
**Pulps — Preparation of laboratory sheets
for physical testing —**

**Part 2:
Rapid-Köthen method**

*Pâtes — Préparation des feuilles de laboratoire pour essais physiques —
Partie 2: Méthode Rapid-Köthen*
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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.

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.

International Standard ISO 5269-2 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps*, Subcommittee SC 5, *Test methods and quality specifications for pulp*.

This second edition cancels and replaces the first edition (ISO 5269-2:1980), of which it constitutes a technical revision.

ISO 5269 consists of the following parts, under the general title *Pulps — Preparation of laboratory sheets for physical testing*:

- *Part 1: Conventional sheet-former method*
- *Part 2: Rapid-Köthen method*

Annex A of this part of ISO 5269 is for information only.

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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 part of ISO 5269, 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 this part of ISO 5269 should preferably be used with the PFI mill or Jokro mill methods of laboratory beating according to ISO 5264-2 and ISO 5264-3, respectively. The method specified in ISO 5269-1 (Conventional sheet-former method) should preferably be used with the Valley beater or PFI mill methods of laboratory beating according to ISO 5264-1^[2] and 5264-2, respectively.

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Pulps — Preparation of laboratory sheets for physical testing —

Part 2: Rapid-Köthen method

1 Scope

This part of ISO 5269 specifies a method, using a Rapid-Köthen 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.

This part of ISO 5269 is applicable to most kinds of pulp. It is not suitable for some pulps with very long fibres, such as those made from unshortened cotton, flax and similar materials.

This method is not suitable for the preparation of laboratory sheets for the determination of diffuse blue reflectance factor (ISO brightness) in accordance with ISO 3688^[1].

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2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 5269. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 5269 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 4119:1995, *Pulps — Determination of stock concentration.*

ISO 5263:1995, *Pulps — Laboratory wet disintegration.*

ISO 5264-2:1979, *Pulps — Laboratory beating — Part 2: PFI mill method.*

ISO 5264-3:1979, *Pulps — Laboratory beating — Part 3: Jokro mill method.*

ISO 5269-1:1998, *Pulps — Preparation of laboratory sheets for physical testing — Part 1: Conventional sheet-former method.*

3 Principle

A circular sheet is formed from a pulp suspension on a wire screen under suction. The sheet is subjected to pressure and dried in a dryer, with almost complete prevention of shrinkage, in a specified way with respect to the pressure applied, the suction and the temperature.

4 Equipment

4.1 Rapid-Köthen apparatus, consisting of a sheet former, transfer equipment, one or more dryers and accessories (see figure 1). The parts of the instrument which come into contact with stock or water shall be corrosion resistant.

4.1.1 Sheet former, consisting of a stock container for preparing the pulp suspension, the screen section on which wet fibre is forwarded, and the suction chamber for drawing off and holding the water after passing through the screen. The lower part of the stock container, screen section and suction chamber may be sealed off.

4.1.1.1 Stock container (see figure 1)

The stock container consists of a transparent cylindrical tube (1) with an internal diameter of $200 \text{ mm} \pm 0,5 \text{ mm}$ and a capacity of not less than 10 litres. The container is graduated in litres. Around the circumference of the lower part of the stock container are two rows of holes (2), 1,5 mm in diameter, one above the other, connecting radially to a circular cavity (3) round the outside of the cylinder. Each row contains 40 holes. The distance between the screen surface and the lower row of holes is 10 mm, and the space between the lower and upper rows is 7 mm. The lower row of holes is drilled horizontally and the upper row is inclined upwards at an angle of 30° towards the centre of the cylinder.

The stock container is so constructed that it can be lifted off the screen section. The circular cavity can be filled with water and compressed air.

4.1.1.2 Screen section

The screen section, which separates the stock container and the suction chamber, consists of the sheet-forming screen (4) and the supporting screen (5).

The nickel sheet-forming screen gauze is evenly stretched over the ring and can be lifted off from the supporting screen. The dimensions of the twilled sheet-forming screen gauze are as follows:

Number of warp wires:	60 wires/cm
Number of weft wires:	55 wires/cm
Wire diameter:	0,060 mm to 0,065 mm

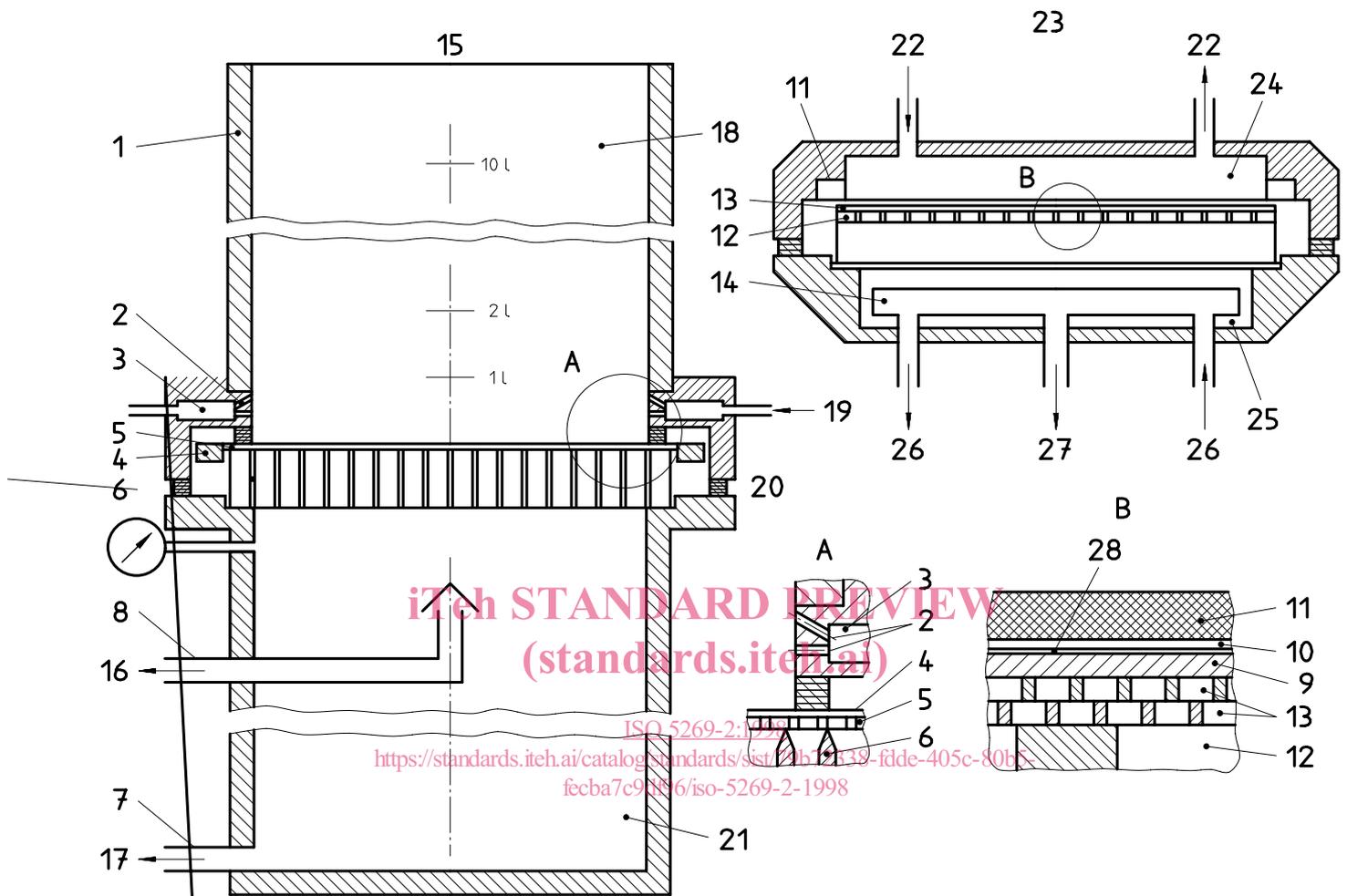
The supporting screen gauze is evenly stretched over bars (6) having a width of 2 mm and a height of 30 mm arranged parallel to one another and spaced $10 \text{ mm} \pm 2 \text{ mm}$ apart. The two upper edges of each bar are chamfered at an angle of 75° to the horizontal in such a way that a 0,5 mm wide ledge remains as a support for the supporting screen. The supporting screen shall be exactly horizontally aligned.

The dimensions of the supporting screen gauze in simple plain weave, made from phosphor bronze are as follows:

Number of warp wires:	8 wires/cm
Number of weft wires:	7 wires/cm
Wire diameter:	0,35 mm

4.1.1.3 Suction chamber

The suction chamber has a capacity of more than 10 litres, and has a water outlet (7) that can be closed. The suction chamber can be connected to a vacuum pump by means of a suction tube (8) placed at its axis, and covered so that it is protected against the infiltration of water. A regulating vent limits the maximum suction in the suction chamber to 27 kPa.



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Key

- | | | |
|--------------------------------|----------------------------------|---------------------|
| 1 Transparent cylindrical tube | 11 Rubber membrane | 21 Suction chamber |
| 2 Rows of holes | 12 Perforated, flat plate | 22 Hot water |
| 3 Circular cavity | 13 Phosphor bronze screen gauzes | 23 Dryer |
| 4 Sheet-forming screen | 14 Cooling body | 24 Heating chamber |
| 5 Supporting screen | 15 Sheet former | 25 Steam chamber |
| 6 Bars | 16 Air | 26 Tap water |
| 7 Water outlet | 17 Water | 27 Vacuum pump |
| 8 Suction tube | 18 Stock container | 28 Laboratory sheet |
| 9 Carrier boards | 19 Water or air | |
| 10 Paper cover sheets | 20 Screen section | |

Figure 1 — Rapid-Köthen sheet-forming and drying instrument

4.1.2 Transfer equipment for the wet fibre sheet, consisting of a couch roll, carrier boards and paper cover sheets.

4.1.2.1 Couch roll

The couch roll has a diameter of 120 mm to 130 mm, a length of 240 mm to 260 mm and a mass of 3,0 kg \pm 0,2 kg. The outer surface shall be resilient and is preferably made of felt about 20 mm thick.

4.1.2.2 Carrier boards (9)

Circular sheets of bleached lined folding boxboard, without colorants and fluorescent whitening agents, having a diameter of 240 mm, a grammage of 200 g/m², and a well-sized surface.¹⁾

4.1.2.3 Paper cover sheets (10)

Circular sheets of well-sized calendered writing paper, with a grammage of 65 g/m² \pm 5 g/m², and a diameter of 205 mm.¹⁾

4.1.3 Dryer, consisting of a heating chamber with a rubber diaphragm to transmit the heat and pressure, the supporting screen and a steam chamber fitted with a cooling body. The heating chamber, supporting screen and steam chamber can be sealed off.

4.1.3.1 Heating chamber

The chamber consists of a cavity provided with an inlet and an outlet for hot water at 93 °C \pm 4 °C. The bottom of the cavity consists of a temperature-resistant, highly elastic rubber diaphragm (11) of thickness 1 mm to 2 mm. The diameter of the rubber is slightly greater than 201 mm. The heating chamber can be lifted off the supporting screen. With a submerged heating chamber, the distance between the flat rubber diaphragm and the supporting screen is 1 mm.

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4.1.3.2 Supporting screen

The screen consists of a perforated, flat plate (12), above which two phosphor bronze screen gauzes (13) are stretched and firmly attached to the edge of the plate. The plate shall be so supported that negligible deformation occurs under a surface pressure of 100 kPa.

The dimensions of the supporting screen are as follows:

Upper screen gauze

Number of warp wires:	32 wires/cm
Number of weft wires:	24 wires/cm
Wire diameter:	0,16 mm to 0,17 mm

1) Further properties of carrier boards and paper cover sheets that have proved suitable are given below.

Carrier boards made of imitation chromoboard, based upon mechanical pulp covered with woodfree, machine-sized white top liner. The grammage of top liner is 60 g/m² \pm 5 g/m², the Cobb water absorption is 20 g/m² \pm 5 g/m² and the Bekk smoothness is 20 s to 25 s. The air permeance of the carrier board should exceed 1,83 \times 10⁻⁶ m/Pa·s, and the apparent density is 0,65 g/m³ to 0,70 g/m³.

Paper cover sheets of woodfree, supercalendered white paper, with a mass fraction of ash less than 5 % with a Cobb water absorption of 15 g/m² \pm 2 g/m², and a Bekk smoothness of 80 s to 120 s.

Suitable carrier boards and paper cover sheets are available commercially.

Lower screen gauze

Number of warp wires:	8 wires/cm
Number of weft wires:	7 wires/cm
Wire diameter:	0,35 mm

Supporting plate

Thickness:	2 mm
Hole diameter:	3 mm to 4 mm
Spacing of holes:	5 mm

4.1.3.3 Steam chamber

The chamber consists of a hermetically sealed cavity situated directly below the supporting screen, and having an exhaust nozzle at the deepest position. The steam chamber shall be evacuated by the exhaust nozzle to a pressure of 5 kPa absolute.

A cooling body (14) with a large surface, through which tap water flows, is fitted in the steam chamber. The temperature of the cooling water shall not exceed 20 °C. Part of the steam passing through the supporting screen condenses on the cooling body.

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4.2 Accessories

The following are important accessories of the Rapid-Köthen sheet forming and drying instrument, apart from the measuring equipment for checking compliance with the above-mentioned operating conditions.

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4.2.1 Dilution water pump, for passing water at (18 to 20) litres/min into the stock container (4.1.11) of the sheet former.

NOTE — The same pump is generally used for the passage of dilution water, cooling water and compressed air, as well as for evacuation.

4.2.2 Compressed air pump, for passing air at about 60 litres/min into the stock container (4.1.1.1) of the sheet former.

4.2.3 Hot-water heater, for providing heating water at a temperature of 93 °C ± 4 °C.

4.2.4 Hot-water pump, for circulating the heating water between the hot-water heater and the heating chamber (4.1.3.1) at a delivery rate of (3 to 6) litres/min per heating chamber.

4.2.5 Cooling water pump, for passing tap water at about 2 litres/min through the cooling body in the steam chamber (4.1.3.3) of the dryer.

4.2.6 Vacuum pump, capable of evacuating the steam chamber (4.1.3.3) of the dryer within 10 s to a pressure of 5 kPa absolute.