SLOVENSKI STANDARD
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SIST EN 50104:2002
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Električne naprave za odkrivanje in merjenje kisika - Zahteve za delovanje in preskusne metode

Electrical apparatus for the detection and measurement of oxygen - Performance requirements and test methods

Elektrische Geräte für die Detektion und Messung von Sauerstoff - Anforderungen an das Betriebsverhalten und Prüfverfahren

Appareils électriques de détection et de mesure de l'oxygène - Règles de performance et méthodes d'essai

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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

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English version

Electrical apparatus for the detection and measurement of oxygen - Performance requirements and test methods

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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

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 potentially explosive atmospheres, on the basis of EN 50104:2002. It was submitted to the Unique Acceptance Procedure and approved by CENELEC as EN 50271 on 2010-06-01.

This document supersedes EN 50104:2002 + A1:2004.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

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)	2011-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2013-06-01

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.

The State of the Art is included in Annex ZY "*Significant changes between this European Standard and EN 50104:2002*".

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1 Scope

This European Standard specifies general requirements for construction, testing and performance, and describes the test methods that apply to portable, transportable and fixed apparatus for the measurement of the oxygen concentration in gas mixtures indicating up to 25 % (v/v). The apparatus, or parts thereof, may be intended for use in potentially explosive atmospheres (see 4.1) and in mines susceptible to firedamp.

In the case of inert gas purging (inertization), it applies also to apparatus with an oxygen measuring function for explosion protection.

NOTE Commonly used oxygen sensors in commercial equipment for industrial application are:
a) paramagnetic sensors;
b) electrochemical sensors (aqueous and solid electrolytes);
c) tunable diode laser absorption spectroscopy sensors (TDLAS).

This standard is also applicable when an apparatus manufacturer makes any claims regarding any special features of construction or superior performance that exceed the minimum requirements of this standard. All such claims shall be verified and the test procedures shall be extended or supplemented, where necessary, to verify the claimed performance. The additional tests shall be agreed between the manufacturer and test laboratory and identified and described in the test report.

This European Standard is applicable to oxygen alarm apparatus intended to measure reliably the oxygen concentration, to provide an indication, alarm or other output function, the purpose of which is to give a warning of a potential hazard and, in some cases, to initiate automatic or manual protective action(s), whenever the level exceeds or falls below a preselected alarm concentration.

This standard is applicable to apparatus, including 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 medical equipment, or to apparatus used only for process control purposes. For apparatus used for sensing the presence of multiple gases, this standard applies only to the measurement of oxygen.

This standard is also applicable to apparatus using optical principles (e.g. TDLAS), where the optical transmitter and receiver or the optical transceiver (i.e. combined transmitter and receiver) and a suitable reflector are not located in a common enclosure. However, in this case it will be necessary to modify the test conditions described in Clause 5 and to introduce supplementary tests to Clause 6 of this standard. Such supplementary tests will include alignment, beam block fault, long range operation. Guidance to appropriate modification of the test conditions and supplementary tests may be taken from EN 60079-29-4. Modifications of the test conditions as well as modified and supplementary tests shall be agreed between the manufacturer and test laboratory and identified and described in the test report.

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
EN 60079-0	Explosive atmospheres - Part 0: Equipment - General requirements (IEC 60079-0)
EN 60079-29-4	Explosive atmospheres - Part 29-4: Gas detectors - Performance requirements of open path detectors for flammable gases (IEC 60079-29-4)

3 Definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Gas properties

3.1.1
ambient air
normal atmosphere surrounding the apparatus

3.1.2
poisons (for sensors)
substances which lead to temporary or permanent loss of sensitivity of the sensors

3.1.3
reference air
air, under normal ambient conditions, with an oxygen concentration of (21 ± 0,4) % (v/v)

3.1.4
standard test gas
test gas with a composition specified for each apparatus to be used for all tests unless otherwise stated (see 5.3.2)

3.1.5
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.

3.1.6
zero test gas
gas, such as nitrogen, which is free of oxygen, and interfering and contaminating substances

3.2 Types of apparatus

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
automatically aspirated apparatus
aspirated apparatus with an integral pump

3.2.4
continuous duty apparatus
apparatus that is powered for long periods of time, but may have either continuous or intermittent sensing

3.2.5
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 not aspirated flow

3.2.6
fixed apparatus
apparatus that is intended to have all parts permanently installed

3.2.7
portable apparatus
apparatus that has been designed to be carried readily 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, suitable for one-handed operation without accessories (such as sampling probes, sample lines) fitted,

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) another 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

3.2.8
spot-reading apparatus
apparatus intended to be used for short, intermittent or irregular periods of time as required (typically 5 min or less)

3.2.9
transportable apparatus
apparatus not intended to be portable, but which can be readily moved from one place to another

3.2.10

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), 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

3.2.11
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
integral sensor
sensor which is integral to the main body of the apparatus

3.3.2
measuring principle
type of physical or physico-chemical detection principle and the measurement procedure to determine the measured value

3.3.3
remote sensor
sensor which is not integral to the main body of the apparatus

3.3.4
sensing element
part of the sensor which directly picks up the quantity to be measured and which is sensitive to that quantity

3.3.5
sensor
assembly in which the sensing element is housed and which may also contain associated circuit components

3.4 Supply of gas to apparatus

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 pre-set 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
repeatability
closeness of agreement between the results of successive measurements of the same value of the same quantity carried out by the same method, with the same measuring instruments, by the same observer, in the same laboratory at quite short intervals of time in unchanged conditions

3.6 Times

3.6.1
drift
variation in the apparatus indication with time, at any fixed gas volume fraction under constant ambient conditions

3.6.2
final indication
indication given by the apparatus after stabilisation

3.6.3
stabilisation
state when three successive readings of an apparatus, taken at 2 min intervals, indicate no changes greater than ± 1 % of the measuring range

3.6.4
time of response tx (not applicable to spot-reading apparatus)
time interval, with the apparatus in a warmed-up condition, between the time when an instantaneous variation in volume fraction is produced at the apparatus inlet and the time when the response reaches a stated percentage (x) of the difference between the initial and the final indication

3.6.5
minimum time to operate (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

3.6.6
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 Figure 1)

4 General requirements

4.1 Introduction

The apparatus shall comply with the requirements of this standard.

Electrical assemblies and components shall comply with the construction and test requirements of 4.2, where applicable. In addition, parts of the gas detection apparatus intended for use in potentially explosive atmospheres shall employ materials, and comply with the construction and explosion protection as specified in the appropriate regulations for explosion protection.

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 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 manufacture's ratings or limitations unless otherwise specified by appropriate safety standards.

4.2.2 Indicating devices

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

NOTE The indication may be shown at the control unit.

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 additional indicating or recording devices for the purpose of testing the compliance of the apparatus with this standard. The indication on the read-out device of the apparatus shall not contradict the results obtained by the additional indicating or recording devices.

Any under-range or over-range measurements shall be clearly indicated.

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

If only one indicating light is provided for signalling alarms, faults and other indications, it shall be coloured red. If separate indicating lights are used or if a multi-coloured indicating light is provided, the colours shall be used in the following order of priority ((a) being highest priority):

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.

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

4.2.3 Alarm or output functions

Alarm devices shall not be adjustable to operate outside the measuring range.

If alarm devices, output contacts or alarm signal outputs are provided as part of fixed or continuous duty portable apparatus and are intended to operate when a potentially hazardous gas concentration is detected, they shall be of a latching type requiring a deliberate manual action to reset. If two or more alarm set points having the same direction (activation at increasing or decreasing oxygen concentration, respectively) are provided, the first alarm may be non-latching - based on user preference.

NOTE 1 The latching device may reside in software.

Alarms shall remain in operation while the alarm condition is still present. An additional audible alarm may be silenced.

NOTE 2 This implies that it may not be possible to switch off the apparatus if an alarm condition is present.

If it is possible to de-activate alarm devices, output contacts or alarm signal outputs, e.g. for calibration purposes, this deactivation shall be indicated by a signal. For fixed apparatus, this shall include a contact or other transmittable output signal. Alternatively, the output signal or contacts are not required if the alarms are automatically re-enabled within 15 min.

4.2.4 Fault signal

Fixed and transportable apparatus shall provide a fault signal in the event of failure of power to the apparatus. A short circuit or open circuit in connections to any remote sensor shall be indicated by a fault signal.

Automatically aspirated apparatus shall be provided

a) in the case of fixed and transportable apparatus: with an integral flow-indicating device that produces a fault signal in the event of flow failure,

b) in the case of portable apparatus: with a means of verifying the air flow.

4.2.5 Adjustments

All adjustment devices shall be designed so as to discourage unauthorised or inadvertent interference with the apparatus. Examples would include procedural devices, in the case of a keyboard instrument, or mechanical devices such as a cover requiring the use of a tool.

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

The adjustments of the zero and signal amplification shall be so designed that adjustments of one will not affect the 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 explained in the manual.

4.2.7 Stand-alone gas detection apparatus for use with separate control units

A specification shall be supplied with the apparatus that describes the relationship the gas concentration (detected by the apparatus) has with the corresponding output signal or indication (transfer function). Such specification shall be detailed to the extent that the accuracy of this transfer function can be verified. As a minimum, the manufacturer shall provide data showing the relationship between the output signal and the gas concentrations corresponding to 0,10 %, 25 %, 50 %, 75 % and 100 % of full-scale output indication. Full-scale output and status signals (e.g. fault, inhibit) shall also be specified by the manufacturer.

Where necessary, equipment shall be provided by the manufacturer to interpret the output signal or indication, which will enable the accuracy of the transfer function to be verified.

4.2.8 Separate control units for use with stand-alone gas detection apparatus

A specification shall be supplied with the apparatus that describes the relationship the input signal has with the calculated gas concentration (transfer function). Such specification shall be detailed to the extent that the accuracy of this transfer function can be verified. As a minimum, the manufacturer shall provide data showing the relationship between the input signal and the gas concentrations corresponding to 0,10 %, 25 %, 50 %, 75 % and 100 % of full-scale indication. Required inputs for full-scale indication and status signals (e.g. fault, inhibit) shall also be specified by the manufacturer.

Where necessary, equipment shall be provided by the manufacturer to provide the input signals, which will enable the accuracy of the transfer function to be verified.

4.2.9 Apparatus using software and/or digital technologies

The apparatus shall fulfil the requirements of EN 50271.

4.3 Labelling and marking

The apparatus shall be marked legibly and indelibly. The following minimum requirements apply:

a) name and address of the manufacturer;

b) certification marking;

c) designation of series or type;

d) serial number, if any;

e) year of construction (may be encoded within the serial number);

f) “EN 50104” (to represent conformance with this performance standard). If due to size constraints this information cannot be put onto the apparatus, it shall be included in the instruction manual;

g) If applicable, the apparatus shall comply with the additional marking requirements of EN 60079-0.

4.4 Instruction manual

Each apparatus shall be provided with an instruction manual that includes the following information:

a) complete instructions, drawings and diagrams for safe and proper operation, installation and servicing of the apparatus;

b) adjustment procedures;

c) recommendations for initial checking and calibration of the apparatus on a routine basis, including procedures and time intervals

NOTE Users are referred to EN 60079-29-2.

d) instructions for the use of the field verification kit including sample flow rate limits, if provided;