GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 13.340.10

CCS C 73

GB 24539-2021

Replacing GB 24539-2009, GB 24540-2009, GB/T 29511-2013

Protective clothing - Chemical protective clothing

防护服装 化学防护服

Issued on: August 10, 2021 **Implemented on: September 01, 2022**

Issued by: State Administration for Market Regulation.

Standardization Administration of PRC.

Table of Contents

Protective clothing - Chemical protective clothing

1 Scope

This document stipulates the type division, grading, marking, basic technical requirements, test methods of chemical protective clothing.

This document applies to the chemical protective clothing required by employees in the workplace and emergency rescue work.

This document does not apply to chemical protective clothing used in firefighting and other occasions.

Note 1: This document does not specifically propose performance indicator requirements for personal protective equipment, such as gloves, protective boots/shoes, protective masks, view windows, safety glasses, breathing apparatus, unless the protective equipment is an integral part of the protective clothing and provides corresponding chemical protection properties.

Note 2: The protection objects involved in this document include gaseous, liquid, solid chemical substances.

2 Normative references

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, for dated reference documents, only the version corresponding to the date applies to this document; for undated reference documents, the latest version (including all amendments) applies to this document.

GB/T 2912.1 Textiles - Determination of formaldehyde - Part 1: Free and hydrolyzed formaldehyde (water extraction method)

GB/T 3820 Determination of thickness of textiles and textile products

GB/T 3917.3 Textiles - Tear properties of fabrics - Part 3: Determination of tear force of trapezoid-shaped test specimens

GB/T 3920 Textiles - Tests for color fastness - Color fastness to rubbing

GB/T 3923.1 Textiles - Tensile properties of fabrics - Part 1: Determination of maximum force and elongation at maximum force using the strip method

GB/T 4669 Textiles - Woven fabrics - Determination of mass per unit length and

mass per unit area

GB/T 4744 Textiles - Testing and evaluation for water resistance - Hydrostatic pressure method

GB/T 7573 Textiles - Determination of pH of aqueous extract

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

GB/T 8685 Textiles - Care labeling code using symbols

GB/T 12586 Rubber-or plastics-coated fabrics - Determination of resistance to damage by flexing

GB/T 13640 Size designation of protective clothing

GB/T 13773.2 Textiles - Seam tensile properties of fabrics and made-up textile articles - Part 2: Determination of maximum force to seam rupture using the grab method

GB/T 17592 Textiles - Determination of the banned azo colorants

GB 18401 National general safety technical code for textile products

GB/T 19981.2 Textiles - Professional care, drycleaning and wet cleaning of fabrics and garments - Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene

GB/T 20655 Protective clothing - Mechanical properties - Determination of the resistance to puncture

GB/T 21196.2-2007 Textiles - Determination of the abrasion resistance of fabrics by the Martindale method - Part 2: Determination of specimen breakdown

GB/T 21294-2014 Testing methods of physical and chemical performance of garments

GB/T 23344 Textiles - Determination of 4-aminoazobenzene

GB/T 23462 Protective clothing - Test method for chemical protective materials to permeation by chemicals

ISO 15797 Textiles - Industrial washing and finishing procedures for testing of workwear

3.6

Gas-tight chemical protective clothing

A single-piece chemical protective clothing with hood, window, hand and foot protection, which can protect against higher levels of toxic and harmful chemicals (gas, liquid, solid particles, etc.), when used in conjunction with appropriate respiratory protective equipment.

3.7

Chemical protective suits for emergency response team

Type of chemical protective clothing, which is worn by workers during emergency rescue work.

Note: The abbreviation "ET" represents the chemical protective clothing used by emergency rescue response teams, such as: gas-tight chemical protective suits for emergency response team, liquid jet tight chemical protective suits for emergency response team.

3.8

Gas-tight chemical protective suits for emergency response team

A single-piece chemical protective clothing worn by workers during emergency rescue work, which is equipped a hood, view window, hand and foot protection; can protect against toxic and harmful chemical substances, such as gases, liquids, solid particles.

3.9

Liquid tight chemical protective clothing

Protective clothing to protect against liquid chemicals.

Note: A full-body protective suit that maintains a liquid-tight connection, between the various parts of the protective suit, as well as between the hood, gloves, shoes, visor or respiratory protection and other equipment used in conjunction with it. It can be a single jumpsuit, a suit with upper and lower parts, or a matching hood, visor, socks, boots, gloves, etc.

3.10

Liquid jet tight chemical protective clothing

Full body protective clothing for protection against liquid chemicals with high pressure.

Note: Maintain spray liquid-tight connections between the various components of the protective clothing, as well as between the hoods, gloves, shoes, visors or respiratory protection equipment used with them. It can be a single jumpsuit, an upper and lower body suit, or it can be equipped with a hood, visor, socks, boots, gloves, etc.

3.11

Liquid spray tight chemical protective clothing

Full-body protective clothing for protection against liquid chemicals with low or no pressure.

Note: Keep spray liquid-tight connections between the various components of the protective clothing, as well as between the hoods, gloves, shoes, visors or respiratory protection equipment used with them. It can be a single jumpsuit, an upper and lower body suit, or it can be equipped with a hood, visor, socks, boots, gloves, etc.

3.12

Chemical protective clothing providing protection against airborne solid particulate

Full-body protective clothing to protect against solid chemical particles in the air in the workplace.

Note: It can be equipped with or without gloves and boot covers.

3.13

Limited liquid spray chemical protective clothing

Full-body protective clothing capable of providing limited protection against liquid chemicals.

Note: Maintain a limited spray liquid-tight connection between each component of the protective clothing, as well as between the hood, gloves, shoes, visor or respiratory protection and other equipment used with it. It can be a single jumpsuit, a two-piece upper and lower body suit, or it can be equipped with a hood, socks, boots, shoe covers, etc.

3.14

Woven material liquid acid and alkali chemical protective clothing

Protective clothing made of woven clothing materials, that can protect against liquid acidic and/or alkaline chemicals (excluding hydrofluoric acid, ammonia, organic acids and bases).

Note: Woven material liquid acid and alkali chemical protective clothing is divided into

Type 1a: Gas-tight chemical protective clothing with built-in self-contained breathing apparatus;

For example, chemical protective clothing with built-in self-contained compressed air breathing apparatus;

Type 1b: Gas-tight chemical protective clothing with external self-contained breathing apparatus;

For example, chemical protective clothing with external self-contained compressed air breathing apparatus;

Type 1c: Gas-tight chemical protective clothing that provides positive pressure into the protective clothing through an external respiratory air source;

For example, long-tube air supply gas-tight protective clothing.

c) All type 1 chemical protective clothing shall be made of clothing materials, that are resistant to chemical penetration; it shall provide personnel with a clean air source for breathing through a self-contained (built-in or external to the protective clothing) respirator or other external air supply device.

d) Type 1a and 1c chemical protective clothing shall be equipped with 2 or more one-way exhaust valves; type 1b chemical protective clothing shall be equipped with 1 or more one-way exhaust valves. It is required that when exhausting from the inside of the chemical protective clothing to the environment, it can completely prevent the reverse inflow of external gas.

e) Design transparent view windows with chemical protection functions on the eyes and face to meet the observation needs of the wearer. If necessary, the manufacturer shall provide defogging measures for the visor.

f) Each product of type 1 chemical protective clothing shall pass the overall gas tightness test. In addition, type 1b and type 1c chemical protective clothing whose masks are not permanently fixed to the garment shall also pass the inward leakage rate test.

g) It is allowed to wear protective clothing, protective gloves and/or protective boots/shoes outside of chemical protective clothing, to meet all performance requirements of chemical protective clothing. All parts of the combination and its layers of materials shall be tested as a chemical protective clothing, as a whole.

5.2.2 Gas-tight chemical protective suits for emergency response team

The design of gas-tight chemical protective suits for emergency response team (Type 1-ET) shall comply with the following requirements:

a) The fully encapsulated chemical protective clothing is designed to provide overall protection for the wearer's torso, head, eyes, face, arms, hands, legs, feet.

b) The type 1-ET of gas-tight chemical protective clothing is divided into 1a-ET and 1b-ET types, which provide personnel with a clean air source for breathing through a self-contained respirator (built-in or external).

Type 1a-ET: Gas-tight chemical protective clothing with built-in self-contained breathing apparatus for emergency response team;

Type 1b-ET: Gas-tight chemical protective clothing with external self-contained breathing apparatus for emergency response team.

c) Each product shall pass the overall gas tightness test. In addition, type 1b-ET chemical protective clothing, in which the mask is not permanently fixed to the garment, shall also pass the inward leakage rate test.

d) Type 1a-ET chemical protective clothing shall be equipped with two or more one-way exhaust valves; type 1b-ET chemical protective clothing shall be equipped with one or more one-way exhaust valves. It is required that the chemical protective clothing can completely prevent the reverse inflow of external air, when it exhausts from inside the protective clothing to the environment.

e) Design transparent view windows with chemical protection functions on the eyes and face, to meet the observation needs of the wearer.

f) It is allowed to meet all performance requirements of chemical protective clothing, by wearing protective clothing, protective gloves and or protective boots/shoes over the chemical protective clothing. All multi-layer materials involving combinations shall be tested as a whole.

5.2.3 Liquid jet tight chemical protective clothing and liquid jet tight chemical protective suits for emergency response team

The design of liquid jet tight chemical protective clothing (type 3) and liquid jet tight chemical protective suits for emergency response team (type 3-ET) shall comply with the following requirements:

a) It shall provide at least protection for the wearer's torso, head, arms, legs;

b) Chemical protective clothing materials shall meet the penetration and permeation requirements of chemical substances;

c) Chemical protective clothing shall pass the liquid-tight jet test.

5.2.4 Liquid spray tight chemical protective clothing

The design of liquid spray tight chemical protective clothing (type 4) shall comply with

5.3.2.4 Liquid spray tight

According to the provisions of 6.7, the overall liquid spray tight performance test is conducted on the liquid spray tight chemical protective clothing. The stain area formed by penetrating liquid on the indicator clothing shall be less than 3 times the calibrated stain area.

5.3.2.5 Limited liquid spray tight

According to the provisions of 6.8, the overall limited liquid spray tight performance test is carried out on limited liquid spray chemical protective clothing and woven material liquid acid and alkali chemical protective clothing. The stain area formed by penetrating liquid on the indicator clothing shall be less than 3 times the calibrated stain area.

5.3.2.6 Inward leakage rate of solid particles

According to the provisions of 6.9, the chemical protective clothing providing protection against air borne solid particulate is tested for the inward leakage rate of solid particles. The inward leakage rate of solid particles is $L_{jmn,\ 82/90} \leq 30\%$; the total inward leakage rate of a single-piece protective clothing is $L_{S,\ 8/10} \leq 15\%$.

Note 1: $L_{jmn,\ 82/90}$: Inward leakage rate is expressed as a percentage. 82/90 means that all 90 leakage rates are arranged, in order from small to large, and the 82^{nd} inward leakage rate is taken. The 90 data include the inward leakage rate of the all test actions, collection points, test sample.

Note 2: $L_{S,\ 8/10}$: Total inward leakage rate of a single-piece protective clothing. 8/10 refers to the 8^{th} value in ascending order of the inward leakage rates of 10 protective clothing samples;

Note 3: If more than 10 protective clothing samples are tested, $L_{jmn,\ 82/90}$ data is taken at 91%, from all leakage rates in ascending order; $L_{S,\ 8/10}$ data is taken at 80%, from all inward leakage rates in ascending order.

5.3.2.7 Practical performance

According to the provisions of 6.10, conduct overall practical performance test and evaluation of gas-tight chemical protective clothing and gas-tight chemical protective suits for emergency response team.

During the practical performance test, the chemical protective clothing shall not restrict the subject from completing any prescribed actions.

The subject shall read a mark, which consists of four random characters, which are 100 mm high and 20 mm wide, at a distance of 6 m. If the distance between the hood of the chemical protective clothing and the subject's glasses is not fixed, the hood or visor shall be fixed in a typical position during the test.

If the following factors restrict the subject from completing any action of the practical performance test, the subject shall subjectively evaluate and record relevant factors.

- Strap comfort.

- Safety of connections and joints.

- Ease of operation of control components and pressure gauges (if any).

- Visual clarity of the mask or visor.

- Surround view of the visor.

- Clothing comfort.

- Convenience of verbal communication.

- Other aspects indicated by the subject.

5.3.3 Chemical protective properties of clothing materials

5.3.3.1 Permeation performance

According to the provisions of 6.11, select the chemical substances listed in Table 5, to conduct the permeation performance test of chemical protective clothing materials. Grade and mark it according to Table 6, according to the minimum value of the penetration time test results. Specific requirements are as follows:

a) For gas-tight chemical protective suits for emergency response team (type 1-ET), at least 15 chemical substances in Table 5 shall be selected for testing; the permeation properties of the tested 15 chemical substances shall not be lower than level 3. The test results of the 15 chemical substances shall be listed in the manufacturer's product technical specifications.

b) For gas-tight chemical protective clothing (type 1), 15 chemical substances in Table 5 shall be selected for test. The permeation of at least 12 chemical substances shall not be lower than level 3. The test results of 15 chemical substances shall be listed in the manufacturer's product technical specifications.

c) For liquid jet tight chemical protective suits for emergency response team (type 3-ET), 15 chemical substances in Table 5 shall be selected for test. The permeation of at least 12 chemical substances is not less than level 2. The test results of all 15 chemical substances shall be listed in the manufacturer's product technical specifications.

d) For liquid jet tight chemical protective clothing (type 3), at least one chemical substance in Table 5 shall be selected for test; the permeation performance shall not be lower than level 3.

5.3.4.7 High temperature resistance

According to the provisions of 6.27, after the clothing material is pretreated at 70 °C for 8 hours, the breaking strength of clothing material shall not decrease by more than 30%.

5.3.4.8 Low temperature resistance

According to the provisions of 6.27, after the clothing material is pretreated at -30 °C for 8 hours, the breaking strength of clothing material shall not decrease by more than 30%.

5.3.5 Material performance requirements for protective view windows, chemical protective gloves, chemical protective boots/shoes

5.3.5.1 Protective view window

5.3.5.1.1 Permeation performance

The testing and grading of the permeation performance of view window materials shall comply with the requirements of 5.3.3.1.

The view window material of the type 1-ET gas-tight chemical protective clothing shall be tested with at least 15 chemicals listed in Table 5. The permeation of the 15 chemicals shall be no less than level 3.

The view window material of type 1 gas-tight chemical protective clothing shall be tested with 15 chemical substances in Table 5; the permeation of at least 12 chemical substances shall not be lower than level 3. The test results for the 15 chemical substances shall be listed in the manufacturer's product technical specifications.

5.3.5.1.2 Puncture resistance

The testing and grading of puncture resistance of view window materials shall comply with the requirements of 5.3.4.6.

For gas-tight chemical protective clothing type 1-ET (including reusable chemical protective clothing and limited use chemical protective clothing) and gas-tight chemical protective clothing type 1, the puncture resistance of the view window material shall not be lower than level 3.

5.3.5.2 Chemical protective gloves, chemical protective boots/shoes

5.3.5.2.1 Permeation performance of chemical protective gloves, chemical protective boots/shoes materials

The testing and grading of the permeation performance of protective gloves and protective boots/shoes materials shall comply with the requirements of 5.3.3.1.

For protective gloves and protective shoes/boot materials of type 1-ET gas-tight chemical protective clothing, 15 chemical substances in Table 5 shall be selected for testing. The permeation performance of the 15 chemicals shall not be lower than level 3.

For protective gloves and protective shoes/boot materials of type 1 gas-tight chemical protective clothing, 15 chemical substances in Table 5 shall be selected for testing. The permeation performance of at least 12 chemical substances shall not be lower than level 3. The test results for the 15 chemical substances shall be listed in the manufacturer's product technical specifications.

5.3.5.2.2 Liquid pressure penetration resistance of chemical protective gloves and chemical protective boots/shoes materials

The testing and grading of the liquid pressure penetration resistance of protective gloves and protective boots/shoe materials shall comply with the requirements of 5.3.3.2.

For the chemical protective glove materials and chemical protective boots/shoe materials of gas-tight chemical protective clothing type 1 and gas-tight chemical protective clothing type 1-ET, 3 liquid chemical substances in Table 5 shall be selected for testing; the liquid pressure penetration resistance shall be not less than level 1.

5.3.6 Requirements for joint performance

5.3.6.1 Permeation performance

The testing and grading of joint permeation performance of chemical protective clothing shall comply with the requirements of 5.3.3.1.

For the joints of the type 1-ET gas-tight chemical protective clothing, 15 chemical substances in Table 5 shall be selected for testing. The permeation performance of the 15 chemicals shall not be lower than level 3.

For the joints of type 1 gas-tight chemical protective clothing, 15 chemical substances in Table 5 shall be selected for testing. The permeation performance of at least 12 chemicals shall be no less than level 3.

For the joints of the type 3-ET spray liquid tight chemical protective clothing, 15 chemical substances in Table 5 shall be selected for testing. The permeation performance of at least 12 chemical substances shall not be lower than level 2.

For the joints of type 3 spray liquid tight chemical protective clothing, at least 1 chemical substance in Table 5 shall be selected for testing. The permeation performance shall not be lower than level 3.

For the joints of type 4 liquid spray tight chemical protective clothing, at least 1 chemical substance in Table 5 shall be selected for testing. The permeation performance

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------