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Textiles — Determination of fineness of flax fibres — Permeametric methods

Textiles — Détermination de la finesse des fibres de lin — Méthodes perméamétriques

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 23, *Fibres and yarns*.

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This third edition cancels and replaces the second edition (ISO 2370:1980), which has been technically revised. The main changes compared to the previous edition are as follows:

— addition of the third method for the determination of the fineness of flax fibres as Clause 7, "Constant pressure method";

— deletion of Annex C and Annex D.

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Introduction

Fineness can be considered as a vital characteristic of flax. However, because of their special structure, the measurement of the fineness of such fibres presents a difficult problem.

Whereas cotton, wool, man-made fibres, etc., form individual fibres of a given dimension and are easily separated one from the other, flax fibres form, after retting and scutching, fibre strands. These consist of a certain number of ultimate fibres, bound together more or less imperfectly by pectic substances which give certain fibres a branching form. During the spinning operations, these fibre strands are progressively divided without such a process ending in the complete separation into ultimate fibres.

In these conditions, determination of the fineness of flax fibres presents the following difficulties.

— Difficulty from the continuous alteration of the amount of division of the substance during the spinning. One cannot therefore refer to fineness as such, but only to fineness corresponding to a state consecutive to a given operation. It will therefore always be necessary to specify the state in which the substance is found when making any measurement.

— Difficulty, from the fact that the separation of the fibrous elements is a delicate operation, which also results from the constitution of the substance.

Taking these difficulties into account, “permeametric” methods seem most suitable for measuring the fineness of bast.

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Textiles — Determination of fineness of flax fibres — Permeametric methods

1 Scope

This document specifies three permeametric methods for the determination of the fineness of flax fibres.

— Constant flow method, with two compressions, using a test piece of parallel fibres (see Clause 5);

— Simplified constant flow method, with one compression, using a test piece of fibres distributed "at random" (see Clause 6);

— Constant pressure method, with one compression, using a test piece of fibres distributed "at random" (see Clause 7).

This document is applicable to the various forms possible for flax fibres, i.e. long strands, broken strands, all kinds of tow and at all stages of manufacture of these substances.

2 Normative references

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The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 139, *Textiles — Standard atmospheres for conditioning and testing*

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ISO 1130, *Textile fibres — Some methods of sampling for testing*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
wad of fibre
fibrous mass introduced into the centre channel of a cylindrical casing forming the test piece and on which the measurement will be made

Note 1 to entry: In the constant flow method, the fibrous elements forming the wad are placed parallel to the axis of the casing. In the simplified constant flow method and constant pressure method, the fibrous mass is introduced into a chamber so that the fibres forming the wad are placed at random. In all three methods, it is essential that the density of the filling is as regular as possible.

3.2
resistance of a wad of fibres to the passage of air in laminar flow
R
quotient of the depression ΔP (hPa) produced by the *wad of fibres* (3.1) to flow Q (cm^3/s) passing through it

Note 1 to entry: It is expressed in $hPa·s/cm^3$.

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3.3
specific surface of a wad of fibres
A
quotient of the total side surface of the constituent fibrous elements by their volume

Note 1 to entry: It is expressed in cm^2/cm^3.

3.4
index of specific surface of a wad of fibres
A'
arithmetic product of the specific surface (A) and the square root of the product of the viscosity of the air (μ) and a dimensionless empirical factor of proportionality (k)

3.5
index of fineness standard
IFS
index of fineness determined by a conventional method (gravimetric method) on reference lots

Note 1 to entry: Itis relatively close to values expressed by the Tex system.

Note 2 to entry: Compensation is permitted for the fact that the fineness of flax fibres cannot be defined in an absolute manner.

4 Conditioning and test atmosphere

Weighing and measuring shall be carried out in the standard atmosphere for conditioning and testing of textiles, defined in ISO 139, on test pieces previously conditioned in the same atmosphere.

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5 Constant flow method

5.1 Principle

Measurement of the resistance to the passage of air of a wad of parallel fibres of given mass placed successively in two casings of specified size but different diameters, then, from the two values obtained, deduction of the index of specific surface of the wad and the density of the fibres, which characterize the fineness of the fibres.

5.2 Sampling

Samples shall be representative of a batch.

Sampling shall be carried out by one of the methods given in ISO 1130.

5.3 Test pieces

5.3.1 Requirement

The test piece shall consist of a stub of parallel fibres about 80 mm ± 1 mm long, having a mass between 2,8 g and 3,2 g, depending on the material. Five test pieces shall be prepared for each sampling.

5.3.2 Preparation

5.3.2.1 Scutched or hackled flax

Cut from the desired place (for example top, middle, bottom) stubs 80 mm ± 1 mm long.

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5.3.2.2 Flax tow

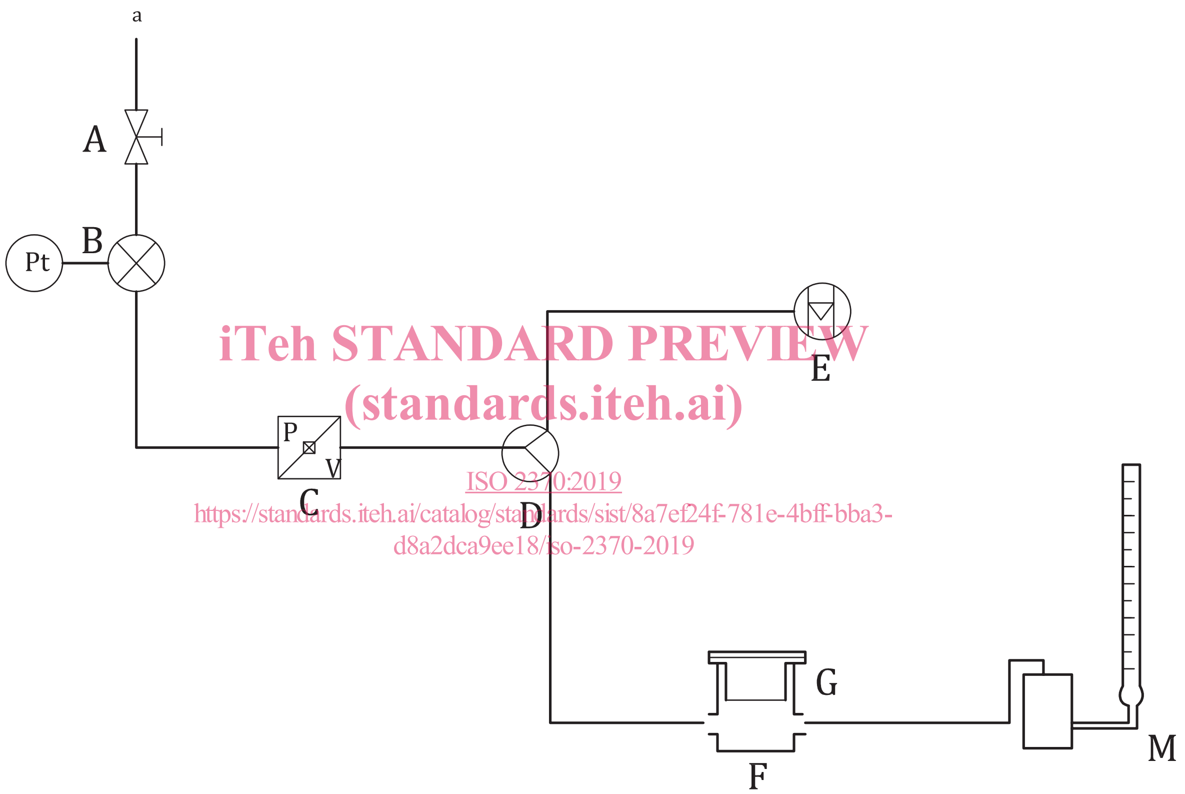
Carry out carding to make the fibres parallel by using hand carding machines as specified in Annex A. Cut from the middle stubs 80 mm ± 1 mm long.

5.3.2.3 Slivers

Take, at intervals, sections about 80 mm ± 1 mm long. Bring together the various stubs and take the mass required for the test.

5.4 Apparatus

5.4.1 Apparatus, shown in Figure 1.



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Key

A air tap

B gauge

C butterfly valve for output control

D three-way tap

E output meter

F measuring chamber

G threaded cap

M manometer

a To compressor.

Figure 1 — Apparatus for the constant flow method

5.4.1.1 Air tap, A, below an air chamber (minimum pressure 0,15 MPa) fed by a compressor or by a general dry compressed air line.

5.4.1.2 Gauge, B, graduated from 0 MPa to 0,2 MPa, with a control device.

5.4.1.3 Butterfly valve for output control, C, (0,15 cm^3/s to 0,85 cm^3/s).

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5.4.1.4 Three-way tap, D.

5.4.1.5 Soap bubble output meter, E, or any other apparatus permitting precise measurement of low output.

5.4.1.6 Measuring chamber, F, into which the casing containing the parallel fibres is placed. The edge of this casing, fitted with a supple joint, comes against the edge of F and is retained there by a threaded cap G.

5.4.1.7 Threaded cap, G, having a circular opening.

5.4.1.8 Water manometer, M, formed by a tube with variable tilt permitting readings of maximum depression corresponding to 250 mm, 50 mm, 25 mm and 12,5 mm, according to the tilt. One of the ends is open to the air and the other connected to the chamber F.

5.4.2 Casings, 10 mm high and with diameters of 10 mm and 11 mm (to the nearest 10 µm) respectively.

5.4.3 Circular sharp blade, mounted on a rapidly rotating axle.

5.4.4 Balance, with a resolution of 0,01 g.

5.5 Procedure

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5.5.1 Determination of output

Adjust the output controlled by butterfly valve C to 0,50 cm^3/s ± 0,01 cm^3/s. Determine the exact output before each series of measurements. For this purpose:

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— leave the apparatus connected to the flow for 30 min to obtain a stationary flow, the initial pressure being controlled at 0,1 MPa;

— open the three-way tap, D, in the direction of the output meter. Determine the time necessary for a bubble to obtain a predetermined level corresponding to 50 cm^3. Take the mean of five measurements.

The butterfly valve, C, permits maintenance of the output at a constant value, even in the case of variation of the initial pressure or the counter pressure.

5.5.2 Measurement of resistance, R_1

Introduce the parallel fibres of flax(scutched, hackled) or prepared parallel fibres (tow or slivers) into the channel of the 10 mm diameter casing, as shown in Figure 2. Cut the fibres which stick out of the channel using the rapidly rotating sharp circular blade; during this operation, the casing shall rotate at a slower speed.

Start the apparatus, introduce the casing into the chamber and screw on the cover, G. After stabilization of the pressure, read the height Δh_1 on the manometer and deduce the resistance R_1, using the Formula (1).

$$R_1 = \frac{\rho g \Delta h_1}{Q_1} \quad (1)$$

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where

R_1 is the resistance of a wad of fibres to the passage of air in laminar flow by using 10 mm diameter casing, in hPa·s/cm^3;

ρ is the density of water, 1 g/cm^3;

g is the acceleration due to gravity, considered as equal to 981 cm/s^2;

Δh_1 is the difference in level, in cm;

Q_1 is the flow, in cm^3/s.

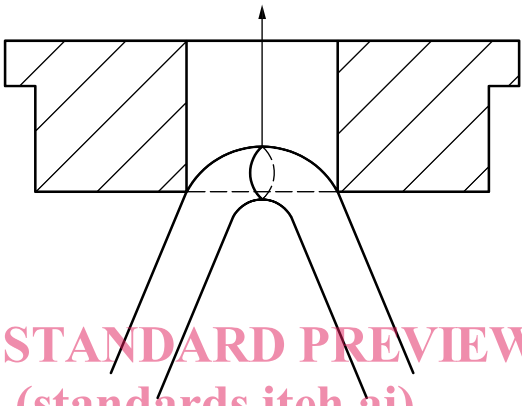

Figure 2 — Introducing the fibres into the casing

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5.5.3 Measurement of resistance, R_2

Withdraw the casing from the chamber. Place it on the 11 mm diameter casing, so that the axes coincide, and push the wad of fibres into this second casing as shown in Figure 3, using a metal ram of 9,8 mm diameter. This transfer of the wad will inevitably create preferential channels. It is essential to eliminate these by the following manual operation; with the casing in the left hand, submit the fibre wad to a transverse vibration between the thumb and second finger of the right hand.

Make a second measurement of the manometric height (Δh_2), proceeding as indicated in 5.5.2. Deduce from this new measurement the resistance R_2, using the Formula (2).

$$R_2 = \frac{\rho g \Delta h_2}{Q_2} \tag{2}$$

where

R_2 is the resistance of a wad of fibres to the passage of air in laminar flow by using 11 mm diameter casing, in hPa·s/cm^3;

ρ is the density of water, 1 g/cm^3;

g is the acceleration due to gravity, considered as equal to 981 cm/s^2;

Δh_2 is the difference in level, in cm;

Q_2 is the flow, in cm^3/s.

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