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Firestop material

防火封堵材料

[Including 2012XG1]

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Firestop material

1 Scope

This standard specifies the terms and definitions, classification and marking, requirements, test methods, inspection rules, comprehensive judgment criteria, packaging, marking, storage, transportation of firestop material.

This standard is applicable to firestop material or firestop subassembly, which are used in various through holes and structural gaps in buildings, structures, various facilities. It is not applicable to the fire-proof expansion seals which are used inside the building accessories AND the rigid polyvinyl chloride firestop ring for the drainage pipeline for building purpose.

2 Normative references

The provisions in following documents become the provisions of this Standard through reference in this Standard. For the dated references, the subsequent amendments (excluding corrections) 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 2408-2008 Plastics - Determination of burning characteristics - Horizontal and vertical test

GB/T 2611 General requirements for testing machines

GB/T 5455 Textiles - Burning behavior - Vertical method

GB/T 7019-1997 Test methods for fiber cement products

GB/T 8333 Test method for flammability of rigid cellular plastic - Vertical burning method

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

GA 304-2001 Fire stopping collar of PVC-U pipe for building drainage

- Firestop materials for plastic pipes, refer to the firestop materials and products, which are used to maintain the overall fire resistance of the structure, when plastic pipes pass through holes in walls and floor slabs.

4.1.2 Firestop materials can be divided into the following types, according to the composition and shape characteristics of the product:

- Flexible organic plugging material: It uses organic materials as adhesives; it has a certain degree of flexibility or plasticity when used; the product is a clay-like material;
- Inorganic plugging material: It is a powdery solid, which uses inorganic materials as the main component; it has proper workability when blended with admixtures;
- Flame-retardant bag: A bag-like object, which is made of fire-resistant packaging materials, AND suitable for firestop of larger holes or fire-proof separation of cable bridges (flame-retardant bags are also called fire-endurance bags or fire-proof bags);
- Fire-retardant module: A solid with a certain shape and size, which is made of fireproof materials, can be easily cut and drilled, AND is suitable for firestop of holes or cable trays;
- Firestop plate: A plate, made of fire-proof materials, which can be easily cut and drilled, AND is suitable for firestop of large holes;
- Foam plugging material: Fireproof material, that can expand and foam and seal the hole after being injected into the hole;
- Gap plugging material: A solid fireproof material, which is placed in the gap and used to block fixed or movable joints;
- Fire-resistant sealant: Liquid fireproof material, which has fireproof sealing function;
- Fire-resistant tape: A flexible, winding, crimping ribbon-like product, which is made of fireproof materials, wound on the outer surface of a plastic pipe, wrapped by steel tape or fixed by other appropriate methods. It expands and squeezes the softened pipe after a fire, thereby sealing the holes left by the plastic pipes due to burning or softening.

4.2 Markings

The corresponding relationship between the names and codes of various firestop materials is as follows:

6.7.2 Corrosion test of other plugging materials

Take two Q235 ordinary carbon structural steel plates, which have a size of 150 mm × 100 mm × 0.8 mm AND three cables, which have a length of 25 mm and an outer diameter of $\phi 30$ mm ~ $\phi 40$ mm. Apply the blended inorganic plugging materials, flexible organic plugging materials, foam plugging materials, or fire-resistant sealant, on the surface of the steel plate and the outer rubber of the cable. After seven days, observe whether there is rust or corrosion, at the contact portion BETWEEN the steel plate and the outer rubber of the cable AND the plugging material specimen.

6.8 Water resistance

6.8.1 Preparation of specimens

Inorganic plugging material, fire-resistant sealant: Inject the blended specimen into a standard test mold, which has a size of 200 mm × 20 mm × 20 mm. Tamp it compact AND smoothen it. After it is basically cured, remove the mold. After the curing period expires, saw the specimen into three cube test blocks, each of which has a size of 20 mm × 20 mm × 20 mm. The blending and curing of the specimens are carried out in accordance with the product instructions.

Flexible organic plugging material: Take a certain amount of specimen. Knead it uniformly, to make three spheres, each of which has a diameter of 20 mm.

Flame-retardant bag: The specimens are three complete bags.

Other firestop materials: Cut the specimen into three test blocks, each of which has a size of 20 mm × 20 mm × 20 mm, with a coated firestop material on the surface. The exposed section shall be coated with the same surface material. For materials which have a thickness of less than 20 mm, the thickness of the test block is the same as that of the material.

Note: For fire-resistant sealants that cannot be cured, they can be coated on three 50 mm × 50 mm × 2 mm stainless steel plates or polyethylene plastic plates for testing. The coating thickness is 1 mm ± 0.5 mm.

6.8.2 Test procedure

Immerse the prepared and cured specimen in tap water. Keep the temperature at 20 °C ± 5 °C. Observe once a day. Take it out after three days. Observe whether the specimen swells or cracks; whether the flame-retardant bag is complete, whether there is damage, AND whether there is any obvious change in the inner material.

6.8.3 Judgment conditions

Put the prepared and cured test piece in water at $23\text{ °C} \pm 2\text{ °C}$ for 18 h. Then put the specimens in a low temperature box at $-20\text{ °C} \pm 2\text{ °C}$. When the temperature in the box reaches -18 °C , freeze it for 3 h. Then take the test piece out of the low temperature box. Immediately put it into a $50\text{ °C} \pm 2\text{ °C}$ incubator. Keep it at constant temperature for 3 hours. Take out the test piece, to repeat the above operation, for a total of 15 cycles. Observe whether the specimen is cracked or powdered.

6.11.3 Judgment conditions

Determine according to the requirements of 6.10.3.

6.12 Acid resistance

6.12.1 Preparation of specimens

Prepare specimens according to the requirements of 6.8.1.

6.12.2 Test procedure

Place the prepared and cured specimen, in a 3% hydrochloric acid solution, Keep the temperature at $20\text{ °C} \pm 5\text{ °C}$. Observe once a day, to check whether the specimen swells or cracks.

6.12.3 Judgment conditions

After immersing for three days, at least two of the three specimens shall not swell or crack.

6.13 Alkali resistance

6.13.1 Preparation of specimens

Prepare specimens according to the requirements of 6.8.1.

6.13.2 Test procedure

Immerse the prepared and cured specimen in a 3% ammonia solution. Keep the temperature at $20\text{ °C} \pm 5\text{ °C}$. Observe once a day, to check whether the specimen swells or cracks.

6.13.3 Judgment conditions

After immersing for three days, at least two of the three specimens shall not swell or crack.

6.14 Swelling performance

6.14.1 Preparation of specimens

specified in GB/T 2408-2008.

Note: For the test pieces that cannot be self-supported, they are allowed to be placed on a metal net for testing.

6.15.3 The foam plugging material shall be tested in accordance with the provisions of GB/T 8333.

6.15.4 For the flame-retardant module, firestop plate, gap plugging material, flame-retardant tape, the combustion performance shall be tested in accordance with the vertical method as specified in GB/T 2408-2008.

6.16 Fire resistance

6.16.1 Test device

6.16.1.1 Refractory test furnace

It meets the requirements of GB/T 9978.1 for refractory test furnace.

The refractory test furnace shall meet the requirements of specimen installation, heating conditions, pressure conditions, temperature testing, observation during testing.

6.16.1.2 Temperature measuring equipment

The temperature measuring equipment for the fire resistance test shall meet the following requirements:

a) Temperature test in the furnace

For temperature measurement in the furnace, use a thermocouple, which has a wire diameter of $\phi 0.75$ mm ~ $\phi 2.30$ mm. The hot end of the thermocouple shall extend out of the sleeve for 25 mm; the temperature sensing end of the thermocouple shall be 100 mm away from the fire plane of the plugging material. The number of thermocouples in the furnace shall not be less than 5.

b) Temperature measurement of the fire-back surface of the test piece

The fire-back surface of the test piece - For the temperature measurement of the plugging material, the surface of the cable or the surface of the pipe, the surface of the frame which is 25 mm from the edge of the plugging material, the surface of the plastic pipe, use a thermocouple, which has a wire diameter of $\Phi 0.5$ mm, industrial grade II; the quantity shall not be less than 6 pieces. The distribution is as follows: On the surface of the plugging material, which is 25 mm from the surface of the penetration: not less than 2 pieces; on the surface of the penetration (cable, cable bundle or pipe),

production of test pieces may select the preparation method of standard test piece, which is specified in this standard. For the test piece used in actual engineering, the production of the test piece shall be consistent with the actual use. When the test piece, which is produced according to the actual engineering application, already contains all the penetrations and their combinations in the standard test piece, if its fire resistance meets the specified requirements, the test results may also be used to judge the quality of the product.

6.16.4.1.2 For the tested plugging head (head length 50 mm, thickness 25 mm), which is used for the fire end of the cable, the length of the cable, which is exposed to the fire, is 300 mm. For the inner diameter of the tested plugged pipe, which is used for the fire end of the pipe, the plugging length is 100 mm, the pipe extends out of the fire surface of the test piece for 300 mm; the length of the penetration is 1500 mm.

6.16.4.1.3 The penetration or support on the fire-back surface shall be fixed in an appropriate manner, to prevent the penetration or support from slipping off before or during the test.

6.16.4.2 Firestop material test piece for holes

6.16.4.2.1 The standard test piece of firestop material for holes, shall include firestop materials for concrete frames, penetrations, brackets, holes. For the size and detailed production requirements of standard test pieces, see A.1 in Appendix A.

6.16.4.2.2 For inorganic plugging materials, flame-retardant bag or flame-retardant module, the firestop materials in Figure A.1 shall be one of the tested inorganic plugging materials, flame-retardant bag or flame-retardant module. It is allowed to be used in conjunction with flexible organic plugging materials or foam plugging materials.

6.16.4.2.3 For flexible organic plugging materials or foam plugging materials, the plugging material in Figure A.1 is substituted by the C30 concrete, on which a rectangular hole (hole length: 510 mm, height: 110 mm) is reserved. The rectangular hole is reserved at the position where the cable tray, cable, steel pipe and other penetrations need to be laid, as shown in Figure A.1. Lay penetrations such as cable trays, cables, steel pipes in the reserved rectangular holes, according to Figure A.2. Use flexible organic plugging materials or foam plugging materials to block all gaps in the holes.

Note: The specimen production of flexible organic plugging material or foam plugging material is as shown in Figure A.2.

6.16.4.2.4 For firestop plates, the firestop material in Figure A.1 shall use one firestop plate, on each of the fire-receiving surface and the fire-back surface. It

The installation of the test piece shall reflect the actual use situation. According to the test requirements, the test piece is installed on the combustion test furnace vertically or horizontally for testing. Arrange thermocouples on the firestop material, penetrations, frame of the fire-back surface, to measure the temperature rise of the fire-back surface. The cantilever end of the penetration shall use effective support (bracket).

6.16.6.2 Measurement and observation

The thermocouples used for temperature measurement in the furnace shall meet the requirements of GB/T 9978.1. The setting of thermocouples shall be no less than 5. The temperature recording period shall be no more than 30 s.

a) The temperature of back-fire side of specimen

Measure and observe the temperature of the surface of the firestop material on the back-fire surface, the temperature of the cable surface at a distance of 25 mm from the back-fire surface of the firestop material, the temperature of the surface of pipe at a distance of 25 mm from the back-fire surface of the firestop material, the temperature on the frame surface at 25 mm from the back-fire surface of the firestop material.

b) Integrity

Measure and observe whether there is flame or hot air, that passes through and ignites cotton pad, on the back-fire surface of the test piece; whether there is continuous flame on the back-fire surface of the test piece for more than 10 s. The requirements and use of cotton pads shall meet the requirements of GB/T 9978.1.

c) Thermal insulation

Measure and record the temperature rise of all temperature measurement points, on the back-fire surface, including the temperature rise of the moving thermocouple, as well as the time it takes for the temperature rise at any temperature measurement point to reach 180 °C.

6.16.7 Judgment criteria for fire resistance limit

6.16.7.1 Judgment of fire resistance polarity

When any of the loss of integrity or loss of thermal insulation, which are specified in 6.16.7.2 and 6.16.7.3, occurs in the test, it means that the integrity or thermal insulation of the firestop material has reached the limit state; the recorded time is the fire resistance time limit when the integrity OR the thermal insulation of the firestop material is lost.

A - The area under the actual furnace temperature curve of the first 3/4 I;

A_s - The area under the standard furnace temperature curve in the same time period as A.

6.16.10 Application of fire resistance test results

Refer to Appendix B for the application of fire resistance test results.

7 Inspection rules

7.1 The technical indicators, such as fire resistance, combustion performance, all physical and chemical properties, as specified in this standard, are type inspection items.

7.2 In one of the following situations, the product shall undergo type inspection:

- a) Trial production appraisal of a new product after being put into production or a trans-plant produced product;
- b) After formal production, when there are major changes in the raw materials, formulas, production processes of the product, or when the normal production has reached three years;
- c) When the production is restored after suspension form more than 1 year;
- d) Where there is a big difference between the exit-factory inspection results and the last type inspection;
- e) When requested by the national quality supervision agency.

7.3 The appearance, apparent density, initial setting time, drop resistance, swelling performance, water resistance, oil resistance, alkali resistance, combustion performance, which are specified in this standard, are the exit-factory inspection items.

8 Comprehensive judgment criteria

8.1 The samples required for firestop material shall be randomly selected from the batch product or the site of use.

8.2 When the fire resistance of the firestop material reaches a certain level (1 h, 2 h, 3 h), AND all other performance indicators meet the standard requirements, the product is recognized as qualified for a certain level of product quality.

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