

INTERNATIONAL STANDARD



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Paper and board — Determination of tensile strength after immersion in water for a specified period

Papier et carton — Détermination de la résistance à la traction après immersion dans l'eau pendant une durée spécifiée

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3781 was drawn up by Technical Committee ISO/TC 6, *Paper, board and pulps*, and was circulated to the Member Bodies in April 1975.

It has been approved by the Member Bodies of the following countries :

Belgium	Ireland	Sweden
Bulgaria	Israel	Switzerland
Canada	Italy	Thailand
Czechoslovakia	Mexico	Turkey
Finland	Netherlands	United Kingdom
France	Norway	U.S.A.
Germany	Poland	U.S.S.R.
Hungary	Romania	
Iran	South Africa, Rep. of	

The Member Bodies of the following countries expressed disapproval of the document on technical grounds :

Australia
New Zealand

Paper and board — Determination of tensile strength after immersion in water for a specified period

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determining the wet strength of paper by measuring the tensile strength of the material after it has been immersed in water for a specified period.

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

2 REFERENCES

ISO 186, *Paper and board — Sampling for testing.*¹⁾

ISO 187, *Paper and board — Conditioning of test samples.*²⁾

ISO 1924, *Paper and board — Determination of tensile strength.*

3 DEFINITIONS

For the purposes of this International Standard, the following definitions apply:

3.1 wet tensile strength: The maximum force that a test piece of paper or board will stand, after soaking in water, before it breaks, under the specified conditions.

3.2 wet strength retention: The ratio of the value of the tensile strength of a paper or board in the wet state to that of the same paper or board in the dry state, measured under the specified conditions.

4 PRINCIPLE

Immersion in water for the appropriate period of a test piece of the paper or board to be tested and determination of the tensile strength.

5 EQUIPMENT

5.1 Apparatus complying with ISO 1924 for dry tensile testing.

For details of a soaking attachment, see the annex.

5.2 Water for soaking

Use a drinking water with a total solids content not exceeding 500 mg/l; if necessary, add a small quantity of a suitable buffering agent to maintain the pH value between 6,8 and 7,2 for the soaking period. The water shall be used at the temperature specified in ISO 187 for conditioning.³⁾

6 SAMPLING

Specimens shall be selected in accordance with ISO 186.

7 TEST PIECES

7.1 Preparation

Test pieces shall be prepared in accordance with ISO 1924.

NOTE — When the 20 s soaking time (see 8.2) is used, with the soaking attachment (see annex), it may be convenient to have the clamps only 100 mm apart; a convenient length for the test pieces is then about 150 mm.

7.2 Conditioning

7.2.1 For dry tensile tests 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 before soaking for 1 h (or longer).

7.2.2 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 for the wet strength to be fully developed, before soaking the test pieces.

1) At present at the stage of draft. (Revision of ISO/R 186.)

2) At present at the stage of draft. (Revision of ISO/R 187.)

3) Preferred temperature 23 ± 1 °C.

8 PROCEDURE

8.1 Normal 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 as specified in 5.2 and a suitable shallow dish.

After soaking, remove the test pieces from the dish, lightly blot them to remove surplus water and immediately test them by the method specified in ISO 1924.

8.2 Procedure for very absorbent papers

Use the soaking attachment described in the annex, which enables the test piece to be soaked in water while in position for the tensile test.

Fix the attachment (known as the Finch device) squarely in position in the lower clamp of the tensile tester. Loop the dry test piece, which shall be about 150 mm long, under the dry horizontal rod and fix the two ends in the top clamp, making sure that the test piece is gently and evenly tensioned.

Then raise the container, with water in it, to the upper position so that the looped end of the test piece is immersed to a depth of not less than 19 mm. After 20 ± 1 s, lower the container. Immediately start the tensile test, as in 8.1.

NOTE — If a soaking attachment is used when measuring the wet strength and the determination of wet strength retention is required, use the same attachment when measuring the dry tensile strength. Use the dry tensile strength measured in this way in calculating only the wet strength retention.

8.3 Other special soaking times

Boards and very hard sized papers may require a soaking time of 24 h or even longer.

In some instances a soaking time may be selected to simulate as closely as possible particular conditions of use.

The procedure after soaking for more than 1 h is as given in 8.1.

8.4 Number of tests

For the wet tensile test, carry out ten tests in the machine-direction and ten in the cross-direction.

If the dry tensile strength is also to be measured (for determination of wet strength retention), repeat the twenty tests with dry test pieces.

9 EXPRESSION OF RESULTS

Calculate the results separately for the machine-direction and the cross-direction. The calculations are given in ISO 1924 for dry tensile strength.

The results may be expressed as :

- mean wet tensile strength, in kilonewtons per metre width;
- mean wet tensile strength retention, i.e. as a percentage of the corresponding mean value in the dry state.

10 PRECISION

In the present state of knowledge, no general statement can be made as to the precision of this method.

11 TEST REPORT

The test report shall include the following particulars :

- a reference to this International Standard;
- soaking time (if other than 1 h);
- type of tensile tester used;
- the results (as detailed in clause 9) and the 95 % confidence limits of the mean value;
- details of any items that are optional or not covered in this International Standard or in the International Standards to which reference is made, and any other features that may have affected the results.

ANNEX

DESCRIPTION OF SOAKING ATTACHMENT

The object of the Finch attachment is firstly to enable tensile tests to be carried out immediately after short soaking periods and secondly to avoid the difficulty of handling wet test pieces of low strength.

The Finch device (see the figure) consists of a rigid inverted metal stirrup of width about 38 mm and length about 76 mm. A horizontal rod, of length about 28 mm and diameter about $5 \pm 0,05$ mm, is attached to the metal stirrup as shown. Between the metal straps which form the framework of the stirrup is a small easily removable container for holding water. Spring clips hold the container in position (as shown in the illustration) and also enable it to be slid up and down and to be left in either the raised or the lowered position. However, in view of the short immersion period (20 s) standardized for the types of paper that normally require to be tested in this way, it is on the whole more convenient to slide the container up and hold it for the requisite period of time. The friction sliding device is very useful, however, for special cases in which longer soaking times are necessary. The depth of immersion is not less than 19 mm so that a total length of paper of at least 38 mm is under water during the soaking period. A metal tongue at the bottom of the apparatus permits the device to be fastened securely in the lower clamp of the tensile tester. It is essential, in constructing this apparatus, to ensure that it is quite rigid so that the tensile force is applied evenly to the test strip.

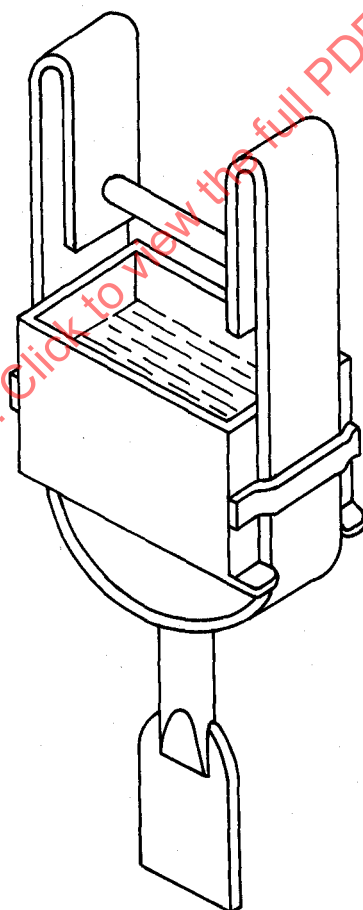


FIGURE — Finch device

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