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Wool — Determination of fibre length (barbe and hauteur) using a comb sorter

Laine — Détermination de la longueur de barbe et de la hauteur des fibres sur appareil à peignes

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Descriptors : natural fibres, animal fibres, wool fibres, dimensional measurement, length.

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

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.

Prior to 1972, the results of the work of the technical committees were published as ISO Recommendations; these documents are in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 38, *Textiles*, has reviewed ISO Recommendation R 920-1969 and found it technically suitable for transformation. International Standard ISO 920 therefore replaces ISO Recommendation R 920-1969 (incorporating Amendment 1-1969), to which it is technically identical.

ISO Recommendation R 920 had been approved by the member bodies of the following countries :

Australia	Ireland	South Africa, Rep. of
Austria	Israel	Spain
Chile	Italy	Sweden
Czechoslovakia	Japan	Switzerland
Denmark	Korea, Rep. of	Turkey
France	New Zealand	United Kingdom
Hungary	Norway	U.S.S.R.
India	Portugal	Yugoslavia
Iran	Romania	

The member bodies of the following countries had expressed disapproval of the Recommendation on technical grounds :

Belgium	Germany
Egypt, Arab Rep. of	Netherlands

The member bodies of the following countries disapproved the transformation of the Recommendation into an International Standard :

Germany
U.S.S.R.

Wool – Determination of fibre length (barbe and hauteur) using a comb sorter

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for the determination of wool fibre length, barbe and hauteur, and their coefficients of variation, by means of a comb sorter.

This method is applicable to twistless combed wool slivers and to prepared wool slivers (rovings).

2 REFERENCE

ISO 139, *Textiles – Standard atmospheres for conditioning and testing*.

3 DEFINITIONS

3.1 barbe : The mean length of the fibres of a sliver or of a roving, calculated from the proportions by mass of the fibres in the sliver or the roving.

If

$n_1, n_2 \dots$ represent the number of fibres in each length group,

$L'_1, L'_2 \dots$ represent the length of each group determined on partially decrimped fibres, expressed in millimetres,

$a_1, a_2 \dots$ represent the linear density of partially decrimped fibres of each group,

P_1, P_2, \dots represent the total mass of the fibres belonging to each length group,

the barbe is equal to

$$\frac{n_1 a_1 L'_1{}^2 + n_2 a_2 L'_2{}^2 + \dots}{n_1 a_1 L'_1 + n_2 a_2 L'_2 + \dots} = \frac{P_1 L'_1 + P_2 L'_2 + \dots}{P_1 + P_2 + \dots}$$

3.2 hauteur : The mean length of the fibres of a sliver or of a roving, calculated from the proportions by titre of the fibres in the sliver or the roving.

If the same symbols are used as for the barbe, the hauteur, expressed in millimetres, is equal to

$$\frac{n_1 a_1 L'_1 + n_2 a_2 L'_2 + \dots}{n_1 a_1 + n_2 a_2 + \dots} = \frac{P_1 + P_2 + \dots}{\frac{P_1}{L'_1} + \frac{P_2}{L'_2} + \dots}$$

4 PRINCIPLE

A numerical sample of the fibres is taken and the fibres are classified by lengths. They are then divided into length groups and weighed.

5 APPARATUS

5.1 Balance, having an accuracy of 1 mg.

5.2 Comb sorter, consisting basically of a bed of combs which can be lowered successively and of which the spacings determine the classes of the fibre lengths.

This apparatus shall permit the following operations :

- successive draws of several tufts of fibres at the squared-off end of a sliver or a roving;
- the deposition of these tufts as they are drawn onto the comb bed so that the aligned ends of the combed fibres in each tuft are placed on the last comb;
- the removal of the fibres which project beyond each comb by means of a drawing-off system, starting with the longest fibres.

A type of apparatus which performs these operations semi-automatically is described in the annex.

The apparatus used shall permit the application of the method with a reproducibility at least equivalent to that indicated in 9.3.

6 PREPARATION OF TEST PIECES

From each sliver or roving to be tested, a test piece of 1 m in length shall be taken. It shall be twisted (approximately twenty twists), and its two ends placed side by side and held in the hand, so that the folded sliver or roving then twists slightly upon itself¹⁾.

The test piece, which shall be slightly dry, shall be placed in one of the standard atmospheres for testing defined in ISO 139, and kept for 24 h in this atmosphere.

1) This slight twisting is intended to prevent the test piece from losing fibres or from becoming distorted during its exposure to the standard atmosphere.

7 TEST ATMOSPHERE

The test shall be carried out in one of the standard atmospheres for testing specified in ISO 139.

8 PROCEDURE

8.1 Positioning of fibres on the combs

Place the untwisted test piece at the position specified on the apparatus for drawing off the tufts; the end from which the fibres are to be taken shall project by about 200 mm.

Using the hands and then by means of a grip, square off the end by taking and discarding small quantities of fibre, not exceeding 12,5 mm increments, from the overhanging end of the test piece until just enough projects to permit the following operations :

- a) Using the grip, draw off further tufts of wool from the squared-off end of the sliver or roving to give a test specimen of mass 500 to 4 000 mg, and arrange it on the bed of combs. Bring the aligned ends of the combed fibres to the last comb.
- b) Regulate the depth of the wool in the combs by pressing with a rod or other suitable device.

8.2 Sorting of fibres by length groups

Lower the combs one by one, until the ends of the longest fibres project beyond a single comb.

Note the number of combs remaining in the raised position so as to calculate from this the average length of the longest group.

Using the drawing device, draw the fibres which project. Then place them on one side for weighing.

Lower the next comb, again draw off the fibres which project and place them in a separate group for weighing.

Continue in this way until the last group of fibres is reached.

Weigh the fibres in each group to an accuracy of 1 mg.

9 CALCULATION AND EXPRESSION OF RESULTS

9.1 Presentation of results

The necessary information shall be given in a table, an example of which is given by table 1¹⁾.

9.2 Calculation

As a function of A , B and C , calculate the hauteur and barbe of the fibres and the corresponding coefficients of variation, by application of the following formulae.

9.2.1 Hauteur expressed in millimetres

$$\frac{100}{\sum \frac{R}{L'}} = \frac{100}{B}$$

9.2.2 Barbe expressed in millimetres

$$\sum \frac{RL'}{100} = \frac{A}{100}$$

9.2.3 Coefficient of variation of hauteur (as a percentage)

$$\sqrt{(A \times B) - 10\,000}$$

9.2.4 Coefficient of variation of barbe (as a percentage)

$$100 \sqrt{\frac{C \times 100}{A^2} - 1}$$

9.3 Reproducibility of method

Tests on six slivers of wool fibres, repeated three times, by six different laboratories gave the results shown in table 2.

10 TEST REPORT

The test report shall include the following particulars :

- a) a reference to this International Standard;
- b) the type of apparatus used;
- c) the results obtained in accordance with 9.2;

and if requested :

- d) the histogram of the frequencies (percentage) or the polygon of these cumulative frequencies²⁾;
- e) any operational details not specified in this International Standard, and any incidents likely to have an influence on the results.

1) The figures given as examples in table 1 refer specifically to the Schlumberger apparatus (see annex).

2) Such a diagram makes it possible to see immediately the presence of long fibres, the more or less square nature of the comb, the percentage of fibres longer than a given length, etc.

TABLE 1

1	2	3	4	5	6	7	8
Groups mm	L' mm	L'^2	Masses P_0 mg	Percentages R of masses of column 4 %	RL'	$\frac{R}{L'}$	RL'^2
195/205	201	40 401					
185/195	191	36 481					
175/185	181	32 761					
165/175	171	29 241					
155/165	161	25 921					
145/155	151	22 801					
135/145	141	19 881					
125/135	131	17 161					
115/125	121	14 641					
105/115	111	12 321					
95/105	101	10 201					
85/95	91	8 281					
75/85	81	6 561					
65/75	71	5 041					
55/65	61	3 721					
45/55	51	2 601					
35/45	41	1 681					
25/35	31	961					
0/25	18	324					
				100,000	A	B	C

NOTES

1 In column 1 are to be found the desired intervals of the length groups, expressed in millimetres.

In column 2, the mean values of group L' (see 3.1) to be used in later calculations shall be shown in millimetres.

In column 3, the values of L' squared (L'^2) shall be shown.

In column 4, the masses (P_0) of the fibres in each group shall be shown, expressed in milligrams.

In column 5, the expression (R) of these same masses as a percentage of the total mass of all the groups shall be shown.

In columns 6, 7 and 8 the product RL' , the quotient R/L' and the product RL'^2 shall be shown.

2 The totals of columns 6, 7 and 8 are designated by the letters A, B and C. Other columns may be added in order to indicate the cumulative masses and frequencies (percentage).

TABLE 2

	Error of method	Maximum interval of measurement %
Hauteur	0,86 mm	4,3
Barbe	0,70 mm	3,2
Coefficient of variation of hauteur	0,96 %	7,3
Coefficient of variation of barbe	0,63 %	5,2

NOTE — In this table, the error of the method is defined as follows :

- each lot measured obtains, in each laboratory, a mean value;
- the means of the six laboratories make it possible to calculate an inter-laboratory mean which is distributed with a certain interlaboratory standard deviation for each lot;
- the error of the method is the quadratic mean of these inter-laboratory standard deviations for all the lots.

ANNEX

**SCHLUMBERGER COMB SORTER, TYPE M.A.E.
FOR THE DETERMINATION OF WOOL FIBRE LENGTH¹⁾**

A.1 CHARACTERISTICS

The Schlumberger type M.A.E. comb sorter comprises a feed trough for the sliver which is driven to and fro, thus feeding the squared end of the sliver to a grip which lies above a bed of combs whose spacings determine the length groups of the fibres. This bed of combs may be moved laterally (in a direction perpendicular to that of the fibres in the feed trough), while the combs themselves can be lowered successively in a similar manner to a gill box used in spinning. A drawing-off system consisting of two endless leather belts is located at the front edge of the bed of combs and a circular brush collects the fibres drawn off.

The sequence of operations carried out semi-automatically is as follows :

- a) movement of the feed trough towards the grip, thus taking successive draws of fibres the gripped ends of which are aligned;
- b) deposition of the tufts drawn, over the whole width of the bed of combs which moves laterally each time the feed trough moves. The aligned ends of the fibres are placed on the last comb.
- c) removal of the fibres projecting beyond each comb by means of a drawing-off system during the lateral movement of the bed of combs, starting with the longest fibres.

A.2 PROCEDURE**A.2.1 Arrangement of wool on combs**

A.2.1.1 Place the sliver in the feed trough of the comb sorter, projecting 200 mm towards the grip. The part of the sliver in the feed trough is under very slight tension.

A.2.1.2 Square off the sliver, first of all by hand up to approximately 10 mm from the comb being fed and then by twenty draws by means of the grip, forming a length of $20 \times 4 \text{ mm} = 80 \text{ mm}$ of sliver (with the comb sorter operating and the comb bed removed). Discard these fibres.

A.2.1.3 Verify that all the combs are at the same level, except for the last which should remain below the others and which will be raised later.

A.2.1.4 Then cover the combs with the wool automatically over the whole length of movement of the carriage. When this operation is completed, raise the last comb to the level of the others.

A.2.1.5 Regulate the depth of wool in each spacing by pressing it down slightly with the rod designed for this purpose (a rod curved at both ends) and starting with the last spacing, i.e. that of the shorter fibres. Carry out the operation a second time.

A.2.1.6 Place the retaining rod (not curved at the ends) in the next to last space.

A.2.2 Length sorting by means of the comb sorter

A.2.2.1 The comb bed comprises a series of consecutive spacings of 10 mm.

A.2.2.2 Depress the first combs until the longest fibres have their ends projecting beyond a single comb. It is essential here to evaluate correctly the first mean of the group under consideration. For this purpose, the number of remaining combs is taken as n , and the mean length of the group is taken as $10(n + 1)$, expressed in millimetres.

This value is justified empirically. Thus the number of groups in existence can be seen.

¹⁾ The information given on this apparatus is not intended to favour its use or to give preference to the use of this apparatus.