



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 6505-2017

**Man-made fiber -- Test method for thermal shrinkage of filament
yarns (after treatment)**

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1 Scope

This Standard specifies test methods for boiling water shrinkage and dry-hot air shrinkage of man-made filament yarns (after treatment) -- stranded filament method and single filament method. The stranded filament method provides two modes:

manual measurement and instrument measurement; manual measurement shall be used when there is a dispute.

This Standard is applicable to man-made fiber filament yarns with a linear density of less than 3,000 dtex.

This Standard is inapplicable to pre-oriented yarns.

2 Normative References

The following documents are indispensable to the application of this document. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 4146 (all parts) Textiles - Man-made Fibers

GB/T 6502 Sampling Method of Man-made Filament Yarns

GB/T 6682 Water for Analytical Laboratory Use - Specification and Test Methods (GB/T 6682-2008, ISO 3696:1987, MOD)

GB/T 9994 Conventional Moisture Regains of Textile Materials

GB/T 14343 Testing Method for Linear Density of Man-made Filament Yarns FZ/T 50005 Testing Method for Linear Density of Spandex Filament Yarns

3 Terms and Definitions

The terms and definitions defined in GB/T 4146 (all parts) are applicable to this document.

4 Principle

Under specified conditions, use thermal medium (boiling water or dry-hot air) to treat the test specimen. Measure the length variation of the test specimen before and after the treatment; calculate its percentage to the original length of the test specimen. Thus, the thermal shrinkage rate can be obtained.

5.1 Filament yarn length measuring instrument, attached with:

- a) A device that can adjust tension and a reciprocating filament-guiding device;
- b) A device that can adjust the speed, so as to ensure that the tension fluctuation is within the allowable range;
- c) Yarn frame, with a circumference of (1.000 ± 0.002) m;
- d) A reel counting device.

5.2 Filament-stranding rack: a cylindrical frame mechanism; multiple test specimens

can be placed at the same time.

Each test specimen has a 2.5 cN hook weight, with a height of at least 600 mm. There is respectively a row of hooks at the upper and lower ends. During the test, the stranded filament is hung between the upper and lower hooks. The upper hook is fixed;

the lower hook is the 2.5 cN hook weight, which frictionlessly lifts and lowers along the metal wires on both sides.

5.3 Manual length measuring rack, attached with:

- a) Vertical measuring scale: measuring range is 1 m; minimum division value is 1 mm. The upper end is equipped with clamps and hooks. The clamping surface of the clamp is flat; it shall not damage the filament or slip during the clamping. The hooks are

made of steel wire with a diameter of 2 mm ~ 3 mm;

the upper end of the outer circle of the steel wire at the yarn hanging position is parallel to the zero position of the measuring scale;

b) Device for applying pre-tension: the accuracy of applying pre-tension is $\pm 10\%$;

tension device is a combination weight with a hook or a combination weight with a clamp.

5.4 Automatic length measuring instrument: it can automatically measure the length of

the stranded filament before and after thermal treatment; calculate the thermal shrinkage rate and automatically adjust the tension. It is also equipped with a filament-the upper limit of the laboratory's relative humidity;

---When the temperature of the sample is 5°C lower than the laboratory temperature.

6.2.2 Standard atmosphere for conditioning and testing

For test specimens with a conventional moisture regain less than 4.5%: temperature $(20 \pm 2)^{\circ}\text{C}$, relative humidity $(65 \pm 5)\%$.

For test specimens with a conventional moisture regain greater than or equal to 4.5%: temperature $(20 \pm 2)^{\circ}\text{C}$, relative humidity $(65 \pm 3)\%$.

The conventional moisture regain of various fibers shall refer to GB/T 9994.

6.2.3.1 Add Grade-3 water that complies with GB/T 6682 to the water tank. The amount

of water shall ensure that the test specimen is completely immersed and kept away from the wall of the water tank.

6.2.3.3 After boiling, the drying temperature is $(55 \pm 5)^{\circ}\text{C}$; the drying time is around 60

min.

NOTE: since the boiling point of water depends on the atmospheric pressure at the measuring point, variation in atmospheric pressure may cause changes in the result of the boiling water shrinkage.

6.2.4 Conditions of dry-hot air treatment

In accordance with different types of fibers, different hot air temperatures and thermal treatment times shall be adopted. The recommended conditions of hot air temperature and

thermal treatment time are shown in Table 1. For filaments that are not applicable, the hot air temperature and thermal treatment time may be determined through negotiation.

When manual measurement is chosen, the test specimen may also be placed in a mesh bag or be wrapped with gauze in accordance with Appendix E.

7.1.1.2 Preparation and treatment of test specimen

7.1.1.2.1 Withdraw the surface filaments from the reel. Insert the reel on a bobbin frame; draw out the filament end.

7.1.1.2.2 Introduce the filament into the tension device, so as to fix the filament end on

the clamping piece of the yarn frame of the length measuring instrument. The coiling tension shall be calculated in accordance with Formula (3). Evenly and smoothly wind for the number of reels specified in 6.3.1, with knots at both ends.

7.1.1.2.3 Carefully remove the stranded filament from the yarn frame; prevent it from

twisting. Loosely hang it on the filament-stranding rack without any tension.

7.1.1.2.4 In the standard atmosphere specified in 6.2.2, the test specimen shall be equilibrated before thermal treatment for the time specified in 6.2.5.

7.1.1.3.1 Manual measurement

Successively hang the test specimens on the hooks of the vertical measuring scale as described in 5.3 a); align the inner side of the stranded filament with the zero point of the vertical measuring scale. In accordance with the stipulations of 6.4.1, calculate the tension. In addition, in accordance with this tension, on the lower end of the stranded filament, carefully hang the weight with the hook as described in 5.3 b); prevent twisting of the stranded filament. After (30 $\pm$ 3) s, the upper end of the outer circle of the hook at eye level and the scale of the vertical measuring scale at the same level is the length L_0 of the test specimen before the treatment, accurate to 1 mm.

7.1.1.3.2 Measurement with an instrument

On the filament-stranding rack, add a 2.5 cN weight to the lower end of each test specimen, so that the filament is vertically downward. Then, put it into the instrument.

In accordance with the stipulations of 6.4.1, set the pre-tension. After the instrument automatically loads for (30 $\pm$ 3) s, read the length L_0 of the test specimen before the