



SLOVENSKI STANDARD
SIST EN 50054:1997

01-junij-1997

**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 das Aufspüren 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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Ta slovenski standard je istoveten z: EN 50054:1991

ICS:

13.320	Alarmni in opozorilni sistemi	Alarm and warning systems
29.260.20	Električni aparati za eksplozivna ozračja	Electrical apparatus for explosive atmospheres

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EUROPEAN STANDARD

EN 50054

NORME EUROPEENNE

EUROPÄISCHE NORM

June 1991

UDC 614.838.14:621.317.7:614.833.4:620.1

Descriptors: Electrical apparatus, explosive atmosphere, detector, measuring apparatus, flammable gas, combustible gas, safety requirement, test method

ENGLISH VERSION

ELECTRICAL APPARATUS FOR THE DETECTION
MEASUREMENT OF COMBUSTIBLE GASES
GENERAL REQUIREMENTS AND TEST METHODS

Appareils électriques de détection
et de mesure des gaz combustibles
Règles générales et méthodes
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Elektrische Geräte für das
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This European Standard was approved by CENELEC on 1990-12-10. 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 list 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 European Standard has been prepared by the CENELEC Subcommittee SC 31-9, Gas detectors.

The text of the draft was approved by CENELEC as EN 50054 on 10 December 1990.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1991-12-01
- latest date of withdrawal of conflicting national standards (dow) 1991-12-01

For products which have complied with the relevant national standard before 1991-12-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1996-12-01.

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IEC PUBLICATIONS REFERRED TO IN EUROPEAN STANDARD EN 50 054

- IEC 79-10 (1986) Electrical apparatus for explosive atmospheres
Part 10. Classification of hazardous areas
- IEC 79-14 (1984) Electrical apparatus for explosive atmospheres
Part 14. Electrical installations in explosive gas
atmospheres (other than mines)
- IEC 801-4 (1988) Electromagnetic compatibility for industrial-process
measurement and control equipment
Part 4. Electrical fast transient/burst requirements.

ISO STANDARDS REFERRED TO IN EUROPEAN STANDARD EN 50 054

- ISO 2738 (1987) Permeable sintered metal materials - Determination of
density, oil content, and open porosity
- ISO 4003 (1977) Permeable sintered metal materials - Determination of
bubble test pore size
- ISO 4022 (1987) Permeable sintered metal materials - Determination of
fluid permeability
- ISO 6142 (1981) Gas analysis - Preparation of calibration gas
mixtures - Weighing methods
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- ISO 6145 (1986) <https://standards.iteh.ai/catalog/standards/sist/880994e6-c36d-4e6b-ab40-6c07702c6c99/sist-en-50054-1997>
Gas analysis - Preparation of calibration gas
mixtures - Dynamic volumetric methods
Parts 1, 3, 4 and 6.
- ISO 6146 (1979) Gas analysis - Preparation of calibration gas mixtures
- Manometric methods
- ISO 6147 (1979) Gas analysis - Preparation of calibration gas mixtures
- Saturation methods

EUROPEAN STANDARDS REFERRED TO IN EUROPEAN STANDARD EN 50 054

- EN 50 014 (1977) Electrical apparatus for potentially explosive
atmospheres. General requirements
Amendment No. 1 (July 1979)
Amendment No. 2 (June 1982)
Amendment No. 3 (December 1982)
Amendment No. 4 (December 1982)
Amendment No. 5 (February 1986)
- EN 50 015 (1977) Electrical apparatus for potentially explosive
atmospheres. Oil immersion 'o'
Amendment No. 1 (July 1979)
- EN 50 016 (1977) Electrical apparatus potentially explosive
atmospheres. Pressurized apparatus 'p'
Amendment No. 1 (July 1979)

- EN 50 017 (1977) Electrical apparatus for potentially explosive atmospheres. Powder filling 'q'
Amendment No. 1 (July 1979)
- EN 50 018 (1977) Electrical apparatus for potentially explosive atmospheres. Flameproof enclosure 'd'
Amendment No. 1 (July 1979)
Amendment No. 2 (December 1982)
Amendment No. 3 (November 1985)
- EN 50 019 (1977) Electrical apparatus for potentially explosive atmospheres. Increased safety 'e'
Amendment No. 1 (July 1979)
Amendment No. 2 (September 1983)
Amendment No. 3 (December 1985)
- EN 50 020 (1977) Electrical apparatus for potentially explosive atmospheres. Intrinsic safety 'i'
Amendment No. 1 (July 1979)
Amendment No. 2 (December 1985)
- EN 50 028 (1986) Electrical apparatus for potentially explosive atmospheres. Encapsulation 'm'.
- EN 50 039 (1980) Electrical apparatus for potentially explosive atmospheres. Intrinsically safe electrical systems 'i'
- EN 50 055 (1991) 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 50 056 (1991) Electrical apparatus for the detection and measurement of combustible gases. Performance requirements for Group I apparatus indicating up to 100 % (v/v) methane
- EN 50 057 (1991) Electrical apparatus for the detection and measurement of combustible gases. Performance requirements for Group II apparatus indicating up to 100 % lower explosive limit
- EN 50 058 (1991) Electrical apparatus for the detection and measurement of combustible gases. Performance requirements for Group II apparatus indicating up to 100 % (v/v) gas
- HD 323.2.6 S2 Basic environmental testing procedures
Part 2. Tests
Test Fc and guidance. Vibration (sinusoidal)
- HD 481.1 S1 Electromagnetic compatibility for industrial-process measurement and control equipment
Part 1. General introduction (IEC 801-1: 1984)
- HD 481.3 S1 Electromagnetic compatibility for industrial-process measurement and control equipment
Part 3. Radiated electromagnetic field requirements (IEC 801-3: 1984)

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 2.1) 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 50 055: Performance requirements for Group I apparatus indicating up to 5 % (v/v) methane in air
- EN 50 056: Performance requirements for Group I apparatus indicating up to 100 % (v/v) methane
- EN 50 057: Performance requirements for Group II apparatus indicating up to 100 % lower explosive limit
- EN 50 058: Performance requirements for Group II apparatus indicating up to 100 % (v/v) gas

NOTE 1. This European Standard, in association with those referred to above, is intended to provide for the supply of apparatus giving a basic or minimum level of safety and 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. For example, Group I apparatus (i.e. that to be used in mines susceptible to firedamp) is not permitted to be used without the additional and prior approval of the relevant Authority in mines under its jurisdiction. Such particular tests/approval are to be regarded as additional to and separate from the provisions of the European Standards referred to above and do not preclude certification to or compliance with these standards.

NOTE 2. 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 3. For the purposes of this European Standard the term 'combustible gas' includes combustible vapours.

NOTE 4. Attention is drawn to IEC Publication 79-10 which provides guidance on the classification of non-mining areas where flammable gas or vapour risks may arise. Group II electrical apparatus for use in such areas can be selected with IEC Publication 79-14.

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 Definitions

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

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

2.2 **firedamp.** A flammable gas, consisting mainly of methane, found naturally in mines.

2.3 **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 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 (see 2.5) 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.

2.4 **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).

2.5 **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 2.3). (See annex A).

2.6 **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).

2.7 **Group I apparatus.** Electrical apparatus for mines susceptible to firedamp.

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

2.9 **fixed apparatus.** An apparatus which is intended to have all parts permanently installed.

2.10 **transportable apparatus.** An apparatus not intended to be portable, but which can readily be moved from one place to another.

2.11 **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:

(a) hand-held apparatus, typically less than 1 kg, suitable for single-handed operation;

(b) 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

(c) 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.

2.12 **continuous duty apparatus.** Combustible gas detecting apparatus which are continuously powered but may have continuous or intermittent sensing.

2.13 **spot reading apparatus.** An apparatus intended to be used for short periods of time as required.

2.14 **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.

- 2.15 **sensor**. An assembly in which the sensing element is housed and which may contain associated circuit components.
- 2.16 **remote sensor**. A sensor which is not integral with the main body of the apparatus.
- 2.17 **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.
- 2.18 **aspirated apparatus**. Combustible gas detecting apparatus which obtains the gas by drawing it to the gas sensor, for example by means of a hand operated or electric pump.
- 2.19 **sample line**. The pipeline by means of which the gas being sampled is conveyed to the sensor.
- 2.20 **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.
- 2.21 **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.
- 2.22 **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.
- 2.23 **latching alarm**. An alarm which, once activated, requires deliberate action to deactivate it.
- 2.24 **ambient air**. The normal atmosphere surrounding the apparatus.
- 2.25 **clean air**. Air which is free of combustible gases, and interfering and contaminating substances.
- 2.26 **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.
- 2.27 **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.

2.28 **final indication.** The indication given by the apparatus when stabilized.

2.29 **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).

2.30 **time of response t_x (not applicable to spot-reading apparatus).** The time interval, with the apparatus in a warmed-up condition 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.

2.31 **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.

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

2.33 **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.

2.34 **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.

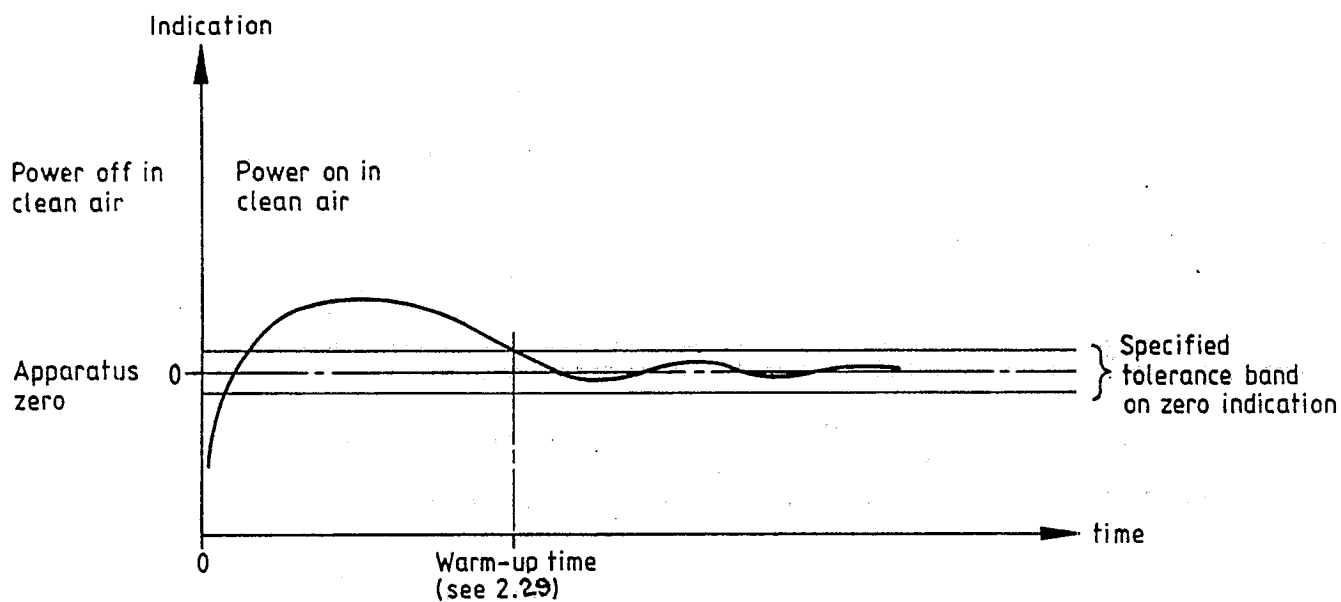


Figure 1. Warm-up time in clean air

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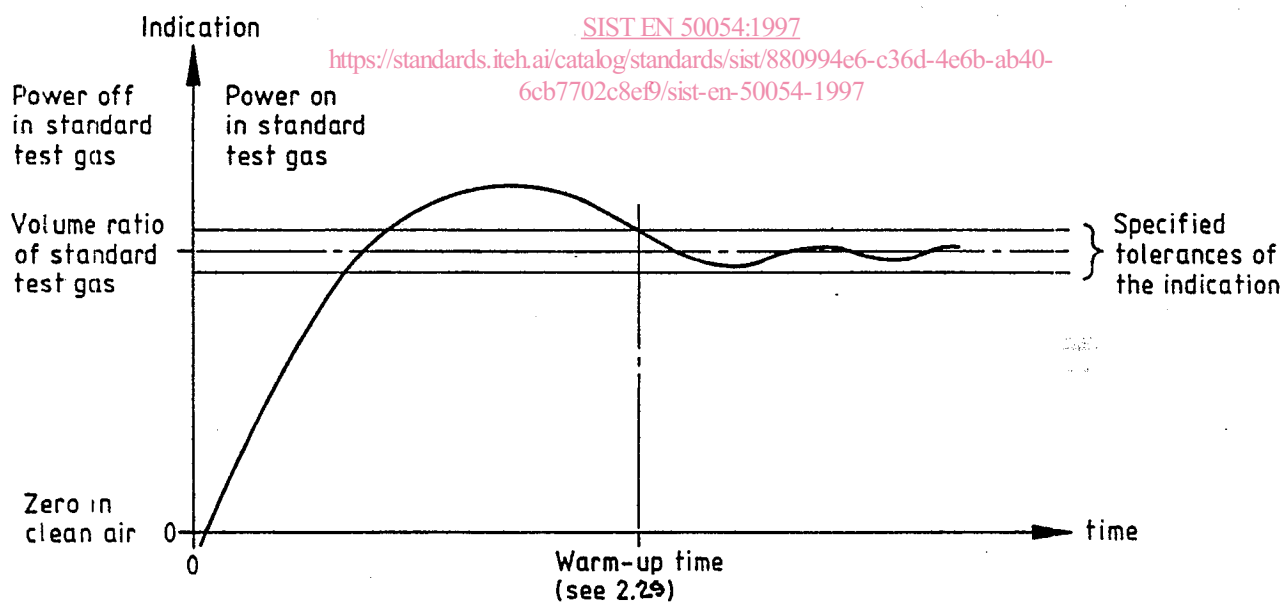


Figure 2. Warm-up time in standard test gas

3 General requirements

3.1 Introduction

3.1.1 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.

3.1.2 Electrical assemblies and components shall comply with the construction and test requirements of 3.2 and clause 4, where applicable. In addition all parts of the combustible gas detection apparatus shall employ materials and construction as specified in the appropriate European Standards listed in 1.1, and shall comply with EN 50 014 to EN 50 020, EN 50 028, EN 50 039 or any other type of protection covered by European standards (e.g. flame arresters shall be permitted in accordance with annexes C, D, E and F which have been taken from prEN 50018 (2nd edition)*).

3.1.3 For Group I apparatus any electrical circuits to be installed in the same area as the sensor, including those within the sensor, shall be intrinsically safe ('ia'); the sensing elements shall be intrinsically safe, or their enclosures shall comply with the safety requirements specified in the European Standards listed in 1.1.

3.2 Construction

3.2.1 *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 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.

* The requirements specified in the finally agreed text of EN 50018 will replace the requirements specified in annexes C, D, E and F.