

Specification for open path apparatus for the detection of combustible or toxic gases and vapours —

Part 1: General requirements and test methods

The European Standard EN 50241-1:1999, with the incorporation of amendment A1:2004 has the status of a British Standard

ICS 13.320; 19.080

National foreword

This British Standard is the official English language version of EN 50241-1:1999, including amendment A1:2004.

The UK participation in its preparation was entrusted by Technical Committee GEL/31, Electrical apparatus for use in explosive atmospheres, to Subcommittee GEL/31/19, Gas detectors, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

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Summary of pages

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Specification for open path apparatus for the detection of combustible or toxic gases and vapours — Part 1: General requirements and test methods

(includes amendment A1:2004)

Spécifications pour les détecteurs à chemin optique ouvert de gaz et vapeurs toxiques --
Partie 1: Règles générales et méthodes d'essai
(inclut l'amendement A1:2004)

Anforderungen an Geräte mit offener Meßstrecke für die Detektion brennbarer oder toxischer Gase und Dämpfe --
Teil 1: Allgemeine Anforderungen und Prüfverfahren
(enthält Änderung A1:2004)

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CENELEC

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

This European Standard was 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.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50241-1 on 1998-10-01.

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) 1999-10-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1999-10-01

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

Foreword to amendment A1

This amendment to the European Standard EN 50241-1:1999 was 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.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A1 to EN 50241-1:1999 on 2004-02-01.

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Contents

	Page
Foreword	2
1 Scope	3
2 Normative references	3
3 Definitions	4
4 General requirements	7
4.1 Introduction	7
4.2 Construction	7
5 Test requirements	8
5.1 Introduction	8
5.2 General requirements for tests	8
5.3 Normal conditions for test	11
5.4 Test methods	13
6 Field verification equipment	18
7 Information for use	18
7.1 Labelling and marking	18
7.2 Instruction manual	18
Annex A (informative) Atmospheric visibility	20
Annex B (informative) Bibliography	20

1 Scope

This European Standard specifies general requirements for the construction and testing of apparatus for the detection and measuring of combustible or toxic¹⁾ gases or vapours in ambient air by measuring the spectral absorption by the gases or vapours over extended optical paths, ranging typically from one metre to a few kilometres.

Such apparatus measures the integral concentration of the absorbing gas over the optical path in units such as LEL metre for combustible gases and ppm metre for toxic gases.

NOTE 1 Actual values of concentration can only be deduced where it can be established that the concentration is uniform over the optical path, as for example in very short optical paths (<100 mm). In such cases, the apparatus is within the scope of EN 50054 to EN 50058 and prEN 45544-1 to prEN 45544-4.

Apparatus falling within the scope of this European Standard is classified as follows by the following types.

Type 1: an optical transmitter and receiver, located at either end of a path through the atmosphere to be monitored.

Type 2: an optical transceiver (i.e. combined transmitter and receiver) and a suitable reflector, which may be a topographic feature or a retroreflector, located at either end of a path through the atmosphere to be monitored.

This European Standard does not apply to any of the following:

- a) apparatus intended to provide range resolution of gas concentration (e.g. LIDAR);
- b) apparatus consisting of a passive optical receiver without a dedicated optical source;
- c) apparatus intended to measure the local volumetric concentration of gas (point sensors);
- d) apparatus intended for the detection of dusts or mists in air;
- e) apparatus for cross stack monitoring;
- f) apparatus intended for the detection of explosives and vapours; and
- g) apparatus intended for quantitative and simultaneous multicomponent analysis, e.g. FTIR.

This European Standard covering general requirements and test methods is supplemented by the following European Standard concerning specific requirements of performance:

EN 50241-2, *Performance requirements for apparatus for the detection of combustible gases*.

This European Standard is applicable to apparatus which is intended for use in both hazardous and non-hazardous areas. Apparatus for use in hazardous areas which may contain potentially combustible atmospheres is required to be designed for safe operation, see 4.1.2.

This European Standard applies to transportable and fixed apparatus intended for commercial and industrial applications.

NOTE 2 This European Standard and EN 50241-2 as referenced above are intended to provide for the supply of apparatus giving a level of performance suitable for general purpose applications. However, for specific applications a prospective purchaser or an appropriate authority may additionally require apparatus to be submitted to particular tests or approval. Such tests or approval are to be regarded as additional to and separate from the provisions of the European Standards referred to above.

2 Normative references

This European Standard incorporates by dated or undated references, provisions from other publications. These normative references are cited at the appropriate place in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 50270:1999, *Electromagnetic compatibility: electrical apparatus for the detection and measurement*.

EN 60068-2-6:1995, *Environmental testing — Part 2-6: Test Fc and guidance: Vibration (sinusoidal)*.

EN 60825-1:1994, *Safety of laser products — Part 1: Equipment classification, requirements and user's guide*.

¹⁾ The word "toxic" is used in accordance with its dictionary definition and includes "harmful", "toxic" and "very toxic" meanings.

3 Definitions

The following definitions are applicable for all parts of this European Standard.

3.1 Apparatus

3.1.1

alarm only apparatus

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

3.1.2

fixed apparatus

an apparatus which is intended to have all its parts permanently installed

3.1.3

transportable apparatus

apparatus which is not intended to be portable, but which can be moved from one place to another and used after alignment

3.2 Alarms

3.2.1

alarm set point

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

3.2.2

alarm signal

an audible, visual, electronic or other signal generated by the apparatus when an integral concentration of gas in excess of a pre-set value is detected

3.2.3

latching alarm

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

3.3 Signals and indications

3.3.1

fault signal

an audible, visual, or other type of output which provides, directly or indirectly, a warning or indication that the apparatus is defective

3.3.2

beam blocked signal

an 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 apparatus to function normally

3.3.3

inhibition signal

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

3.3.4

indicating devices

means for displaying values or states in analogue or digital form

3.4 Gaseous atmospheres

3.4.1

ambient air

the atmosphere in the area being monitored by the apparatus

3.4.2

clean air

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

3.4.3

combustible atmosphere

a mixture with air, under normal atmospheric conditions, of combustible materials in the form of gas, vapour or mist, in which, after ignition, combustion spreads throughout the unconsumed mixture

NOTE 1 This definition specifically excludes dusts and fibres in suspension in air. Mists, though included in the definition are not covered by this European Standard.

NOTE 2 Although a mixture which has a concentration above the upper explosive limit is not a combustible atmosphere, there is a risk of creating a combustible atmosphere by dilution.

NOTE 3 Normal atmospheric conditions include variations above and below reference levels of 101,3 kPa (1 013 mbar) and 20 °C provided the variations have negligible effect on the explosion properties of the combustible materials.

NOTE 4 For the purposes of this European Standard “explosive”, “combustible” and “flammable” are regarded as synonymous.

3.4.4

combustible gas

a gas, which, when mixed with air in certain volumetric ratios, forms a combustible atmosphere

3.4.5

integral concentration

the mathematical integral of the gas concentration along the optical path. It is expressed in units of concentration multiplied by distance, e.g. LEL metre for combustible gases or ppm metre for toxic gases

NOTE 100 % LEL × 1 metre = 1 LEL metre;

10 % LEL × 10 metre = 1 LEL metre.

3.4.6

upper explosive limit (UEL)

the volume ratio of combustible gas or vapour in air below which a combustible gas atmosphere will not be formed

3.4.7

explosion protection

the measures applied in the construction of electrical apparatus to prevent ignition of a surrounding combustible atmosphere by the apparatus

3.4.8

toxic gas

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

3.5 Optical apparatus

3.5.1

open path

an 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

3.5.2

optical axis

the median line of the optical path

3.5.3

optical path

the path traversed by optical radiation from an optical transmitter to an optical receiver. The radiation may traverse the path once, twice or many times depending on the form taken by the instrument

3.5.4

optical radiation

the ultra-violet, visible or infra-red regions of the electromagnetic spectrum

3.5.5

albedo

the proportion of incident light scattered back from a surface

3.5.6

transmitter

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

3.5.7

transceiver

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

3.5.8

receiver

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

3.5.9

retroreflector

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

3.5.10

gas cell

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

3.6 Performance characteristics

3.6.1

drift

variation with time of the indication produced by the apparatus under normal conditions when monitoring a fixed distribution of gas concentration in the optical path

3.6.2

time of response t_x (not applicable to spot reading apparatus)

the time interval, with the apparatus stabilized, between the time when an instantaneous variation in the integral concentration is produced in the optical path and the time when the indication reaches a stated percentage (x) of its final value

3.7 Atmospheric optics (see Annex A)

3.7.1

transmittance

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

3.7.2

meteorological optical range (MOR)

the 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 0,05 of its original value