involving soaking for 1 h or longer.

If the material has been specially treated (for example, with urea-formaldehyde), care shall be taken to ensure that sufficient time has elapsed after treatment to allow the wet strength to be fully developed before soaking the test pieces.

8 Preparation of test pieces

Depending on the method chosen, using an apparatus operating at a constant rate of elongation of 20 mm/min or 100 mm/min, prepare test pieces in accordance with ISO 1924-2 or ISO 1924-3 respectively.

Prepare a sufficient number of test pieces to enable ten valid wet tensile strength readings in the machine direction (MD) and ten valid readings in the cross direction (CD).

If the wet tensile strength retention is also to be calculated, then ten additional test pieces for determination of the dry tensile strength in the MD and another ten for the CD are required.

9 Procedure

In the absence of any agreement to the contrary, soak the test pieces until saturated; normally, this means a soaking time of 1 h. Use water (5.2) and a suitable shallow dish.

Boards and other hard-sized papers may require a soaking time of 24 h or longer to attain a satisfactory degree of saturation. The appropriate soaking time may be selected to simulate particular conditions of use, by agreement between the interested parties.

For very absorbent papers, it is recommended that only the centre portion of the test piece be wetted, while the portion held by the clamps remains dry (see ISO 12625-5^[1]).

After soaking, remove the test pieces from the dish. Lightly blot the first test piece in order to remove surplus water and immediately test it by the method specified in ISO 1924-2 or ISO 1924-3. Repeat for the remaining test pieces.

Carry out ten tests in the MD and ten in the CD of the immersed test pieces.

If the wet tensile strength retention is also to be calculated, carry out ten additional tests in the MD and another ten in the CD of the dry, conditioned test pieces.

10 Calculation and expression of results

10.1 General

Calculate and report the wet tensile strength and, if required, the wet tensile strength retention separately for the MD and CD, as follows.

10.2 Wet tensile strength

Calculate the wet tensile strength, σ_{wet} , using Equation (1):

$$\sigma_{\text{wet}} = \frac{\bar{F}_{\text{wet}}}{b} \quad (1)$$

where

\bar{F}_{wet} is the mean maximum tensile force, in kilonewtons;

b is the width of the dry test piece (15 mm), in metres.

Report the wet tensile strength, in kilonewtons per metre, to three significant figures.

10.3 Wet tensile strength retention

If required, calculate the wet tensile strength retention, σ_{R} , as a percentage of the corresponding value in the dry state using Equation (2):

$$\sigma_{\text{R}} = \frac{\sigma_{\text{wet}} \times 100}{\sigma_{\text{dry}}} \quad (2)$$

where

σ_{wet} is the wet tensile strength, in kilonewtons per metre;