

INTERNATIONAL STANDARD

**Explosive atmospheres –
Part 29-1: Gas detectors – Performance requirements of detectors for flammable
gases**





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**Explosive atmospheres –
Part 29-1: Gas detectors – Performance requirements of detectors for flammable
gases**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES –**Part 29-1: Gas detectors – Performance requirements
of detectors for flammable gases**

FOREWORD

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International Standard IEC 60079-29-1 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This second edition of IEC 60079-29-1 cancels and replaces the first edition of IEC 60079-29-1:2007 series and constitutes a technical revision.

Significant technical changes between IEC 60079-29-1, Edition 1 (2007), and IEC 60079-29-1, Edition 2 (2016), is as listed below:

Significant changes with respect to IEC 60079-29-1:2007

Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Measuring range up to 20 %LEL (Modified requirements)	All		X	
Definitions (Additional clarifications)	3	X		
Manufacturer's claims (special applications requirements)	4.1.1	X		
General construction (Malfunction effects on safety related function)	4.2.1			C1
General indicating devices (portable equipment with visual and audible indication)	4.2.2.1			C2
Suppression of indication and measured values below zero (functional limits)	4.2.2.5			C3
Fault signals (Fault indication below minimum voltage limit, sensor disconnection and zero drift condition)	4.2.4			C4
Adjustments (Zero and sensitivity adjustments)	4.2.5			C5
Marking (Portable equipment protective case)	4.3		X	
Instruction Manual (Additions and clarifications)	4.4			C6
Samples and sequence of tests (Optical filter special sensitivity limits, and modification considerations)	5.2.2		X	
Preparation of equipment before testing (separate gas detection control units)	5.2.3	X		
Test gas (methane, and propane or butane for general purpose gas detector)	5.3.2			C7
General test methods (selectable range and wiring worst case conditions)	5.4.1		X	
Calibration curve (fixed volume fractions)	5.4.3.2			C8
Response to different gases (semiconductor and catalytic high gas concentration exposure)	5.4.3.3			C9
Stability (duration of test method)	5.4.4		X	
Alarm set point(s) (alarm set point test method)	5.4.5	X		
Temperature (portable) (temperature range and stabilization period)	5.4.6			C10
Temperature (all other equipment) (temperature range and stabilization period)	5.4.6		X	
Pressure (tolerance on pressure measurement)	5.4.7	X		
Humidity of test gas (test method clarification)	5.4.8	X		
Air velocity (test method clarification)	5.4.9	X		
Flow rate for aspirated equipment (test method clarification)	5.4.10	X		
Vibration (test method clarification)	5.4.12	X		

Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Drop test for portable and transportable equipment (Automatic re-starting or shut-down requirement clarification)	5.4.13	X		
Warm-up time (user prompt requirement)	5.4.14			C11
High gas concentration operation above the measuring range (test method and requirement clarification)	5.4.16	X		
Battery capacity (test method clarification)	5.4.17	X		
Power supply variation (minimum supply voltage fault limit)	5.4.18			C12
Poisons (applicable only to Group I apparatus with catalytic or semiconductor sensors) (test method clarification)	5.4.20.2	X		
Electromagnetic compatibility (test methods and requirements)	5.4.21			C13
Field calibration kit (test method clarification)	5.4.22	X		
Software function (supporting documentation)	5.4.23		X	
Determination of time of response (test method clarification)	Annex B		X	

NOTE 1 The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version. More guidance may be found by referring to the Redline Version of the standard.

Explanations:

A) Definitions

Minor and editorial changes

Clarification decrease of technical requirements minor technical change editorial corrections.

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

Extension

Addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous standard. Therefore, these will not have to be considered for products in conformity with the preceding edition.

Major technical changes

Addition of technical requirements increase of technical requirements.

These are changes to technical requirements (addition, increase of the level or removal) made in a way that a product conforming to the preceding edition will not always be able to fulfil the requirements given in the later edition. These changes have to be considered for products conforming to the preceding edition. For these changes additional information is provided in B) below.

NOTE 2 These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

B) Information about the background of ‘Major technical changes’

- C1 Addition of malfunction effects not adversely affecting the safety related function (4.2.1).
- C2 Addition of visual and audible indication for portable equipment (4.2.2.1).
- C3 Addition of functional limits for suppression of indication and for measured values below zero (4.2.2.5).
- C4 Addition of requirements for fault indication below minimum voltage limit, sensor disconnection and zero drift condition (4.2.4).
- C5 Addition of requirements for zero and sensitivity adjustments (4.2.5).
- C6 Addition and clarification requirements for inclusion within the instruction manual (4.4).
- C7 Addition of methane and propane or butane as required test gases for general purpose gas detector (5.3.2).
- C8 Specification of fixed volume fractions which are expressed as a percentage of the measuring range (5.4.3.2).
- C9 Addition of requirement for semiconductor and catalytic sensors to be exposed to high gas concentration on response to different gases (5.4.3.3).
- C10 Addition of temperature range and stabilization period (5.4.6).
- C11 Addition of requirement where equipment prompts the user (5.4.14).
- C12 Addition of requirement for output functionality above the minimum supply voltage fault limit (5.4.18).
- C13 Addition of test methods and requirements for electromagnetic compatibility tests (5.4.21).

The text of this standard is based on the following documents:

FDIS	Report on voting
31/1257/FDIS	31/1266/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60079 series, under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

This part of IEC 60079-29 specifies general requirements for construction, testing and performance, and describes the test methods that apply to portable, transportable and fixed equipment for the detection and measurement of flammable gas or vapour concentrations with air.

Guidance for the selection, installation, use and maintenance of gas detecting equipment is set out in IEC 60079-29-2: *Explosive atmospheres – Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen*.

Guidance for functional safety of fixed gas detection systems is set out in IEC 60079-29-3: *Explosive atmospheres – Part 29-3: Gas detectors – Guidance on functional safety of fixed gas detection systems*.

General requirements for construction, testing and performance of open path detectors for flammable gases are set out in IEC 60079-29-4: *Explosive atmospheres – Part 29-4: Gas detectors – Performance requirements of open path detectors for flammable gases*.

EXPLOSIVE ATMOSPHERES –

Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases

1 Scope

This part of IEC 60079-29 specifies general requirements for construction, testing and performance, and describes the test methods that apply to portable, transportable and fixed equipment for the detection and measurement of flammable gas or vapour concentrations with air. The equipment, or parts thereof, is intended for use in explosive atmospheres and in mines susceptible to firedamp.

This part of IEC 60079-29 is applicable to flammable gas detection equipment with a measuring range up to any volume fraction as declared by the manufacturer, and which is intended to provide an indication, alarm or other output function; the purpose of which is to indicate a potential explosion hazard and in some cases, to initiate automatic or manual protective action(s).

For the purposes of this part of IEC 60079-29, the term “indicating up to a volume fraction of X % or X %LFL” includes equipment with an upper limit of the measuring range equal to or less than X % or X %LFL.

This part of IEC 60079-29 is applicable to equipment, including the integral sampling systems of aspirated equipment, intended to be used for commercial, industrial and non-residential safety applications.

This part of IEC 60079-29 does not apply to external sampling systems, or to equipment of laboratory or scientific type, or to equipment used only for process monitoring and/or control purposes. It also does not apply to open path (line of sight) detectors which are within the scope of IEC 60079-29-4. Only equipment with very short optical paths intended for use where the concentration is uniform over the optical path are within the scope of this standard.

For equipment used for sensing the presence of multiple gases, this part of IEC 60079-29 applies only to the detection of flammable gas or vapour.

This part of IEC 60079-29 supplements and modifies the general requirements of IEC 60079-0. Where a requirement of this standard conflicts with a requirement of IEC 60079-0, the requirement of IEC 60079-29-1 takes precedence.

NOTE 1 IEC 60079-29-1 is intended to provide for the supply of equipment giving a level of safety and performance suitable for general purpose applications. However, for specific applications, a prospective purchaser (or an appropriate authority) can additionally require the equipment to be submitted to particular tests or approval. For example, Group I equipment (i.e. equipment to be used in mines susceptible to firedamp) might not be permitted to be used without the additional, prior approval of the relevant authority in mines under its jurisdiction. Such particular tests/approval are to be regarded as additional to and separate from the provisions of the standards referred to above and do not preclude certification to or compliance with these standards.

NOTE 2 All equipment calibrated on specific gases or vapours can not be expected to correctly indicate on other gases or vapours.

For the purposes of this standard, the terms "lower flammable limit (LFL)" and "lower explosive limit (LEL)" are deemed to be synonymous, and likewise the terms "upper flammable limit (UFL)" and "upper explosive limit (UEL)" are deemed to be synonymous. For ease of reference, the two abbreviations LFL and UFL may be used hereinafter to denote these two sets of terms. It should be recognized that particular authorities having jurisdiction

may have overriding requirements that dictate the use of one of these sets of terms and not the other.

NOTE 3 Indication of concentration in %(v/v) or vol ppm can also be available for equipment which measures up to 100 %LFL or 20 %LFL. In that case, units of measurement might need to be selected in agreement with the manufacturer when verifying the performance requirements of Annex A.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-426, *International Electrotechnical Vocabulary – Part 426: Equipment for explosive atmospheres*

IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60079-20-1, *Explosive atmospheres – Part 20-1: Material characteristics for gas and vapour classification – Test methods and data*

IEC 61326-1:2012, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0 and the following apply. Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426.

3.1 gas properties

3.1.1 ambient air

normal atmosphere surrounding the equipment

3.1.2 clean air

air that is free of gases or vapours which the sensor is sensitive to or which influence the performance of the sensor

3.1.3 flammable gas

gas or vapour which, when mixed with air in a certain proportion, will form an explosive atmosphere

Note 1 to entry: For the purposes of this part of IEC 60079-29, the term "flammable gas" includes flammable vapours.

Note 2 to entry: For the purposes of this part of IEC 60079-29, the terms "combustible gas" and "flammable gas" are equivalent.

3.1.4 lower flammable limit

LFL
concentration of flammable gas or vapour in air, below which an explosive gas atmosphere does not form

Note 1 to entry: This is also known as lower explosive limit (LEL).

Note 2 to entry: The concentration may be expressed as either a volume fraction or a mass per unit volume.

3.1.5 poisons

<for sensing elements> substances that lead to temporary or permanent change of performance, particularly loss of sensitivity of the sensing element

3.1.6 upper flammable limit

UFL

concentration of of flammable gas or vapour in air, above which an explosive gas atmosphere does not form

Note 1 to entry: This is also known as upper explosive limit (UEL).

Note 2 to entry: The concentration may be expressed as either a volume fraction or a mass per unit volume.

3.1.7 volume fraction

v/v

quotient of the volume of a specified component and the sum of the volumes of all components of a gas mixture before mixing, all volumes referring to the pressure and the temperature of the gas mixture

Note 1 to entry: The volume fraction and volume concentration take the same value if, at the same state conditions, the sum of the component volumes before mixing and the volume of the mixture are equal. However, because the mixing of two or more gases at the same state conditions is usually accompanied by a slight contraction or, less frequently, a slight expansion, this is not generally the case.

3.1.8 zero gas

gas recommended by the manufacturer, which is free of flammable gases and interfering and contaminating substances, the purpose of which is calibration/adjustment of the equipment zero

3.1.9 standard test gas

test gas with a composition specified for each item of equipment and gas and/or vapour to be used for all tests unless otherwise stated

3.2 types of equipment

3.2.1 alarm-only equipment

equipment with an alarm but not having an indication of measured value

3.2.2 aspirated equipment

equipment that samples the gas by drawing it to the gas sensor

Note 1 to entry: A hand operated or electric pump is often used to draw gas to the sensor.

3.2.3 automatically aspirated equipment

aspirated equipment with an integral pump or separate pump, which is connected directly to the equipment

3.2.4**continuous duty equipment**

equipment that is powered for long periods of time, but may have either continuous or intermittent sensing

Note 1 to entry: For this edition of the standard, all equipment is regarded as continuous duty.

3.2.5**diffusion equipment**

equipment in which the transfer of gas from the atmosphere to the sensor takes place without aspirated flow

3.2.6**equipment, fixed**

equipment fastened to a support, or otherwise secured in a specific location when energized

3.2.7**Group I equipment**

equipment for mines susceptible to firedamp

3.2.8**Group II equipment**

equipment for places with an explosive gas atmosphere, other than mines susceptible to firedamp

3.2.9**equipment, portable**

equipment intended to be carried by a person during operation

Note 1 to entry: A portable equipment is battery powered and includes, but is not limited to

- a) a hand-held equipment, typically less than 1 kg, which requires use of only one hand to operate,
- b) personal monitors, similar in size and mass to the hand-held equipment, that are continuously operating (but not necessarily continuously sensing) while they are attached to the user, and
- c) larger equipment that can be operated by the user while it is carried either by hand, by a shoulder strap or carrying harness and which may or may not have a hand directed probe.

3.2.10**equipment, transportable**

equipment not intended to be carried by a person during operation, nor intended for fixed installation

3.2.11**gas detection transmitter**

fixed gas detection equipment that provide a conditioned electronic signal or output indication to a generally accepted industry standard (such as 4 to 20 mA), intended to be utilized with separate gas detection control units or signal processing data acquisition, central monitoring and similar systems, which typically process information from various locations and sources including, but not limited to gas detection equipment

3.2.12**gas detection control unit**

equipment intended to provide display indication, alarm functions, output contacts and/or alarm signal outputs or any combinations when operated with remote sensor(s)

3.2.13**separate gas detection control unit**

equipment intended to provide display indication, alarm functions, output contacts or alarm signal outputs or any combination when operated with gas detection transmitter(s)