

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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**Explosive atmospheres –  
Part 29-2: Gas detectors – Selection, installation, use and maintenance of  
detectors for flammable gases and oxygen**

**Atmosphères explosives –  
Partie 29-2: Détecteurs de gaz – Sélection, installation, utilisation et maintenance  
des détecteurs de gaz inflammables et d'oxygène**





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IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

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ICS 29.260.20

ISBN 978-2-8322-5029-7

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# INTERNATIONAL ELECTROTECHNICAL COMMISSION

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## EXPLOSIVE ATMOSPHERES –

### **Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen**

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International Standard IEC 60079-29-2 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This bilingual version (2017-12) corresponds to the monolingual English version, published in 2015-03.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

This edition includes the following significant changes with respect to the previous edition:

Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Addition of group 1 to scope	1		x	
Addition of Open Path Gas Detection	3, 4.6, 5.4, 6.2.3.5, 8.2, 8.6, 8.7, 8.8, 11, A4		x	
Changed “combustible” to “flammable”	Throughout	x		
Addition of specific applications	4.5		x	
Improvements to sampling systems	6.2.3.4, 8.2.3, 8.5, 11.2.2	x		

NOTE 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:

- 1) **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.

- 2) **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.

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

- 3) **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 in conformity with 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 in conformity with the preceding edition.

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

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

FDIS	Report on voting
31/1169/FDIS	31/1179/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.

The French version of this standard has not been voted upon.

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

A list of all parts in the IEC 60079 series, published 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.

## INTRODUCTION

Flammable gas detection equipment may be used whenever there is the possibility of a hazard to life or property caused by the accumulation of a flammable gas-air mixture. Such equipment can provide a means of reducing the hazard by detecting the presence of a flammable gas and issuing suitable audible or visual warnings. Gas detectors may also be used to initiate precautionary steps (for example plant shutdown, evacuation, and operation of fire extinguishing procedures).

Equipment may be used to monitor a gas atmosphere below the lower flammable limit in circumstances where accumulation of gas may result in a concentration of the gas/air mixture to potentially explosive levels. Performance requirements for gas detecting equipment for such purposes are set out in IEC 60079-29-1 and IEC 60079-29-4. Guidance for functional safety of fixed gas detection systems are set out in IEC 60079-29-3.

However performance capability alone cannot ensure that the use of such equipment will properly safeguard life or property where flammable gases may be present. The level of safety obtained depends heavily upon correct selection, installation, calibration and periodic maintenance of the equipment, combined with knowledge of the limitations of the detection technique required. This cannot be achieved without responsible informed management.

An additional hazard to life is the toxicity of some gases and of the vapours of all liquids except water. It is not generally appreciated that all flammable vapours are potentially toxic at concentration levels which are very small fractions of their respective lower flammable limits. Equipment covered by IEC 60079-29-1 and IEC 60079-29-4 is not specifically intended for toxic protection, and additional personal protection precautions will normally be needed where personnel could be exposed to toxic vapours.

Portable equipment covered by IEC 60079-29-1 and IEC 60079-29-2 commonly have additional detectors for specific toxic gases and also for oxygen deficiency. Users are cautioned that even mild oxygen deficiency may be due to toxic concentrations of some other gas or vapour, which may not be detectable or adequately detected by the equipment in use.

General requirements for the handbook or manual of any particular flammable gas detection equipment are specified in IEC 60079-29-1 and IEC 60079-29-4. These standards provide some necessary background knowledge on the points mentioned above.

This standard has been specifically written to cover all the functions necessary from selection to ongoing maintenance for a successful gas detection operation. Different clauses are appropriate for different tasks within this range of operations. Each clause has been written as stand-alone as far as practicable. This means that some information is repeated in different clauses but with a different emphasis.

Table 1 gives a broad suggestion as to the most relevant clauses to the typical tasks to be performed.

**Table 1 – Typical Tasks and Most Relevant Causes**

Tasks	Definitions	Basic information properties of gas and vapours	Measuring principles	Selection of equipment	Behaviour of gas releases	Design and installation of fixed gas detection systems	Use of portable and transportable flammable gas detection equipment	Training of operational personnel	Maintenance, routine procedures General administrative control	Measuring principles (full detail) (normative)	Environmental parameters (informative)
Function (Clause)	3	4	5	6	7	8	9	10	11	Annex A	Annex B
Authorities	+	+++	+++	+	+	-	-	-	+	-	-
General management	+	+++	+++	+	+	-	-	+	+	-	+
Selection	+++	+++	+	+++	+++	+	++	-	+	+++	+++
Design engineering / management	+++	+++	+	+++	+++	+++	-	-	-	+++	+++
Installation engineering / management	+++	+++	+	++	+++	+++	-	-	-	+++	+++
Installation, technical	++	+++	++	++	++	++	-	-	-	+	++
Commissioning	+++	+++	++	+	++	+++	-	++	+	-	-
Operations management	++	+++	++	+	+	++	++	+++	+++	+	+++
Operation training	+++	+++	+	+	+	+++	+++	+++	+++	+++	+++
Servicing / Calibration	+++	+++	-	-	-	++	++	+	+++	++	++
Repair	++	+++	++	-	-	+	+	+	+++	++	-
“+++” Most appropriate “++” Advisable “+” Useful “-” Not applicable  It should be noted that Clause 5 is a simplified version of Annex A.											

This standard makes recommendations on how to establish maintenance and calibration intervals. In certain countries there are mandatory general or industry-specific regulations which must be followed as a minimum requirement.

## EXPLOSIVE ATMOSPHERES –

### Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen

#### 1 Scope

This part of IEC 60079-29 gives guidance on, and recommended practice for, the selection, installation, safe use and maintenance of electrically operated Group II equipment intended for use in industrial and commercial safety applications and Group I equipment in underground coal mines for the detection and measurement of flammable gases complying with the requirements of IEC 60079-29-1 or IEC 60079-29-4.

This standard is applicable for oxygen measurement for the purpose of inertisation where explosion protection is provided by the exclusion of oxygen instead of measuring the flammable gases or vapours present. A similar application is measuring oxygen when inertising a goaf (mined out) area in an underground coal mine.

This standard is a compilation of practical knowledge to assist the user, and applies to equipment, instruments and systems that indicate the presence of a flammable or potentially explosive mixture of gas or vapour with air by using an electrical signal from a gas sensor to produce a meter reading, to activate a visual or audible pre-set alarm or other device, or any combination of these.

Such equipment may be used as a means of reducing the risk whenever there is the possibility of a risk to life or property specifically due to the accumulation of a flammable gas-air mixture, by providing such warnings. It may also be used to initiate specific safety precautions (e.g. plant shutdown, evacuation, fire extinguishing procedures).

This standard is applicable to fixed installations and transportable equipment. Similarly it is applicable to the safe use of portable equipment. Since much modern equipment of this type also includes oxygen deficiency detection and/or specific toxic gas sensors, some additional guidance is given for these topics.

For the purposes of this standard, except where specifically stated otherwise, flammable gases include flammable vapours.

Mists are not covered by this standard due to measurement techniques currently used.

This standard applies to Group II equipment (i.e. equipment intended for use in industrial and commercial safety applications, involving areas classified in accordance with IEC 60079-10-1) and Group I equipment.

For the purposes of this standard, equipment includes

- a) fixed equipment including equipment mounted on a vehicle;
- b) transportable equipment; and
- c) portable equipment.

This standard is not intended to cover, but may provide useful information, for the following:

- a) equipment intended only for the detection of non-flammable toxic gases;
- b) equipment of laboratory or scientific type intended only for analysis or measurement purposes;

- c) equipment intended only for process control applications;
- d) equipment intended for applications in explosives processing and manufacture;
- e) equipment intended for the detection of a explosive atmosphere resulting from dust or mist in air.

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

IEC 60079-10-1:2008, *Explosive atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres*

IEC 60079-10-2, *Explosive atmospheres – Part 10-2: Classification of areas – Combustible dust atmospheres*

IEC 60079-13, *Explosive atmospheres – Part 13: Equipment protection by pressurized room "p"*

IEC 60079-17, *Explosive atmospheres – Part 17: Electrical installations inspection and maintenance*

IEC 60079-19, *Explosive atmospheres – Part 19: Equipment repair, overhaul and reclamation*

IEC 60079-29-1:2007, *Explosive atmospheres – Part 29-1: Gas detectors – Performance requirements of detectors for flammable gases*

IEC 60079-29-4, *Explosive atmospheres – Part 29-4: Gas detectors – Performance requirements of open path detectors for flammable gases*

IEC 61285, *Industrial-process control – Safety of analyser houses*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0, as well as the following apply. In addition, since this is intended as a stand-alone standard, certain definitions within IEC 60079-29-1 and IEC 60079-29-4 are repeated below for the convenience of the reader.

NOTE Additional definitions applicable to explosive atmospheres can be found in the International Electrotechnical Vocabulary (IEV), IEC 60050-426.

### 3.1 Gas properties and other physics

#### 3.1.1

##### **ambient air**

normal atmosphere surrounding the equipment

#### 3.1.2

##### **clean air**

air which is free from gases or vapours (flammable, toxic or environmentally harmful gases) to which the equipment is sensitive or which influence the performance of the equipment

### **3.1.3 concentration**

amount of the gas or vapour of interest in a specified amount of the background gas or air, expressed in suitable units

Note 1 to entry: Typical units include volume fraction (v/v) (see 3.1.19); molar (moles per mole – m/m); percentage of the LFL of a particular substance; parts per million by volume (ppm); parts per billion by volume (ppb).

### **3.1.4 dose**

total amount of substance absorbed or trapped, proportional to the concentration and the duration of exposure

### **3.1.5 explosive gas atmosphere**

mixture with air, under normal atmospheric conditions, of flammable substances in the form of gas or vapour, which, after ignition, permits self-sustaining flame propagation

### **3.1.6 explosive range**

range of gas or vapour mixtures with air, with concentrations between the lower and upper explosive (flammable) limits

### **3.1.7 firedamp**

flammable mixture of gases, consisting mainly of methane, naturally occurring in a mine

### **3.1.8 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 standard, the term "flammable gas" includes flammable vapour

### **3.1.9 flashpoint**

lowest liquid temperature at which, under certain standardized conditions, a liquid gives off vapours in a quantity such as to be capable of forming an ignitable vapour/air mixture

### **3.1.10 lower flammable limit LFL**

volume fraction of flammable gas or vapour in air below which an explosive gas atmosphere does not form, expressed as a percentage (see IEC 60079-20-1)

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

### **3.1.11 optical radiation**

ultra-violet, visible or infrared regions of the electromagnetic spectrum

### **3.1.12 relative density**

density of gas or vapour relative to the density of air at the same pressure and at the same temperature

Note 1 to entry: Air is equal to 1,0.

**3.1.13****release rate**

quantity of flammable gas or vapour emitted per unit time from the source of release which itself could be a liquid surface

**3.1.14****source of release**

point or location from which a flammable gas, vapour or liquid may be released into the atmosphere in such a way that an explosive gas atmosphere could be formed

[SOURCE: IEC 60050-426:2008. 426-03-06, modified by removal of Note]

**3.1.15****toxic gas**

gas that may be harmful to human health and/or the performance of persons due to its physical or physico-chemical properties

**3.1.16****upper flammable limit****UFL**

volume fraction of flammable gas or vapour in air above which an explosive gas atmosphere does not form, expressed as a percentage (see IEC 60079-20-1)

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

**3.1.17****vapour**

gaseous state of a substance that can reach equilibrium with its liquid or solid state in the temperature and pressure range of interest

Note 1 to entry: This is a simplification of the scientific definition, for the purposes of this standard, and merely requires that the substance is below its boiling point or sublimation point at the ambient temperature and pressure.

**3.1.18****ventilation**

movements of air and replacement with fresh air due to the effects of wind, temperature gradients or artificial means (for example fans or extractors)

**3.1.19****volume fraction****v/v**

ratio of the volume of a component gas to the volume of the gas mixture under specified conditions of temperature and pressure

Note 1 to entry: This is also known as volume ratio.

**3.2 Types of equipment****3.2.1****alarm only equipment**

equipment which generates an alarm signal but does not have a meter or output giving a measure of the integral concentration

**3.2.2****aspirated equipment**

equipment that samples the gas by drawing it to the gas sensor – for example by means of a hand-operated or electric pump

**3.2.3****continuous duty equipment**

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

**3.2.4****diffusion equipment**

equipment in which the transfer of gas from the atmosphere to the gas sensor takes place by random molecular movement, i.e. under conditions in which there is no aspirated flow

**3.2.5****explosion protected equipment**

equipment incorporating a type of explosion protection covered by the IEC 60079 series of standards

**3.2.6****explosion protection**

measures applied in the construction of equipment to prevent ignition of a surrounding flammable atmosphere by the equipment

**3.2.7****fixed equipment**

equipment that is intended to have all its parts permanently installed

**3.2.8****group I equipment**

equipment for mines susceptible to firedamp

**3.2.9****group II equipment**

electrical equipment for use in places with an explosive gas atmosphere other than mines susceptible to firedamp

**3.2.10****portable equipment**

spot reading or continuous duty equipment that has been designed to be readily carried from place to place and to be used while it is being carried

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 by a carrying harness; which may or may not have a hand directed probe

**3.2.11****sample (sampling) system**

equipment which typically draws more than one sample, conditions them as necessary, and presents them to a sensor in aspirated equipment

Note 1 to entry: This usually refers to fixed equipment where multiple samples from different detection points are presented sequentially to one or more sensors;

**3.2.12****spot reading equipment**

equipment intended to be used for short, intermittent or irregular periods of time as required (typically 5 min or less)

**3.2.13****transportable equipment**

equipment not intended to be portable, but which can be readily moved from one place to another

**3.3 Sensors and detectors****3.3.1****catalytic sensor**

sensor, the operation of which depends upon the oxidation (combustion) of gases on an electrically heated catalytic element

**3.3.2****electrochemical sensor**

sensor, the operation of which depends upon changes of the electrical parameters of electrodes placed in an electrolyte due to redox reactions of the gas on the surface of the electrodes

**3.3.3****flame ionisation detector****FID**

sensor, the operation of which depends upon the ionization of the gas being detected in a hydrogen flame

**3.3.4****flame temperature analyser****FTA**

sensor, the operation of which depends upon the change of temperature of a flame by the gas being detected

**3.3.5****infrared absorption sensor**

sensor, the operation of which depends upon the absorption of infrared radiation by the gas being detected

**3.3.6****paramagnetic oxygen detector**

sensor, the operation of which depends upon the magnetic properties of oxygen

**3.3.7****photo ionisation detector****PID**

sensor, the operation of which is based on the ionisation of gaseous compounds by ultraviolet (UV) radiation

**3.3.8****remote sensor**

sensor that is not integral with the main body of the equipment

**3.3.9****semiconductor sensor**

sensor, the operation of which depends upon changes of the electrical conductance of a semiconductor due to chemisorption of the gas being detected at its surface

**3.3.10****sensor**

assembly in which the sensing element is housed that may also contain associated circuit components

**3.3.11****sensing element**

part of a sensor that reacts in the presence of a flammable gas mixture to produce some physical or chemical change that can be used to activate a measuring or alarm function, or both

**3.3.12****single point sensor**

sensor capable of detecting gas at a single point location

**3.3.13****thermal conductivity sensor**

sensor, the operation of which depends upon the change of heat loss by conduction of an electrically heated element located in the gas to be measured, compared with that of a similar element located in a reference gas cell

**3.4 Supply of gas to instruments****3.4.1****measuring point****measurement point**

location of a single sensor aspirated by diffusion or by a probe

**3.4.2****point detection equipment**

detection equipment located at a measurement point

Note 1 to entry: This normally refers to a complete single point sensor, rather than a sampling point, and is in contrast with open path equipment

**3.4.3****sample line**

means by which the gas being sampled is conveyed to the sensor including accessories

EXAMPLE Filter, water trap.

**3.4.4****sampling point**

point from which sample is taken in an aspirated equipment

Note 1 to entry: Typically this term is applied to fixed aspirated systems.

Note 2 to entry: Typically the equipment at this point will consist of a filter, but there may be other sample conditioning equipment as well.

**3.4.5****sampling probe**

separate sample line which is attached to the equipment as required, that may or may not be supplied with the equipment

Note 1 to entry: It is usually short (e.g. in the order of 1 m) and rigid (although it may be telescopic), but it may be connected by a flexible tube to the equipment.

**3.5 Signals and alarms****3.5.1****alarm setpoint**

fixed or adjustable setting of the equipment that is intended to pre-set the level of concentration at which the equipment will automatically initiate an indication, alarm or other output function

### 3.5.2

#### **alarm signal**

audible, visual, electronic or other signal generated by the equipment when an integral concentration of gas in excess of a preset value is detected

### 3.5.3

#### **continuous or quasi-continuous sensing**

mode of operation in which power is applied continuously to the sensing element and readings are taken continuously or at regular and frequent intervals

### 3.5.4

#### **fault signal**

audible, visual, or other type of output which provides, directly or indirectly, a warning or indication that the equipment is defective or out of adjustment

### 3.5.5

#### **indicating devices**

means for displaying values or states in analogue or digital form

### 3.5.6

#### **inhibition signal**

audible, visual, or other type of output which provides, directly or indirectly, a warning or indication that normal operation has been suspended

### 3.5.7

#### **intermittent sensing**

mode of operation in which the power or flow to the sensor is applied intermittently according to a predetermined cycle and readings taken at the predetermined cycle

### 3.5.8

#### **latching alarm**

alarm which, once activated, requires a deliberate action to deactivate it

### 3.5.9

#### **safety function**

function (inclusive from gas sampling to signal output of the gas detection equipment) to enable the overall system to achieve a safe state.

## 3.6 Times, checks and equipment behaviour

### 3.6.1

#### **drift**

variation with time of the indication produced by the equipment under normal conditions when monitoring a fixed gas volume fraction, or, in the case of open path, a fixed concentration distribution, (including clean air) under constant ambient conditions

### 3.6.2

#### **functional check**

application of test gas or other means of obtaining a response from the sensor to check its function

Note 1 to entry: This may include the generation of an alarm. This check is performed without adjustments of sensitivity.

Note 2 to entry: This is also known as a “response check” or “bump test”.

### 3.6.3

#### **initial calibration**

first calibration for a specific substance, measuring range and application carried out by the manufacturer before delivery, or on site, before starting the operation

### **3.6.4** **poisons** **<for sensors>**

substances which lead to temporary or permanent loss of sensitivity of the sensors

### **3.6.5** **recalibration**

calibrations carried out periodically to check and adjust the zero signal and the sensitivity of the sensor with a known calibration gas mixture without any changing of the parameters, type of gas, measuring range, specific application, which have been established by the initial calibration

### **3.6.6** **recovery time**

time interval between the time when an instantaneous decrease in gas concentration is produced at the sensor input and the time when the response reaches a stated indication

### **3.6.7** **selectivity**

response of the equipment to the gas of interest compared with the response to other gases

Note 1 to entry: If there is high selectivity to the target gas, the results will be less ambiguous and the cross-sensitivity to other gases will be low.

### **3.6.8** **sensitivity**

ratio of change produced in the equipment by a known concentration of gas or vapour

Note 1 to entry: Depending on context, this can refer to the minimum change in concentration of gas or vapour that the equipment will detect.

Note 2 to entry: High sensitivity implies that low concentrations can be measured.

### **3.6.9** **span**

reading on the normal test gas of the equipment

### **3.6.10** **time of response** **tx**

time interval, with the equipment in a warmed-up condition, between the time when an instantaneous change between clean air and the standard test gas, or vice versa, is produced at the equipment inlet, and the time when the response reaches a stated percentage (x) of the stabilised signal on the standard test gas

Note 1 to entry: Not applicable to spot reading equipment.

### **3.6.11** **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

## **3.7 Terms exclusive to open path equipment**

### **3.7.1** **albedo**

proportion of incident light scattered back from a surface

### 3.7.2

#### **beam blocked signal**

audible, visual or other type of output which provides, directly or indirectly, a warning or indication that the optical path is obscured or that the signal detected is too weak to enable the equipment to function normally

### 3.7.3

#### **gas calibration cell**

sealed enclosure with transparent ends which can be filled with test gases

### 3.7.4

#### **integral concentration**

mathematical integral of the gas concentration along the optical path

Note 1 to entry: It is expressed in units of concentration multiplied by distance, e.g. LFL metre for flammable gases or ppm metre for toxic gases

Note 2 to entry: 100 %LFL x 1 metre = 1 LFL metre;

10 %LFL x 10 metre = 1 LFL metre.

### 3.7.5

#### **meteorological optical range**

##### **MOR**

length of path in the atmosphere required to reduce the luminous flux in a collimated beam from an incandescent lamp, at a colour temperature of 2 700 K to 5 % of its original value

### 3.7.6

#### **open path**

optical path which traverses the area (or part of the area) in which the atmosphere is being monitored and through which gases in the atmosphere are free to move

### 3.7.7

#### **optical axis**

median line of the optical path

### 3.7.8

#### **optical path**

path traversed by optical radiation from an optical transmitter to an optical receiver

Note 1 to entry: The radiation may traverse the path once, twice or many times depending on the form taken by the instrument

### 3.7.9

#### **receiver**

assembly in which the optical detecting element(s) are housed and which may contain associated optical and electrical components

### 3.7.10

#### **retroreflector**

individual or multiple arrangement of reflecting corners of cubes arrayed so that light is reflected back parallel to its incident path

### 3.7.11

#### **gas detection transmitter**

fixed gas detection equipment that provide a self-conditioned electronic signal or output indication to a generally accepted industry standard (such as 4-20 mA or relay), 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

**3.7.12****transceiver**

assembly in which the optical detecting element(s) and optical transmitting element(s) are housed and which may contain associated optical and electrical components

**3.7.13****transmittance**

fraction of luminous flux which remains in a single beam after traversing an optical path of a given length in the atmosphere

**3.7.14****transmitter**

assembly in which the optical transmitting element(s) are housed and which may contain associated optical and electrical components

## **4 Basic information on the properties, behaviour, gases and vapours, and specific applications of gas detection**

### **4.1 Detecting gases and vapours**

#### **4.1.1 General**

For the purposes of Clause 4, a distinction is drawn between gases, which remain gaseous at typical ambient pressures and temperatures, and vapours where liquid can also exist at any relevant pressure or temperature.

Effective operation of flammable gas detection equipment depends not only on its performance but also on its correct usage.

Equipment capability, and its suitability for the intended application and the user's knowledge of its limitations, both generic relating to sensor technology, and individual relating to its other design features, cannot alone ensure that its use will properly safeguard personnel, areas, or locations where flammable gases or vapours may be or are present. The level of safety obtained also depends upon the user having a basic knowledge of gas and vapour properties and phenomena.

This knowledge should enable the user to determine whether the gases are heavier or lighter than air, and whether the vapours are heavier than air or of similar density, and therefore where they may accumulate. If the direction and velocity of air movement is known, it can be seen how they may propagate. In addition, there may be physical or chemical reasons imposing limitations on a particular application, such as calibration considerations.

Consideration shall be given not only to those gases and vapours that are required to be detected, but also to those gases and vapours that are not required to be detected, but may also be present.

The effects of humidity and temperature variations may need to be evaluated, particularly when sampling lines are used, and, more importantly, if vapours other than water are involved.

Small environmental changes, such as a rise or fall in temperature, which may be ignored for most purposes, can significantly modify conditions, particularly if liquids are present and produce increased amounts of vapours, or if vapours condense as fogs or inside the equipment itself.

Failure to take these properties of gases and vapours into account at any of the stages of selection, installation, commissioning, training, operation and on-going maintenance of even the simplest of equipment can result in the production of erroneous readings. These in turn