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Paper and board — Determination of water absorption after immersion in water

Papier et carton — Détermination de l'absorption d'eau après immersion dans l'eau

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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 document 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).

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This document 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 5637:1989), which has been technically revised.

The main changes are as follows:

— Clause 2 Normative references has been updated;

— Former Clause 5 Reagent and Clause 6 Apparatus incorporated into new Clause 5 Apparatus, reagents and materials and revised;

— Clause 6 Sampling is revised;

— Clause 8 Procedure has been revised, especially immersion time and excess water removal;

— 8.5 "mass determination" has been added;

— Former Clause 9 Expression of results has been updated and the average water absorption has been added;

— Clause 11 Test report has been revised;

— Annex A with examples of possible support systems has been added;

— editorially revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Paper and board — Determination of water absorption after immersion in water

1 Scope

This document specifies a method for the determination of the water absorption of paper and board after total immersion in water for a specified time.

The method is applicable to all types of paper and board which have a degree of water resistance. It is not applicable to very absorbent papers such as tissue papers 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*

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

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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

3.1
water absorption
mass of water absorbed per unit area under the specified conditions of test

3.2
relative water absorption
ratio of the mass of water absorbed to the mass of the conditioned test piece

4 Principle

Weighing the test piece before and after immersion in water and calculating the water absorption, in g/m^2, or the relative water absorption as the percentage increase in mass.

5 Apparatus, reagents and materials

5.1 Balance, which enables reading to the nearest 1 mg.

5.2 Tank of water, maintained in the standard atmosphere according to ISO 187, large enough to hold the test pieces in a vertical position, cleaned with reagent water (5.7) to ensure that it is free from surfactants. The temperature shall be measured with a thermometer (5.8) before immersion to ensure that the water temperature is maintained in accordance with ISO 187.

If the tank (5.2) is maintained in a non-conditioned atmosphere, the tank shall include thermostatic control in accordance with ISO 187. If evaporation can expose samples to the air, a lid shall be added and the water level shall be monitored. Tanks should be cleaned periodically using tap water, cloths, and brushes with a following tap water rinse to eliminate any paper fibre film on the tank side walls and bottoms.

The used temperature shall be stated in the test report (see clause 10).

5.3 Metal roller, with a smooth face, 200 mm ± 10 mm wide, a diameter of 90 mm ± 10 mm, and a mass of 10 kg ± 0,5 kg.

5.4 Blotting paper, with a grammage of 250 g/m^2 ± 25 g/m^2. The blotting paper shall have larger dimensions than the test piece (see 7.1) and smaller than the width of the metal roller (5.3).

5.5 Support system, either in the vertical or horizontal attitude, to facilitate immersion (see 8.3), in water and to prevent a test piece from folding over on itself or coming in contact with other test pieces (examples are given in Annex A, Figures A.1 to A.4). A sketch of a possible support system is shown in Figure 1. The support system shall keep the test pieces:

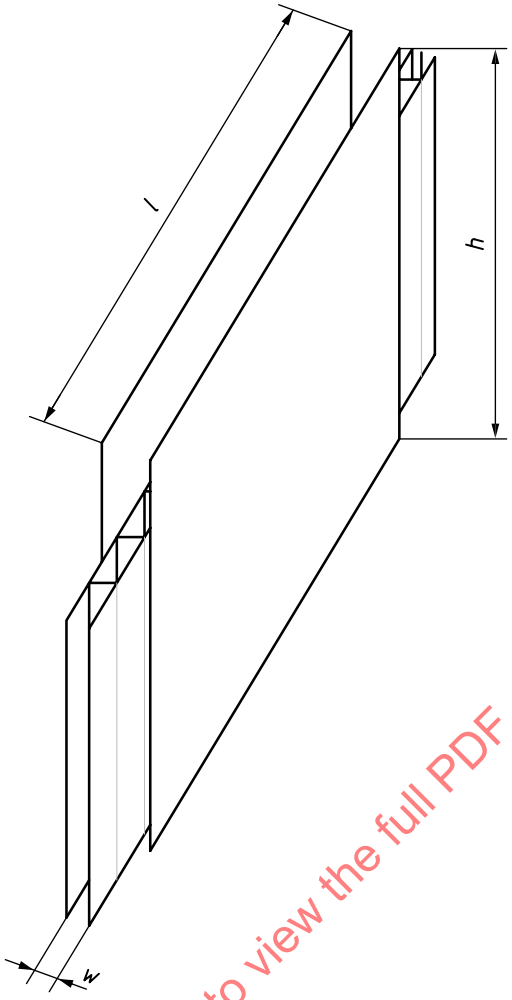
a) above the bottom of the soak tank;

b) 20 mm below the surface of the water;

c) away from the sides/ends of the soak tank;

d) hang straight (not able to fold over on themselves);

e) away from each other.



Key

l length of cell shorter than test piece shall provide for support for corrugated board or paper test piece ends

h height of cell to accommodate test piece height

w cell width to accommodate the thickness of a triplewall test piece

Figure 1 — Sketch of a possible support system

5.6 Tared containers, of suitable size, such as pre-weighed polyethylene bags.

5.7 Water, distilled or deionized in accordance with ISO 14487 at the laboratory conditioning temperature, i.e. 23 °C ± 1 °C or 27 °C ± 1 °C in tropical countries.

5.8 Thermometer, with the accuracy of ±0,1 °C.

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, the specimens test piece taken are representative of the sample received.

7 Test pieces

7.1 Preparation

Cut a sufficient number of test pieces to achieve 10 valid test results, each of them measuring 200 mm ± 1 mm x 250 mm ± 1 mm, with the longer side in the machine direction. Cut the test pieces one at a time, ensuring that the edges are straight, cleanly cut and undamaged.

Any accurately known area, e.g. die-cut test pieces at least 100 mm x 100 mm, may be used, provided that the precision of the balance (5.1) and the calculations (Clause 9) are adjusted accordingly and provided that it has been established that the adjusted results are equivalent to those for standard size test pieces for the specific type of paper or board. The effect of a change in test piece dimensions may depend on the product when testing products which absorb slowly at the surface and quickly at the edges.

7.2 Conditioning

Condition the test pieces in accordance with ISO 187. Keep them in the conditioning atmosphere throughout the test.

8 Procedure

8.1 Preparation

Weigh each test piece separately to an accuracy of ±0,01 g. If tared containers (5.6) are used, place each test piece in a tared container and weight to an accuracy of ±0,01 g.

8.2 Immersion time

Select the appropriate immersion time from the following:

a) low water resistance: 5 min ± 5 s;

b) medium water resistance: 30 min ± 1 min;

c) high water resistance: 24 h ± 15 min.

The combination of factors can influence achieving complete saturation. As the correlation of material density, thickness, sheet vs corrugated board, single wall vs multiple wall, water resistant additives, and other factors may influence immersion times, it is common to use other immersion times to result in complete saturation of samples. This should be determined with the relevant parties. In addition, sufficient backup data should be recorded to demonstrate that immersion times used for specific substrates are adequate to achieve complete saturation.

8.3 Immersion of the test piece

Immerse each test piece vertically in clean water (5.7) in the tank (5.2), so that the upper edge is at least 20 mm below the surface. Ensure that the test pieces are separated from each other and from the bottom and sides of the tank. If tared containers (5.6) are used (8.1), separately remove each test piece from its tared container and insert it into the support system (5.5).

For paper test pieces, the machine direction is vertical and test pieces are held in place by the clips to the support system (5.5),

Corrugated fibreboard shall be immersed with the flutes and the glue lines vertical, in order to avoid trapping air, which could affect the amount of water absorbed during immersion. Clips to the support system can be needed unless the support system has restraints preventing test pieces from floating to the surface of the water.

Immersed test pieces shall be observed periodically to ensure the test pieces remain below the water level and that air bubbles are not observed. If air bubbles are observed, a gentle manual vibration of the support

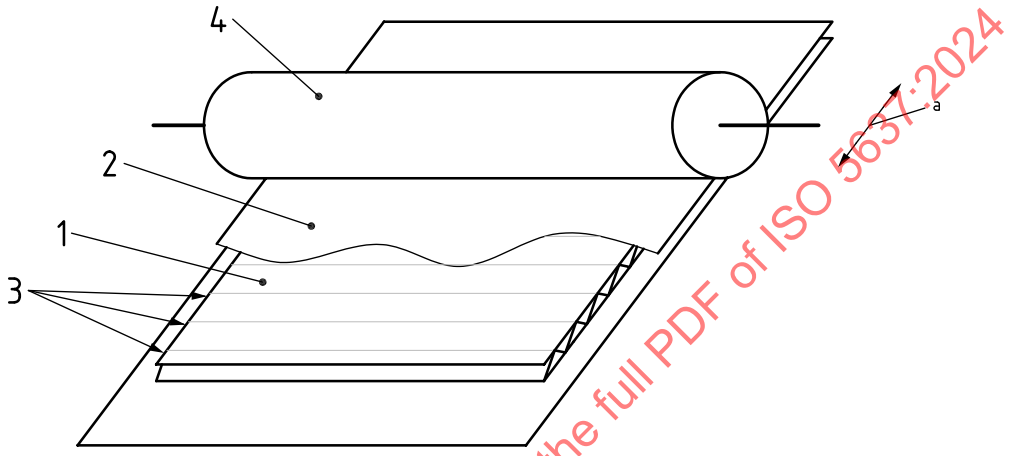
system (5.5) shall be performed (with the test pieces remaining under water) to allow the air bubbles to dissipate.

8.4 Excess water removal

After immersion for the specified period (8.2), remove the test pieces from the water individually and place the test pieces between two sheets of blotting paper (5.4) quickly, with the least possible delay.

Remove the excess water by rolling the metal roller (5.3) once forward and once backward over the blotting paper (5.4), without applying pressure on the metal roller (5.3). Return each drained test piece to its tared container (5.6), if used.

When corrugated board is tested, the axis of the metal roller shall be parallel to the glue lines (see Figure 2).



Key

1 test piece
2 blotting paper
3 glue lines
4 metal roller
a Rolling direction of the metal roller, axis parallel to the glue lines of the corrugated board.

Figure 2 — Application of metal roller

8.5 Mass determination

Determine the mass of each test piece immediately after the roller process is complete by weighing the test piece and recording the mass.

Care shall be taken to ensure the time taken for blotting and weighing each test piece is identical.

Examples of possible procedures to help the operators.

a) Multiple support systems (5.5), each holding one piece, within the tank (5.2), so that the support systems can be immersed on a staggered time schedule.

b) The support systems could have multiple “slots”, but only one “slot” would be used. The design of these support systems would be such that at least three could be immersed in the tank at one time.

c) Additional lab personnel with duplicate blotting equipment.

9 Calculation of results

9.1 General

Use the determined mass (8.5) to calculate the average water absorption (9.3) or the relative water absorption (9.4) as required.

9.2 Individual water absorption

The individual water absorption of each test piece m_A, expressed in grams per square meter, is given by the formula

$$m_A = (m_2 - m_1) \times \frac{10\,000}{A} \quad (1)$$

where

m_1 is the mass, in grams, of the conditioned test piece before immersion;

m_2 is the mass in grams, of the test piece immediately after immersion for the specified period;

A is the test piece area, in cm^2.

Express the result to the nearest 1 g/m^2.

9.3 Average water absorption

Use the individual water absorption m_A to calculate the mean water absorption and the standard deviation.

Express the result to the nearest 1 g/m^2.

9.4 Relative water absorption

The relative water absorption m_R, expressed as a percentage, is given by the formula

$$m_R = \left(\frac{\sum_n^1 (m_2 - m_1)}{\sum_n^1 m_1} \right) \times 100 \quad (2)$$

Express the result to the nearest 1 %.

10 Test report

The test report shall contain at least the following information:

a) A reference to this document i.e. ISO 5367:2024;

b) date and place of testing;

c) all information necessary for complete identification of the sample;

d) temperature and relative humidity of test atmosphere if testing atmosphere deviates from 7.2;

e) time of immersion (see 8.3);

f) temperature of the water;

g) mean and standard deviation of water absorption in g/m^2, expressed as in 9.3 or, if required, relative water absorption in percentage, expressed as in 9.4;

h) number of tests;

i) any deviation, by agreement or otherwise, from the procedure specified in this document, including the use of non-standard size test pieces.

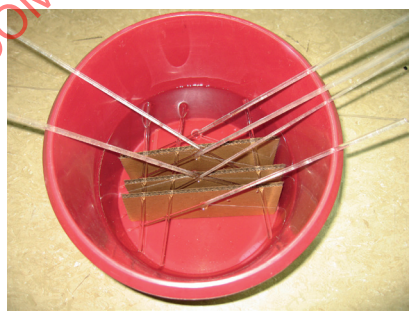
Annex A
(informative)

Examples for support systems

A.1 Possible support systems

a) System to prevent the test pieces from touching the ground

b) System to prevent the test pieces from touching each other



c) System to prevent the test pieces from rising

Figure A.1 — Example of a support system