



SLOVENSKI STANDARD
SIST EN 50054:2000

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**Electrical apparatus for the detection and measurement of combustible gases -
General requirements and test methods**

Electrical apparatus for the detection and measurement of combustible gases - General requirements and test methods

Elektrische Geräte für die Detektion und die Messung brennbarer Gase - Allgemeine Anforderungen und Prüfmethoden

Appareils électriques de détection et de mesure des gaz combustibles - Règles générales et méthodes d'essais

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EUROPEAN STANDARD

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English version

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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

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

Foreword

This second edition of the 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, on the basis of EN 50054:1991, its amendment A1:1995 and a second amendment.

This second amendment was approved by CENELEC on 1996-12-09 for incorporation into a new edition of EN 50054.

This European Standard replaces EN 50054:1991 + A1:1995.

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- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1999-01-01

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.

Annexes designated "informative" are given for information only.

In this standard, annexes A, B and C are informative.

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Contents

1 Scope	5
2 Normative references	5
3 Definitions	6
4 General requirements	8
4.1 Introduction	8
4.2 Construction	8
4.2.1 General	8
4.2.2 Indicating devices	9
4.2.3 Alarm or output functions	9
4.2.4 Fault signals	10
4.2.5 Adjustments	10
4.2.6 Battery-powered apparatus	10
5 Test requirements	10
5.1 Introduction	10
5.2 General requirements for tests	10
5.2.1 Samples and sequence of tests	10
5.2.2 Preparation of apparatus before testing	11
5.2.3 Mask for calibrations and tests	12
5.3 Normal conditions for test	12
5.3.1 General	12
5.3.2 Test gases	12
5.3.3 Standard test gas	12
5.3.4 Flow rate for test gases	13
5.3.5 Voltage	13
5.3.6 Ambient temperature	13
5.3.7 Pressure	13
5.3.8 Humidity	13
5.3.9 Stabilization time	13
5.3.10 Orientation	13
5.4 Test methods	14
5.4.1 General	14
5.4.2 Unpowered storage	14
5.4.3 Calibration and adjustment	14
5.4.4 Drift (continuous duty apparatus)	14
5.4.5 Drift (spot reading apparatus)	15
5.4.6 Alarm set point(s)	15
5.4.7 Temperature	15
5.4.8 Pressure	16
5.4.9 Humidity	16
5.4.10 Air speed	16
5.4.11 Pumping rate	16
5.4.12 Orientation	16
5.4.13 Vibration (applicable to Group I machine-mounted apparatus and to Group II fixed and transportable apparatus)	17
5.4.14 Drop test (applicable to portable apparatus and remote sensors)	17
5.4.15 Warm-up time (not applicable to spot-reading apparatus)	17
5.4.16 Time of response (not applicable to spot-reading apparatus)	17
5.4.17 Minimum time of operation (spot-reading apparatus)	18
5.4.18 High gas concentrations above the measuring range (Applicable only to apparatus indicating up to 5 % (v/v) methane or 100 % LEL)	18
5.4.19 Battery capacity	18
5.4.20 Power supply variations	19

5.4.21 Power supply interruptions, voltage transients and step changes of voltage.....	19
5.4.22 Addition of sampling probe.....	19
5.4.23 Dust (applicable to Group I apparatus only).....	20
5.4.24 Poisons and other gases.....	20
5.4.25 Electromagnetic immunity.....	20
6 Field calibration kit.....	21
7 Information for use.....	21
7.1 Labelling and marking.....	21
7.1.1 General.....	21
7.1.2 Identification of the calibration gas for Group II apparatus (see also 7.2 r).....	21
7.2 Instruction manual (see also 7.2 r).....	22

Annexes

A (informative) Flammability limits (i.e. LEL and UEL) of some flammable gases and vapours.....	26
B (informative) Determination of time of response.....	30
B.1 Aspirated apparatus (see also figure B.1).....	30
B.2 Apparatus that samples by diffusion.....	30
C (informative) Bibliography.....	37

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Figures

1 Warm-up time in clean air.....	24
2 Warm-up time in standard test gas.....	25
B.1 Schematic example of equipment for use with aspirated apparatus (see also B.1).....	32
B.2 Schematic example of equipment during application of clean air or test gas (see also B.2.2).....	33
B.3 Schematic example of equipment showing change-over from clean air to test gas to begin the time of response measurement (see also B.2.2).....	34
B.4 Schematic example of applicator and sensor inlet during application of test gas or clean air (see also B.2.2).....	35
B.5 An example of an automated test chamber (see also B.2.3.1).....	36

1 Scope

1.1 This European Standard specifies general requirements for construction and testing and describes the test methods that apply to portable, transportable and fixed apparatus for the detection and measurement of combustible gas or vapour concentrations with air. The apparatus, or parts thereof, is intended for use in potentially explosive atmospheres (see 3.1) and in mines susceptible to firedamp.

This European standard is supplemented by the following European Standards, concerning the specific requirements for performance of the various types of apparatus:

EN 50055	Performance requirements for Group I apparatus indicating up to 5 % (v/v) methane in air
EN 50056	Performance requirements for Group I apparatus indicating up to 100 % (v/v) methane
EN 50057	Performance requirements for Group II apparatus indicating up to 100 % lower explosive limit
EN 50058	Performance requirements for Group II apparatus indicating up to 100 % (v/v) gas

NOTE 1: Group I apparatus indicating up to 100 % (v/v) methane and Group II apparatus indicating up to 100 % (v/v) gas are suitable for use only with the specific gases for which they have been calibrated.

NOTE 2: For the purposes of this European Standard the term 'combustible gas' includes combustible vapours but excludes mist and dust, see 3.3 note 1.

1.2 This European Standard is applicable to combustible gas detection apparatus intended to provide an indication) alarm and/or other output function, the purpose of which is to give a warning of potential explosion hazard and in some cases to initiate automatic or manual protective actions.

1.3 This European Standard is applicable to apparatus, including the integral sampling systems of aspirated apparatus intended to be used for commercial and industrial safety applications.

1.4 This European Standard does not apply to external sampling systems, or to apparatus of the laboratory or scientific types, or to apparatus used only for process control purposes.

2 Normative references

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

EN 50055	1998	Electrical apparatus for the detection and measurement of combustible gases - Performance requirements for Group I apparatus indicating up to 5 % (v/v) methane in air
EN 50056	1998	Electrical apparatus for the detection and measurement of combustible gases - Performance requirements for Group I apparatus indicating up to 100 % (v/v) methane in air
EN 50057	1998	Electrical apparatus for the detection and measurement of combustible gases - Performance requirements for Group II apparatus indicating up to 100 % lower explosive limit
EN 50058	1998	Electrical apparatus for the detection and measurement of combustible gases - Performance requirements for Group II apparatus indicating up to 100 % (v/v) gas

EN 60068-2-6	1995	Environmental testing – Part 2: Tests - Test Fc: Vibration (sinusoidal) (IEC 60068-2-6:1995 + corrigendum Mar. 1995)
EN 61000-4-3	1996	Electromagnetic compatibility (EMC) -- Part 4: Testing and measurement techniques -- Section 3: Radiated, radio frequency, electromagnetic field immunity test (IEC 61000-4-3:1995, modified)
EN 61000-4-4	1995	Electromagnetic compatibility (EMC) -- Part 4: Testing and measurement techniques -- Section 4 : Electrical fast transient/burst immunity test (IEC 61000-4-4:1995)
HD 481.1 S1		Electromagnetic compatibility for industrial-process measurement and control equipment -- Part 1: General introduction (IEC 60801-1:1984)
ISO 6142	1981	Gas analysis - Preparation of calibration gas mixtures - Weighing methods.
ISO 6145	1986	Gas analysis - Preparation of calibration gas mixtures - Dynamic volumetric methods (Parts 1, 3, 4 and 6).
ISO 6147	1979	Gas analysis - Preparation of calibration gas mixtures - Saturation method

3 Definitions

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The following definitions are applicable in this European Standard and in the European Standards listed in 1.1.

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3.1 potentially explosive atmosphere: An atmosphere which could become explosive (the danger is a potential one).

3.2 firedamp: A flammable gas, consisting mainly of methane, found naturally in mines.

3.3 explosive gas atmosphere: A mixture with air, under normal atmospheric conditions, of flammable 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 fibers 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 (see 3.5) 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 reference levels of 101,3 kPa (1013 mbar) and 20 °C provided the variations have negligible effect on the explosion properties of the flammable materials.

3.4 lower explosive limit (LEL): The volume ratio of flammable gas or vapour in air below which an explosive gas atmosphere will not be formed. (See annex A).

3.5 upper explosive limit (UEL): The volume ratio of flammable gas or vapour in air above which an explosive gas atmosphere will not be formed (see also note 2 to 3.3). (See annex A).

3.6 type of protection: The measures applied in the construction of electrical apparatus to prevent ignition of the surrounding explosive atmosphere by such apparatus (see 3.1.2).

3.7 Group I apparatus: Electrical apparatus for mines susceptible to firedamp.

3.8 Group II apparatus: Electrical apparatus for places with a potentially explosive atmosphere, other than mines susceptible to firedamp.

- 3.9 fixed apparatus:** An apparatus which is intended to have all parts permanently installed.
- 3.10 transportable apparatus:** An apparatus not intended to be portable, but which can readily be moved from one place to another.
- 3.11 portable apparatus:** Spot reading or continuously sensing apparatus that has been designed to be readily carried from place to place and to be used whilst being carried. Portable apparatus is battery powered and includes, but is not limited to:
- hand-held apparatus, typically less than 1 kg, suitable for single-handed operation;
 - personal monitors, similar in size and mass to the hand held apparatus, that are continuously operating (but not necessarily continuously sensing) whilst attached to the user; and
 - larger apparatus up to 5 kg that can be operated by the user whilst suspended by hand, by a shoulder strap or by a carrying harness; it may or may not have a hand directed probe.
- 3.12 continuous duty apparatus:** Combustible gas detecting apparatus which are continuously powered but may have continuous or intermittent sensing.
- 3.13 spot reading apparatus:** An apparatus intended to be used for short periods of time as required.
- 3.14 alarm-only apparatus:** Apparatus having an alarm but not having a meter or other indicating device that would allow measurement of the deviations permitted by the requirements of the appropriate European Standards listed in 1.1.
- 3.15 sensor:** An assembly in which the sensing element is housed and which may contain associated circuit components.
- 3.16 remote sensor:** A sensor which is not integral with the main body of the apparatus.
- 3.17 diffusion apparatus:** An apparatus in which the transfer of gas from the atmosphere to the gas sensor takes place by diffusion, i.e. there is no aspirated flow.
- 3.18 aspirated apparatus:** Combustible gas detecting apparatus which obtain the gas by drawing it to the gas sensor, for example by means of a hand operated or electric pump.
- 3.19 sample line:** The pipeline by means of which the gas being sampled is conveyed to the sensor.
- 3.20 sampling probe:** A separate sample line that may or may not be supplied with the apparatus, which is attached to the apparatus as required. It is usually short (e.g. of the order 1 m) and rigid (e.g. it may be telescopic), but may be connected by a flexible tube to the apparatus.
- 3.21 special tool:** A tool required to gain access to, or to adjust, controls. The design of the tool is intended to discourage unauthorized interference with the apparatus.
- 3.22 fault signal:** An 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.
- 3.23 latching alarm:** An alarm which, once activated, requires deliberate action to deactivate it.
- 3.24 ambient air:** The normal atmosphere surrounding the apparatus.
- 3.25 clean air:** Air which is free of combustible gases, and interfering and contaminating substances.
- 3.26 alarm set point:** A 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.

3.27 stabilized apparatus: An apparatus shall be considered to be stabilized when three successive indications taken at 5 min intervals indicate no changes greater than $\pm 1\%$ of the measuring range.

3.28 final indication: The indication given by the apparatus when stabilized.

3.29 warm-up time (not applicable to spot-reading apparatus): The 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).

3.30 time of response t_x (not applicable to spot-reading apparatus): The time interval, with the apparatus in a warmed-up conditions between the time when an instantaneous variation in volume ratio is produced at the apparatus inlet and the time when the response reaches a stated percentage (x) of the final indication.

3.31 minimum time of operation. (Spot reading apparatus): The time interval between the initiation of a measurement procedure and the time when the apparatus indication reaches a stated percentage of the final indication.

3.32 drift: The variation in apparatus indication with time at any gas level (including clean air).

3.33 response error: The difference between the arithmetical average of n consecutive measurements with a reference gas, carried out in the reference conditions, and the actual value of its concentration.

3.34 volume ratio (v/v): Ratio of the volume of a component to the volume of the gas mixture under specified conditions of temperature and pressure.

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4 General requirements <https://standards.iteh.ai/catalog/standards/sist/d39840de-99da-4d52-88a9-db778455b2b9/sist-en-50054-2000>

4.1 Introduction

4.1.1 Apparatus shall comply with the requirements of this European Standard, together with the supplementary requirements given in the appropriate European Standards listed in 1.1.

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, combustible gas detection apparatus shall comply with the appropriate regulations for explosion protection.

4.1.3 In the design of software-controlled apparatus, special account shall be taken of the risks arising from faults in the programme.

4.2 Construction

4.2.1 General

Equipment and protective systems shall be so designed and manufactured as to avoid physical injury or other harm which might be caused by direct or indirect contact.

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 byproducts 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 so constructed as to facilitate regular accuracy checks.

The design of a combustible gas detection apparatus shall be such that all materials used in the construction and all components, including electrical and electronic components, employed in the apparatus shall be used within the manufacturers ratings, or limits specified by the material or component

manufacturer, unless otherwise specified by appropriate safety standards taking into account the limits of specified operating conditions.

Group I hand-held apparatus shall be so constructed as to permit single-handed operation and designed so that measurements can be taken at places of difficult access, e.g. by fitting of probes.

4.2.2 Indicating devices

4.2.2.1 An indication shall be provided to show that the apparatus is switched on.

4.2.2.2 When the apparatus is intended for the measurement of volume ratios of gas, the indicating or recording device shall permit measurement of the deviations permitted by the requirements of the European Standards listed in 1.1.

For Group I apparatus indicating up to 5 % (v/v) methane, the width of the needle on the meter shall be less than half of the scale division representing 0.1% (v/v) methane. The graduations on the scale shall be equivalent to not more than 0.1 % (v/v) methane between 0 % (v/v) and 2 % (v/v) methane, and not more than 0,25 % (v/v) methane, between 2 % (v/v) and 5% (v/v) methane. If digital displays are used, it shall be possible to distinguish intervals of 0,05% (v/v) methane.

4.2.2.3 For alarm-only apparatus the manufacturer shall identify suitable points for connecting, indicating or recording devices for the purpose of testing the compliance of the apparatus with this European Standard.

4.2.2.4 If the apparatus has more than one measuring range, the range selected shall be clearly identified.

4.2.2.5 If individual coloured indicating lights are fitted, they shall be coloured as follows:

- a) Alarms indicating the presence of gas at potentially dangerous levels shall be coloured RED.
- b) Equipment fault indicators shall be coloured YELLOW.
- c) Power supply indicators shall be coloured GREEN.

4.2.2.6 In addition to the colour requirements, the indicator lights shall be adequately labelled to show their functions.

4.2.3 Alarm or output functions

4.2.3.1 Continuous duty apparatus

Where alarm devices, output contacts, or signal outputs intended to indicate a combustible gas volume ratio are fitted, they should be of a latching type requiring a deliberate manual action to reset but if a non-latching type is used, this shall be indicated clearly and prominently in the instruction manual (see 7.2 I)).

4.2.3.2 Group II portable apparatus indicating up to 100 % LEL

Alarm devices provided as part of portable gas detection apparatus shall be set to operate at a gas volume ratio not higher than 60 % LEL.

NOTE 1: For other Group II apparatus it is recommended that alarm devices should be set to operate at a gas volume ratio not higher than 60 % LEL.

NOTE 2: In addition, it is also permissible to fit Group II apparatus with an alarm designed to indicate when full scale has been exceeded and which is therefore set to operate at 100% LEL.

4.2.4 Fault signals

Fixed and transportable apparatus shall provide a fault signal in the event of failure of power to the apparatus, loss of continuity or short circuit (i.e. loop failure) in one or more of the wires to any remote sensor, or loss of electrical continuity of any gas sensing system.

Automatically aspirated apparatus shall be provided with an integral flow proving device which produces a fault signal in the event of flow failure (see 7.2 i)).

4.2.5 Adjustments

All adjustment devices and all tools intended for adjustment of, or access to, such adjustment devices shall be designed so as to discourage unauthorized interference with the apparatus.

Fixed apparatus housed in explosion protected enclosures shall be designed so that if any facilities for adjustment are necessary for routine recalibration and for resetting or like functions they shall be externally accessible. The means for making adjustments shall not degrade the explosion protection of the enclosure.

The adjustments of the zero point and of the amplification shall not affect each other.

4.2.6 Battery-powered apparatus

Apparatus powered with integral batteries shall be provided with an indication of low battery condition and the nature and purpose of this indication shall be clearly explained in the manual (see 7.2 j)). All battery powered apparatus shall be so constructed that, testing according to 5.4.19, it shall comply with the requirements of the appropriate European Standards listed in 1.1.

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5 Test requirements

5.1 Introduction

The test methods and procedures described in 5.2 to 5.4 are intended as a basis for establishing whether the apparatus conforms with the supplementary requirements for performance given in the appropriate European Standards listed in 1.1.

5.2 General requirements for tests

5.2.1 Samples and sequence of tests

5.2.1.1 For the purposes of type-testing, the tests shall be carried out on one apparatus.

5.2.1.2 The apparatus shall be subjected to all of the tests applicable to that type of apparatus) as described in 5.4 and in the following sequence. The order within each block of tests shall be at the discretion of the test house.

- 1) Unpowered storage (5.4.2)
- 2) Preparation and verification
 - calibration and adjustment (5.4.3)
 - alarm set point(s) (5.4.6)
 - pumping rate (5.4.11)
 - warm-up time (5.4.15)
 - time of response (5.4.16)
 - minimum time of operation (5.4.17)
 - addition of sampling probe (5.4.22)
 - field calibration kit (clause 6)