BS EN 50270:2015

BSI Standards Publication

Electromagnetic compatibility — Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen

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National foreword

This British Standard is the UK implementation of EN 50270:2015. It supersedes BS EN 50270:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EXL/31/1, Gas detectors.

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

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Electromagnetic compatibility - Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen

Compatibilité électromagnétique - Appareils de détection et de mesure de gaz combustible, de gaz toxique et d'oxygène

Elektromagnetische Verträglichkeit - Elektrische Geräte für die Detektion und Messung von brennbaren Gasen, toxischen Gasen oder Sauerstoff

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Contents

Foreword

This document (EN 50270:2015) has been prepared by CLC/SC 31-9 "Electrical apparatus for the detection and measurement of combustible gases to be used in industrial and commercial potentially explosive atmospheres" of CLC/TC 31, "Electrical apparatus for explosive atmospheres" and by CLC/TC 216 "Gas detectors".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-10-20
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2017-10-20

This document supersedes EN 50270:2006.

EN 50270:2015 includes the following significant technical changes with respect to EN 50270:2006:

– requirements updated according to EN 61326–1:2013;

– aspects related to functional safety considered;

– several requirements of EN 61326–3–2 implemented;

– the hierarchical level between criteria B and C re-inserted by modifying the requirements for B;

– Tables 1 to 4 updated according to above mentioned points;

– Table 5 modified according to new and updated performance standards;

– Table 5 now includes also the requirements for criterion B.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

1 Scope

This European Standard specifies requirements for the electromagnetic compatibility (EMC) for electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen which are subject to the performance standards for gas detection apparatus, for example EN 45544 (all parts), EN 50104, EN 50194 (all parts), EN 50291 (all parts), EN 50379 (all parts), EN 50543, EN 50545-1, EN 60079-29-1 or EN 60079-29-4.

NOTE For the purpose of this standard the word ‘toxic’ covers ‘very toxic’, ‘toxic’, ‘harmful’, ‘corrosive‘, ‘irritating‘, ‘sensitising‘, ‘carcinogenic‘, ‘mutagenic‘ and ‘teratogenic‘.

This European Standard applies to apparatus intended for use in residential, commercial and light-industrial environments as well as to apparatus intended for use in industrial environments. The apparatus may be AC-, DC- or battery powered.

This European Standard is also applicable to apparatus which is intended for use in hazardous areas which may contain explosive or potentially explosive atmospheres. It covers only normal operation and does not cover safety requirements related to EMC phenomena.

This standard is a product standard which is based on the product family standard EN 61326-1. This product standard takes precedence over the product family standard and over generic standards.

This standard applies to electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen that include functions specified by the manufacturer as being safety functions and can include functions specified as not being safety functions.

All performance standards for the detection and measurement of combustible gases, toxic gases or oxygen include the minimum requirements for functional safety specified in EN 50271. There are also gas detectors and gas detection systems which are intended to be used with safety integrity levels SIL 1 to SIL 3 according to EN 50402 and EN 61508 (all parts). For functional safety in industrial applications, this standard has taken into account those aspects of EN 61326–3–2 relating to the measuring and warning function of the apparatus defined as safety function.

This standard specifies requirements for immunity tests in relation to continuous and transient, conducted and radiated disturbances, including electrostatic discharges, and also for emission tests. The test requirements are specified for each port considered.

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

- Type 1: apparatus intended for use in residential, commercial and light-industrial environments, as described in EN 61000-6-1 and EN 61000-6-3.
- Type 2: apparatus intended for use in industrial environments, as described in EN 61000-6-2 and EN 61000-6-4.

Apparatus of type 1 where the manufacturer claims a safety integrity level should be considered as type 2 apparatus with regard to immunity requirements.

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

- apparatus intended for the detection of dusts or mists in air;
- scientific or laboratory based apparatus used only for analysis or measurement;
- apparatus used exclusively for process measurement purposes;
- apparatus for medical purposes;
- apparatus used for breath alcohol measurement
- apparatus intended for the direct measurement of automotive exhaust gases.

2 Normative references

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

EN 45544-1, *Workplace atmospheres - Electrical apparatus used for the direct detection and direct concentration measurement of toxic gases and vapours - Part 1: General requirements and test methods*

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 50291-1, *Electrical apparatus for the detection of carbon monoxide in domestic premises - Part 1: Test methods and performance requirements*

EN 50291-2, *Electrical apparatus for the detection of carbon monoxide in domestic premises - Part 2: Electrical apparatus for continuous operation in a fixed installation in recreational vehicles and similar premises including recreational craft - Additional test methods and performance requirements*

EN 50402, *Electrical apparatus for the detection and measurement of combustible or toxic gases or vapours or of oxygen - Requirements on the functional safety of fixed gas detection systems*

EN 50545-1, *Electrical apparatus for the detection and measurement of toxic and combustible gases in car parks and tunnels - Part 1: General performance requirements and test methods for the detection and measurement of carbon monoxide and nitrogen oxides*

EN 60079-11:2012, *Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i" (IEC 60079-11:2011)*

EN 61000-4-2, *Electromagnetic compatibility (EMC) - Part 4-2: Testing and measuring techniques - Electrostatic discharge immunity test (IEC 61000-4-2)*

EN 61000-4-3:2006 + A1:2008 + A2:2010, *Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3:2006 A1:2007 + A2:2010)*

EN 61000-4-4, *Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test (IEC 61000-4-4)*

EN 61000-4-5:2006, *Electromagnetic Compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test (IEC 61000-4-5:2005)*

EN 61000-4-6, *Electromagnetic compatibility (EMC) - Part 4-6: Testing and measuring techniques - Immunity to conducted disturbances, induced by radio frequency fields (IEC 61000-4-6)*

EN 61000-4-8, *Electromagnetic compatibility (EMC) - Part 4-8: Testing and measuring techniques -: Power-frequency magnetic field immunity test (IEC 61000-4-8)*

EN 61000-4-11, *Electromagnetic compatibility (EMC) - Part 4-11: Testing and measuring techniques - Voltage dips, short interruptions and voltage variations immunity tests (IEC 61000-4-11)*

EN 61000-4-29, *Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests (IEC 61000-4-29)*

EN 61000-6-1, *Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1)*

EN 61000-6-2, *Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments (IEC 61000-6-2)*

EN 61000-6-3, *Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3)*

EN 61000-6-4, *Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4)*

EN 61326-3-2:2008, *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 3-2: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) - Industrial applications with specified electromagnetic environment (IEC 61326-3-2:2008)*

EN 61508-1, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements (IEC 61508-1)*

EN 61508-2, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems (IEC 61508-2)*

EN 61508-3, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 3: Software requirements (IEC 61508-3)*

EN 61508-4, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 4: Definitions and abbreviations (IEC 61508-4)*

IEC 60050-161, *International Electrotechnical Vocabulary - Chapter 161: Electromagnetic compatibility*

3 Terms and Definitions

For the purposes of this document, the following terms and definitions apply plus those found in IEC 60050-161.

3.1
Type 1 apparatus
apparatus intended for use in residential, commercial and light-industrial environments, as described in EN 61000-6-1 and EN 61000-6-3

3.2
Type 2 apparatus
apparatus intended for use in industrial environments, as described in EN 61000-6-2 and EN 61000-6-4

3.3
port
particular interface of the specified apparatus with the external electromagnetic environment (see Figure 1)

3.4
enclosure port
physical boundary of the apparatus through which electromagnetic fields may radiate or impinge on

3.5
signal port
port at which a conductor or cable intended to carry signals is connected to the apparatus

Note 1 to entry: Examples are analog inputs, outputs and control lines; data busses; communication networks etc.

Note 2 to entry: Within this document, ports intended to be connected with earth potential for functional reasons (functional earth ports) are considered as I/O ports.

3.6
power port
port at which a conductor or cable carrying the primary electrical power needed for the operation (functioning) of an apparatus or associated apparatus is connected to the apparatus

3.7
intrinsically safe circuit
circuit in which any spark or any thermal effect produced in the conditions as specified in EN 60079-11, which include normal operation and specified fault conditions, is not capable of causing ignition of a given explosive atmosphere

3.8
intrinsically safe port
port connected to an intrinsically safe circuit

3.9
sensor
assembly in which the sensing element is housed and which may contain associated circuit components

3.10
remote sensor
sensor which is not integral with the main body of the apparatus

3.11
potentially explosive atmosphere
an atmosphere which could become explosive

3.12
safety barrier
a device for obtaining intrinsic safety of electrical apparatus for potentially explosive atmospheres

[SOURCE: EN 60079-11:2012, 8.6]

3.13
standard test gas
test gas with a composition specified for each apparatus to be used for all tests unless otherwise stated

3.14
measuring function of the apparatus
generation, transmission or output of measured values or status information (e.g. fault, alarm)

3.15
safety function of the apparatus
function to be implemented by electrical apparatus for the detection and measurement of combustible gases, toxic and oxygen that is intended to achieve or maintain a safe state, in respect of a specific hazardous event

Note 1 to entry:The measuring and warning function of the apparatus including all associated outputs is always part of the safety function.

3.16
DC distribution network
local d.c. electricity supply network in the infrastructure of a certain site or building intended for connection of any type of equipment

[SOURCE: EN 61326-3-2:2008, 3.11]

Note 1 to entry: Connection to a local or remote battery is not regarded as a DC distribution network if such a link comprises only the power supply for a single piece of equipment.

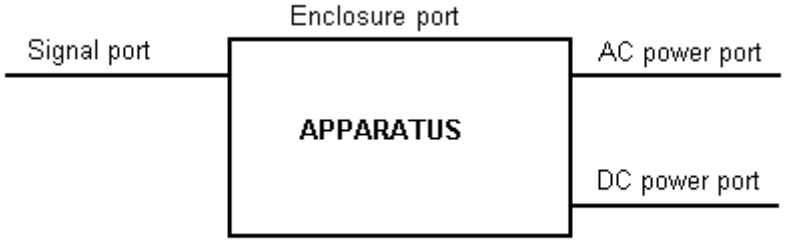

Figure 1 - Examples of ports

3.17
combustible gas
gas or vapour which, when mixed with air in a certain proportion, will form an explosive atmosphere

Note to entry: For the purposes of this standard, the terms "combustible gas" and "flammable gas" are equivalent.

4 EMC test plan

4.1 General

An EMC test plan shall be established prior to testing. It shall contain, as a minimum, the elements given in 4.2 to 4.4. It shall also include :

– the type of apparatus (type 1 or 2);

– the specification of the safety function(s);

– the specification of the non-safety function(s);

– the specific pass / fail criteria as defined in Tables 1 to 4 for the relevant functions appropriate to criteria A, B or C.

It may be determined from consideration of the electrical characteristics and usage of a particular apparatus that some tests are inappropriate and therefore unnecessary. In such cases, the decision not to test shall be justified and recorded in the EMC test plan.

The tests shall be carried out as single tests in sequence. The sequence of testing is optional.

4.2 Configuration of the apparatus (EUT) during testing

4.2.1 General

Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen within the scope of this standard often consists of systems with no fixed configuration. The kind, number and installation of different subassemblies within the apparatus may vary from system to system.

For simulating realistic EMC conditions (related both to emissions and immunity), the assembly of the apparatus shall represent a typical installation as specified by the manufaturer. Such tests shall be carried out as type tests under normal conditions as specified by the manufacturer in the instruction manual. External EMC protection devices or measures specified in the instruction manual for the apparatus shall be used or fitted for the tests.

4.2.2 Composition of EUT

All devices, racks, modules, boards, etc. significant to EMC and belonging to the EUT shall be documented in the test plan. A rationale supporting the configuration of the EUT shall also be provided.

4.2.3 Configuration of EUT, operation modes

If an EUT has a variety of configurations, the type test shall be made with that configuration having the maximum susceptibility. If necessary, the configuration shall be varied. Each type of module shall be tested at least once. The rationale for this selection shall be recorded in the EMC test plan. When designing the most susceptible configuration, possible electromagnetic interaction between modules of the apparatus shall be taken into consideration.

NOTE The manufacturer may elect to perform all tests either on a single EUT or more than one.

The test shall be performed in measuring mode.

For portable battery powered apparatus which may also be operated when connected to an external power supply both operational modes (battery powered as well as externally supplied) shall be tested.

If the apparatus has sensors with different measuring principles (e.g. electrochemical sensors or catalytic sensors) the apparatus shall be tested with each type of sensor. If the apparatus has more than one measuring range for a particular sensor the most sensitive specified by the manufacturer shall be tested. If the apparatus is designed for the detection of a variety of gases where the target gas can be changed by changing the sensor of a given type only (e.g. electrochemical sensors) the sensor with the maximum EMC-susceptibility shall be tested.

If an apparatus consists of a central unit and additional separate equipment (e.g. remote sensors or printer) the control unit and the separate equipment may be tested separately if possible.

4.2.4 I/O ports

If the apparatus has a large number of similar ports or ports with similar connections, then a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered.

Connections between e.g. remote sensors or hand held terminals with the respective apparatus shall be considered as I/O lines.

Where there are multiple I/O ports, which are all of the same type, connecting a cable to just one of those ports is sufficient, provided that it can be shown that the additional cables would not affect the results significantly.

The rationale for this selection shall be justified and recorded in the EMC test plan.

4.2.5 Auxiliary equipment

When a variety of devices is provided for use with the EUT, at least one of each type of device shall be selected to simulate actual operating conditions. Auxiliary devices can be simulated.

4.2.6 Cabling and earthing (grounding)

The cables and earth (ground) shall be connected to the EUT in accordance with the manufacturer's specifications.

4.3 Operation conditions of EUT during testing

4.3.1 Test gases, alarm settings

For linear measuring principles, the tests shall be carried out with the apparatus showing a reading between 10 % and 90 % of full scale.

For non-linear measuring principles, the tests shall be carried out with the apparatus showing a gas reading that is likely to represent the worst case conditions for the tests. If the volume fraction of the standard test gas is not defined an indication between 40 % and 60 % of full scale shall be used.

For apparatus according to EN 50545-1 the calculation of 15 min. averages shall be deactivated.

A test gas having a volume fraction of 75 ppm shall be used for apparatus according to EN 50291-1 or EN 50291-2. A test gas with a higher volume fraction may be applied prior to the test in order to set the apparatus into alarm state.

The alarm set points shall be set in such a manner that the alarms are active when test gas is applied. In doing so, the alarm set points shall be set below or above the volume fraction of the test gas according to the performance criteria listed in table 5. For alarm only apparatus or if the alarm set points cannot be set to these values, the test gas volume fraction shall be chosen accordingly above or below the alarm set point.

For tests 1.1 to 1.4, 2.1, 3.1 and 4.1 of Tables 1 to 4, the dwell time at each frequency shall be chosen in such a manner that it does not fall below the update time used for calculating the measured value or the alarm, respectively. The manufacturer shall specify this update time used for calculation in the EMC test plan.

NOTE This is particularly valid for apparatus complying with EN 50291 or EN 50545. The requirements of these standards to averaging times need not be considered for these tests.

The application of test gas may be simulated (e.g. by inserting an absorbing filter into the optical path of an infrared sensor). The sensitivity of the apparatus shall not be changed.

If absorbing filters are used to simulate the application of a test gas the test plan shall include a justification that demonstrates how this arrangement is equivalent to the operating conditions present when the relevant test gas is used.

Where the test gas is hazardous (combustible or toxic), an alternative test gas may be applied to the apparatus under test. Where this is done the test plan shall include a rationale that demonstrates how this is equivalent to the operating conditions present with the hazardous test gas.

4.3.2 Environmental conditions

The tests shall be carried out within the manufacturer's specified environmental operating range (for example, ambient temperature, humidity, atmospheric pressure), and within the rated ranges of supply voltage and frequency unless otherwise specified in Table 1 to Table 4.

4.3.3 EUT software during test

That part of the software which is relevant to the measuring function of the apparatus shall be identical with the production software. Other software modifications are allowed which facilitates EMC testing. Modifications and justifications for them shall be documented in the EMC test plan.

4.4 Test description

Each test to be applied shall be specified in the EMC test plan. The description of the tests, the test methods, the characteristics of the tests, and the test set-ups are given in the basic standards which are referred to in Table 1 to Table 4. Additional information needed for the practical implementation of the tests is given also in this standard. The contents of the basic standards need not be reproduced in the test plan.

5 Immunity tests

5.1 Performance criteria

For the functions specified by the manufacturer as being safety functions (see 3.15) the following hierarchical performance criteria shall apply.

For safety functions the following performance criteria shall be used for the tests in Table 1 to Table 4:

For functions specified by the manufacturer as not being safety functions the allowed performance shall be that specified by the manufacturer in the instruction manual, unless specified in the Table 1 to Table 4.

Performance criterion A:

The apparatus shall continue to operate as intended both during and after the test.

For those functions specified by the manufacturer as being safety functions, when the apparatus is used as intended no loss of function is allowed and the performance requirements given in Table 5 shall be complied with.

Performance criterion B:

During the test

- degradation of performance is allowed but the performance requirements given in table 5 shall not be exceeded by more than a factor of 2, or
- the apparatus shall show a specified fault indication and/or output.

After the test any degradation in performance shall be self-recoverable and the apparatus shall continue to operate as intended. No permanent change of actual operating state or stored data or continuous deactivation of alarm is allowed.

If the apparatus includes latching alarms or status signals it is permitted that these may be triggered during the test. After the test signal has been removed, the latching circuits shall be reset and the correct operation of the alarm circuit verfied by applying test gas or simulation of signal depending on the type of apparatus.

Performance criterion C:

Temporary loss of function is allowed during the test, provided the loss of function is self recoverable or can be easily restored by the operation of the controls. The apparatus shall operate as intended after the test. No change of stored data is allowed.

If performance criterion C is required in Table 1 to Table 4, the requirements can be presumed to be fulfilled if the apparatus complies with performance criterion A or B.

5.2 Requirements

Apparatus of type 1 where the manufacturer claims a safety integrity level shall be considered as type 2 apparatus with regard to immunity requirements.

The apparatus shall fulfil the performance criteria of Table 1 to Table 4. These performance criteria are given on a port-by-port basis.

If the apparatus also belongs to other product families additional EMC requirements may apply.

Apparatus shall not become dangerous or unsafe as a result of the application of the tests defined in this standard.

6 Emission tests

The tests shall be performed in ambient air. The requirements of EN 61000-6-3 for type 1 apparatus or of EN 61000-6-4 for type 2 apparatus shall be fulfilled.

If the apparatus also belongs to other product families additional EMC requirements may apply.

NOTE More stringent requirements may exist for special applications.

7 Test report

The test results shall be documented in a comprehensive test report with sufficient detail to provide for test repeatability.

The test report shall contain the following minimum information:

- description of the appratus (EUT) including versions of hardware and software;
- the EMC test plan;
- Arrangement of the apparatus for each test;
- test data, their evaluation and results;
- test equipment and set-up.

8 Modifications

If hardware or software are modified subsequent to the completion of the tests described in this standard an impact analysis shall be carried out and it shall be decided whether the EMC test shall be repeated as a whole, in parts or not at all. Impact analysis and decision shall be added to the EMC test plan for the apparatus.

Table 1 - Immunity - Enclosure ports

	Environmental phenomena		Test specifications		Units	Basic standards	Remarks	Performance criteria	
			Type 1	Type 2				Type 1	Type 2
1.1	Power-frequency magnetic field		50, 60 3	50, 60 30	Hz A/m	EN 61000-4-8	The test shall be carried out at the frequencies appropriate to the apparatus power supply frequency used during the tests. Apparatus intended for use in areas supplied only at one of these frequencies need only be tested at that frequency. Note 1.	A	A
1.2	Radio-frequency electromagnetic field. Amplitude modulated		80 to 1 000 3 80	80 to 1 000 10 80	MHz V/m % AM (1 kHz)	EN 61000-4-3 + A1 + A2	The test level specified is the r.m.s. value of the unmodulated carrier. Note 2.	A	A
1.3	Radio-frequency electromagnetic field. Amplitude modulated		1,4 to 2,0 3 80	1,4 to 2,0 10 80	GHz V/m % AM (1 kHz)	EN 61000-4-3 + A1 + A2	The test level specified is the r.m.s. value of the unmodulated carrier. Note 2.	A	A
1.4	Radio-frequency electromagnetic field. Amplitude modulated		2,0 to 2,7 1 80	2,0 to 2,7 3 80	GHz V/m % AM (1 kHz)	EN 61000-4-3 + A1 + A2	The test level specified is the r.m.s. value of the unmodulated carrier. Note 2.	A	A
1.5	Electrostatic discharge	Contact discharge	± 4	± 6	kV (charge voltage)	EN 61000-4-2	See basic standard for applicability of contact and/or air discharge tests. Performance criterion B for type 2 apparatus for properties which are not relevant for the safety function of the apparatus	B	A
		Air discharge	± 8	± 8	kV (charge voltage)			B	A

NOTE 1 Applicable only to apparatus containing devices susceptible to magnetic fields.

NOTE 2 EN 61000-4-20 may be used for approriately sized apparatus as defined in EN 61000-4-20:2010, 6.2.

Table 2 - Immunity - Signal ports

	Environmental phenomena	Test specifications		Units	Basic standards	Remarks	Performance criteria	
		Type 1	Type 2				Type 1	Type 2
2.1	Radio-frequency common mode	0,15 to 80 3 80	0,15 to 80 10 80	MHz V % AM (1 kHz)	EN 61000-4-6	The test level specified is the r.m.s. value of the unmodulated carrier. Performance criterion B is acceptable for type 2 apparatus for digital data transmission which is not relevant for the measuring function of the apparatus. Note 1	A	A
2.2	Fast transients / bursts	± 0,5 ± 1 5 / 50 5	± 1 ± 2 5 / 50 5	kV (for ports not directly connected to the power network) kV (for ports with direct connection to the power network) Tr / Th ns kHz (repetition frequency)	EN 61000-4-4	Capacitive clamp used. Note 1	B	A
2.3	Surges line-to- earth line-to-earth line-to-line	1,2 / 50 (8 / 20) ± 1 ± 1 ± 0,5	1,2 / 50 (8 / 20) ± 1 ± 2 ± 1	Tr / Th μs kV (for ports not directly connected to the power network) kV (for ports with direct connection to the power network) kV (for ports with direct connection to the power network)	EN 61000-4-5	Note 2.	B	B

NOTE 1 Applicable only to ports interfacing with cables whose total length according to the manufacturers functional specification may exceed 3 m.

NOTE 2 Applicable only to ports interfacing with cables whose total length according to the manufacturer's specification may exceed 30 m, or with cables which leave the building (including lines of outdoor installations).

Table 3 - Immunity - DC power ports

	Environmental phenomena	Test specifications		Units	Basic standards	Remarks	Performance criteria	
		Type 1	Type 2				Type 1	Type 2
3.1	Radio-frequency common mode	0,15 to 80 3 80	0,15 to 80 10 80	MHz V % AM (1 kHz)	EN 61000-4-6	The test level specified is the r.m.s. value of the unmodulated carrier. Note 2.	A	A
3.2	Surge line-to-line line-to-earth	1,2 / 50 (8 / 20) ± 0,5 ± 1	1,2 / 50 (8 / 20) ± 1 ± 2	Tr / Th μs kV kV	EN 61000-4-5	Notes 1 and 2.	B	B
3.3	Fast transients / bursts	± 1 5 / 50 5	± 2 5 / 50 5	kV Tr / Th ns kHz (repetition frequency)	EN 61000-4-4	Notes 1 and 3.	B	A
3.4	Voltage dips	0 1000 ms	0 1000 ms	% residual voltage duration	EN 61000-4-29	Notes 4, 5 and 6.	C	C
		40 1000 ms	40 1000 ms	% residual voltage duration			C	C
3.5	Short interruptions	0 20 ms	0 20 ms	% residual voltage duration	EN 61000-4-29	Notes 4, 5 and 6..	C	C

NOTE 1 Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the apparatus for recharging.

NOTE 2 DC connections between components of apparatus or systems which are not directly connected to the DC power network are treated as signal ports.

NOTE 3 For battery powered apparatus tests for DC power lines are applicable only to apparatus that can be connected to the mains while in use.

NOTE 4 Not applicable to DC connections between components of apparatus or systems which are not directly connected to the DC power network.

NOTE 5 Applicable only to input ports.

Performance criterion A may be achieved by use of a redundant power supply whose properties shall be described in the instruction manual. In this case, performance criterion C shall be fulfilled when operated without the redundant power supply.

Table 4 - Immunity - AC power ports

	Environmental phenomena	Test specifications				Units	Basic standards	Remarks	Performance criteria	
		Type 1		Type 2					Type 1	Type 2
4.1	Radio-frequency common mode	0,15 to 80 3 80		0,15 to 80 10 80		MHz V % AM (1 kHz)	EN 61000-4-6	The test level specified is the r.m.s. value of the unmodulated carrier.	A	A
4.2	Voltage dips	0 1		0 1		% residual voltage cycle	EN 61000-4-11	Voltage shift at zero crossing. Note 1.	C	C
		40 10 / 12	70 25 / 30	40 10 / 12	70 25 / 30	% residual voltage cycle (at 50 / 60 Hz)			C	C
4.3	Voltage interruptions	0 250 / 300		0 250 / 300		% residual voltage cycle	EN 61000-4-11	Voltage shift at zero crossing. Note 1.	C	C
4.4	Surges line-to-line line-to-earth	1,2 / 50 (8 / 20) ± 1 ± 2		1,2 / 50 (8 / 20) ± 1 ± 2		Tr / Th μs kV kV	EN 61000-4-5		B	A
4.5	Fast transients / bursts	± 1 5 / 50 5		± 2 5 / 50 5		kV Tr/Th ns kHz (repetition frequency)	EN 61000-4-4	Note 2.	B	A

Performance criterion A may be achieved by use of a redundant power supply whose properties shall be described in the instruction manual. In this case, performance criterion C shall be fulfilled when operated without the redundant power supply.

NOTE For battery powered apparatus tests for AC power lines are applicable only to apparatus that can be connected to the mains while in use.

Table 5 - Performance requirements

	Gas to be detected	Measuring range / Application	Performance requirements	
			Type 1	**Type 2**
5.1	Combustible	up to 20 % LEL	± 10 % of the measuring range	± 10 % of the measuring range
5.2	Combustible	up to 100 % LEL	± 5 % of the measuring range	± 5 % of the measuring range
5.3	Combustible	up to 100 % (v/v)	± 5 % of the measuring range	± 5 % of the measuring range
5.4	Combustible	for domestic premises	no deactivation of alarm and, after the test, no manual reset of alarm possible	—
5.5	Combustible	open path apparatus	± 5 % of the measuring range	± 5 % of the measuring range
5.6	Oxygen	up to 25 % (v/v)	± 2,5 % of the measuring range	± 2,5 % of the measuring range
5.7	Oxygen	up to 100 % (v/v)	± 2,5 % of the measuring range	± 2,5 % of the measuring range
5.8	Toxic	for exposure measurement	± 30 % of Volume fraction of standard test gas (according to EN 45544-1) but not more than ± 6 % of the measuring range	± 30 % of Volume fraction of standard test gas (according to EN 45544-1) but not more than ± 6 % of the measuring range
5.9	Toxic	for general gas detection	± 10 % of the measuring range	± 10 % of the measuring range
5.10	Toxic	alarm only apparatus	no deactivation of alarm and, after the test, no manual reset of alarm possible	no deactivation of alarm and, after the test, no manual reset of alarm possible
5.11	Toxic	for domestic premises	no deactivation of alarm and, after the test, no manual reset of alarm possible	—
5.12	Toxic	In car parks and tunnels	± 10 % of the measuring range	± 10 % of the measuring range
5.13	Combustion flue gas	for statutory inspections and assessment	± 10 % of the measuring range	—
5.14	Combustion flue gas	for non-statutory servicing	± 10 % of the measuring range	—

(v/v) : volume by volume.

LEL : Lower Explosive Limit.

The performance requirements of this table are applicable for criterion A.

For criterion B the tolerances of the table are to be doubled.

Annex ZZ
(informative)
Coverage of Essential Requirements of EU Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in Article 4 of the EU Directive 2004/108/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive[s] concerned.

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

Bibliography

EN 45544-2, *Workplace atmospheres - Electrical apparatus used for the direct detection and direct concentration measurement of toxic gases and vapours - Part 2: Performance requirements for apparatus used for exposure measurement*

EN 45544-3, *Workplace atmospheres - Electrical apparatus used for the direct detection and direct concentration measurement of toxic gases and vapours - Part 3: Performance requirements for apparatus used for general gas detection*

EN 50104, *Electrical apparatus for the detection and measurement of oxygen - Performance requirements and test methods*

EN 50194-1, *Electrical apparatus for the detection of combustible gases in domestic premises - Part 1: Test methods and performance requirements*

EN 50194-2, *Electrical apparatus for the detection of combustible gases in domestic premises - Part 2: Electrical apparatus for continuous operation in a fixed installation in recreational vehicles and similar premises - Additional test methods and performance requirements*

EN 50379-1, *Specification for portable electrical apparatus designed to measure combustion flue gas parameters of heating appliances - Part 1: General requirements and test methods*

EN 50379-2, *Specification for portable electrical apparatus designed to measure combustion flue gas parameters of heating appliances - Part 2: Performance requirements for apparatus used in statutory inspections and assessment*

EN 50379-3, *Specification for portable electrical apparatus designed to measure combustion flue gas parameters of heating appliances - Part 3: Performance requirements for apparatus used in non-statutory servicing of gas fired heating appliances*

EN 50543, *Electronic portable and transportable apparatus designed to detect and measure carbon dioxide and/or carbon monoxide in indoor ambient air - Requirements and test methods*

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

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EN 61326-1:2013, *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2012)*

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