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NATIONAL STANDARD OF THE
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ICS 13.220.50

CCS C 84

GB 16807-2025

Replacing GB 16807-2009

Fire intumescent seals

防火膨胀密封件

Issued on: August 01, 2025

Implemented on: August 01, 2026

**Issued by: State Administration for Market Regulation;
Standardization Administration of the People's Republic of China.**

Table of Contents

Foreword	3
1 Scope.....	4
2 Normative references	4
3 Terms and definitions.....	5
4 Grade code and model compilation	5
5 Technical requirements	6
6 Test methods	8
7 Inspection rules	15
8 Marking, packaging, transportation and storage.....	17

Fire intumescent seals

1 Scope

This document specifies the grade code and model compilation, technical requirements, inspection rules, as well as marking, packaging, transportation and storage of fire intumescent seals, and describes the corresponding test methods.

This document applies to the design, manufacture and inspection of fire intumescent seals with fireproof sealing functions used in building components such as fire-resistant doorsets, fire resistant windows, fire shutter assemblies, fire dampers, and fire-resistant glass partitions.

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 the referenced document (including any amendments) applies.

GB/T 191, Packaging - Pictorial marking for handling of goods

GB/T 6003.1, Test sieves - Technical requirements and testing - Part 1: Test sieves of metal wire cloth

GB/T 6388, Transport package shipping mark

GB/T 8627, Test method for density of smoke from the burning or decomposition of building materials

GB/T 9978.1-2008, Fire-resistance tests - Elements of building construction - Part 1: General requirements

GB 12955, Fire-resistant doorsets

GB/T 14522-2008, Artificial weathering test method for plastics, coating and rubber materials used for machinery industrial products - Fluorescent UV lamps

GB 15763.1, Safety glazing materials in building - Part 1: Fire-resistant glass

GB 16809, Fire resistant windows

GB/T 20285, Toxic classification of fire effluents hazard for materials

3 Terms and definitions

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

3.1

fire intumescent seals

Materials that expand when exposed to fire or high temperature and are used to assist building components in providing them with fireproof, smokeproof, heat-insulating and other fire-proof sealing properties.

3.2

intumescent components

Material in fire intumescent seals that expands when exposed to fire or high temperatures.

4 Grade code and model compilation

4.1 Grade code

The smoke density and smoke toxicity grade codes of fire intumescent seals are shown in Table 1, and the fireproof sealing grade codes are shown in Table 2.

4.2 Type designation

The method for compiling the model of fire intumescent seals is shown in Figure 1.

Example 1: FPJ-Y1D3F1.0-10-15×2-A, indicating a fire intumescent seal, of smoke density grade 1, smoke toxicity grade 3, overall fire resistance integrity of building components used ≥ 60 min, nominal expansion ratio 10 times, rectangular cross-section width 15 mm, thickness 2 mm, and the enterprise-customized A.

Example 2: FPJ-Y2D2F1.5-8- ϕ 6-B, indicating a fire intumescent seal, of smoke density grade 2, smoke toxicity grade 2, overall fire resistance integrity of building components used ≥ 90 min, nominal expansion ratio 8 times, circular cross-section outer diameter 6 mm, and enterprise-customized B.

Example 3: FPJ-Y3D1F0.5-6-t13×3, indicating a fire intumescent seal, of smoke density grade 3, smoke toxicity grade 1, overall fire resistance integrity of building components used ≥ 30 min, nominal expansion ratio 6 times, and special-shaped cross-section characteristic dimensions 13 mm × 3 mm.

5 Technical requirements

5.1 Appearance

The exposed surface of the fire intumescent seal shall be flat and smooth, without cracks, indentations, uneven thickness, or obvious falling off or powdering of the intumescent component.

5.2 Deviation of mass (weight) per unit length

The deviation of mass (weight) per unit length of the fire intumescent seal from the value announced by the manufacturer shall not exceed 10%.

5.3 Expansion performance

5.8.1 After the acid resistance test, the fire intumescent seals shall not show obvious corrosion, swelling, powdering or falling off.

5.8.2 After the acid resistance test, the mass (weight) change rate of fire intumescent seals shall not be greater than 5%.

5.8.3 After the acid resistance test, the expansion ratio of the intumescent component of the fire intumescent seal shall not be less than 90% of the initial expansion ratio ($\bar{n}$).

5.9 Alkali resistance

5.9.1 After the alkali resistance test, the fire intumescent seals shall not show obvious corrosion, swelling, powdering or falling off.

5.9.2 After the alkali resistance test, the mass (weight) change rate of fire intumescent seals shall not be greater than 5%.

5.9.3 After the alkali resistance test, the expansion ratio of the intumescent components of the fire intumescent seals shall not be less than 90% of the initial expansion ratio ($\bar{n}$).

5.10 Freeze-thaw cycle resistance

5.10.1 After the freeze-thaw cycle resistance test, the fire intumescent seals shall not show obvious powdering or falling off.

5.10.2 After the freeze-thaw cycle resistance test, the expansion ratio of the intumescent components of the fire intumescent seals shall not be less than 90% of the initial expansion ratio ($\bar{n}$).

5.11 UV radiation resistance

5.11.1 After the UV radiation resistance test, the fire intumescent seals shall not show obvious powdering or falling off.

5.11.2 After the UV radiation resistance test, the expansion ratio of the intumescent components of the fire intumescent seals shall not be less than 90% of the initial expansion ratio ($\bar{n}$).

5.12 Fireproof sealing

The overall fire resistance integrity of building components shall comply with the requirements of Table 2.

6 Test methods

6.1 Appearance

Verify by visual inspection at any position of the test sample.

$$\beta = \frac{|\bar{n} - n_0|}{n_0} \times 100\% \quad \dots\dots\dots (4)$$

Where:

$\bar{n}$ – initial expansion ratio, in milliliters per gram (mL/g);

n_0 – nominal expansion ratio, in milliliters per gram (mL/g);

β – expansion ratio deviation.

When the expansion height of the test sample ($H_2 - H_1$) exceeds 60 mm, the mass of the test sample shall be appropriately reduced and the test shall be repeated.

6.4 Smoke density

6.4.1 Randomly select one section of the fire intumescent seal sample, which shall include the decoration, covering layer and related accessories.

6.4.2 Carry out the test according to the method specified in GB/T 8627. The dimensions of the fence on all four sides of the sample are 64 mm × 64 mm × 64 mm, and the fence is made of a 6 mm × 6 mm × 0.9 mm stainless steel mesh. The sample length shall be (25.4±0.3) mm (without assembly). The remaining dimensions and structures shall maintain the actual application state of the test sample. During the test, the side with the larger projected area of the fire intumescent seal shall face the flame, and the four sides of the sample shall be centered on the sample holder.

6.5 Smoke toxicity

6.5.1 Randomly take a section of fire intumescent seal sample with a length of not less than (400 ± 5) mm. The sample shall include decoration, covering layer and other related accessories.

6.5.2 Carry out the test according to the method specified in GB/T 20285.

6.6 Air aging resistance test

6.6.1 Randomly take fire intumescent seals and cut them into three sections of samples with a length of (500 ± 5) mm. If the mass (weight) per unit length of the sample is small, the sampling length may be appropriately increased. Place the samples in an electric forced air drying oven at a temperature of (70 ± 2) °C for 168 h under the blast condition; remove the samples and place them in a desiccator to cool naturally to room temperature. Inspect the surfaces of the samples and the intumescent components; all three samples shall meet the requirements of 5.6.1.

6.6.2 Take the samples that have passed the test in 6.6.1; remove the decoration, covering layer and other accessories of the samples; place them in a desiccator for more

than 24 hours; measure the expansion ratio of the intumescent components according to the method specified in 6.3.3; take the average of the three test data as the test result.

6.7 Water resistance test

6.7.1 Randomly take fire intumescent seals and cut them into three sections of samples with a length of (500 ± 5) mm. If the mass (weight) per unit length of the sample is small, the sampling length may be appropriately increased. Place the prepared samples in an electric forced air drying oven at (60 ± 5) °C for 24 h; after removal, place them in a desiccator to cool to room temperature.

6.7.2 Remove the samples from the desiccator; weigh them individually, and record the mass (weight) m_0 of each sample (accurate to 0.01 g); immerse the samples completely in tap water and maintain them at room temperature (20 ± 5) °C for 360 h before removing them. After the test, observe the surface conditions of the samples; at least two samples shall meet the requirements of 5.7.1.

6.7.3 Dry the qualified samples that have passed the test in 6.7.2 in an electric forced air drying oven at (60 ± 5) °C for 24 h; cool them to room temperature in a desiccator; weigh the mass (weight) m_1 of each sample. Calculate the mass (weight) change rate (γ) of each sample according to Formula (5):

$$\gamma = \frac{|m_1 - m_0|}{m_0} \times 100\% \quad \dots\dots\dots (5)$$

Where:

m_0 – mass (weight) of the sample before the water resistance test, in grams (g);

m_1 – mass (weight) of the sample after the water resistance test, in grams (g);

γ – sample mass (weight) change rate.

Calculate the average value of the test results.

6.7.4 Take the samples that have passed the test in 6.7.3; remove the decoration, covering layer and other accessories of the samples; determine the expansion ratio of the intumescent components according to the method specified in 6.3.3; take the average value of the three test results.

6.8 Acid resistance test

Test according to the method specified in 6.7, but use 5% hydrochloric acid solution instead of tap water for the acid resistance test. After soaking, rinse gently with tap water before observation and drying.

6.9 Alkali resistance test

Test according to the method specified in 6.7, but use 1% sodium hydroxide solution instead of tap water for the alkali resistance test. After soaking, rinse gently with tap water before observation and drying.

6.10 Freeze-thaw cycle resistance test

6.10.1 Randomly take fire intumescent seals and cut them into three sections of samples with a length of (500 ± 5) mm. If the mass (weight) per unit length of the sample is small, the sampling length may be appropriately increased. Place the samples in tap water at (23 ± 2) °C for 18 hours; then, place the samples in a low-temperature box at (-20 ± 2) °C and freeze them for 3 hours; then, remove the samples from the low-temperature box and immediately place them in a constant temperature box at (50 ± 2) °C for 3 hours. This constitutes one cycle. Repeat the test for 15 cycles. At least two samples shall meet the requirements of 5.10.1.

6.10.2 Take the test samples that have passed the test in 6.10.1; dry them in an electric forced air drying oven at (60 ± 5) °C for 24 h; then cool them to room temperature in a desiccator. Remove the decoration, covering layer and other accessories of the sample; measure the expansion ratio of the intumescent component according to the method specified in 6.3.3; take the average value of the three test results.

6.11 Ultraviolet radiation resistance test

6.11.1 Randomly take fire intumescent seals and cut them into three test samples of (500 ± 5) mm in length. If the mass (weight) per unit length of the sample is small, the sampling length may be appropriately increased. Test according to the second exposure cycle type specified in Table C.1 of GB/T 14522-2008 for 30 times. After the test, observe the surface condition of the test samples. At least two test samples shall meet the requirements of 5.11.1.

6.11.2 Take the test samples that have passed the test in 6.11.1; dry them in an electric forced air drying oven at (60 ± 5) °C for 24 h; then cool them to room temperature in a desiccator. Remove the decoration, covering layer and other accessories of the sample; measure the expansion ratio of the intumescent component according to the method specified in 6.3.3; take the average value of the three test results.

6.12 Fireproof sealing test

Test the fireproof sealing performance based on the actual use of the fire intumescent seals. Before the test, install the fire intumescent seal on the building components provided by the manufacturer or the entrusting unit according to the method specified in the instruction manual for overall testing. Appropriate measures shall be taken in other locations not related to the sample's use position to avoid affecting the sample's fireproof sealing properties.

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