INTERNATIONAL STANDARD

ISO 17202

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Textiles — Determination of twist in single spun yarns — Untwist/retwist method

Textiles — Détermination de la torsion des filés de fibres simples — Méthode de détorsion/retorsion

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17202 was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 23, *Fibres and yarns*.

Annex A of this International Standard is for information only.

Introduction

The direct twist method (see [1] and [2]) has, for a long time, been recognized as the most accurate method of twist determination but the much faster untwist/retwist method has long been used in industry in many countries. In the 1980s the hope was expressed by some Institutes that the untwist/retwist method would be suitable for the measurement of twist of open-end yarns that cannot be measured by the direct method. First experiments in the 1970s and later in the 1990s showed, however, that the untwist/retwist method is not suitable to OE yarns. The present method is therefore restricted to ring spun yarns.

Textiles — Determination of twist in single spun yarns — Untwist/retwist method

1 Scope

This International Standard specifies a method for the determination of the direction of twist in single yarns and the amount of twist, in terms of turns per unit length, by the indirect untwist/retwist method.

This International Standard is applicable to single spun yarns.

This International Standard is not applicable to:

a) open-end spun yarns;

b) false twist and self twist yarns;

c) air-jet yarns;

d) yarns that stretch more than 0,5 % when the tension increases from 0,5 cN/tex to 1,0 cN/tex.

NOTE Such yarns may be tested under special conditions of tension which are accepted by all parties interested in the test results.

e) yarns that are too large to permit their being placed in the clamps of testing apparatus without crushing or distortion severe enough to affect the test results.

The method is designed primarily for yarns in packages, but by the application of special precautions the procedures can be used for yarns taken from fabrics.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2:1973, *Textiles — Designation of the direction of twist in yarns and related products*

ISO 139:1973, *Textiles — Standard atmospheres for conditioning and testing*

ISO 2060:1994, *Textiles — Yarn from packages — Determination of linear density (mass per unit length) by the skein method*

EN 12751, *Textiles — Sampling of fibres, yarns and fabrics*

3 Terms and definitions

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

3.1
twist
number of turns about the axis of a yarn based on its nominal gauge length before untwisting

NOTE Twist should preferably be expressed as turns per metre (turns/m).

3.2
gauge length
distance between two effective clamping points of the test specimen mounted in the testing equipment

3.3
initial length
length of a test specimen under a specified pretension at the beginning of a test

3.4
moisture equilibrium for testing
that state reached when the rate of increase in mass of a sample or specimen in a specified (test) atmosphere does not exceed that prescribed for the material being tested

(See ISO 139.)

NOTE A textile material is in moisture equilibrium with the ambient atmosphere when it does not exchange water with this atmosphere; its mass then remains constant as long as the experiment is carried out in an unchanged atmosphere.

3.5
yarn package
length or lengths of yarn in a form suitable for use, handling, storing or shipping

NOTE Packages may be comprised of unsupported yarn, such as balls and skeins, or supported yarn, such as cakes, bobbins, cops, cones, pirns, spools, tubes or beams.

3.6
twist factor
measure of the spiralling orientation of the fibres in a spun yarn or of the filaments in a filament yarn

NOTE It is related to the angle that fibres on the surface of the yarn make with the axis of the yarn and is a measure of the hardness of the resulting yarn due to twist.

4 Principle

4.1 General

The untwist/retwist method is an indirect method for determining twist. It involves untwisting a specimen and then retwisting it in the opposite direction until it has regained its initial length. It is assumed that the number of turns inserted during retwisting is equal to the initial twist of the specimen and that consequently, half the number of turns recorded on the counter represents the twist of the specimen.

The untwist/retwist method is very sensitive to the pretension used, therefore two methods are proposed: the generally-used method A and a double method B which is less sensitive to inaccuracies in pretension and therefore gives more reliable accurate results. Method B is, however, more time-consuming than method A and it is therefore recommended mainly for automatic twist testers.

4.2 Method A — Single method

Specimens are tested according to the principle described in 4.1.

4.3 Method B — Double method

An initial specimen is tested as described in 4.1. A second specimen is tested by untwisting to a quarter of the turns obtained on the initial specimen, then retwisting back to the initial length to correct for errors caused by pretensioning.

4.4 Comparison of methods

The untwist/retwist method, whether A or B, is used for acceptance testing for economic reasons because it requires less testing time and fewer specimens than the reference direct-counting method. The accuracy of the untwist-retwist method, especially of method B, is good, that is, the results are comparable to those of the direct method, provided appropriate pretension and extension control limits have been utilized.

If there is disagreement arising from differences in values reported by the purchaser and the seller when the untwist/retwist method is used for acceptance testing, then the statistical bias, if any, between the laboratory of the purchaser and that of the seller should be determined; each comparison shall be based on test specimens randomly drawn from one sample of material of the type being evaluated.

The “setting” of twist in some fibres causes excessive contraction when the yarn is retwisted in the reverse direction. Therefore, the number of turns required to bring the specimen back to its original length may be less than the number of turns removed in untwisting. This effect may be partially offset by the use of higher pre-tensioning load; but this increases the danger of stretching the yarn. Little information is available on the correct tensions to use, either for yarns made from different fibres or with different amounts of twist.

The untwist/retwist method can be useful where the objective is to measure variations from an average value. Another possible application is where a large amount of twist testing is required on yarns of similar type and twist. In this case, preliminary tests comparing the results of the untwist/retwist method with the results of the reference direct method could be used to determine the correct pre-tension.

5 Apparatus

5.1 Twist counter or **twist tester**, consisting of a pair of clamps, one of which is rotatable in either direction and positively connected to a revolution counter.

The tests are carried out preferably on a motorized twist tester with a speed of 1 000 turns/min ± 200 turns/min.

The position of one clamp (or both clamps) shall be adjustable to accommodate specimens having the length prescribed in 8.1. The tester shall be provided with a variable tensioning device so constructed that a specific load may be applied to the specimen at the beginning and end of the test and removed completely during the intervening untwisting and twisting operations.

6 Standard atmosphere

The atmosphere for conditioning and testing shall be as specified in ISO 139. The procedure for conditioning shall follow ISO 139. Preconditioning is not necessary.

The amount of twist is not directly affected by changes in relative humidity, but since wide changes in humidity cause changes in length of some materials, all determinations shall be made after conditioning the sample for at least 24 h in the appropriate standard atmosphere.

7 Sampling

Samples shall be taken in one of the following ways:

a) according to directions, if any, given in the material specification;

b) according to EN 12751 if directions on sampling are not included in the material specification;

c) according to the method given in annex A, if neither a) nor b) is applicable.

Bulk samples shall be taken as directed in A.1.

Packages of the laboratory sample shall be taken from the bulk sample as directed in A.2.

8 Test Specimens

8.1 Length

The initial length of the specimen shall be 500 mm ± 1 mm.

8.2 Selection

8.2.1 The test specimens shall be taken at the lowest tension practicable, in the manner in which the yarn would normally be taken from the package during subsequent processing (i.e. by unrolling from the side of the package). The few metres of yarn at the beginning and, if relevant, at the end of package shall be discarded in order to avoid damaged sections.

8.2.2 If two or more test specimens are taken from an individual yarn package, they shall be taken at random intervals of at least 1 m in order to minimize the effects of cyclic variation introduced during manufacture. If more than two specimens are taken from an individual package, take groups of specimens, not more than five to a group, at intervals of several metres.

8.2.3 For woven fabrics, take warp specimens from separate ends, since each represents a separate package. Because the fabrics may have been woven on any of a variety of looms which are either random quilling (traditional), sequential quilling or shuttleless, take weft specimens at random through the whole laboratory sample to obtain data as representative as possible. If a strip 2 m long is used as a source of specimens, this procedure will usually provide specimens from several different bobbins of weft yarns.

8.2.4 For weft-knit fabrics known to be multi-feed, take specimens from successive courses in one portion of the laboratory sample. For weft-knit fabrics known to be single-feed or for which the type of feed is not known, take specimens at random from the whole sample.

8.2.5 In warp-knit fabrics, it is, in most cases, impossible to unravel specimens with the necessary length. Therefore, the untwist/retwist method is usually not applicable.

8.3 Number of test specimens

8.3.1 Take the number of specimens required in the material specification, when applicable.

8.3.2 In the absence of material specification, take a number of specimens such that the user may expect at the 95 % probability level that the test results are not more than 5 % of the average above or below the true average of the lot. Determine the number of specimens for each lot sample as follows.

a) Reliable estimate of v: when there is a reliable estimate of v based upon extensive past records for similar materials tested in the user's laboratory as directed in the method, calculate the required number of specimens using equation (1):

$$n = \left(t^2 \times v^2\right) / A^2 = 0{,}154\, v^2 \quad (1)$$

where

n is the number of specimens (rounded upward to a whole number when n is less than 50 or to a multiple of five when n is 50 or more);

t = 1,96, the value of Student's t for infinite degrees of freedom, two-sided limits, and a 95 % probability level (t^2 = 3,842);

v is the reliable estimate of the coefficient of variation of individual observations on similar materials in the user's laboratory under conditions of single-operator precision;

A = 5 % of the average, the value of the permissible variation, and 0,154 is calculated by t^2/A^2.

b) No reliable estimate of v: when there is no reliable estimate of v for the user's laboratory, equation (1) shall not be used directly. Instead, specify a fixed number of 16 specimens. This number of specimens is calculated using v = 10,5 % of the average which is a somewhat larger value of v than is usually found in practice. When a reliable estimate of v for the user's laboratory becomes available, equation (1) will usually require fewer than 16 specimens.

9 Procedure 1 — Determination of direction of twist

Hold one end of the yarn in such a position that a short length (at least 100 mm) is suspended in a vertical position. Examine the vertical section of the yarn and determine if the slope of the yarn elements (fibres) conforms to the slope of the central portion of the letters "S" or "Z". Designate the direction of twist as "S" or "Z" as observed, in accordance with ISO 2.

10 Procedure 2 — Determination of amount of twist

10.1 Preliminary procedure — Determination of permissible extension

This parameter shall be determined separately for each lot of yarn, using specimens conditioned in a standard atmosphere.

For quality control of production, it is possible, however, to establish internal reference values.

— set the specimen length at 500 mm;

— determine linear density in accordance with ISO 2060;

— adjust the pre-tension to 0,50 cN/tex ± 0,10 cN/tex;

— fasten the specimen in the grip of the moving part;

— fasten the specimen in the rotating grip, setting the pointer at zero;

— turn the grip at 800 turns/min or more slowly if slippage is not distinct;

— read the value of slippage at the moment of breakage to within ± 1 mm;

— if the yarn does not break, take the extension corresponding to the maximum extension attained before retwisting in the opposite direction;

— carry out five tests in this way and calculate the mean;

— position the stop in order to have tolerated extension equal to 25 % of this value of slippage.

10.2 Selection of pretension

10.2.1 All spun yarns except worsted yarns

A pretension of 0,50 cN/tex ± 0,10 cN/tex shall be used.

10.2.2 Worsted yarns

Select the pretension as a function of the twist factor α.

— $a < 80$: 0,10 cN/tex ± 0,02 cN/tex

— $80 \leqslant a \leqslant 150$: 0,25 cN/tex ± 0,05 cN/tex

— $a > 150$: 0,50 cN/tex ± 0,05 cN/tex

NOTE In special cases when the measured twist is higher or lower than the known inserted twist on the spinning machine, it is to recommend to make some preliminary tests at higher pretensions. The determination of twist shall be carried out at the determined pretension.

10.3 Procedure of the untwist/retwist test

10.3.1 Method A — Single method

— set the specimen length at 500 mm ± 1 mm;

— remove and discard a length of 2 m to 3 m of yarn;

— taking care not to disturb the twist, fasten the specimen in the grip of the moving part;

— insert the specimen in the rotating grip under the prescribed pretension, adjust its length by moving the pointer to zero, then tighten the grip;

— untwist the yarn at a speed of 1 000 turns/min ± 200 turns/min, then retwist it in the opposite direction until the pointer returns to zero;

— note the counter reading which represents the twist expressed in turn/m;

— remove about 1 m of yarn between two successive specimens.

10.3.2 Method B — Double method

— follow the complete procedure described in 10.3.1 but do not reset the counter to zero;

— take a second specimen and mount it in the grips as described above;

— untwist the yarn at a speed of 1 000 turns/min ± 200 turns/min but only until reaching a quarter of the twist (nominal, or as determined by preliminary tests), then twist back until the pointer returns to zero;

— note the counter reading which represents the twist expressed in turns/m;

— repeat the above two-specimen procedure until the required number of tests has been performed;

— remove about 1 m of yarn between successive specimens.

11 Calculations

11.1 General

The specimen length is 500 mm, therefore, the counter reading corresponds directly to the value of the twist expressed in turns per metre.

11.2 Average twist per sample

Calculate the average twist per sample, in turns/m, using the formula:

$$\overline{t_x} = \frac{\sum t_x}{n}$$

where

$\overline{t_x}$ is average twist of the sample;

$\sum t_x$ is the sum of the twist in all test specimens;

n is the number of test specimens.

11.3 Variation of observations

If the coefficient of variation and 95 % confidence interval of the twist are desired, they shall be calculated by standard statistical methods.

11.4 Twist factor (a)

If desired, the twist factor can be calculated, as follows:

$$\alpha = t\left(\frac{T}{1000}\right)^{1/2}$$

where

a is the twist factor;

t is the twist, in turns per metre;

T is the linear density, expressed in tex.

12 Test report

The test report shall state that the tests were performed in accordance with this International Standard and shall indicate which of any alternative or optional requirements have been met. In addition, it shall give the following information, depending on the type of yarn.

a) identification of material;

b) date of test;

c) apparatus used;

d) form of the material sample (yarn package, warps, fabrics);

e) sampling scheme used;

f) number of specimens examined;

g) length of the test specimens, in millimetres;

h) pretension used;

i) for each package, the mean twist in turns per metre and the coefficient of variation in percent, if required;

j) for all packages, the mean twist in turns per metre and the coefficient of variation in percent;

k) 95 % confidence interval (with appropriate dimension) if required;

l) direction of twist, “S” or “Z”, in the yarn;

m) twist factor, if required;

n) details of any deviation from the specified procedures.

Annex A
(informative)

Suggested procedure for sampling

A.1 Bulk sample (number of cases from a shipment or lot)

Take a bulk sample of one or more cases as representative of the lot to be tested, in accordance with Table A.1.

Table A.1 — Bulk sample

Number of cases in shipment or in lot	Minimum number of cases, to be selected at random
3 or less	1
4 to 10	2
11 to 30	3
31 to 75	4
76 or more	5

Take care that none of the cases selected for sampling shows signs of damage or dampness incurred during transit.

A.2 Number of laboratory sample packages

In the absence of material specification, take ten yarn packages from the bulk sample, taking as near as possible the same number of packages from each case. Take packages at random from the top, middle and bottom layers in the cases and from the middles and sides of the layers. Take, as near as possible, the same number of specimens from each package of the laboratory sample.

If it is desired to sample woven or knitted fabrics, the samples must be large enough to furnish a sufficient number of test specimens. The test specimens should be taken in such a manner that the twist of the yarns is not changed during sampling. When yarns in woven fabric are to be tested, warp specimens should be taken so as to represent as many cops or pirns as practicable. The specific sampling procedure shall be reported.

Bibliography

[1] ISO 2061:1995, *Textiles — Determination of twist in yarns — Direct counting method*

[2] ISO 7211-4:1984, *Textiles — Woven fabrics — Construction — Methods of analysis — Part 4: Determination of twist in yarn removed from fabric*

[3] ISO/TR 8091:1983, *Textiles — Twist factor related to the Tex System*

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ISO 10306

Second edition
2014-06-01

Textiles — Cotton fibres — Evaluation of maturity by the air flow method

Textiles — Fibres de coton — Évaluation de la maturité par la méthode à courant d'air

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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.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 38, *Textiles*, Subcommittee SC 23, *Fibres and yarns*.

This second edition cancels and replaces the first edition (ISO 10306:1993), of which it constitutes a minor revision.

Introduction

The term "cotton fibre maturity" is commonly used to signify the relative degree of fibre wall development. The measurement of the relative degree of wall thickening is too laborious for most practical purposes, therefore the determination of the maturity of cotton fibres is done by indirect methods. A microscopic method is described in ISO 4912:1981. This method has been used as a reference method for the industrial evaluation of the maturity of cotton fibres using air flow instruments, which is the object of this standard.

Textiles — Cotton fibres — Evaluation of maturity by the air flow method

1 Scope

This International Standard specifies a method for the evaluation of the maturity of loose randomized cotton fibres by measuring the resistance to air flow of a plug of cotton fibres under two prescribed conditions. The method is applicable to cotton taken at random from bales. Laps and slivers or other sources of lint cotton may be tested, however results may differ if fibres are taken from bales.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 139:2005, *Textiles — Standard atmospheres for conditioning and testing*

ISO 1130:1975, *Textile fibres — Some methods of sampling for testing*

ISO 2403:2014, *Textiles — Cotton fibres — Determination of micronaire value*

ISO 4912:1981, *Textiles — Cotton fibres — Evaluation of maturity — Microscopic method*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4912:1981 and ISO 2403:2014 apply. The following terms and definitions are repeated here for the convenience of the user.

3.1
immature fibre
fibre which, upon swelling, either assumes a spiral form or lies flat, thinly outlined and almost transparent

Note 1 to entry: It has a wall thickness of less than one-fourth of the maximum fibre width.

[SOURCE: ISO 4912:1981]

3.2
mature fibres
fibres, the cell walls of which have developed sufficiently so that upon swelling, they become unconvoluted and almost rod-like in shape

Note 1 to entry: Such fibres have a wall thickness equal to or greater than one-fourth of the maximum fibre width.

[SOURCE: ISO 4912:1981]

3.3
maturity ratio, *M*
ratio of the degree of wall thickening to a standard degree of thickening selected arbitrarily to equal 0,577

[SOURCE: ISO 4912:1981]

3.4
percent maturity, P_m
average percentage of mature fibres in a sample, based on the total number of fibres

[SOURCE: ISO 4912:1981]

3.5
micronaire value
measure of the air permeability of a mass of cotton under specified conditions, expressed in terms of an arbitrary scale, the so-called micronaire scale

Note 1 to entry: The micronaire scale is based on a range of cottons to which micronaire values have been assigned by international agreement.

[SOURCE: ISO 2403:2014]

4 Principle

Air is passed through a test specimen consisting of a plug of well-opened randomized cotton fibres. For the same mass of fibres the permeability is measured by two different compressions of the plug. For each compression, air is passed through the plug at a specified rate and the pressure drop across the plug is indicated on a pressure gauge and expressed as the height, in millimetres, of a water column. The pressure drop obtained at low compression of the plug is designated PL and the other, at high compression, is designated PH. These two pressures may be used to calculate a maturity ratio and fibre linear density or a percentage of mature fibres using appropriate formulae. The micronaire value is determined solely from the PL value.

5 Apparatus and materials

5.1 Balance, of sufficient capacity to weigh the test specimen required for the air flow instrument used, with a sensitivity of better than 0,005 g.

5.2 Air flow instrument (see Annex A).

The principal parts comprising the air flow instrument are:

5.2.1 Compression cylinder, with perforated end, of such dimensions that with the specified mass of specimen each cubic centimetre of the cylinder shall contain 0,191 1 g of cotton at low compression and 0,382 1 g of cotton at high compression.

5.2.2 Means of measuring air permeability of the specimen, comprising for example:

a) a suitable air pump;

b) two valves or other means for controlling the flow of air through the specimen or the pressure drop across the specimen in the compression cylinder;

c) means for setting the required rate of air flow through the specimen and a gauge for measuring the air pressure drop across the specimen.

NOTE Details of certain commercially available instruments which comply with this specification are given in Annexes A and B. The method of calibration of air flow instruments is described in Annex B.

5.3 International calibration cotton standards

Reference cotton used for the calibration of air flow instruments is described in B.2.2.

5.4 Specimen preparation apparatus

Any blending apparatus is considered suitable if it produces randomly oriented samples.

NOTE Apparatus that produces webs of predominantly parallel fibres is not suitable.

6 Atmosphere for conditioning and testing

6.1 Condition test samples in the standard atmosphere for 4 h in moving air or alternatively for 12 h in still air. Preconditioning is not required.

6.2 Weigh and test the specimen in the standard atmosphere for conditioning (see ISO 139:2005).

7 Sampling and number of specimens

The sampling scheme, the number of specimens to be tested and the number of measurements to be made on each specimen will normally be determined by the material specification or will be agreed between the interested parties. In the absence of any instructions, test at least two specimens, making two tests on each. Samples of raw cotton from bales may be taken according to the method described in ISO 1130:1975.

The mass of the test specimens shall be as specified by the manufacturer of the air flow instrument.

8 Procedure

8.1 Before each series of measurements, make the necessary preliminary adjustments appropriate to the instrument in use (see Annexes A and B).

8.2 Divide the weighed specimen with the fingers into four to six portions, tease each portion out randomly until about 50 mm to 70 mm in diameter and place each portion successively into the sample holder until the entire specimen is loaded. Carefully insert the first portion so as to fill in the bottom edges of the sample holder by pushing it well into the bottom of the sample holder and outwards to the edges. Take care to insert all the specimen and not to lose any of the fibres. Insert the compression plunger and lock it in its position. Avoid fibres sticking between the cylinder wall and the compression plunger.

8.3 Cause air to flow through the specimen at the appropriate flow rate for the low compression of the plug and after 10 s note the reading, PL. on the pressure scale of the instrument to an accuracy of 1 mm of the water column. Next cause air to flow through the specimen at the appropriate flow rate for the high compression of the plug and after 10 s note the reading, PH, on the pressure scale of the instrument to the same accuracy of 1 mm of the water column.

8.4 Remove the test specimen from the cylinder and reinsert it, reversing the individual portions, and repeat the procedure given in 8.2 and 8.3.

8.5 Repeat the procedure given in 8.2 to 8.4 on a second test specimen taken from the same sample.

If the PL or PH readings of the two successive specimens from the same sample differ by more than 5 %, it is recommended to examine a new specimen from the same sample and to calculate the average readings for all specimens tested.

9 Calculations and expression of results

Average the two readings of each pressure drop, PL and PH, taken for each specimen tested from a sample. Using each pair of average readings, PL and PH, calculate the maturity ratio, *M*, or the percent

maturity, P_m of each specimen via the appropriate conversion formula (see Annex A). Average the readings of pressure drops PL and PH, and average the values calculated for the two specimens tested from a sample.

10 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) the material source and if possible type and/or botanical species;

c) the number of specimens tested, the number of readings per specimen, the number of samples used, and the sampling method;

d) the average of the values measured for PL and PH, the calculated values such as maturity ratio, M, or percent maturity, P_m, and also the equation used;

e) type, make and model of instrument used;

f) date of the test.

Annex A
(normative)

Operation of the air flow instrument "Fineness/Maturity Tester"

A.1 General

There are several models of "Fineness/Maturity Testers". They vary only in details of construction and operation. Any details of the operation of a particular model which differ from the instructions given in this annex are described in the manufacturer's instructions included with the instrument.

A.2 Fineness/Maturity Tester, Type .....

A.2.1 Turn on the instrument and wait 15 min for it to warm up.

A.2.2 Proceed to the different verifications recommended in the manufacturer's manual.

A.2.3 Calibrate the instrument following one of the methods described in Annex B.

A.2.4 Carry out the measurements as described in Clause 8.

A.2.5 Using the PL and PH readings, calculate either the maturity ratio or the percent maturity via conversion Formula (A.1) or (A.2), respectively.

A.2.5.1 Maturity ratio

$$M = 0{,}247\,\mathrm{PL}^{0{,}125}\left(\frac{\mathrm{PL}}{\mathrm{PH}}\right)^2 \tag{A.1}$$

A.2.5.2 Percent maturity

$$P_\mathrm{m} = 95{,}0\frac{\mathrm{PL}}{\mathrm{PH}} - 50{,}8 \tag{A.2}$$

NOTE PL and PH readings may also be used to calculate the micronaire value using Formula (A.3) or linear density using Formula (A.4).

$$\text{Micronaire value} = 0{,}60 + \frac{850}{\mathrm{PL}+40} \tag{A.3}$$

$$\text{Linear density (mtex)} = \frac{60\,000}{\mathrm{PL}}\cdot\left(\frac{\mathrm{PH}}{\mathrm{PL}}\right)^{1{,}75} \tag{A.4}$$

Annex B
(normative)

Method for instrument calibration

B.1 The calibration of air flow instruments is performed by setting the air flow valves to the appropriate air flow rate corresponding to the degree of compression applied to the cotton fibre plug.

B.2 For the calibration of the instrument proceed as follows:

B.2.1 Set the air flow control successively for each compression of the plug so that the upper edge of the float comes to rest at the upper setting line on the manometer for the low compression and at the lower setting line on the manometer for the high compression, the test chamber being empty. The air flow is then set to 4 l/min or 1 1/min depending on the degree of compression. In both cases great care should be taken to align the top of the float with the setting line, avoiding parallax. These settings are critical and the readings should be checked at regular intervals during testing.

B.2.2 Set the air flow control successively for each compression of the plug so that the manometer reads predetermined values of pressure drops PL and PH for the reference cotton, the test cylinder being filled with the specified mass of plug taken from the reference cotton used.

NOTE A series of international reference cottons for calibration are available from the Standards Section. Cotton Division, Agricultural Marketing Service, US Department of Agriculture, P.O. Box 17723, Memphis, TN 38112, USA.

Until the International Calibration Cotton Standards Committee takes over the work, the ITMF Working Group on Maturity will provide the standard values PL and PH to be used for reference cottons.

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