

ICS 59.080.30

CCS W04



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

GB/T 38413-2019

Textiles - Test methods for the filtration of particulate matter

纺织品 细颗粒物过滤性能试验方法

Issued on: December 31, 2019

Implemented on: July 1, 2020

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

Table of Contents

1 Scope
2 Normative references
3 Terms and definitions
3.1 Particulate matter PM
4 Principle...
5 Test equipment...
5.1.3 Test system
5.1.3.3 Photometer
6 Materials and reagents...
7 Sample...
7.2 Temperature and humidity pretreatment
7.4 Sampling requirements
8 Test conditions...
9 Test procedure...
9.3 Start test
9.3.1 Mask
10 Test data processing

1 Scope

China's national test methods for the particulate filtration performance of textiles. It specifies the terms and definitions, the principle, the test equipment and the materials. Filtration efficiency is not a single number, and the reason is the physics: a fibrous filter catches large particles by interception and impaction, and very small ones by diffusion, and both mechanisms weaken toward the middle of the range - so every filter has a most penetrating particle size, typically a few tenths of a micron, where its efficiency is worst. A filter quoted as ninety-nine per cent efficient without saying at what particle size has said almost nothing. The other half of the measurement is pressure drop, since efficiency can always be bought by making the fabric denser, at the cost of making it unbreathable. It is the ratio of the two that describes a filter medium, and it is why this method fixes the aerosol, the face velocity and the reporting together.

This Standard specifies the test method for determining the filtration of particulate matter of textiles. This Standard applies to products such as fabrics for air filtration and masks.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the dated version applies to this document. For undated references, the latest edition (including all amendments) applies to this document.

GB/T 6529, Textiles - Standard atmospheres for conditioning and testing

GB/T 6682, Water for analytical laboratory use - Specification and test methods

GB/T 8629-2017, Textiles - Domestic washing and drying procedures for textile testing

GB/T 10586, Specification for damp heat testing chambers

GB/T 10589, Specifications for low temperature test chambers

GB/T 11158, Specifications for high temperature test chambers

3 Terms and definitions

The following terms and definitions are applicable to this document.

3.1 Particulate matter PM

2.5 Particulate matter whose aerodynamic equivalent diameter is less than or equal to 2.5 μm in ambient air.

3.2 Filtration efficiency It shall be able to generate non-oily particles and oily particles that meet the test requirements; it shall be able to neutralize the charge of the generated particles, and ensure that the particles are evenly distributed at the sampling port before filtration.

5.1.2.2 Non-oily particles Sodium chloride (NaCl) particles. The count median diameter (CMD) of the particle is $0.075 \mu\text{m} \pm 0.020 \mu\text{m}$; the geometric standard deviation of the particle size distribution is not greater than 1.86. The concentration of non-oily particles is set according to the product use environment. The concentration of general industrial products is not more than 200 mg/m^3 ; the concentration of civil products is not more than 30 mg/m^3 . According to product needs, other test concentrations can also be set.

5.1.2.3 Oily particles Diisooctyl sebacate (DEHS), dioctyl phthalate (DOP) or other applicable oils (such as paraffin oil) particles. The count median diameter (CMD) of the particle is $0.185 \mu\text{m} \pm 0.020 \mu\text{m}$; the geometric standard deviation of the particle size distribution is not greater than 1.60. The concentration of oily particles is set according to the product use environment. The concentration of general industrial products is 50 mg/m^3 ~ 200 mg/m^3 ; the concentration of civil products is not more than 30 mg/m^3 . According to product needs, other test concentrations can also be set.

5.1.3 Test system

5.1.3.1 General requirements It shall include sample fixtures, photometers, pressure gauges and flow meters; the sampling frequency is ≥ 1 times/min; the detection range of filtration efficiency is 0% ~ 99.999%; the resolution is at least 0.003%.

5.1.3.2 Sample fixture It shall be made of corrosion-resistant metal materials and composed of upper and lower holders. The fixture shall ensure that the sample has a circular measured area of $100 \text{ cm}^2 \pm 1 \text{ cm}^2$, unless otherwise specified. There shall be no leakage at the edge of the sample after clamping; the used sealing ring shall not change the measured area of the sample. The surface of the fixture that is in contact with the test aerosol shall be clean, easy to clean, corrosion-resistant, conductive and grounded.

7.2 Temperature and humidity pretreatment

7.2.1 Equipment The sample temperature and humidity pretreatment equipment requirements are as follows:

- a) The technical performance of the damp heat testing chamber shall meet the requirements of GB/T 10586;
- b) The technical performance of the high temperature test chamber shall meet the requirements of GB/T 11158;
- b) The technical performance of the low temperature test chamber shall meet the requirements of GB/T 10589;

7.2.2 Method Take the sample out of the original packaging and proceed as follows:

- a) Place it in an environment at $38.0 \text{ }^\circ\text{C} \pm 2.5 \text{ }^\circ\text{C}$, where the relative humidity is $(85 \pm 5) \%$, for $24 \text{ h} \pm 1 \text{ h}$;
- b) Place it in a dry environment at $70 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$ for $24 \text{ h} \pm 1 \text{ h}$;
- c) Place it in an environment at $-30 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$ for $24 \text{ h} \pm 1 \text{ h}$. Before proceeding to the above-mentioned
- c) treatment steps, the sample temperature shall be restored to room temperature for at least 4 h before proceeding to the subsequent steps. After the step c), the sample shall be placed in an airtight container and tested within 10 h.

7.3 Washing pretreatment According to the type-A standard washing machine in GB/T 8629-2017, washing procedure 4H, use standard detergent to continuously wash the sample 3 times; after washing, hang to dry. According to product standards or negotiated by interested parties, the number of washes can also be specified separately, which needs to be stated in the test report.

7.4 Sampling requirements

7.4.1 Sampling Cut a circular sample, whose diameter is at least 150 mm, uniformly from the fabric for filtration, or a square sample whose side length is at least 150 mm.

9.1.4 When performing a non-oily aerosol test, turn on the heater, to dry the aerosol to form NaCl particles. When performing an oily aerosol test, it's unnecessary to turn on the heater.

9.1.5 After the instrument is turned on, it takes at least 30 min to make the instrument in a stable state.

9.2 Set air flow The air flow setting range shall be 0 L/min ~ 100 L/min. Under normal circumstances, the air flow of the mask is 85 L/min (if multiple filter elements are used, the flow shall be divided equally; for example, for dual filter elements, the detection air flow of each filter element shall be

42.5 L/min; if multiple filter elements are possible to be used separately, it shall be tested according to the detection conditions of a single filter element); the air flow rate of the filter fabric for the air filter is 32 L/min. The air flow rate can also be set according to product standard requirements or customer requirements, which must be given in the test report.

9.3.1 Mask

9.3.1.1 Place the sample on the sample fixture and fix it, so that the dust-facing surface of the sample faces the direction of the airflow; prevent the sample from twisting or edge gas leakage during the test.

Note 1: Test the mask as a whole without damage.

Note 2: A hot melt glue gun can be used to completely seal the breathing valve cover of the mask, so as to prevent gas leakage at the edge of the respirator valve.

9.3.1.2 Start the test button, and the gas will flow through the sample; observe and record the pre-test filtration efficiency E of the sample; the result is accurate to 0.1%. Use electronic pressure sensor or pressure gauge (5.1.3.4) to measure the pressure difference on both sides of the sample; obtain the initial resistance drop of the sample and record; the result is accurate to

0.1 Pa.

Note: It takes about 15 s to measure the pre-test filtration efficiency E and the initial pressure drop.

9.3.1.3 Calculate the estimated filter time according to Formula (1); stop the test immediately after the actual test time reaches the estimated filter time T . Use the minimum filtration efficiency that is obtained during the entire filter time T as the filtration efficiency of the sample; the result is accurate to 0.1%.