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Special type fire detectors

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Contents

Foreword

Subsections 4, 5, 6 and 7 of this Standard are mandatory, whilst the rest are recommended.

This Standard replaces GB 15631-1995, “Performance requirements and test methods for point infrared flame detectors.” The main changes to this Standard when compared with GB 15631-1995 are as follows:

—the technical requirements for aspirated smoke detectors, image-type fire detectors and point-type carbon monoxide detectors have been increased;

— the latest version of electromagnetic compatibility requirements have been adopted and the appropriate severity classification for connection with the international world has been selected.

Annex A and Annex B to this Standard are normative annexes.

This Standard was proposed by the Ministry of Public Security of the People’s Republic of China

This Standard is under the jurisdiction of the 6th Branch Technical Committee of the National Technical Committee for Fire Protection Standardisation.

The unit responsible for drafting this Standard is the Shengyang Fire Research Institute, the Ministry of Public Security.

The units that participated in drafting this Standard are Anhui Fire Station, Xi-an Bokang Electronics Co., Ltd., Shenzhen Forsafe System Technology Co., Ltd., and KD Lian Safety Technology Co., Ltd.

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This Standard replaces the following previously issued version of the Standard:

— GB15631-1995.

Special Type Fire Detectors

1 Scope

This Standard sets the classifications, technical requirements, test methods, inspection rules, markings and user manual requirements for the special type fire detectors (hereinafter referred to as “detectors”).

This standard applies to special type fire detectors installed in general industry and civil architectures. This Standard also applies to special type fire detectors requiring special installation for use in other environments, with the exception of special performances specified by other related standards.

2 Normative references

The provisions of the following documents become provisions of this Standard after being referenced. For dated reference documents, all later amendments (excluding corrigenda) and revised versions do not apply to this Standard. However, the parties to the agreement are encouraged to study whether the latest version of these documents applies. For undated reference documents, the latest versions apply.

GB 4706.1-1998 Safety of household and similar electrical appliances — Part 1: General requirements (Eqv. IEC335-1: 1991)

GB 9969.1 General principles for preparation of instructions for use of industrial products

GB 12978 Rules for product test of fire alarm equipments

GB 16838 Environmental test methods and severities for fire electronic products

3 Classification

3.1 According to the detection principles, special type fire detectors can be classified as:

a) point-type infrared flame detectors;

b) aspirated smoke detectors;

c) image-type fire detectors;

d) point-type carbon monoxide detectors.

3.2 According to the ways in which they are used, point-type carbon monoxide detectors can be classified as:

a) independent type;

b) systematic type.

3.3 According to the range of response threshold values, aspirated smoke detectors can be classified as:

a) general type;

b) sensitive type;

c) highly sensitive type.

3.4 According to function formation, aspirated smoke detectors can be classified as:

a) detection type;

b) detection alarm type.

3.5 According to sampling methods, aspirated smoke detectors can be classified as:

a) pipe-sampling type;

b) point-sampling type.

4 Technical requirements

4.1 Requirements for general use

4.1.1 Alarm confirmation light

The detector should possess a red alarm confirmation light. When the fire parameters in the zone under surveillance meet the alarm conditions, the alarm confirmation light of the detector should be turned on and remain on until restoration. With regard to the displaying of other functional modes of the detector through the alarm confirmation light, the display of such modes should be clearly distinguishable from the fire alarm mode. The alarm confirmation light of dismountable detectors may be installed at the probe or on the base. When the alarm confirmation light is turned on, there should be a clear view 6m in front of it and with an illumination of no more than 5001x.

4.1.2 Connection of auxiliary equipments

When the detector is to be connected to other auxiliary equipments (e.g. remote confirmation light, control relay, etc.), the open circuit and short circuit connecting to the auxiliary equipment should not affect the normal functioning of the detector.

4.1.3 Pre-delivery setting

The pre-delivery setting of the detector should not be changed unless by special means (e.g. special tool or code) or by breaking the seal tape.

4.1.4 On-the-spot setting of response performance

If the response performance of the detector can undergo on-the-spot setting of the detector or its connected control and indication equipment, the following requirements should be met:

a) If the manufacturer declares that all of the settings meet the requirements set out in this Standard, the detector, when operating on the 'random' setting, should meet the requirements set out in this Standard, and the on-the-spot device may only be realised by means of separation from the base through special tools, codes or probe.

b) If the manufacturer declares that a certain setting does not meet the requirements set out in this Standard, the setting should only be able to be realised by means of special tools or codes. There should be clear indication on the detector or related documents stating that this setting does not meet the requirements set out in this Standard.

4.1.5 Prevention from invasion of foreign matter

The detector should be able to prevent any spherical object at a diameter of (1.3 ± 0.05) mm from invading the detection room.

4.1.6 User manual

The corresponding Chinese manual should be enclosed with the detector. The contents of the manual should meet the requirements set out in GB9969.1, and should be consistent with the performance of the product.

4.1.7 Climatic environment tests

4.1.7.1 Running tests

The detector should be able to perform the various tests under the climatic environment conditions specified in Table 1. During the test period and after the tests, the following requirements should be met:

a) during the test, the detector should not send out a fire alarm signal or malfunction signal;

b) after the test, the detector should be able to operate normally. When the response threshold value of point-type infrared flame detectors is compared with its response threshold value in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.3. When the response threshold values of the aspirated smoke detector and point-type carbon monoxide detector are compared with their response threshold values in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6. The response threshold value of the image-type fire detector should meet the requirements set out in Subsection 4.4.1.

Table 1 Requirements for climatic environment conditions of running test

Name of Test	Test Parameters	Test Conditions	Functional mode
High temperature (running) test	Temperature, ^{o}C	55 ± 2	Normal surveillance mode
	Duration, h	2	
Low temperature (running) test	Temperature, ^{o}C	-10 ± 3	Normal surveillance mode
	Duration, h	2	
Steady-state damp heat (running) test	Temperature, ^{o}C	40 ± 2	Normal surveillance mode
	Relative humidity, %	93 ± 3	
	Duration, h	4	

4.1.7.2 Durability tests

The detectors should be able to perform the various tests under the climatic environment conditions specified in Table 2, and should meet the following requirements after the tests:

a) when normal surveillance mode resumes after the tests, the detector should not send out a fire alarm signal or malfunction signal;

b) after the tests, the detector should be able to operate normally. When the response threshold value of the point-type infrared flame detector is compared with its response threshold value in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.3. When the response threshold values of the aspirated smoke detector and point-type carbon monoxide detector are compared with their response threshold values in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6. The response threshold value of the image-type fire detector should meet the requirements set out in Subsection 4.4.1.

Table 2 Requirements for climatic environment conditions for durability test

Name of Test	Test Parameters	Test Conditions	Functional mode
Steady state damp heat (durability) test	Temperature, ^{o}C	40 ± 2	Power disconnection mode
	Relative humidity, %	93 ± 3	
	Duration, d	21	
Corrosion test	Temperature, ^{o}C	25 ± 2	Power disconnection mode
	Relative humidity, %	93 ± 3	
	Duration, d	21	
	SO_2 concentration 10^{-6}	25 ± 5	

4.1.8 Mechanical environment tests

4.1.8.1 Running tests

The detectors should be able to perform the various tests under the mechanical

environment conditions specified in Table 3. During the test period and after the tests, the detectors should meet the following requirements:

a) during the test period, the detectors should not send out a fire alarm signal or malfunction signal;

b) after the tests, there should be no mechanical damage to the detectors or loosening at the tightening parts;

c) after the tests, the basic operation of the detectors should be normal. When the response threshold value of the point-type infrared flame detector is compared with its response threshold value in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.3. When the response threshold values of the aspirated smoke detector and point-type carbon monoxide detector are compared with their response threshold values in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6. The response threshold value of the image-type fire detector should meet the requirements set out in Subsection 4.4.1.

Table 3 Requirements for mechanic environmental conditions for running test

Name of Test	Test Parameters	Test Conditions	Functional mode
Vibration test (sine) (running)	Frequency range, Hz	10 ~ 150 ~ 10	Normal surveillance mode
	Acceleration, m/s^2	9.8	
	Frequency sweep speed, octave per minute	1	
	No of axes	3	
	No of frequency sweeps per axis	20	
Impact test	Peak value acceleration, m/s^2	(100-20m) × 10 (mass m• 4.75 kg inch)	Normal surveillance mode
		0 (mass m > 4.75 kg inch)	
	Pulse time, ms	6	
	Impact direction	6	
Collision test	Hammer head speed, m/s	1.5 ± 0.125	Normal surveillance mode
	Kinetic energy of impact, J	1.9 ± 0.1	
	No of impacts	1	

4.1.8.2 Durability tests

The detectors should be able to perform the various tests under the mechanical environment conditions specified in Table 4. After the tests, the detectors should meet the following requirements:

a) when normal surveillance mode is resumed, the detectors should not send out a fire alarm signal or malfunction signal;

b) after the tests, the basic operation of the detectors should be normal. When the response threshold value of the point-type infrared flame detector is compared with its response threshold value in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.3. When the response threshold values of the aspirated smoke detector and point-type carbon monoxide detector are compared with their response threshold values in the consistence test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6. The response threshold value of the image-type fire detector should meet the requirements of Subsection 4.4.1.

Table 4 Requirements for mechanic environmental conditions of durability test

Name of Test	Test Parameters	Test Conditions	Functional mode
Vibration test (sine) (durability)	Frequency range, Hz	10 ~ 150 ~ 10	Power disconnection mode
	Acceleration, m/s^2	10	
	Frequency sweep speed, octave per minute	1	
	No of axes	3	
	No of frequency sweeps per axis	20	

4.1.9 Electromagnetic compatibility test

The detectors should be able to perform the electromagnetic compatibility tests specified in Table 5. During the test period and after the tests, the detectors should meet the following requirements:

a) during the test, the detectors should not send out a fire alarm signal or malfunction signal;

b) after the tests, the basic operation of the detectors should be normal. When the response threshold value of the point-type infrared flame detector is compared with its response threshold value in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.3. When the response threshold values of the aspirated smoke detector and point-type carbon monoxide detector are compared with their response threshold values in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6. The response threshold value of the image-type fire detector should meet the requirements set out in

Subsection 4.4.1.

Table 5 Requirements of electromagnetic compatibility test conditions

Name of Test	Test Parameters	Test Conditions	Functional mode
Immunity test of radio-frequency electromagnetic radiation	Field strength, V/m	10	Normal surveillance mode
	Frequency range, MHz	80 ~ 1000	
	Modulation amplitude	80% (Hz, sine)	
	Frequency sweep speed, decuple octave per second	• 1.5×10^{-3}	
Immunity test of conductive interference of radio-frequency field sensor	Voltage, dB• V	140	Normal surveillance mode
	Frequency range, MHz	0.15 ~ 100	
	Modulation amplitude	80% (Hz, sine)	
	Frequency sweep speed, decuple octave per second	• 1.5×10^{-3}	
Immunity test of static discharge	Discharge voltage, kV	Air discharge (sample with insulated shell) 8	Normal surveillance mode
		Contact discharge (sample with conductive shell and coupling plate) 6	
	No of discharges per point	10	
	Discharge electrode	Positive, negative	
	Time interval, s	• 1	
Immunity test of electric speedy transient pulses	Voltage peak, kV	$1 \times (1 \pm 0.1)$	Normal surveillance mode
	Repetition frequency, kHz	$5 \times (1 \pm 0.2)$	
	Electrode	Positive, negative	
	Time	1 min. each time	
Immunity test of surging (impact)	Voltage of surging impact, kV	Wire-ground $1 \times (1 \pm 0.1)$	Normal surveillance mode
	Electrode	Positive, negative	
	No of tests taken	5	

4.2 Point-type infrared flame detectors

4.2.1 Consistency of distribution of response threshold values

Measure the response threshold value of each detector under normal environmental conditions. The ratio of its maximum response threshold value to the minimum response threshold value should not be greater than 2.0.

4.2.2 Repetitiveness

Measure the response threshold value of the same detector in a random bearing 6 times continuously under normal environmental conditions. The ratio of its maximum response threshold value to the minimum response threshold value should not be greater than 1.3.

4.2.3 Bearing

The angles included between the axes and optical axes of detectors are set to 0^o, 0^o, 15^o, 30^o and 45^o. Each of the response threshold values is measured once. The cone angle of detector should not be smaller than 45^o. The ratio of its maximum response threshold value to the minimum response threshold value should not be greater than 2.0.

4.2.4 Power connection

The detectors should be able to run under normal surveillance mode for 7 consecutive days. During the test period, the samples should not send out a fire alarm signal or malfunction signal. After the tests, the response threshold value should be compared with the response threshold value of this detector in the consistency test, and the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.3.

4.2.5 Power-source parameter fluctuation

The voltage of the power supply to the detectors is -15% and +10% of the rated working voltage. Measure the response threshold value, which is compared with the response threshold value in the consistency test; the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6.

4.2.6 Interference of environmental beam

During the following environmental beam functioning periods, the detectors should not send out a fire alarm signal or malfunction signal. After the environmental beam interference is over, the response threshold value of detector should measured under the condition that the incandescent lamp and fluorescent lamp are simultaneously turned on. When the response threshold value is compared with the response threshold value of this detector in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6. After the test, the ratio of the response threshold values of sample, $S_{max} : S_{min}$ should not be greater than 1.3.

a) allow two 25W incandescent lamps (colour temperature at 2850K ± 100K) to be turned on for 1 second and turned off for 1 second, repeating 20 times.

b) allow a 30W ring-shaped fluorescent lamp at a diameter 308mm to be turned on for 1 second and turned off for 1 second, repeating 20 times.

c) allow the abovementioned incandescent lamps and fluorescent lamp to be

turned on for 2 hours.

4.2.7 Fire sensitivity

Under the fire test conditions specified in Table 6, the detectors should send out a fire alarm signal within 30 seconds. When sending out a fire alarm signal, a distance of 25m between the sample and the centre of the test fire is regarded as Grade I sensitivity; a distance of 17m is regarded as Grade II sensitivity; and a distance of 12m is regarded as Grade III sensitivity.

Table 6 Requirements for the conditions of fire sensitivity test

Name of Test Fire	Test Fire Conditions	
Normal heptane fire	Fuel	Heptane (analytical pure/AP grade) plus toluene at volume fraction 3%
	Mass	650g
	Layout	Place the fuel in a container made of steel plates of 2mm thickness, base dimensions 33cm×33cm, and height 5cm
	Ignition way	Flame or electric spark
Ethanol open fire	Fuel	Industrial ethanol (above 90% of ethanol content, with small amount of methanol)
	Mass	2000g
	Layout	Place the fuel in a container made of steel plates of 2mm thickness, base dimensions 33cm×33cm, and height 5cm
	Ignition way	Flame or electric spark

4.3 Aspirated smoke detectors

4.3.1 Performance of the main parts of pipe sampling-type aspirated smoke detectors

4.3.1.1 Indicating lights

4.3.1.1.1 There should be a yellow light on the detector to indicate malfunctions. When the detector sends out a malfunction signal, the indicating light should be lit and should remain lit until the malfunction has been resolved. When the indicating light is lit, objects within 3m should be clearly visible under the condition that the illumination of the surrounding environment is 5Lx ~500Lx

4.3.1.1.2 There should be a green power indicating light on the detector. When the detector is connected to a power supply, the indicating light should be lit and remain lit. When the indicating light is ignited, and under the condition that the illumination of the surrounding environment is 5Lx ~500Lx, the things at the place of 3m from its front should be clearly visible.

4.3.1.1.3 The functions of the indicating lights should be indicated. If this is in the form of a written indication, the text should be in Chinese.

4.3.1.2 Letter/symbol–number displayer

Should a letter/symbol–number displayer be attached to the detector, when the displayer is in display mode, and under the condition that the illumination of the environment is 5Lx ~500Lx, it should be readable from within 0.8m from the front of the detector.

4.3.1.3 Fuse

The rated current value of the fuse for power circuit or other overcurrent protection devices should generally not be greater than 2 times of the maximum working current of detector. When the maximum working current is greater than 6A, its 1.5 times can be taken as the current value of the fuse. The parameter values should be clearly indicated close to the fuse or other over-current protection devices.

4.3.1.4 Wiring terminal

The number or symbols of each wiring terminal should be clearly and firmly indicated. Its corresponding purposes should be indicated in the related documents.

4.3.1.5 Switch and buttons

The functions of the switches and buttons of the detector should be clearly indicated in a position above or close to them in Chinese text as a minimum.

4.3.1.6 Aspiration pipe

The aspiration pipe should be firm and durable, painted in red or painted with a red mark at a width not smaller than 2mm along the pipe. Within 1m from the two ends, the following words should be indicated - aspiration pipe of detector, with the height of each word no greater than 5mm. The diameter of the aspiration pipe should not be smaller than 2mm.

4.3.1.7 Sounding device

Detecting and alarm mode aspirated smoke detectors should be equipped with a sounding device to indicate fire alarm and malfunctions. Under normal working conditions, the sound pressure (weighted A) of the sounding device 1m from the front of the detector should be greater than 65dB and smaller than 115dB. It should be able to function under 85% of rated working voltage condition.

4.3.2 Basic performances

4.3.2.1 Malfunction warning

If a leakage or blockage of the detector aspiration pipe makes the aspiration flow of the detector greater than 150% of normal aspiration flow or less than 50% of normal aspiration flow, a malfunction signal should be sent out within 100 seconds.

4.3.2.2 Fire alarm function

When the smoke parameter of fire acquired by the detector from any single sampling hole meets the alarm conditions, it should send out a fire alarm signal within 120 seconds.

4.3.2.3 Special functions of detecting and alarm mode detectors

4.3.2.3.1 Fire alarm function

The detector should be able to send out a fire alarm sound and light signal to indicate the place in which the fire occurs, record the time at which the fire alarm sounds (the error of the clock of detector should not exceed 30 seconds per day), and retain it until it is turned off. The alarm sound signal should be able to be turned off manually. With regard to detectors with multiple fire alarms: when another fire occurs, the detector should be able to send out a fire alarm sound and light signal once again. The fire alarm signal shall have a higher priority than the malfunction alarm signal.

4.3.2.3.2 Malfunction alarm

If the detector and its connected parts malfunction, the detector should be able to send out malfunction sound and light signal, which are clearly different to those of fire alarm signal. The malfunction light signal should stay on until the malfunction problem is resolved. The sounding signal of the detector should be able to be turned off manually. If a new malfunction signal or sound signal occurs, it should be able to be restarted. The detector should indicate when the following kinds of malfunction occur:

a) disconnection of the main power source or insufficiency of voltage;

b) the disconnection or short circuit of the connection wire between the charger charging the reserve power and the reserve power;

c) disconnection or short circuit of the connection wire between the reserve power and its load, or insufficient voltage for the protection of the normal working of detector when power is independently supplied by reserve power.

4.3.2.3.3 Power source function

a) alternating current (AC) power

When the detector is supplied by AC power supply, it should be able to operate normally under the condition that the rated working voltage is between 110% and 85% and has the function of main/reserve power switch. When the main power is disconnected, the detector should be able to switch to the reserve power automatically. When the main power is resumed, it should be able to switch to the main power automatically. The working mode of the main and reserve power supply should be indicated. The main power source should have overcurrent protection measures. The main reserve power switch should not make the detector send out a fire alarm signal.

b) reserve power

Under the condition that the reserve power is discharged to the end voltage and then charged for 24 hours, its capacity should be able to guarantee that the detector can work for 30 minutes under alarm mode after it has been working under normal surveillance mode for 8 hours.

4.3.2.3.4 Self-inspection function

The detector should be able to manually inspect all indicating lights and displays on its panel. During self-inspection, not all the output joints under control of the detector should function. When the self-inspection time of the detector exceeds 1 minute, or when it cannot automatically stop the self-inspection function, the self-inspection function of the detector should not affect the fire alarm function of the parts that do not undergo self-inspection and the detector itself.

4.3.2.3.5 Restoration

The restoration of the detector can only be realised by means of special tool, code, etc.

4.3.2.3.6 On/off power

The power for turning the detector on and off can only be realised by means of special tool, code, etc.

4.3.3 Response threshold values

4.3.3.1 The response threshold values of the detector should meet the requirements set out in Table 7.

Table 7 Requirements of response threshold values

Type of detector	Response threshold value m (indicated by dim rate)
High sensitivity	m • 0.8 % obs/m
Sensitivity	0.8%obs/m < m • 2 % obs/m
General	m > 2% obs/m

When the response threshold value of the detector is adjustable at or above two ranges in Table 1, the range of response threshold values should be indicated, and should meet the corresponding requirements.

4.3.3.2 The response threshold value of the detector should be measured according to the following methods:

4.3.3.2.1 Normal surveillance mode of test

If test method stipulates that the detector must work under normal surveillance mode, the sample should be connected to the control and indicating equipment provided by the manufacturer. When there are no special stipulations in the related subsections, the working voltage of the detector should be guaranteed at the rated working voltage, and the working voltage during the test period should be kept stable.

Note: The detection report of the detector should indicated the model numbers and manufacturers of the control and indicating equipment adapted to the detector during the test period.

4.3.3.2.2 Installation of detector

The pipe-sampling-type detectors should be installed according to normal installation methods with the maximum length of pipe as specified by the

manufacturer. If methods for multiple installations are provided in the manual, the installation method that would be most unfavourable to the operation of the detector should be used in the test, and the measurement of the response threshold value should be conducted at the most unfavourable sampling hole. The point-sampling-type detector should be installed according to the normal installation method specified by the manufacturer. If multiple installation methods are provided in the manual, the installation method that would be most unfavourable to the operation of the detector should be used in the test.

4.3.3.3 As to the detectors with adjustable response threshold values, measurement should be respectively made according to the gradation of response threshold values specified by the manufacturer.

4.3.4 Repetitiveness

Measure the response threshold value of the sample at a random sampling hole in a normal working position 6 times continuously. The ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6.

4.3.5 Consistency of distribution of response threshold values

Measure the response threshold value of each detector under normal environmental conditions. The ratio of the maximum response threshold value to the average response threshold value should not be greater than 1.33. The ratio of the average response threshold value to the minimum response threshold value should not be greater than 1.5.

4.3.6 Power-source parameter fluctuation

The voltage of the power supply to detectors is -15% and +10% of the rated working voltage. Measure the response threshold value, which is compared with the response threshold value in the consistency test; the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6.

4.3.7 Insulation performance

The insulation resistance value between the frame and the externally charged terminal of the detector with insulation requirement should not be less than 20M• . The insulation resistance value between the frame and the power input end should not be less than 50M• .

4.3.8 Current leakage

When the detector is working at 1.06 times of the rated voltage, the current leakage should not exceed 0.5mA.

4.3.9 Power transient

Allow the main power of the detector to be disconnected continuously 500

times according to the fixed procedures of “power connection (9 seconds) - power disconnection (1 second).” During the test, the detector should remain in normal surveillance mode. After the test, the basic operation of the detector should be normal. When the response threshold value of this detector is compared with its response threshold value of in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6.

4.3.10 Voltage fall

Allow the main voltage of detector to fall by 60% for 20 minutes and repeat 10 times, after which allow the main voltage to fall by 100% for 10 minutes, repeating 10 times. During the test, the detector should remain in normal surveillance mode. After the test, the basic operation of the detector should be normal. When the response threshold value of this detector is compared with its response threshold value of in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6.

4.3.11 Fire sensitivity

Install two samples on the ceiling surface of the burning test room by the most unfavourable way according to the requirements of GB 4715. Install the remaining detection pipes at the outer side of the burning test room. The samples are situated at normal surveillance mode according to the requirements. Install and adjust the samples according to the manual of the manufacturer. As to the samples with adjustable response threshold values, their response threshold values should be preset at the maximum limit values.

Before each kind of test fire ends, the detector should send out fire alarm signal.

4.4 Image-type fire detector

4.4.1 Response threshold value

4.4.1.1 When the sample is under Grade 1 and Grade 2 fire-prevention detection modes, the smallest discovered flame dimensions and positioning accuracy should meet the requirements set out Table 8.

4.4.1.2 The response time from the time at which the fire occurs to the time the fire alarm signal is sent out should not be more than 20 seconds.

Table 8 Table of Grade 1 and Grade 2 fire-prevention detection parameters

Distance D (m)	Lens (mm)	Angle of field of view		Dimensions of burning disc (m × m)		Positioning accuracy	
		Horizontal •	Vertical •	Grade 1 five prevention	Grade 2 five prevention	r X	r Y
5	4	64°	50°	0.020 × 0.020	0.060 × 0.060	± 0.100	± 0.147
	6	42 °	32°	0.020 × 0.020	0.040 × 0.040	± 0.100	± 0.142

	8	32^o	24^o	0.020 × 0.020	0.030 × 0.030	± 0.100	± 0.142
	12	22^o	17^o	0.020 × 0.020	0.020 × 0.020	± 0.100	± 0.806
25	4	64^o	50^o	0.090 × 0.090	0.400 × 0.400	± 0.488	± 0.754
	6	52^o	32^o	0.060 × 0.060	0.250 × 0.250	± 0.300	± 0.727
	8	32^o	24^o	0.040 × 0.040	0.150 × 0.150	± 0.225	± 0.723
	12	22^o	17^o	0.030 × 0.030	0.090 × 0.090	± 0.153	± 0.931
50	6	42^o	32^o	0.150 × 0.150	0.550 × 0.550	± 0.600	± 0.643
	8	32^o	24^o	0.090 × 0.090	0.400 × 0.490	± 0.450	± 0.494
	12	22^o	17^o	0.060 × 0.060	0.260 × 0.250	± 0.306	± 0.360
100	12	22^o	17^o	0.150 × 0.150	0.600 × 0.600	± 0.612	± 0.612

4.4.2 Repetitiveness

Measure the response threshold value of a detector 3 times in a row. After being connected to a power supply for 7 days, the response threshold value of the detector should be re-measured 3 times in a row. Whilst connected to the power supply, the detector should not send out a fire alarm signal or malfunction signal. Its response threshold values should meet the requirements set out in Subsection 4.4.1.

4.4.4 Interference of environmental beam

During the following environmental beam functioning periods, the detectors should not send out a fire alarm signal or malfunction signal. After the test, the response threshold value of the detector should meet the requirements set out in Subsection 4.4.1.

a) Allow two 25W incandescent lamps (colour temperature at 2850K ± 100K) to be turned on for 1 second and turned off for 1 second, and repeat 20 times.

b) Allow a 30W ring-shaped fluorescent lamp at a diameter of 308mm to be turned on for 1 second and turned off for 1 second, and repeat 20 times.

c) Allow the abovementioned incandescent lamps and fluorescent lamp to be turned on for 2 hours.

4.5 Point-type carbon monoxide fire detector

4.5.1 Measurement of fixed response threshold value

4.5.1.1 The response threshold value of the detector should be selected from the range specified in Table 9.

4.5.1.2 The measurement of the response threshold value of the detector should be carried out using a gas inspection device, which should meet the requirements set out in Annex A, as well as the test requirements for position, voltage fluctuation, airflow, high temperature, etc. The gas sensor installed at the inspection device should meet the requirements set out in Annex B.

4.5.1.3 The detector should be installed in the gas inspection device. If no special requirements are set out in the related subsections, the most unfavourable position

should be adopted. The airflow around the detector should be (0.2 ± 0.04)m/s, and the airflow temperature should be (23 ± 5)^{o}C.

4.5.1.4 The concentration of gas is expressed as the volume fraction in percentage (hereinafter referred to as "ul/l").

4.5.1.5 Before the test, the concentration of carbon monoxide inside the air test device and detector should be lower than 5ul/l. If no special requirements are set out in the related subsections, the detector should be able to operate stably under normal surveillance mode for 15 minutes.

4.5.1.6 According to the speed of 5ul/l/min., the concentration of carbon monoxide inside the gas inspection device is increased to 15ul/l, and maintained as such for 10 minutes. The detector should not send out a fire alarm or malfunction signal.

4.5.1.7 At the continuous speed of 5ul/l/min., carbon monoxide is added into the gas inspection device until the detector sends out a fire alarm signal or until the concentration of carbon monoxide reaches 100ul/l. Record the concentration value of carbon monoxide at the time at which the detector sends out an alarm signal. Such a concentration value is just the response threshold value (S) of detector.

4.5.1.8 The response threshold value (S) of the detector should meet the requirements set out in Table 9. Through the detector or its connected control and indicating equipment, it should be able to check the preset response threshold value (S_0) of detector.

Table 9 Fixed response threshold values

Response threshold value	Preset response threshold value (S_0)	Minimum response threshold value	Maximum response threshold value
ul/l	26 ~ 45	0.7 S_0	1.5 S_0

4.5.2 Measurement of adjustable response threshold value

4.5.2.1 The response threshold value of the detector should be continuously adjustable within the S_0 range specified in Table 10.

4.5.2.2 The detector should be adjusted to be the preset maximum and minimum response threshold values. Perform the test of response threshold value according to Subsections 4.5.1.1 - 4.5.1.7.

4.5.2.3 The response threshold value (S) of detector should meet the requirements of Table 10. Through the detector or its connected control and indicating equipment, it should be able to check the preset response threshold value of detector.

4.5.2.4 In addition to the specified special test requirements, the response threshold value testing of the detector can be performed at any single specified preset value.

Table 10 Adjustable response threshold values

Response threshold value	Preset response threshold value (S_0)	Minimum response threshold value	Maximum response threshold value
ul/l	23 ~ 66	0.7 S_0	1.5 S_0

4.5.3 Basic performances of independent-type detector

4.5.3.1 When a fire occurs in the area under surveillance and reaches the alarm, the detector should send out sound and light fire alarm signals.

4.5.3.2 At a distance of 3m from the detector, the sound pressure of the fire alarm signal should be greater than 60dB (weighted A).

4.5.3.3 The detector should possess a self-inspection function. During self-inspection, the detector should send out sound and light fire alarm signals.

4.5.3.4 For detectors with multiple indicating lights, the indicating lights should be identified and marked by different colours. The fire indicating light should be red, and the malfunction indicating light should be yellow. Detectors which use AC power should have a light indicating the AC power connection. The AC power indicating light is green.

4.5.3.5 The power of the detector should meet the following requirements:

4.5.3.6 For detectors powered by an internal battery and detectors powered by external battery, the capacity of the battery should be such that it guarantees the normal operation of the detector for not less than 5 months. Before the battery fails to make the detector operate in alarm mode, it should send out a malfunction signal, which should sound clearly different to the fire alarm signal. The malfunction signal should continuously sound at least once every minute over at least 7 consecutive days. Before this stage, the detector should be able to send out sound and light fire alarm signals. The fire alarm signal should last for at least 4 minutes.

4.5.3.7 For detectors operating through an external power supply that are equipped with an internal reserve battery, when the external power cannot operate normally, the detector should automatically switch to the reserve battery power supply. The reserve battery should guarantee the detector’s operation in surveillance mode for at least 72 hours. Before the battery fails to make the detector operate in alarm mode, it should send out a sounding malfunction signal that is clearly different to the fire alarm signal.

4.5.3.8 The reverse polarity of the power of detector should not damage the detector.

4.5.4 Interference of gas

Allow the detector to be exposed to gases with the concentrations specified in Table 11 for 1 hour. During the test period, the detector should not send out a fire alarm signal or malfunction signal.

Table 11 Interference Gas Concentrations

Type of Gas	Concentration Value (ul/l)
Methane	500
Butane	300
Heptane	500
Ethyl acetate	200
Isopropanol	200
Carbon dioxide	1000

4.5.5 Repetitiveness

Measure the response threshold value of the same detector in a random bearing and in a normal working position 6 times continuously. The ratio of its maximum response threshold value to the minimum response threshold value should not be greater than 1.6. The minimum response threshold value should not be smaller than 0.8 time of the preset response threshold value.

4.5.6 Bearing

Allow the detector rotate 45^{o} in the same direction around the vertical wire, repeating 8 times. Measure the response threshold value once each time. The ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6. The minimum response threshold value should not be less than 0.8 time of the preset response threshold value. In the subsequent tests, the corresponding bearings of the maximum response threshold value and the minimum response threshold value are called “the most unfavourable” and “the most favourable” bearings respectively.

4.5.7 Consistency of the distribution of response threshold values

Measure the response threshold value of each detector. The ratio of its maximum response threshold value to the average response threshold value should not be greater than 1.33. The ratio of the average response threshold value to the minimum response threshold value should not be greater than 1.5. The minimum response threshold value should not be less than 0.7 times the preset response threshold value. The maximum response threshold value should not be greater than 1.5 times the preset response threshold value.

4.5.8 Long-term stability

Put the detector into normal surveillance mode, and maintain in the said mode for 3 months. The detector should not send out a malfunction signal. After the test, when the response threshold value of the detector is compared with the response threshold value in the consistency test, the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6.

4.5.9 High concentration flooding

After the detector has been kept in carbon monoxide for 3 hours with its concentration increased to 500ul/l at a speed of 5ul/l/min., it should be kept under normal atmospheric conditions for 4 hours. After the test, compare the response threshold value of the detector with its response threshold value in the consistency test; the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6.

4.5.10 Carbon monoxide response sensitivity

Keep the detector keep in an environment with carbon monoxide at the concentration 70ul/l and other interference gases with the concentrations specified in Table 12 for 1 hour. During the test, the sample should continuously send out a fire alarm signal.

Table 12 Concentration of gas

Type of Gas	Concentration of gas ul/l
Hydrogen	20
Nitrogen oxide	10

4.5.11 Power source parameter fluctuation

The voltage of the power supply to detectors is -15% and +10% of the rated working voltage. Measure the response threshold value and compare with the response threshold value in the consistency test; the ratio of the maximum response threshold value to the minimum response threshold value should not be greater than 1.6. The minimum response threshold value should not be less than 0.8 times the preset response threshold value.

4.5.12 Airflow

When the detector is under the surrounding airflow velocities (0.2 ± 0.04) m/s and (1.0 ± 0.2) m/s, the response threshold values in “the most unfavourable” and “the most favourable” bearings are respectively measured, and are expressed as $S_{(0.2)\ max}$ [(1)], $S_{(0.2)\ min}$, $S_{(1.0)\ max}$ [(2)], and $S_{(1.0)\ min}$ respectively.

Note 1: The subscript 0.2 refers that the airflow velocity is (0.2 ± 0.04) m/s.

Note 2: The subscript 1.0 refers that the airflow velocity is (1.0 ± 0.2) m/s.

The response threshold value of detector should satisfy: $0.625 \cdot (S_{(0.2)\ max} + S_{(0.2)\ min}) / (S_{(1.0)\ max} + S_{(1.0)\ min}) \cdot 1.6$.

5 Test methods

5.1 General rules

5.1.1 Atmospheric conditions of test

In addition to the conditions specified in the related subsections, each item should be tested under the following atmospheric conditions:

— Temperature: $15^{o}C \sim 35^{o}C$;

— Humidity: 25%RH ~ 75%RH;

— Atmospheric pressure: 86kPa ~ 106kPa.

5.1.2 Normal surveillance mode of test

If the test methods stipulate that the detector (hereinafter referred to as "sample") should be connected to the control and indicating equipment provided by the manufacturer when in normal surveillance mode, then when there are no special requirements specified in the related subsections, the working voltage of the detector should be guaranteed to be the rated working voltage, and the working voltage should remain stable during the test period.

Note: The detector test report should specify the details of the control and indicating equipment connected during the test period, including their model numbers and manufacturers.

5.1.3 Tolerance

In addition to the conditions specified in the related subsections, the tolerance of each test data is ± 5%, and the deviation for the parameters of environmental conditions should meet the requirements set out in GB16838.

5.1.4 Pre-test inspection

5.1.4.1 Before testing, an appearance inspection should be carried out on the sample, which should meet the following requirements:

a) there should be no corrosion, displaced coating and bubbling on the surface of the sample, and no mechanical damage, such as scratches, cracks, etc.

b) there should be no loosening at the tightening parts.

5.1.4.2 Before testing, an inspection should be carried out on the sample according to the requirements specified in Subsections 4.1.1 - 4.1.6. Testing may not be carried out cannot until the sample meets the requirements.

5.1.5 Test samples (hereinafter referred to as "samples")

5.1.5.1 Point-type infrared flame detectors

10 detectors, which are given numbers before being tested.

5.1.5.2 Aspirated smoke detectors

4 detectors, (composed of all the parts of the detector, including the control and indicating equipment required for it to be connected), which are given numbers before being tested.

5.1.5.3 Image-type fire detectors

4 sets of detectors, which are given numbers before being tested.

5.1.5.4 Point-type carbon monoxide detectors

16 sets of detectors, which are given numbers before being tested.

5.1.6 Installation of detectors

The detectors should be installed according to the normal installation methods

specified by the manufacturer. If multiple methods for installation are provided in the manual, the installation method that is most unfavourable to the operation of the detectors should be adopted in the tests.

5.1.7 Test procedures

Tests should be performed according to the procedures specified in Table 13.

Table 13 Test procedures

Serial No	Subsection	Test item	Point-type infrared flame detector	Aspirated smoke detector	Image-type fire detector	Point-type carbon monoxide detector
1	5.2~5.5	Basic performance tests of detector	1~10	1~4	1~4	1~16
2	5.6	High temperature (running) test	2	3[a]	1	4
3	5.7	Low temperature (running) test	3	4	2	5
4	5.8	Steady-state damp heat (running) test				
5	5.9	Steady-state damp heat (durability) test				
6	5.10	Corrosion test				
7	5.11	Vibration (sine) (running) test				
8	5.12	Impact test				
9	5.13	Collision test				
10	5.14	Vibration (sine) (running) test				
11	5.15	Immunity test of radio-frequency electromagnetic radiation				
12	5.16	Immunity test of conductive interference of radio-frequency field sensor				
13	5.17	Immunity test of static discharge				
14	5.18	Immunity test of electric speedy transient pulses				
15	5.19	Immunity test of surging				

		(impact)				
16	5.20	Fire sensitivity test				
Note a: applies to point-type sampling method.						

5.2 Basic performance tests of point-type infrared flame detector

5.2.1 Measurement of response threshold values

5.2.1.1 Purpose

To measure the response threshold values of detectors.

5.2.1.2 Equipment

The test device of an infrared flame detector is equipment for special use. It is composed of an optical orbit, infrared light source, light dimmer, shutter, modulator, sample stand and other related parts (as shown in Figure 1). This equipment should satisfy the test requirements set out in Subsections 5.2.1 -5.2.7.

1 – flame; 2 – methane gas burning furnace, 3 – modulator; 4 – light dimmer; 5 – shutter; 6 – sample; 7 – sample stand; 8 – receiving surface; 9 – infrared filter; 10 – sensor; 11 – adjustable mechanism; 12 – optical orbit; 13 – radiation meter

Figure 1 Structural diagram of test device of infrared flame sample

5.2.1.2.1 Optical orbit

Main technical parameter

Length: 2m

Flatness: less than 0.04mm

5.2.1.2.2 Infrared light source

The infrared light source adopts the flame produced from burning methane with purity not lower than 99.9%. During the test process, the volume change of the light source radiation energy should not be greater than ± 5%.

5.2.1.2.3 Light dimmer

The light dimmer has the function of weakening the infrared radiation. The neutral light dimmer adopted in this test device can go through the infrared radiation with a wavelength greater than 850mm and smaller than 1050mm. Its transmittance depends on the concrete test requirements.

5.2.1.2.4 Modulator (selective)

The modulator is composed of a chopper and direct current (DC) electric motor. The DC electric motor drives the chopper to rotate by the required frequency, and

modulates the radiation produced by flame burning (as shown in Figure 2).

Unit: mm

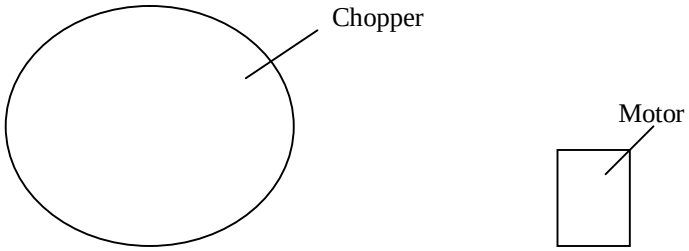


Figure 2 Structural diagram of modulator

5.2.1.2.5 Installation stand

The installation stand can be installed with samples of different model numbers, and can slide along the optical orbit. The height of the stand is adjustable. It can also rotate by taking the perpendicular of the axle centre of optical orbit as the axle centre. The stand itself should perform blackening treatment. There should be no reflection on the surface.

5.2.1.3 Methods

5.2.1.3.1 Installation of sample

Install the sample on the test device stand, so that it is situated on the same horizontal line as the light source, enabling it to receive the greatest amount of infrared light radiation and connect with the control or indicating equipment. It should be in normal surveillance mode and should be maintained stable.

Use a radiation meter to measure the radiation energy of the light source at 1500mm distance from the light source.

5.2.1.3.2 Measurement of D value of the sample at the response point

Repeatedly move the installation stand of the sample along the optical obit. Ensure that the sample is at a position with a reliable response within 30 seconds and at the greatest distance from the light source. Measure the distance between the point and the light source, which is simply the D value of the sample at the response point.

According to the optical principles, the square of the distance K between the response point and light source of the sample are inversely proportional to the effective power S of light source on the radiation of the sensing surface of sample, implying that:

$$S = K / D^2$$ (K is the transformation constant)

For samples with random response properties, its response threshold value should first be measured repeatedly at least 6 times until the change of the response threshold value of the next measurement does not exceed the average of the response threshold values measured in the previous several times by 10%.

For detectors that require a flicker frequency, the modulator should be adjusted to the flicker frequency provided by the manufacturer (including 0).

5.2.1.3.3 Calculation of response threshold ratio

Compare the response threshold values measured 2 times, the greater one being S_{max} and the smaller one being S_{min}, corresponding to D_{max} and D_{min} respectively. The response threshold ratio is $S_{max} : S_{min} = D^2_{max} : D^2_{min}$: .

5.2.2 Consistence test

5.2.2.1 Purpose

To test the distribution consistency of response threshold values of the detector.

5.2.2.2 Methods

Measure the D values of 10 samples at the response points according to the methods specified in Subsection 5.2.1.3. Among these values, the maximum value is D_{max}, the minimum value is D_{min}, and the calculated response threshold ratio is $S_{max} : S_{min}$.

5.2.2.3 Requirements

The detector should meet the requirements set out in Subsection 4.2.1.

5.2.2.4 Equipment

Test device of infrared flame sample.

5.2.3 Repetitiveness test

5.2.3.1 Purpose

To test the stability of the detector during continuous operation.

5.2.3.2 Methods

According to the methods specified in Subsection 5.2.5.3, the D value of sample at the response point in a random bearing is measured 6 times continuously under normal operation. Among these values, the maximum value is D_{max}, the minimum value is D_{min}, and the calculated response threshold ratio is $S_{max} : S_{min}$.

5.2.3.3 Requirements

The detector should meet the requirements set out in Subsection 4.2.2.

5.2.3.4 Test equipment

Test equipment of infrared flame sample.

5.2.4 Bearing test

5.2.4.1 Purpose

To confirm the visual cone angle of the detector and to test the response performance of a sample at different angles within the visual cone angle.

5.2.4.2 Methods

Measure the D value of the sample at the response point according to the methods specified in Subsection 5.2.1.3. After taking each measurement, the sample should be rotated at an angle, making the included angles between the axes and

optical axes of detectors 0^o, 0^o, 15^o, 30^o and 45^o. Among these values, the maximum value is D_{max}, the minimum value is D_{min}, and the calculated response threshold ratio is S_{max} : S_{min}.

5.2.4.3 Requirements

The detector should meet the requirements set out in Subsection 4.2.3.

5.2.4.4 Equipment

Test device of infrared flame sample.

5.2.5 Electrification test

5.2.5.1 Purpose

To test the stability of the continuous operation of the detector when operating under normal atmospheric conditions.

5.2.5.2 Methods

Allow the sample to operate under normal surveillance mode for 7 days continuously. After the test, the D value of the sample at the response point should be measured according to the methods specified in Subsection 5.2.1.3. This value is compared with the D value of this sample at the response point in the consistency test. The maximum value is D_{max}, the minimum value is D_{min}, and the calculated response threshold ratio is S_{max} : S_{min}.

5.2.5.3 Requirements

The detector should meet the requirements set out in Subsection 4.2.4.

5.2.5.4 Test equipment

Test device of infrared flame sample.

5.2.6 Power-source parameter fluctuation test

5.2.6.1 Purpose

To test the adaptability of the detector to the change of power-source parameter.

5.2.6.2 Methods

Allow the rated voltage of the working voltage ratio of the sample to be reduced by 15% and increased by 10% respectively. Measure the D value of the sample at the response point according to the methods specified in Subsection 5.2.1.3. This value is compared with the D value of this sample at the response point in the consistency test. Among these 3 values, the maximum value is D_{max}, the minimum value is D_{min}, and the calculated response threshold ratio is S_{max} : S_{min}.

5.2.6.3 Requirements

The detector should meet the requirements set out in Subsection 4.2.5.

5.2.4.4 Equipment

Test device of infrared flame sample.

5.2.7 Environmental beam interference test

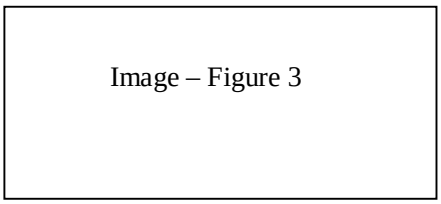
5.2.7.1 Purpose

To test the performance stability of the detector under environmental beam action.

5.2.7.2 Methods

5.2.7.2.1 Installation of sample

The environmental beam interference simulation device is placed between the sample and the light source of the test device of the ultraviolet flame sample (as shown in Figure 3), making it at a distance of 500mm from the sample.



1 – incandescent lamps; 2 – ringed fluorescent lamp; 3 -- sample

Figure 3 Structural diagram of environmental beam interference simulation device

5.2.7.2.2 Test procedures:

a) all of the lamps should be turned off;

b) turn on two 25W incandescent lamps (colour temperature at 2850K ± 100K) for 1 second and then turn off for 1 second, and repeat 20 times;

c) allow a 30W ring-shaped fluorescent lamp with a diameter of 308mm to be turned on for 1 second and turned off for 1 second, and repeat 20 times;

d) allow the abovementioned incandescent lamps and fluorescent lamp to be turned on for 2 hours. Measure the D value at the response point according to the methods specified in Subsection 5.2.1.3;

e) all of the lamps should be turned off;

f) measure the D value at the response point according to the methods specified in Subsection 5.2.1.3.

5.2.7.2.3 Calculation of response threshold ratio

Measure the D value of sample at the response point according to the methods specified in Subsection 5.2.1.3. This value is compared with the D value of this sample at the response point in the consistency test. The maximum value is D_{max}, the minimum value is D_{min}, and the calculated response threshold ratio is S_{max} : S_{min}.

5.2.7.3 Requirements

The detector should meet the requirements set out in Subsection 4.2.6.

5.2.7.4 Test equipment

Test device of infrared flame sample, and the environmental beam interference simulation device.

5.3 Basic performance tests of aspirated smoke detector

5.3.1 Performance tests of main parts

5.3.1.1 Purpose

To inspect the performances of the main parts of the detector.

5.3.1.2 Methods

5.3.1.2.1 Inspect and record the colour identification, visibility and function of the indicating light and displayer.

5.3.1.2.2 Inspect and record the parameter indication of the fuse of the sample, and its actual capacity value.

5.3.1.2.3 Inspect and record the indication of different switches and buttons on the sample.

5.3.1.2.4 Inspect and record the indication of the wiring terminal of the sample.

5.3.1.2.5 Inspect and record the marking of the aspiration pipe of the sample.

5.3.1.2.6 Put the sample into fire alarm mode. Measure and record the sound pressure grade of the sound alarm signal of the sample, and then reduce the voltage of power to 85% of the rated voltage. Observe and record the sound alarm signal of the sample.

5.3.1.3 Requirements

The detector should meet the requirements set out in Subsection 4.3.1.

5.3.2 Basic performance tests

5.3.2.1 Purpose

To inspect the basic performance of the detector

5.3.2.2 Methods

5.3.2.2.1 Allow the smoke parameter sample of the sample acquired at any sampling hole to reach the concentration with alarm turned on. Observe and record any changes that appear, the fire alarm situation and time interval of the sample.

5.3.2.2.2 Allow the aspiration flow of the aspiration pipe of the detector to be greater than 150% of normal aspiration flow and lower than 50% of normal aspiration flow respectively. Observe and record the sample's malfunction sound, light signal, and the time interval during malfunction.

5.3.2.2.3 At 1m directly in front of the sample, the sound pressure grades (weighted A) of the fire alarm sound signal and malfunction sound signal should be measured respectively.

5.3.2.2.4 Allow signals to be sent out by the sample. Observe and record the fire alarm sound and light signal sent out by the sample, as well as timing. Manually disable the fire alarm sound signal. Allow the detector with multiple fire alarm function to send out fire alarm signal. Inspect the noise damping function and the fire alarm function of the sample.

5.3.2.2.5 Test the function of each malfunction item of the sample. Observe and

record the sample's malfunction sound, light signal, the time interval during malfunction, and classify the types of malfunction. Manually remove the malfunction sound signal, and allow another part send out the malfunction signal. Inspect the noise damping function and the sample's malfunction sound signal's restart function.

5.3.2.2.6 Place the sample firstly into malfunction mode, and then into fire alarm mode. Observe and record the alarm priority of the sample.

5.3.2.2.7 When the sample is operating in normal surveillance mode, cut off the main power source of the sample. Allow the sample to be supplied with reserve power. Resume the main power supply again. Inspect and record the transformation of the main/reserve power source of the sample, the indication of the modes, and the over-current protection of the main power source.

5.3.2.2.8 Allow the reserve power of the sample to be discharged to the end voltage, and then charged for 24 hours. Turn off the main power of the sample. After 8 hours, place the detector into fire alarm mode for 30 minutes. Observe and record the modes of the sample respectively.

5.3.2.2.9 Manually operate the self-inspection mechanism of the sample. Observe and record the fire alarm sound, light signal and output junction action. For samples with self-inspection time exceeding 1 minute or that are unable to stop the self-inspection function automatically, place any single non-self-inspection part into fire alarm mode during the self-inspection period. Observe and record details about the fire alarm.

5.3.2.2.10 Observe and record the operation for the restoration of the sample.

5.3.2.2.11 Observe and record the power on/off of the sample.

5.3.2.3 Requirements

The basic performance of the sample should meet the requirements set out in Subsection 4.3.2.

5.3.3 Repetitiveness test

5.3.3.1 Purpose

To inspect the consistence of the response threshold values of a single detector during multiple alarms.

5.3.3.2 Methods

5.3.3.2.1 Measure the response threshold value of the sample at a random sampling hole of a normal operating position 6 times, one after the other.

5.3.3.2.2 Among the 6 response threshold values, the maximum value is expressed as m_{max}, and the minimum value is expressed as m_{min}.

5.3.3.3 Requirements

The detector should meet the requirements set out in Subsection 4.3.4.

5.3.3.4 Equipment

Inspection device of the response threshold value, with its measurement range at 0.01%obs/m ~ 20%obs/m and measurement error smaller than ± 5%.

5.3.4 General tests

5.3.4.1 Purpose

To test the consistency of the response threshold values of the detector.

5.3.4.2 Methods

5.3.4.2.1 Sequentially measure the response threshold values of 4 samples according to the requirements set out in Subsections 5.1.2 and 5.1.6.

5.3.4.2.2 Calculate the average value of the response threshold values of the 4 samples, and express it by m_{rep}.

5.3.4.2.3 Among the 4 samples, the maximum response threshold value is expressed as m_{max}, and the minimum response threshold value is expressed as m_{min}.

5.3.4.3 Requirements

The detector should meet the requirements set out in Subsection 4.3.5.

5.3.4.4 Equipment

Inspection device of response threshold value, with its measurement range at 0.01%obs/m ~ 20%obs/m and measurement error smaller than ± 5%.

5.3.5 Power-source parameter fluctuation test

5.3.5.1 Purpose

To inspect the stability of the response threshold value of the detector under the fluctuation condition of power-source parameter.

5.3.5.2 Methods

5.3.5.2.1 Test-type detector

Supply power to the sample according to the upper and lower limits of the power supply parameter as specified by the manufacturer (e.g. if no condition is specified, the upper and lower limit parameters are 110% and 85% of the rated parameter respectively), and measure the response threshold values respectively. These values are compared with the response threshold value of this sample in the consistency test. Among these 3 values, the maximum response threshold value is expressed as m_{max}, and the minimum response threshold value is expressed as m_{min}.

5.3.5.2.2 Detect-alarm-type detector

Adjust the test device. Measure the response threshold values respectively after allowing the input voltages of the samples be 187V (50Hz) and 242V (50Hz), or according to the upper and lower limits of the rated working voltage specified by the manufacturer. Compare the measured response threshold values with the response threshold value of this sample in the consistency test. Among these 3 values, the maximum response threshold value is expressed as m_{max}, and the minimum response threshold value is expressed as m_{min}.

5.3.5.3 Requirements

The detector should meet the requirements set out in Subsection 4.3.6.

5.3.4.4 Equipment

Inspection device of response threshold value, with its measurement range at 0.01%obs/m ~ 20%obs/m and measurement error smaller than ± 5%.

5.3.6 Insulation resistance test

5.3.6.1 Purpose

To inspect the insulation performance of the detector.

5.3.6.2 Methods

Apply 500V ± 50V DC voltage at the following parts of the sample respectively. After the situation is sustained for 60s ± 5s, measure the insulation resistance values:

a. between the frame and the externally charged terminal with insulation requirement;

b. between the power plug (or the wiring terminal of power source) and the frame (the power switch is situated at the connected position, but the power plug is not inserted in the electric network).

5.3.6.3 Requirements

The detector should meet the requirements set out in Subsection 4.3.7.

5.3.4.4 Test equipment

The insulation resistance test equipment should meet the following technical requirements:

— test voltage: DC 500V ± 50V (the earth terminal is a metal plate);

— measurement range: OM• ~ 500 OM• ; minimum graduation: 0.1 M• ; timing: 60s ± 5s.

5.3.7 Current leakage test

5.3.7.1 Purpose

To inspect the current leakage resistance of the detector.

5.3.7.2 Methods

Place the sample into normal surveillance mode. Adjust the voltage of the main power supply to be 1.06 times of the rated voltage. Measure and record the total current leakage value.

5.3.7.3 Requirements

The detector should meet the requirements set out in Subsection 4.3.8.

5.3.7.4 Test equipment

The circuit with the measured current leakage meeting the requirements set out in Annex G of GB4706.1.

5.3.8 Power source transient test

5.3.8.1 Purpose

To inspect the resistance of the detector to power source transient interference.

5.3.8.2 Methods

5.3.8.2.1 Connect the sample with the equivalent load according to the requirements in normal surveillance mode. Connect the sample to the power source transient test device, under normal surveillance mode.

5.3.8.2.2 Turn on the test device. Allow the main power source of the detector perform continuous connection 500 times according to the fixed procedures of "connection (9s) ~ disconnection (1s)." During the test period, observe and record the working mode of the sample. After the test, a function test is performed according to Subsection 5.2.

5.3.8.2.3 Measure the response threshold value according to the requirements. The measured response threshold value is compared with the response threshold value of this sample in the consistency test. The great response threshold value is expressed as m_{max}, and the small response threshold value is expressed as m_{min}.

5.3.8.3 Requirements

The detector should meet the requirements set out in Subsection 4.3.9.

5.3.8.4 Test equipment

The power source device that can create the test conditions meeting the requirements set out in Subsection 5.3.8.2.

5.3.9 Immunity tests of temporary reduction, short-term termination and voltage change

5.3.9.1 Purpose

To inspect the immunity ability under temporary reduction, short-term termination and change of voltage to the detector (e.g. the change is caused by the actions of load switch and component protection in the main distribution network).

5.3.9.2 Methods

5.3.9.2.1 According to normal surveillance mode, the sample is connected with the equivalent load, and with the falling and termination test device of main voltage, making it operate in normal surveillance mode.

5.3.9.2.2 Allow the main voltage to fall by 60%, and sustain for 20 minutes. Repeat 10 times. Allow the main voltage to fall by 100%, and sustain for 10 minutes. Repeat the action 10 times. During the test period, observe and record the working mode of the sample. After the test, a function test is performed according to Subsection 5.3.2.

5.3.9.2.3 Measure the response threshold value according to the requirements. The measured response threshold value is compared with the response threshold value of this sample in the consistency test. Among the values, the great response threshold value is expressed as m_{max}, and the small response threshold value is expressed as

m_{min}.

5.3.9.3 Requirements

The detector should meet the requirements set out in Subsection 4.3.2.

5.3.9.4 Test equipment

The test equipment should meet the related requirements of GB16838.

5.4 Basic performance tests for image-type fire detector

5.4.1 Response threshold value test

5.4.1.1 Purpose

To inspect the response time of the detector to the specified test fire, and its positioning accuracy.

5.4.1.2 Methods

5.4.1.2.1 Take a set of samples and 4 sets of lenses of different focuses (4mm, 6mm, 8mm and 12mm) to perform the test.

5.4.1.2.2 Use a lens with a focus 4mm. After the sample is connected with the matched control and indicating equipment, allow the system to operate in surveillance mode.

5.4.1.2.3 Place the test burning plate 25m from the front end of the sample. Allow the test burning plate to be situated within the visual field of the video camera. Ignite the burning liquid. After the height of the flame stabilises, Grade 1 fire prevention operation is performed. Observe and record the sound and light alarm situations, the alarm response time and the fire coordinates.

5.4.1.2.4 Place the test burning plate 25m from the front end of the sample. Allow the test burning plate to be situated within the visual field of the video camera. Ignite the burning liquid. After the height of the flame stabilises, perform Grade 2 fire prevention operation. Observe and record details of the sound and light alarm, the alarm response time and the fire coordinates.

5.4.1.2.5 Use lenses of different focuses (4mm, 6mm, 8mm and 12mm) and pick, from Table 8, the dimensions of the corresponding burning plates. Repeat the test procedures set out in Subsections 5.4.1.2.2 ~ 5.4.1.2.4.

5.4.1.2.6 Positioning accuracy

$|\Delta X| = |x1 - x2|, |\Delta Y| = |y1 - y2|$

In the test, (x_1, y_1) are the coordinates of the centre of burning plate, and (x_2, y_2) are the coordinates of the displayed fire of the control mainframe when the alarm is sent out.

5.4.1.3 Requirements

The response threshold value of the detector should meet the requirements set out in Subsection 4.4.1.

5.4.1.4 Test equipment

The test equipment is shown in Figure 4. It comprises the test turning plate, timer, measuring scale, installation stand, etc.:

a) Test flame

The test flame adopts the burning flame of a blended fluid of kerosene and gasoline at a blending ratio of 10:1.

b) Test burning plate

The dimensions of test burning plate are shown in Table 8. The depth of the burning plate is greater than 0.02m.

c) Installation height

The installation height of the sample is 4m. At the same time, the sample should be able to rotate at the angle of 90^{o} upward and downward, and 180^{o} leftward and rightward.

d) Test place

The test place is a space with a length no less than 25m, width no less than 5m, and height no less than 6m, as shown in Figure 4.

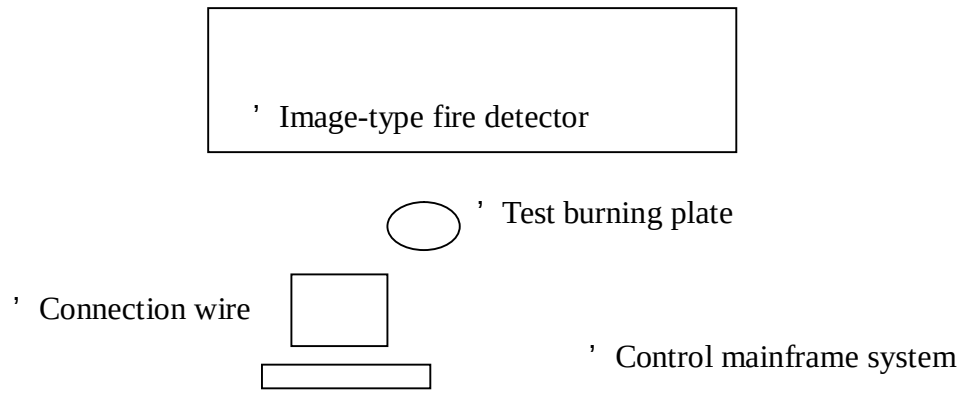


Figure 4 Schematic diagram of test equipments and place

5.4.2 Repetitiveness test

5.4.2.1 Purpose

To inspect the stability of the continuous operation of the detector.

5.4.2.2 Methods

5.4.2.2.1 Connect the sample to the matched control and indicating equipment.

5.4.2.2.2 Measure the response time 3 times according to the requirements set out in Subsection 5.4.1.2. The time interval between two measurements should not be less than 10 minutes, but should not be greater than 1 hour. After the last measurement, the mode of the sample should remain unchanged.

5.4.2.2.3 Supply uninterrupted power to the sample for 7 days, after which time the response time should be measured 3 times according to the requirements set out n Subsection 5.4.1.2**.** The time interval between two measurements should not be less than 10 minutes, but should not be greater than 1 hour.

5.4.2.3 Requirements

The detector should meet the requirements set out in Subsection 4.4.2.

5.4.3 Power-source parameter fluctuation test

5.4.3.1 Purpose

To inspect the adaptability of the detector to the change of power-source parameter.

5.4.3.2 Test methods

5.4.3.2.1 Sample supplied with power of DC constant voltage

Connect the sample to the matched control and indicating equipment. Reduce the rated working voltage by 15% and increase by 10% respectively, or measure the response time of the sample according to the upper and lower limits of the rated working voltage specified by the manufacturer and according to the requirements set out in Subsection 5.4.1.2.

5.4.3.2.2 Sample supplied with power of pulse voltage

Pass the sample through a copper double twisted lead wire with a length of 1000m and cross-section area of 1.0mm^2 (or according to the conditions provided by the manufacturer), and connect with the matched control and indicating equipment. Reduce the rated working voltage by 15% and increase by 10% respectively, or measure the response time of sample according to the upper and lower limits of the rated working voltage specified by the manufacturer.

5.4.3.3 Requirements

The detector should meet the requirements set out in Subsection 4.4.3.

5.4.4 Environmental beam interference test

5.4.4.1 Purpose

To test the performance stability of the detector under environmental beam action.

5.4.4.2 Methods

Fix the sample to the fixed surface of the installation stand according to the normal operating position, and connect it to the control and indicating equipment, so it is under normal surveillance mode. Place the environmental beam interference simulation device (simply called beam interference device, as shown in Figure 5) at a distance of 500mm from the sample.

Test procedures:

a) none of the lamps are turned on;

b) use two 25W incandescent lamps (the colour temperature at 2850K ± 100K), which should be turned on for 1 second and turned off for 1 second, repeating 20 times.

c) turn on a 30W ring-shaped fluorescent lamp at a diameter of 308mm for 1

second then turn off for 1 second, and repeat 20 times.

d) turn on the abovementioned incandescent lamps and fluorescent lamp for 2 hours. Measure the response threshold value of the sample during the test period.

e) none of the lamps are turned on;

f) measure the response threshold value of sample according to the methods specified in Subsection 5.4.1.2.

5.4.4.3 Requirements

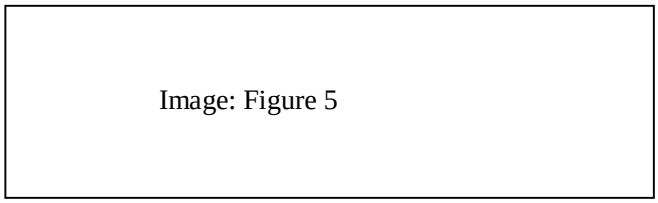
The detector should meet the requirements set out in Subsection 4.4.4.

5.4.4.4 Test equipment

a) 25W incandescent lamps are installed at the place shown in Figure 5. Before use, they should undergo charging for 1 hour. The accumulated time of use should not exceed 750 hours.

b) 30W ring-shaped fluorescent lamp is installed at the place shown in Figure 5. Before use, it should undergo charging for 100 hours. The accumulated time of use should not exceed 2000 hours.

Unit: mm



1 – incandescent lamps; 2 -- ring-shaped fluorescent lamp; 3 – sample

Figure 5 Structural diagram of environmental beam interference test equipment

5.5 Basic performance tests of point-type carbon monoxide fire detector

5.5.1 Basic performance tests of independent detector

5.5.1.1 Purpose

To inspect the basic performance of independent detectors

5.5.1.2 Methods

5.5.1.2.1 Place the sample in fire alarm mode. Observe and record the sound and light alarm signals of the sample.

5.5.1.2.2 At 1m right in front of the sample, measure the sound pressure grade (weighted A) of the sound alarm signal.

5.5.1.2.3 Operate the self-inspection of the sample. Observe and record the sound and light alarm signals of the sample.

5.5.1.2.4 Observe and record the colour identification of the indicating light of the sample.

5.5.1.2.5 For alarms that are not supplied with power from an internal battery, the

polarity of the external power wire should be reversely connected. Maintain this situation for 2 hours unless the alarm sends out a malfunction or fire alarm signal. If the alarm is interconnected during use, the connection wire between them should also undergo reverse connection.

5.5.1.2.6 For alarms that are powered by the battery (including the reserve battery), if permitted by the structure of the alarm, the battery should be reversely connected with the connection terminal of the battery on the alarm. Maintain this situation for 2 hours unless the alarm sends out a malfunction or fire alarm signal.

5.5.1.2.7 Supply an alarm that is powered by battery (including reserve battery) with a malfunction voltage. Observe whether the alarm sends out a malfunction signal.

5.5.1.2.8 Following the above operation, the power of the alarm should be reconnected. Inspect the basic functions of the sample according to the requirements set out in Subsections 5.5.1.2.1 - 5.5.1.2.6.

5.5.1.3 Requirements

The detector should meet the requirements set out in Subsection 4.5.3.

5.5.2 Gas interference test

5.5.2.1 Purpose

To inspect the anti-misdeclaration ability of detector when exposed to non-carbon-monoxide gas with specific concentration.

5.5.2.2 Methods

5.5.2.2.1 Place the sample in normal surveillance mode and allow it to operate stably for at least 15 minutes according to Subsections 4.5.1.2 - 4.5.1.3. If the response threshold value of the sample is adjustable, the response threshold value of the sample should be preset to the smallest value.

5.5.2.2.2 Exposed the sample to the gas with concentration specified in Table 11 for 1 hour.

5.5.2.3 Requirements

The detector should meet the requirements set out in Subsection 4.5.4.

5.5.3 Repetitiveness test

5.5.3.1 Purpose

To inspect the consistency of the response threshold values of the detector over several alarm signals.

5.5.3.2 Methods

5.5.3.2.1 Measure the response threshold value of a sample in a random bearing of a normal operating position 6 times continuously according to the requirements set out in Subsection 4.5.1 or 4.5.2.

5.5.3.2.2 Among the 6 response threshold values, the maximum value is expressed

as S_{max}, and the minimum value is expressed as S_{min}.

5.5.3.3 Requirements

The detector should meet the requirements set out in Subsection 4.5.5.

5.5.4 Bearing test

5.5.4.1 Purpose

To inspect the aspiration performance of the detector in different bearings, and to confirm "the most favourable" and "the most unfavourable" bearings for the response of detector.

5.5.4.2 Methods

5.5.4.2.1 Measure the response threshold value according to the requirements set out in Subsection 4.5.1 or 4.5.2. After a test is completed once, the sample should rotate 45^{o} in the same direction around its vertical axis. The measurement should be taken 8 times.

5.5.4.2.2 Record the corresponding bearings of the maximum response threshold value and the minimum response threshold value of the sample. In the subsequent tests, these two bearings are called "the most unfavourable" and "the most favourable" bearings respectively.

5.5.4.3 The maximum response threshold value is expressed as S_{max}, and the minimum response threshold value is expressed as S_{min}.

5.5.4.4 Requirements

The detector should meet the requirements set out in Subsection 4.5.6.

5.5.5 Consistency test

5.5.5.1 Purpose

To inspect the consistency of the response threshold values of multiple detectors.

5.5.5.2 Methods

5.5.5.2.1 Sequentially measure the response threshold values of 16 samples according to the requirements set out in Subsection 4.5.1 or 4.5.2.

5.5.5.2.2 Calculate the average value of the response threshold values of the 16 samples, and express it by S_{rep}.

5.5.5.2.3 Among the 16 samples, the maximum response threshold value is expressed as S_{rmax}, and the minimum response threshold value is expressed as S_{rmin}.

5.5.5.3 Requirements

The detector should meet the requirements set out in Subsection 4.5.7.

5.5.6 Long-term stability

5.5.6.1 Purpose

To inspect the long-term running stability of the detector under normal atmospheric conditions.

5.5.6.2 Methods

5.5.6.2.1 Under the atmospheric conditions specified in Subsection 5.1.1, place the sample in normal surveillance mode according to the requirements set out in Subsection 5.1.2, and maintain the situation for 3 months.

5.5.6.2.2 Measure the response threshold value of sample according to the requirements set out in Subsection 4.5.1 or 4.5.2. The value should be compared with the response threshold value of this sample in the consistency test. Among them, the maximum response threshold value is expressed as S_{max}, and the minimum response threshold value is expressed as S_{min}.

5.5.6.3 Requirements

The detector should meet the requirements set out in Subsection 4.5.8.

5.5.7 High concentration flooding test

To inspect the adaptability of the detector to operation under high-concentration carbon monoxide gas.

5.5.7.2 Methods

5.5.7.2.1 The sample should be installed in the gas inspection device according to the requirements set out in Subsection 5.1.2.

5.5.7.2.2 Before testing, the concentration of carbon monoxide inside the gas test device and the sample should be lower than 5ul/l. Allow the sample to operate stably under normal surveillance mode for at least 15 minutes.

5.5.7.2.3 Increase the concentration of carbon monoxide inside the gas inspection device to 500ul/l at a speed of 5ul/l/min., and maintain the situation for 2 hours.

5.5.7.2.4 After the sample has resumed to normal atmospheric conditions for 4 hours, the response threshold value of the sample should be measured according to the requirements set out in Subsection 4.5.1 or 4.5.2. Measure the response threshold value of the sample according to the requirements set out in Subsection 4.5.1 or 4.5.2. The value should be compared with the response threshold value of this sample in the consistency test. Among them, the great response threshold value is expressed as S_{max}, and the small response threshold value is expressed as S_{min}.

5.5.7.3 Requirements

The detector should meet the requirements set out in Subsection 4.5.9.

5.5.8 Carbon monoxide response sensitivity

5.5.8.1 Purpose

To inspect the response sensitivity of the detector when coexisting with carbon monoxide and other gases.

5.5.8.2 Methods

5.5.8.2.1 Install the sample in the gas inspection device according to the requirements set out in Subsection 5.1.2.

5.5.8.2.2 Before testing, the concentration of carbon monoxide inside the gas test device and the sample should be lower than 5ul/l. Allow the sample to work stably under normal surveillance mode for at least 15 minutes.

5.5.8.2.3 Increase the concentration of carbon monoxide inside the gas inspection device to 70ul/l. Allow other interference gases keep at the concentrations given in Table 10 for 1 hour.

5.5.8.3 Requirements

The detector should meet the requirements set out in Subsection 4.5.10.

5.5.9 Power-source parameter fluctuation test

5.5.9.1 Purpose

To inspect the stability of response threshold value of the detector under the fluctuation condition of power-source parameter.

5. 5.9.2 Methods

5.5.9.2.1 Detectors supplied with constant voltage power

Supply power to the sample according to the upper and lower limits of the power supply parameter specified by the manufacturer (e.g. if there is no condition specified, the upper and lower limit parameters are 110% and 85% of the rated parameter respectively), and measure the response threshold values respectively according to the requirements set out in Subsection 4.5.1 or 4.5.2. These values should be compared with the response threshold value of this sample in the consistency test. Among these 3 values, the maximum response threshold value is expressed as S_{max}, and the minimum response threshold value is expressed as S_{min}.

5.5.9.2.2 Detectors supplied with power of pulse voltage

Allow the sample to pass the copper-made twin twisted lead wire at a length of 1000m and cross-section area of 1.0mm^2 (or according to the conditions provided by the manufacturer), and connect with the matched control and indicating equipment. The sample should be in normal surveillance mode. Adjust the test device. Allow the input voltages of the control and indicating equipment to be 187V (50Hz) and 242V (50Hz) respectively. Measure the response threshold values of the sample respectively according to the requirements set out in Subsection 4.5.1 or 4.5.2. These values should be compared with the response threshold value of this sample in the consistency test. Among these 3 values, the maximum response threshold value is expressed as S_{max}, and the minimum response threshold value is expressed as S_{min}.

5.5.9.3 Requirements

The detector should meet the requirements set out in Subsection 4.5.11.

5.5.10 Airflow test

5.5.10.1 Purpose

To test the immunity of the detector to airflow interference and the stability of

response threshold values under the airflow interference condition.

5.5.10.2 Test methods

Under the condition that the airflow velocity around the sample is (0.2 ± 0.04) m/s, the response threshold values in "the most unfavourable" and "the most favourable" bearings should be respectively measured, being expressed as $S_{(0.2)\ max}^{(1)}$, $S_{(0.2)\ min}$ respectively. Under the condition that the airflow velocity surrounding the sample is (1.0 ± 0.02) m/s, the above test should be repeated. The response threshold values are expressed as $S_{(1.0)\ max}^{(2)}$, and $S_{(1.0)\ min}$ respectively.

Note 1: The subscript 0.2 refers that the airflow velocity is (0.2 ± 0.04) m/s.

Note 2: The subscript 1.0 refers that the airflow velocity is (1.0 ± 0.2) m/s.

5.5.10.3 Requirements

The detector should meet the requirements set out in Subsection 4.5.12.

5.6 High temperature (running) test

5.6.1 Purpose

To inspect the adaptability of the detector when used in high temperatures.

5.6.2 Methods

5.6.2.1 Place the sample and its base in the high temperature test box. Connect to the control and indicating equipment, making them operate under normal surveillance mode.

5.6.2.2 Under the condition that the temperature is 23°C ± 5°C, the temperature is increased to 55°C ± 2°C at a temperature increase speed of no greater than 0.5°C/min. Maintain this condition for 2 hours. During the test period, observe and record the working mode of the sample.

5.6.2.3 After the test, the sample should be removed, and placed under normal atmospheric conditions for 1 hour, after which time the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.6.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.7.1.

5.6.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.7 Low temperature (running) test

5.7.1 Purpose

To inspect the adaptability of the detector when used in low temperatures.

5.7.2 Methods

5.7.2.1 Place the sample and its base in the low temperature test box. Connect to the control and indicating equipment, making them operate under normal surveillance mode.

.

5.7.2.2 Retain the sample under a temperature of 15°C - 20°C with a relative humidity not greater than 70%, for 1 hour, after which time the temperature should be reduced to -10°C ± 3°C at a temperature reduction speed of no greater than 0.5°C/min. Retain at this condition for 2 hours (the sample should not freeze). During the test period, observe and record the operation of the sample.

5.7.2.3 When the test is complete, the sample should be removed and placed in normal atmospheric conditions for 1 hour, after which time the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.7.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.7.1.

5.7.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.8 Steady-state damp heat (running) test

5.8.1 Purpose

To inspect the adaptability of the detector when used in environments with high humidity.

5.8.2 Methods

5.8.2.1 Place the sample and its base in the damp heat test box. Connect to the control and indicating equipment under normal surveillance mode.

5.8.2.2 Adjust the damp heat test box. Retain the sample under a temperature of 40°C ± 2°C and relative humidity of 93% ± 3% for 4 days continuously. During the test period, observe and record the operation of the sample.

5.8.2.3 After the test, the sample should be removed and placed under normal atmospheric conditions for 1 hour, after which time the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.8.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.7.1.

5.8.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.9 Steady-state damp heat (durability) test

5.9.1 Purpose

To inspect the resistance of the detector when used in environments of high humidity.

5.9.2 Methods

5.9.2.1 Place the sample and its base in the damp heat test box.

5.9.2.2 Adjust the damp heat test box. Retain the sample under a temperature of $40^{o}C \pm 2^{o}C$ and relative humidity of 93% ± 3% for 21 days continuously.

5.9.2.3 After the test, remove the sample and placed under normal atmospheric conditions for 1 hour, after which time the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.9.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.7.2.

5.9.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.10 Corrosion test

5.10.1 Purpose

To inspect the corrosion resistance of the detector.

5.10.2 Methods

5.10.2.1 Place the sample and its base in the corrosion test box.

5.10.2.2 Apply the following tests of astringent grade towards the sample:

a) Temperature: $25^{o}C \pm 2^{o}C$;

b) Relative humidity: 90% ~ 96%;

c) SO_2 concentration: $(25 + 5) \times 10^{-6}$ (specific volume);

d) Test period: 21 days.

5.10.2.3 After the test, remove the sample and placed under normal atmospheric conditions for 1 hour, after which time the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.10.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.7.2.

5.10.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.11 Vibration (sine) (running) test

5.11.1 Purpose

To inspect the ability of the detector after having been under the influence of vibration for a long time.

5.11.2 Methods

5.11.2.1 Place the sample and its base on the vibration test platform. Connect to the control and indicating equipment under normal surveillance mode.

5.11.2.2 Carry out frequency scanning cycle once on 3 mutually vertical axes sequentially, with a frequency circulation range of 10Hz - 150Hz, an acceleration amplitude of $5m/s^2$, and at the frequency scanning speed of 1 octave/min.

5.11.2.3 After the vibration, the response threshold value is measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and **4.5.2.**

5.11.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.8.1.

5.11.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.12 Impact test

5.12.1 Purpose

To inspect the immunity of the detector to non-recurring mechanical impacts.

5.12.2 Test methods

5.12.2.1 Place the sample and its base on the impact test platform. Connect to the control and indicating equipment under normal surveillance mode.

5.12.2.2 When mass m(kg), for samples when m • 4.75, the peak acceleration is (100 – 20m) × 10 m/s^2; when m > 4.75, the peak acceleration is 0, and the pulse duration is 6 minutes. Turn on the impact test platform and apply impact to the sample from 6 directions.

5.12.2.3 After the test, the response threshold value is measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and **4.5.2.**

5.12.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.8.1.

5.12.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.13 Collision test

5.13.1 Purpose

To inspect the reliability of the parts on the surface of the pipe-sampling-type detector when collision occurs, and the adaptability of other kinds of detectors under mechanical impacts.

5.13.2 Test methods

5.13.2.1 For pipe-sampling-type detectors, place under normal surveillance mode according to the specified requirements. Each of the damageable parts on the surface of the sample (e.g. indicating lamp, displayer, etc.) should be applied with a collision with energy 0.5J ± 0.04J 3 times. During the test, the procedures should be carried out carefully, ensuring that the results of the previous group (3 times) of collisions do not influence the results of the various subsequent groups of collision. When such influence is thought to be possibly caused, any discovered defects should not be considered. Take a new sample and carry out a collision test at the same position once

again. During the test period, observe and record the working operation of the sample.

5.13.2.2 For other types of detector, allow them and their bases to be fixed on the horizontal installation plate of the collision test platform at the normal working position according to the specified requirements. Connect to the control and indicating equipment under normal surveillance mode. Before carrying out the test, the sample should be electrified for at least 15 minutes.

Adjust the collision test equipment. Allow the centre of the colliding side of hammerhead collide with the sample in horizontal direction, and aim at the part that can be most easily damaged, after which time a collision should be made with the sample once at the hammerhead speed of 1.5 m/s ± 0.125 m/s, and the collision energy 1.9J ± 0.1J. During the test period, observe and record the working mode of the sample.

5.13.2.3 After the test, the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.13.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.8.1.

5.13.4 Test equipment

The collision test equipment for pipe-sampling type aspirated smoke detector should meet the related requirements of National Standard GB 16838.

For test equipment for other types of detectors, the main body should be a pendulum mechanism. The hammerhead of the pendulum should be made of hard aluminium alloy, $AlCu_4SiMg$ (having gone through solid solution and ageing treatment). Its appearance should be a hexagon with a slanted collision surface. The pendulum bar of the hammerhead should be fixed on the steel wheel hub with ball bearing. The ball bearing should be installed on the fixed steel axle of the hard steel frame. The structure of the hard steel frame should guarantee that the pendulum can rotate freely before the sample is installed.

The dimensions of the hammerhead are: length 94mm, width 76mm, height 50mm, and mass 0.79kg. The included angle between the slanted surface of hammerhead and the vertical axle should be $60^o \pm 1^o$. The pendulum bar of the hammerhead should have an outer diameter of 25mm ± 0.1mm and wall thickness of 1.6mm ± 0.1mm.

The radial distance between the vertical axle of hammerhead and the rotating axis is 305mm. It should be guaranteed that the pendulum bar axis of the hammerhead is vertical to the rotating axis. The steel wheel hub with outer diameter of 102mm and length of 200mm should be concentrically assembled on the steel axle with diameter of 25mm. The accuracy of the diameter of steel axle should be determined by the

dimension tolerance of the used bearing.

In the opposing direction of the steel wheel hub and the pendulum bar two steel-made ballast arms with outer diameter of 20mm, length of 185 mm each and stretching length of 150mm should be installed. On the two ballast arms a ballast weight with adjustable positioning should be installed, so as to achieve a balance between the hammerhead and the ballast arms. On one end of the steel wheel hub an aluminium alloy pulley with a thickness of 12mm and a length of 150mm should be installed. A wire winds the pulley, with one end fixed on the pulley and the other tied with the heavy working punch at a mass of around 0.55 kg.

The steel frame supports the horizontal installation plate of the installation sample. The installation plate can be adjusted upwards and downwards, so as for the centre of the colliding side of hammerhead to collide with the sample in horizontal direction.

When using the test equipment, the positions of the sample and the installation plate must firstly be adjusted according to Figure 6. After adjustment, the installation plate is fixed on the steel frame. Remove the working heavy punch. The pendulum mechanism is balanced through the adjustment of the ballast weight. After it is adjusted and balanced, the pendulum bar is pulled to the horizontal position to tie with the working heaving punch. When the pendulum mechanism is released, the working heavy punch makes the hammerhead rotate for 270^{o} to collide with the sample.

Unit: mm

a – installation plate; b – sample; c – hammerhead; d – pendulum bar; e – steel wheel hub; f – ball bearing; g – rotation for 270^{o}; h – working heavy punch; j – ballast weight; k – ballast arm; l – pulley

Figure 6 Structural diagram of collision test device

5.14 Vibration (sine) (durability) test

5.14 Purpose

To inspect the ability of the detector after having been under the vibration influence for a long time.

5.14.2 Methods

5.14.2.1 Fix the sample and its base onto the vibration test platform.

5.14.2.2 Carry out a frequency scanning cycle 20 times on 3 mutually vertical axes sequentially, with a frequency circulation range of 10Hz - 150Hz, acceleration amplitude of $10m/s^2$, and at the frequency scanning speed of 1 octave/min.

5.14.2.3 After the test, the response threshold value is measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and **4.5.2**

5.14.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.8.2.

5.14.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.15 Immunity test of radio-frequency electromagnetic radiation

5.15.1 Purpose

To inspect the adaptability of the detector when working in an environment with radio-frequency electromagnetic radiation.

5.15.2 Methods

5.15.2.1 Place the sample on the non-conducting support, and connect it to a power supply under normal surveillance mode for 15 minutes.

5.15.2.2 According to the requirements set out in GB 16838, electromagnetic interference is applied on the sample under the conditions specified in Table 5.

5.15.2.3 During the interference period, observe and record the working mode of the sample.

5.15.2.4 After the interference environment ends, the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.15.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.9.

5.15.4 Test equipment

The test equipment should meet the related requirements of GB 16838.

5.16 Immunity test of conductive interference of radio-frequency field sensor

5.16.1 Purpose

To inspect the adaptability of the detector when working in an environment with electromagnetic interference caused by the radio-frequency transmitter.

5.16.2 Methods

5.16.2.1 Place the sample on the insulation platform, and connect it to a power supply under normal surveillance mode for 15 minutes.

5.16.2.2 According to the requirements set out in GB 16838, electromagnetic interference is applied on the sample under the conditions specified in Table 5.

5.16.2.3 During the interference period, observe and record the working mode of the sample.

5.16.2.4 After the interference ends, the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3,

4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.16.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.9.

5.16.4 Test equipment

The test equipment should meet the related requirements of GB 16838.

5.17 Immunity test of static discharge

5.17.1 Purpose

To inspect the adaptability of the detector to the static discharge caused by the staff or objects carrying static electricity.

5.17.2 Methods

5.17.2.1 Place the sample on the support frame at a distance of 0.8m from the grounding referential plane, and connect it to a power supply under normal surveillance mode for 15 minutes.

5.17.2.2 Implement air discharge towards the sample with insulated shell. Implement contact discharge towards the sample with conductive shell.

5.17.2.3 According to the requirements set out in GB 16838, electromagnetic interference is applied on the sample under the conditions specified in Table 5.

5.17.2.4 During the interference period, observe and record the working operation of the sample.

5.17.2.5 After the interference ends, the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.17.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.9.

5.17.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.18 Immunity test of electric speedy transient pulses

5.18.1 Purpose

To inspect the immunity ability of detector to electric speedy transient pulses.

5.18.2 Methods

5.18.2.1 Place the sample on the insulation platform, and connect it to a power supply under normal surveillance mode for 15 minutes.

5.18.2.2 According to the requirements set out in GB 16838, electromagnetic interference is applied on the sample under the conditions specified in Table 5.

5.18.2.3 During the interference period, observe and record the working mode of the sample.

5.18.2.4 After the interference ends, the response threshold value is measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2,

5.4.1.2, 4.5.1 and 4.5.2.

5.18.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.9.

5.18.4 Test equipment

The test equipment should meet the related requirements set out in GB 16838.

5.19 Immunity test of surging (impact)

5.19.1 Purpose

To inspect the adaptability of the detector to the lightning nearby or the power switch of power supply system and low-voltage network, including the voltage transient (electric surging) inference caused by the large-capacity load switch.

5.19.2 Methods

5.19.2.1 Place the sample on the insulation platform, and connect it to a power supply under normal surveillance mode for 15 minutes.

5.19.2.2 According to the requirements set out in GB 16838, electromagnetic interference is applied on the sample under the conditions specified in Table 5.

5.19.2.3 During the interference period, observe and record the working operation of the sample.

5.19.2.4 After the interference ends, the response threshold value should be measured according to the corresponding methods specified in Subsections 5.2.1.3, 4.3.3.2, 5.4.1.2, 4.5.1 and 4.5.2.

5.19.3 Requirements

The detector should meet the requirements set out in Subsection 4.1.9.

5.19.4 Test equipment

The test equipment should meet the related requirements of GB 16838.

5.20 Fire sensitivity test

5.20.1 Purpose

To inspect the response performance of the detector when subjected to test fire.

5.20.2 Methods

5.20.2.1 Point-type infrared flame detector

5.20.2.1.1 Fix 4 samples in parallel direction at a high place of 1.5m ± 0.1m, and separate them from fire. Connect to the control and indicating equipment, under normal surveillance mode.

Ignite the test fire. After a certain period of time, the radiation becomes stable. Remove the separating object, and start timekeeping.

During the test, the distance between the samples and the centres of test fires are 12m, 17m and 25m respectively.

5.20.2.1.2 Heptane fire

a) Fuel: Heptane (analytical pure / AP grade), plus toluene at volume fraction

3%;

b) Weight: 650g;

c) Layout: Place the fuel in a container made of steel plates with a thickness 2mm, base dimensions 33cm×33cm, and height 5cm;

d) Ignition method: flame or electric spark.

5.20.2.1.3 Ethanol open fire:

a) Fuel: industrial ethanol (above 90% of ethanol content, with small amount of methanol);

b) Mass: 2000g;

c) Layout: place the fuel in a container made of steel plates with a thickness of 2mm, base dimensions 33cm×33cm, and height 5cm;

d) Ignition way: flame or electric spark.

5.20.2.2 Aspirated smoke detector

5.20.2.2.1 Install two samples on the ceiling surface of the burning test room by the most unfavourable method according to the requirements set out in GB 4715. The samples are under normal surveillance mode according to the requirements. For samples with adjustable response threshold values, the response threshold values should be preset at the maximum limit values.

5.20.2.2.2 According to the requirements set out in GB 4715, place the sample in an area with clean air, and allow it to operate stably for 30 minutes.

5.20.2.2.3 Ignite each test fire according to the requirements set out in GB 4715. After ignition, the test staff should leave the test room immediately. Prevent airflow from influencing the test fire. All the doors, windows or other openings should be closed. During the test period, the fire parameters, such as r T, m, y, etc., should be measured at all times.

5.20.3 Requirements

Point-type infrared flame detectors should meet the requirements set out in Subsection 4.2.7. Aspirated smoke detectors should meet the requirements set out in Subsection 4.3.11.

6 Inspection rules

6.1 Pre-delivery inspection of products

6.1.1 Pre-delivery inspection of point-type infrared flame detectors

Before the products are delivered from the factory, the enterprise concerned should inspect the detectors for the following test items:

a) consistency test;

b) bearing test;

c) repetitiveness test;

d) low temperature (running) test.

The manufacturer should specify the sampling methods, inspection and determination rules.

6.1.2 Pre-delivery inspection of aspirated smoke detectors

Before the products are delivered from the factory, enterprise concerned should inspect the detectors for the following test items:

a) functional test of detect-alarm-type detector;

b) repetitiveness test;

c) consistency test;

d) insulation resistance test;

d) current leakage test.

The manufacturer should specify the sampling methods, inspection and determination rules.

6.1.3 Pre-delivery inspection of image-type fire detectors

Before the products are delivered from the factory, the enterprise concerned should inspect the detectors for the following test items:

a) response threshold value test;

b) repetitiveness test;

c) high temperature test;

d) environmental beam interference test.

The manufacturer should specify the sampling methods, inspection and determination rules.

6.1.4 Pre-delivery inspection of point-type carbon monoxide fire detectors

Before the products are delivered from the factory, the enterprise concerned should inspect the detectors for the following test items:

a) consistency test;

b) repetitiveness test;

c) collision test;

d) low temperature (running) test;

e) steady-state damp heat (running) test;

f) power-source parameter fluctuation test.

The manufacturer should specify the sampling methods, inspection and determination rules.

6.2 Type inspection

6.2.1 The type inspection items are the test items specified in Subsection 5 of this Standard. The inspection samples are selected from products that have passed the pre-delivery inspection.

6.2.2 Type inspection should be performed under one of the following circumstances:

a) appraisal of sample of trial product when a new product is produced or an old product is produced in another factory;

b) after official production, changes are made to the structure, main parts or components, production technology, etc. of the product that may influence the performance of the product; or after the product has officially been in production for 4 years;

c) a product resumes production after the termination of production for over 1 year;

d) the pre-delivery inspection results differ greatly to the previous type inspection results;

e) a significant mass or quantity event occurs.

6.2.3 The determination of the inspection results should be made according to the determination methods for type inspection results specified in GB12978.

7 Markings

7.1 General rules

7.1.1 The markings on products should be clearly visible in the installation and maintenance processes of the detector.

7.1.2 The markings on products should not be attached to the screw or other parts that may be easily dismantled.

7.2 Markings

7.2.1 Product markings for point-type infrared flame detectors

7.2.1.1 The following information should be clearly marked on each detector:

a) Product name;

b) Implementation standard;

c) Name or trademark of manufacturer;

d) Model number;

e) Binding post indication;

f) Manufacturing date, product code, country of origin, and version number of the software inside the detector;

g) Main technical parameters of the product (including the radiation spectrum range of the response flame of sample, sensitivity of sample).

7.2.1.2 With regard to dismountable detectors, the contents of the markings on the sonde should include the content of the abovementioned items a), b), c), d), f) and g). The content of the markings of the base should include the content of items d) and e)

as a minimum.

7.2.1.3 If uncommon symbols or short-form terms are used in the product markings, a further explanation should be specified in the detector user manual.

7.2.2 Product markings for aspirated smoke detectors

Clear and durable product markings should be visible on each detector. The product markings should include the following:

a) Name and address of manufacturer;

b) Product name;

c) Model number of product;

d) Main technical parameters of product;

e) Manufacturing date and product code;

f) Implementation standard.

7.2.3 Product markings for image-type fire detectors

7.2.3.1 The following information should be clearly marked on each detector:

a) Name and model number of product;

b) Name and address of manufacturer;

c) Implementation standard;

d) Binding post indication;

e) Manufacturing date, product code, and version number of the software inside the sample;

f) Main technical parameters of the product (including the smallest flame dimensions, angle of field of view).

7.2.3.2 For dismountable detectors, the contents of the markings on the sonde should include the contents of the abovementioned items a), b), c), d), e) and f). The contents of the markings on the base should include the contents of item d) as a minimum.

7.2.3.3 If uncommon symbols or short-form terms are used in the product markings, a detailed explanation should be specified in the related detector user manual.

7.2.4 Markings of the products of point-type carbon monoxide fire detectors

7.2.4.1 The following information should be marked on each detector:

a) Name of product;

b) Model number;

c) Name or trademark of manufacturer; Implementation standard;

d) Standard number relating to this Part;

e) Binding post indication;

f) Manufacturing date, product code, country of origin and version number of the software inside the detector;

For dismountable detectors, the contents of the markings on the sonde should

include the abovementioned items a), b), c), d) and f). The contents of the markings on the base should include the contents of items b) and e) as a minimum

7.2.4.2 If uncommon symbols or short-form terms are used in the product markings, a further explanation should be provided in the user manual together with the detector.

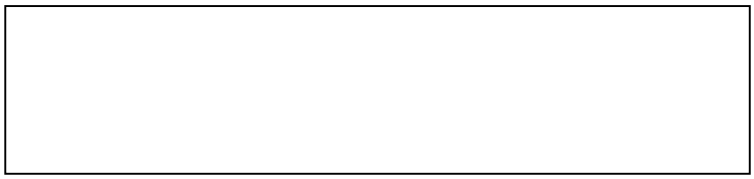
7.3 Mass inspection marking

Each detector should obtain a passed mark of mass inspection.

Annex A
(Normative Annex)
Gas inspection devices

A.1 Test equipment

A.1.1 The layout of measurement zone, test instruments and detector is shown in Figure A.1:



Remarks: 1 – Measurement working zone; 2 – Measurement platform; 3 – Detector;
4 – Temperature sensor; 5 – Damping screen;
6 – Connecting place of control and indicating equipment;
7 – Connecting place of control and indicating equipment of gas inspection device;
8 – airflow; 9 – gas sensor.

Figure A.1 Layout diagram of detector and test instruments

A.1.2 Gas inspection devices should guarantee that the measurement of the airflow velocity inside the working zone meets the test requirements of airflow velocity.

A.1.3 Gas inspection devices should be able to measure the temperature rise to 55 ± 2^{o}C inside the working zone at a temperature rise velocity of no greater than 1^{o}C/min.

Annex B
(Normative Annex)
Gas Sensors

B.1.1 The measurement-use sensor attached to gas inspection device should be able to measure the concentration of the gases of oxygen, carbon monoxide, methane, butane, heptane, ethyl acetate, isopropanol, carbon dioxide, hydrogen, nitrogen monoxide, etc.

B.1.2 The measurement accuracy of the sensor should be 5ul/l as a minimum.