

Explosive atmospheres —

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

ICS 13.320; 29.260.20

National foreword

This British Standard is the UK implementation of EN 60079-29-1:2007. It was derived from IEC 60079-29-1:2007. It supersedes BS EN 61779-1:2000, BS EN 61779-2:2000, BS EN 61779-3:2000, BS EN 61779-4:2000 and BS EN 61779-5:2000, which will be withdrawn on 1 November 2010.

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by tags (e.g. [C] [C]).

National Annex NA (informative) reproduces IEC Interpretation Sheet 1, 2007.

The UK participation in its preparation was entrusted by Technical Committee GEL/31, Equipment for explosive atmospheres, to Subcommittee GEL/31/19, Gas detectors.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

Atmosphères explosives -
Partie 29-1: Détecteurs de gaz -
Exigences d'aptitude à la fonction
des détecteurs de gaz inflammables
(CEI 60079-29-1:2007, modifiée)

Explosionsfähige Atmosphäre -
Teil 29-1: Gasmessgeräte -
Anforderungen an das Betriebsverhalten
von Geräten für die Messung
brennbarer Gase
(IEC 60079-29-1:2007, modifiziert)

This European Standard was approved by CENELEC on 2007-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 31/695/FDIS, future edition 1 of IEC 60079-29-1, prepared by IEC TC 31, Equipment for explosive atmospheres, was submitted to the IEC-CENELEC parallel vote.

A draft amendment, prepared by SC 31-9, Electrical apparatus for the detection and measurement of combustible gases to be used in industrial and commercial potentially explosive atmospheres, of Technical Committee CENELEC TC 31, Electrical apparatus for explosive atmospheres, containing common modifications to document 31/695/FDIS was submitted to the formal vote.

The combined texts of document 31/695/FDIS and the draft amendment prAA were approved by CENELEC as EN 60079-29-1 on 2007-11-01.

This European Standard supersedes EN 61779-1:2000 + A11:2004, EN 61779-2:2000, EN 61779-3:2000, EN 61779-4:2000 and EN 61779-5:2000.

The main changes with respect to the EN 61779 series are listed below:

- Subclause 4.2.3 (Alarm or output functions) was modified to ensure alarm devices cannot be adjustable outside their measuring range and to include requirements for de-activation of alarm devices;
- Subclause 4.2.7 (Stand-alone gas detection apparatus for use with separate control units) was added to allow separate evaluation of detection apparatus providing an industry recognized output signal;
- Subclause 4.2.8 (Separate control units for use with stand-alone gas detection apparatus) was added to allow separate evaluation of control unit apparatus using an industry recognized input signal;
- Subclause 4.2.9 (Software-controlled apparatus) was added to the document for improved evaluation of software. The added text is based upon the guiding principles and requirements of EN 50271;
- Subclause 5.2.1.1 was modified to require the center wavelength of the optical filters of two apparatus at the minimum and maximum limit of this standard;
- Subclause 5.2.1.2 was modified to allow the order of testing within each block to be conducted at the discretion of the test laboratory;
- Subclause 5.3.11 (Communications options) was added to ensure maximum transaction rates are applied during testing;
- Subclause 5.3.12 (Gas detection apparatus as part of systems) was added to ensure maximum transaction rates are applied during testing;
- Subclause 5.4.6 (Alarm set point(s)) was modified to include text related to alarms that are activated at decreasing concentrations;
- Subclause 5.4.10 (Air velocity) was modified to include testing at 3 m/s and 6 m/s;
- Subclause 5.4.16 (Time of response) was modified to exclude recovery time test requirements for Group II apparatus with a volume fraction up to 100 % LFL indication;
- Subclause 5.4.18 (High gas concentration operation above the measuring range) was modified to define the sequence of tests;
- Annex A (Performance requirements) has undergone major modifications by eliminating the gas/vapour table and replacing the annex with the performance requirements of Parts 2 to 5 of EN 61779. Additionally, performance requirements of Parts 2 to 5 of EN 61779 were adjusted for consistency as appropriate. The intent of this change is to condense Parts 1 to 5 of EN 61779 within a single standard.

This part of EN 60079-29 is to be used in conjunction with the following standards:

- EN 60079-0, Electrical apparatus for explosive gas atmospheres – Part 0: General requirements
- EN 60079-29-2, Explosive atmospheres – Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2008-11-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2010-11-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 94/9/EC. See Annex ZZ.

Annexes ZA and ZZ have been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60079-29-1:2007 was approved by CENELEC as a European Standard with agreed common modifications.

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INTRODUCTION

Guidance for the selection, installation, use and maintenance of gas detecting apparatus are 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.

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 apparatus for the detection and measurement of flammable gas or vapour concentrations with air. The apparatus, or parts thereof, are intended for use in potentially explosive atmospheres (see 3.1.8) and in mines susceptible to firedamp.

This standard is also applicable when an apparatus manufacturer makes any claims regarding any special features of construction or superior performance that exceed these minimum requirements. In these cases, all such claims should be verified and the test procedures should be extended or supplemented, where necessary, to verify the performance claimed by the manufacturer. When verifying the superior performance of one criterion, other performance criteria are not required to meet the standards minimum requirements, however, these reduced claimed performance criteria (as confirmed in the manufactures Installation Manual) should also be verified. (e.g. temperature range of 0 °C to 60 °C; 0 °C to 40 °C at $\pm 10\%$ accuracy and 40 °C to 60 °C at $\pm 15\%$ (manufacturers claimed accuracy). The additional tests should be agreed between the manufacturer and test laboratory and identified and described in the test report.

This standard is applicable to flammable gas detection apparatus intended to provide an indication, alarm or other output function; the purpose of which is to give a warning of a potential explosion hazard and in some cases, to initiate automatic or manual protective action(s).

This standard is applicable to apparatus, including the integral sampling systems of aspirated apparatus, intended to be used for commercial, industrial and non-residential safety applications.

This standard does not apply to external sampling systems, or to apparatus of laboratory or scientific type, or to apparatus used only for process control purposes. It also does not apply to open path (line of sight) area monitors. For apparatus used for sensing the presence of multiple gases, this standard applies only to the detection of flammable gas or vapour.

This standard 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 will take precedence.

Ⓒ Note deleted Ⓒ

Ⓒ NOTE 1 Ⓒ All apparatus calibrated on specific gases or vapours can not be expected to correctly indicate on other gases or vapours.

Ⓒ NOTE 2 Ⓒ 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 Ⓒ For the purposes of this standard, the term "indicating up to a volume fraction of X %" includes apparatus with an upper limit of the measuring range equal to or less than X %.

2 Normative references

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

Ⓒ EN 50270, *Electromagnetic compatibility – Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen*

EN 50271, *Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen – Requirements and tests for apparatus using software and/or digital technologies* Ⓒ

IEC 60079-0: *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*

IEC 60079-20: *Electrical apparatus for explosive gas atmospheres – Part 20: Data for flammable gases and vapours, relating to the use of electrical apparatus*

IEC 60079-29-2, *Explosive atmospheres – Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen*

Ⓒ Text deleted Ⓒ

3 Terms and definitions

For the purposes of this document, the terms and definitions given in Ⓒ EN 60079-0 Ⓒ and the following apply.

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

3.1 Gas properties

3.1.1

ambient air

normal atmosphere surrounding the apparatus

3.1.2

clean air

air that is free of flammable gases and interfering or contaminating substances

3.1.3

explosive gas atmosphere

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

NOTE 1 This definition specifically excludes dusts and fibres in suspension in air. Mists are not covered by this standard.

NOTE 2 Although a mixture that has a concentration above the upper flammable limit (see 3.1.9) is not an explosive atmosphere, in certain cases for area classification purposes, it is advisable to consider it as an explosive gas atmosphere.

NOTE 3 Normal atmospheric conditions include variations above and below the reference levels of 101,3 kPa and 20 °C provided the variations have a negligible effect on the explosive properties of the flammable materials.

3.1.4

firedamp

flammable gas, consisting mainly of methane, found naturally in mines

3.1.5

flammable gas

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

NOTE For the purposes of this standard, the term "flammable gas" includes flammable vapours.

3.1.6

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)

NOTE This is also known as lower explosive limit (LEL).

3.1.7

poisons (for sensors)

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

3.1.8

potentially explosive atmosphere

atmosphere that could become explosive (the danger is a potential one)

NOTE This would include an atmosphere with gas concentration currently above UFL, where dilution with air would render it explosive.

3.1.9

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)

NOTE This is also known as upper explosive limit (UEL).

3.1.10

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 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.

3.1.11

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 apparatus zero

3.2 Types of instruments

3.2.1

alarm-only apparatus

apparatus having an alarm but not having a meter or other indicating device

3.2.2

aspirated apparatus

apparatus 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 apparatus

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

3.2.4

diffusion apparatus

apparatus 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

fixed apparatus

apparatus that is intended to have all parts permanently installed

3.2.6

group I apparatus

apparatus for mines susceptible to firedamp

3.2.7

group II apparatus

apparatus for places with a potentially explosive atmosphere, other than mines susceptible to firedamp

3.2.8

portable apparatus

spot-reading or continuous duty apparatus that has been designed to be readily carried from place to place and to be used while it is being carried. A portable apparatus is battery powered and includes, but is not limited to

- a) a hand-held apparatus, 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 apparatus, that are continuously operating (but not necessarily continuously sensing) while they are attached to the user, and

- c) larger apparatus 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.

3.2.9

spot-reading apparatus

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

3.2.10

transportable apparatus

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

3.2.11

stand-alone gas detection apparatus

fixed gas detection apparatus that provide a conditioned electronic signal or output indication to a generally accepted industry standard (such as 4-20 mA or 3-15 psi), intended to be utilized with stand-alone 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 apparatus

3.2.12

stand-alone control unit

fixed gas detection control units intended to provide meter indication, alarm functions, output contacts and/or alarm signal outputs when utilized with stand-alone gas detection apparatus

3.3 Sensors

3.3.1

remote sensor

sensor that is not integral to the main body of the apparatus

3.3.2

sensor

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

3.4 Supply of gas to instrument

3.4.1

sample line

a means by which the gas being sampled is conveyed to the sensor including accessories, e.g. filter, water trap

3.4.2

sampling probe

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

3.5 Signals and alarms

3.5.1

alarm set point

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

3.5.2

fault signal

audible, visible or other type of output, different from the alarm signal, permitting, directly or indirectly, a warning or indication that the apparatus is not working satisfactorily

3.5.3

latching alarm

alarm that, once activated, requires deliberate action to be deactivated

3.5.4

special state

all states of the apparatus other than those in which monitoring of gas concentration takes place, for example warm-up, calibration mode or fault condition

3.6 Times

3.6.1

drift

variation in the apparatus indication with time at any fixed gas volume fraction (including clean air) under constant ambient conditions

3.6.2

final indication

indication given by the apparatus after stabilisation

3.6.3

minimum time of operation (spot-reading apparatus)

time interval between the initiation of a measurement procedure and the time when the apparatus indication reaches a stated percentage of the final indication

3.6.4

stabilisation

state when three successive readings of an apparatus, taken at 2 min intervals, indicates no changes greater than ± 1 % of the measuring range

3.6.5

time of response $t(x)$ (not applicable to spot-reading apparatus)

time interval, with the apparatus 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 apparatus inlet, and the time when the response reaches a stated percentage (x) of the stabilised signal on the standard test gas

3.6.6

warm-up time (not applicable to spot-reading apparatus)

time interval, with the apparatus in a stated atmosphere, between the time when the apparatus is switched on and the time when the indication reaches and remains within the stated tolerances (see Figures 1 and 2)

3.7 Miscellaneous

3.7.1

nominal supply voltage

voltage that is given by manufacturers as the recommended operating voltage of their gas detection apparatus

3.7.2

special tool

tool required to gain access to, or to adjust, controls. The design of the tool is intended to discourage unauthorised interference with the apparatus

3.7.3

type of protection

measures applied in the construction of electrical equipment to prevent ignition of the surrounding explosive atmosphere by such apparatus (see 4.1.2)

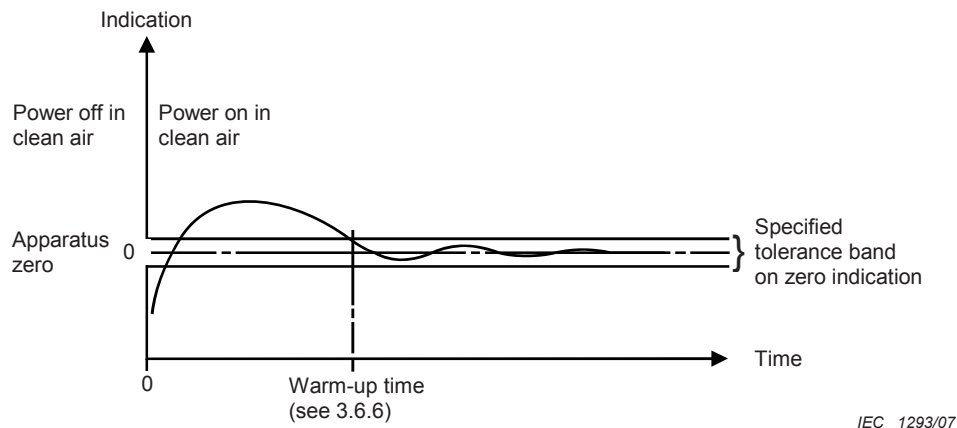


Figure 1 – Warm-up time in clean air (typical)

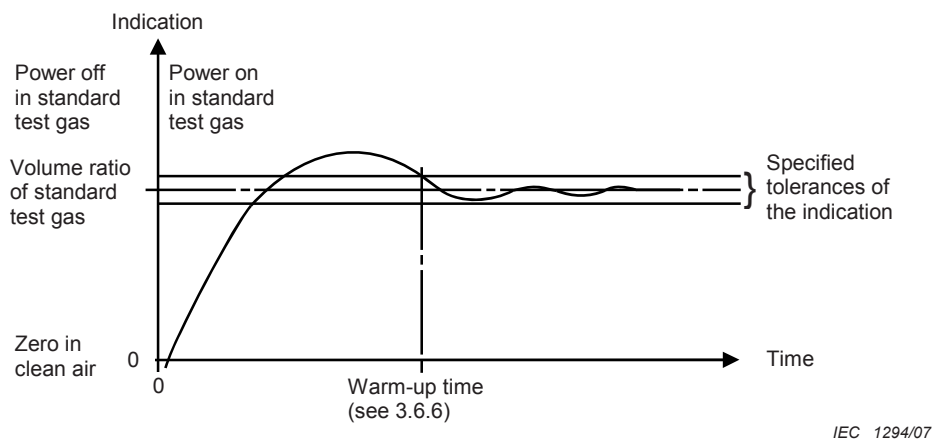


Figure 2 – Warm-up time in standard test gas (typical)

4 General requirements

4.1 Introduction

4.1.1 The apparatus shall comply with the requirements of this standard and Annex A criteria.

Where an apparatus manufacturer makes any claims regarding any special features of construction or superior performance that exceed these minimum requirements, all such claims shall be verified and the test procedures shall be extended or supplemented, where necessary, to verify the claimed performance.

4.1.2 Electrical assemblies and components shall comply with the construction and test requirements of 4.2 and Clause 5, where applicable. In addition, parts of the flammable gas detection apparatus intended for use in hazardous areas shall employ materials, and comply with the construction and explosion protection as specified [C] in the appropriate regulations for explosion protection. [C]

The operation and storage temperature limits of this standard could exceed the required temperature limits [C] of the appropriate regulations for explosion protection [C] for certain types of equipment. Therefore, the certification of the protection technique(s) used for the apparatus shall cover this extended temperature range. Conversely, where the certification is required outside the normal temperature limits appropriate to the protection technique(s) used, the test temperature exceeding the required ranges within this standard shall be changed appropriately.

4.1.3 [C] Void [C]

4.2 Construction

4.2.1 General

Gas detection apparatus or parts thereof (e.g. remote sensors) specifically intended for use in the presence of corrosive vapours or gases, or which may produce corrosive by-products as a result of the detection process (e.g. catalytic oxidation or other chemical process) shall be constructed of materials known to be resistant to corrosion by such substances.

All apparatus shall be constructed to facilitate regular accuracy checks.

All materials and components used in the construction of the apparatus shall be used within the manufacturer's ratings or limitations, unless otherwise specified by appropriate safety standards.

NOTE Apparatus using absorption principles where the gas is sampled by diffusion would typically be expected to have an optical chamber length of up to 30 cm. However, for special applications a longer fixed optical chamber length may be employed for point detection purposes.

4.2.2 Indicating devices

4.2.2.1 General

An indication shall be provided to show that the apparatus is energized.

NOTE For fixed apparatus the indication may be shown at the control unit.

4.2.2.2 Resolution

For alarm-only apparatus or apparatus where the resolution of the read-out device is inadequate to demonstrate compliance with this standard, the manufacturer shall identify suitable points for connecting indicating or recording devices for the purpose of testing the compliance of the apparatus with this standard. The indication on the readout device shall not contradict the results obtained by additional indicating or recording devices.