Guideline No.E-17 (202607)

E-17

FIXED HYDROCARBON GAS DETECTION SYSTEM

Issued date: July, 1, 2026

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Foreword

China Classification Society (hereinafter referred to as CCS) Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at http://www.ccs.org.cn. Your comments or suggestions are welcomed and may be sent to our email addressed service@ccs.org.cn.

Historical versions and release date: E-17(201510) October 20, 2015

E-17(201610) October 28, 2016

E-17(201705) May 9, 2017

E-17(202009) September 21, 2020

E-17(202208) August 25, 2022

Main changes:

1. According to feedback of guideline, the requirements for the insulation resistance and withstand voltage tests of the detector and controller have been revised to align with the requirements in CCS GD019-2024 <Test Guidelines for Type Approval of Electrical and Electronic Products> (2024).

CONTENTS

1 Application....4

2 Basis for approval and inspection....4

3 Terms and definitions....5

4 Plans and documents....5

5 Technical requirement....6

6 Materials and components....16

7 Type Test....16

8 Unit/batch Inspection after Approval....27

FIXED HYDROCARBON GAS DETECTION SYSTEM

1 Application

The Guideline applies to the type approval and test of the marine point-type fixed hydrocarbon gas detection system. The fixed hydrocarbon gas detection system for measuring hydrocarbon gas concentrations in all ballast tanks and void spaces of double-hull and double-bottom spaces adjacent to the cargo tanks of oil tankers is to comply with Chapter 16 of the Fire Safety Systems Code (FSS CODE) and IMO MSC.1/Circ.1370.

It can also be referred to the guideline for the fixed hydrocarbon gas detection system used for the platform.

The gas detectors and controllers of fixed hydrocarbon gas detection system shall be designed and tested according to IEC 60079-29-1: 2016, Explosive atmospheres - Part 29-1: Gas detectors-Performance requirements of detectors for flammable gases, if used for the following purposes:

(1) The fixed hydrocarbon gas detection system installed on natural gas fueled ships which applied of IGF CODE (MSC.391(95), MSC.422(98), MSC.458(101)) or CCS “Rules for Ships Using Natural Gas Fuels 2021”;

(2) The fixed hydrocarbon gas detection system installed on ships carrying liquefied gases in bulk which applied of IGC CODE Amendments (MSC.370(93), MSC.411(97), MSC.441(97)), CCS “Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk”;

(3) The gas analysis unit of fixed hydrocarbon gas detection system including gas detection transmitters and gas detection control units describing in Chapter 16 of the Fire Safety Systems Code (FSS CODE).

2 Basis for approval and inspection

2.1 Article 4.5.10 of Part B in Chapter II-2 of the SOLAS Convention

2.2 Chapters 1 and 2 of Part Four and Chapter 3 of Part Six of Rules for Classification of Sea-Going Steel Ships

2.3 CCS GD 22-2015<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version) (including requirements of IACS UR E10 Rev.7)

2.4 IEC 60079-29-1: 2020 Explosive atmospheres - Part 29-1: Gas detectors-Performance requirements of detectors for flammable gases

2.5 GB 15322.1-2019 Combustible gas detectors - Part1: Point-type combustible gas detectors for industrial and commercial use

2.6 GB 16808-2008 Combustible gas alarm control units

2.6 GB 3836 or IEC 60079 Serial Standards

3 Terms and definitions

3.1 Alarm settings: The preset hydrocarbon gas alarm concentration value.

3.2 Alarm operating value: The min. hydrocarbon gas concentration value when the detector gives alarms.

3.3 Lower explosive limit (LEL): The lowest concentration of explosion of hydrocarbon gas or steam in the air (the explosive gas atmosphere cannot be formed at a concentration lower than that).

4 Plans and documents

4.1 The following plans and documents should be submitted to CCS for approval:

4.1.1 Technical product conditions/enterprise standard (the type of the hydrocarbon gas should be noted in the document);

4.1.2 General assembly plan;

4.1.3 Wiring diagram;

4.1.4 System control flow chart;

4.1.5 Electrical schematic diagram;

4.1.6 Controller panel arrangement plan;

4.1.7 Machinery design plans for the enclosure, foundation, cable entry, and fixing device;

4.1.8 Type test program.

4.2 The following plans and documents should be submitted to CCS for information:

4.2.1 Product nameplate and marking graph;

4.2.2 List of main components and materials of the product;

4.2.3 Product operation instructions;

4.2.4 Software documentation including equipment to which the software belongs, unambiguous identification of the program version, functional description, software structure and software modification;

4.2.5 Product manufacturing process flow chart;

4.2.6 Statement and relevant evidence of the hydrocarbon gas type applicable to the hydrocarbon gas detector.

5 Technical requirement

5.1 Technical requirement on detector

5.1.1 The hydrocarbon gas detection system should give an alarm when the hydrocarbon gas concentration in the monitored area reaches the alarm setting value.

5.1.2 Alarm setting value

For detector the alarm value of which can be set, only one alarm value or two values (min. and max.) can be set. For detector with output signal of 4~20 mA, the alarm value should be set in the controller. The upper limit of the alarm setting value should meet the requirement of the monitored area, for example, 10%LEL for pump room of the liquid cargo ship; 30%LEL for oil recovery ship; 20%LEL and / or 40%LEL for natural gas fuel ship; 30%LEL and / or 60%LEL for bulk liquid gas tanker; 20%LEL and / or 40%LEL for LNG bunkering pontoon.

5.1.3 Alarm operating value

(1) For all test items specified in the Guideline, the system alarm operating value should not be less than 5% of the LEL.

(2) The absolute value of the difference between the alarm operating value and alarm setting value should not exceed 3 % of the LEL.

5.1.4 Range indication deviation

For detectors with the measurement range between 3%LEL and 100%LEL, the absolute value of the difference between the displayed value and the actual value on the test point should not exceed 5% of the LEL.

5.1.5 Response time

Inject test gas with flow rate of 500ml/min and concentration of 60% of full range to the detector, keep it for 60s, and record the display value of the detector as the reference value. The time required for the display value to reach 90% of the reference value is the response time of the detector. The response time of detector shall not be greater than 30s.5.1.6 Storage with power cutoff

Place the detector at the temperature of -25℃ ±3℃ for 24 h, then restore it in normal environmental conditions for at least 24 h, then place it at the temperature of 60℃ ±2℃ for 24 h, and then restore it in normal environmental conditions for at least 24 h. After test, the detector should be free of coating damage or corrosion and function normally, and the difference between the alarm operating value and alarm setting value should not exceed ±3% of the LEL.

5.1.7 Direction (except for the suction-type detector)

Measure the alarm operating value of the detector after rotation by 45 °on the three axes X, Y and Z respectively perpendicular to each other. The absolute value of the difference between the alarm operating value and alarm setting value should not exceed ±3 % of the LEL.

5.1.8 High-concentration gas shock resistance performance

The test gas with a volume fraction of 100% is delivered to the sampling part of the detector at a flow rate of 500ml / min for 2min. Make the detector in normal monitoring state for 30min, and then measure its alarm action value. The absolute value of the difference between the alarm operating value and alarm setting value shall not exceed 5% of the LEL.5.1.9 Alarm repeatability

Under normal environmental conditions, measure the alarm operating value of the same detector for 6 times, which should differ from the alarm setting value of the detector by no more than 3% of the LEL.

5.1.10 High-speed air flow

When the air flow speed is 6 m/s±0.2m/s, the absolute value of the difference between the alarm operating value and alarm setting value of the detector should not exceed 5 % of the LEL.

5.1.11 Voltage fluctuation and energy failure test

When the power supply voltage of the detector is ±15% of its rated power supply voltage, the absolute value of the difference between the alarm operating value and alarm setting value should not exceed 3% of the LEL.

The detector should pass the energy failure test specified in chapter 2.4 of <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), and the absolute value of the difference between the alarm operating value and alarm setting value should not exceed 3% of the LEL.

5.1.12 Long-term stability performance

The detector should be capable of operation for 28 d under normal environmental conditions. During test, the detector should not send out alarm or failure signals. After test, the absolute value of the difference between the alarm operating value and alarm setting value of the detector should not exceed 5 % of the LEL.

5.1.13 **Insulation resistance and voltage resisting performance**

For the detector, the insulation resistance between the external live terminal or the power plug and the enclosure, all of which should meet insulation requirement, should not be less than 100 MΩ in the hygrothermal environment respectively. The above-mentioned parts should also be subject to withstand AC voltage test for 1 min. with rated voltage tolerance frequency of 50 Hz or 60 Hz and effective voltage of 1 500 V (at rated working voltage from 66V to 250 V) or effective voltage of twice the rated working voltage + 500 V (at rated working voltage not more than 65 V). During the test, the detector should not be subject to discharge or breakdown; after the test, the detector should function normally, and the insulation resistance should meet the requirement of chapter 2.3.4 of <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version).

5.1.14 The electromagnetic compatibility of the detector should meet the following requirements:

(1) Conduction emission and enclosure port radiation emission test should be conducted according to the requirement of Chapter 3 of <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), and the test result should meet the requirement of 3.2 and 3.3 of <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version).

(2) The detector should pass the electrostatic discharge test, radio - frequency electromagnetic radiation test, electrical fast transient burst test, surge test, low frequency conduction test (if applicable), and radio-frequency field conducted disturbance test under normal monitoring status and the electrical interference conditions specified in <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), and the following requirements should be met during and after the test:

① During the test, detector should not send out any alarm signal or unrecoverable failure signal;

② After the test, the absolute value of the difference between the alarm operating value and alarm setting value of the detector should not exceed 5% of the LEL.

5.1.15 The detector should pass the dry heat test, low-temperature test and cyclic damp heat test under the normal monitoring status and the environmental conditions specified in <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), and the following requirements should be met during and after the test:

(1) During test, the detector should not send out alarm or failure signals;

(2) After test, the detector should be free of coating damage or corrosion, and the absolute value of the difference between the alarm operating value and alarm setting value should not exceed 7% of the LEL.

5.1.16 The detector should pass the tests listed in the table below, and meet the following requirements during and after the test:

(1) During test, the detector should not send out alarm or failure signals;

(2) After test, the detector should be free of mechanical damage or looseness of the fastening part, and the absolute value of the difference between the alarm operating value and alarm setting value of the detector should not exceed 5% of the LEL.

List of detector test items **Table 5.1.16**

Test name	Test parameter	Test condition	Operating status
Vibration test	Table 2.7.3(2) of <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version)	Chapter 2.7.3 of <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version)	Normal monitoring status
Drop test	Drop height (mm)	1000 (mass of less than 2 kg)	Power-off status
		500 (mass of 2kg~5 kg)	
		Not test (mass of more than 5 kg)	
	Drop time (s)	2	

5.1.17 Gas interference performance test

Make the detector work in the following gas interference environment for 30min respectively, during which the detector shall not send alarm signal or fault signal:

a) Acetic acid: (6000 ±200) ×10-6 (volume fraction);

b) Ethanol: (2000 ±200) ×10-6 (volume fraction).

After the interference of each kind of gas, the detector is in the normal monitoring state for 1h, and then the alarm action value is measured. The absolute value of the difference between the alarm operating value and alarm setting value of the detector should not exceed ±5% of the LEL.

5.1.18 Salt mist test (for detectors to be installed on the exposed deck)

The detector should pass the salt mist test specified in chapter 2.12 of <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version).

5.1.19 Main part performance

(1) The electronic components should be subject to three types of protective treatments (dampproofing, mould proofing, and salt mist proofing).

(2) The detector enclosure should adopt the incombustible or burn-resisting material.

5.1.20 Explosive-proof grade

The detector should reach the explosive-proof grade in line with the explosive-proof requirement of the installation place, and have the explosive-proof certificate issued by the competent explosive-proof test agency accepted by CCS.

5.2 Technical requirement on controller

5.2.1 Basic functional requirement

(1) General requirements

① The controller should be provided with protective grounding terminal.

② It can supply power to the hydrocarbon gas detector and other parts connected.

③ The controller should be provided with relevant interfaces for connecting the continuous visual and audio alarm signal equipment arranged in the pump room, engine control room, cargo control room and navigation bridge. At the state of alarming, the controller should trigger automatically the above-mentioned alarm signal equipment to remind relevant personnel of potential dangers.

(2) Hydrocarbon gas concentration display function

① The controller should show the current hydrocarbon gas concentration, and the full-range indication deviation should not exceed ±5% of the LEL.

② The alarm status of the controller should not affect the concentration display of the controller. The failure status of the controller should not affect the concentration display of any failure-free loop.

(3) Hydrocarbon gas alarm function

① It can receive directly or indirectly the alarm signal of the hydrocarbon gas detector and other alarm trigger components, send out sound and light alarm signals, indicate alarm position, record alarm time, and maintain the status till manual restoration.

② In case of any hydrocarbon gas alarm signal input, the controller should send out sound and light signals within 10 s.

③ The controller should be provided specially with general hydrocarbon gas alarm indicating lamp (device). When the controller is in the hydrocarbon gas alarm state, the general indicating lamp (device) should be on.

④ The hydrocarbon gas alarm signal should be eliminated manually, and restarted if any alarm signal is input again.

⑤ The controller should meet the following requirements:

(a) It should display the total number of the current alarm positions;

(b) It should distinguish clearly the first alarm position;

(c) The following-up alarm positions should be displayed continuously as per the alarm time. If the display area is insufficient to display all the alarm positions, they should be displayed in order circularly, and manual query button (key) should be provided.

⑥ The controller should be provided with manual reset button (key). After resetting, the existing status and relevant information should be kept and reestablished in 20 s.

⑦ The controller should be provided with alarm timing device with daily timing error of not more than 30 s. When a printer is used to record the alarm time, such information as the month, day, hour, and minute should be printed. However, the alarm time cannot be recorded merely by the printer.

⑧ The controller with history alarm recording function should record at least 999 pieces of relevant information, and keep the information for 14 d after the controller is powered off.

⑨ If the controller can be used to change the alarm setting value of the hydrocarbon gas detector connected to it, such value should be queried on the controller manually.

⑩ Any operation (except for resetting) on the controller should not prevent the controller from receiving and sending out the hydrocarbon gas alarm signal.

(4) Failure alarm function

① The controller should be provided with a special failure indicating lamp (device), which should be on whenever there is failure signal regardless the status of the controller.

② In any of the following circumstances, the hydrocarbon gas alarm controller should send out sound-light failure signals different with the hydrocarbon gas alarm signals within 100 s:

(a) The connecting line disconnection, short circuit (excluding the situation when a hydrocarbon gas alarm signal is sent out in case of short circuit) and grounding that affects the hydrocarbon gas alarm function between the hydrocarbon gas alarm controller and the hydrocarbon gas detector as well as the alarm trigger connected;

(b) Gas sensor of the hydrocarbon gas detector falling off from the controller (only applicable to gas sensor with plug-in connection method;

(c) Under-voltage of the main power supply of the controller;

(d) Connecting line disconnection and short circuit between the charger of the controller backup power supply and the backup power supply;

(e) Connecting line disconnection between the controller and its backup power supply.

For failures of (a) and (b), the failure positions should be indicated, and for those of (c), (d) and (e), the failure types should be indicated; the sound failure signal should be eliminated manually, and the light failure signal should be maintained if the failure persists; if the failure persists and there is hydrocarbon gas alarm signal input in the failure-free loop, the hydrocarbon gas alarm controller should send out a hydrocarbon gas alarm signal. The failure information may not be displayed if the controller has alarm signal, but it should be queried manually.

③ The controller should display all the failure information. If all the failure information cannot be displayed at the same time, those not displayed should be queried manually.

④ If the main power supply is switched off, and the backup power supply cannot guarantee the normal operation of the controller, the controller should send out an audible failure signal for more than 1 h.

⑤ After the failure is eliminated, the failure signal of the controller should be reset automatically or manually. After being reset, the controller should display the existing failure again in 100 s.

⑥ No failure should affect the normal operation of the failure-free part.

⑦ If the controller adopts the general operation mode, a bus short circuit isolator should be provided. When the short circuit isolator works, the controller should indicate the part number of the part isolated. If the short circuit isolator works due to a short circuit failure occurred to certain bus, the number of the parts affected by the short circuit isolator should not exceed 32.

(5) Self-inspection function

① The controller should be capable of self-inspection on the hydrocarbon gas alarm function (hereinafter referred to as the self-inspection). During the self-inspection, the externally-connected equipment and output nodes under the control of the controller should not work. If the self-inspection time exceeds 1 min. or the controller cannot stop the self-inspection by itself, such inspection should not affect the part not subject to self-inspection as well as the hydrocarbon gas alarm function of the controller itself.

② The functions of all indicators (devices) and displays on the panel of the controller should be checked manually.

(6) Power supply function

The power supply of the controller should be provided with main power supply and backup power supply conversion device. If the main power supply is switched off, it can be shifted automatically to the backup power supply, and shifted back to the main power supply automatically after the main power supply is resumed; the indicator should be provided to indicate the working status of the main and backup power supplies, and the main power

supply should be provided with overcurrent protection means. The conversion between the main and backup power supplies should not cause any maloperation of the controller.

(7) Operation level

Matching list of the controller operation levels **Table 5.2.1. (7)**

No.	Operation items	Ⅰ	Ⅱ	Ⅲ	Ⅳ
1	Query information	O	M	M	
2	Elimination of controller sound signal	O	M	M	
3	Reset	P	M	M	
4	Entering self-inspection status	P	M	M	
5	Timing device adjustment	P	M	M	
6	Data inputting or modification	P	P	M	
7	Partition programming	P	P	M	
8	Time delay function setting	P	P	M	
9	Connection, disconnection or adjustment of main and backup power supplies of the controller	P	P	M	M
10	Software and hardware modification or change	P	P	P	M

Note 1: P-The same level operation prohibited; O-Select the same level operation or not; M-The same level or lower-level operation allowed.

Note 2: Key or operation code should be used for entering level-II & III operation function status; the key or operation code used to enter level-III operation function status can be used to enter level-II operation function status, but not vice versa.

Note 3: Level-IV operation function cannot be conducted via only the controller.

5.2.2 The hydrocarbon gas alarm controller should pass the dry heat test, low temperature test, and damp heat test-cyclic specified in <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version). The performance during/after the test should meet the basic functional requirements of 5.2.1 of the guideline.

5.2.3 The hydrocarbon gas alarm controller should pass the vibration test specified in <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), and the crash test specified in the table below. The performance during/after the test should meet the basic functional requirements of 5.2.1 of the guideline.

List of crash tests **Table 5.2.3**

Test name	Test parameter	Test condition	Operating status
Crash test	Crash energy Crash time (s)	0.5J±0.04J 3 times for each vulnerable point	Normal monitoring status

5.2.4 The electromagnetism of the hydrocarbon gas alarm controller should meet the following requirements:

(1) Conduction emission and enclosure port radiation emission test should be conducted according to the requirement of Chapter 3 of <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), and the test result should meet the requirement of 3.2 and 3.2 of <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version).

(2) Pass the electrostatic discharge test, radio-frequency electromagnetic field radiation test, electrical fast transient burst test, conducted low frequency interference test (if applicable), radio-frequency field conducted disturbance test, and surge immunity test specified in <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), as well as the power transient test in the table below. The performance during/after the test should meet the basic functional requirements of 5.2.1 of the guideline.

List of power transient tests **Table 5.2.4. (2)**

Test name	Test parameter	Test condition	Operating status
Power transient tests	Power transient method Time (s) applied	Power-on for 9 s - Power-off for 1 s 500 times	Normal monitoring status

5.2.5 When the hydrocarbon gas alarm controller is subjected to the energy failure test and power supply variation test specified in <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), the performance during/after the test should meet the basic functional requirements of 5.2.1 of the guideline.

5.2.6 For the hydrocarbon gas alarm controller, the insulation resistance between the external live terminal or the power plug (or power connection terminal) and the enclosure, all of which should meet insulation requirement, should be greater than 100 MΩ under normal atmospheric conditions.

The above-mentioned parts should also be subject to high voltage test according to relevant requirement of the <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version).

5.2.7 Main part (device) performance

(1) The main parts (devices) of the controller should be the approved products complying with relevant standards.

(2) Indicating lamp (device)

Colors should be adopted for marking, namely, red indicates the alarm signal, yellow the failure signal, and green the normal operation of the main power supply and backup power supply. The indicating lamp should be seen clearly at a distance 3 m away under normal light conditions.

(3) Letter-digit display

The letter-digit display should be readable at a distance of 0.8 m away under normal light conditions.

(4) Audio device

The sound pressure level (A weighting) at a distance 1 m away from the center of the audio device should be higher than 65 dB and lower than 115 dB at rated working voltage. It should work normally at 85% of the rated working voltage.

(5) Fuse

The rated current of the fuse used in the power circuit or other overcurrent protection device should not exceed 2 times the max. working current of the hydrocarbon gas alarm controller generally. When the max. working current is more than 6 A, the current of the fuse can be 1.5 times such value. The parameter value should be marked clearly at the place close to the fuse or other overcurrent protection devices.

(6) Connection terminal

Each connection terminal should be marked clearly and securely with its number and sign, and the corresponding usage should be described in relevant document.

(7) Switch and key

Text should be clearly marked on the top or close to the switch and key to indicate the function.

(8) Electronic Components

It should be subject to three types of protective treatments (damp proofing, mould proofing and salt mist proofing), and the parameter should meet the requirements on max. working voltage and max. working current.

5.3 Enclosure protection level

The enclosure protection level of the detector and controller should meet relevant requirements in Chapter 1 of Part Four of CCS *Rules for Classification of Sea-Going Steel Ships*.

5.4 Flame retardant test

The plastic part (if any) of the product should pass the flame retardant test specified in <Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version).

6 Materials and components

The materials and components of the product should be controlled as per relevant requirement of current regulations of CCS.

7 Type Test

7.1 If the detectors are to be approved according to GB15322.1, the type test items, technical requirement and test method of the detector are shown in the table below:

List of type test items of the detector (GB15322.1) Table 7.1

No.	Test items	Technical requirement	Test method
1	Visual inspection	GB15322., 5.1.3	GB15322.1, 5.1.3
2	Basic performance test	GB15322.1, 5.2	GB15322.1, 5.2
3	Alarm operating value test	GB15322.1, 4.3.2	GB15322.1, 5.3
4	Position test	GB15322.1, 4.3.5	GB15322.1, 5.6
5	Alarm repeatability test	GB15322.1, 4.3.6	GB15322.1, 5.7
6	High-speed air flow test	GB15322.1, 4.3.7	GB15322.1, 5.8
7	Power supply variation test	5.1.11 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.4
8	Energy failure test	5.1.11 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.5
9	Range indication deviation test	GB15322.1, 4.3.3	GB15322.1, 5.4

Continued Table 7.1

No.	Test items	Technical requirement	Test method
10	Response time test	GB15322.1, 4.3.4	GB15322.1, 5.5
11	Insulation resistance measurement	5.1.13 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.3
12	High voltage test	5.1.13 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.14
13	Conduction emission	5.1.14 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.2
14	Radiation emission at the enclosure port	5.1.14 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.3
15	Electrostatic discharge test	5.1.14 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.4
16	Radio-frequency electromagnetic radiation test	5.1.14 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.5
17	Electrical fast transient burst test	5.1.14 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.6
18	Surge	5.1.14 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.7
19	Low frequency conduction (if applicable)	5.1.14 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.8
20	Radio-frequency field conducted disturbance test	5.1.14 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.9

Continued Table 7.1

21	Dry heat test	5.1.15 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.8
22	Low-temperature test	5.1.15 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.9
23	Cyclic damp heat test	5.1.15 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.10
24	Vibration test	5.1.16 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.7
25	Drop test	GB15322.1, 4.3.16	GB15322.1, 5.25
26	Long-term stability test	GB15322.1, 4.3.21	GB15322.1, 5.30
27	Gas interference performance test	GB15322.1, 4.3.17	GB15322.1, 5.26
28	Anti-poisoning test	GB15322.1, 4.3.18	GB15322.1, 5.27
29	High-concentration shock resistance performance	GB15322.1, 4.3.19	GB15322.1, 5.28
30	Low-concentration operation test	GB15322.1, 4.3.20	GB15322.1, 5.29
31	Enclosure protection test	5.3. of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.15
32	Salt mist test Kb (applicable to equipment installed on open deck)	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.12	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.12
33	Flame retardant test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.16	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.16
34	Explosion-proof performance test items	GB3836 or IEC60079 series standards, which will be specified by the explosion-proof product approval agency	

7.2 If the detectors are to be approved according to IEC60079-29-1, the type test items, technical requirement and test method of the detector are shown in the table below:

List of type test items of the detector (IEC60079-29-1) Table 7.2

No.	Test items	Technical requirement	Test method
1	Visual inspection	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.1	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.1
2	Unpowered storage	IEC60079-29-1, 5.4.2	IEC60079-29-1, 5.4.2
3	Calibration and adjustment	IEC60079-29-1, 5.4.3 and Annex A, Table A.1	IEC60079-29-1, 5.4.3
4	Short-term stability	IEC60079-29-1, 5.4.4.2 and Annex A, Table A.1	IEC60079-29-1, 5.4.4.2
5	Long-term stability	IEC60079-29-1, 5.4.4.5 and Annex A, Table A.1	IEC60079-29-1, 5.4.4.5
6	Alarm set point(s)	IEC60079-29-1, 5.4.5 and Annex A, Table A.1	IEC60079-29-1, 5.4.5
7	Temperature test (combined with dry heat test and low temperature test)	IEC60079-29-1, 5.4.6 and Annex A, Table A.1	IEC60079-29-1, 5.4.6
8	Pressure test	IEC60079-29-1, 5.4.7 and Annex A, Table A.1	IEC60079-29-1, 5.4.7
9	Humidity of test gas (combined with damp heat test-cyclic)	IEC60079-29-1, 5.4.8 and Annex A, Table A.1	IEC60079-29-1, 5.4.8
10	Air velocity	IEC60079-29-1, 5.4.9 and Annex A, Table A.1	IEC60079-29-1, 5.4.9
11	Flow rate for aspirated equipment	IEC60079-29-1, 5.4.10 and Annex A, Table A.1	IEC60079-29-1, 5.4.10
12	Orientation	IEC60079-29-1, 5.4.11.2 and Annex A, Table A.1	IEC60079-29-1, 5.4.11.2
13	Warm-up time	IEC60079-29-1, 5.4.14 and Annex A, Table A.1	IEC60079-29-1, 5.4.14
14	Time of response	IEC60079-29-1, 5.4.15 and Annex A, Table A.1	IEC60079-29-1, 5.4.15

Continued Table 7.2

No.	Test items	Technical requirement	Test method
15	High gas concentration operation above the measuring range	IEC60079-29-1, 5.4.16 and Annex A, Table A.1	IEC60079-29-1, 5.4.16
16	Field calibration kit (if applicable)	IEC60079-29-1, 5.4.22 and Annex A, Table A.1	IEC60079-29-1, 5.4.22
17	Software function	IEC60079-29-1, 4.2.9	IEC60079-29-1, 5.4.23
18	Insulation resistance measurement	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.3	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.3
19	Power supply variation test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.4	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.4
20	Power supply failure test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.5	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.5
21	Vibration test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.7	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.7
22	Dry heat test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.8	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.8
23	Low-temperature test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.9	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.9
24	Damp heat test-cyclic	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.10	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.10
25	Salt mist test Kb (applicable to equipment installed on open deck)	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.12	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.12

Continued Table 7.2

No.	Test items	Technical requirement	Test method
26	High voltage test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.14	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.14
27	Enclosure protection test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.15	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.15
28	Flame retardant test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.16	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.16
29	Conduction emission	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.2	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.2
30	Radiation emission at the enclosure port	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.3	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.3
31	Electrostatic discharge test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.4	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.4
32	Radio-frequency electromagnetic radiation test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.5	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.5
33	Electrical fast transient burst test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.6	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.6
34	Surge	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.7	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.7
35	Low frequency conduction (if applicable)	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.8	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.8

Continued Table 7.2

No.	Test items	Technical requirement	Test method
36	Radio-frequency field conducted disturbance test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.9	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.9
37	Explosion-proof performance test items	GB3836 or IEC60079 series standards, which will be specified by the explosion-proof product approval agency	

7.3 If the controller is to be approved according to GB16808, the type test items, technical requirement and test method of the controller are shown in the table below:

List of type test items of the controller (GB16808) Table 7.3

No.	Test items	Technical requirement	Test method
1	Visual inspection	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.1	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.1
2	Test of hydrocarbon gas concentration display function	5.2.1.2 of the Guideline	GB16808, 5.2
3	Hydrocarbon gas alarm function test	5.2.1.3 of the Guideline	GB16808, 5.3
4	Failure alarm function test	5.2.1.4 of the Guideline	GB16808, 5.4
5	Self-inspection function test	5.2.1.5 of the Guideline	GB16808, 5.6
6	Power supply function test	5.2.1.6 of the Guideline	GB16808, 5.7
7	Dry heat test	5.2.2 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.8
8	Low-temperature test	5.2.2 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.9
9	Damp heat test-cyclic	5.2.2 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.10

Continued Table 7.3

No.	Test items	Technical requirement	Test method
10	Vibration test	5.2.3 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.7
11	Crash test	5.2.3 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 5.21
12	Energy failure test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.5	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.5
13	Conduction emission	5.2.4 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.2
14	Radiation emission at the enclosure port	5.2.4 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.3
15	Electrostatic discharge test	5.2.4 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.4
16	Radio-frequency field electromagnetic radiation test	5.2.4 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.5
17	Electrical fast transient burst test	5.2.4 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.6
18	Surge immunity test	5.2.4 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.7
19	Conducted low frequency interference test (if applicable)	5.2.4 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.8
20	Radio-frequency field conducted disturbance test	5.2.4 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.9
21	Power transient tests	5.2.4 of the Guideline	GB16808, 5.15

Continued Table 7.3

No.	Test items	Technical requirement	Test method
22	Power supply variation test	5.2.5 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.4
23	Insulation resistance measurement	5.2.6 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.3
24	High voltage test	5.2.6 of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.14
25	Enclosure protection test	5.3. of the Guideline	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.15
26	Flame retardant test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.16	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.16
27	Explosion-proof performance test items (if applicable)	GB3836 or IEC60079 series standards, which will be specified by the explosion-proof product approval agency	

7.4 If the controller is to be approved according to IEC60079-29-1, the type test items, technical requirement and test method of the controller are shown in the table below:

List of type test items of the controller (IEC60079-29-1) Table 7.4

No.	Test items	Technical requirement	Test method
1	Visual inspection	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.1	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.1
2	Unpowered storage	IEC60079-29-1, 5.4.2	IEC60079-29-1, 5.4.2
3	Calibration and adjustment	IEC60079-29-1, 5.4.3and Annex A, Table A.1	IEC60079-29-1, 5.4.3
4	Alarm set point(s)	IEC60079-29-1, 5.4.5 and Annex A, Table A.1	IEC60079-29-1, 5.4.5

Continued Table 7.4

No.	Test items	Technical requirement	Test method
5	Temperature test (combined with dry heat test and low temperature test)	IEC60079-29-1, 5.4.6 and Annex A, Table A.1	IEC60079-29-1, 5.4.6
6	Warm-up time	IEC60079-29-1, 5.4.14 and Annex A, Table A.1	IEC60079-29-1, 5.4.14
7	Time of response	IEC60079-29-1, 5.4.15 and Annex A, Table A.1	IEC60079-29-1, 5.4.15
8	High gas concentration operation above the measuring range	IEC60079-29-1, 5.4.16 and Annex A, Table A.1	IEC60079-29-1, 5.4.16
9	Battery capacity (if applicable)	IEC60079-29-1, 5.4.17 and Annex A, Table A.1	IEC60079-29-1, 5.4.17
10	Software function	IEC60079-29-1, 4.2.9	IEC60079-29-1, 5.4.23
11	Insulation resistance measurement	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.3	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.3
12	Power supply variation test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.4	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.4
13	Power supply failure test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.5	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.5
14	Vibration test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.7	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.7
15	Dry heat test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.8	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.8
16	Low-temperature test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.9	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.9
17	Damp heat test-cyclic	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.10	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.10

Continued Table 7.4

18	High voltage test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.14	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.14
19	Enclosure protection test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.15	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.15
20	Flame retardant test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.16	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 2.16
21	Conduction emission	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.2	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.2
22	Radiation emission at the enclosure port	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.3	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.3
23	Electrostatic discharge test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.4	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.4
24	Radio-frequency electromagnetic radiation test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.5	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.5
25	Electrical fast transient burst test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.6	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.6
26	Surge	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.7	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.7
27	Low frequency conduction (if applicable)	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.8	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.8
28	Radio-frequency field conducted disturbance test	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.9	<Guidelines for Type Approval Test of Electric and Electronic Products> (current valid version), 3.9
29	Explosion-proof performance test items (if applicable)	GB3836 or IEC60079 series standards, which will be specified by the explosion-proof product approval agency	

8 Unit/batch Inspection after Approval

8.1 For the unit/batch inspection after approval, the Surveyor should conduct sampling inspection according to actual conditions after the factory completes the 100% delivery inspection as well as the spot check items on detectors required by relevant standard.

8.2 Items of unit/batch inspection after approval should include:

8.2.1 The detector should subject to the following inspections:

(1) Visual inspection

(2) Alarm operating value test

(3) Alarm repeatability test

(4) Insulation resistance measurement

(5) High voltage test

8.2.2 The controller should be subject to the following inspection:

(1) Visual inspection

(2) Hydrocarbon gas concentration display function test

(3) Hydrocarbon gas alarm function test

(4) Failure alarm function test

(5) Self-inspection function test

(6) Power supply function test

(7) Insulation resistance measurement

(8) High voltage test