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Personal Clothing -

Protective Clothing against Liquid Acids and Alkalis

防护服装 酸碱类化学品防护服

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Personal Clothing - Protective Clothing against Liquid Acids and Alkalis

1 Scope

This Standard specifies the grading, technical requirements, test methods, inspection rules and marking of protective clothing against liquid acids and alkalis.

This Standard is applicable to protective clothing against liquid acids and alkalis used by operators in industrial workplaces.

This Standard is not applicable to protective clothing against liquid acids and alkalis used in fire-fighting, emergency rescue and other workplaces.

This Standard is not applicable to protective clothing against hydrofluoric acid, ammonia, organic acids and alkalis.

NOTE: The protection objects of products covered by this Standard are liquid acids and alkalis; but this Standard cannot cover the protection against all liquid acids and alkalis. Users shall combine the protection performance data provided by the manufacturer according to the actual situation on site to choose appropriate protective equipment by referring to relevant selection and preparation standards.

2 Normative References

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 2912.1-1998 Textiles - Determination of Formaldehyde - Part 1: Free and Hydrolyzed Formaldehyde (Water Extraction Method) (eqv ISO 14184-1:1997)

GB/T 3917.3-1997 Textiles - Tear Properties Fabrics - Part 3: Determination of Tear Force of Trapezoidal Shaped Test Specimens (eqv ISO 9073-4:1984)

GB/T 3920-2008 Textiles - Tests for Color Fastness - Color Fastness to Rubbing (ISO 105-X12:2001, MOD)

GB/T 3923.1-1997 Textiles - Tensile Properties of Fabrics - Part 1: Determination

pinholes or defects.

3.5 Permeation

The process of chemical molecules passing through the protective clothing, including the process of the adsorption of chemical molecules by the clothing material, the diffusion in the clothing material, and the desorption from the other side of the clothing material.

4 Grading

Fabric protective clothing is divided into Grade-I, Grade-II and Grade-III according to penetration time and liquid static pressure resistance; non-fabric protective clothing is divided into Grade-I, Grade-II and Grade-III according to penetration time. Among them, the protection performance of the Grade-I is the lowest; and the protection performance of the Grade-III is the highest. The lowest level among the grading conditions is taken as the protection level.

5 Technical Requirements

5.1 General requirements

5.1.1 The structure of the clothing shall be conducive to the safety and hygiene of the wearer. The materials in direct contact with the skin shall be free of skin irritation or other harmful health effects, and shall not affect the normal physiological requirements of the human body.

5.1.2 The clothing shall be easy to put on and take off and facilitate physical activities during operation.

5.1.3 Jacket of the two-piece protective clothing shall be "neckline tight, cuffs tight and hem tight"; while the pants shall be straight pants (see Figure 1 for schematic diagram). One-piece protective clothing shall be "neckline tight, cuffs tight, bottom of pants tight" (see Figure 2 for schematic diagram). The clothing shall be as light as possible and easy to act and easy to put on and take off.

5.1.4 The joint portions of the protective clothing shall be tight and reasonable to prevent intrusion of acids and alkalis; the structure of the protective clothing shall be considered for use with other protective equipment, such as jacket sleeves and protective gloves, pants and protective shoes (boots), the joint parts of which shall be tight and reasonable to prevent intrusion of acids and alkalis.

5.1.5 There shall be no patch pockets and other structures on the clothing that can store acids and alkalis, but there may be inside pockets.

6.5 Seam breaking strength

The seam breaking strength shall be tested according to Appendix H.

6.6 Spray liquid tightness

The spray liquid tightness shall be tested according to Appendix I.

6.7 Jet liquid tightness

The jet liquid tightness shall be tested according to Appendix J.

6.8 Wear resistance

The non-fabric protective clothing against liquid acids and alkalis shall be tested according to 4.3.1 in AQ 6102-2007.

6.9 Flexibility resistance

The non-fabric protective clothing against liquid acids and alkalis shall be tested according to Method-A in GB/T 12586-2003.

6.10 Puncture resistance

The non-fabric protective clothing against liquid acids and alkalis shall be tested according to GB/T 20655-2006.

6.11 Breaking strength and tearing strength

The breaking strength and tearing strength of the fabric protective clothing against liquid acids and alkalis shall be tested according to GB/T 3923.1-1997; while the tearing strength shall be tested according to GB/T 3917.3-1997. The breaking strength of the non-fabric protective clothing against liquid acids and alkalis shall be tested according to HG/T 2580-1994.

6.12 Color fastness to dry rubbing

The fabric protective clothing against liquid acids and alkalis shall be tested according to GB/T 3920-2008.

6.13 Formaldehyde content

The fabric protective clothing against liquid acids and alkalis shall be tested according to GB/T 2912.1-1998.

6.14 pH value

The fabric protective clothing against liquid acids and alkalis shall be tested according

4 – Sample;

5 – Marking line;

6 – Reagent chamber;

7 – Sampling end;

8 – Flange ring.

Figure B.1 – Schematic Diagram of Permeation Test Chamber

B.2.2 Analytical device

The corresponding concentration analysis device shall be selected according to the type of reagent; and the accuracy of the analysis device shall reach 0.71 mg/L.

B.2.3 Reagents

From Table L.1 in Appendix L, select the acid and/or alkali corresponding to the protection object marked on the product as the test reagent. The protective clothing against inorganic acid shall be tested with 98% sulfuric acid, 30% hydrochloric acid and 60% nitric acid, respectively; the protective clothing against inorganic alkali shall be tested with 40% sodium hydroxide; the protective clothing against inorganic acid and alkali shall be tested with 98% sulfuric acid and 30% hydrochloric acid, 60% nitric acid and 40% sodium hydroxide, respectively.

B.2.4 Collection medium

Use water as the collection medium.

B.3 Test preparation

Cut a sample with size of no less than 60mm × 60mm from three different parts of the protective clothing, respectively. Place the sample in the environment at (20±10) °C, relative humidity (65±5) % for 24h.

B.4 Test procedures

B.4.1.1 The test shall be carried out in environment at (17~30) °C.

B.4.1.2 Fix the sample to the test cavity; the side facing outward when wearing is in contact with the reagent; inject the reagent into the reagent cavity; inject the collection medium into the collection cavity; and start the timing.

B.4.1.3 Determine the concentration of the reagent in the collection medium. When the reagent concentration reaches 0.71 mg/L, terminate the test; and record the time from the start of the test to the end of the test, which is the permeation time, *t*, of the sample.

D.2.9 Reagent

From Table L.1 in Appendix L, select the acid and/or alkali corresponding to the protection object marked on the product as the test reagent. The protective clothing against inorganic acid shall be tested with 80% sulfuric acid, 30% hydrochloric acid and 40% nitric acid, respectively; the protective clothing against inorganic alkali shall be tested with 30% sodium hydroxide; the protective clothing against inorganic acid and alkali shall be tested with 80% sulfuric acid and 30% hydrochloric acid, 40% nitric acid and 30% sodium hydroxide, respectively.

D.3 Test conditions

Temperature: (17~30) °C; relative humidity: (65 ± 5) %.

D.4 Prepare the sample

D.4.1 Apply the method specified in Appendix K to wash the protective clothing; and take three samples from the clothing before and after washing in the warp and weft directions, respectively; the size is (360±2) mm × (235±2) mm.

D.4.2 Place the cut specimen under test environmental conditions for 8h.

D.5 Test procedures

D.5.1 Cut one rectangular filter paper and one transparent film each with a size of (360±2) mm × (235±5) mm.

D.5.2 Put the weighed transparent film into a hard-transparent tank, covered with filter paper, and closely fit each other. Be careful not to leave any gaps or wrinkles; and ensure that the lower ends of the hard-transparent groove, transparent film, and filter paper are aligned with one another.

D.5.3 Place the sample on the filter paper so that the long side of the sample is parallel to the tank side; the outer surface is upward; and the folded side of the sample exceeds the lower end of the tank by 30 mm. Check the sample carefully to ensure that its surface closely fits the filter paper; and then fix the sample on the hard-transparent tank with a clip.

D.5.4 Weigh the mass of the small beaker, m_1, by a balance; and accurate to 0.01g.

D.5.5 Place the small beaker under the folded edge of the sample to ensure that all reagents flowing down from the surface of the sample can be collected.

D.5.6 The needle of the syringe is downward and vertically installed on the bracket. The needle shall pass through the axis of the hard-transparent tank; and its vertical distance from the surface of the sample is (100±2) mm. The length between the spray point on the outer surface of the sample and the lower end faces of the sample is

Appendix F

(Normative)

Test Methods for Strength Decline Rate of Fabric Protective Clothing against Liquid Acids and Alkalis

F.1 Principle

According to the average breaking strength $\overline{F_a}$ and $\overline{F_b}$ of the protective clothing before and after immersing in the reagent, the strength decline rate of the clothing material after immersing in the reagent may be calculated.

F.2 Reagent

From Table L.1 in Appendix L, select the acid and/or alkali corresponding to the protection object marked on the product as the test reagent. The protective clothing against inorganic acid shall be tested with 80% sulfuric acid, 30% hydrochloric acid and 40% nitric acid, respectively; the protective clothing against inorganic alkali shall be tested with 30% sodium hydroxide; the protective clothing against inorganic acid and alkali shall be tested with 80% sulfuric acid and 30% hydrochloric acid, 40% nitric acid and 30% sodium hydroxide, respectively.

F.3 Test conditions

Temperature: (17~30) °C; relative humidity: (65±5) %.

F.4 Prepare the sample

According to the provisions of GB/T 3923.1-197, cut the protective clothing into samples with specified size and quantity.

Immerse the sample in the reagent for 5min; and dry it according to the manufacturer's instruction manual after cleaning.

F.5 Test procedures

F.5.1 According to the provisions of GB/T3923.1-1997, respectively measure the breaking strength of each sample when it is not immersed in the reagent; and take the arithmetic average to obtain the average breaking strength, $\overline{F_a}$, of the sample before immersing into the reagent.

F.5.2 According to the provisions of GB/T3923.1-1997, respectively measure the breaking strength of each sample when it is immersed in the reagent; and take the arithmetic average to obtain the average breaking strength, $\overline{F_b}$, of the sample after

Appendix G

(Normative)

Test Methods for Strength Decline Rate of Non-Fabric Protective Clothing against Liquid Acids and Alkalis

G.1 Principle

Respectively measure the average breaking strength $\overline{F_a}$ and $\overline{F_b}$ of the protective clothing before and after immersing in the reagent, the strength decline rate of the clothing material after immersing in the reagent may be calculated.

G.2 Reagent

From Table L.1 in Appendix L, select the acid and/or alkali corresponding to the protection object marked on the product as the test reagent. The protective clothing against inorganic acid shall be tested with 98% sulfuric acid, 30% hydrochloric acid and 60% nitric acid, respectively; the protective clothing against inorganic alkali shall be tested with 40% sodium hydroxide; the protective clothing against inorganic acid and alkali shall be tested with 98% sulfuric acid and 30% hydrochloric acid, 60% nitric acid and 40% sodium hydroxide, respectively.

G.3 Test conditions

Temperature: (17~30) °C; relative humidity: (65±5) %.

G.4 Prepare the sample

G.4.1 According to the provisions of HG/T 2580-1994, cut the protective clothing is cut into sample with the specified size and quantity.

G.4.2 Immerse the sample in the reagent for 5min, and dry it according to the manufacturer's instruction manual after cleaning.

G.4.3 Test procedures

According to the provisions of HG/T 2580-1994, respectively measure the average breaking strength, $\overline{F_a}$, of the sample before immersing in the reagent; and the average breaking strength, $\overline{F_b}$, of the sample after immersing in the reagent.

G.5 Result processing

The same as F.5.3.

Appendix I

(Informative)

Test Methods for Spray Liquid Tightness

I.1 Principle

Test the dummy model wearing the absorbent coverall and the protective clothing to examine the liquid tightness of the protective clothing by the stain area on the absorbent coverall.

I.2 Testing apparatus

I.2.1 Dummy model

Full-body dummy that is used for testing wears absorbent coverall, out of which wears protective clothing under the test.

I.2.2 Standard test liquid

It is made through dissolving the wetting agent and coloring agent into water, which shall meet the following requirements:

--- The surface tension is $(30\pm5) \times 10^{-3}$ N/m.

--- Drop 0.1ml of test liquid on the outer surface of the absorbent coverall, and calibrated stains with a diameter of no less than 2cm shall be formed.

I.2.3 Absorbent coverall

It is made of water-absorbing material, with a hood, the thickness not exceeding 5mm.

I.2.4 Stain discrimination

Drop the 0.1 mL of standard test liquid on the outer surface of the absorbent coverall, it shall produce a clearly visible stain; and the diameter of the stain shall be no less than 2cm.

I.2.5 Turntable

The turntable that is made of waterproof material can drive the dummy to rotate at a speed of 1 rad/min.

I.2.6 Water pump

It is equipped with pressure gauge and flow adjustment device.

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