BS ISO 18066:2015

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Textiles — Manmade filament yarns — Determination of shrinkage in boiling water

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee TCI/24, Physical testing of textiles.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Textiles — Manmade filament yarns — Determination of shrinkage in boiling water

Textiles — Fils de filaments synthétiques — Détermination du retrait dans l'eau bouillante

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Foreword

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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*.

INTERNATIONAL STANDARD ISO 18066:2015(E)

Textiles — Manmade filament yarns — Determination of shrinkage in boiling water

1 Scope

This International Standard specifies a test method for the determination of the boiling water shrinkage of non-textured and textured multifilament yarns (made of polyester, polyamide, polypropylene, cellulose fibre, etc.)

Only automatic method is specified in this International Standard.

This International Standard is applicable to manmade filament yarns of linear density less than 3 000 dtex.

This International Standard is not applicable to partially oriented yarns.

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 referenced document (including any amendments) applies.

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

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

3 Terms and definitions

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

3.1
shrinkage in boiling water
decrease in length of a specimen as a result of thermal treatment in boiling water, expressed as a percentage of its original length, which measured under tension before and after treatment

4 Principle

Under specific condition, a test specimen is treated in boiling water. Shrinkage is calculated as variation in length, measured before and after treatment.

5 Apparatus and materials

5.1 Skein winding reel

a) Reel with a circumference of (1 000 ± 2,5) mm, driven either automatically or manually.

b) A traversing mechanism to avert overlapping while a number of skeins being wound at the same time.

c) A tensioning device, to an accuracy of ±10 %, maintaining tension within the recommended limits.

d) A device to count the turns of the reel, preferably warning or stopping winding automatically, just prior to the specified number of reel revolutions.

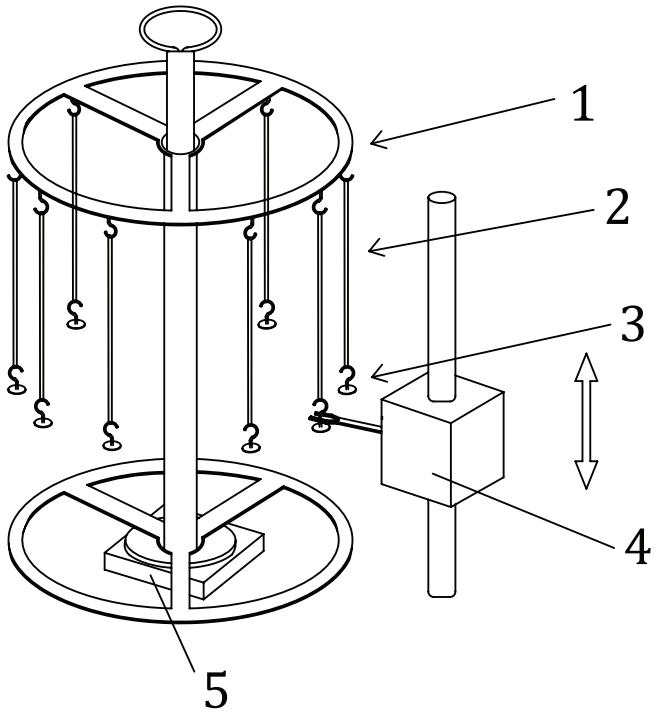
e) A mechanism to reduce the reel circumference is advisable for easy removal of the skein.

5.2 Automatic shrinkage tester (see Figure 1).

a) Automatically application of the specified tension, appliance to measure the length of the specimen and to calculate the shrinkage based on the length values.

b) Resolution of the length measurement is 0,05 mm .

c) Fitted with a specimen holder, over 600 mm high, in which a number of skeins arranged and tested in succession. Each skein is applied with a 2,5 cN load, which remains throughout the whole testing procedure.



Key

1 specimen holder
2 specimen
3 2,5 cN load
4 loading apparatus and length measuring system
5 force measuring system

Figure 1 — Automatic shrinkage tester

5.3 Boiling water container

a) The utilizable space shall have a height of at least 600 mm and suitable width and depth to accommodate the specimen holder of the shrinkage tester in an upright position, so as to make the specimens completely covered by boiling water during the thermal treatment.

b) The temperature shall be adjustable to 100 °C. The temperature variation from the set value shall not exceed ±3 °C.

c) The specimen holder of the shrinkage tester should be fixed in boiling water container.

5.4 Ventilated oven, which meets the following requirements.

a) The interior height shall be at least 600 mm, to accommodate the specimen holder in an upright position. The occupied space is not more than 80 % of the volume.

b) A thermometer to measure and record the temperature in the vicinity of the specimens.

c) Forced ventilation as to maintain the temperature to an accuracy of ±3 °C.

5.5 Reagent

a) Distilled water or grade 3 water in accordance with ISO 3696.

b) Surfactant with wetting effect in concentration of 1 g/l.

6 Test specimen

6.1 Sampling

Sampling shall be performed as follows:

a) bulk laboratory sample shall be taken on demand;

b) number of lot sample and laboratory sample are listed in Table 1.

Table 1 — Number of lot sample and laboratory sample

Number of containers in the consignment	Number of containers in the first selection	Number of containers taken for consignment sample	Number of packages sampled from each container	Number of packages chosen for laboratory sample
10 or less	all	all	see note below	20 approx
11 to 20	10	10	2	20
21 to 40	20	10	2	20
more than 40	40	20	1	20
NOTE Take an equal number of packages from each container. The number of packages for laboratory sample should be at least 20. If the consignment includes less than 20 packages, sample all of them. Packages that have been dampened, bruised, or opened during the transportation shall not be sampled.				

6.2 Preparation of the test specimen

6.2.1 Discard yarns on outer layer of the package in the laboratory samples. If test specimens are sampled from the same package, at least 5 m yarn should be discarded between each specimen.

6.2.2 Lead the yarn through the tension device and fix the end on the clip of the reel. Smoothly reel the skein using a uniform tension lower than the specific tension (calculated as ,Formula 2) and reel the specific turns (calculated as Formula 1). Cut the yarn close to the clip and tie two yarn ends together, without stretch. Remove the skein from the reel carefully and avoid tangling.

$$n = \frac{T_t}{2 \times T} \tag{1}$$

where

n number of turns, rounded to nearest whole number;

T_t set linear density of the skein, expressed in dtex;

T nominal linear density of the specimen, expressed in dtex.

Table 2 — Set linear density of the skein

Nominal linear density of the specimen	Set linear density of the skein
≤400 dtex	2 500 dtex
>400 dtex ~ 3000 dtex	10 000 dtex

6.3 Numbers of tests

6.3.1 For bulk laboratory sample, the minimum number of specimens shall be 2 from each package and the total number of tests shall not be less than 20 for one lot.

6.3.2 Batch laboratory sample shall contain at least 20 packages and each package is tested twice.

7 Test procedures

7.1 Preconditioning and conditioning

7.1.1 The standard atmosphere for preconditioning, conditioning, and testing shall be as specified in ISO 139.

7.1.2 Time for specimens to reach moisture equilibrium should be more than 2 h before treatment, and more than 4 h after treatment.

7.2 Measuring the initial length of the test specimens

7.2.1 Hang the skeins sequentially on the specimen holder of automatic shrinkage tester (see 5.2, Figure 1), while knots placed at the hook. Attach a tension load of 2,5 cN to the bottom of each skein so as to avoid entanglement and keep skein vertically downwards.

7.2.2 Place the holder into the automatic shrinkage tester and set the tension according to Formula 2. After automatically applying and maintaining the tension for (30 ± 1) s, auto-measure the straightened length L_0 of a skein, to an accuracy of 0,1 mm.

$$F = P \times T_t \tag{2}$$

where

F tension, expressed in cN;

P tension per unit linear density, expressed in cN/dtex;

— not-textured yarns, (0,05 ± 0,005) cN/dtex,

— textured yarns, (0,20 ± 0,02) cN/dtex.

T_t set linear density of the skein, expressed in dtex. (see 6.2.2, Table 2)

7.2.3 Repeat auto-loading and auto-measuring procedures in sequence, until all skeins in the specimen holder have been tested.

7.3 Boiling and drying treatment

7.3.1 Fill the container with reagent specified in 5.5. The quantity of reagent shall be sufficient to make the specimen holder completely immersed.

7.3.2 Place the specimen holder with the specimens and tensioning weights into the boiling water container preheated to the required temperature. Maintain it vertically, immerse it completely in water and keep it there for (30 ± 5) min.

7.3.3 After treatment, take the specimen holder out carefully and let the water drip away for 10 min. Then place the specimen holder into the oven (specified in 5.4) at a temperature of (55 ± 3) °C for 30 min. If the specimens are not completely dry, extend the drying time accordingly. Afterwards, expose the specimens in standard atmosphere to reach moisture equilibrium. Alternatively, the specimens may be just exposed in standard atmosphere, without oven-drying, to reach moisture equilibrium.

NOTE Since the boiling point of water depends on the air pressure, the shrinkage in boiling water would change subject to air pressure.

7.4 Measuring the length of the test specimens after treatment

Following similar procedure in 7.2 to place the specimen holder into the automatic shrinkage tester and measure the straightened length L_1 of each skein to an accuracy of 0,1 mm.

8 Calculation and expression of the results

8.1 Calculation

The shrinkage in boiling water is calculated according to Formula 3, be accurate to the first decimal place.

$$BWS = \frac{L_0 - L_1}{L_0} \times 100 \quad (3)$$

where

BWS shrinkage in boiling water, expressed in %;

L_0 length before treatment, expressed in mm;

L_1 length after treatment, expressed in mm.

8.2 Precision

See Annex A.

9 Test report

The test report shall include the following information:

a) a reference to this International Standard, ISO 18066;

b) all details necessary for the identification of the sample tested (including method of preparation, if applicable);

c) testing conditions (temperature, boiling point of water, treatment time, loading speed and tension);

d) air pressure;

e) test results (length of the test specimen before treatment, length of the test specimen after treatment and shrinkage in boiling water);

f) any deviation, by agreement or otherwise, of the procedure specified;

g) any unusual phenomenon observed.

Annex A
(informative)

Precision experiment

A.1 Description

Eight laboratories participated in precision experiment, providing test results for five materials and each one tested twice. Results are analysed according to ISO 5725-2:1994.

A.2 Repeatability

Following the test method specified in this International Standard, one operator tests identical specimens using the same apparatus in an appropriate short time.

Calculate the difference of two test results of the same test specimen. The difference which is greater than repeatability as listed in Table A.1 shall not exceed once among 20 tests.

A.3 Reproducibility

Following the test method specified in this International Standard, operators in different laboratories tests identical specimens, using different apparatus.

Calculate the difference of two test results of the same test specimen. The difference which is greater than reproducibility as listed in Table A.1 shall not exceed once among 20 tests.

Table A.1 — Precision of test results in five materials

Materials	Polyester non-textured yarns	Polyester textured yarns	Polyamide 6 non-textured yarns	Polyamide 6 textured yarns	Polyamide 66 non-textured yarns
Repeatability, *r*	0,18	0,08	0,24	0,17	0,19
Reproducibility, *R*	0,87	0,46	1,51	0,99	1,44

A.4 Mean value

Test two specimens and calculate twice test results of the same test specimen.

If the difference equals or exceed the repeatability and reproducibility listed in Table A.1, two mean values should be considered significantly different at the 95 % probability level.

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