
**Pulps — Laboratory sheets —
Determination of physical properties**

Pâtes — Feuilles de laboratoire — Détermination des propriétés physiques

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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 5270 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps*, Subcommittee SC 5, *Test methods and quality specifications for pulps*.

This third edition cancels and replaces the second edition (ISO 5270:1998), which has been technically revised. The list of relevant International Standards for paper and board, to be used for testing the physical properties of laboratory sheets, has been updated and new standards, such as ISO 1924-3 and ISO 15754, have been included. The option to determine air permeance, using the Bendtsen method (ISO 5636-3) or the Sheffield method (ISO 5636-4) has been inserted, as well as the option to measure optical properties.

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Introduction

This International Standard includes the determination of physical properties of both “low grammage” sheets and “high grammage” sheets, prepared in accordance with ISO 5269-1, ISO 5269-2 or ISO 5269-3. The oven-dry grammage of the “low grammage” sheets is (60 ± 2) g/m² using the conventional sheet former, as described in ISO 5269-1 and ISO 5269-3, or (75 ± 2) g/m² using the Rapid-Köthen sheet former, as described in ISO 5269-2 and ISO 5269-3. The oven-dry grammage of the “high grammage” sheets is 140 g/m², with a tolerance of 3 % using the conventional and the Rapid Köthen sheet formers, except for the z-directional tensile strength where the grammage is ≥ 90 g/m².

For determination of physical properties, ISO 5270 refers to the relevant International Standards for paper and board for the description and calibration of the required equipment, and for the calculation and reporting of results. This International Standard, however, specifies the procedures for testing laboratory sheets where the amount of material is limited, compared to testing of paper and board to which the relevant International Standards referred to are applicable, and for that reason there may be a discrepancy.

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Pulps — Laboratory sheets — Determination of physical properties

1 Scope

This International Standard specifies the relevant International Standards to be used for the determination of physical properties of laboratory sheets made of all kind of pulps. It is applicable to laboratory sheets prepared in accordance with ISO 5269-1, ISO 5269-2 or ISO 5269-3.

In this International Standard, it is left to the pulp producer and the pulp user to agree upon which properties are relevant to be tested. The results are, if applicable, reported in index form.

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 187:1990, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 534, *Paper and board — Determination of thickness, density and specific volume*

ISO 536, *Paper and board — Determination of grammage*

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 1974, *Paper — Determination of tearing resistance — Elmendorf method*

ISO 2493-1, *Paper and board — Determination of bending resistance — Part 1: Constant rate of deflection*

ISO 2493-2, *Paper and board — Determination of bending resistance — Part 2: Taber-type tester*

ISO 2758, *Paper — Determination of bursting strength*

ISO 5269-1, *Pulps — Preparation of laboratory sheets for physical testing — Part 1: Conventional sheet-former method*

ISO 5269-2, *Pulps — Preparation of laboratory sheets for physical testing — Part 2: Rapid-Köthen method*

ISO 5269-3, *Pulps — Preparation of laboratory sheets for physical testing — Part 3: Conventional and Rapid-Köthen sheet formers using a closed water system*

ISO 5626, *Paper — Determination of folding endurance*

ISO 5636-3, *Paper and board — Determination of air permeance (medium range) — Part 3: Bendtsen method*

ISO 5636-4, *Paper and board — Determination of air permeance (medium range) — Part 4: Sheffield method*

ISO 5636-5, *Paper and board — Determination of air permeance (medium range) — Part 5: Gurley method*

ISO 7263, *Corrugating medium — Determination of the flat crush resistance after laboratory fluting*

ISO 9895, *Paper and board — Compressive strength — Short-span test*

ISO 12192, *Paper and board — Determination of compressive strength — Ring crush method*

ISO 15754, *Paper and board — Determination of z-directional tensile strength*

NOTE A separate International Standard, ISO 15361^[1], has been published for pulps describing the determination of zero-span tensile strength, wet or dry.

3 Principle

Determination of physical properties of laboratory sheets using the procedure and equipment described in the relevant International Standards given in Tables 1 and 2. The results are, if applicable, reported in index form.

NOTE The properties to be measured are jointly determined by the pulp producer and the pulp user.

4 Apparatus

The equipment is specified in the respective International Standards given in Tables 1 and 2 to which this International Standard refers. The equipment shall be calibrated in accordance with the instructions in the relevant International Standards given in Tables 1 and 2.

5 Trimmed laboratory sheets

5.1 Selection of laboratory sheets

Depending on the properties to be tested, determine the number of laboratory sheets required (see Table 1 and/or Table 2). The specification of the number of test pieces needed for each property defines the area required for testing and thus the number of sheets.

Each sheet shall be free of visible defects.

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5.2 Conditioning of laboratory sheets

Condition the laboratory sheets in the standard atmosphere (23 ± 1 °C and (50 ± 2) % relative humidity, or in the atmosphere allowed in tropical countries, according to ISO 187.

ISO 187 states in its Introduction that “Unless otherwise specified, the equilibrium condition should be attained by the sorptive process”. For tests in which the hysteresis of the equilibrium moisture content may lead to important errors, the sample shall be pre-conditioned before conditioning (see ISO 187:1990, 6.1). If it is known that conditioning will result in an equilibrium moisture content equivalent to that achieved by sorption, the pre-conditioning may be omitted.

If the laboratory sheets have been prepared using the conventional sheet former, according to ISO 5269-1 or ISO 5269-3, the sheets may reach equilibrium by desorption. If the laboratory sheets have been prepared using the Rapid-Köthen sheet former, according to ISO 5269-2 or ISO 5269-3, the sheets may reach equilibrium by sorption of moisture.

Whenever the test atmosphere is known to have been outside the limits and there is any chance that the moisture content of the sheets has been changed by such excursions, all sheets must be reconditioned before any further testing (see ISO 187).

Keep the laboratory sheets in the conditioning atmosphere until testing is completed.

NOTE 1 Pre-conditioning using heat may change the optical properties and is, for that reason, not recommended for the sheets to be used for measuring optical properties.

NOTE 2 It is not recommended to use the Rapid-Köthen sheet former, described in ISO 5269-2 and ISO 5269-3, for preparation of laboratory sheets intended for determination of optical properties, since the high temperature used when drying the sheets may change the optical properties.

NOTE 3 The moisture content and thus physical properties of laboratory sheets at a given relative humidity (e.g. at 50 % RH) depend on the moisture history of the sheets. The moisture content of sheets dried from high relative humidity to low relative humidity follows a different, higher moisture content, path in comparison with sheets taken from low to high relative humidity, an effect called hysteresis. For laboratory sheets prepared using the Rapid-Köthen sheet former (ISO 5269-2 and ISO 5269-3), the 50 % RH is reached from a lower relative humidity by sorption of moisture, whereas for laboratory sheets prepared using the conventional sheet former (ISO 5269-1 and ISO 5269-3), the 50 % RH is reached by desorption of moisture. Thus sheets prepared using the conventional sheet former will have higher moisture content at equilibrium than those prepared using the Rapid-Köthen sheet former. If laboratory sheets are pre-conditioned, moisture content differences caused by this effect can be eliminated.

5.3 Optical properties

For certain purposes, it may be desirable to measure optical properties of laboratory sheets prepared using the conventional sheet former (ISO 5269-1 or ISO 5269-3). Depending on the purpose, light scattering and light absorption coefficients, opacity, ISO brightness and CIE whiteness can be measured.

Optical properties for sheets prepared using the conventional sheet former (ISO 5269-1, ISO 5269-3) should be tested without pre-conditioning and no optical tests should be performed on sheets prepared using the Rapid-Köthen sheet former (ISO 5269-2, ISO 5269-3).

NOTE 1 Preparation of laboratory sheets for the measurement of diffuse blue reflectance factor (ISO brightness) of pulp is specified in ISO 3688^[2]. The sheets having a grammage of 200 g/m² are prepared in a sheet former (ISO 5269) or in a Büchner funnel. The measurement of ISO brightness is described in ISO 2470-1^[3].

NOTE 2 For the determination of light scattering and light absorption coefficients of the low-grammage laboratory sheets ISO 9416^[4] is recommended, and for the determination of opacity ISO 2471^[5] is recommended.

NOTE 3 For the determination of CIE whiteness, it is recommended to use either ISO 14475^[6] or ISO 14476^[7].

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5.4 Determination of grammage, bulking thickness and apparent bulk density

Trim the laboratory sheets, using a punch, or a ruler and a pair of scissors, to obtain a defined size so that the area can be determined to an accuracy of 0,5 %. For "low grammage" sheets, consult Table 1 in 5.5 to establish a suitable size for the trimmed sheets that allows them to be used for cutting test pieces.

Before cutting test pieces, determine the grammage of the conditioned trimmed sheets using ISO 536. The mass of the trimmed sheets shall be determined to an accuracy of 0,2 % and the grammage shall be reported to three significant figures.

NOTE If a circular sheet having a diameter of 158 mm is used, only two test pieces for the determination of flat crush resistance or ring crush resistance can be cut from each sheet. These test pieces may be used for the determination of grammage.

Measure the bulking thickness of a pack of four trimmed sheets, with the same sides up, using ISO 534. Take measurements at five different places of the pack, taking care that the sheets are not displaced when changing the position of the pack for each measurement. Calculate and report the mean bulking thickness of a single sheet to three significant figures.

Calculate and report the apparent bulk density ρ , in kilograms per cubic metre, to three significant figures.

5.5 Preparation of test pieces

From the conditioned trimmed sheets, cut a sufficient number of test pieces depending on the property to be determined. The minimum number of test pieces for "low grammage" sheets is given in Table 1 and for "high grammage" sheets in Table 2.