

BS EN ISO 535:2014



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

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**National foreword**

This British Standard is the UK implementation of EN ISO 535:2014. It supersedes BS EN 20535:1994 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PAI/11, Methods of test for paper, board and pulps.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

## Paper and board - Determination of water absorptiveness - Cobb method (ISO 535:2014)

Papier et carton - Détermination de l'absorption d'eau -  
Méthode de Cobb (ISO 535:2014)

Papier und Pappe - Bestimmung des  
Wasserabsorptionsvermögens - Cobb-Verfahren (ISO  
535:2014)

This European Standard was approved by CEN on 23 December 2013.

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## Foreword

This document (EN ISO 535:2014) has been prepared by Technical Committee ISO/TC 6 “Paper, board and pulps” in collaboration with Technical Committee CEN/TC 172 “Pulp, paper and board” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2014, and conflicting national standards shall be withdrawn at the latest by August 2014.

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The text of ISO 535:2014 has been approved by CEN as EN ISO 535:2014 without any modification.

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## Foreword

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The committee responsible for this document is 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 535:1991), which has been technically revised to include precision data.

## Introduction

The test described in this International Standard permits the determination of the quantity of water that can be absorbed by the surface of paper or board in a given time. Water absorptiveness is a function of various paper and board characteristics such as sizing, porosity, etc.





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

## 1 Scope

This International Standard specifies a method of determining the water absorptiveness of sized paper and board, including corrugated fibreboard, under standard conditions. It may not be suitable for paper of grammage less than 50 g/m<sup>2</sup> or embossed paper. It is not suitable for porous papers such as newsprint or unsized papers such as blotting paper or other papers having a relatively high water absorptiveness for which ISO 8787<sup>[2]</sup> is more suitable.

This method is not intended to be used for precise evaluation of the writing properties of paper although it does give a general indication of suitability for use with aqueous inks.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 5269-1, *Pulps — Preparation of laboratory sheets for physical testing — Part 1: Conventional sheet-former method*

## 3 Terms and definitions

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

### 3.1

#### **water absorptiveness (Cobb value)**

calculated mass of water absorbed in a specified time by 1 m<sup>2</sup> of paper or board under specified conditions

Note 1 to entry: The test area is normally 100 cm<sup>2</sup>.

## 4 Principle

A test piece is weighed immediately before and immediately 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/m<sup>2</sup>).

## 5 Reagents and materials

**5.1 Water, distilled or deionized.** The temperature of the water is important and should be maintained during the test at the temperature used for conditioning and testing.

**5.2 Blotting paper,** having a grammage of 250 g/m<sup>2</sup> ± 25 g/m<sup>2</sup>. Pulp evaluation blotters are acceptable for the purposes of this International Standard (see ISO 5269-1).

## 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 contact with water 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 approximately  $100 \text{ cm}^2$ ) 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.

NOTE 1 For materials where leakage between the cylinder and the upper surface of the test piece may occur during the test, a soft, elastic, non-absorbent gasket may be interposed to prevent this. This gasket should have the same internal diameter as the cylinder after clamping.

NOTE 2 To prevent damage to the machined edge of the cylinder caused by clamping it upside down it is advisable to mark the top in some way so that it can be identified readily.

NOTE 3 If a cylinder of a small area is used it is recommended that this should not be less than  $50 \text{ cm}^2$ . The water depth must still be 10 mm.

**6.2 Metal roller**, with a smooth face, 200 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**, with an accuracy of 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 being 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, make sure that the specimens taken are representative of the sample received.

## 8 Conditioning

Condition the specimens as specified in ISO 187. Keep them in the conditioning atmosphere throughout the test.

## 9 Preparation of test pieces

Prepare the test pieces in the same atmospheric conditions used to condition the specimens. Avoid contact of the test area with hands or fingers, cut from the specimens at least 10 test pieces of sufficient

size to exceed the diameter of the cylinder by at least 10 mm from any edge, ensuring that the test area is free from visible folds, creases, cracks or other defects.

NOTE For normal apparatus (see [6.1](#)) a width of about 125 mm is suitable.

If watermarks are present, these areas should be avoided if possible. When the specimens available are too small to allow the normal apparatus to be used, a smaller test area may be agreed upon between the interested parties and depending on the corresponding equipment availability.

## 10 Procedure

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

### 10.1 Mounting of the test piece

Ensure that the upper surface of the base plate and the edge of the cylinder which will come in contact with the test piece are dry before commencing each test.

Weigh the test piece to the nearest 1 mg and place it with the surface to be tested uppermost on the base plate. Place the cylinder with the machined edge in contact with the test piece and clamp sufficiently firmly to prevent any leakage of water between it and the test piece.

### 10.2 Exposure to water and blotting

For the purposes of this International Standard, the time of test is defined as the time between the moment the water first contacts the test piece and the commencement of blotting.

Pour 100 ml  $\pm$  5 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. Use new water for each determination.

The test procedure for any selected exposure time should, where possible, conform to the conditions summarized in [10.3](#), the exposure time being selected according to the water absorptiveness of the paper and board under consideration. If, for example, a test time of 60 s has been selected, pour off the excess water after 45 s (see [Table 1](#)), 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 s after commencement of the test, place a second sheet of blotting paper on top of the test piece and remove the excess water, using the hand roller ([6.2](#)) with two rollings (once forward and once back) without exerting any pressure on the roller.

NOTE 1 On corrugated fibreboard the roller should be applied with its axis parallel to the flutes.

NOTE 2 Where corrugated fibreboard is indented by the cylinder edge or which exhibits “washboarding” it may not be possible for the blotting paper to contact the entire wet area of the test piece. In such cases it is recommended that instead of using the roller, the back of the blotting paper is gently rubbed by hand.

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.

NOTE 3 In the case of board it may not be possible to fold the test piece. In such cases the second weighing must be carried out with the least possible delay.

Repeat the processes described in [10.1](#) and above 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.

### 10.3 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 may be increased according to the water absorptiveness and to the special nature of the paper or board under consideration and by agreement of the interested parties. In all cases, except Cobb<sub>30</sub>, the difference in time between removing excess water and blotting shall be 15 s ± 2 s.

**Table 1 — Test times**

Recommended times of test s	Symbol	Time at which excess water is removed s	Time at which blotting is carried out s
30	Cobb <sub>30</sub>	20 ± 1	30 ± 1
60	Cobb <sub>60</sub>	45 ± 1	60 ± 2
120	Cobb <sub>120</sub>	105 ± 2	120 ± 2
300	Cobb <sub>300</sub>	285 ± 2	300 ± 2
1 800	Cobb <sub>1 800</sub>	1 755 to 1 815	15 ± 2 after removing excess water

NOTE The times given in columns three and four are calculated from the moment the water comes into first contact with the test piece (see 10.2).

## 10.4 Rejection of test pieces

Reject test pieces which

- have been penetrated through, by the water; or
- show signs of leakage around the clamped area; or
- show excess water after blotting (which is indicated by the gloss of the surface).

If the percentage of rejects due to a) 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 the equation

$$A = (m_2 - m_1)F$$

where

$m_1$  is the dry mass, in grams, of the test piece;

$m_2$  is the wet mass, in grams, of the test piece;

$F$  is 10 000/test area (for normal apparatus this is 100 cm<sup>2</sup>).

**11.2** For each side tested calculate the mean water absorptiveness to the nearest 0,5 g/m<sup>2</sup> and the standard deviation.

**11.3** Use a standard notation, for example

Cobb<sub>60</sub> (value in grams per square metre) at  $t$  °C

dependent on the time of the test, in seconds.

**11.4** If the faces are not identifiable, give the mean and standard deviation of the grouped results.

## **12 Test report**

The test report shall include the following information:

- a) a reference to this International Standard;
- 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<sup>2</sup>;
- g) number of rejected test pieces and the reason for rejection;
- h) any circumstances or factors which may have influenced or affected the results.

## Annex A (informative)

### Precision

#### A.1 General

In 2012, 16 laboratories, from 11 European countries, tested two samples according to this International Standard. The data for water absorption Cobb<sub>60</sub> (paper), water absorption Cobb<sub>600</sub> (board) and water absorption Cobb<sub>1800</sub> (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<sub>60</sub> (paper) are presented in [Clause A.2](#). The data for water absorption Cobb<sub>600</sub> (board) are presented in [Clause A.3](#). The data for water absorption Cobb<sub>1800</sub> (corrugated board) are presented in [Clause A.4](#).

The calculations were made according to ISO/TR 24498[3] and TAPPI T 1200[4]

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[1].

The repeatability and reproducibility limits reported are estimates of the maximum difference which 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 may 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, viz.:

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

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<sub>60</sub> (paper)

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

**Table A.1 — Estimation of repeatability (Cobb<sub>60</sub>)**

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

**Table A.2 — Estimation of reproducibility (Cobb<sub>60</sub>)**

Sample	Number of laboratories	Mean water absorption Cobb <sub>60</sub> g/m <sup>2</sup>	Reproducibility standard deviation $s_R$ g/m <sup>2</sup>	Coefficient of variation $C_{V,R}$ %	Reproducibility limit $R$ g/m <sup>2</sup>
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 Cobb<sub>600</sub> (board)

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

**Table A.3 — Estimation of repeatability (Cobb<sub>600</sub>)**

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

**Table A.4 — Estimation of reproducibility (Cobb<sub>600</sub>)**

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

### A.4 Water absorption Cobb<sub>1800</sub> (corrugated board)

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

**Table A.5 — Estimation of repeatability (Cobb<sub>1800</sub>)**

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

**Table A.6 — Estimation of reproducibility (Cobb<sub>1800</sub>)**

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

## Bibliography

- [1] ISO 5725-1:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*
- [2] ISO 8787:1986, *Paper and board — Determination of capillary rise — Klemm method*
- [3] ISO/TR 24498:2006, *Paper, board and pulps — Estimation of uncertainty for test methods*
- [4] TAPPI Test method T 1200 sp-07, *Interlaboratory evaluation of test methods to determine TAPPI repeatability and reproducibility*









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