Technical Information Service Report

TIS Report: 80140446
Date: September 22, 2022

CLIENT: RKI Instruments Inc.
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United States

Attention: Kimberly Cook

Issued by: Bhas Nanavati

SUBJECT: Detailed Test Report for Combustible Gas Detection Performance of GX-3R and GX-3R Pro assessed as part of CSA Report 80013224 (CSA Project 80013224).

APPLICABLE REQUIREMENTS:

CAN/CSA C22.2 No. 60079-29-1:12	Explosive Atmospheres - Part 29-1: Gas Detectors - Performance Requirements of Gas Detectors for Flammables Gases - First Edition
ANSI/ISA 60079-29-1:13	Explosive Atmospheres - Part 29-1: Gas Detectors - Performance Requirements of Gas Detectors for Flammables Gases - First Edition

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Tests mentioned in the ASSESSMENT section conducted as part of GX-3R and GX-3R Pro CSA Report 80013224 (CSA Project 80013224). This TIS report provides detailed test results only.

ASSESSMENT:

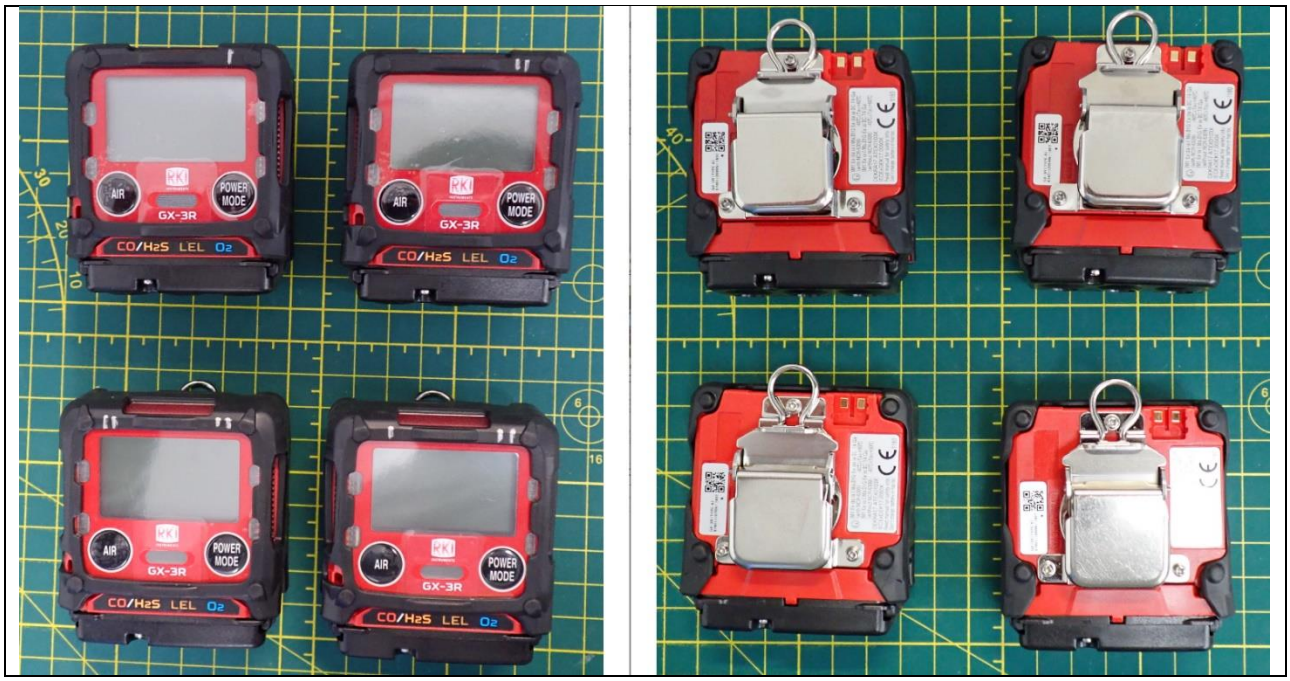
Submittor: RKI Instruments

Devices Tested: GX-3R with NCR-6309 LEL combustible gas sensor

Instrument Type/Features: Portable continuous duty diffusion multi-gas detectors with integral sensor

Rating: Rechargeable lithium-ion battery output 3.7V 750mAh 2.8Wh
Range: 0-100% LEL
Storage Temperature Range: -20 to +50°C
Operating Temperature Range: -20 to +50°C
Part number: GX-3R
Material number; 40156172
Sample and Serial No.: Sample #1 Methane CH_4 SN: 974011200RN
Sample #2 Methane CH_4 SN: 974011205RN
Sample #3 Propane C3H8 SN: 974011198RN
Sample #4 Propane C3H8 SN: 974011197RN

Firmware Rev. No.: 06110-9257 (Main ROM) 05979-C1Ed (Sensor ROM)



Output Detail: Display

Meter: 0-100%LEL

Alarm Device(s): Alarm LEDs, distinctive audible/vibrating alarms

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Alarm Setting(s): Range is 5 to 60% LEL (Increasing concentration), leachable alarm adjustable by user

Transfer Function (Parameters): N/A

Notes: LFL values is reference to ANSI/NFPA 497; Methane LFL is 5% Vol; Propane LFL is 2.1% Vol; Samples have been load with CO/H2S, O2 and LEL sensor for testing.

General Note:
5.2 General requirements for tests
Where it is necessary to apply LFL and UFL values for the purposes of this standard, they shall be taken from ANSI/NFPA 497.

ISA 5.2.1.1 Samples and sequence of tests - General
For the purpose of type testing, the tests shall be carried out on one apparatus except for the long term stability tests (see 5.4.4.4 and 5.4.4.5) and environmental exposure tests (see 5.4.29) which may be conducted on a separate apparatus.

ISA 5.2.1.2 Sequence
The unpowered storage (5.4.2), drop test (5.4.14), and vibration (5.4.13) tests shall be conducted prior to all remaining tests. The test sequence on all remaining tests shall be carried out to a schedule agreed upon between the manufacturer and the test laboratory.

IEC 5.2.1.1 Samples and sequence of tests - General
For the purpose of type testing, the tests shall be carried out on one apparatus. Another apparatus may be used for tests according to 5.4.4.2 to 5.4.4.5, 5.4.18 and 5.4.24.
For IR-sensors using optical filters, the test 5.4.3.3 shall be conducted with two apparatus where the centre wavelength of the optical filters shall be at the minimum and maximum limits of the specification. One of these units may be used subsequently for 5.4.4.2 to 5.4.4.5, 5.4.18 and 5.4.24.

IEC 5.2.1.2 Sequence
The apparatus shall be subjected to all of the tests applicable to that type of apparatus, as described in 5.4.
Test 5.4.2 shall be conducted prior to all other tests. The manufacturer may request a particular order of the other tests. However, the tests 5.4.4.2 to 5.4.4.5, 5.4.18, and 5.4.24 shall always be conducted in this sequence.

5.3.9 Stabilization time
In each instance where the apparatus is subjected to a different test condition, the apparatus shall be allowed to stabilize under these new conditions before measurements are taken.

5.4.1 Test method - General
The following tests shall be performed in accordance with 5.3, unless otherwise stated. All tests shall be performed. At the end of each test, indications shall be taken in both clean air and the standard test gas, unless otherwise stated. The values of the indications used for verification of compliance with the performance requirements of Annex A shall be the final indications (see 3.6.2) of both the clean air and standard test gas readings, unless otherwise stated.

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The following results (summarized below) were obtained according to the test requirements of C22.2 No. 60079-29-1:12 / ANSI/ISA-60079-29-1 (12.13.01)-2013 Clause 5.

Sample#	Test Conducted	CSA-C22.2 No. 60079-29-1:12	ANSI/ISA-60079-29-1 (12.13.01)-2013	Compliance
1,2,3,4	Unpowered storage	5.4.2	5.4.2	Yes, See comments
	Calibration and adjustment	5.4.3	5.4.3	—
2	Initial Preparation of the apparatus	5.4.3.1	5.4.3.1	Yes
2	Calibration Curve	5.4.3.2	5.4.3.2	Yes
	Stability (continuous duty apparatus only)	5.4.4	5.4.4	----
2	Short-term stability	5.4.4.1	5.4.4.1	Yes
1	Long-term stability (portable apparatus)	5.4.4.5	5.4.4.5	Yes
	Alarm set point(s)	5.4.6	5.4.6	---
2	Increasing concentration	5.4.6.2	5.4.6.2	Yes
2	Temperature	5.4.7	5.4.7	Yes, See comments
2	Pressure	5.4.8	5.4.8	Yes
2	Humidity	5.4.9	---	Yes
2	Humidity	---	5.4.9	Yes
2	Air Velocity	5.4.10	5.4.10	Yes
	Orientation	5.4.12	5.4.12	—
2	Portable apparatus	5.4.12.1	5.4.12.1	Yes
	Vibration	5.4.13	5.4.13	—
2	Procedure 1	5.4.13.2.2	5.4.13.2.2	Yes
2	Drop test for portable apparatus	5.4.14	5.4.14	Yes
2	Warm –up time	5.4.15	5.4.15	Yes
	Time of response	5.4.16	5.4.16	---
2	Increasing concentration	5.4.16(a)	5.4.16(a)	Yes
	High gas concentration operation above the measuring range	5.4.18	5.4.18	---
1	Apparatus other than spot-reading apparatus	5.4.18.2	5.4.18.2	Yes, See comments
	Battery capacity	5.4.19	5.4.19	---
	Battery-powered portable continuous duty apparatus	5.4.19.1	5.4.19.1	—
2	Battery discharge	5.4.19.1.1	5.4.19.1.1	Yes
2	Low battery duration	5.4.19.1.2	5.4.19.1.2	Yes
2	Field calibration kit	5.4.26	5.4.26	Yes, See comments

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2	Fault signals	----	5.4.28	Yes

Sample#	Test Conducted	CSA-C22.2 No. 60079-29-1:12	ANSI/ISA-60079-29-1 (12.13.01)-2013	Compliance
	Calibration and adjustment	5.4.3	5.4.3	—
4	Initial Preparation of the apparatus	5.4.3.1	5.4.3.1	Yes
4	Calibration Curve	5.4.3.2	5.4.3.2	Yes
	Stability (continuous duty apparatus only)	5.4.4	5.4.4	---
4	Short-term stability	5.4.4.1	5.4.4.1	Yes
3	Long-term stability (portable apparatus)	5.4.4.5	5.4.4.5	Yes
	Alarm set point(s)	5.4.6	5.4.6	---
4	Increasing concentration	5.4.6.2	5.4.6.2	Yes
4	Temperature	5.4.7	5.4.7	Yes, See comments
4	Pressure	5.4.8	5.4.8	Yes
4	Humidity	5.4.9	---	Yes
4	Humidity	---	5.4.9	Yes
4	Air Velocity	5.4.10	5.4.10	Yes
	Orientation	5.4.12	5.4.12	—
4	Portable apparatus	5.4.12.1	5.4.12.1	Yes
	Vibration	5.4.13	5.4.13	—
4	Procedure 1	5.4.13.2.2	5.4.13.2.2	Yes
4	Drop test for portable apparatus	5.4.14	5.4.14	Yes
4	Warm –up time	5.4.15	5.4.15	Yes
	Time of response	5.4.16	5.4.16	---
4	Increasing concentration	5.4.16(a)	5.4.16(a)	Yes
	High gas concentration operation above the measuring range	5.4.18	5.4.18	---
3	Apparatus other than spot-reading apparatus	5.4.18.2	5.4.18.2	Yes
	Battery capacity	5.4.19	5.4.19	---
	Battery-powered portable continuous duty apparatus	5.4.19.1	5.4.19.1	—
4	Battery discharge	5.4.19.1.1	5.4.19.1.1	Yes
4	Low battery duration	5.4.19.1.2	5.4.19.1.2	Yes
4	Field calibration kit	5.4.26	5.4.26	Yes, See comments
4	Fault signals	----	5.4.28	Yes

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Unpowered storage

Test sample GX-3R: Sample #1,2,3,4

All parts of the apparatus shall be exposed sequentially to the following conditions in clean air.

a) a temperature of (-25± 3) ºC for 24 hours.
b) ambient temperature for at least 24 hours.
c) a temperature of (60± 2) ºC for 24 hours.
d) ambient temperature for at least 24 hours.

At each temperature, the humidity of the clean air shall be so that condensation does not occur.

The above temperatures may be varied after agreement with the manufacturer.

Result:

Temperature (°C)	Duration (h)	Observation
-20	24	No apparent damage
Normal Ambient	24	No apparent damage
50	24	No apparent damage
Normal Ambient	24 minimum	No apparent damage

Comments: Manufacturer claims the storage temperature range is -20 ºC to 50 ºC

Start Date: 2019-10-17

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Calibration and adjustment
Initial preparation of the apparatus

Test sample GX-3R: Sample #2 Methane CH_4

Initial calibration gas mixture (50 percent of full scale gas concentration)

Combustible Component	Percent in Air	Applicable Scale/Range
CH_4	2.5	0-100%LEL

Comments:

Lab Environment : 22.4ºC/26.2%RH/989.2hPa

Date: 2019-11-19

Calibration curve

Test sample GX-3R: Sample #2 Methane CH_4

Combustible: Methane (CH_4)

Test gas mixtures:

Applicable scale/range	0-100%LEL
% Full Scale Gas Concentration	Test Gas Mixture (% Combustible in Air)
0	0
10	0.5
30	1.5
50	2.5
70	3.5
90	4.5

Meter/output indication:

Applicable scale/range	0-100%LEL		
% Full Scale Test Gas	Indication Set 1 (%LEL)	Indication Set 2 (%LEL)	Indication Set 3 (%LEL)
0	0	0	0
10	11	10	11
30	32	32	32
50	53	52	52
70	73	73	73
90	96	96	96

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Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment: 22.4ºC/26.2%RH/989.2hPa

Date: 2019-11-19

Stability (continuous duty apparatus only)

Note: For these tests, battery powered apparatus should be powered from internal batteries wherever possible, otherwise an external power supply may be used.

Short-term stability

Test sample GX-3R: Sample #2 Methane CH_4

The apparatus shall be exposed to six applications of the standard test gas for 3min followed by exposure to clean air for a period of 7min. Indications shall be taken at the end of each exposure to air and the standard test gas.

Applicable scale/range		**0-100%LEL**		
Application		**Indication (%LEL)**		**Indication (%LEL)**
1	Standard test gas (3min)	50	Clean air (7min)	1
2	Standard test gas (3min)	52	Clean air (7min)	1
3	Standard test gas (3min)	52	Clean air (7min)	1
4	Standard test gas (3min)	51	Clean air (7min)	1
5	Standard test gas (3min)	52	Clean air (7min)	2
6	Standard test gas (3min)	52	Clean air (7min)	2

Performance requirements: ±3% of measuring range or ±10% of indication

Comments:

Lab environment: 22.8ºC/27.4%RH/998.7hPa

Date: 2019-11-20

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Long –term stability ((portable apparatus – Group II only))

Test sample GX-3R: Sample #1 Methane CH_4 GX-3R

The apparatus shall be operated in clean air continuously for a period of at least 8 h per working day over a total of at least 20 working days. The apparatus shall be exposed to the standard test gas until stabilized, once during each operating period. Indications shall be taken prior to the application of, after stabilization and prior to removal of the standard test gas.

	Date/Time		Indication (% LEL)		
Cycle	Started	Completed	Before gas applied	After stabilization	Prior to removal of gas
1	2019-10-24 8:00	2019-10-24 16:00	Lab environment	21.9°C / 34%rH / 1001.6hPa	
			0	51	51
2	2019-10-25 8:00	2019-10-25 16:00	Lab environment	22°C / 34.4%rH / 1002.3hPa	
			0	51	51
3	2019-10-28 8:00	2019-10-28 16:00	Lab environment	21.9°C / 39.5%rH / 997.8hPa	
			0	50	50
4	2019-10-29 8:00	2019-10-29 16:00	Lab environment	22.3°C / 44.7%rH / 997.9hPa	
			0	49	49
5	2019-10-30 8:00	2019-10-30 16:00	Lab environment	22.5°C / 37.7%rH / 1001hPa	
			0	50	50
6	2019-10-31 8:00	2019-10-31 16:00	Lab environment	22.9°C / 40.5%rH / 976.3hPa	
			0	49	49
7	2019-11-01 8:00	2019-11-01 16:00	Lab environment	21.7°C / 29.6%rH / 1000.8hPa	
			1	51	51
8	2019-11-04 8:00	2019-11-04 16:00	Lab environment	21.4°C / 32.5%rH / 992.4hPa	
			1	51	51
9	2019-11-05 8:00	2019-11-05 16:00	Lab environment	22.1°C / 26.9%rH / 998.5hPa	
			1	51	51
10	2019-11-06 8:00	2019-11-06 16:00	Lab environment	22.5°C / 20.6%rH / 1004.9hPa	
			0	50	51
11	2019-11-07 8:00	2019-11-07 16:00	Lab environment	24.7°C / 21.5%rH / 1000.2hPa	
			1	51	51
12	2019-11-11 8:00	2019-11-11 16:00	Lab environment	22.3°C / 21.2%rH / 999.5hPa	
			1	51	51
13	2019-11-12 8:00	2019-11-12 16:00	Lab environment	19.9°C / 22.5%rH / 1000.2hPa	
			1	51	51
14	2019-11-13 8:00	2019-11-13 16:00	Lab environment	17.8°C / 22.3%rH / 1005.9hPa	
			2	51	51
15			Lab environment	20.1°C / 29.8%rH / 999.5hPa	

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	2019-11-14 8:00	2019-11-14 16:00	1	49	49
16	2019-11-18 8:00	2019-11-18 16:00	Lab environment	22.4°C / 25.9%rH / 987.9hPa	
			1	49	49
17	2019-11-19 8:00	2019-11-19 16:00	Lab environment	22.6°C / 26.3%rH / 989.3hPa	
			1	51	51
18	2019-11-20 8:00	2019-11-20 16:00	Lab environment	22.7°C / 28.1%rH / 999hPa	
			1	50	50
19	2019-11-21 8:00	2019-11-21 16:00	Lab environment	26.8°C / 23.2%rH / 991.2hPa	
			1	49	49
20	2019-11-22 8:00	2019-11-22 16:00	Lab environment	23°C / 20.1%rH / 992.9hPa	
			2	49	49

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

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Alarm set points

Test sample GX-3R: Sample #2 Methane CH_4

5.4.6.1 General

When the apparatus is provided with either
Type A) externally adjustable means of setting either one or more alarm set points, or
Type B) fixed internally pre-set alarm point(s),
The activation of such alarms by gas at the appropriate set point values shall be verified by using test gases as described in 5.4.6.2 and 5.4.6.3. In all cases, the test gas shall be applied until either activation of the alarm(s) or twice the respective t(90), whichever is less.
For equipment apparatus with several multiple individual alarms set points, these tests shall be carried out for each alarm set point.

5.4.6.2 Increasing concentration

For apparatus of Type A) set the alarm set point at 10 % relative below the concentration of the standard test gas. If the alarm set point cannot be set at this concentration, the alarm shall be set as near as possible to that concentration. In this case and for apparatus of Type B), the test gas shall have a volume fraction of 10 % relative above the concentration of the alarm set point. Expose the apparatus to clean air and then to the standard test gas or the specified test gas.

Check alarm manual reset operation

Compliance: Yes

Comments:

Lab environment: 22.8°C/27.4%RH/998.7hPa

Date:2019-11-20

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Temperature

Test sample GX-3R: Sample #2 Methane CH_4

This test shall be performed in a temperature chamber having the capability of holding the sensor or apparatus at the specified temperature within ±2 °C. When the apparatus (or the portion under test) has reached the temperature specified in Annex A, as appropriate, the sensor shall be exposed sequentially to air and the standard test gas, which shall be at the same temperature as the atmosphere in the test chamber. The dew point of the air or standard test gas shall be below the lowest temperature of the test chamber and kept constant during the test.

		Test Environment	
	Device	Clean Air / Cal. Gas Mix	Normal / Variable Temp
	Applicable scale/range	0-100%LEL	
Clause	Gas mix	Zero Gas	Initial Calibration Gas
5.4.6(a) 5.4.6(b) 5.4.6(c)	Indication at +20ºC level (%LEL)	0	51
	Ambient chamber temperature (ºC) at time of reading	22	22
5.4.6(a) 5.4.6(c)	Indication at -10ºC level (%LEL)	2	52
	Ambient chamber temperature (ºC) at time of reading	-10	-10
Manufacturer claims*	Indication at -20ºC level (%LEL)	2	53
	Ambient chamber temperature (ºC) at time of reading	-20	-20
Manufacturer claims*	Indication at -40ºC level (%LEL)	3	54
	Ambient chamber temperature (ºC) at time of reading	-40	-40
5.4.6(a)	Indication at +40ºC level (%LEL)	4	53
	Ambient chamber temperature (ºC) at time of reading	+40	+40
Manufacturer claims*	Indication at +50ºC level (%LEL)	5	54
	Ambient chamber temperature (ºC) at time of reading	50	50
Manufacturer claims*	Indication at +60ºC level (%LEL)	7	54
	Ambient chamber temperature (ºC) at time of reading	60	60

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Performance requirements: Group II equipment limits (whichever value is greater) Volume fraction up to 100 % lower flammable limit indication

5.4.7(a) portable/transportable		-10ºC, 20ºC, 40ºC	±5% measuring range or ±10% of indication from 20ºC
5.4.7(b) fixed with remote sensor	Sensor	-25ºC, 20ºC, 55ºC	±10% measuring range or ±20% of indication from 20°C
	Control unit	5ºC, 20ºC, 55ºC	±3% measuring range or ±10% of indication from 20ºC
5.4.7(c) fixed with sensor		-10ºC, 20ºC, 55ºC	±5% measuring range or ±15% of indication from 20°C

Comments: *Manufacturer claims the operation temperature range are -20 ºC to 50 ºC, and -40 ºC to 60 ºC for 15 minutes. The equipment acclimated at -40 ºC to 60 ºC for 15 minutes and other level of the temperature minimum of 1 hour for test. It was exposed sequentially to clean air and the standard test gas.

Date: 2019-11-21

Pressure

Test sample GX-3R: Sample #2 Methane CH_4

The effects of pressure variation shall be observed by placing the sensor or apparatus (including the aspirator for aspirated apparatus) in a test chamber that permits the pressure of clean air and of the standard test gas to be varied over the range specified in Annex A.
The pressure shall be maintained at the specified levels for 5 min, before a reading is accepted or a test is made. Readings shall be taken with clean air and standard test gas.

Pressure	**Clean Air (%LEL)**	**Standard test gas (%LEL)**
80kPa	3	46
100kPa	0	49
120kPa	-4	50

Performance requirements: ±5% of measuring range or ±30% of indication from 100kPa
(test: 80kPa, 100kPa, 120kPa)

Comments:

Date: 2019-12-05

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Humidity

Test sample GX-3R: Sample #2 Methane CH_4

The test shall be done with three different humidities evenly distributed over the range specified in Annex A. The apparatus shall be allowed to stabilize at 40 °C. After stabilization it shall be adjusted (zeroed/calibrated) according to the instructions of the manufacturer. For each humidity, the apparatus shall be exposed for 15 min to clean air and then to the standard test gas at the same humidity. The relative humidity levels shall be known to within ±3 % RH.
The concentration of the test gas shall be held constant, or due allowance of changes in its concentration by dilution in water shall be made.

50% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	0	49
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	50	50

20% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	3	58
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	20	20

90% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	-3	40
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	90	90

Performance requirements: ±10% of measuring range or ±30% of indication from the indication at adjustment at 40 °C (test: 20% RH, 50% RH, 90% RH)

Comments:

Date: 2020-01-20

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Humidity

Test sample GX-3R: Sample #2 Methane CH_4

The sensor shall be exposed for at least 2 h to clean air having 50±5 % RH at (20±5)°C and then calibrated per the manufacturer's recommendations. The sensor shall be exposed to the standard test gas until stabilized at the 50±5 % RH at (20±5)°C and the equipment reference point reading shall be recorded. Next, the sensor shall be exposed for at least 2 h to clean air at 20±5 % RH at (20±5)°C. The sensor shall then be exposed to the standard test gas until stabilized at 20±5 % RH at (20±5)°C and record the results. Next, the sensor shall be exposed for at least 2 h to clean air at 90±5 % RH at (20±5)°C. The sensor shall then be exposed to the standard test gas until stabilized at 90±5 % RH at (20±5)°C and record the results.

50% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	0	50
Exposure period prior to reading (min)	120	5
RH at time of reading (%)	50	50

20% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	1	55
Exposure period prior to reading (min)	120	5
RH at time of reading (%)	20	20

90% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	-1	45
Exposure period prior to reading (min)	120	5
RH at time of reading (%)	90	90

Performance requirements: ±10% of measuring range or ±30% of indication from 50%RH

Comments:

Date: 2020-01-21

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Air Velocity Variation

Test sample GX-3R: Sample #2 Methane CH_4

5.4.10.1 General
The effects of air speed over a range of 0 m/s to 6 m/s on apparatus with sensors that operate by diffusion shall be determined using the test conditions given in 5.4.10.2.
5.4.10.2 Test conditions
The separate sensors of apparatus with remote sensors and, when practicable, the entire apparatus if the sensors are integral shall be tested in a flow chamber.
NOTE: The flow chamber should be suitable for the application of clean air and the standard test gas.
For apparatus having integral sensors, which are too large to be tested in a flow chamber, other flow apparatus for carrying out the test shall be permitted.

Irrespective of whether a flow chamber or other flow apparatus is used, orient the sensor in relation to the direction of the air flow as follows:
1) Sensor oriented directly towards direction of flow,
2) Sensor oriented away from the direction of flow,
3) Sensor oriented at right angles to the direction of flow.
Measurements shall be made under static conditions, at 3 m/s and at 6 m/s.
NOTE Directions of flow which are not likely to occur in practice, due to the design of the apparatus, or which are expressly prohibited within the manufacturer's instruction manual may not be tested.

Sensor exposed to clean air:

Applicable scale/range	0-100%LEL		
Measured velocity at sensor (m/s)	at 0 m/s	at 3 m/s	at 6 m/s
Sensor position relative to mixture stream	Indication (%LEL)		
1) flow directed at the sensor inlet	0	0	0
2) flow directed 180° to 1)	0	0	0
3) flow directed 90° to 1)	0	0	0

Sensor exposed to standard test gas:

Applicable scale/range	0-100%LEL		
Measured velocity at sensor (m/s)	at 0 m/s	at 3 m/s	at 6 m/s
Sensor position relative to mixture stream	Indication (%LEL)		
1) flow directed at the sensor inlet	50	51	51
2) flow directed 180° to 1)	50	51	51
3) flow directed 90° to 1)	50	51	51

Performance requirements: ±5% of measuring range or ±10% of indication
Comments:
Lab Environment : 22.7ºC ; 16.4%RH ; 982.3hPa
Date: 2020-02-06

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Orientation

Test sample GX-3R: Sample #2 Methane CH_4

5.4.12.1 Portable apparatus
During tests with clean air and standard test gas, rotate the sensor, or the whole apparatus if relevant, through 360º in steps of 90º around each of its three mutually perpendicular axes (one axis at a time). Record the indication in each position.

Clean Air

Applicable scale/range	0-100%LEL			
Rotation Positions	0º	90º	180º	270º
Measured Values				
X-axis	0	0	0	0
Y-axis	0	0	0	0
Z-axis	0	0	0	0

Standard test gas

Applicable scale/range	0-100%LEL			
Rotation Positions	0º	90º	180º	270º
Measured Values				
X-axis	49	49	49	49
Y-axis	49	49	49	49
Z-axis	49	49	49	49

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment : 24ºC; 15.4%RH; 979.8hPa

Date: 2020-02-06

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Vibration

Test sample GX-3R: Sample #2 Methane CH_4

Zero and Initial Calibration Gas (50% LEL) checked/adjusted - Yes
The alarm set point shall be set to 20% of full-scale range.
The apparatus shall be energized and mounted on the vibration test machine and vibrated successively in each of three planes respectively parallel to each of the three major axes of the apparatus.
The apparatus shall be vibrated over the frequency range specified at the excurs ion or constant acceleration peak specified, for a period of 1 h in each of the three mutually perpendicular planes. The rate of change of frequency shall not exceed 10 Hz/min.
Vibration, Procedures 1 (Cl 5.4.13.2.1).
For portable and transportable apparatus, remote sensors, and controllers where the sensor is integral with or directly attached to the controller, the vibration shall be as follows:
10 Hz to 30 Hz, 1.0 mm total excursion,
31 Hz to 150 Hz, 19.6 m/s^2 acceleration peak.
Criteria:

a) Meter/Output indication before Vibration Test
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

b) Meter/Output indication after Vibration Test (±10% of measuring range or ±20% of indication):
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

c) Loss of function: No
False alarm: No
False indication of malfunction: No
Fault signal: No

d) Visible or hidden damage including loose components or damage to the enclosure that would manifest itself in a loss of function or electrical hazard:

Evident damage: No
If yes, specify:

Note: Observation of the effects of "hidden damage" is embodied in the balance of the prescribed test program.

Performance requirements: ±5% of measuring range or ±10% of indication; and no loss of function, no fault signal, no damage resulting in a hazard and no false alarms

Comments:

Lab environment: 22.1ºC / 31%RH / 992.2hPa

Date: 2019-10-23

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Drop test for portable and transportable apparatus

Test sample GX-3R: Sample #2 Methane CH_4

While in the operating mode, the instrument (with carrying case if applicable) shall be released from a height of 1m above a concrete and allowed to free-fall.

Portable apparatus shall be released, while operating, from a height of 1m above a concrete surface and allowed to free fall.

Transportable apparatus with a mass of less than 5kg shall be released, while not operating, from a height of 0.3 m above a concrete surface and allowed to free fall.

Other transportable apparatus shall be released, while not operating, from a height of 0.1m above a concrete surface and allowed to free fall.

The test required above shall be performed three separate times, the portable apparatus being released each time with a different side (surface) facing down at the time of release and the transportable apparatus to be in an orientation for normal transport.

Meter/Output indication before Drop Test

Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

Meter/Output indication after Drop Test (±5% of measuring range or ±10% of indication):

Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 51%LEL

Loss of function after test (e.g. alarm, pump function, controls, display): No

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment: 22.5ºC/24.9%RH/989.3hPa

Date:2019-11-19

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Warm –up time

Test sample GX-3R: Sample #2 Methane CH_4

The alarm set point shall be set to 20% of full-scale range.

The apparatus shall be switched off and left for 24h in clean air: Yes

After the 24h period, the apparatus shall be switched on in clean air and the warm up time measured: 38.5s

Fixed/transportable: (±5 % measuring range drift within manual spec. time, and no false alarm)

Indication measured:

Continuous duty portable: (±5% of measuring range within 2min., and no false alarm)

Indication measured: 47%LEL

Comments:

Lab Environment: 23.5ºC;21.3%RH;995.3hPa

Date:2020-02-10

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Time of Response

Test sample GX-3R: Sample #2 Methane CH_4

The equipment shall be switched on in clean air and, after an interval corresponding to at least two times the warm-up time, as determined in accordance with 5.4.15, without switching off, the equipment or the sensor(s) shall be subjected to step changes from clean air to the standard test gas and from standard test gas to clean air. These changes shall be introduced by means of suitable equipment (see Annex B).
The times of response t(50) and t(90) for increasing concentration, and t(50) and t(10) for decreasing concentration shall be measured.
For an optional sampling probe, an extra test is required to measure the additional delay. This shall be less than 3 s/m of the total length of the probe plus tubing or any greater value, which is stated in the instruction manual.

Notes:
1. These times apply without optional accessories e.g. collecting cones, weather protection, attached to the sensor for special purposes.
2. For an optional sampling probe, test additional delay.

Test gas mixture delivery method:
(Apparatus Per CSA152-Cl. A4).

Apparatus per Cl A4 - Yes

Other (if No) –

Increasing Response:

Applicable scale/range	0-100%LEL
Standard test gas mixture concentration (% combustible in air)	2.5%CH_4 in air
Elapsed time (in seconds) to indicate 50% of test gas concentration (20s allowable)	8.3s
Elapsed time (in seconds) to indicate 90% of test gas concentration (60s allowable)	14.2s

If required response not achieved, include the following observations as applicable:

Indication at 20 second time limit: _____
Indication at 60 second time limit: _____
Maximum indication achieved: _____

Comments:

Lab Environment: 23.5ºC; 17.7%RH; 995.5hPa

Date:2020-02-11

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High gas concentration operation above the measuring range

Test sample GX-3R: Sample #1 Methane CH_4

This subclause applies to all apparatus with an upper limit of the measuring range less than 100 % (v/v) gas.
The entire apparatus, or the remote sensors of fixed or transportable apparatus, shall be subjected to the test given in 5.4.18.1 or 5.4.18.2 using a test apparatus that simulates a step change between gas concentrations such as those described in Annex B.
All gas concentrations above full scale shall be indicated by a full scale meter indication and, where fitted, an alarm. If the indication is digital, a clear indication shall be given that the upper limit of the measuring range has been exceeded.

Test gas delivery method:
Apparatus per CSA152 - Cl A4 - No

Other (if No) – calibration cap

Indication before test: 50%LEL

The apparatus or remote sensor shall be subjected to a step change from clean air to a volume fraction of 100% gas that shall be maintained for 3min.

Compliance: Yes

The sensor shall then be subjected to clean air for 20min, followed by the standard test gas.

Compliance: Yes

Indication measured: 46%LEL

Performance requirements: ±7 % measuring range or +20 % / –10 % of indication

Comments: Indication went down to under range after subjected to clean air. 'uuu' Minus Over Range "M Over" were on the display.

Lab Environment: 23.9ºC/17.2%RH/994hPa

Date:2020-02-11

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Battery capacity

5.4.19.1 Battery powered portable continuous duty apparatus

5.4.19.1.1 Battery discharge

Test sample GX-3R: Sample #2 Methane CH_4

With a battery fully charged at the beginning of the test, the apparatus shall be operated in clean air for a total period of:
a) 8h, if fitted with a user-operated on/off switch.
b) 10h, if not so fitted, or
c) any longer time as specified by the manufacturer

At the end of the specified period, the apparatus is exposed to the standard test gas.

Test period: 8 hours and 25 hours
Indication: 50%LEL and 52%LEL

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: 25 hours in Measuring Mode (Non Alarm Operation, Fully Charged)

Lab Environment: 23.3C/16%RH/996.6hPa

Date: 2020-02-12

5.4.19.1.2 Low battery duration

The apparatus shall then continue to operate until an indication that the low battery condition has been reached. The apparatus shall continue to operate for an additional 10min:

Additional test period: 10 minutes
Indication: 52%LEL

Performance requirements: ±7% of measuring range or ±15% of indication

Comments: The last bar in the battery icon starts flashing is indicate as low battery warning.

Lab Environment: 23.3C/16%RH/996.6hPa

Date: 2020-02-12

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Field calibration kit

Test sample GX-3R: Sample #2 Methane CH_4

If a field calibration kit is provided with the apparatus, carry out the following test:

a) Calibrate the apparatus in accordance with 5.4.3.1 using the test conditions given in 5.3 and using the test equipment for the tests described in 5.4

b) Use the field calibration kit in a manner corresponding to the manufacturer's instructions for checking the apparatus response.

Calibration kit hardware evaluation: 0.25 LPM fixed flow regulator, Non-absorbent tubing and Calibration cup
Hardware Items: Calibration Cap

Reading with kit hardware, using initial calibration gas mixture as above:

Applicable Scale/Range		0-100%LEL	
a) Indication by use calibration kit		b) Indication in normal operation	
clean air	standard test gas	clean air	standard test gas
0	50	0	52

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: Use the flow controller and primary standard gas mixture to similar the regulator and gas cylinder in the calibration kit. Client only provided calibration cap for evaluation.

Lab Environment: 22.4ºC/26.2%RH/989.2hPa

Date:2019-11-19

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Fault signals

Test sample GX-3R: Sample #2 Methane CH_4

Verify fault signals.

Under-range values at or below minus 10% (-10%) of the measuring range (e.g. caused by drift)

The instrument was zero calibrated whilst the sensing head was subjected to a gas mix consisting of 0.50% CH_4 by volume in air. Upon successful calibration, the sensing head was exposed to clean air.

Observation: 0 to -10%LEL indicated as is. Below -10%LEL have failure alarm and 'nnn' and over range alarm "over" were on the display flashing.

Performance requirements: Verify signal and no spurious alarms

Comments:

Lab Environment : 23.9ºC/17.2%RH/994hPa

Date : 2020-02-11

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Calibration and adjustment
Initial preparation of the apparatus

Test sample GX-3R: Sample #4 Propane C3H8

Initial calibration gas mixture (50 percent of full scale gas concentration)

Combustible Component	Percent in Air	Applicable Scale/Range
C3H8	1.05	0-100%LEL

Comments:

Lab Environment : 22.4ºC/26.2%RH/989.2hPa

Date : 2019-11-19

Calibration curve

Test sample GX-3R: Sample #4 Propane C3H8

Combustible: Propane (C3H8)

Test gas mixtures:

Applicable scale/range	0-100%LEL
% Full Scale Gas Concentration	Test Gas Mixture (% Combustible in Air)
0	0
10	0.21
30	0.63
50	1.05
70	1.47
90	1.89

Meter/output indication:

Applicable scale/range	0-100%LEL		
% Full Scale Test Gas	Indication Set 1 (%LEL)	Indication Set 2 (%LEL)	Indication Set 3 (%LEL)
0	0	0	0
10	11	9	10
30	33	30	30
50	52	50	50
70	70	69	68
90	88	86	86

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Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment: 22.4ºC/26.2%RH/989.2hPa

Date: 2019-11-19

Stability (continuous duty apparatus only)

Note: For these tests, battery powered apparatus should be powered from internal batteries wherever possible, otherwise an external power supply may be used.

Short-term stability

Test sample GX-3R: Sample #4 Propane C3H8

The apparatus shall be exposed to six applications of the standard test gas for 3min followed by exposure to clean air for a period of 7min. Indications shall be taken at the end of each exposure to air and the standard test gas.

Applicable scale/range		**0-100%LEL /**		
Application		**Indication (%LEL)**		**Indication (%LEL)**
1	Standard test gas (3min)	50	Clean air (7min)	0
2	Standard test gas (3min)	50	Clean air (7min)	0
3	Standard test gas (3min)	50	Clean air (7min)	0
4	Standard test gas (3min)	50	Clean air (7min)	0
5	Standard test gas (3min)	50	Clean air (7min)	0
6	Standard test gas (3min)	50	Clean air (7min)	0

Performance requirements: ±3% of measuring range or ±10% of indication

Comments:

Lab Environment: 22.8ºC/27.4%RH/998.7hPa

Date: 2019-11-20

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Long –term stability ((portable apparatus – Group II only))

Test sample GX-3R: Sample #3 Propane C3H8

The apparatus shall be operated in clean air continuously for a period of at least 8 h per working day over a total of at least 20 working days. The apparatus shall be exposed to the standard test gas until stabilized, once during each operating period. Indications shall be taken prior to the application of, after stabilization and prior to removal of the standard test gas.

	Date/Time		Indication (% LEL)		
Cycle	Started	Completed	Before gas applied	After stabilization	Prior to removal of gas
1	2019-10-25 8:00	2019-10-25 16:00	Lab environment	22ºC / 34.4%rH / 1002.3hPa	
			1	52	52
2	2019-10-28 8:00	2019-10-28 16:00	Lab environment	21.9ºC / 39.5%rH / 997.8hPa	
			1	51	51
3	2019-10-29 8:00	2019-10-29 16:00	Lab environment	22.3ºC / 44.7%rH / 997.9hPa	
			0	51	51
4	2019-10-30 8:00	2019-10-30 16:00	Lab environment	22.5ºC / 37.7%rH / 1001hPa	
			0	52	52
5	2019-10-31 8:00	2019-10-31 16:00	Lab environment	22.9ºC / 40.5%rH / 976.3hPa	
			1	51	51
6	2019-11-01 8:00	2019-11-01 16:00	Lab environment	21.7ºC / 29.6%rH / 1000.8hPa	
			2	52	52
7	2019-11-04 8:00	2019-11-04 16:00	Lab environment	21.4ºC / 32.5%rH / 992.4hPa	
			2	52	52
8	2019-11-05 8:00	2019-11-05 16:00	Lab environment	22.1ºC / 26.9%rH / 998.5hPa	
			2	52	52
9	2019-11-06 8:00	2019-11-06 16:00	Lab environment	22.5ºC / 20.6%rH / 1004.9hPa	
			1	51	52
10	2019-11-07 8:00	2019-11-07 16:00	Lab environment	24.7ºC / 21.5%rH / 1000.2hPa	
			2	51	51
11	2019-11-11 8:00	2019-11-11 16:00	Lab environment	22.3ºC / 21.2%rH / 999.5hPa	
			2	52	52
12	2019-11-12 8:00	2019-11-12 16:00	Lab environment	19.9ºC / 22.5%rH / 1000.2hPa	
			2	53	53
13	2019-11-13 8:00	2019-11-13 16:00	Lab environment	17.8ºC / 22.3%rH / 1005.9hPa	
			2	53	53
14	2019-11-14 8:00	2019-11-14 16:00	Lab environment	20.1ºC / 29.8%rH / 999.5hPa	
			2	52	52
15	2019-11-18 8:00	2019-11-18 16:00	Lab environment	22.4ºC / 25.9%rH / 987.9hPa	
			2	52	52
16			Lab environment	22.6ºC / 26.3%rH / 989.3hPa	

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	2019-11-19 8:00	2019-11-19 16:00	1	52	52
17	2019-11-20 8:00	2019-11-20 16:00	Lab environment	22.7ºC / 28.1%rH / 999hPa	
			2	52	52
18	2019-11-21 8:00	2019-11-21 16:00	Lab environment	26.8ºC / 23.2%rH / 991.2hPa	
			2	52	52
19	2019-11-22 8:00	2019-11-22 16:00	Lab environment	23ºC / 20.1%rH / 992.9hPa	
			2	52	52
20	2019-11-25 8:00	2019-11-25 16:00	Lab environment	23.2ºC / 29.2%rH / 984.9hPa	
			2	51	51

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Alarm set points

Test sample GX-3R: Sample #4 Propane C3H8

5.4.6.1 General

When the apparatus is provided with either
Type A) externally adjustable means of setting either one or more alarm set points, or
Type B) fixed internally pre-set alarm point(s),
The activation of such alarms by gas at the appropriate set point values shall be verified by using test gases as described in 5.4.6.2 and 5.4.6.3. In all cases, the test gas shall be applied until either activation of the alarm(s) or twice the respective t(90), whichever is less.
For equipment apparatus with several multiple individual alarms set points, these tests shall be carried out for each alarm set point.

5.4.6.2 Increasing concentration

For apparatus of Type A) set the alarm set point at 10 % relative below the concentration of the standard test gas. If the alarm set point cannot be set at this concentration, the alarm shall be set as near as possible to that concentration. In this case and for apparatus of Type B), the test gas shall have a volume fraction of 10 % relative above the concentration of the alarm set point. Expose the apparatus to clean air and then to the standard test gas or the specified test gas.

Check alarm manual reset operation

Compliance: Yes

Comments:

Lab Environment: 22.8ºC/27.4%RH/998.7hPa

Date: 2019-11-20

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Temperature

Test sample GX-3R: Sample #4 Propane C3H8

This test shall be performed in a temperature chamber having the capability of holding the sensor or apparatus at the specified temperature within ±2 °C. When the apparatus (or the portion under test) has reached the temperature specified in Annex A, as appropriate, the sensor shall be exposed sequentially to air and the standard test gas, which shall be at the same temperature as the atmosphere in the test chamber. The dew point of the air or standard test gas shall be below the lowest temperature of the test chamber and kept constant during the test.

		Test Environment	
	Device	Clean Air / Cal. Gas Mix	Normal / Variable Temp
	Applicable scale/range	0-100%LEL /	
Clause	Gas mix	Zero Gas	Initial Calibration Gas
5.4.6(a) 5.4.6(b) 5.4.6(c)	Indication at +20ºC level (%LEL)	0	50
	Ambient chamber temperature (ºC) at time of reading	21	21
5.4.6(a) 5.4.6(c)	Indication at -10ºC level (%LEL)	3	54
	Ambient chamber temperature (ºC) at time of reading	-10	-10
Manufacturer claims	Indication at -20ºC level (%LEL)	4	55
	Ambient chamber temperature (ºC) at time of reading	-20	-20
Manufacturer claims	Indication at -40ºC level (%LEL)	4	56
	Ambient chamber temperature (ºC) at time of reading	-40	-40
5.4.6(a)	Indication at +40ºC level (%LEL)	1	53
	Ambient chamber temperature (ºC) at time of reading	+40	+40
Manufacturer claims	Indication at +50ºC level (%LEL)	1	53
	Ambient chamber temperature (ºC) at time of reading	+50	+50
Manufacturer claims	Indication at +60ºC level (%LEL)	1	53
	Ambient chamber temperature (ºC) at time of reading	+60	+60

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Performance requirements: Group II equipment limits (whichever value is greater) Volume fraction up to 100 % lower flammable limit indication

5.4.7(a) portable/transportable		-10ºC, 20ºC, 40ºC	±5% measuring range or ±10% of indication from 20ºC
5.4.7(b) fixed with remote sensor	Sensor	-25ºC, 20ºC, 55ºC	±10% measuring range or ±20% of indication from 20°C
	Control unit	5ºC, 20ºC, 55ºC	±3% measuring range or ±10% of indication from 20ºC
5.4.7(c) fixed with sensor		-10ºC, 20ºC, 55ºC	±5% measuring range or ±15% of indication from 20°C

Comments:

Comments: *Manufacturer claims the operation temperature range are -20 ºC to 50 ºC, and -40 ºC to 60 ºC for 15 minutes. The equipment acclimated at -40 ºC to 60 ºC for 15 minutes and other level of the temperature minimum of 1 hour for test. It was exposed sequentially to clean air and the standard test gas.

Date: 2019-11-25

Pressure

Test sample GX-3R: Sample #4 Propane C3H8

The effects of pressure variation shall be observed by placing the sensor or apparatus (including the aspirator for aspirated apparatus) in a test chamber that permits the pressure of clean air and of the standard test gas to be varied over the range specified in Annex A.
The pressure shall be maintained at the specified levels for 5 min, before a reading is accepted or a test is made. Readings shall be taken with clean air and standard test gas.

Pressure	**Clean Air (%LEL)**	**Standard test gas (%LEL)**
80kPa	4	49
100kPa	0	49
120kPa	-3	46

Performance requirements: ±5% of measuring range or ±30% of indication from 100kPa
(test: 80kPa, 100kPa, 120kPa)

Comments:

Date: 2019-12-06

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Humidity

Test sample GX-3R: Sample #4 Propane C3H8

The test shall be done with three different humidities evenly distributed over the range specified in Annex A. The apparatus shall be allowed to stabilize at 40 °C. After stabilization it shall be adjusted (zeroed/calibrated) according to the instructions of the manufacturer. For each humidity, the apparatus shall be exposed for 15 min to clean air and then to the standard test gas at the same humidity. The relative humidity levels shall be known to within ±3 % RH.
The concentration of the test gas shall be held constant, or due allowance of changes in its concentration by dilution in water shall be made.

50% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	0	50
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	50	50

20% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	4	54
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	20	20

90% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	-3	44
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	90	90

Performance requirements: ±10% of measuring range or ±30% of indication from the indication at adjustment at 40 °C (test: 20% RH, 50% RH, 90% RH)

Comments:

Date: 2020-01-23

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Humidity

Test sample GX-3R: Sample #4 Propane C3H8

The sensor shall be exposed for at least 2 h to clean air having 50±5 % RH at (20±5)°C and then calibrated per the manufacturer's recommendations. The sensor shall be exposed to the standard test gas until stabilized at the 50±5 % RH at (20±5)°C and the equipment reference point reading shall be recorded. Next, the sensor shall be exposed for at least 2 h to clean air at 20±5 % RH at (20±5)°C. The sensor shall then be exposed to the standard test gas until stabilized at 20±5 % RH at (20±5)°C and record the results. Next, the sensor shall be exposed for at least 2 h to clean air at 90±5 % RH at (20±5)°C. The sensor shall then be exposed to the standard test gas until stabilized at 90±5 % RH at (20±5)°C and record the results.

50% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	0	50
Exposure period prior to reading (min)	120	15
RH at time of reading (%)	50	50

20% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	1	52
Exposure period prior to reading (min)	120	15
RH at time of reading (%)	20	20

90% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	-2	46
Exposure period prior to reading (min)	120	15
RH at time of reading (%)	90	90

Performance requirements: ±10% of measuring range or ±30% of indication from 50%RH

Comments:

Date: 2020-02-03

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Air Velocity Variation

Test sample GX-3R: Sample #4 Propane C3H8

5.4.10.1 General
The effects of air speed over a range of 0 m/s to 6 m/s on apparatus with sensors that operate by diffusion shall be determined using the test conditions given in 5.4.10.2.
5.4.10.2 Test conditions
The separate sensors of apparatus with remote sensors and, when practicable, the entire apparatus if the sensors are integral shall be tested in a flow chamber.
NOTE: The flow chamber should be suitable for the application of clean air and the standard test gas.
For apparatus having integral sensors, which are too large to be tested in a flow chamber, other flow apparatus for carrying out the test shall be permitted.

Irrespective of whether a flow chamber or other flow apparatus is used, orient the sensor in relation to the direction of the air flow as follows:
1) Sensor oriented directly towards direction of flow,
2) Sensor oriented away from the direction of flow,
3) Sensor oriented at right angles to the direction of flow.
Measurements shall be made under static conditions, at 3 m/s and at 6 m/s.
NOTE Directions of flow which are not likely to occur in practice, due to the design of the apparatus, or which are expressly prohibited within the manufacturer's instruction manual may not be tested.

Sensor exposed to clean air:

Applicable scale/range	0-100%LEL		
Measured velocity at sensor (m/s)	at 0 m/s	at 3 m/s	at 6 m/s
Sensor position relative to mixture stream	Indication (%LEL)		
1) flow directed at the sensor inlet	0	0	0
2) flow directed 180° to 1)	0	0	0
3) flow directed 90° to 1)	0	0	0

Sensor exposed to standard test gas:

Applicable scale/range	0-100%LEL		
Measured velocity at sensor (m/s)	at 0 m/s	at 3 m/s	at 6 m/s
Sensor position relative to mixture stream	Indication (%LEL)		
1) flow directed at the sensor inlet	48	50	50
2) flow directed 180° to 1)	48	50	50
3) flow directed 90° to 1)	48	50	50

Performance requirements: ±5% of measuring range or ±10% of indication
Comments:

Lab Environment : 22.7ºC; 16.4%RH; 982.3hPa
Date: 2020-02-06

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Orientation

Test sample GX-3R: Sample #4 Propane C3H8

5.4.12.1 Portable apparatus
During tests with clean air and standard test gas, rotate the sensor, or the whole apparatus if relevant, through 360º in steps of 90º around each of its three mutually perpendicular axes (one axis at a time). Record the indication in each position.

Clean Air

Applicable scale/range	0-100%LEL			
Rotation Positions	0º	90º	180º	270º
Measured Values				
X-axis	0	0	0	0
Y-axis	0	0	0	0
Z-axis	0	0	0	0

Standard test gas

Applicable scale/range	0-100%LEL			
Rotation Positions	0º	90º	180º	270º
Measured Values				
X-axis	51	51	51	51
Y-axis	51	51	51	51
Z-axis	51	51	51	51

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment: 24ºC; 15.4%RH;979.8hPa

Date:2020-02-06

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Vibration

Test sample GX-3R: Sample #4 Propane C3H8

Zero and Initial Calibration Gas (50% LEL) checked/adjusted - Yes
The alarm set point shall be set to 20% of full-scale range.
The apparatus shall be energized and mounted on the vibration test machine and vibrated successively in each of three planes respectively parallel to each of the three major axes of the apparatus.
The apparatus shall be vibrated over the frequency range specified at the excurs ion or constant acceleration peak specified, for a period of 1 h in each of the three mutually perpendicular planes. The rate of change of frequency shall not exceed 10 Hz/min.

Vibration, Procedures 1 (Cl 5.4.13.2.1).

For portable and transportable apparatus, remote sensors, and controllers where the sensor is integral with or directly attached to the controller, the vibration shall be as follows:
10 Hz to 30 Hz, 1.0 mm total excursion,
31 Hz to 150 Hz, 19.6 m/s^2 acceleration peak.
Criteria:

a) Meter/Output indication before Vibration Test
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 51%LEL

b) Meter/Output indication after Vibration Test (±10% of measuring range or ±20% of indication):
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 51%LEL

c) Loss of function: No
False alarm: No
False indication of malfunction: No
Fault signal: No

d) Visible or hidden damage including loose components or damage to the enclosure that would manifest itself in a loss of function or electrical hazard:

Evident damage: No
If yes, specify:

Note: Observation of the effects of "hidden damage" is embodied in the balance of the prescribed test program.

Performance requirements: ±5% of measuring range or ±10% of indication; and no loss of function, no fault signal, no damage resulting in a hazard and no false alarms

Comments:

Lab Environment: 22.1ºC / 31%RH / 992.2hPa

Date: 2019-10-23

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Drop test for portable and transportable apparatus

Test sample GX-3R: Sample #4 Propane C3H8

While in the operating mode, the instrument (with carrying case if applicable) shall be released from a height of 1m above a concrete and allowed to free-fall.

Portable apparatus shall be released, while operating, from a height of 1m above a concrete surface and allowed to free fall.

Transportable apparatus with a mass of less than 5kg shall be released, while not operating, from a height of 0.3 m above a concrete surface and allowed to free fall.

Other transportable apparatus shall be released, while not operating, from a height of 0.1m above a concrete surface and allowed to free fall.

The test required above shall be performed three separate times, the portable apparatus being released each time with a different side (surface) facing down at the time of release and the transportable apparatus to be in an orientation for normal transport.

Meter/Output indication before Drop Test

Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 51%LEL

Meter/Output indication after Drop Test (±5% of measuring range or ±10% of indication):

Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 51%LEL

Loss of function after test (e.g. alarm, pump function, controls, display): No

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment: 22.5ºC/24.9%RH/989.3hPa

Date: 2019-11-29

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Warm –up time

Test sample GX-3R: Sample #4 Propane C3H8

The alarm set point shall be set to 20% of full-scale range.

The apparatus shall be switched off and left for 24h in clean air: Yes

After the 24h period, the apparatus shall be switched on in clean air and the warm up time measured: 38.4s

Fixed/transportable: (±5 % measuring range drift within manual spec. time, and no false alarm)

Indication measured:

Continuous duty portable: (±5% of measuring range within 2min., and no false alarm)

Indication measured: 50%LEL

Comments:

Lab Environment: 23.5ºC;21.3%RH;995.3hPa

Date:2020-02-10

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Time of Response

Test sample GX-3R: Sample #4 Propane C3H8

The equipment shall be switched on in clean air and, after an interval corresponding to at least two times the warm-up time, as determined in accordance with 5.4.15, without switching off, the equipment or the sensor(s) shall be subjected to step changes from clean air to the standard test gas and from standard test gas to clean air. These changes shall be introduced by means of suitable equipment (see Annex B).
The times of response t(50) and t(90) for increasing concentration, and t(50) and t(10) for decreasing concentration shall be measured.
For an optional sampling probe, an extra test is required to measure the additional delay. This shall be less than 3 s/m of the total length of the probe plus tubing or any greater value, which is stated in the instruction manual.

Notes:
1. These times apply without optional accessories e.g. collecting cones, weather protection, attached to the sensor for special purposes.
2. For an optional sampling probe, test additional delay.

Test gas mixture delivery method:
(Apparatus Per CSA152-Cl. A4).

Apparatus per Cl A4 - Yes

Other (if No) –

Increasing Response:

Applicable scale/range	0-100%LEL
Standard test gas mixture concentration (% combustible in air)	1.05 %C3H8 in air
Elapsed time (in seconds) to indicate 50% of test gas concentration (20s allowable)	14.5s
Elapsed time (in seconds) to indicate 90% of test gas concentration (60s allowable)	24.7s

If required response not achieved, include the following observations as applicable:

Indication at 20 second time limit: _____
Indication at 60 second time limit: _____
Maximum indication achieved: _____

Comments:

Lab Environment: 23.5ºC;17.7%RH;995.5hPa

Date: 2020-02-11

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High gas concentration operation above the measuring range

Test sample GX-3R: Sample #3 Propane C3H8

This subclause applies to all apparatus with an upper limit of the measuring range less than 100 % (v/v) gas.
The entire apparatus, or the remote sensors of fixed or transportable apparatus, shall be subjected to the test given in 5.4.18.1 or 5.4.18.2 using a test apparatus that simulates a step change between gas concentrations such as those described in Annex B.
All gas concentrations above full scale shall be indicated by a full scale meter indication and, where fitted, an alarm. If the indication is digital, a clear indication shall be given that the upper limit of the measuring range has been exceeded.

Test gas delivery method:
Apparatus per CSA152 - Cl A4 - No

Other (if No) – calibration cap

Indication before test: 50%LEL

The apparatus or remote sensor shall be subjected to a step change from clean air to a volume fraction of 100% gas that shall be maintained for 3min.

Compliance: Yes

The sensor shall then be subjected to clean air for 20min, followed by the standard test gas.

Compliance: Yes

Indication measured: 47%LEL

Performance requirements: ±7 % measuring range or +20 % / –10 % of indication

Comments: Indication went down to -4% LEL in clean air

Lab Environment : 23.3C/16%RH/996.6hPa

Date : 2020-02-12

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Battery capacity

5.4.19.1 Battery powered portable continuous duty apparatus

5.4.19.1.1 Battery discharge

Test sample GX-3R: Sample #4 Propane C3H8

With a battery fully charged at the beginning of the test, the apparatus shall be operated in clean air for a total period of:
a) 8h, if fitted with a user-operated on/off switch.
b) 10h, if not so fitted, or
c) any longer time as specified by the manufacturer

At the end of the specified period, the apparatus is exposed to the standard test gas.

Test period: 8 hours and 25 hours
Indication: 50%LEL and 50%LEL

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: 25 hours in Measuring Mode (Non Alarm Operation, Fully Charged)

Lab Environment: 23.3C/16%RH/996.6hPa

Date: 2020-02-12

5.4.19.1.2 Low battery duration

The apparatus shall then continue to operate until an indication that the low battery condition has been reached. The apparatus shall continue to operate for an additional 10min:

Additional test period: 10 minutes
Indication: 50%LEL

Performance requirements: ±7% of measuring range or ±15% of indication

Comments: The last bar in the battery icon starts flashing is indicate as low battery warning.

Lab Environment: 23.3C/16%RH/996.6hPa

Date: 2020-02-12

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Field calibration kit

Test sample GX-3R: Sample #4 Propane C3H8

If a field calibration kit is provided with the apparatus, carry out the following test:

a) Calibrate the apparatus in accordance with 5.4.3.1 using the test conditions given in 5.3 and using the test equipment for the tests described in 5.4

b) Use the field calibration kit in a manner corresponding to the manufacturer's instructions for checking the apparatus response.

Calibration kit hardware evaluation: 0.25 LPM fixed flow regulator, Non-absorbent tubing and Calibration cup
Hardware Items: Calibration Cap

Reading with kit hardware, using initial calibration gas mixture as above:

Applicable Scale/Range		0-100%LEL	
a) Indication by use calibration kit		b) Indication in normal operation	
clean air	standard test gas	clean air	standard test gas
0	50	0	50

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: Use the flow controller and primary standard gas mixture to similar the regulator and gas cylinder in the calibration kit. Client only provided calibration cap for evaluation.

Lab Environment: 22.4ºC/26.2%RH/989.2hPa

Date:2019-11-19

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Fault signals

Test sample GX-3R: Sample #4 Propane C3H8

Verify fault signals.

Under-range values at or below minus 10% (-10%) of the measuring range (e.g. caused by drift)

The instrument was zero calibrated whilst the sensing head was subjected to a gas mix consisting of 0.19% C3H8 by volume in air. Upon successful calibration, the sensing head was exposed to clean air.

Observation: 0 to -10%LEL indicated as is. Below -10%LEL have failure alarm and 'nnn' and over range alarm "over" were on the display flashing.

Performance requirements: Verify signal and no spurious alarms

Comments:

Lab Environment : 23.9ºC/17.2%RH/994hPa

Date : 2020-02-11

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Submittor: RKI Instruments

Devices Tested: GX-3R-PRO with NCR-6309 LEL combustible gas sensor

Instrument Type/Features: Portable continuous duty diffusion multi-gas detectors with integral sensor

Rating: Rechargeable lithium-ion battery output 3.7V 750mAh 2.8Wh
Or 2 MN2400/PC2400 Alkaline batteries
Range: 0-100% LEL
Storage Temperature Range: -20 to +50°C
Operating Temperature Range: -20 to +50°C
Part number: GX-3R-PRO
Material number; 40156172; 40156620; 40156932
Sample and Serial No.: Sample #1 Methane CH_4 SN: 52J0147201-9RN
Sample #2 Methane CH_4 SN: 52J0147201-2RN
Sample #3 Propane C3H8 SN: 52J0147201-4RN
Sample #4 Propane C3H8 SN: 52J0147201-5RN
Sample #5 Methane CH_4 SN: 52J0147201-9RN
with Alkaline battery pack

Firmware Rev. No.: 06109-9D55 (Main ROM) 05979-C1ED (Sensor ROM)

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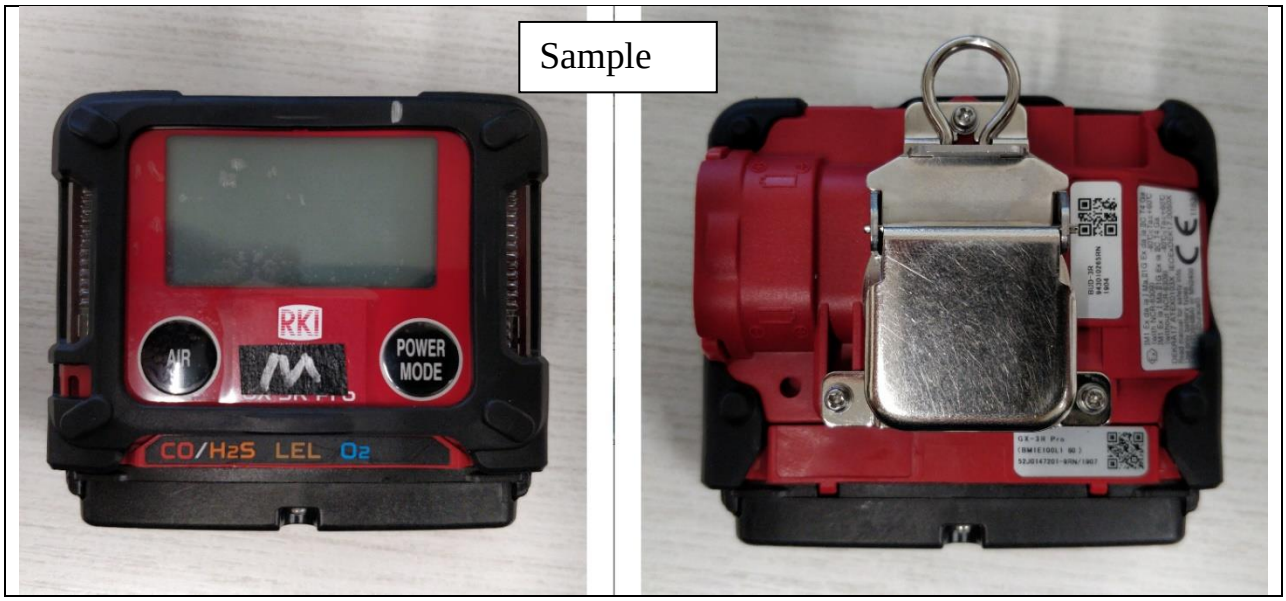

Output Detail: Display

Meter: 0-100%LEL

Alarm Device(s): Alarm LEDs, distinctive audible/vibrating alarms

Alarm Setting(s): Range is 5 to 60% LEL (Increasing concentration), leachable alarm adjustable by user

Transfer Function (Parameters): N/A

Notes: LFL values is reference to ANSI/NFPA 497; Methane LFL is 5% Vol; Propane LFL is 2.1% Vol;
Samples have been load with CO/H2S, O2 and LEL sensor for testing.
Tests in clause 5.4.3, 5.4.7, 5.4.16 and 5.4.19 performed with the RK Link App was kept ON in the smartphone and communicating with the device during the test.

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General Note:
5.2 General requirements for tests
Where it is necessary to apply LFL and UFL values for the purposes of this standard, they shall be taken from ANSI/NFPA 497.

ISA 5.2.1.1 Samples and sequence of tests - General
For the purpose of type testing, the tests shall be carried out on one apparatus except for the long term stability tests (see 5.4.4.4 and 5.4.4.5) and environmental exposure tests (see 5.4.29) which may be conducted on a separate apparatus.

ISA 5.2.1.2 Sequence
The unpowered storage (5.4.2), drop test (5.4.14), and vibration (5.4.13) tests shall be conducted prior to all remaining tests. The test sequence on all remaining tests shall be carried out to a schedule agreed upon between the manufacturer and the test laboratory.

IEC 5.2.1.1 Samples and sequence of tests - General
For the purpose of type testing, the tests shall be carried out on one apparatus. Another apparatus may be used for tests according to 5.4.4.2 to 5.4.4.5, 5.4.18 and 5.4.24.
For IR-sensors using optical filters, the test 5.4.3.3 shall be conducted with two apparatus where the centre wavelength of the optical filters shall be at the minimum and maximum limits of the specification. One of these units may be used subsequently for 5.4.4.2 to 5.4.4.5, 5.4.18 and 5.4.24.

IEC 5.2.1.2 Sequence
The apparatus shall be subjected to all of the tests applicable to that type of apparatus, as described in 5.4.
Test 5.4.2 shall be conducted prior to all other tests. The manufacturer may request a particular order of the other tests. However, the tests 5.4.4.2 to 5.4.4.5, 5.4.18, and 5.4.24 shall always be conducted in this sequence.

5.3.9 Stabilization time
In each instance where the apparatus is subjected to a different test condition, the apparatus shall be allowed to stabilize under these new conditions before measurements are taken.

5.4.1 Test method - General
The following tests shall be performed in accordance with 5.3, unless otherwise stated. All tests shall be performed. At the end of each test, indications shall be taken in both clean air and the standard test gas, unless otherwise stated. The values of the indications used for verification of compliance with the performance requirements of Annex A shall be the final indications (see 3.6.2) of both the clean air and standard test gas readings, unless otherwise stated.

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The following results (summarized below) were obtained according to the test requirements of C22.2 No. 60079-29-1:12 / ANSI/ISA-60079-29-1 (12.13.01)-2013 Clause 5.

Sample#	Test Conducted	CSA-C22.2 No. 60079-29-1:12	ANSI/ISA-60079-29-1 (12.13.01)-2013	Compliance
1,2,3,4,5	Unpowered storage	5.4.2	5.4.2	Yes, see comments
	Calibration and adjustment	5.4.3	5.4.3	—
2	Initial Preparation of the apparatus	5.4.3.1	5.4.3.1	Yes
2	Calibration Curve	5.4.3.2	5.4.3.2	Yes
	Stability (continuous duty apparatus only)	5.4.4	5.4.4	----
2	Short-term stability	5.4.4.1	5.4.4.1	Yes
1	Long-term stability (portable apparatus)	5.4.4.5	5.4.4.5	Yes
	Alarm set point(s)	5.4.6	5.4.6	---
2	Increasing concentration	5.4.6.2	5.4.6.2	Yes
2	Temperature	5.4.7	5.4.7	Yes, See comments
2	Pressure	5.4.8	5.4.8	Yes
2	Humidity	5.4.9	---	Yes
2	Humidity	---	5.4.9	Yes
2	Air Velocity	5.4.10	5.4.10	Yes
	Orientation	5.4.12	5.4.12	—
2	Portable apparatus	5.4.12.1	5.4.12.1	Yes
	Vibration	5.4.13	5.4.13	—
2	Procedure 1	5.4.13.2.2	5.4.13.2.2	Yes
2	Drop test for portable apparatus	5.4.14	5.4.14	Yes
2	Warm –up time	5.4.15	5.4.15	Yes
	Time of response	5.4.16	5.4.16	---
2	Increasing concentration	5.4.16(a)	5.4.16(a)	Yes
	High gas concentration operation above the measuring range	5.4.18	5.4.18	---
1	Apparatus other than spot-reading apparatus	5.4.18.2	5.4.18.2	Yes, See comments
	Battery capacity	5.4.19	5.4.19	---
	Battery-powered portable continuous duty apparatus	5.4.19.1	5.4.19.1	—
2	Battery discharge	5.4.19.1.1	5.4.19.1.1	Yes
2	Low battery duration	5.4.19.1.2	5.4.19.1.2	Yes
2	Field calibration kit	5.4.26	5.4.26	Yes, See comments
2	Fault signals	----	5.4.28	Yes

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	Vibration	5.4.13	5.4.13	—
5	Procedure 1	5.4.13.2.2	5.4.13.2.2	No, See comments
	Vibration	5.4.13	5.4.13	—
5	Procedure 1	5.4.13.2.2	5.4.13.2.2	No, See comments
Sample#	Test Conducted	CSA-C22.2 No. 60079-29-1:12	ANSI/ISA-60079-29-1 (12.13.01)-2013	Compliance
	Calibration and adjustment	5.4.3	5.4.3	—
4	Initial Preparation of the apparatus	5.4.3.1	5.4.3.1	Yes
4	Calibration Curve	5.4.3.2	5.4.3.2	Yes
	Stability (continuous duty apparatus only)	5.4.4	5.4.4	---
4	Short-term stability	5.4.4.1	5.4.4.1	Yes
3	Long-term stability (portable apparatus)	5.4.4.5	5.4.4.5	Yes
	Alarm set point(s)	5.4.6	5.4.6	---
4	Increasing concentration	5.4.6.2	5.4.6.2	Yes
4	Temperature	5.4.7	5.4.7	Yes, See comments
4	Pressure	5.4.8	5.4.8	Yes
4	Humidity	5.4.9	---	Yes
4	Humidity	---	5.4.9	Yes
4	Air Velocity	5.4.10	5.4.10	Yes
	Orientation	5.4.12	5.4.12	—
4	Portable apparatus	5.4.12.1	5.4.12.1	Yes
	Vibration	5.4.13	5.4.13	—
4	Procedure 1	5.4.13.2.2	5.4.13.2.2	Yes
4	Drop test for portable apparatus	5.4.14	5.4.14	Yes
4	Warm –up time	5.4.15	5.4.15	Yes
	Time of response	5.4.16	5.4.16	---
4	Increasing concentration	5.4.16(a)	5.4.16(a)	Yes
	High gas concentration operation above the measuring range	5.4.18	5.4.18	---
3	Apparatus other than spot-reading apparatus	5.4.18.2	5.4.18.2	Yes
	Battery capacity	5.4.19	5.4.19	---
	Battery-powered portable continuous duty apparatus	5.4.19.1	5.4.19.1	—
4	Battery discharge	5.4.19.1.1	5.4.19.1.1	Yes
4	Low battery duration	5.4.19.1.2	5.4.19.1.2	Yes

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4	Field calibration kit	5.4.26	5.4.26	Yes, See comments
4	Fault signals	----	5.4.28	Yes

Unpowered storage

Test sample GX-3R-Pro: Sample #1,2,3,4,5

All parts of the apparatus shall be exposed sequentially to the following conditions in clean air.

a) a temperature of (-25± 3) ºC for 24 hours.
b) ambient temperature for at least 24 hours.
c) a temperature of (60± 2) ºC for 24 hours.
d) ambient temperature for at least 24 hours.

At each temperature, the humidity of the clean air shall be so that condensation does not occur.

The above temperatures may be varied after agreement with the manufacturer.

Result:

Temperature (°C)	Duration (h)	Observation
-20	24	No apparent damage
Normal Ambient	24	No apparent damage
50	24	No apparent damage
Normal Ambient	24 minimum	No apparent damage

Comments: Manufacturer claims the storage temperature range is -20 ºC to 50 ºC

Start Date: 2019-10-17

Calibration and adjustment
5.4.3.1 Initial preparation of the apparatus

Test sample GX-3R-Pro: Sample #2 Methane CH_4

Initial calibration gas mixture (50 percent of full scale gas concentration)

Combustible Component	Percent in Air	Applicable Scale/Range
CH_4	2.5	0-100%LEL

Comments:

Lab Environment : 22.4ºC/26.2%RH/989.2hPa

Date: 2019-11-19

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Calibration curve

Test sample GX-3R-Pro: Sample #2 Methane CH_4

Combustible: Methane (CH_4)

Test gas mixtures:

Applicable scale/range	0-100%LEL
% Full Scale Gas Concentration	Test Gas Mixture (% Combustible in Air)
0	0
10	0.5
30	1.5
50	2.5
70	3.5
90	4.5

Meter/output indication:

Applicable scale/range	0-100%LEL		
% Full Scale Test Gas	Indication Set 1 (%LEL)	Indication Set 2 (%LEL)	Indication Set 3 (%LEL)
0	0	0	0
10	10	10	10
30	30	31	32
50	51	52	52
70	73	74	75
90	98	98	98

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: RK Link App was kept ON in the smartphone and communicating with the device during the test

Lab Environment: 22.4ºC/26.2%RH/989.2hPa

Date: 2019-11-19

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Stability (continuous duty apparatus only)

Note: For these tests, battery powered apparatus should be powered from internal batteries wherever possible, otherwise an external power supply may be used.

5.4.4.1 Short-term stability

Test sample GX-3R-Pro: Sample #2 Methane CH_4

The apparatus shall be exposed to six applications of the standard test gas for 3min followed by exposure to clean air for a period of 7min. Indications shall be taken at the end of each exposure to air and the standard test gas.

Applicable scale/range		**0-100%LEL**		
Application		**Indication (%LEL)**		**Indication (%LEL)**
1	Standard test gas (3min)	50	Clean air (7min)	0
2	Standard test gas (3min)	51	Clean air (7min)	0
3	Standard test gas (3min)	51	Clean air (7min)	0
4	Standard test gas (3min)	51	Clean air (7min)	0
5	Standard test gas (3min)	52	Clean air (7min)	0
6	Standard test gas (3min)	52	Clean air (7min)	0

Performance requirements: ±3% of measuring range or ±10% of indication

Comments:

Lab environment: 22.8ºC/27.4%RH/998.7hPa

Date: 2019-11-20

Long –term stability ((portable apparatus – Group II only))

Test sample GX-3R-Pro: Sample #1 Methane CH_4 GX-3R-PRO

The apparatus shall be operated in clean air continuously for a period of at least 8 h per working day over a total of at least 20 working days. The apparatus shall be exposed to the standard test gas until stabilized, once during each operating period. Indications shall be taken prior to the application of, after stabilization and prior to removal of the standard test gas.

	Date/Time		Indication (% LEL)		
Cycle	Started	Completed	Before gas applied	After stabilization	Prior to removal of gas
1	2019-10-24 8:00	2019-10-24 16:00	Lab environment	21.9ºC / 34%rH / 1001.6hPa	
			0	50	50
2	2019-10-25 8:00	2019-10-25 16:00	Lab environment	22ºC / 34.4%rH / 1002.3hPa	
			1	50	50
3	2019-10-28 8:00	2019-10-28 16:00	Lab environment	21.9ºC / 39.5%rH / 997.8hPa	
			0	49	49
4	2019-10-29 8:00	2019-10-29 16:00	Lab environment	22.3ºC / 44.7%rH / 997.9hPa	
			0	48	48

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5	2019-10-30 8:00	2019-10-30 16:00	Lab environment	22.5ºC / 37.7%rH / 1001hPa	
			1	49	49
6	2019-10-31 8:00	2019-10-31 16:00	Lab environment	22.9ºC / 40.5%rH / 976.3hPa	
			1	49	49
7	2019-11-01 8:00	2019-11-01 16:00	Lab environment	21.7ºC / 29.6%rH / 1000.8hPa	
			1	50	50
8	2019-11-04 8:00	2019-11-04 16:00	Lab environment	21.4ºC / 32.5%rH / 992.4hPa	
			1	50	50
9	2019-11-05 8:00	2019-11-05 16:00	Lab environment	22.1ºC / 26.9%rH / 998.5hPa	
			1	50	50
10	2019-11-06 8:00	2019-11-06 16:00	Lab environment	22.5ºC / 20.6%rH / 1004.9hPa	
			1	49	50
11	2019-11-07 8:00	2019-11-07 16:00	Lab environment	24.7ºC / 21.5%rH / 1000.2hPa	
			1	50	50
12	2019-11-11 8:00	2019-11-11 16:00	Lab environment	22.3ºC / 21.2%rH / 999.5hPa	
			2	49	49
13	2019-11-12 8:00	2019-11-12 16:00	Lab environment	19.9ºC / 22.5%rH / 1000.2hPa	
			1	49	50
14	2019-11-13 8:00	2019-11-13 16:00	Lab environment	17.8ºC / 22.3%rH / 1005.9hPa	
			2	50	50
15	2019-11-14 8:00	2019-11-14 16:00	Lab environment	20.1ºC / 29.8%rH / 999.5hPa	
			1	50	50
16	2019-11-18 8:00	2019-11-18 16:00	Lab environment	22.4ºC / 25.9%rH / 987.9hPa	
			2	50	50
17	2019-11-19 8:00	2019-11-19 16:00	Lab environment	22.6ºC / 26.3%rH / 989.3hPa	
			2	51	51
18	2019-11-20 8:00	2019-11-20 16:00	Lab environment	22.7ºC / 28.1%rH / 999hPa	
			1	48	48
19	2019-11-21 8:00	2019-11-21 16:00	Lab environment	26.8ºC / 23.2%rH / 991.2hPa	
			1	48	48
20	2019-11-22 8:00	2019-11-22 16:00	Lab environment	23ºC / 20.1%rH / 992.9hPa	
			2	48	48

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

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Alarm set points

Test sample GX-3R-Pro: Sample #2 Methane CH_4

5.4.6.1 General

When the apparatus is provided with either
Type A) externally adjustable means of setting either one or more alarm set points, or
Type B) fixed internally pre-set alarm point(s),
The activation of such alarms by gas at the appropriate set point values shall be verified by using test gases as described in 5.4.6.2 and 5.4.6.3. In all cases, the test gas shall be applied until either activation of the alarm(s) or twice the respective t(90), whichever is less.
For equipment apparatus with several multiple individual alarms set points, these tests shall be carried out for each alarm set point.

5.4.6.2 Increasing concentration

For apparatus of Type A) set the alarm set point at 10 % relative below the concentration of the standard test gas. If the alarm set point cannot be set at this concentration, the alarm shall be set as near as possible to that concentration. In this case and for apparatus of Type B), the test gas shall have a volume fraction of 10 % relative above the concentration of the alarm set point. Expose the apparatus to clean air and then to the standard test gas or the specified test gas.

Check alarm manual reset operation

Compliance: Yes

Comments:

Lab Environment: 22.8°C/27.4%RH/998.7hPa

Date:2019-11-20

Temperature

Test sample GX-3R-Pro: Sample #2 Methane CH_4

This test shall be performed in a temperature chamber having the capability of holding the sensor or apparatus at the specified temperature within ±2 °C. When the apparatus (or the portion under test) has reached the temperature specified in Annex A, as appropriate, the sensor shall be exposed sequentially to air and the standard test gas, which shall be at the same temperature as the atmosphere in the test chamber. The dew point of the air or standard test gas shall be below the lowest temperature of the test chamber and kept constant during the test.

		Test Environment	
	Device	Clean Air / Cal. Gas Mix	Normal / Variable Temp
	Applicable scale/range	0-100%LEL	
Clause	Gas mix	Zero Gas	Initial Calibration Gas
5.4.6(a)	Indication at +20ºC level (%LEL)	0	50

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5.4.6(b) 5.4.6(c)	Ambient chamber temperature (ºC) at time of reading	22	22
5.4.6(a) 5.4.6(c)	Indication at -10ºC level (%LEL)	2	54
	Ambient chamber temperature (ºC) at time of reading	-10	-10
Manufacturer claims*	Indication at -20ºC level (%LEL)	2	55
	Ambient chamber temperature (ºC) at time of reading	-20	-20
Manufacturer claims*	Indication at -40ºC level (%LEL)	4	57
	Ambient chamber temperature (ºC) at time of reading	-40	-40
5.4.6(a)	Indication at +40ºC level (%LEL)	2	54
	Ambient chamber temperature (ºC) at time of reading	+40	+40
Manufacturer claims*	Indication at +50ºC level (%LEL)	3	53
	Ambient chamber temperature (ºC) at time of reading	50	50
Manufacturer claims*	Indication at +60ºC level (%LEL)	4	53
	Ambient chamber temperature (ºC) at time of reading	60	60

Performance requirements: Group II equipment limits (whichever value is greater) Volume fraction up to 100 % lower flammable limit indication

5.4.7(a) portable/transportable		-10ºC, 20ºC, 40ºC	±5% measuring range or ±10% of indication from 20ºC
5.4.7(b) fixed with remote sensor	Sensor	-25ºC, 20ºC, 55ºC	±10% measuring range or ±20% of indication from 20°C
	Control unit	5ºC, 20ºC, 55ºC	±3% measuring range or ±10% of indication from 20ºC
5.4.7(c) fixed with sensor		-10ºC, 20ºC, 55ºC	±5% measuring range or ±15% of indication from 20°C

Comments: *Manufacturer claims the operation temperature range are -20 ºC to 50 ºC, and -40 ºC to 60 ºC for 15 minutes. The equipment acclimated at -40 ºC to 60 ºC for 15 minutes and other level of the temperature minimum of 1 hour. It was exposed sequentially to clean air and the standard test gas.
RK Link App was kept ON in the smartphone and communicating with the device during the test

Date: 2019-11-22

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Pressure

Test sample GX-3R-Pro: Sample #2 Methane CH_4

The effects of pressure variation shall be observed by placing the sensor or apparatus (including the aspirator for aspirated apparatus) in a test chamber that permits the pressure of clean air and of the standard test gas to be varied over the range specified in Annex A.
The pressure shall be maintained at the specified levels for 5 min, before a reading is accepted or a test is made. Readings shall be taken with clean air and standard test gas.

Pressure	Clean Air (%LEL)	Standard test gas (%LEL)
80kPa	5	49
100kPa	0	51
120kPa	-3	53

Performance requirements: ±5% of measuring range or ±30% of indication from 100kPa
(test: 80kPa, 100kPa, 120kPa)

Comments:

Date: 2019-12-05

Humidity

Test sample GX-3R-Pro: Sample #2 Methane CH_4

The test shall be done with three different humidities evenly distributed over the range specified in Annex A. The apparatus shall be allowed to stabilize at 40 °C. After stabilization it shall be adjusted (zeroed/calibrated) according to the instructions of the manufacturer. For each humidity, the apparatus shall be exposed for 15 min to clean air and then to the standard test gas at the same humidity. The relative humidity levels shall be known to within ±3 % RH.
The concentration of the test gas shall be held constant, or due allowance of changes in its concentration by dilution in water shall be made.

50% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	0	51
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	50	50

20% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	3	58
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	20	20

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90% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	-5	40
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	90	90

Performance requirements: ±10% of measuring range or ±30% of indication from the indication at adjustment at 40 °C (test: 20% RH, 50% RH, 90% RH)

Comments:

Date: 2020-01-21

Humidity

Test sample GX-3R-Pro: Sample #2 Methane CH_4

The sensor shall be exposed for at least 2 h to clean air having 50±5 % RH at (20±5)°C and then calibrated per the manufacturer's recommendations. The sensor shall be exposed to the standard test gas until stabilized at the 50±5 % RH at (20±5)°C and the equipment reference point reading shall be recorded. Next, the sensor shall be exposed for at least 2 h to clean air at 20±5 % RH at (20±5)°C. The sensor shall then be exposed to the standard test gas until stabilized at 20±5 % RH at (20±5)°C and record the results. Next, the sensor shall be exposed for at least 2 h to clean air at 90±5 % RH at (20±5)°C. The sensor shall then be exposed to the standard test gas until stabilized at 90±5 % RH at (20±5)°C and record the results.

50% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	0	50
Exposure period prior to reading (min)	120	5
RH at time of reading (%)	50	50

20% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	1	53
Exposure period prior to reading (min)	120	5
RH at time of reading (%)	20	20

90% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	-1	44
Exposure period prior to reading (min)	120	5
RH at time of reading (%)	90	90

Performance requirements: ±10% of measuring range or ±30% of indication from 50%RH
Comments:
Date: 2020-01-22

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Air Velocity Variation

Test sample GX-3R-Pro: Sample #2 Methane CH_4

5.4.10.1 General
The effects of air speed over a range of 0 m/s to 6 m/s on apparatus with sensors that operate by diffusion shall be determined using the test conditions given in 5.4.10.2.
5.4.10.2 Test conditions
The separate sensors of apparatus with remote sensors and, when practicable, the entire apparatus if the sensors are integral shall be tested in a flow chamber.
NOTE: The flow chamber should be suitable for the application of clean air and the standard test gas.
For apparatus having integral sensors, which are too large to be tested in a flow chamber, other flow apparatus for carrying out the test shall be permitted.

Irrespective of whether a flow chamber or other flow apparatus is used, orient the sensor in relation to the direction of the air flow as follows:
1) Sensor oriented directly towards direction of flow,
2) Sensor oriented away from the direction of flow,
3) Sensor oriented at right angles to the direction of flow.
Measurements shall be made under static conditions, at 3 m/s and at 6 m/s.
NOTE Directions of flow which are not likely to occur in practice, due to the design of the apparatus, or which are expressly prohibited within the manufacturer's instruction manual may not be tested.

Sensor exposed to clean air:

Applicable scale/range	0-100%LEL		
Measured velocity at sensor (m/s)	at 0 m/s	at 3 m/s	at 6 m/s
Sensor position relative to mixture stream	Indication (%LEL)		
1) flow directed at the sensor inlet	0	0	0
2) flow directed 180° to 1)	0	0	0
3) flow directed 90° to 1)	0	0	0

Sensor exposed to standard test gas:

Applicable scale/range	0-100%LEL		
Measured velocity at sensor (m/s)	at 0 m/s	at 3 m/s	at 6 m/s
Sensor position relative to mixture stream	Indication (%LEL)		
1) flow directed at the sensor inlet	50	51	51
2) flow directed 180° to 1)	50	51	51
3) flow directed 90° to 1)	50	51	51

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:
Lab Environment : 24.6ºC; 15.3%RH; 981.6hPa

Date : 2020-02-06

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Orientation

Test sample GX-3R-Pro: Sample #2 Methane CH_4

5.4.12.1 Portable apparatus
During tests with clean air and standard test gas, rotate the sensor, or the whole apparatus if relevant, through 360º in steps of 90º around each of its three mutually perpendicular axes (one axis at a time). Record the indication in each position.

Clean Air

Applicable scale/range	0-100%LEL			
Rotation Positions	0º	90º	180º	270º
Measured Values				
X-axis	0	0	0	0
Y-axis	0	0	0	0
Z-axis	0	0	0	0

Standard test gas

Applicable scale/range	0-100%LEL			
Rotation Positions	0º	90º	180º	270º
Measured Values				
X-axis	50	50	50	50
Y-axis	50	50	50	50
Z-axis	50	50	50	50

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment : 24ºC; 15.4%RH; 979.8hPa

Date: 2020-02-06

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Vibration

Test sample GX-3R-Pro: Sample #2 Methane CH_4

Zero and Initial Calibration Gas (50% LEL) checked/adjusted - Yes
The alarm set point shall be set to 20% of full-scale range.
The apparatus shall be energized and mounted on the vibration test machine and vibrated successively in each of three planes respectively parallel to each of the three major axes of the apparatus.
The apparatus shall be vibrated over the frequency range specified at the excurs ion or constant acceleration peak specified, for a period of 1 h in each of the three mutually perpendicular planes. The rate of change of frequency shall not exceed 10 Hz/min.

Vibration, Procedures 1 (Cl 5.4.13.2.1).

For portable and transportable apparatus, remote sensors, and controllers where the sensor is integral with or directly attached to the controller, the vibration shall be as follows:
10 Hz to 30 Hz, 1.0 mm total excursion,
31 Hz to 150 Hz, 19.6 m/s^2 acceleration peak.
Criteria:

a) Meter/Output indication before Vibration Test
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

b) Meter/Output indication after Vibration Test (±10% of measuring range or ±20% of indication):
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

c) Loss of function: No
False alarm: No
False indication of malfunction: No
Fault signal: No

d) Visible or hidden damage including loose components or damage to the enclosure that would manifest itself in a loss of function or electrical hazard:

Evident damage: No
If yes, specify:

Note: Observation of the effects of "hidden damage" is embodied in the balance of the prescribed test program.

Performance requirements: ±5% of measuring range or ±10% of indication; and no loss of function, no fault signal, no damage resulting in a hazard and no false alarms

Comments:

Lab environment: 22.1ºC / 31%RH / 992.2hPa

Date: 2019-10-23

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Drop test for portable and transportable apparatus

Test sample GX-3R-Pro: Sample #2 Methane CH_4

While in the operating mode, the instrument (with carrying case if applicable) shall be released from a height of 1m above a concrete and allowed to free-fall.

Portable apparatus shall be released, while operating, from a height of 1m above a concrete surface and allowed to free fall.

Transportable apparatus with a mass of less than 5kg shall be released, while not operating, from a height of 0.3 m above a concrete surface and allowed to free fall.

Other transportable apparatus shall be released, while not operating, from a height of 0.1m above a concrete surface and allowed to free fall.

The test required above shall be performed three separate times, the portable apparatus being released each time with a different side (surface) facing down at the time of release and the transportable apparatus to be in an orientation for normal transport.

Meter/Output indication before Drop Test

Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

Meter/Output indication after Drop Test (±5% of measuring range or ±10% of indication):

Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

Loss of function after test (e.g. alarm, pump function, controls, display): No

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment: 22.5ºC/24.9%RH/989.3hPa

Date:2019-11-19

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Warm –up time

Test sample GX-3R-Pro: Sample #2 Methane CH_4

The alarm set point shall be set to 20% of full-scale range.

The apparatus shall be switched off and left for 24h in clean air: Yes

After the 24h period, the apparatus shall be switched on in clean air and the warm up time measured: 38.4s

Fixed/transportable: (±5 % measuring range drift within manual spec. time, and no false alarm)

Indication measured:

Continuous duty portable: (±5% of measuring range within 2min., and no false alarm)

Indication measured: 55%LEL

Comments:

Lab Environment: 23.5ºC;21.3%RH;995.3hPa

Date:2020-02-10

Time of Response

Test sample GX-3R-Pro: Sample #2 Methane CH_4

The equipment shall be switched on in clean air and, after an interval corresponding to at least two times the warm-up time, as determined in accordance with 5.4.15, without switching off, the equipment or the sensor(s) shall be subjected to step changes from clean air to the standard test gas and from standard test gas to clean air. These changes shall be introduced by means of suitable equipment (see Annex B).
The times of response t(50) and t(90) for increasing concentration, and t(50) and t(10) for decreasing concentration shall be measured.
For an optional sampling probe, an extra test is required to measure the additional delay. This shall be less than 3 s/m of the total length of the probe plus tubing or any greater value, which is stated in the instruction manual.

Notes:
1. These times apply without optional accessories e.g. collecting cones, weather protection, attached to the sensor for special purposes.
2. For an optional sampling probe, test additional delay.

Test gas mixture delivery method:
(Apparatus Per CSA152-Cl. A4).

Apparatus per Cl A4 - Yes

Other (if No) –

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Increasing Response:

Applicable scale/range	0-100%LEL
Standard test gas mixture concentration (% combustible in air)	2.5%CH_4 in air
Elapsed time (in seconds) to indicate 50% of test gas concentration (20s allowable)	7.4s
Elapsed time (in seconds) to indicate 90% of test gas concentration (60s allowable)	17.4s

If required response not achieved, include the following observations as applicable:

Indication at 20 second time limit: _____
Indication at 60 second time limit: _____
Maximum indication achieved: _____

Comments: RK Link App was kept ON in the smartphone and communicating with the device during the test

Lab Environment: 23.5ºC; 17.7%RH; 995.5hPa

Date:2020-02-11

High gas concentration operation above the measuring range

Test sample GX-3R-Pro: Sample #1 Methane CH_4

This subclause applies to all apparatus with an upper limit of the measuring range less than 100 % (v/v) gas.
The entire apparatus, or the remote sensors of fixed or transportable apparatus, shall be subjected to the test given in 5.4.18.1 or 5.4.18.2 using a test apparatus that simulates a step change between gas concentrations such as those described in Annex B.
All gas concentrations above full scale shall be indicated by a full scale meter indication and, where fitted, an alarm. If the indication is digital, a clear indication shall be given that the upper limit of the measuring range has been exceeded.

Test gas delivery method:
Apparatus per CSA152 - Cl A4 - No

Other (if No) – calibration cap

Indication before test: 51%LEL

The apparatus or remote sensor shall be subjected to a step change from clean air to a volume fraction of 100% gas that shall be maintained for 3min.

Compliance: Yes

The sensor shall then be subjected to clean air for 20min, followed by the standard test gas.

Compliance: Yes

Indication measured: 44%LEL

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Performance requirements: ±7 % measuring range or +20 % / –10 % of indication

Comments: Indication went down to under range after subjected to clean air. 'uuu' Minus Over Range "M Over" were on the display.

Lab Environment: 23.9ºC/17.2%RH/994hPa

Date:2020-02-11

Battery capacity

5.4.19.1 Battery powered portable continuous duty apparatus

5.4.19.1.1 Battery discharge

Test sample GX-3R-Pro: Sample #2 Methane CH_4

With a battery fully charged at the beginning of the test, the apparatus shall be operated in clean air for a total period of:
a) 8h, if fitted with a user-operated on/off switch.
b) 10h, if not so fitted, or
c) any longer time as specified by the manufacturer

At the end of the specified period, the apparatus is exposed to the standard test gas.

Test period: 8 hours and 25 hours
Indication: 50%LEL and 50%LEL

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: 25 hours in Measuring Mode (Non Alarm Operation, Fully Charged); RK Link App was not communicating with the device during the test

Lab Environment: 23.3C/16%RH/996.6hPa

Date: 2020-02-12

5.4.19.1.2 Low battery duration

The apparatus shall then continue to operate until an indication that the low battery condition has been reached. The apparatus shall continue to operate for an additional 10min:

Additional test period: 10 minutes
Indication: 50%LEL

Performance requirements: ±7% of measuring range or ±15% of indication
Comments: The last bar in the battery icon starts flashing is indicate as low battery warning. RK Link App was not communicating with the device during the test

Lab Environment: 23.3C/16%RH/996.6hPa
Date: 2020-02-12

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Field calibration kit

Test sample GX-3R-Pro: Sample #2 Methane CH_4

If a field calibration kit is provided with the apparatus, carry out the following test:

a) Calibrate the apparatus in accordance with 5.4.3.1 using the test conditions given in 5.3 and using the test equipment for the tests described in 5.4

b) Use the field calibration kit in a manner corresponding to the manufacturer's instructions for checking the apparatus response.

Calibration kit hardware evaluation: 0.25 LPM fixed flow regulator, Non-absorbent tubing and Calibration cup
Hardware Items: Calibration Cap

Reading with kit hardware, using initial calibration gas mixture as above:

Applicable Scale/Range		0-100%LEL	
a) Indication by use calibration kit		b) Indication in normal operation	
clean air	standard test gas	clean air	standard test gas
0	50	0	52

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: Use the flow controller and primary standard gas mixture to similar the regulator and gas cylinder in the calibration kit. Client only provided calibration cap for evaluation.

Lab Environment: 22.4ºC/26.2%RH/989.2hPa

Date:2019-11-19

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Fault signals

Test sample GX-3R-Pro: Sample #2 Methane CH_4

Verify fault signals.

Under-range values at or below minus 10% (-10%) of the measuring range (e.g. caused by drift)

The instrument was zero calibrated whilst the sensing head was subjected to a gas mix consisting of 0.50% CH_4 by volume in air. Upon successful calibration, the sensing head was exposed to clean air.

Observation: 0 to -10%LEL indicated as is. Below -10%LEL have failure alarm and 'nnn' and over range alarm "over" were on the display flashing.

Performance requirements: Verify signal and no spurious alarms

Comments:

Lab Environment : 23.9ºC/17.2%RH/994hPa

Date : 2020-02-11

Vibration

Test sample GX-3R-Pro: Sample #5 Methane CH_4 with Alkaline battery pack

Zero and Initial Calibration Gas (50% LEL) checked/adjusted - Yes
The alarm set point shall be set to 20% of full-scale range.
The apparatus shall be energized and mounted on the vibration test machine and vibrated successively in each of three planes respectively parallel to each of the three major axes of the apparatus.
The apparatus shall be vibrated over the frequency range specified at the excurs ion or constant acceleration peak specified, for a period of 1 h in each of the three mutually perpendicular planes. The rate of change of frequency shall not exceed 10 Hz/min.
Vibration, Procedures 1 (Cl 5.4.13.2.1).
For portable and transportable apparatus, remote sensors, and controllers where the sensor is integral with or directly attached to the controller, the vibration shall be as follows:
10 Hz to 30 Hz, 1.0 mm total excursion,
31 Hz to 150 Hz, 19.6 m/s^2 acceleration peak.
Criteria:

a) Meter/Output indication before Vibration Test
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

b) Meter/Output indication after Vibration Test (±10% of measuring range or ±20% of indication):
Sensing element exposed to clean air: N/A
Sensing element exposed to initial calibration mixture: N/A

c) Loss of function: Yes
False alarm: Yes
False indication of malfunction: No
Fault signal: Yes

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d) Visible or hidden damage including loose components or damage to the enclosure that would manifest itself in a loss of function or electrical hazard:

Evident damage: No
If yes, specify:

Note: Observation of the effects of "hidden damage" is embodied in the balance of the prescribed test program.

Performance requirements: ±5% of measuring range or ±10% of indication; and no loss of function, no fault signal, no damage resulting in a hazard and no false alarms

Comments: Low battery alarm went on.

Lab Environment: 23.4ºC/14.2%RH/998.6hPa

Date: 2020-02-12

Vibration

Test sample GX-3R-Pro: Sample #5 Methane CH_4 with Alkaline battery pack

Zero and Initial Calibration Gas (50% LEL) checked/adjusted - Yes
The alarm set point shall be set to 20% of full-scale range.
The apparatus shall be energized and mounted on the vibration test machine and vibrated successively in each of three planes respectively parallel to each of the three major axes of the apparatus.
The apparatus shall be vibrated over the frequency range specified at the excurs ion or constant acceleration peak specified, for a period of 1 h in each of the three mutually perpendicular planes. The rate of change of frequency shall not exceed 10 Hz/min.
Vibration, Procedures 1 (Cl 5.4.13.2.1).
For portable and transportable apparatus, remote sensors, and controllers where the sensor is integral with or directly attached to the controller, the vibration shall be as follows:
10 Hz to 30 Hz, 1.0 mm total excursion,
31 Hz to 150 Hz, 19.6 m/s^2 acceleration peak.
Criteria:

a) Meter/Output indication before Vibration Test
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

b) Meter/Output indication after Vibration Test (±10% of measuring range or ±20% of indication):
Sensing element exposed to clean air: N/A
Sensing element exposed to initial calibration mixture: N/A

c) Loss of function: Yes
False alarm: Yes
False indication of malfunction: No
Fault signal: Yes

d) Visible or hidden damage including loose components or damage to the enclosure that would manifest itself in a loss of function or electrical hazard:

Evident damage: No
If yes, specify:

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Note: Observation of the effects of "hidden damage" is embodied in the balance of the prescribed test program.

Performance requirements: ±5% of measuring range or ±10% of indication; and no loss of function, no fault signal, no damage resulting in a hazard and no false alarms

Comments: Over range alarm and low battery warming went on

Lab Environment: 22.1ºC / 31%RH / 992.2hPa

Date: 2020-02-19

Calibration and adjustment

5.4.3.1 Initial preparation of the apparatus

Test sample GX-3R-Pro: Sample #4 Propane C3H8

Initial calibration gas mixture (50 percent of full scale gas concentration)

Combustible Component	Percent in Air	Applicable Scale/Range
C3H8	1.05	0-100%LEL

Comments:

Lab Environment : 22.4ºC/26.2%RH/989.2hPa

Date : 2019-11-19

Calibration curve

Test sample GX-3R-Pro: Sample #4 Propane C3H8

Combustible: Propane (C3H8)

Test gas mixtures:

Applicable scale/range	0-100%LEL
% Full Scale Gas Concentration	Test Gas Mixture (% Combustible in Air)
0	0
10	0.21
30	0.63
50	1.05
70	1.47
90	1.89

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Meter/output indication:

Applicable scale/range	0-100%LEL		
% Full Scale Test Gas	Indication Set 1 (%LEL)	Indication Set 2 (%LEL)	Indication Set 3 (%LEL)
0	0	0	0
10	11	10	10
30	33	31	31
50	53	51	51
70	71	71	70
90	91	90	89

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: RK Link App was kept ON in the smartphone and communicating with the device during the test

Lab Environment: 22.4ºC/26.2%RH/989.2hPa

Date: 2019-11-19

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Stability (continuous duty apparatus only)

Note: For these tests, battery powered apparatus should be powered from internal batteries wherever possible, otherwise an external power supply may be used.

5.4.4.1 Short-term stability

Test sample GX-3R-Pro: Sample #4 Propane C3H8

The apparatus shall be exposed to six applications of the standard test gas for 3min followed by exposure to clean air for a period of 7min. Indications shall be taken at the end of each exposure to air and the standard test gas.

Applicable scale/range		**0-100%LEL /**		
Application		**Indication (%LEL)**		**Indication (%LEL)**
1	Standard test gas (3min)	51	Clean air (7min)	0
2	Standard test gas (3min)	51	Clean air (7min)	0
3	Standard test gas (3min)	51	Clean air (7min)	0
4	Standard test gas (3min)	51	Clean air (7min)	1
5	Standard test gas (3min)	51	Clean air (7min)	1
6	Standard test gas (3min)	51	Clean air (7min)	1

Performance requirements: ±3% of measuring range or ±10% of indication

Comments:

Lab Environment: 22.8ºC/27.4%RH/998.7hPa

Date: 2019-11-20

Long –term stability ((portable apparatus – Group II only))

Test sample GX-3R-Pro: Sample #3 Propane C3H8

The apparatus shall be operated in clean air continuously for a period of at least 8 h per working day over a total of at least 20 working days. The apparatus shall be exposed to the standard test gas until stabilized, once during each operating period. Indications shall be taken prior to the application of, after stabilization and prior to removal of the standard test gas.

	Date/Time		Indication (% LEL)		
Cycle	Started	Completed	Before gas applied	After stabilization	Prior to removal of gas
1	2019-10-25 8:00	2019-10-25 16:00	Lab environment	22ºC / 34.4%rH / 1002.3hPa	
			0	50	50
2	2019-10-28 8:00	2019-10-28 16:00	Lab environment	21.9ºC / 39.5%rH / 997.8hPa	
			0	50	50
3	2019-10-29 8:00	2019-10-29 16:00	Lab environment	22.3ºC / 44.7%rH / 997.9hPa	
			0	49	49
4	2019-10-30 8:00	2019-10-30 16:00	Lab environment	22.5ºC / 37.7%rH / 1001hPa	
			1	51	51

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5	2019-10-31 8:00	2019-10-31 16:00	Lab environment	22.9ºC / 40.5%rH / 976.3hPa	
			0	49	49
6	2019-11-01 8:00	2019-11-01 16:00	Lab environment	21.7ºC / 29.6%rH / 1000.8hPa	
			1	50	50
7	2019-11-04 8:00	2019-11-04 16:00	Lab environment	21.4ºC / 32.5%rH / 992.4hPa	
			1	50	50
8	2019-11-05 8:00	2019-11-05 16:00	Lab environment	22.1ºC / 26.9%rH / 998.5hPa	
			1	50	50
9	2019-11-06 8:00	2019-11-06 16:00	Lab environment	22.5ºC / 20.6%rH / 1004.9hPa	
			1	50	50
10	2019-11-07 8:00	2019-11-07 16:00	Lab environment	24.7ºC / 21.5%rH / 1000.2hPa	
			1	49	49
11	2019-11-11 8:00	2019-11-11 16:00	Lab environment	22.3ºC / 21.2%rH / 999.5hPa	
			2	49	50
12	2019-11-12 8:00	2019-11-12 16:00	Lab environment	19.9ºC / 22.5%rH / 1000.2hPa	
			2	50	50
13	2019-11-13 8:00	2019-11-13 16:00	Lab environment	17.8ºC / 22.3%rH / 1005.9hPa	
			2	50	50
14	2019-11-14 8:00	2019-11-14 16:00	Lab environment	20.1ºC / 29.8%rH / 999.5hPa	
			2	50	50
15	2019-11-18 8:00	2019-11-18 16:00	Lab environment	22.4ºC / 25.9%rH / 987.9hPa	
			2	50	50
16	2019-11-19 8:00	2019-11-19 16:00	Lab environment	22.6ºC / 26.3%rH / 989.3hPa	
			1	51	51
17	2019-11-20 8:00	2019-11-20 16:00	Lab environment	22.7ºC / 28.1%rH / 999hPa	
			1	49	49
18	2019-11-21 8:00	2019-11-21 16:00	Lab environment	26.8ºC / 23.2%rH / 991.2hPa	
			1	49	49
19	2019-11-22 8:00	2019-11-22 16:00	Lab environment	23ºC / 20.1%rH / 992.9hPa	
			2	49	49
20	2019-11-25 8:00	2019-11-25 16:00	Lab environment	23.2ºC / 29.2%rH / 984.9hPa	
			2	49	49

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

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Alarm set points

Test sample GX-3R-Pro: Sample #4 Propane C3H8

5.4.6.1 General

When the apparatus is provided with either
Type A) externally adjustable means of setting either one or more alarm set points, or
Type B) fixed internally pre-set alarm point(s),
The activation of such alarms by gas at the appropriate set point values shall be verified by using test gases as described in 5.4.6.2 and 5.4.6.3. In all cases, the test gas shall be applied until either activation of the alarm(s) or twice the respective t(90), whichever is less.
For equipment apparatus with several multiple individual alarms set points, these tests shall be carried out for each alarm set point.

5.4.6.2 Increasing concentration

For apparatus of Type A) set the alarm set point at 10 % relative below the concentration of the standard test gas. If the alarm set point cannot be set at this concentration, the alarm shall be set as near as possible to that concentration. In this case and for apparatus of Type B), the test gas shall have a volume fraction of 10 % relative above the concentration of the alarm set point. Expose the apparatus to clean air and then to the standard test gas or the specified test gas.

Check alarm manual reset operation

Compliance: Yes

Comments:

Lab Environment: 22.8ºC/27.4%RH/998.7hPa

Date: 2019-11-20

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Temperature

Test sample GX-3R-Pro: Sample #4 Propane C3H8

This test shall be performed in a temperature chamber having the capability of holding the sensor or apparatus at the specified temperature within ±2 °C. When the apparatus (or the portion under test) has reached the temperature specified in Annex A, as appropriate, the sensor shall be exposed sequentially to air and the standard test gas, which shall be at the same temperature as the atmosphere in the test chamber. The dew point of the air or standard test gas shall be below the lowest temperature of the test chamber and kept constant during the test.

		Test Environment	
	Device	Clean Air / Cal. Gas Mix	Normal / Variable Temp
	Applicable scale/range	0-100%LEL /	
Clause	Gas mix	Zero Gas	Initial Calibration Gas
5.4.6(a) 5.4.6(b) 5.4.6(c)	Indication at +20ºC level (%LEL)	0	50
	Ambient chamber temperature (ºC) at time of reading	21	21
5.4.6(a) 5.4.6(c)	Indication at -10ºC level (%LEL)	1	50
	Ambient chamber temperature (ºC) at time of reading	-10	-10
Manufacturer claims	Indication at -20ºC level (%LEL)	1	50
	Ambient chamber temperature (ºC) at time of reading	-20	-20
Manufacturer claims	Indication at -40ºC level (%LEL)	1	50
	Ambient chamber temperature (ºC) at time of reading	-40	-40
5.4.6(a)	Indication at +40ºC level (%LEL)	3	54
	Ambient chamber temperature (ºC) at time of reading	+40	+40
Manufacturer claims	Indication at +50ºC level (%LEL)	4	55
	Ambient chamber temperature (ºC) at time of reading	+50	+50
Manufacturer claims	Indication at +60ºC level (%LEL)	5	56
	Ambient chamber temperature (ºC) at time of reading	+60	+60

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Performance requirements: Group II equipment limits (whichever value is greater) Volume fraction up to 100 % lower flammable limit indication

5.4.7(a) portable/transportable		-10ºC, 20ºC, 40ºC	±5% measuring range or ±10% of indication from 20ºC
5.4.7(b) fixed with remote sensor	Sensor	-25ºC, 20ºC, 55ºC	±10% measuring range or ±20% of indication from 20°C
	Control unit	5ºC, 20ºC, 55ºC	±3% measuring range or ±10% of indication from 20ºC
5.4.7(c) fixed with sensor		-10ºC, 20ºC, 55ºC	±5% measuring range or ±15% of indication from 20°C

Comments: *Manufacturer claims the operation temperature range are -20 ºC to 50 ºC, and -40 ºC to 60 ºC for 15 minutes. The equipment acclimated at -40 ºC to 60 ºC for 15 minutes and other level of the temperature minimum of 1 hour for test. It was exposed sequentially to clean air and the standard test gas.
RK Link App was kept ON in the smartphone and communicating with the device during the test

Date: 2019-11-25

Pressure

Test sample GX-3R-Pro: Sample #4 Propane C3H8

The effects of pressure variation shall be observed by placing the sensor or apparatus (including the aspirator for aspirated apparatus) in a test chamber that permits the pressure of clean air and of the standard test gas to be varied over the range specified in Annex A.
The pressure shall be maintained at the specified levels for 5 min, before a reading is accepted or a test is made. Readings shall be taken with clean air and standard test gas.

Pressure	**Clean Air (%LEL)**	**Standard test gas (%LEL)**
80kPa	4	50
100kPa	0	50
120kPa	-2	48

Performance requirements: ±5% of measuring range or ±30% of indication from 100kPa
(test: 80kPa, 100kPa, 120kPa)

Comments:

Date: 2019-12-06

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Humidity

Test sample GX-3R-Pro: Sample #4 Propane C3H8

The test shall be done with three different humidities evenly distributed over the range specified in Annex A. The apparatus shall be allowed to stabilize at 40 °C. After stabilization it shall be adjusted (zeroed/calibrated) according to the instructions of the manufacturer. For each humidity, the apparatus shall be exposed for 15 min to clean air and then to the standard test gas at the same humidity. The relative humidity levels shall be known to within ±3 % RH.
The concentration of the test gas shall be held constant, or due allowance of changes in its concentration by dilution in water shall be made.

50% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	0	50
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	50	50

20% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	3	55
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	20	20

90% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	-3	42
Exposure period prior to reading (min)	15	5
RH at time of reading (%)	90	90

Performance requirements: ±10% of measuring range or ±30% of indication from the indication at adjustment at 40 °C (test: 20% RH, 50% RH, 90% RH)

Comments:

Date: 2020-01-22

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Humidity

Test sample GX-3R-Pro: Sample #4 Propane C3H8

The sensor shall be exposed for at least 2 h to clean air having 50±5 % RH at (20±5)°C and then calibrated per the manufacturer's recommendations. The sensor shall be exposed to the standard test gas until stabilized at the 50±5 % RH at (20±5)°C and the equipment reference point reading shall be recorded. Next, the sensor shall be exposed for at least 2 h to clean air at 20±5 % RH at (20±5)°C. The sensor shall then be exposed to the standard test gas until stabilized at 20±5 % RH at (20±5)°C and record the results. Next, the sensor shall be exposed for at least 2 h to clean air at 90±5 % RH at (20±5)°C. The sensor shall then be exposed to the standard test gas until stabilized at 90±5 % RH at (20±5)°C and record the results.

50% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	0	50
Exposure period prior to reading (min)	120	15
RH at time of reading (%)	50	50

20% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	1	52
Exposure period prior to reading (min)	120	15
RH at time of reading (%)	20	20

90% Relative Humidity Exposure:

	Clean Air	Standard Test Gas
Indication (% LEL)	-1	45
Exposure period prior to reading (min)	120	15
RH at time of reading (%)	90	90

Performance requirements: ±10% of measuring range or ±30% of indication from 50%RH

Comments:

Date: 2020-01-23

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Air Velocity Variation

Test sample GX-3R-Pro: Sample #4 Propane C3H8

5.4.10.1 General
The effects of air speed over a range of 0 m/s to 6 m/s on apparatus with sensors that operate by diffusion shall be determined using the test conditions given in 5.4.10.2.
5.4.10.2 Test conditions
The separate sensors of apparatus with remote sensors and, when practicable, the entire apparatus if the sensors are integral shall be tested in a flow chamber.
NOTE: The flow chamber should be suitable for the application of clean air and the standard test gas.
For apparatus having integral sensors, which are too large to be tested in a flow chamber, other flow apparatus for carrying out the test shall be permitted.

Irrespective of whether a flow chamber or other flow apparatus is used, orient the sensor in relation to the direction of the air flow as follows:
1) Sensor oriented directly towards direction of flow,
2) Sensor oriented away from the direction of flow,
3) Sensor oriented at right angles to the direction of flow.
Measurements shall be made under static conditions, at 3 m/s and at 6 m/s.
NOTE Directions of flow which are not likely to occur in practice, due to the design of the apparatus, or which are expressly prohibited within the manufacturer's instruction manual may not be tested.

Sensor exposed to clean air:

Applicable scale/range	0-100%LEL		
Measured velocity at sensor (m/s)	at 0 m/s	at 3 m/s	at 6 m/s
Sensor position relative to mixture stream	Indication (%LEL)		
1) flow directed at the sensor inlet	0	0	0
2) flow directed 180° to 1)	0	0	0
3) flow directed 90° to 1)	0	0	0

Sensor exposed to standard test gas:

Applicable scale/range	0-100%LEL		
Measured velocity at sensor (m/s)	at 0 m/s	at 3 m/s	at 6 m/s
Sensor position relative to mixture stream	Indication (%LEL)		
1) flow directed at the sensor inlet	49	50	51
2) flow directed 180° to 1)	49	50	51
3) flow directed 90° to 1)	49	50	51

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment : 22.7ºC; 16.4%RH; 982.3hPa

Date: 2020-02-06

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Orientation

Test sample GX-3R-Pro: Sample #4 Propane C3H8

5.4.12.1 Portable apparatus
During tests with clean air and standard test gas, rotate the sensor, or the whole apparatus if relevant, through 360º in steps of 90º around each of its three mutually perpendicular axes (one axis at a time). Record the indication in each position.

Clean Air

Applicable scale/range	0-100%LEL			
Rotation Positions	0º	90º	180º	270º
Measured Values				
X-axis	0	0	0	0
Y-axis	0	0	0	0
Z-axis	0	0	0	0

Standard test gas

Applicable scale/range	0-100%LEL			
Rotation Positions	0º	90º	180º	270º
Measured Values				
X-axis	51	51	51	51
Y-axis	51	51	51	51
Z-axis	51	51	51	51

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment: 24ºC; 15.4%RH;979.8hPa

Date:2020-02-06

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Vibration

Test sample GX-3R-Pro: Sample #4 Propane C3H8

Zero and Initial Calibration Gas (50% LEL) checked/adjusted - Yes
The alarm set point shall be set to 20% of full-scale range.
The apparatus shall be energized and mounted on the vibration test machine and vibrated successively in each of three planes respectively parallel to each of the three major axes of the apparatus.
The apparatus shall be vibrated over the frequency range specified at the excurs ion or constant acceleration peak specified, for a period of 1 h in each of the three mutually perpendicular planes. The rate of change of frequency shall not exceed 10 Hz/min.

Vibration, Procedures 1 (Cl 5.4.13.2.1).

For portable and transportable apparatus, remote sensors, and controllers where the sensor is integral with or directly attached to the controller, the vibration shall be as follows:
10 Hz to 30 Hz, 1.0 mm total excursion,
31 Hz to 150 Hz, 19.6 m/s^2 acceleration peak.
Criteria:

a) Meter/Output indication before Vibration Test
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 50%LEL

b) Meter/Output indication after Vibration Test (±10% of measuring range or ±20% of indication):
Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 51%LEL

c) Loss of function: No
False alarm: No
False indication of malfunction: No
Fault signal: No

d) Visible or hidden damage including loose components or damage to the enclosure that would manifest itself in a loss of function or electrical hazard:

Evident damage: No
If yes, specify:

Note: Observation of the effects of "hidden damage" is embodied in the balance of the prescribed test program.

Performance requirements: ±5% of measuring range or ±10% of indication; and no loss of function, no fault signal, no damage resulting in a hazard and no false alarms

Comments:

Lab Environment: 22.1ºC / 31%RH / 992.2hPa

Date: 2019-10-23

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Drop test for portable and transportable apparatus

Test sample GX-3R-Pro: Sample #4 Propane C3H8

While in the operating mode, the instrument (with carrying case if applicable) shall be released from a height of 1m above a concrete and allowed to free-fall.

Portable apparatus shall be released, while operating, from a height of 1m above a concrete surface and allowed to free fall.

Transportable apparatus with a mass of less than 5kg shall be released, while not operating, from a height of 0.3 m above a concrete surface and allowed to free fall.

Other transportable apparatus shall be released, while not operating, from a height of 0.1m above a concrete surface and allowed to free fall.

The test required above shall be performed three separate times, the portable apparatus being released each time with a different side (surface) facing down at the time of release and the transportable apparatus to be in an orientation for normal transport.

Meter/Output indication before Drop Test

Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 51%LEL

Meter/Output indication after Drop Test (±5% of measuring range or ±10% of indication):

Sensing element exposed to clean air: 0%LEL
Sensing element exposed to initial calibration mixture: 51%LEL

Loss of function after test (e.g. alarm, pump function, controls, display): No

Performance requirements: ±5% of measuring range or ±10% of indication

Comments:

Lab Environment: 22.5ºC/24.9%RH/989.3hPa

Date: 2019-11-29

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Warm –up time

Test sample GX-3R-Pro: Sample #4 Propane C3H8

The alarm set point shall be set to 20% of full-scale range.

The apparatus shall be switched off and left for 24h in clean air: Yes

After the 24h period, the apparatus shall be switched on in clean air and the warm up time measured: 38.5s

Fixed/transportable: (±5 % measuring range drift within manual spec. time, and no false alarm)

Indication measured:

Continuous duty portable: (±5% of measuring range within 2min., and no false alarm)

Indication measured: 49%LEL

Comments:

Lab Environment: 23.5ºC;21.3%RH;995.3hPa

Date:2020-02-10

Time of Response

Test sample GX-3R-Pro: Sample #4 Propane C3H8

The equipment shall be switched on in clean air and, after an interval corresponding to at least two times the warm-up time, as determined in accordance with 5.4.15, without switching off, the equipment or the sensor(s) shall be subjected to step changes from clean air to the standard test gas and from standard test gas to clean air. These changes shall be introduced by means of suitable equipment (see Annex B).
The times of response t(50) and t(90) for increasing concentration, and t(50) and t(10) for decreasing concentration shall be measured.
For an optional sampling probe, an extra test is required to measure the additional delay. This shall be less than 3 s/m of the total length of the probe plus tubing or any greater value, which is stated in the instruction manual.

Notes:
1. These times apply without optional accessories e.g. collecting cones, weather protection, attached to the sensor for special purposes.
2. For an optional sampling probe, test additional delay.

Test gas mixture delivery method:
(Apparatus Per CSA152-Cl. A4).

Apparatus per Cl A4 - Yes

Other (if No) –

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Increasing Response:

Applicable scale/range	0-100%LEL
Standard test gas mixture concentration (% combustible in air)	1.05 %C3H8 in air
Elapsed time (in seconds) to indicate 50% of test gas concentration (20s allowable)	13.6s
Elapsed time (in seconds) to indicate 90% of test gas concentration (60s allowable)	28.5s

If required response not achieved, include the following observations as applicable:

Indication at 20 second time limit: _____
Indication at 60 second time limit: _____
Maximum indication achieved: _____

Comments: RK Link App was kept ON in the smartphone and communicating with the device during the test

Lab Environment: 23.5ºC;17.7%RH;995.5hPa

Date: 2020-02-11

High gas concentration operation above the measuring range

Test sample GX-3R-Pro: Sample #3 Propane C3H8

This subclause applies to all apparatus with an upper limit of the measuring range less than 100 % (v/v) gas.
The entire apparatus, or the remote sensors of fixed or transportable apparatus, shall be subjected to the test given in 5.4.18.1 or 5.4.18.2 using a test apparatus that simulates a step change between gas concentrations such as those described in Annex B.
All gas concentrations above full scale shall be indicated by a full scale meter indication and, where fitted, an alarm. If the indication is digital, a clear indication shall be given that the upper limit of the measuring range has been exceeded.

Test gas delivery method:
Apparatus per CSA152 - Cl A4 - No

Other (if No) – calibration cap

Indication before test: 50%LEL

The apparatus or remote sensor shall be subjected to a step change from clean air to a volume fraction of 100% gas that shall be maintained for 3min.

Compliance: Yes

The sensor shall then be subjected to clean air for 20min, followed by the standard test gas.

Compliance: Yes

Indication measured: 45%LEL

Performance requirements: ±7 % measuring range or +20 % / –10 % of indication

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Comments: Indication went down to -6% LEL in clean air

Lab Environment : 23.3C/16%RH/996.6hPa

Date : 2020-02-12

Battery capacity

5.4.19.1 Battery powered portable continuous duty apparatus

5.4.19.1.1 Battery discharge

Test sample GX-3R-Pro: Sample #4 Propane C3H8

With a battery fully charged at the beginning of the test, the apparatus shall be operated in clean air for a total period of:
a) 8h, if fitted with a user-operated on/off switch.
b) 10h, if not so fitted, or
c) any longer time as specified by the manufacturer

At the end of the specified period, the apparatus is exposed to the standard test gas.

Test period: 8 hours and 25 hours
Indication: 50%LEL and 50%LEL

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: 25 hours in Measuring Mode (Non Alarm Operation, Fully Charged); RK Link App was kept ON in the smartphone and communicating with the device during the test

Lab Environment: 23.3C/16%RH/996.6hPa

Date: 2020-02-12

5.4.19.1.2 Low battery duration

The apparatus shall then continue to operate until an indication that the low battery condition has been reached. The apparatus shall continue to operate for an additional 10min:

Additional test period: 10 minutes
Indication: 50%LEL

Performance requirements: ±7% of measuring range or ±15% of indication

Comments: The last bar in the battery icon starts flashing is indicate as low battery warning. RK Link App was kept ON in the smartphone and communicating with the device during the test

Lab Environment: 23.3C/16%RH/996.6hPa

Date: 2020-02-12

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Field calibration kit

Test sample GX-3R-Pro: Sample #4 Propane C3H8

If a field calibration kit is provided with the apparatus, carry out the following test:

a) Calibrate the apparatus in accordance with 5.4.3.1 using the test conditions given in 5.3 and using the test equipment for the tests described in 5.4

b) Use the field calibration kit in a manner corresponding to the manufacturer's instructions for checking the apparatus response.

Calibration kit hardware evaluation: 0.25 LPM fixed flow regulator, Non-absorbent tubing and Calibration cup
Hardware Items: Calibration Cap

Reading with kit hardware, using initial calibration gas mixture as above:

Applicable Scale/Range		0-100%LEL	
a) Indication by use calibration kit		b) Indication in normal operation	
clean air	standard test gas	clean air	standard test gas
0	50	0	51

Performance requirements: ±5% of measuring range or ±10% of indication

Comments: Use the flow controller and primary standard gas mixture to similar the regulator and gas cylinder in the calibration kit. Client only provided calibration cap for evaluation.

Lab Environment: 22.4ºC/26.2%RH/989.2hPa

Date:2019-11-19

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Fault signals

Test sample GX-3R-Pro: Sample #4 Propane C3H8

Verify fault signals.

Under-range values at or below minus 10% (-10%) of the measuring range (e.g. caused by drift)

The instrument was zero calibrated whilst the sensing head was subjected to a gas mix consisting of 0.19% C3H8 by volume in air. Upon successful calibration, the sensing head was exposed to clean air.

Observation: 0 to -10%LEL indicated as is. Below -10%LEL have failure alarm and 'nnn' and over range alarm "over" were on the display flashing.

Performance requirements: Verify signal and no spurious alarms

Comments:

Lab Environment : 23.9ºC/17.2%RH/994hPa

Date : 2020-02-11

---End of Report---

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