
**Paper and board — Determination of
water absorptiveness — Cobb method**

*Papier et carton — Détermination de la capacité d'absorption d'eau
— Méthode de Cobb*

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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.

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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 172, *Pulp, paper and board*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 535:2014), which has been technically revised.

The main changes are as follows:

- requirements in [5.1](#) and [5.2](#) added;
- [Clause 6](#) and [6.2](#) revised;
- preparation of test pieces added in [Clause 9](#);
- [Subclauses 10.3](#) and [10.4](#) revised and requirements added;
- several additional explanations added in [10.5](#).

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 absorptiveness — Cobb method

1 Scope

This document specifies a method for determining the water absorptiveness of paper and board, including corrugated fibreboard, under standard conditions.

This document is not applicable for paper of grammage less than 50 g/m² or embossed paper. It is not applicable for porous papers such as newsprint or papers such as blotting paper or other papers having a relatively high-water absorptiveness for which ISO 8787 is more suitable.

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 absorptiveness

Cobb value

calculated mass of water absorbed in a specified time by 1 m² of paper or board under specified conditions

Note 1 to entry: The test area is normally 100 cm².

4 Principle

A test piece is weighed immediately before and after exposure for a specified time of one surface to water, followed by blotting. The result of the increase in mass is expressed in grams per square metre (g/m²).

The test piece shall not show any sign of penetration through or leakage outside the test ring (see 10.5).

5 Reagents and materials

5.1 Water, distilled or deionized, at the laboratory conditioning temperature, i.e. $23\text{ °C} \pm 1\text{ °C}$ or $27\text{ °C} \pm 1\text{ °C}$ in tropical countries. The water shall fulfil the requirements of ISO 14487.

5.2 Blotting paper, having a grammage of $250\text{ g/m}^2 \pm 25\text{ g/m}^2$.

The blotting paper shall have dimensions of at least $140\text{ mm} \times 140\text{ mm}$ either circular or rectangular.

Blotting papers in accordance with ISO 5269-1 are suitable, see [Annex B](#).

6 Apparatus

6.1 Absorptiveness tester for the determination of water absorptiveness.

Any type of apparatus may be used which permits

- an immediate and uniform contact of the water with the part of the test piece submitted to the test,
- controlled rapid removal of the unabsorbed water from the test piece at the end of the contact period, and
- the rapid removal of the test piece without the risk of water contacting the test piece outside the test area.

In its simplest form, the apparatus consists of a rigid base with a smooth, planar surface, and a rigid metal cylinder of $112,8\text{ mm} \pm 0,2\text{ mm}$ internal diameter (corresponding to a test area of 100 cm^2) and with a means of clamping it firmly to the base plate. The edge of the cylinder in contact with the test piece shall be flat and machined smooth with a thickness sufficient to prevent the cylinder cutting into the test piece. The height of the cylinder is not important, provided it is sufficient to contain a water depth of 10 mm.

For materials where leakage between the cylinder and the upper surface of the test piece can occur during the test, a soft, elastic, non-absorbent gasket may be interposed to prevent this. This gasket shall have the same internal diameter as the cylinder after clamping.

If a gasket is used, it shall be used for all test pieces.

The diameter of the compressed gasket can be tested as follows: mount a piece of carbonless paper which has roughly the same dimensions as the test piece, into the absorptiveness tester, and close the cylinder as for the test. If the pressure is not high enough for an adequate impression, use a usual test piece and the carbonless paper to increase the thickness of the arrangement. In some cases, a compressible, blotter-like paper or other papers can be more suitable to test the diameter of the gasket.

To prevent damage to the machined edge of the cylinder caused by clamping it upside down it is recommended to mark the top in some way so that it can be identified readily. If a cylinder of a small area is used it should not be less than 50 cm^2 . The water depth shall still be 10 mm.

When testing corrugated fibreboard, it is recommended to use an apparatus with adjustable pressure to adjust the cylinder according to the structural conditions of the test piece.

6.2 Metal roller, with a smooth face, $200\text{ mm} \pm 10\text{ mm}$ wide, a diameter of $90\text{ mm} \pm 10\text{ mm}$ and a mass of $10\text{ kg} \pm 0,5\text{ kg}$.

6.3 Balance, which can be read to the nearest 1 mg.

6.4 Timer, reading in seconds and capable of timing up to at least 30 min.

6.5 Graduated cylinder, or other means of measuring appropriate aliquots.

7 Sampling

If the tests are made to evaluate a lot, the sample shall be selected in accordance with ISO 186. If the tests are made on another type of sample, the test pieces shall be representative of the sample received.

8 Conditioning

Condition the sample as specified in ISO 187. Keep it in the conditioning atmosphere throughout the test.

9 Preparation of test pieces

Prepare the test pieces in the atmospheric conditions identical to those used to condition the samples. Avoiding contact of the test area with hands or fingers, cut from the sample at least five test pieces for each face to be tested. The test pieces shall be of sufficient size to exceed the diameter of the cylinder by at least 10 mm from any edge. Ensure that the test area is free from visible folds, creases, cracks or other defects.

If printed areas are present, these areas should be avoided if possible. If not possible, it shall be mentioned in the test report.

When the test pieces available are too small to allow the common apparatus to be used, a smaller test area may be agreed upon between the interested parties taking account of equipment availability.

10 Procedure

10.1 General

Carry out the test in the same atmospheric conditions used to condition the test pieces (see [Clause 8](#)).

10.2 Mounting of the test pieces

Ensure that the surface of the base plate and the edge of the cylinder that will come in contact with the test piece are clean and dry before commencing each test. Weigh the specimen to the nearest 1 mg and place it with the surface to be tested in such a way that it will be in contact with the water during the test. Bring the smooth machined edge cylinder in contact with the test piece and clamp sufficiently firmly to prevent any leakage of water between it and the test piece.

10.3 Exposure to water and blotting

For the purposes of this document, the time of test is defined as the time between first contact between water and test piece and the commencement of blotting.

Pour $100 \text{ ml} \pm 5 \text{ ml}$ of water ([5.1](#)) or proportionately less for a smaller test area, into the cylinder, thus providing a head of 10 mm and start the timer ([6.4](#)) immediately. Replace water for each determination.

NOTE On some types of instruments, the timer will start automatically after the water is brought in contact with the test piece.

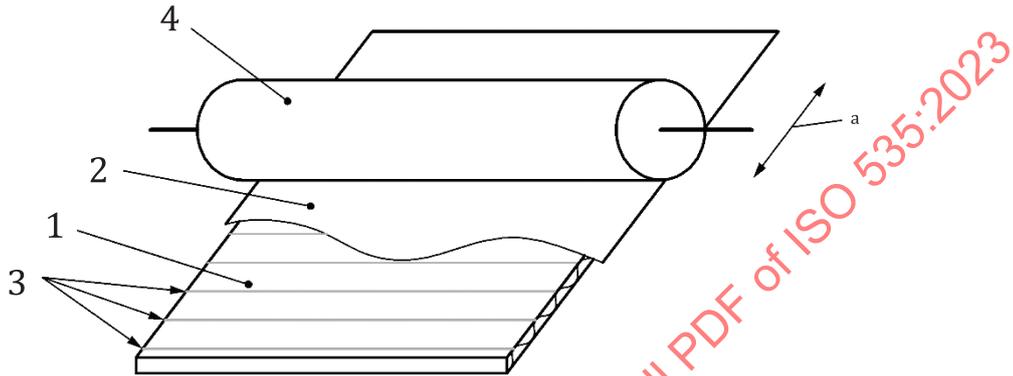
The test procedure for any selected exposure time should follow the conditions summarized in [10.4](#). The exposure time is selected according to the expected water absorptiveness of the paper and board (see [Table 1](#)). If, for example, a test time of 60 s has been selected, pour off the excess water after $45 \text{ s} \pm 1 \text{ s}$, taking care that no water comes into contact with the surface of the test piece outside the test area. Quickly unclamp the cylinder and remove it. Remove the test piece and place it, test face

uppermost, on a sheet of dry blotting paper (5.2) previously placed on a flat rigid surface. $60\text{ s} \pm 2\text{ s}$ after commencement of the test, place a second sheet of blotting paper (5.2) on top of the test piece and remove the excess water, using the metal roller (6.2) with two rollings (once forward and once back) without exerting any pressure on the metal roller.

If using a rotatable test device¹⁾, it is recommended to place the test piece with the test face, face down on a sheet of dry blotting paper (5.2) to avoid excess water from spilling outside the test area.

Use new blotting paper (5.2) for each test piece.

On corrugated fibreboard the metal roller (6.2) should be applied with its axis parallel to the gluelines.



Key

- 1 test piece
- 2 blotting paper
- 3 gluelines
- 4 metal roller
- a Rolling direction of the metal roller, axis parallel to the gluelines.

Figure 1 — Application of metal roller

Where corrugated fibreboard is indented by the cylinder edge or where corrugated fibreboard exhibits “washboarding” it might not be possible for the blotting paper (5.2) to contact the entire wet area of the test piece. In such cases, it is recommended after using the metal roller (6.2) to gently blot any remaining water with the edge of the blotting paper (5.2). Instead of using the metal roller (6.2), it is also possible to gently rub the back of the blotting paper (5.2) over the test piece by hand. In all cases, it is important to work without any pressure to avoid any water being pressed into the surface of the test piece (see Figure 1).

Immediately after blotting, fold the test piece with the wet side inside, and weigh again so that the increase in mass due to absorption of water can be determined before any loss by evaporation occurs.

In the case of board or corrugated fibreboard it might not be possible to fold the test piece. In such cases, the second weighing shall be carried out with the least possible delay.

Repeat the processes described in 10.2 and above instructions in 10.3 for all the other test pieces so that at least five tests have been carried out on each face of the paper or board required to be tested.

To increase the visibility of any water that could have penetrated through the test piece or of possible signs of leakage, a black rubber base or underlayer can be helpful.

1) The rotatable device is also called cobb-unger tester. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product. Equivalent products may be used if they can be shown to lead to the same results.

10.4 Times of test

[Table 1](#) specifies the times of tests together with the times at which excess water is removed and the times at which blotting is carried out.

The times of test can be increased according to the water absorptiveness and to the special nature of the paper or board being tested and by agreement of the interested parties.

All test pieces shall be tested using the same test time. For unknown samples, it might be necessary to execute a pre-test to determine the test time.

Since the relationship between the test results and contact time is not linear, converting the results between test times is not permitted.

Table 1 — Test times

Recommended time s	Symbol	Time at which excess water is removed ^a s	Time at which blotting is carried out ^a s
30	Cobb ₃₀	20 ± 1	30 ± 1
60	Cobb ₆₀	45 ± 1	60 ± 2
120	Cobb ₁₂₀	105 ± 2	120 ± 2
300	Cobb ₃₀₀	285 ± 2	300 ± 2
600	Cobb ₆₀₀	585 ± 2	600 ± 2
1 800	Cobb _{1 800}	1 785 ± 30	15 ± 2 after removing excess water

^a The times are set from the moment the water comes into first contact with the test piece (see [10.3](#)).

10.5 Rejection of test pieces

Test pieces shall be rejected if any of the following occur:

- leakage or spillage beyond the test area (also drops of water);
- any penetration through the test piece (an area or punctual spots on the backside of the test piece);
- penetration through the corrugated board test piece
- any kind of leakage caused by damage due to high pressure of the cylinder and therefore damage of the liner of corrugated fibreboard;
- any kind of leakage caused by low pressure of the cylinder;
- water outside the test area caused by handling failures (e. g. rotatable test devices).

Test pieces that show excess water after blotting (which can be indicated by the gloss of the surface) shall be rejected.

If the percentage of rejects due to penetration through the test piece exceeds 20 %, reduce the time of test until a satisfactory result is obtained. If no reduced time is satisfactory, this method is not suitable.

11 Expression of results

11.1 Calculate the water absorptiveness, A , expressed in grams per square metre, to the first decimal place for each test piece from [Formula \(1\)](#):

$$A = \frac{m_2 - m_1}{S} \times 10000 \quad (1)$$

where

- m_1 is the dry mass, in g, of the test piece;
- m_2 is the wet mass, in g, of the test piece;
- S is test area in cm^2 .

11.2 For each side tested calculate the mean water absorptiveness to the nearest $0,5 \text{ g/m}^2$ and the standard deviation.

11.3 Use a standard notation, for example:

- Cobb_{60} (value in grams per square metre) at t °C;
- dependent on the time of the test, in seconds.

12 Precision

The repeatability and reproducibility of this method were determined by conducting an interlaboratory comparison study with several types of samples. A description of the samples used in this study and the interlaboratory comparison results are presented in [Annex A](#).

13 Test report

The test report shall include at least the following information:

- a) a reference to this document, i.e. ISO 535:2023;
- b) all the information necessary for complete identification of the sample;
- c) date and place of testing;
- d) conditioning atmosphere used;
- e) mean and standard deviation of the test results for each face tested expressed as in [11.3](#);
- f) test area if other than 100 cm^2 ;
- g) number of rejected test pieces and the reasons for rejection, if any;
- h) any circumstances or factors which may have influenced or affected the results;
- i) any test piece with watermarks or printed areas shall be mentioned;
- j) any deviation, by agreement or otherwise, from the procedure specified.

Annex A (informative)

Precision

A.1 General

In 2012, 16 laboratories, from 11 European countries, tested two samples in accordance with this document. The data for water absorption $Cobb_{60}$ (paper), water absorption $Cobb_{600}$ (board) and water absorption $Cobb_{1800}$ (corrugated board) have been obtained from CEPI-CTS, the Comparative Testing Service of the Confederation of European Paper Industries. The data for water absorption $Cobb_{60}$ (paper) are presented in [Clause A.2](#). The data for water absorption $Cobb_{600}$ (board) are presented in [Clause A.3](#). The data for water absorption $Cobb_{1800}$ (corrugated board) are presented in [Clause A.4](#).

The calculations were made according to ISO/TR 24498:2006²⁾ and TAPPI T 1200 sp-07.

The repeatability standard deviation reported in [Table A.1](#) is the “pooled” repeatability standard deviation that is, the standard deviation is calculated as the root-mean-square of the standard deviations of the participating laboratories. This differs from the conventional definition of repeatability in ISO 5725-1:1994.

The repeatability and reproducibility limits reported are estimates of the maximum difference that should be expected in 19 of 20 instances, when comparing two test results for material similar to those described under similar test conditions. These estimates might not be valid for different materials or different test conditions. Repeatability and reproducibility limits are calculated by multiplying the repeatability and reproducibility standard deviations by 2,77.

NOTE 1 The repeatability standard deviation and the within-laboratory standard deviation are identical. However, the reproducibility standard deviation is not the same as the between-laboratories standard deviation. The reproducibility standard deviation includes both the between-laboratories standard deviation and the standard deviation within a laboratory:

$$s_{\text{repeatability}}^2 = s_{\text{within lab}}^2 \quad \text{but} \quad s_{\text{reproducibility}}^2 = s_{\text{within lab}}^2 + s_{\text{between lab}}^2$$

NOTE 2 $2,77 = 1,96\sqrt{2}$, provided that the test results have a normal distribution and that the standard deviation s is based on a large number of tests.

A.2 Water absorption $Cobb_{60}$ (paper)

See [Tables A.1](#) and [A.2](#).

Table A.1 — Estimation of repeatability ($Cobb_{60}$)

Sample	Number of laboratories	Mean water absorption $Cobb_{60}$ g/m ²	Repeatability standard deviation s_r g/m ²	Coefficient of variation $C_{V,r}$ %	Repeatability limit r g/m ²
Sample 1	16	19,7	0,8	3,9	2,1
Sample 2	15	27,7	0,9	3,4	2,6

2) Withdrawn.

Table A.2 — Estimation of reproducibility (Cobb₆₀)

Sample	Number of laboratories	Mean water absorption Cobb ₆₀ g/m ²	Reproducibility standard deviation <i>s_R</i> g/m ²	Coefficient of variation <i>C_{V,R}</i> %	Reproducibility limit <i>R</i> g/m ²
Sample 1	16	19,7	1,4	7,0	4,0
Sample 2	15	27,7	1,4	5,0	3,9

A.3 Water absorption Cobb₆₀₀ (board)

See [Tables A.3](#) and [A.4](#).

Table A.3 — Estimation of repeatability (Cobb₆₀₀)

Sample	Number of laboratories	Mean water absorption Cobb ₆₀₀ g/m ²	Repeatability standard deviation <i>s_r</i> g/m ²	Coefficient of variation <i>C_{V,r}</i> %	Repeatability limit <i>r</i> g/m ²
Sample 1	16	96,1	2,2	2,2	6,0

Table A.4 — Estimation of reproducibility (Cobb₆₀₀)

Sample	Number of laboratories	Mean water absorption Cobb ₆₀₀ g/m ²	Reproducibility standard deviation <i>s_R</i> g/m ²	Coefficient of variation <i>C_{V,R}</i> %	Reproducibility limit <i>R</i> g/m ²
Sample 1	16	96,1	5,0	4,7	12,5

A.4 Water absorption Cobb₁₈₀₀ (corrugated board)

See [Tables A.5](#) and [A.6](#).

Table A.5 — Estimation of repeatability (Cobb₁₈₀₀)

Sample	Number of laboratories	Mean water absorption Cobb ₁₈₀₀ g/m ²	Repeatability standard deviation <i>s_r</i> g/m ²	Coefficient of variation <i>C_{V,r}</i> %	Repeatability limit <i>r</i> g/m ²
Sample 1	14	115	2,5	2,2	6,9

Table A.6 — Estimation of reproducibility (Cobb₁₈₀₀)

Sample	Number of laboratories	Mean water absorption Cobb ₁₈₀₀ g/m ²	Reproducibility standard deviation <i>s_R</i> g/m ²	Coefficient of variation <i>C_{V,R}</i> %	Reproducibility limit <i>R</i> g/m ²
Sample 1	14	115	6,9	7,0	19,0