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Testing methods for cotton fibres

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Textile Evaluation Technology Council (JTETC)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS L 1019**: 1999 is replaced with this Standard.

This revision has been made based on **ISO 2403**: 1972 *Textiles—Cotton fibres—Determination of micronaire value*, **ISO 3060**: 1974 *Textiles—Cotton fibres—Determination of breaking tenacity of flat bundles* and **ISO 4913**: 1981 *Textiles—Cotton fibres—Determination of length (span length) and uniformity index* for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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Testing methods for cotton fibres

Introduction This Japanese Industrial Standard has been prepared based on the first edition of **ISO 2403** *Textiles—Cotton fibres—Determination of micronaire value* published in 1972, the first edition of **ISO 3060** *Textiles—Cotton fibres—Determination of breaking tenacity of flat bundles* published in 1974 and the first edition of **ISO 4913** *Textiles—Cotton fibres—Determination of length (span length) and uniformity index* published in 1981 with some modifications of the technical contents.

Annexes 1 to 7 contain previous provisions of Japanese Industrial Standard which, in this revision, are given in the form of Annexes (informative), for use in quality control conducted in spinning mills. The portions with continuous sidelines or dotted underlines in this Standard are the matters in which the contents of the original International Standard have been modified. A list of modifications with explanations is given in Annex 8 (informative).

1 Scope This Standard specifies the testing methods of cotton fibres⁽¹⁾.

Note (1) The cotton fibres include sliver and cotton fibres disentangled from roving or yarn and woven fabric.

NOTE : The International Standards corresponding to this Standard are as follows:

In addition, the symbols which denote the degree of correspondence in the contents between **JIS** and the relevant International Standards are IDT (identical), MOD (modified) and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 2403:1972 *Textiles—Cotton fibres—Determination of micronaire value* (MOD)

ISO 3060:1974 *Textiles—Cotton fibres—Determination of breaking tenacity of flat bundles* (MOD)

ISO 4913:1981 *Textiles—Cotton fibres—Determination of length (span length) and uniformity index* (MOD)

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS K 8103 *Diethyl ether*

JIS K 8150 *Sodium chloride*

JIS K 8288 *Trisodium citrate dihydrate*

JIS K 8576 *Sodium hydroxide*

JIS K 8625 *Sodium carbonate*

JIS K 8983 *Copper (II) sulfate pentahydrate*

JIS L 0105 *General principles of physical testing methods for textiles*

NOTE : **ISO 139** *Textiles—Standard atmospheres for conditioning and testing* is equivalent to the said standard.

JIS L 0208 *Glossary of terms used in textile industry—Testing*

JIS L 0209 *Glossary of terms used in spinning*

JIS L 1069 *Tensile strength tests of natural fibres*

JIS R 3503 *Glass apparatus for chemical analysis*

JIS Z 8401 *Guide to the rounding of numbers*

3 Definitions For the purpose of this Standard, the definitions given in **JIS L 0105**, **JIS L 0208**, and **JIS L 0209** apply.

4 Test place The test shall be performed in accordance with **5.1** of **JIS L 0105**.

5 Sampling and preparation The sampling and preparation shall be performed in accordance with **6.1** or **6.2** of **JIS L 0105**.

6 Classification of tests The classification of tests shall be as follows.

- a) Moisture percentage
- b) Fibre length
- c) Tensile strength
- d) Fineness
- e) Maturity
- f) Colour and gloss
- g) Impurity (non lint)
- h) Foreign matter, nep and mote
- i) Sugar content (honeydew)
- j) Oil and fat content

7 Test method

7.1 Moisture percentage The moisture percentage shall be as follows.

- a) **Sample** 100 g to 200 g
- b) **Operation** Put the sample into the cage of small mesh sized wire gauze during drying taking care that it does not fly and measure the mass before drying and absolute dry mass of the sample. Obtain the moisture percentage (%) according the following formula.

Express the moisture percentage by rounding the result to one decimal place in accordance with **JIS Z 8401**.

$$\text{Moisture percentage (\%)} = \frac{W - W'}{W'} \times 100$$

where, W : mass before drying (g)

W' : absolute dry mass (g)

$$\text{Information : Moisture content (\%)} = \frac{W - W'}{W} \times 100$$

7.2 Fibre length

7.2.1 Method by combsorter The method by a combsorter shall be as follows.

a) **Sample** 55 mg to 75 mg

75 mg for method B.

b) **Operation** The operation includes the following methods.

- 1) **Method A (double combsorter method)** Pull the sample with the first fingers and second fingers of both hands and double it. Repeat this several times and align the fibre approximately in parallel. Next, insert this in the left-hand side comb, so that it is at right angles to the comb, with a hand and a depressor. As required, dropping the teeth of the comb one by one with a comb faller, sample fibres with a clip successively from the near side comb, align one end of them with the right-hand side nearest comb to move them and insert them with the hand and depressor. Repeat this operation, and move all fibres to the right-hand side comb (the first transfer). Next, rotate the combsorter through 180° and make the right-hand side comb come to the left-hand side. Here, repeat the same operation as that of the first transfer carefully successively from the longer fibres (the second transfer).

Again, rotate the combsorter through 180° , pull with a clip in small batches successively from the longer fibres, arrange in the same thickness so that the length becomes 16 cm aligning the one end on the base line marked on the lower place of a velvet board, and create a staple diagram. Using this staple diagram, obtain the effective fibre length (mm) and short fibre content (%) by drawing as shown in figure 1.

Express the effective fibre length and short fibre content by rounding the result to one decimal place in accordance with **JIS Z 8401**.

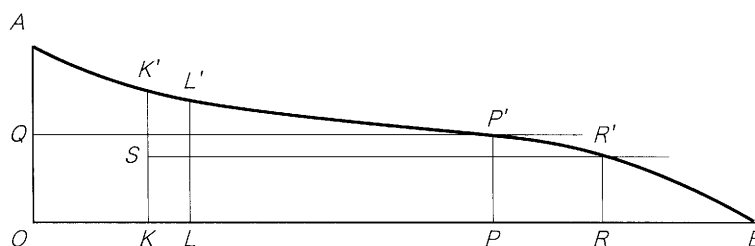


Figure 1 Staple diagram

Here, give $OQ = \frac{1}{2}OA$, draw the parallel line from Q to the base line OB , and take the intersection point with the curve as P' . Drop the perpendicular line $P'P$ from P' to OB , give $OK = \frac{1}{4}OP$, drop the perpendicular line from K to OB , and obtain K' . Give $SK = \frac{1}{2}KK'$, draw the parallel line from S to OB , and drop the perpendicular line $R'R$ from the intersection point R' with the curve to OB . Give $OL = \frac{1}{4}OR$, drop the perpendicular line from L , obtain L' on the curve, and take LL' as effective fibre length.

In addition, obtain the short fibre content from $\frac{RB}{OB} \times 100$.

- 2) **Method B (classification method by group)** After aligning fibres with the comb sorter in accordance with the above-mentioned method A, arrange nips of fibres by clip, one by one, successively from the longer ones on the velvet board at intervals of about 5 mm, so that they are parallel with one another. The number of clip nips shall be 65 to 100 when the arrangement of all fibres is finished. Arrange these nips into groups with length difference of 3.175 mm from the longer ones, and weigh the mass of each group to the nearest 0.1 mg. The total sum of mass shall be $75 \text{ mg} \pm 2 \text{ mg}$. From the length and mass of each length group of fibres, the mean fibre length (mm) and the upper half mean fibre length (mm) according to the following formula shall be obtained.

For the test result, express the mean fibre length (mm) and upper half mean fibre length by rounding to one decimal place in accordance with **JIS Z 8401**.

$$\text{Mean fibre length (mm)} = \frac{\sum w_i l_i}{W}$$

$$\text{Upper half mean fibre length (mm)} = \frac{\sum w_j l_j}{\frac{W}{2}}$$

where, $\sum w_i l_i$: total sum of the values obtained by multiplying mass of each fibre group by its length (mg·mm)

$\sum w_j l_j$: total sum of the values obtained by multiplying mass of each fibre group corresponding to the upper half (mass of a group in a boundary is divided proportionally) by its length (mg·mm)

W : measured fibre gross mass (mg)

7.2.2 Method by fibrograph The method by a fibrograph shall be as follows.

- a) **Sample** 50 g to 100 g
- b) **Operation** After attaching a comb to the fibrograph sampler with the teeth turned upward, place the sample in the cylinder and press it against the perforated sample plate. Next, rotate the pivot arm for one complete counter-clockwise revolution, while maintaining evenly distributed over the surface of the sample, to load, and after combing the sample, remove the loaded comb from the sampler.

Next, attach the sample to the fibrograph, remove floating fibres and trash with a brush, and after aligning them straightly, illuminate scanning the sample with a photo emissive cell, read the value of mean fibre length and upper half mean fibre length, and obtain uniformity index (%) according to the following formula.

Express the 2-time mean value of uniformity index by rounding the result to the nearest integer in accordance with **JIS Z 8401**. For mean fibre length and upper half mean fibre length, obtain them by rounding to one decimal place.

$$\text{Uniformity index (\%)} = \frac{ML}{UHML} \times 100$$

where, ML : mean fibre length (mm)

$UHML$: upper half mean fibre length (mm)

- NOTES 1 Mean fibre length may be expressed as 50 % fibre length, and upper half mean fibre length as 2.5 % fibre length.
- 2 Upper half mean fibre length refers to mean fibre length of fibres longer than mean fibre length.

7.3 Tensile strength

7.3.1 Method by fibre bundle The method by a fibre bundle shall be as follows.

- a) **Sample** 100 mg to 150 mg
- b) **Operation** The operation shall include the following methods.
- 1) **Method A (zero gauge method)** Comb the sample with a coarse comb, take 60 mg to 80 mg from the tassel aligned almost in parallel, and align them in parallel with an attached fine comb by combing alternately the left half when holding fibres with the first finger and second finger of right hand or the right half when holding fibres with the first finger and second finger of left hand. At this time, take care so that hands do not contact the centre part of the fibre ruptured when measuring. Put this on the clamp (zero gauge) attached to the vice by forming the ribbon shape about 5 mm to 6 mm in width, make it straight by giving a suitable tension, and tighten it with a fixed force.

Next, remove the clamp from the vice, and cut the fibres coming out of both sides of the clamp perfectly with a knife.

Raise the beam of the Pressley tester, insert the clamp into the measurement part (for a zero gauge), lower the carriage, and read the graduation of the beam when the fibres are ruptured. In this case, when the reading is 10 or less, re-perform the operation. Furthermore, measure the mass (mg) of the fibres after rupture with a precision balance.

- 2) **Method B (3.2-mm gauge method)** After attaching the sample to the clamp (3.2-mm gauge) according to the same operation as that of method A, raise the beam of the Pressley tester, insert the clamp into the measurement part (for 3.2-mm gauge), lower the carriage and read the graduation of the beam when the fibres are ruptured. In this case, re-perform the operation when the reading is 10 or less. Furthermore, measure the mass (mg) of the fibre after rupture with a precision balance.
- c) **Expression of tensile strength** Take the measured reading of the beam as S (N), take the mass of the sample at that time as W (mg), and obtain the tensile strength according to the following formula.

Express the 5-time mean value of tensile strength by rounding the result to one decimal place in accordance with **JIS Z 8401**.

$$\text{Pressley index (P} \cdot \text{I)} = \frac{S}{W}$$

NOTE : Tensile strength (4 450 N/6.45 cm²) = $P \cdot I \times 10.81$

Tensile strength (N/tex) = $P \cdot I \times 5.36$

7.3.2 Method by single fibre The method by a single fibre shall be as specified in **JIS L 1069**.

7.4 Fineness

7.4.1 Method by micronaire The method by micronaire shall be as follows.

- a) **Sample** 3.24 g
- b) **Operation** Adjust the compressed air from a compressor (pressure of 0.25 MPa or more) to the Micronaire instrument to 0.175 MPa and then further to 0.042 MPa with a pressure controller, confirm that the micronaire scale is within the range of ± 0.10 of the standard value using the cotton for a standard calibration. Next, after fully loosening the sample, insert it into the cylinder part uniformly and press down with a plunger. Send the air of the adjusted fixed pressure, read the scale in units of 0.1 at the location which the upper end of the indication float shows, and take this value as the micronaire reading.

Express the 2-time mean value of micronaire reading by rounding the result to one decimal place in accordance with **JIS Z 8401**.

7.4.2 Method by combsorter The method by a combsorter shall be as follows.

- a) **Sample** 55 mg to 75 mg

- b) **Operation** Classify the sample by a fibre length group in accordance with **7.2.1** and arrange in parallel on a velvet board. Take 100 pieces of fibres from each group except the fibre groups of 1.588 mm, 4.763 mm and 2 mg or less, measure the mass to the nearest 0.01 mg with a precision balance and obtain fineness according to the following formula.

Express fineness by rounding the result to two decimal places in accordance with **JIS Z 8401**.

$$\text{Fineness } (\mu\text{g}/2.54 \text{ cm}) = \frac{250 W}{\sum \left(\frac{l_i w_i}{w_i'} \right)}$$

where, l_i : each fibre length of the fibre length group (mm)
 w_i : each fibre mass of the fibre length group (mg)
 w_i' : fibre mass of 100 pieces each taken from the fibre length group (mg)
 W : measured fibre gross mass (mg)

7.5 Maturity

7.5.1 Method by causticare The method by causticare shall be as follows.

- a) **Sample** 8 g to 10 g
- b) **Testing machine** Micronaire instrument (a causticare scale is used.)
- c) **Operation** Read the causticare scale according to the same operation as that in b) of **7.4.1**, add wetting agents of 0.1 % of the mass of all samples to the sodium hydroxide (**JIS K 8576**) solution of a specific gravity of 1.20 (20 °C), immerse all samples sufficiently, wash the samples thoroughly with hot water, and dry them. Leave these in the laboratory in the standard state until they reach moisture equilibrium, reel them sufficiently, again measure with the Micronaire instrument in the same way as that before treatment, and obtain maturity (%) according to the following formula.

Express the 2-time mean value of maturity by rounding the result to the nearest integer in accordance with **JIS Z 8401**.

$$\text{Maturity } (\%) = \frac{A}{B} \times 100$$

where, A : measured value before treatment
 B : measured value after treatment

7.5.2 Method by dyeing The method by dyeing shall be as follows.

- a) **Sample** 3 g
- b) **Dyestuffs and auxiliaries** The dyestuffs and auxiliaries shall be as follows.
- 1) C.I. Direct Red 81 1.2 %

- 2) C.I. Direct Green 26 2.8 %
- 3) **JIS K 8150** (sodium chloride, guaranteed reagent) 5.0 %

NOTE : Any % refers to mass % of a sample.

c) **Operation** The operation shall be as follows.

- 1) **Pretreatment** Put the sample into boiling water, make it wet sufficiently, take out and dehydrate it.
- 2) **Dyeing** Put a dye stuff in boiling distilled water (bath ratio 40 : 1) and put the sample into this dyeing bath. After boiling for 15 min, add sodium chloride to this by 2.5 mass % of the sample, and while stirring it well, dye for 15 min further. Add sodium chloride again by 2.5 mass % of the sample, and while stirring it well, dye for 15 min further.
- 3) **Post treatment** Take the sample from the dyeing bath, and wash 2 times sufficiently with cold water (bath ratio 50 : 1). Next, dehydrate excessive water, and while stirring violently in boiling water (bath ratio 50 : 1), wash for 30 s correctly, and then take out and dehydrate it. Further, wash 2 times with cold water (bath ratio 50 : 1) and dry.

d) **Judgment of maturity** Judge the maturity of the sample fibres by examining the distribution of the colours green and red, based on the fact that the immature fibre is dyed green and the mature fibre, red.

7.6 Colour and gloss The colour and gloss shall be as follows.

- a) **Sample** About 100 g
- b) **Testing machine** Cotton colorimeter
- c) **Operation** Put the sample of which the measuring surface is adjusted to be flat on the sample window of the colorimeter, and press with a fixed load of about 23 N. Next, turn on the switch for measurement, illuminate a light from two light sources to the sample surface, and actuate the two pointers (*Rd* and *+b*) according to the reflected light. Read the value of *Rd* and *+b* at the rest position of the pointers from the colour diagram to one decimal place, and obtain colour and gloss.

Information : *Rd* is a degree of lightness, the greater value of which indicates the greater lightness.

+b is a degree of yellowishness, the greater value of which indicates the greater yellowishness.

7.7 Impurity (non lint) The impurity shall be as follows.

- a) **Sample** 100 g for the raw cotton and the waste cotton with few trashes (flat strip, noil), and 200 g for the waste cotton with many trashes
- b) **Testing machine** Shirley analyzer