International Standard 5267/1

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Pulps — Determination of drainability — Part 1 : Schopper-Riegler method

Pâtes — Détermination de l'égouttabilité — Partie 1 : Méthode Schopper-Riegler

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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 5267/1 was developed by Technical Committee ISO/TC 6, *Paper, board and pulps*, and was circulated to the member bodies in February 1978.

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

Austria	India	South Africa, Rep. of
Belgium	Iran	Spain
Brazil	Ireland	Sweden
Canada	Italy	Switzerland
Chile	Kenya	Turkey
Egypt, Arab Rep. of	Mexico	United Kingdom
Finland	Netherlands	USA
France	Norway	USSR
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Hungary	Romania	

The member body of the following country expressed disapproval of the document on technical grounds :

Bulgaria

Printed in Switzerland

Pulps — Determination of drainability — Part 1 : Schopper-Riegler method

1 Scope

This International Standard specifies a method for determination of the drainability of a pulp suspension in water in terms of the Schopper-Riegler (SR) number.

The Schopper-Riegler test is designed to provide a measure of the rate at which a dilute suspension of pulp may be dewatered. It has been shown that the drainability is related to the surface conditions and swelling of the fibres, and constitutes a useful index of the amount of mechanical treatment to which the pulp has been subjected.

Results of this test do not necessarily correlate with the drainage behaviour of a pulp material on a commercial paper machine.

A method for the determination of drainability in terms of the "Canadian Standard" freeness number is specified in ISO 5267/2.[1)]

2 Field of application

In principle, this method is applicable to all kinds of pulp in aqueous suspension.

NOTE — However, in practice, the Schopper-Riegler test provides acceptable results only if a sufficiently dense mat of fibres is formed on the wire screen. For this reason, the test is not recommended for some extremely short-fibred pulps, such as those from well-beaten hardwoods, as most of the fibres will pass through the wire screen, resulting in anomalous reduction in the SR number. The most reliable results are obtained within the range of 10 to 90 SR number.

3 Reference

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

4 Principle

Draining, through a fibre mat formed during the test on a wire screen, of a given volume of pulp in aqueous suspension into a funnel provided with a bottom and a side orifice. Collection of the discharge from the side orifice in a measuring cylinder, graduated in Schopper-Riegler numbers.

5 Definition

For the purposes of this International Standard, the following definition applies :

Schopper-Riegler number scale : A scale on which a discharge of 1 000 ml corresponds to a SR number of zero and zero discharge to a SR number of 100.

6 Apparatus

Ordinary laboratory apparatus and

6.1 Schopper-Riegler apparatus, as described in annex A.

Instructions for maintenance of the apparatus are given in annex B.

7 Preparation of sample

Take a sample of aqueous suspension of disintegrated pulp. If the concentration is not known exactly, dilute the suspension to approximate 0,22 % (*m*/*m*) with distilled or deionized water (see note 3), and determine the stock concentration in accordance with ISO 4119. Then dilute the suspension to a stock concentration of 0,2 ± 0,002 % (*m*/*m*) and adjust the temperature to 20,0 ± 0,5 °C (see note 4). Throughout the preparation of the sample, take care to avoid the formation of air bubbles in the suspension.

NOTES

1 With time, an aqueous pulp suspension, withdrawn from the stock preparation system or laboratory pulp evaluation equipment, can undergo a change in Schopper-Riegler number. To avoid the effect of this reversion phenomenon, pulp suspensions subjected to testing more than 30 min after sampling should first be treated in the disintegration apparatus for 6 000 revolutions of the propellor, at or near the stock concentration specified for the SR test.

2 The test result is sensitive to the quantity of pulp fines, or "crill", in the suspension. Thickened pulp samples may lose some of this fibre fraction. To avoid such losses during the course of thickening, the filtrate should be recirculated through the pulp pad until the filtrate is clear, and the pulp redispersed by disintegrating as described in note 1. This procedure should be used to concentrate dilute pulp suspension to the Part II stock concentration required for the Schopper-Riegler test.

1) At present at the stage of draft.

3 As the drainage of a pulp suspension is affected considerably by dissolved solids and the pH of the water, either distilled or deionized water of equivalent quality should be used throughout the test.

4 Where necessary for climatic reasons, a temperature of 25 ± 5 °C may be applied, provided that this is noted in the test report. In any case, during the test the basic temperature chosen should be kept constant within ± 0,5 °C.

8 Procedure

Clean the funnel and drainage chamber of the Schopper-Riegler apparatus (6.1) thoroughly and finally rinse with water. Place the drainage chamber in the seat of the funnel. Adjust the temperature of the apparatus by rinsing it with water at 20,0 ± 0,5 °C (see note 4 in clause 7).

Place the sealing cone in the closed position and set the SR measuring cylinder beneath the side orifice.

Whilst stirring, transfer 1 000 ± 5 ml of homogeneous pulp suspension to a clean measuring cylinder. Mix the sample by closing the top of the cylinder by hand and turning it end-over-end for two cycles. Avoid introducing air into the stock at this stage.

Pour the sample rapidly but smoothly into the drainage chamber. Direct the stream against the shaft and the wings of the sealing cone to avoid a vortex.

Raise the sealing cone 5 s after all the pulp suspension has been added. Read the SR number to the nearest unit when no more water drips from the side orifice.

9 Expression of results

Carry out two determinations on each sample. Duplicate determinations which differ by more than 4 % shall be repeated.

10 Test report

The test report shall give the following particulars :

a) reference to this International Standard;

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

c) the test temperature;

d) the results, expressed in Schopper-Riegler numbers;

e) any unusual features observed in the course of the test;

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

Annex A

The Schopper-Riegler apparatus

A.1 The Schopper-Riegler apparatus (see figure 1) comprises a drainage chamber equipped with a wire screen, a sealing cone, and a funnel mounted on a suitable support. All parts are made of non-corrodible material. The drainage chamber is a cylinder having an internal diameter of 137 mm; at its lower end is a 45° tapered section, followed by a cylindrical part having a diameter of 112,9 ± 0,1 mm (cross-sectional area 100 cm^2). The tapering section forms a seat for the sealing cone. The wire screen is of phosphor bronze, and fits tightly into the cylinder 25 mm below the taper. It is plane, is mounted perpendicular to the cylinder axis, and has a thickness of 0,40 mm. It has 24 weft and 32 warp meshes per 10 mm, the weft strands having a thickness of 0,17 mm and the warp strands 0,16 mm.

A.2 The sealing cone (see figure1, part B, and figure 2) has an outside diameter of 120 mm; its tapered surface is at 55° to the vertical. The sealing cone is fitted to a vertical shaft having outside diameter of 20 mm. A vent having a diameter of 10 mm runs axially through the sealing cone and the shaft, to permit the passage of air when the sealing cone is raised. The shaft is provided with two wings placed diametrically and vertically, to prevent vortices in the pulp suspension. The seal consists of a rubber ring of 30° Shore hardness. The sealing cone shall be raised at a constant rate of 100 ± 10 mm/s.

A.3 The funnel (see figure1, part D) has an upper conical section which provides a seating for the drainage chamber, and enables the sealing cone to be centred accurately in the chamber. This conical section is followed by a cylindrical section, having a cross-sectional area of 100 cm^2 and a height of 35 mm. Near the top of this section is a vent for equalization of the air pressure. The cylindrical section has three grooves, which determine the location of the spreader cone.

The lower part of the funnel is conical having a cone angle of 40,0°, it terminates in a separate bottom orifice having the dimensions specified in figure 3. The diameter of the cylindrical section of the bottom orifice is so chosen that 1 000 ml of water at 20,0 ± 0,5 °C poured into the funnel drains out in 149 ± 1 s. This necessitates a diameter of about 2,32 mm (see annex B).

A.4 The side orifice (see figure 4) has an internal diameter of 16,0 ± 0,1 mm and an outside diameter of 19,0 ± 0,1 mm. It penetrates the funnel at an angle of 49,0° to the vertical. The upper end of the side orifice is cut at 12,0° to the central axis of the funnel, and the overflow edge is as close as possible to the centre of the funnel. In this position, the volume between the lower edge of the bottom orifice and the overflow edge of the side orifice is 7,5 to 8,0 ml. The level of the overflow edge is adjustable. A detachable spreader cone is placed in the funnel to prevent splash from entering the side orifice. One of the supporting legs of the spreader cone is set diametrically to the side orifice.

A.5 The measuring cylinder is so graduated that it provides a direct reading of the Schopper-Riegler number, with a volume of 1 000 ml corresponding to zero SR number, and a volume of zero ml to 100 SR units. The distance between two graduations shall be at least 1,5 mm, corresponding to a volume of 10 ml equal to one SR number.

Annex B

Maintenance of the Schopper-Riegler apparatus

B.1 The SR apparatus shall be mounted in a vibration-free environment, and carefully levelled by a machinist's level placed on the open top of the rate-measuring funnel, in position in the bracket. Rotation of the level on the funnel will indicate when the instrument is mounted in a true level position.

B.2 The SR apparatus shall be checked regularly as follows :

B.2.1 Check with a feeler gauge that the gasket on the wire screen makes a tight fit against the screen, so that the effective drainage area is 100 cm^2.

B.2.2 Check that the sealing ring is in good condition. Pour water into the drainage chamber to check that the sealing cone fits tightly.

B.2.3 Check that the apparatus is clean and free from deposits of pitch. If necessary, clean with soap and rinse thoroughly with water. Special attention should be paid to the wire screen. To check that the wire screen is clean, measure the Schopper-Riegler number for distilled water. A value of more than 4 indicates that the wire screen needs cleaning. If necessary, clean the screen with acetone and a soft brush, and rinse it in abundant water. A wire screen that is not in good condition shall be replaced.

B.2.4 Check the position of the side orifice as follows : close the bottom orifice with a finger. Pour 100 ml of water at 20 ± 0,5 °C into the funnel. After the excess has escaped through the side orifice, open the bottom orifice, and collect the water leaving the funnel. The volume of the water shall be 7,5 to 8,0 ml. If this is not the case, adjust the side orifice. Check that the side orifice is in the right position (see A.4) so that the pressure head is correct.

B.2.5 Check the dimension of the bottom orifice as follows : remove the spreader cone. Close the side orifice with a stopper, and fill it by pouring about 500 ml of water at 20 °C into the funnel, while the bottom orifice is closed with a finger. After a moment, allow the excess water to escape through the bottom orifice. When the bottom orifice has been closed again, refill the funnel with 1 000 ± 5 ml of water at 20,0 ± 0,5 °C, and note the time required for the water to drain through the bottom orifice. The time shall be 149 ± 1 s.

If the time is too long, the orifice may be widened by honing it with a suitable tool. If the time is too short, the bottom orifice shall be replaced.

B.2.6 Check that the sealing cone moves at a constant rate of 100 ± 10 mm/s.

Dimensions in millimetres

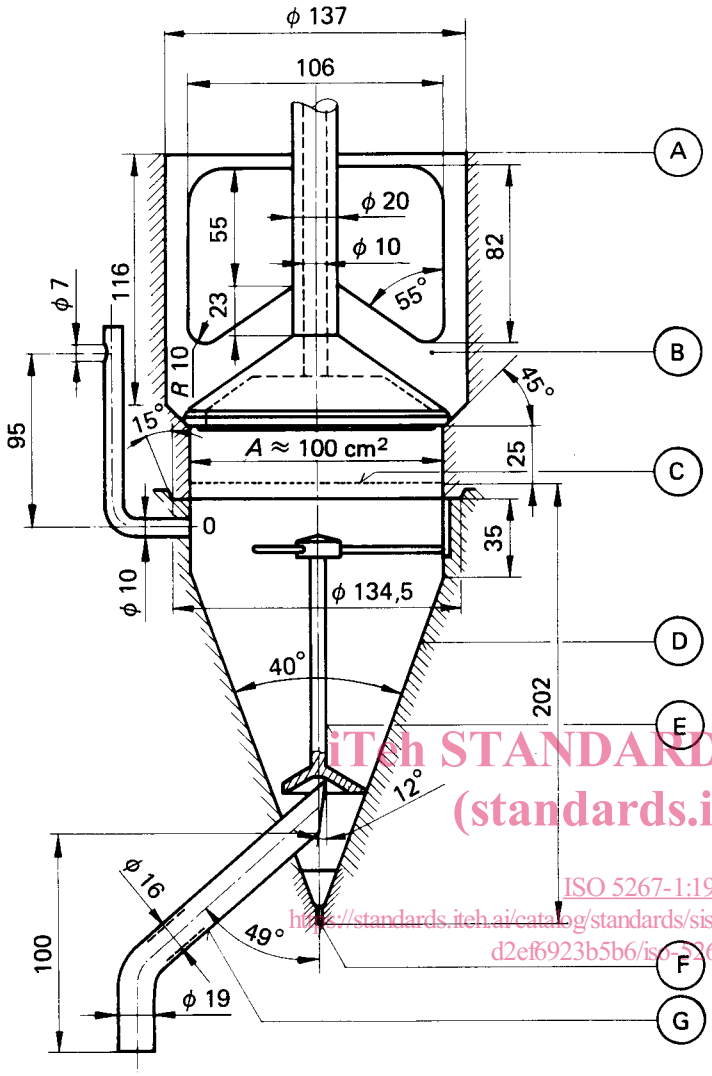

Figure 1 — Schopper-Riegler apparatus

(A) Drainage chamber
(B) Sealing cone
(C) Wire screen
(D) Funnel
(E) Spreader cone
(F) Bottom orifice
(G) Side orifice

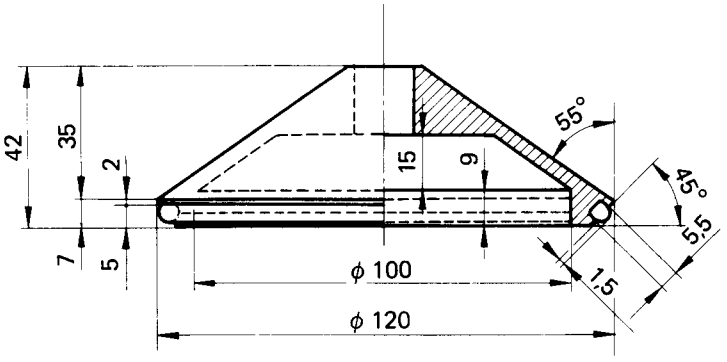

Figure 2 — Sealing cone

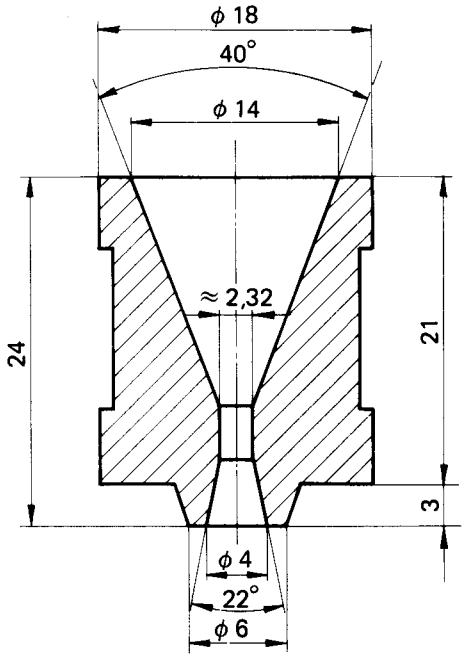

Figure 3 — Bottom orifice

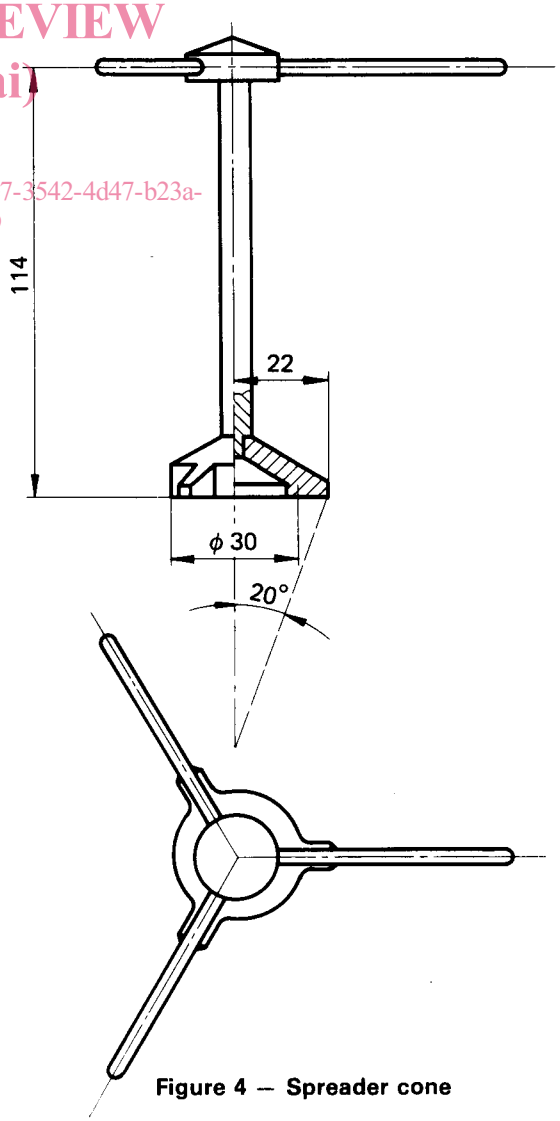

Figure 4 — Spreader cone