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Fire detection and alarm systems – Smoke alarms

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Fire detection and alarm systems – Smoke alarms

1 Scope

This Standard specifies the product classification, technical requirements, test methods, inspection rules, marking, packaging and manufacturer's instructions for fire detection and alarm systems (hereinafter referred to as smoke alarms).

This Standard applies to smoke alarms that are installed in civil architectures and operate using scattered light, transmitted light (photoelectric smoke sensing) and ionization (ion smoke sensing).

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 corrigenda) 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 4715-1993, *Technical requirements and test methods for point type smoke fire detectors*

GB 9969.1-1998, *General principles for preparation of instructions for use of industrial products*

GB 12978-2003, *Rules for test of fire electronic products*

GB 16838-1997, *Environmental test methods and severities for fire electronic products*

3 Product classification

3.1 in accordance with operating principle:

a) photoelectric smoke alarms (using scattered light and transmitted light);

b) ionization smoke alarms.

3.2 in accordance with power supply mode:

a) internal battery smoke alarms;

b) external battery smoke alarms;

c) smoke alarms which have external power supply and are equipped with the internal standby battery.

3.3 in accordance with operating mode:

a) self-contained smoke alarms;

b) interconnectable smoke alarms.

4 General requirements

4.1 When a fire occurs in the monitored area and its smoke parameters achieve the preset values, the smoke alarm shall give acoustical and optical fire alarm signals at the same time.

4.2 For the multiple station smoke alarm, when one alarm gives fire alarm signals, the other smoke alarms connected with it shall also give fire alarm signals.

4.3 3 m from the smoke alarm, the sound pressure level of fire alarm signals shall be greater than 80 dB (A weighting).

4.4 The smoke alarm shall have the self-checking function and give acoustical and optical fire alarm signals during self-checking.

4.5 For the smoke alarm having the alarm-silencing function, the alarm-silence period shall not be less than 100 s; for the interconnectable smoke alarm, the alarm-silence of the smoke alarm shall not prevent the smoke alarms connected with it from giving alarm signals.

4.6 Except battery and fuse, the smoke alarm shall not have components or parts which can be replaced or repaired by user; when the battery is removed, visual warning shall be provided.

4.7 The smoke alarm is capable of communicating with auxiliary equipment such as remote display, but it shall not influence the fire detection performance of the smoke alarm in case of any disconnection or short-circuit fault during the communication between the smoke alarm and the equipment.

4.8 For the smoke alarm having multiple indicator lights, indicator lights shall be marked by color. For the smoke alarm powered by an AC power supply, it shall have AC power supply working indicator lights: the AC power supply working indicator light shall be green; the fire indicator light shall be red; the fault indicator light shall be yellow.

4.9 The smoke alarm shall be provided with a fabric of maximum mesh size not greater than 1 mm or other measures to prevent the ingress of insects.

First supply power at nominal voltage; then decrease the power voltage at the rate of not greater than 0.1 V per min; observe whether the smoke alarm gives fault signals; record the voltage value (fault voltage) when fault signals are given.

5.4.3 Requirement

The smoke alarm shall be capable of giving fault signals.

5.5 Polarity reversal test

5.5.1 Object

Test whether polarity reversal causes damages to the smoke alarm.

5.5.2 Method

5.5.2.1 For smoke alarms which is not connected to the internal battery for power supply, reverse the polarities of the power lines of their external power supply, and maintain this condition for 2 h, unless smoke alarms give fault or fire alarm signals. If smoke alarms are interconnectable in use, then, also reverse the connecting lines between them.

5.5.2.2 For smoke alarms connected to the internal battery (including the standby battery) for power supply, if it is allowed by their structure, reverse the connecting terminals of the battery and the battery of smoke alarms and maintain the condition for 2 h unless smoke alarms give fault or fire alarm signals.

5.5.2.3 For smoke alarms powered by the battery (including the standby battery), use the fault voltage to supply power and observe whether smoke alarms give fault signals.

5.5.2.4 After the above-mentioned operation, re-connect the power supply of smoke alarms as specified in 5.1.4 and measure the response threshold value as specified in 5.2.

Of the two response threshold values measured for the specimen in this test and in the initial sensitivity test, designate the greater as y_{max} or m_{max} and the lesser as y_{min} or $m_{min.}$

5.5.3 Requirement

The ratio of the response threshold values $y_{max} : y_{min}$ or $m_{max} : m_{min}$ shall not be greater than 1.6.

The smoke alarm powered by the battery shall give fault signals under the fault voltage.

5.5.4 Test apparatus

Smoke tunnel.

5.6 Sound pressure test

Designate the maximum response threshold value as y_{max} or m_{max} and the minimum value as y_{min} or m_{min}.

5.11.3 Requirement

The ratio of the response threshold values y_{max} : y_{min} or m_{max} : m_{min} shall not be greater than 1.6.

5.11.4 Test apparatus

Smoke tunnel.

5.12 Conformity test

5.12.1 Object

To test the conformity of the response threshold value of the smoke alarm.

5.12.2 Method

Number 18 smoke alarms in the order of 1 ~ 18 and measure the response threshold value in the “worst” orientation of the smoke alarm. For the smoke alarm having a variable response threshold value, carry out test by setting the response threshold value of the smoke alarm at the maximum-minimum limit values.

Of the 18 smoke alarms, designate the maximum response threshold value as y_{max} or m_{max} and the minimum value as y_{min} or m_{min}.

For the smoke alarm having a variable response threshold value, when setting at the minimum limit value, designate the maximum response threshold value as $y_{max(1)}$ or $m_{max(1)}$ and the minimum value as $y_{min(1)}$ or $m_{min(1)}$. When setting at the minimum limit value, designate the maximum response threshold value as $y_{max(2)}$ or $m_{max(2)}$ and the minimum value as $y_{min(2)}$ or $m_{min(2)}$.

5.12.3 Requirement

5.12.3.1 For smoke alarms having a fixed response threshold value:

a) the ratio of the response threshold values y_{max} : y_{min} or m_{max} : m_{min} shall not be greater than 1.6.

b) the minimum response threshold value y_{min} shall not be less than 0.2, and m_{min} shall not be less than 0.05 dB/m; the maximum response threshold value y_{max} shall not be greater than 3.0, and m_{min} shall not be greater than 2.0 dB/m.

5.12.3.2 For smoke alarms having a variable response threshold value

a) the ratio of the response threshold values $y_{max(1)}$: $y_{min(1)}$ or $m_{max(1)}$: $m_{min(1)}$ and $y_{max(2)}$: $y_{min(2)}$ or $m_{max(2)}$: $m_{min(2)}$ shall not be greater than 1.6.

After taking the other smoke alarm out of the damp heat test chamber, store it in the environment for 72 h at the temperature 15°C ~ 25°C and the relative humidity less than 70%; measure the response threshold value in the “worst” orientation as specified in 5.2.

Compare the response threshold value measured using the two smoke alarms with the response threshold value measured in the conformity test of the two smoke alarms; designate the maximum response threshold value as y_{max} or m_{max} and the minimum response threshold value as y_{min} or $m_{min.}$

In the damp heat test chamber, the surface of the smoke alarm shall be free from condensation when one environment transits to another.

5.18.3 Requirement

a) during test, the smoke alarm shall not give fault or fire alarm signals;

b) after test, the smoke alarm shall be free from coating damage and corrosion;

c) the ratio of the response threshold values y_{max} : y_{min} or m_{max} : m_{min} shall not be greater than 1.6.

5.18.4 Test apparatus

Test apparatus (damp heat test chamber) shall be as specified in 4.5.4 of GB 16838-1997.

5.19 Vibration test (endurance)

5.19.1 Object

To test the adaptability of the smoke alarm and its structural integrity when it is subjected to mechanical vibration other than multiple, repeated vibration.

5.19.2 Method

Mount the smoke alarm and base in its normal mounting position, at the center of the beam bottom surface of the vibration test apparatus; connect to the power supply as specified in 5.1.4; make it remain in the normal monitoring condition.

Adjust the test apparatus to make a cylindrical steel block, 1 kg in mass, drop from 700 mm high to the central part of the beam top surface, along the guiding device; the vibration area is 18 cm^2 ± 10%; it will drop continuously 5 times.

After test, measure the response threshold value in the “worst” orientation as specified in 5.2; compare it with the response threshold value of the smoke alarm measured in the conformity test; designate the maximum response threshold value as y_{max} or m_{max} and the minimum response threshold value as y_{min} or $m_{min.}$

5.19.3 Requirement

5.21.1 Object

To test the ability of the smoke alarm to resist corrosion.

5.21.2 Method

During test, mount the smoke alarm and base in its normal mounting position in a test chamber of temperature 40°C ± 2°C, concentration $25 \times 10^{-6} \pm 5 \times 10^{-6}$ (volume ratio) and relative humidity 90% ~ 95%; subject it to a test for 21 d.

During test, the smoke alarm is not powered on. During loading and unloading the smoke alarm, its surface shall be free from condensation.

After test, condition the smoke alarm and base for 7 d under the normal atmospheric conditions.

When the smoke alarm and the connecting leads are well connected, measure the response threshold value in the “worst” orientation as specified in 5.2; compare it with the response threshold value of the smoke alarm measured in the conformity test; designate the maximum response threshold value as y_{max} or m_{max} and the minimum response threshold value as y_{min} or m_{min}.

5.21.3 Requirement

The ratio of the response threshold values $y_{max} : y_{min}$ or $m_{max} : m_{min}$ shall not be greater than 1.6.

5.21.4 Test apparatus

Test apparatus shall be as specified in 4.9.4 of GB 16838-1997.

5.22 Insulation resistance test

5.22.1 Object

To test the insulating performance of the smoke alarm not connected to the internal battery for power supply.

5.22.2 Method

Mount the smoke alarm not connected to the internal battery for power supply and its base on a metal plate (the voltage ground end) of the insulation resistance test apparatus; connect all connecting points of the smoke alarm to each other in a short circuit; apply a DC voltage of 500 V ± 50 V between the short-circuit and the metal plate; measure the insulating resistance after maintaining it for 60 s ± 5 s. After drying the smoke alarm in a drying oven for 6 h at 40°C ± 5°C, place it into the damp heat test chamber at the temperature 40°C ± 2°C and relative humidity 90% ~ 95%; maintain it for 96 h; store under the normal test atmospheric conditions for 600^{+10}_{0} min; immediately measure the insulating resistance using the above-mentioned method.

5.24.2 Method

Place the smoke alarm in the low temperature test chamber; connect to the power supply as specified in 5.1.4; make it remain in the monitoring condition. Maintain it for 1 h at the temperature 15°C ~ 25°C and the relative humidity not greater than 70%; decrease the temperature to - 10°C ± 3°C at the rate not greater than 0.5°C/min; maintain in the condition for 2 h (the smoke alarm shall not be frozen in the test chamber).

After the low temperature stabilization period, take out the smoke alarm; disconnect the power supply; condition for 1 h ~ 2 h in the environment at the temperature 15°C ~ 25°C and the relative humidity not greater than 70%; measure the response threshold value measured in the "worst" orientation as specified in 5.2; compare with the response threshold value measured in the conformity test of the smoke alarm and designate the maximum response threshold value of the three as y_{max} or m_{max} and the minimum response threshold value as y_{min} or m_{min}.

5.24.3 Requirement

a) during test, the smoke alarm shall not give fault or fire alarm signals;

b) the ratio of the response threshold values $y_{max} : y_{min}$ or $m_{max} : m_{min}$ shall not be greater than 1.6.

5.24.4 Test apparatus

Test apparatus shall be as specified in 4.3.4 of GB 16838-1997.

5.25 Electrostatic discharge test

5.25.1 Object

To test the resistance of the smoke alarm to the electrostatic discharge caused by charged human body.

5.25.2 Method

Place the smoke alarm on the grounding plate for test with the distance from it to the edge of the grounding plate shall not be less than 100 mm. Connect to the power supply as specified in 5.1.4 to make it remain in the normal monitoring condition. Adjust the output voltage of the electrostatic discharge generator to 8,000 V; charge the electrostatic discharge probe connected with 150 pF energy storage capacitor and 150 Ω resistor to 8,000 V; discharge to the smoke alarm through the 150 Ω resistor. After each charge, immediately make the electrostatic probe touch one test point on the enclosure of the smoke alarm. No matter whether an arc discharge occurs, be sure to make the probe tip in close contact with test points. Carry out 10 electrostatic discharges at different test points of the enclosure of the smoke alarm (on the bottom surface and side surface).

5.26.3 Requirement

a) during test, the smoke alarm shall not give fault or fire alarm signals;

b) the ratio of the response threshold values y_{max} : y_{min} or m_{max} : m_{min} shall not be greater than 1.6.

5.26.4 Test apparatus

Test apparatus shall be as specified in 4.17.4 of GB 16838-1997.

5.27 Electrical transient burst test

5.27.1 Object

To test the adaptability of the smoke alarm not connected to the internal battery for power supply to operate under the interferences generated by electrical transient burst.

5.27.2 Method

During test, connect to the power supply as specified in 5.1.4 and make it remain in the normal monitoring condition.

For the smoke alarm not connected to the internal battery for power supply, apply a positive-negative polarity transient voltage 1,000 V ± 10% at the frequency 5 kHz ± 20% to the power lines of the smoke alarm; apply a transient voltage pulse for 15 s every 300 s, with the test duration 2 min.

During test, observe whether the smoke alarm gives fault or fire alarm signals. After test, measure the response threshold value in the “worst” orientation as specified in 5.2; compare it with the response threshold value measured in the conformity test of the smoke alarm; designate the maximum response threshold value as y_{max} or m_{max} and the minimum response threshold value as y_{min} or m_{min}.

5.27.3 Requirement

a) during test, the smoke alarm shall not give fault or fire alarm signals;

b) the ratio of the response threshold values y_{max} : y_{min} or m_{max} : m_{min} shall not be greater than 1.6.

5.27.4 Test apparatus

Test apparatus shall be specified in 4.18.4 of GB 16838-1997.

5.28 Fire sensitivity test

5.28.1 Object

b) when there is a significant change in the structure, major component or part, production process after mass production, which may influence the performance of products, or after four years of mass production;

c) when production is resumed after a production half more than one year;

d) when the results of exit-factory inspection are significantly different from the results of last type inspection;

e) when any major quality accident occurs;

f) when a quality supervisory organization makes a requirement.

6.2.2 The inspection procedures and criteria shall be meet the type inspection requirements of GB 12978-2003.

7 Marking and packaging

7.1 Marking

Smoke alarms shall be marked legibly and indelibly, including product marking and quality inspection marking.

7.1.1 Product marking

Product marking shall include the following content:

a) manufacturer name;

b) product name;

c) product type;

d) trademark;

e) manufacturing date and product number;

f) product main technical parameters;

g) reference standard.

7.1.2 Quality inspection marking

Quality inspection marking shall include the following content:

a) reference to this Standard;

b) tester;

c) conformity mark.

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