International Standard 5269/1

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

Pâtes — Préparation des feuilles de laboratoire pour essais physiques — Partie 1 : Méthode de la formette conventionnelle

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Foreword

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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 5269/1 was developed by Technical Committee ISO/TC 6, *Paper, board and pulps*, and was circulated to the member bodies in November 1977.

It has been approved by the member bodies of the following countries :

Australia	India	Romania
Belgium	Iran	South Africa, Rep. of
Canada	Ireland	Spain
Chile	Israel	Sweden
Czechoslovakia	Italy	Switzerland
Egypt, Arab Rep. of	Kenya	Turkey
Finland	Mexico	United Kingdom
France	Netherlands	USA
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The member bodies of the following countries expressed disapproval of the document on technical grounds :

Bulgaria
New Zealand

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

0 Introduction

It has been agreed that the ultimate aim of standardization of the preparation of laboratory sheets should be to develop one method which is internationally acceptable and which, if possible, permits the use of different types of sheet-making apparatus.

For practical reasons it has not proved possible to achieve this at present. Therefore, as an interim measure, in view of the widespread use of equipment described in this International Standard, it has been decided to provide agreed guidance on the use of different types of equipment in order to achieve consistency of results with each method.

To avoid creating too many levels of results, the method specified in ISO 5269/2 (Rapid-Köthen method) should preferably be used only in connection with the Jokro mill method of laboratory beating according to ISO 5264/3; consequently, the method specified in ISO 5269/1 should preferably be used only in connection with the Valley beater and PFI mill methods of laboratory beating according to ISO 5264/1 and ISO 5264/2 respectively.

1 Scope

This International Standard specifies a method, using a conventional sheet-former, for the preparation of laboratory sheets of pulp for the purpose of carrying out subsequent physical tests on these sheets in order to assess the relevant properties of the pulp itself. ISO 5269/2[1] specifies a Rapid-Köthen method for the preparation of such sheets.

2 Field of application

The method is applicable to most kinds of pulp. It is not suitable for some very long-fibred pulps, such as those from unshortened cotton, flax and similar materials.

This method is not appropriate for the preparation of laboratory sheets for the determination of diffuse blue reflectance factor (ISO brightness) in accordance with ISO 3688.

3 References

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

ISO 565, *Test sieves — Woven metal wire cloth and perforated plate — Nominal sizes of apertures.*

ISO 3310/1, *Test sieves — Technical requirements and testing — Part 1 : Metal wire cloth.*

ISO 5263, *Pulps — Laboratory wet disintegration.*

ISO 5264/1, *Pulps — Laboratory beating — Part 1 : Valley-beater method.*

ISO 5264/2, *Pulps — Laboratory beating — Part 2 : PFI mill method.*

1) At present at the stage of draft.

4 Principle

A circular, rectangular or square sheet is formed in a conventional sheet-former from a pulp suspension on a wire screen under suction. The sheet is subjected twice to a pressure of 400 kPa. The sheet is dried in conditioned air and in contact with a drying plate, to which it adheres so that it does not shrink.

5 Equipment

5.1 Sheet former, consisting of three main parts :

5.1.1 Upper section, comprising a stock container, filled with pulp suspension to a mark located 350 ± 1 mm above a wire screen (see 5.1.3). It is furnished with a rubber gasket to prevent leakage. The cross-section of the container shall be square, rectangular or circular, and constant throughout the height. If the container is rectangular, the shorter side shall be not less than 120 mm and the quotient of the longer by the shorter side shall not exceed 2,5. If the container is circular, it shall not be less than 158 mm in diameter. It shall be of such height that water will not splash over the edge when the stirrer (5.2) is operating.

5.1.2 Lower section, comprising a drainage vessel, consisting of an upper and a lower part. The upper part shall have the same cross-section as the stock container (5.1.1), and its shape shall be such that the flow of liquid through the wire screen is uniform over the whole area. The lower part may be of smaller cross-section but shall be placed symmetrically in relation to the upper part. The lower part shall be fitted with a valve, which is connected to a draining pipe with a water seal at its lower end. The vertical distance from the top of the wire screen to the overflow of the water seal shall be 800 ± 5 mm. The lower part and the drainage valve shall be large enough to permit water in the stock container between the level mark and the wire screen to empty within 4,0 ± 0,2 s. The lower part of the drainage container shall be provided with a water inlet tube. The design shall incorporate a means of releasing vacuum after the sheet has been formed.

5.1.3 Frame, with a perfectly flat plain woven metallic wire screen, to be placed horizontally between the two containers (5.1.1 and 5.1.2). The screen shall be clean, undamaged and fitted without wrinkles and corrugations. It shall have a mesh aperture of 125 µm and the wire shall be 90 µm in diameter. The wire screen is backed by another coarse wire screen, which, in turn, may be backed by a rigid framework.

5.2 Stirrer, made of any non-corroding, rigid material, and consisting of a perforated plate and furnished with vanes to keep the plate parallel to the wire screen (see 5.1.3) and minimize swirling during stirring. The total area of the holes (diameter 10 to 20 mm) shall be about 30 % of the area of the plate; the holes shall be evenly spaced. The dimensions of the plate shall be such that there is a clearance of 2 to 3 mm to the stock container (5.1.1). All edges shall be rounded and smoothed to avoid the accumulation of fibres. The stirrer shall also have a stop that maintains a distance of about 20 mm between the wire screen and the plate in its lowest position.

5.3 Couching equipment, comprising a couch weight, having a mass between 10 and 50 g per square centimetre of test sheet area, with a plane bottom of the same area as the wire screen (5.1.3).

NOTES

1 A couch plate may be used to protect the sheet from distortion when the couch weight is placed on it. The total mass of couch plate and couch weight shall be within the limits given above.

2 In some laboratories, a metal couch roll (mass 13,0 kg, length 178 mm, diameter 102 mm) and a couch plate to protect the sheets are used for couching circular test sheets of diameter 159 mm. The test sheets produced have properties that are equivalent to those obtained by the standard procedure.

5.4 Blotters, made of fully bleached chemical pulp or rag pulp, neutral, free from sizing agents, chemical additives, visible contraries and fluorescent contaminant (see note 1). The blotters shall be of the same area as, or at most 35 % larger than, the test sheets. Their grammage shall be 250 ± 25 g/m^2, the Klemm absorbency (see note 2) shall be not less than 50 mm and the dimensional changes caused by soaking shall not exceed 3 % in any direction. Further, the water uptake (see note 3) of the blotter shall be 450 ± 50 g/m^2.

NOTES

1 For sheets made of highly beaten pulps, the wet-strength of the blotters may be insufficient. In such cases, blotters containing wet-strength agents may be used, provided that it has been proved that wet-strength agent will not migrate to the test sheet.

2 The Klemm absorbency is determined as follows :

From a conditioned specimen, cut test pieces 15 mm wide in the machine and cross directions carry out the test in the conditioning atmosphere. Mark the test pieces 10 mm from one end and fix them to an apparatus which permits the vertically suspended test pieces to be lowered into water to a depth of 10 ± 1 mm. Lower the test pieces until the mark coincides with the water level and start timing. After 10 min, read the capillary rise.

3 The water uptake is determined as follows :

Weigh a conditioned test piece, 40 mm × 40 mm, and immerse it in deionized or distilled water at 23 °C for 2 s. After removal, drain the test piece from one corner for 30 s and determine the difference in mass before and after immersion. Calculate the water uptake as the mass of water absorbed, in grams per square metre of the conditioned blotter.

5.5 Drying plate, of the same size as the formed sheet made of corrosion-resistant metal or other suitable material, such as rigid plastics, glazed or polished on at least one side. It is essential that the wet sheet adheres firmly to the plate. The plate shall be flat and free from any perceptible bulges or distortions.

5.6 Template, to facilitate the stacking of test sheets. This shall be designed to fit the shape of the test sheets and to ensure that they are placed centrally on each other in the press (5.8).

5.7 Separating plates, of the same size as the blotters (5.4) or larger, made of corrosion-resistant material or plastics, to separate laboratory sheets of different kinds.

5.8 Press, capable of exerting an even pressure of 400 ± 10 kPa over the area of a test sheet and of holding this pressure for 5 min. The maximum number of test sheets to be pressed simultaneously should be adjusted to the capacity of the press.

5.9 Means to keep the test sheets in close contact with the drying plate (5.5) during the entire drying so that the test sheets do not shrink.

5.10 Conditioning cabinet or **laboratory** with adequate air circulation, capable of maintaining the same atmospheric conditions as those in which the sheets will be tested. During the period when the sheets are still wet, the relative humidity may be allowed to exceed the limit and the temperature may be allowed to fall a few degrees below the limit.

6 Preparation of sample

Unbeaten pulps shall be disintegrated in accordance with ISO 5263. Laboratory beaten pulps shall be treated as specified in the relevant International Standard (ISO 5264/1 or 5264/2). Slush pulps taken from mill streams do not require any pretreatment.

Obtain the stock and dilute it to a concentration of between 0,2 and 0,5 % (m/m). Mix thoroughly and prepare a trial handsheet (oven-dry grammage 50 to 70 g/m^2) of known area as specified in 7.1.

The preparation of a trial handsheet on the sheet machine eliminates the need for making a correction for the loss of fibres through the woven metallic wire screen. Use the stock for forming sheets with a minimum delay.

NOTE — For pulps that tend to produce flocks, dilute the stock to a concentration of 0,2 to 0,3 % (m/m).

7 Procedure

7.1 Sheet forming

Close the drain valve. Clamp the upper section (5.1.1) in position. Open the inlet valve to wash the wire. Let the water rise to at least 50 mm above the wire screen (5.1.3).

Add an amount of stock corresponding to a grammage of the ready-made sheet of 60,0 ± 3,0 g/m^2, calculated on an oven-dry basis.

Make up to the mark with water and mix the suspension by inserting the stirrer (5.2) and moving it briskly up and down. The stirrer plate shall remain below the surface during the stirring. Perform the double movement six times sufficiently vigorously to ensure thorough mixing, then once more, slowly, before gently withdrawing the stirrer. After exactly 10 s, open the drain valve fully with a rapid movement.

When the water has left the wire screen, let the sheet formed on the wire screen drain under reduced pressure for a period that is about 10 % of the draining time, but not less than 5 s.

Then, disconnect the stock container and close the drainage valve. Place two blotters (5.4), wire side up, centrally over the wet sheet on the wire. To couch the sheet either :

a) place the couch weight (5.3) gently and centrally on the blotters and remove it again after 20 s, or

b) lay the couch plate centrally or the blotters and place the couch roll gently in the middle of the plate. Move the roll backwards and forwards across the plate, applying no other pressure, to within 6 mm of the edges of the plate. Make five complete rolls in about 20 s and lift up the couch roll from middle of the plate.

NOTE — Blotters that have been used in this procedure and are flat and in good condition may be re-used after drying, provided that they are not placed in contact with a test piece. Blotters that are used in contact with test pieces shall be new.

Carefully separate the test sheet, still adhering to the lower blotter, from the wire. Avoid any unnecessary bending and place the blotter, test sheet up in the press or on a suitable bench top. Continue the procedure as specified in 7.2.

NOTE — The sheets should be made and stacked for pressing without interruption.

Empty the drainage vessel and prepare the sheet-former for the next sheet.

7.2 Pressing

Place the laboratory sheet, attached to the couch blotter (5.4) (test sheet up) on top of one dry blotter in the pressing or suitable stacking frame (see note to 5.4). Place the drying plate (5.5), with its polished side down, on top of the test sheet, followed by another dry blotter ready to receive the next couch blotter and laboratory sheet. Ensure that the test sheets are placed centrally on each other by means of the template (5.6).

NOTE — It is essential to keep the drying plates completely clean and free from wax, oil or anything that prevents adhesion of the wet sheet to the polished surface.

The complete stack then consists of dry blotter, couch blotter, laboratory sheet and drying plate, repeated several times. Place a single dry blotter on top of the top drying plate.

NOTE — If the stack contains test sheets from different types of pulp, these shall be separated by inserting a separating plate.

Ensure that the stack (see 5.8) is placed centrally in the press and continuously raise the effective pressure on the sheets to 400 ± 10 kPa within 20 ± 10 s of the time at which the first increase of pressure is registered. Maintain this pressure for 5 min ± 15 s, then release it and remove the stack from the press.

NOTE — The specified pressure is that applied to the laboratory sheets and may differ from the reading on the pressure gauge.

After the first pressing, the laboratory sheets should be firmly attached to the drying plates and any sheets that are not shall be rejected. A second pressing is next carried out, for which

the order of the test sheets is reversed and all the blotters are replaced. To do this, place the top drying plate from the first pressing with laboratory sheet attached (test sheet up) on a dry blotter (wire side up) using the template (5.6).

The complete stack then consists of a dry blotter, drying plate with test sheet, a dry blotter, repeated several times. Press the laboratory sheets by raising the pressure rapidly to 400 ± 10 kPa. Maintain the pressure for 2 min ± 15 s and then release it and remove the stack from the press.

NOTE — There is no need to fix the time-period for attaining the specified pressure in the second pressing, since the risk of sheet rupture is negligible and the platen movement due to compression is very much less than in the first pressing.

7.3 Drying and conditioning

Separate the drying plates together with the attached laboratory sheets from the blotters and mount them in a suitable manner (5.9) in the conditioning cabinet or laboratory (5.10) so that the laboratory sheets remain in contact with their drying plates during the entire drying period to prevent shrinkage. With normal air circulation the sheets will therefore be conditioned and ready for testing the day after preparation. The dry sheets should separate readily from the drying plates and if they have properly adhered to the drying plates, they should be uniformly glazed. In cabinets, where the air circulation is rapid, the drying period can be reduced.

It is essential that the laboratory sheets do not shrink during drying.

NOTE - The shrinkage can be prevented, for example, by clamping the laboratory sheets between specially designed drying frames. Another method is to dry the laboratory sheets with their drying plates on a non-heated, slightly convex metal plate where they are kept in place by means of a cloth and a protecting blotter. A number of such plates can be mounted in a cabinet.

If it is necessary to protect the sheets during the drying, the blotter that was in contact with the laboratory sheet may be left there until the sheet is dry.

The drying period will vary depending on the equipment used, the kind of pulp, the number of sheets prepared, etc. The time required shall be checked with each arrangement for drying and conditioning.

8 Test report

The test report shall include the following particulars :

a) reference to this International Standard;

b) all the indications necessary for complete identification of the sample;

c) statement of the disintegration and beating given to the sample in the laboratory;

d) any unusual features observed in the course of procedure;

e) details of the apparatus used;

f) any variation from the method of drying given in this International Standard;

g) any operations not specified in this International Standard or in the International Standards to which reference is made, or regarded as optional, which might have affected the results.