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REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Electromagnetic compatibility (EMC) –
Part 6-2: Generic standards – Immunity standard for industrial environments

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 6-2: Generic standards – Immunity standard for industrial environments

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 61000-6-2 has been prepared by IEC technical committee 77: Electromagnetic compatibility.

This third edition cancels and replaces the second edition published in 2005. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) improvement of the environmental description;
b) extension of the frequency range for the radio-frequency electromagnetic field test according to IEC 61000-4-3;
c) amended test levels at particular frequencies for the radio-frequency electromagnetic field test according to IEC 61000-4-3;
d) change of the repetition frequency for the fast transients immunity test according to IEC 61000-4-4;
e) introduction of requirements according to IEC 61000-4-34;
f) revision of the test levels;
g) consideration of measurement uncertainty;
h) addition of Annex A.

The text of this standard is based on the following documents:

FDIS	Report on voting
77/521/FDIS	77/523/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

IEC 61000 is published in separate parts according to the following structure:

Part 1: General

General considerations (introduction, fundamental principles)

Definitions, terminology

Part 2: Environment

Description of the environment

Classification of the environment

Compatibility levels

Part 3: Limits

Emission limits

Immunity limits (insofar as these limits do not fall under the responsibility of the product committees)

Part 4: Testing and measurement techniques

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines

Installation guidelines

Mitigation methods and devices

Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into several parts, published either as International Standards or as Technical Specifications or Technical Reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 6-2: Generic standards – Immunity standard for industrial environments

1 Scope ~~and object~~

This part of IEC 61000 for EMC immunity requirements applies to electrical and electronic ~~apparatus~~ equipment intended for use in industrial ~~environments~~ locations, as described below. Immunity requirements in the frequency range 0 Hz to 400 GHz are covered. No tests need to be performed at frequencies where no requirements are specified.

This generic EMC immunity standard is applicable if no relevant dedicated product or product-family EMC immunity standard exists.

This standard applies to ~~apparatus intended to be connected to a power network supplied from a high or medium voltage transformer dedicated to the supply of an installation feeding manufacturing or similar plant, and~~ electrical and electronic equipment intended to be operated in ~~or in proximity to~~ industrial locations, as ~~described below~~ defined in 3.7, both indoor and outdoor.

This standard applies also to ~~apparatus~~ equipment intended to be directly connected to a DC distribution network or which is battery operated, and intended to be used in industrial locations.

~~The environments encompassed by this standard are industrial, both indoor and outdoor.~~

~~Industrial locations are in addition characterised by the existence of one or more of the following:~~

~~– industrial, scientific and medical (ISM) apparatus (as defined in CISPR 11);~~

~~– heavy inductive or capacitive loads are frequently switched;~~

~~– currents and associated magnetic fields are high.~~

~~The object of~~ This standard ~~is to~~ defines the immunity test requirements for ~~apparatus defined~~ equipment specified in the scope in relation to continuous and transient, conducted and radiated disturbances, including electrostatic discharges.

The immunity requirements have been selected to ensure an adequate level of immunity for ~~apparatus at~~ equipment operating within industrial locations. The levels do not, however, cover extreme cases, which may occur at any location, but with an extremely low probability of occurrence. Not all disturbance phenomena have been included for testing purposes in this standard, but only those considered as relevant for the equipment covered by this standard. These test requirements represent essential electromagnetic compatibility immunity requirements. They are specified for each port considered.

NOTE 1 Information on other disturbance phenomena is given in IEC TR 61000-4-1.

NOTE 2 Safety considerations are not covered by this standard.

NOTE 3 In special cases, situations will arise where the level of disturbances may exceed the levels specified in this standard, for example where ~~an apparatus~~ equipment is installed in proximity to industrial, scientific and medical equipment as defined in CISPR 11 or where a hand-held transmitter is used in close proximity to ~~an apparatus~~ equipment. In these instances, special mitigation measures may have to be employed.

~~NOTE 4~~ The industrial environment may be changed by special mitigation measures. Where such measures can be shown to produce an electromagnetic environment equivalent to the residential, commercial or light-industrial environment, then the generic standard for this environment, or the relevant product standard, ~~should~~ may be applied.

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.

IEC 60050-161, *International Electrotechnical Vocabulary – Part 161: Electromagnetic compatibility* (available at: www.electropedia.org)

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
IEC 61000-4-3:2006/AMD1:2007
IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-20:2010, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*

IEC 61000-4-21:2011, *Electromagnetic compatibility (EMC) – Part 4-21: Testing and measurement techniques – Reverberation chamber test methods*

IEC 61000-4-22:2010, *Electromagnetic compatibility (EMC) – Part 4-22: Testing and measurement techniques – Radiated emissions and immunity measurements in fully anechoic rooms (FARs)*

IEC 61000-4-34:2005, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase*
IEC 61000-4-34:2005/AMD1:2009

~~CISPR 22, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*~~

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 as well as the following apply.

NOTE Additional definitions related to EMC and to relevant phenomena are given in other IEC and CISPR publications.

3.1
port
particular interface of the ~~specified apparatus~~ equipment which couples this equipment with or is influenced by the external electromagnetic environment ~~(see Figure 1)~~

Note 1 to entry: ~~In some cases different ports may be combined.~~ Examples of ports of interest are shown in Figure 1. The enclosure port is the physical boundary of the equipment (e.g. enclosure). The enclosure port provides for radiated and electrostatic discharge (ESD) energy transfer, whereas the other ports provide for conducted energy transfer, either by direct injection or by induction.

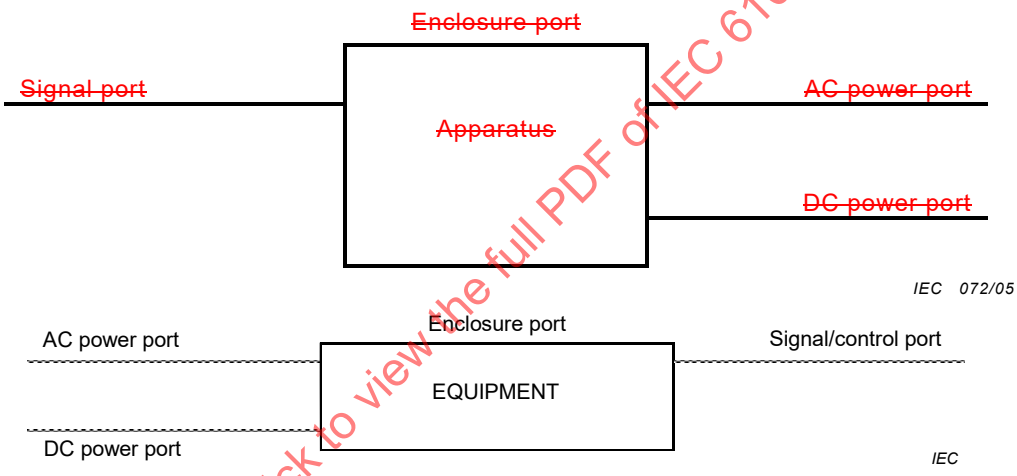


Figure 1 – ~~Example of~~ Equipment ports

3.2
enclosure port
physical boundary of the ~~apparatus~~ equipment through which electromagnetic fields may radiate ~~through~~ or on which they may impinge ~~on~~

~~**3.3**~~
~~**cable port**~~
~~port at which a conductor or a cable is connected to the apparatus~~

~~NOTE Examples are signal and power ports.~~

3.3
signal/control port
port at which a conductor or cable intended to carry signals is connected to the ~~apparatus~~ equipment

~~NOTE~~ EXAMPLE Analog inputs, outputs and control lines; data buses; communication ~~networks~~ lines, etc.

3.4
power port
port at which a conductor or cable, carrying the ~~primary~~ electrical input/output power needed for the operation (functioning) ~~of an apparatus or associated apparatus~~ is connected to the ~~apparatus~~ equipment

3.5
long distance line~~s~~
line~~s~~ connected to a signal/control port and which inside a building ~~are~~ is longer than 30 m, or which leaves the building (including ~~lines of outdoor installations~~ a line installed outdoors)

3.6
DC distribution network
local DC electricity supply network in the infrastructure of a certain site or building intended for flexible use by one or more different types of equipment and ensuring continuous power supply independently from the conditions of the public mains network

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

3.7
industrial location
location characterized by a separate power network, supplied from a high- or medium-voltage transformer, dedicated for the supply of the installation

EXAMPLE Metalworking, pulp and paper, chemical plants, car production, farm building, high-voltage areas of airports.

Note 1 to entry: Industrial locations can generally be described by the existence of an installation with one or more of the following characteristics:

– items of equipment installed and connected together and working simultaneously;
– significant amount of electrical power generated, transmitted and/or consumed;
– frequent switching of heavy inductive or capacitive loads;
– high currents and associated magnetic fields;
– presence of industrial, high power scientific and medical (ISM) equipment (for example, welding machines).

The electromagnetic environment at an industrial location is predominantly produced by the equipment and installation present at the location. There are types of industrial locations where some of the electromagnetic phenomena appear in a more severe degree than in other installations.

Note 2 to entry: The connection between location and electromagnetic environment is given in 3.8.

3.8
electromagnetic environment
totality of electromagnetic phenomena existing at a given location

Note 1 to entry: In general, the electromagnetic environment is time-dependent and its description may need a statistical approach.

Note 2 to entry: It is very important not to confuse the electromagnetic environment and the location itself.

[SOURCE: IEC 60050-161:1990, 161-01-01, modified – Note 2 to entry has been added.]

3.9
public mains network
electricity lines to which all categories of consumers have access and which are operated by an electrical power supply and/or distribution organization for the purpose of supplying electrical energy

4 Performance criteria

~~The variety and the diversity of the apparatus within the scope of this standard makes it difficult to define precise criteria for the evaluation of the immunity test results.~~

~~If, as a result of the application of the tests defined in this standard, the apparatus becomes dangerous or unsafe, the apparatus shall be deemed to have failed the test.~~

A functional description and a definition of specific performance criteria, during or as a consequence of ~~the EMC~~ immunity testing of equipment under test (EUT), shall be provided by the manufacturer and noted in the test report~~, based on~~. They shall be consistent with one of the following general criteria for each test as specified in Table 1 to Table 4:

a) Performance criterion A: The ~~apparatus~~ EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the ~~apparatus~~ EUT is used as intended. ~~The performance level may be replaced by a permissible loss of performance.~~ If the ~~minimum~~ performance level ~~or the permissible performance loss~~ is not specified by the manufacturer, ~~either of these~~ this may be derived from the product description and documentation and what the user may reasonably expect from the ~~apparatus~~ equipment if used as intended.

b) Performance criterion B: The ~~apparatus~~ EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the ~~apparatus~~ EUT is used as intended. The performance level may be replaced by a permissible loss of performance. However, during the test, degradation of performance is allowed but no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the ~~apparatus~~ equipment if used as intended.

c) Performance criterion C: Temporary loss of function is allowed during the test, provided the function is self-recoverable or can be restored by the operation of the controls.

If, as a result of the application of the tests defined in this standard, the EUT becomes dangerous or unsafe, it shall be deemed to have failed the test.

5 Conditions during testing

The equipment under test (EUT) shall be tested in the expected most susceptible operating mode, for example identified by performing limited pre-tests. This mode shall be consistent with normal applications. The configuration of the test sample shall be varied to achieve maximum susceptibility consistent with typical applications and installation practice. The configuration and mode of operation during the tests shall be precisely noted in the test report.

If the ~~apparatus~~ equipment is part of a system, or can be connected to auxiliary ~~apparatus~~ equipment, the ~~apparatus~~ equipment shall be tested while connected to the minimum representative configuration of auxiliary equipment necessary to exercise the ports ~~in a similar manner to that described in CISPR 22~~. Auxiliary equipment may be simulated.

In cases where a manufacturer's specification requires external protection devices or measures which are clearly specified in the user's manual, the test requirements of this standard shall be applied with the external protection devices or measures in place.

~~The configuration and mode of operation during the tests shall be precisely noted in the test report. It is not always possible to test every function of the apparatus; in such cases the most critical mode(s) of operation shall be selected.~~

If the ~~apparatus~~ equipment has a large number of similar ports or ports with many similar connections, a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered. Justification for the selection of the tested ports shall be included in the test report.

The tests shall be carried out at one single set of parameters within the operating ranges of temperature, humidity and atmospheric pressure specified for the product and at the rated supply voltage, unless otherwise indicated in the basic standard.

6 Product documentation

If the manufacturer is using his own specification for an acceptable level of EMC performance or degradation of EMC performance during or after the testing required by this standard, this ~~specification~~ fact shall be ~~provided~~ stated in the ~~product~~ user documentation ~~available to the user~~. This specification itself shall be made available upon request.

7 Applicability

The application of tests for evaluation of immunity depends on the particular ~~apparatus~~ equipment, its configuration, its ports, its technology and its operating conditions.

Tests shall be applied to the relevant ports of the ~~apparatus~~ equipment according to Table 1 to Table 4. Tests shall only be carried out where the relevant ports exist.

It may be determined from consideration of the electrical characteristics and usage of a particular ~~apparatus~~ equipment that some of the tests are inappropriate and, therefore, unnecessary. In such a case, ~~it is required that~~ the decision and justification not to test shall be recorded in the test report.

8 Measurement uncertainty

Where guidance for the assessment of the instrumentation uncertainty of an immunity test is specified in IEC TR 61000-1-6 or in the corresponding basic standard, this should be followed.

9 Immunity test requirements

The immunity test requirements for ~~apparatus~~ equipment covered by this standard are given on a port by port basis and listed in Table 1 to Table 4.

Tests shall be conducted in a well-defined and reproducible manner.

The tests shall be carried out individually as single tests ~~in sequence~~. The tests may be performed in any order. Identical units may be used for testing in parallel, and this information shall be recorded in the test report.

The description of the test, relevant generator, appropriate methods and the set-up to be used are given in basic standards, which are referred to in Table 1 to Table 4.

The contents of these basic standards are not repeated here, however modifications or additional information needed for the practical application of the tests are given in this standard.

Table 1 – Immunity requirements – Enclosure ports

	Environmental phenomena		Test specifications	Units	Basic standards	Remarks	Performance criterion
1.1	Power-frequency magnetic field		50, 60 30	Hz A/m	IEC 61000-4-8	~~a~~ Applicable only to equipment containing devices susceptible to magnetic fields. The test shall be carried out at the frequencies appropriate to the power supply frequency. Equipment intended for use in areas supplied only at one of these frequencies need only be tested at that frequency.	A ~~b~~
1.2	Radio-frequency electromagnetic field. Amplitude modulated		80 to 1 000 10 [d] 80	MHz V/m % AM (1 kHz)	IEC 61000-4-3 [a, b, c]	~~c~~ The test level specified is the r.m.s. value of the unmodulated carrier.	A
1.3	Radio-frequency electromagnetic field. Amplitude modulated		1,4 to ~~2,0~~ 6,0 3 [d] 80	GHz V/m % AM (1 kHz)	IEC 61000-4-3 [a, b, c]	~~c~~ The test level specified is the r.m.s. value of the unmodulated carrier.	A
~~1.4~~	~~Radio-frequency electromagnetic field.~~ ~~Amplitude modulated~~		~~2,0 to 2,7~~ ~~1~~ ~~80~~	~~GHz~~ ~~V/m~~ ~~% AM (1 kHz)~~	~~IEC 61000-4-3 d~~	~~c~~ ~~The test level specified is the r.m.s. value of the unmodulated carrier~~	~~A~~
1.4	Electrostatic discharge	Contact discharge	±4 (charge voltage)	kV	IEC 61000-4-2	See the basic standard for applicability of contact and/or air discharge tests	B
		Air discharge	±8 (charge voltage)	kV			B

~~a Applicable only to apparatus containing devices susceptible to magnetic fields.~~

~~b For CRTs, the acceptable jitter depends upon the character size and is calculated for a test level of 1 A/m as follows:~~

$$J \leq \frac{(3C + 1)}{40}$$

~~where jitter J and character size C are in millimetres.~~

~~As jitter is linearly proportional to the magnetic field strength, tests can be carried out at other test levels extrapolating the maximum jitter level appropriately.~~

~~c Except for the ITU broadcast frequency bands 87 MHz to 108 MHz, 174 MHz to 230 MHz, and 470 MHz to 790 MHz, where the level shall be 3 V/m.~~

~~e The frequency range has been selected to cover the frequencies with the highest potential risk of a disturbance.~~

a IEC 61000-4-20 may be used for small EUTs as defined in IEC 61000-4-20~~, subclause 6.1~~.

b A fully anechoic room (FAR) as described in IEC 61000-4-22 may also be used as a test site for radio-frequency immunity test.

c A reverberation chamber (RVC) as described in IEC 61000-4-21 may also be used. The forward power injected into a reverberation chamber P_{input} is given by the required test electric-field strength E_{test} as follows:

$$P_{input} = \left[\frac{E_{test}}{\left\langle \ddot{E} \right\rangle_{24or9} \times \sqrt{CLF(f)}} \right]^2$$

where $CLF(f)$ is the chamber loading factor (dimensionless) at frequency f, and $\left\langle \ddot{E} \right\rangle_{24or9}$ is the average of the normalized E-field (in (V/m)/W^{0,5}), obtained from the empty chamber validation (see Annexes B and D of IEC 61000-4-21:2011).

d For information regarding situations with a high concentration of mobile transmitters, see for example IEC TR 61000-2-5:2011, 9.3.

Table 2 – Immunity requirements – Signal/control ports

	Environmental phenomena	Test specifications	Units	Basic standards	Remarks	Performance criterion
2.1	Radio-frequency common mode	0,15 to 80 10 80	MHz V % AM (1 kHz)	IEC 61000-4-6	The test level specified is the r.m.s. value of the unmodulated carrier. a,b~~,c~~	A
2.2	Surges line-to-earth	1,2/50 (8/20) ±1	~~Tr/Th~~ T_r/T_d µs kV (open circuit test voltage)	IEC 61000-4-5	c, d, e	B
2.3	Fast transients	±1 5/50 5 or 100	kV (open circuit test voltage) ~~Tr/Th~~ t_r/t_w ns Repetition frequency kHz	IEC 61000-4-4	Capacitive clamp used. ~~d,e~~ b, f	B

a The test level can also be defined as the equivalent current into a 150 Ω load.

~~b Except for the ITU broadcast frequency band 47 MHz to 68 MHz, where the level shall be 3 V.~~

b Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.

c Applicable only to ports interfacing with ~~cables whose total length according to the manufacturer's functional specification may exceed 30 m~~ long distance lines (see 3.5).

d Where normal functioning cannot be achieved because of the impact of the coupling/decoupling network (CDN) on the EUT, the test ~~is not required~~ shall be done with the reduced functionality. A rationale shall be given in the test report for doing so. After the test and the removal of the CDN, the normal function shall not be affected.

e Signal ports directly connected to AC power network shall be treated as AC power ports.

f The test may be performed at one or at both repetition frequencies. The use of 5 kHz repetition frequency is traditional; however, 100 kHz is closer to reality.

Table 3 – Immunity requirements – Input and output DC power ports

	Environmental phenomena	Test specifications	Units	Basic standards	Remarks	Performance criterion
3.1	Radio-frequency common mode	0,15 to 80 10 80	MHz V % AM (1 kHz)	IEC 61000-4-6	The test level specified is the r.m.s. value of the unmodulated carrier. a, ~~b~~, g	A
3.2	Surges line-to-earth line-to-line	1,2/50 (8/20) ±~~0,5~~ 1 ±0,5	~~Tr/Th~~ T_r/T_d µs kV (open circuit test voltage) kV (open circuit test voltage)	IEC 61000-4-5	~~c~~ b, e, f	B
3.3	Fast transients	±~~2~~ 1 5/50 5 or 100	kV (open circuit test voltage) ~~Tr/Th~~ t_r/t_w ns Repetition frequency kHz	IEC 61000-4-4	c, d, h	B
DC ports which are not intended to be connected to a DC distribution network shall be tested as signal ports.						

[a] The test level can also be defined as the equivalent current into a 150 Ω load.

~~[b] Except for the ITU broadcast frequency band 47 MHz to 68 MHz, where the level shall be 3 V.~~

~~[c] Not applicable to input ports intended for connection to a battery or a rechargeable battery which must be removed or disconnected from the apparatus for recharging. Apparatus with a DC power input port intended for use with an AC–DC power adaptor shall be tested on the AC power input of the AC–DC power adaptor specified by the manufacturer or, where none is so specified, using a typical AC–DC power adaptor. DC ports, which are not intended to be connected to a DC distribution network are treated as signal ports.~~

~~[d] Not applicable to input ports intended for connection to a battery or a rechargeable battery which must be removed or disconnected from the apparatus for recharging. Apparatus with a DC power input port intended for use with an AC–DC power adaptor shall be tested on the AC power input of the AC–DC power adaptor specified by the manufacturer or, where none is so specified, using a typical AC–DC power adaptor. The test is applicable to DC power input ports intended to be connected permanently to cables longer than 3 m.~~

[b] Applicable only to ports interfacing with long distance lines; not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the equipment for recharging.

[c] Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the equipment for recharging.

[d] Equipment with a DC power input port intended for use with a dedicated AC–DC power adaptor shall be tested on the AC power input of the AC–DC power adaptor specified by the manufacturer (see the test level of Table 4). Where no adaptor is specified, the test shall be done on the DC power port using the test level of Table 4. Where an adaptor is specified, the test is applicable to DC power input ports only when intended to be connected permanently to cables longer than 3 m.

[e] For supply voltages where no test equipment is commercially available (e.g. CDNs), this test is not required.

[f] Equipment with a DC power input port intended for use with an AC–DC power adaptor shall be tested on the AC power input of the AC–DC power adaptor specified by the manufacturer or, where no adaptor is specified, the test shall be done on the DC power port using the test levels of this table.

[g] Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.

[h] The test may be performed at one or at both repetition frequencies. The use of 5 kHz repetition frequency is traditional; however, 100 kHz is closer to reality.

Table 4 – Immunity requirements – Input and output AC power ports

	Environmental phenomena	Test specifications		Units	Basic standards	Remarks	Performance criterion
4.1	Radio-frequency common mode	0,15 to 80 10 80		MHz V % AM (1 kHz)	IEC 61000-4-6	The test level specified is the r.m.s. value of the unmodulated carrier. [a] ~~, b~~	A
4.2	Voltage dips	0 1		% residual voltage cycle	IEC 61000-4-11 IEC 61000-4-34	Voltage shift at zero crossings. ~~c,~~ [b, e]	B [c]
		40 10/12 at 50/60 Hz	70 25/30 at 50/60 Hz	% residual voltage cycle			C [c]
4.3	Voltage interruptions	0 250/300 at 50/60 Hz		% residual voltage cycle	IEC 61000-4-11 IEC 61000-4-34	Voltage shift at zero crossings. ~~c,~~ [b, e]	C [c]
4.4	Surges line-to-earth line-to-line	1,2/50 (8/20) ±2 ±1		~~Tr/Th~~ T_r/T_d µs kV (open circuit test voltage) kV (open circuit test voltage)	IEC 61000-4-5	See Clause 5, paragraph 3 of this standard. [d]	B
4.5	Fast transients	±2 5/50 5 or 100		kV (open circuit test voltage) ~~Tr/Th~~ t_r/t_w ns Repetition frequency kHz	IEC 61000-4-4	[f]	B

[a] The test level can also be defined as the equivalent current into a 150 Ω load.

~~[b] Except for the ITU broadcast frequency band 47 MHz to 68 MHz, where the level shall be 3 V.~~

[b] Applicable only to input ports.

[c] For electronic power converters, the operation of protective devices (e.g. undervoltage protection) and the performance criterion C ~~is~~ are allowed.

[d] For supply voltages where no test equipment is commercially available (e.g. CDNs), this test is not required.

[e] The test shall be carried out at the frequencies appropriate to the power supply frequency. Equipment intended to be used in regions where only one of these frequencies is applied needs to be tested at this specific frequency only.

[f] The test may be performed at one or at both repetition frequencies. The use of 5 kHz repetition frequency is traditional; however, 100 kHz is closer to reality.

Annex A
(informative)

Guidance for product committees

According to IEC Guide 107 generic immunity standards specify a set of requirements, test procedures and generalized performance criteria applicable to such products or systems intended to be operated at locations having the respective electromagnetic environment. The normative part of this document defines a minimum set of immunity requirements for equipment operating at locations in industrial environments.

However, there are electromagnetic phenomena which are expected to occur or increase in the future which might be relevant for some products or product families or interference cases. EMC committees should provide advice and support to the product committees in setting of corresponding immunity levels.

The purpose of Annex A is to indicate tests which might be relevant for such future situations or for some products or product families. The product committees are requested to consider those tests and test levels given in Table A.1. As these tests are not formally referenced in this standard they are not needed for demonstrating compliance with this standard.

Table A.1 – Immunity tests and test levels to be considered in future or for particular product families

Electromagnetic phenomenon	Basic standard	Test levels according to basic standard	Remarks
Ring wave	IEC 61000-4-12	3	Should be considered for equipment which is likely exposed to oscillatory transients, induced in low-voltage cables due to the switching of electrical networks and reactive loads, faults and insulation breakdown of power supply circuits or lightning.
Harmonics/ interharmonics/ signalling	IEC 61000-4-13	3	Should be considered for equipment which contains phase-controls or other zero-crossing detection techniques.
Common mode conducted disturbances below 150 kHz	IEC 61000-4-16	3	Should be considered for equipment which is likely exposed to disturbances (for example in case of long cabling) typically generated by • the power distribution system, with its fundamental frequency, significant harmonics and interharmonics; • power electronic equipment (e.g. power convertors), which may inject disturbances into the ground conductors and earthing system (through stray capacitance or filters), or generate disturbances in signal and control lines by induction.
Slow damped oscillatory wave	IEC 61000-4-18	3	Should be considered for equipment in industrial plants being exposed to repetitive oscillatory transients generated by switching transients and the injection of impulsive currents in power systems (networks and electrical equipment).
Differential mode conducted disturbances below 150 kHz	IEC 61000-4-19	4	Should be considered for equipment sensitive to AC power supply disturbances in the frequency range 2 kHz to 150 kHz, generated for example by power line communication (PLC) systems or power electronic equipment.
Voltage dips, short interruptions and voltage variations on DC input power ports	IEC 61000-4-29	2	Should be considered for equipment sensitive to these phenomena.
Broadband disturbances	IEC 61000-4-31 [a]		Should be considered for equipment sensitive to AC power supply disturbances in the frequency range above 150 kHz, generated for example by broadband communication systems operating on mains.

[a] This basic standard is currently under development.

Bibliography

IEC TR 61000-1-6, *Electromagnetic compatibility (EMC) – Part 1-6: General – Guide to the assessment of measurement uncertainty*

IEC TR 61000-2-5:2011, *Electromagnetic compatibility (EMC) – Part 2-5: Environment – Description and classification of electromagnetic environments*

IEC 61000-4-1, *Electromagnetic compatibility (EMC) – Part 4-1: Testing and measurement techniques – Overview of IEC 61000-4 series*

IEC 61000-4-12, *Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement techniques – Ring wave immunity test*

IEC 61000-4-13, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*

IEC 61000-4-16, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted common mode disturbances in the frequency range 0 Hz to 150 kHz*

IEC 61000-4-18, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-4-19, *Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports*

~~IEC 61000-4-20, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*~~

IEC 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 61000-4-31[1], *Electromagnetic compatibility (EMC) – Part 4-31: Testing and measurement techniques – AC mains ports broadband conducted disturbance immunity test*

CISPR 11:2009, *Industrial, scientific and medical ~~(ISM) radio-frequency~~ equipment – ~~Electro-magnetic~~ Radio-frequency disturbance characteristics – Limits and methods of measurement*

IEC Guide 107, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*

[1] Under consideration.

IEC 61000-6-2

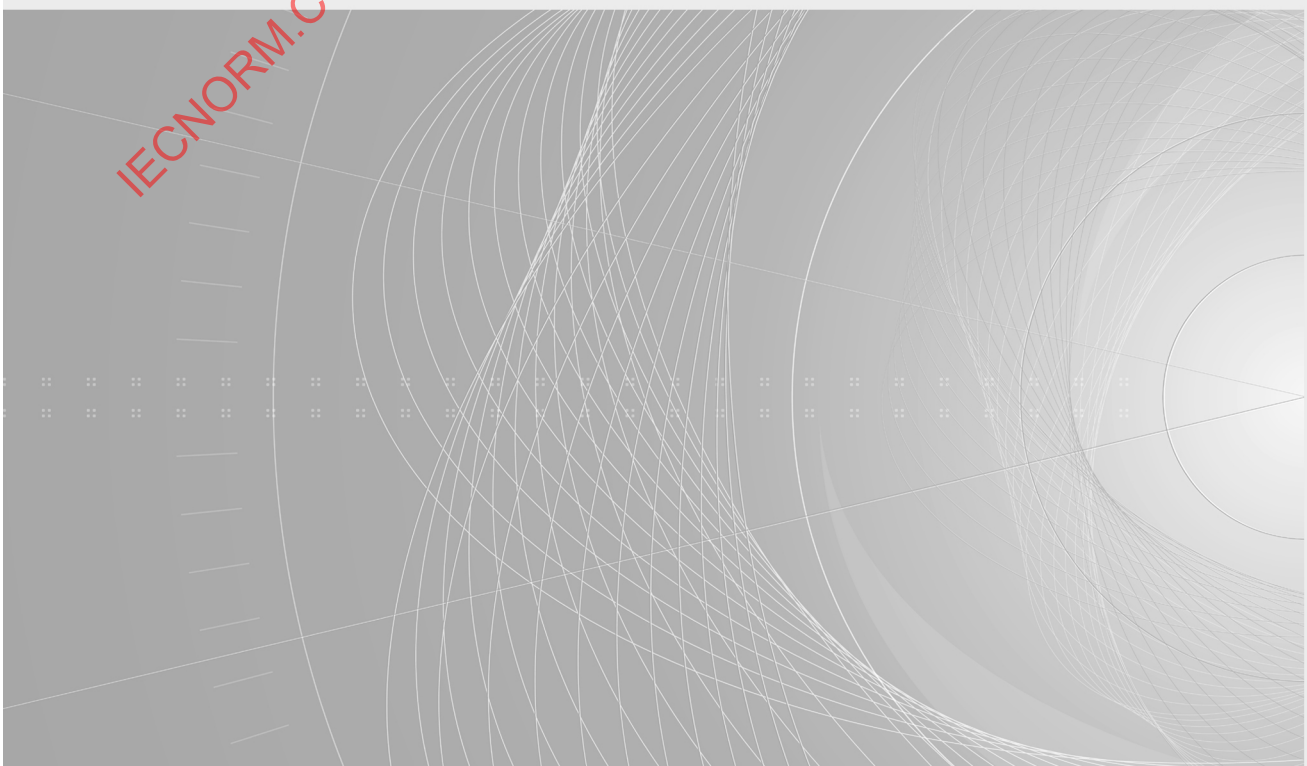
Edition 3.0 2016-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments

Compatibilité électromagnétique (CEM) – Partie 6-2: Normes génériques – Norme d'immunité pour les environnements industriels



IEC 61000-6-2:2016-08(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 6-2: Generic standards – Immunity standard for industrial environments

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61000-6-2 has been prepared by IEC technical committee 77: Electromagnetic compatibility.

This third edition cancels and replaces the second edition published in 2005. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) improvement of the environmental description;
b) extension of the frequency range for the radio-frequency electromagnetic field test according to IEC 61000-4-3;
c) amended test levels at particular frequencies for the radio-frequency electromagnetic field test according to IEC 61000-4-3;

d) change of the repetition frequency for the fast transients immunity test according to IEC 61000-4-4;

e) introduction of requirements according to IEC 61000-4-34;

f) revision of the test levels;

g) consideration of measurement uncertainty;

h) addition of Annex A.

The text of this standard is based on the following documents:

FDIS	Report on voting
77/521/FDIS	77/523/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61000 series, published under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

IEC 61000 is published in separate parts according to the following structure:

Part 1: General

General considerations (introduction, fundamental principles)

Definitions, terminology

Part 2: Environment

Description of the environment

Classification of the environment

Compatibility levels

Part 3: Limits

Emission limits

Immunity limits (insofar as these limits do not fall under the responsibility of the product committees)

Part 4: Testing and measurement techniques

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines

Installation guidelines

Mitigation methods and devices

Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into several parts, published either as International Standards or as Technical Specifications or Technical Reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and a second number identifying the subdivision (example: IEC 61000-6-1).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 6-2: Generic standards – Immunity standard for industrial environments

1 Scope

This part of IEC 61000 for EMC immunity requirements applies to electrical and electronic equipment intended for use in industrial locations, as described below. Immunity requirements in the frequency range 0 Hz to 400 GHz are covered. No tests need to be performed at frequencies where no requirements are specified.

This generic EMC immunity standard is applicable if no relevant dedicated product or product-family EMC immunity standard exists.

This standard applies to electrical and electronic equipment intended to be operated in industrial locations, as defined in 3.7, both indoor and outdoor.

This standard applies also to equipment intended to be directly connected to a DC distribution network or which is battery operated, and intended to be used in industrial locations.

This standard defines the immunity test requirements for equipment specified in the scope in relation to continuous and transient, conducted and radiated disturbances, including electrostatic discharges.

The immunity requirements have been selected to ensure an adequate level of immunity for equipment operating within industrial locations. The levels do not, however, cover extreme cases, which may occur at any location, but with an extremely low probability of occurrence. Not all disturbance phenomena have been included for testing purposes in this standard, but only those considered as relevant for the equipment covered by this standard. These test requirements represent essential electromagnetic compatibility immunity requirements. They are specified for each port considered.

NOTE 1 Information on other disturbance phenomena is given in IEC TR 61000-4-1.

NOTE 2 Safety considerations are not covered by this standard.

NOTE 3 In special cases, situations will arise where the level of disturbances may exceed the levels specified in this standard, for example where equipment is installed in proximity to industrial, scientific and medical equipment as defined in CISPR 11 or where a hand-held transmitter is used in close proximity to equipment. In these instances, special mitigation measures may have to be employed.

The industrial environment may be changed by special mitigation measures. Where such measures can be shown to produce an electromagnetic environment equivalent to the residential, commercial or light-industrial environment, then the generic standard for this environment, or the relevant product standard, may be applied.

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.

IEC 60050-161, *International Electrotechnical Vocabulary – Part 161: Electromagnetic compatibility* (available at: www.electropedia.org)

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
IEC 61000-4-3:2006/AMD1:2007
IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2013, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:2009, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

IEC 61000-4-11:2004, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

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IEC 61000-4-21:2011, *Electromagnetic compatibility (EMC) – Part 4-21: Testing and measurement techniques – Reverberation chamber test methods*

IEC 61000-4-22:2010, *Electromagnetic compatibility (EMC) – Part 4-22: Testing and measurement techniques – Radiated emissions and immunity measurements in fully anechoic rooms (FARs)*

IEC 61000-4-34:2005, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase*
IEC 61000-4-34:2005/AMD1:2009

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 as well as the following apply.

NOTE Additional definitions related to EMC and to relevant phenomena are given in other IEC and CISPR publications.

3.1
port
particular interface of the equipment which couples this equipment with or is influenced by the external electromagnetic environment

Note 1 to entry: Examples of ports of interest are shown in Figure 1. The enclosure port is the physical boundary of the equipment (e.g. enclosure). The enclosure port provides for radiated and electrostatic discharge (ESD) energy transfer, whereas the other ports provide for conducted energy transfer, either by direct injection or by induction.

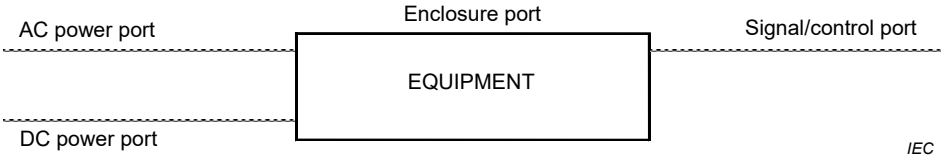

Figure 1 – Equipment ports

3.2
enclosure port
physical boundary of the equipment through which electromagnetic fields may radiate or on which they may impinge

3.3
signal/control port
port at which a conductor or cable intended to carry signals is connected to the equipment

EXAMPLE Analog inputs, outputs and control lines; data buses; communication lines, etc.

3.4
power port
port at which a conductor or cable, carrying the electrical input/output power needed for the operation (functioning), is connected to the equipment

3.5
long distance line
line connected to a signal/control port and which inside a building is longer than 30 m, or which leaves the building (including a line installed outdoors)

3.6
DC distribution network
local DC electricity supply network in the infrastructure of a certain site or building intended for flexible use by one or more different types of equipment and ensuring continuous power supply independently from the conditions of the public mains network

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

3.7
industrial location
location characterized by a separate power network, supplied from a high- or medium-voltage transformer, dedicated for the supply of the installation

EXAMPLE Metalworking, pulp and paper, chemical plants, car production, farm building, high-voltage areas of airports.

Note 1 to entry: Industrial locations can generally be described by the existence of an installation with one or more of the following characteristics:

– items of equipment installed and connected together and working simultaneously;
– significant amount of electrical power generated, transmitted and/or consumed;
– frequent switching of heavy inductive or capacitive loads;
– high currents and associated magnetic fields;
– presence of industrial, high power scientific and medical (ISM) equipment (for example, welding machines).

The electromagnetic environment at an industrial location is predominantly produced by the equipment and installation present at the location. There are types of industrial locations where some of the electromagnetic phenomena appear in a more severe degree than in other installations.

Note 2 to entry: The connection between location and electromagnetic environment is given in 3.8.

3.8
electromagnetic environment
totality of electromagnetic phenomena existing at a given location

Note 1 to entry: In general, the electromagnetic environment is time-dependent and its description may need a statistical approach.

Note 2 to entry: It is very important not to confuse the electromagnetic environment and the location itself.

[SOURCE: IEC 60050-161:1990, 161-01-01, modified – Note 2 to entry has been added.]

3.9
public mains network
electricity lines to which all categories of consumers have access and which are operated by an electrical power supply and/or distribution organization for the purpose of supplying electrical energy

4 Performance criteria

A functional description and a definition of specific performance criteria, during or as a consequence of immunity testing of equipment under test (EUT), shall be provided by the manufacturer and noted in the test report. They shall be consistent with one of the following general criteria for each test as specified in Table 1 to Table 4:

a) Performance criterion A: The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. If the performance level is not specified by the manufacturer, this may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

b) Performance criterion B: The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. However, during the test degradation of performance is allowed but no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, either of these may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.

c) Performance criterion C: Temporary loss of function is allowed during the test, provided the function is self-recoverable or can be restored by the operation of the controls.

If, as a result of the application of the tests defined in this standard, the EUT becomes dangerous or unsafe, it shall be deemed to have failed the test.

5 Conditions during testing

The equipment under test (EUT) shall be tested in the expected most susceptible operating mode, for example identified by performing limited pre-tests. This mode shall be consistent with normal applications. The configuration of the test sample shall be varied to achieve maximum susceptibility consistent with typical applications and installation practice. The configuration and mode of operation during the tests shall be precisely noted in the test report.

If the equipment is part of a system, or can be connected to auxiliary equipment, the equipment shall be tested while connected to the minimum representative configuration of auxiliary equipment necessary to exercise the ports. Auxiliary equipment may be simulated.

In cases where a manufacturer's specification requires external protection devices or measures which are clearly specified in the user's manual, the test requirements of this standard shall be applied with the external protection devices or measures in place.

If the equipment has a large number of similar ports or ports with many similar connections, a sufficient number shall be selected to simulate actual operating conditions and to ensure that all the different types of termination are covered. Justification for the selection of the tested ports shall be included in the test report.

The tests shall be carried out at one single set of parameters within the operating ranges of temperature, humidity and atmospheric pressure specified for the product and at the rated supply voltage, unless otherwise indicated in the basic standard.

6 Product documentation

If the manufacturer is using his own specification for an acceptable level of EMC performance or degradation of EMC performance during or after the testing required by this standard, this fact shall be stated in the user documentation. This specification itself shall be made available upon request.

7 Applicability

The application of tests for evaluation of immunity depends on the particular equipment, its configuration, its ports, its technology and its operating conditions.

Tests shall be applied to the relevant ports of the equipment according to Table 1 to Table 4. Tests shall only be carried out where the relevant ports exist.

It may be determined from consideration of the electrical characteristics and usage of a particular equipment that some of the tests are inappropriate and, therefore, unnecessary. In such a case, the decision and justification not to test shall be recorded in the test report.

8 Measurement uncertainty

Where guidance for the assessment of the instrumentation uncertainty of an immunity test is specified in IEC TR 61000-1-6 or in the corresponding basic standard, this should be followed.

9 Immunity test requirements

The immunity test requirements for equipment covered by this standard are given on a port by port basis and listed in Table 1 to Table 4.

Tests shall be conducted in a well-defined and reproducible manner.

The tests shall be carried out individually as single tests. The tests may be performed in any order. Identical units may be used for testing in parallel, and this information shall be recorded in the test report.

The description of the test, relevant generator, appropriate methods and the set-up to be used are given in basic standards, which are referred to in Table 1 to Table 4.

The contents of these basic standards are not repeated here, however modifications or additional information needed for the practical application of the tests are given in this standard.

Table 1 – Immunity requirements – Enclosure ports

	Environmental phenomena		Test specifications	Units	Basic standards	Remarks	Performance criterion
1.1	Power-frequency magnetic field		50, 60 30	Hz A/m	IEC 61000-4-8	Applicable only to equipment containing devices susceptible to magnetic fields. The test shall be carried out at the frequencies appropriate to the power supply frequency. Equipment intended for use in areas supplied only at one of these frequencies need only be tested at that frequency.	A
1.2	Radio-frequency electromagnetic field. Amplitude modulated		80 to 1 000 10 [d] 80	MHz V/m % AM (1 kHz)	IEC 61000-4-3 [a, b, c]	The test level specified is the r.m.s. value of the unmodulated carrier.	A
1.3	Radio-frequency electromagnetic field. Amplitude modulated		1,4 to 6,0 3 [d] 80	GHz V/m % AM (1 kHz)	IEC 61000-4-3 [a, b, c]	The test level specified is the r.m.s. value of the unmodulated carrier.	A
1.4	Electrostatic discharge	Contact discharge	±4 (charge voltage)	kV	IEC 61000-4-2	See the basic standard for applicability of contact and/or air discharge tests.	B
		Air discharge	±8 (charge voltage)	kV			B

[a] IEC 61000-4-20 may be used for small EUTs as defined in IEC 61000-4-20.

[b] A fully anechoic room (FAR) as described in IEC 61000-4-22 may also be used as a test site for radio-frequency immunity test.

[c] A reverberation chamber (RVC) as described in IEC 61000-4-21 may also be used. The forward power injected into a reverberation chamber P_{input} is given by the required test electric-field strength E_{test} as follows:

$$P_{input} = \left[\frac{E_{test}}{\left\langle \ddot{E} \right\rangle_{24or9} \times \sqrt{CLF(f)}} \right]^2$$

where $CLF(f)$ is the chamber loading factor (dimensionless) at frequency f, and $\left\langle \ddot{E} \right\rangle_{24or9}$ is the average of the normalized E-field (in (V/m)/W^{0,5}), obtained from the empty chamber validation (see Annexes B and D of IEC 61000-4-21:2011).

[d] For information regarding situations with a high concentration of mobile transmitters, see for example IEC TR 61000-2-5:2011, 9.3.

Table 2 – Immunity requirements – Signal/control ports

	Environmental phenomena	Test specifications	Units	Basic standards	Remarks	Performance criterion
2.1	Radio-frequency common mode	0,15 to 80 10 80	MHz V % AM (1 kHz)	IEC 61000-4-6	The test level specified is the r.m.s. value of the unmodulated carrier. [a, b]	A
2.2	Surges line-to-earth	1,2/50 (8/20) ±1	T_r/T_d µs kV (open circuit test voltage)	IEC 61000-4-5	[c, d, e]	B
2.3	Fast transients	±1 5/50 5 or 100	kV (open circuit test voltage) t_r/t_w ns Repetition frequency kHz	IEC 61000-4-4	Capacitive clamp used. [b, f]	B

[a] The test level can also be defined as the equivalent current into a 150 Ω load.

[b] Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.

[c] Applicable only to ports interfacing with long distance lines (see 3.5).

[d] Where normal functioning cannot be achieved because of the impact of the coupling/decoupling network (CDN) on the EUT, the test shall be done with the reduced functionality. A rationale shall be given in the test report for doing so. After the test and the removal of the CDN, the normal function shall not be affected.

[e] Signal ports directly connected to AC power network shall be treated as AC power ports.

[f] The test may be performed at one or at both repetition frequencies. The use of 5 kHz repetition frequency is traditional; however, 100 kHz is closer to reality.

Table 3 – Immunity requirements – Input and output DC power ports

	Environmental phenomena	Test specifications	Units	Basic standards	Remarks	Performance criterion
3.1	Radio-frequency common mode	0,15 to 80 10 80	MHz V % AM (1 kHz)	IEC 61000-4-6	The test level specified is the r.m.s. value of the unmodulated carrier. [a, g]	A
3.2	Surges line-to-earth line-to-line	1,2/50 (8/20) ±1 ±0,5	T_r/T_d µs kV (open circuit test voltage) kV (open circuit test voltage)	IEC 61000-4-5	[b, e, f]	B
3.3	Fast transients	±1 5/50 5 or 100	kV (open circuit test voltage) t_r/t_w ns Repetition frequency kHz	IEC 61000-4-4	[c, d, h]	B
DC ports which are not intended to be connected to a DC distribution network shall be tested as signal ports.						

[a] The test level can also be defined as the equivalent current into a 150 Ω load.

[b] Applicable only to ports interfacing with long distance lines; not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the equipment for recharging.

[c] Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the equipment for recharging.

[d] Equipment with a DC power input port intended for use with a dedicated AC–DC power adaptor shall be tested on the AC power input of the AC–DC power adaptor specified by the manufacturer (see the test level of Table 4). Where no adaptor is specified, the test shall be done on the DC power port using the test level of Table 4. Where an adaptor is specified, the test is applicable to DC power input ports only when intended to be connected permanently to cables longer than 3 m.

[e] For supply voltages where no test equipment is commercially available (e.g. CDNs), this test is not required.

[f] Equipment with a DC power input port intended for use with an AC–DC power adaptor shall be tested on the AC power input of the AC–DC power adaptor specified by the manufacturer or, where no adaptor is specified, the test shall be done on the DC power port using the test levels of this table.

[g] Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.

[h] The test may be performed at one or at both repetition frequencies. The use of 5 kHz repetition frequency is traditional; however, 100 kHz is closer to reality.

Table 4 – Immunity requirements – Input and output AC power ports

	Environmental phenomena	Test specifications		Units	Basic standards	Remarks	Performance criterion
4.1	Radio-frequency common mode	0,15 to 80 10 80		MHz V % AM (1 kHz)	IEC 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		% residual voltage cycle	IEC 61000-4-11 IEC 61000-4-34	Voltage shift at zero crossings. [b, e]	B [c]
		40 10/12 at 50/60 Hz	70 25/30 at 50/60 Hz	% residual voltage cycle			C [c]
4.3	Voltage interruptions	0 250/300 at 50/60 Hz		% residual voltage cycle	IEC 61000-4-11 IEC 61000-4-34	Voltage shift at zero crossings. [b, e]	C [c]
4.4	Surges line-to-earth line-to-line	1,2/50 (8/20) ±2 ±1		T_r/T_d µs kV (open circuit test voltage) kV (open circuit test voltage)	IEC 61000-4-5	See Clause 5, paragraph 3 of this standard. [d]	B
4.5	Fast transients	±2 5/50 5 or 100		kV (open circuit test voltage) t_r/t_w ns Repetition frequency kHz	IEC 61000-4-4	[f]	B

[a] The test level can also be defined as the equivalent current into a 150 Ω load.

[b] Applicable only to input ports.

[c] For electronic power converters, the operation of protective devices (e.g. undervoltage protection) and the performance criterion C are allowed.

[d] For supply voltages where no test equipment is commercially available (e.g. CDNs), this test is not required.

[e] The test shall be carried out at the frequencies appropriate to the power supply frequency. Equipment intended to be used in regions where only one of these frequencies is applied needs to be tested at this specific frequency only.

[f] The test may be performed at one or at both repetition frequencies. The use of 5 kHz repetition frequency is traditional; however, 100 kHz is closer to reality.

Annex A
(informative)

Guidance for product committees

According to IEC Guide 107 generic immunity standards specify a set of requirements, test procedures and generalized performance criteria applicable to such products or systems intended to be operated at locations having the respective electromagnetic environment. The normative part of this document defines a minimum set of immunity requirements for equipment operating at locations in industrial environments.

However, there are electromagnetic phenomena which are expected to occur or increase in the future which might be relevant for some products or product families or interference cases. EMC committees should provide advice and support to the product committees in setting of corresponding immunity levels.

The purpose of Annex A is to indicate tests which might be relevant for such future situations or for some products or product families. The product committees are requested to consider those tests and test levels given in Table A.1. As these tests are not formally referenced in this standard they are not needed for demonstrating compliance with this standard.

Table A.1 – Immunity tests and test levels to be considered in future or for particular product families

Electromagnetic phenomenon	Basic standard	Test levels according to basic standard	Remarks
Ring wave	IEC 61000-4-12	3	Should be considered for equipment which is likely exposed to oscillatory transients, induced in low-voltage cables due to the switching of electrical networks and reactive loads, faults and insulation breakdown of power supply circuits or lightning.
Harmonics/ interharmonics/ signalling	IEC 61000-4-13	3	Should be considered for equipment which contains phase-controls or other zero-crossing detection techniques.
Common mode conducted disturbances below 150 kHz	IEC 61000-4-16	3	Should be considered for equipment which is likely exposed to disturbances (for example in case of long cabling) typically generated by • the power distribution system, with its fundamental frequency, significant harmonics and interharmonics; • power electronic equipment (e.g. power convertors), which may inject disturbances into the ground conductors and earthing system (through stray capacitance or filters), or generate disturbances in signal and control lines by induction.
Slow damped oscillatory wave	IEC 61000-4-18	3	Should be considered for equipment in industrial plants being exposed to repetitive oscillatory transients generated by switching transients and the injection of impulsive currents in power systems (networks and electrical equipment).
Differential mode conducted disturbances below 150 kHz	IEC 61000-4-19	4	Should be considered for equipment sensitive to AC power supply disturbances in the frequency range 2 kHz to 150 kHz, generated for example by power line communication (PLC) systems or power electronic equipment.
Voltage dips, short interruptions and voltage variations on DC input power ports	IEC 61000-4-29	2	Should be considered for equipment sensitive to these phenomena.
Broadband disturbances	IEC 61000-4-31 [a]		Should be considered for equipment sensitive to AC power supply disturbances in the frequency range above 150 kHz, generated for example by broadband communication systems operating on mains.

[a] This basic standard is currently under development.

Bibliography

IEC TR 61000-1-6, *Electromagnetic compatibility (EMC) – Part 1-6: General – Guide to the assessment of measurement uncertainty*

IEC TR 61000-2-5:2011, *Electromagnetic compatibility (EMC) – Part 2-5: Environment – Description and classification of electromagnetic environments*

IEC 61000-4-1, *Electromagnetic compatibility (EMC) – Part 4-1: Testing and measurement techniques – Overview of IEC 61000-4 series*

IEC 61000-4-12, *Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement techniques – Ring wave immunity test*

IEC 61000-4-13, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests*

IEC 61000-4-16, *Electromagnetic compatibility (EMC) – Part 4-16: Testing and measurement techniques – Test for immunity to conducted common mode disturbances in the frequency range 0 Hz to 150 kHz*

IEC 61000-4-18, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-4-19, *Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports*

IEC 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 61000-4-31[1], *Electromagnetic compatibility (EMC) – Part 4-31: Testing and measurement techniques – AC mains ports broadband conducted disturbance immunity test*

CISPR 11:2009, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

IEC Guide 107, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*

[1] Under consideration.

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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COMPATIBILITÉ ÉLECTROMAGNÉTIQUE (CEM) –

Partie 6-2: Normes génériques – Norme d'immunité pour les environnements industriels

AVANT-PROPOS

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La Norme internationale IEC 61000-6-2 a été établie par le comité d'études 77 de l'IEC: Compatibilité électromagnétique.

Cette troisième édition annule et remplace la deuxième édition parue en 2005. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) amélioration de la description de l'environnement;
b) extension de la plage de fréquences pour l'essai aux champs électromagnétiques aux fréquences radioélectriques conformément à l'IEC 61000-4-3;

c) modification des niveaux d'essai à des fréquences particulières pour l'essai aux champs électromagnétiques aux fréquences radioélectriques conformément à l'IEC 61000-4-3;

d) modification de la fréquence de répétition pour l'essai d'immunité aux transitoires rapides, conformément à l'IEC 61000-4-4;

e) présentation des exigences conformément à l'IEC 61000-4-34;

f) révision des niveaux d'essai;

g) prise en compte de l'incertitude de mesure;

h) ajout de l'Annexe A.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
77/521/FDIS	77/523/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 61000, publiées sous le titre général *Compatibilité électromagnétique (CEM)*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

INTRODUCTION

L'IEC 61000 est publiée sous forme de plusieurs parties conformément à la structure suivante:

Partie 1: Généralités

Considérations générales (introduction, principes fondamentaux)

Définitions, terminologie

Partie 2: Environnement

Description de l'environnement

Classification de l'environnement

Niveaux de compatibilité

Partie 3: Limites

Limites d'émission

Limites d'immunité (dans la mesure où elles ne relèvent pas des comités de produits)

Partie 4: Techniques d'essai et de mesure

Techniques de mesure

Techniques d'essai

Partie 5: Guide d'installation et d'atténuation

Guide d'installation

Méthodes et dispositifs d'atténuation

Partie 6: Normes génériques

Partie 9: Divers

Chaque partie est à son tour subdivisée en plusieurs parties, publiées soit comme Normes internationales soit comme Spécifications techniques ou Rapports techniques, dont certaines ont déjà été publiées comme sections. D'autres seront publiées avec le numéro de partie, suivi d'un tiret et complété d'un second numéro identifiant la subdivision (exemple: IEC 61000-6-1).

COMPATIBILITÉ ÉLECTROMAGNÉTIQUE (CEM) –

Partie 6-2: Normes génériques – Norme d'immunité pour les environnements industriels

1 Domaine d'application

La présente partie de l'IEC 61000 concernant les exigences d'immunité en matière de compatibilité électromagnétique s'applique aux équipements électriques et électroniques destinés à être utilisés dans des sites industriels, tels qu'ils sont décrits ci-dessous. La présente partie couvre les exigences d'immunité dans la plage de fréquences de 0 Hz à 400 GHz. Il n'est pas nécessaire de réaliser des essais aux fréquences pour lesquelles aucune exigence n'est spécifiée.

Cette norme générique d'immunité CEM s'applique en l'absence de norme d'immunité CEM applicable, spécifique à un produit ou à une famille de produits.

La présente norme s'applique aux équipements électriques et électroniques destinés à être utilisés dans des sites industriels, comme défini en 3.7, à la fois à l'intérieur et à l'extérieur.

La présente norme s'applique également aux équipements destinés à être directement connectés à un réseau de distribution en courant continu ou alimentés par piles ou batteries et qui sont destinés à être utilisés dans des sites industriels.

La présente norme définit les exigences des essais d'immunité aux perturbations continues et transitoires, conduites et rayonnées, y compris aux décharges électrostatiques, pour les équipements spécifiés dans le domaine d'application.

Les exigences d'immunité ont été choisies pour assurer un niveau adéquat d'immunité pour les équipements utilisés dans des sites industriels. Ces niveaux ne couvrent cependant pas les cas extrêmes qui peuvent apparaître, mais avec une très faible probabilité, sur un site quelconque. La présente norme ne comporte pas, pour les besoins des essais, tous les phénomènes perturbateurs mais uniquement ceux qui sont considérés comme applicables aux équipements couverts par la norme. Ces exigences d'essai représentent les exigences essentielles de compatibilité électromagnétique concernant l'immunité. Elles sont spécifiées pour chaque accès considéré.

NOTE 1 Des informations sur d'autres phénomènes perturbateurs sont fournies dans l'IEC TR 61000-4-1.

NOTE 2 La présente norme ne traite pas des aspects de sécurité.

NOTE 3 Dans des cas spéciaux, des situations peuvent apparaitre dans lesquelles les niveaux de perturbation peuvent dépasser les niveaux d'essai spécifiés dans la présente norme, par exemple lorsqu'un équipement est installé à proximité d'équipements industriels, scientifiques et médicaux tel que défini dans la CISPR 11 ou lorsqu'un émetteur portatif est utilisé à proximité d'un équipement. Dans ces circonstances, des mesures particulières d'atténuation peuvent devoir être employées.

L'environnement industriel peut être modifié par des moyens spéciaux d'atténuation. Lorsqu'il peut être démontré que ces moyens produisent un environnement électromagnétique équivalent à l'environnement résidentiel, commercial ou à l'environnement pour l'industrie légère, la norme générique pour cet environnement ou la norme de produit applicable peut être appliquée.

2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le présent document et sont indispensables pour son application. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60050-161, *Vocabulaire Électrotechnique International – Partie 161: Compatibilité électromagnétique* (disponible sous: www.electropedia.org)

IEC 61000-4-2:2008, *Compatibilité électromagnétique (CEM) – Partie 4-2: Techniques d'essai et de mesure – Essai d'immunité aux décharges électrostatiques*

IEC 61000-4-3:2006, *Compatibilité électromagnétique (CEM) – Partie 4-3: Techniques d'essai et de mesure – Essai d'immunité aux champs électromagnétiques rayonnés aux fréquences radioélectriques*
IEC 61000-4-3:2006/AMD1:2007
IEC 61000-4-3:2006/AMD2:2010

IEC 61000-4-4:2012, *Compatibilité électromagnétique (CEM) – Partie 4-4: Techniques d'essai et de mesure – Essai d'immunité aux transitoires électriques rapides en salves*

IEC 61000-4-5:2014, *Compatibilité électromagnétique (CEM) – Partie 4-5: Techniques d'essai et de mesure –Essai d'immunité aux ondes de choc*

IEC 61000-4-6:2013, *Compatibilité électromagnétique (CEM) – Partie 4-6: Techniques d'essai et de mesure – Immunité aux perturbations conduites, induites par les champs radioélectriques*

IEC 61000-4-8:2009, *Compatibilité électromagnétique (CEM) – Partie 4-8: Techniques d'essai et de mesure – Essai d'immunité au champ magnétique à la fréquence du réseau*

IEC 61000-4-11:2004, *Compatibilité électromagnétique (CEM) – Partie 4-11: Techniques d'essai et de mesure – Essais d'immunité aux creux de tension, coupures brèves et variations de tension*

IEC 61000-4-20:2010, *Compatibilité électromagnétique (CEM) – Partie 4-20: Techniques d'essai et de mesure – Essais d'émission et d'immunité dans les guides d'onde TEM*

IEC 61000-4-21:2011, *Compatibilité électromagnétique (CEM) – Partie 4-21: Techniques d'essai et de mesure – Méthodes d'essai en chambre réverbérante*

IEC 61000-4-22:2010, *Compatibilité électromagnétique (CEM) – Partie 4-22: Techniques d'essai et de mesure – Mesures de l'immunité et des émissions rayonnées dans des enceintes complètement anéchoïques (FAR)*

IEC 61000-4-34:2005, *Compatibilité électromagnétique (CEM) – Partie 4-34: Techniques d'essai et de mesure – Essais d'immunité aux creux de tension, coupures brèves et variations de tension pour matériel ayant un courant d'alimentation de plus de 16 A par phase*
IEC 61000-4-34:2005/AMD1:2009

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions donnés dans l'IEC 60050-161, ainsi que les suivants, s'appliquent.

NOTE D'autres définitions relatives à la compatibilité électromagnétique (CEM) et aux phénomènes qui s'y rattachent figurent dans d'autres publications de l'IEC et du CISPR.

3.1
accès
interface particulière de l'équipement qui couple cet équipement avec ou qui est influencé par l'environnement électromagnétique externe

Note 1 à l'article: Des exemples d'accès présentant un intérêt sont représentés à la Figure 1. L'accès par l'enveloppe est la frontière physique de l'appareil (par exemple l'enveloppe). L'accès par l'enveloppe permet un transfert d'énergie rayonnée et de décharge électrostatique (DES), alors que les autres accès permettent un transfert de l'énergie conduite, soit par injection directe, soit par induction.

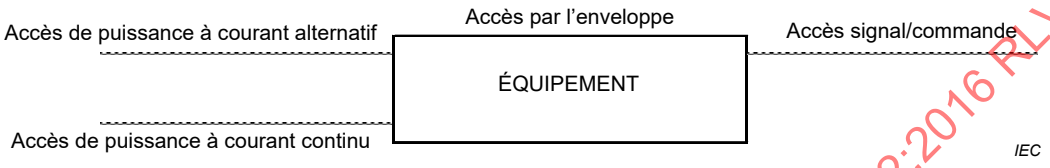

Figure 1 – Accès d'équipement

3.2
accès par l'enveloppe
frontière physique du matériel à travers laquelle des champs électromagnétiques peuvent rayonner ou à laquelle ils peuvent se heurter

3.3
accès signal/commande
accès auquel un conducteur ou un câble destiné à transporter des signaux est connecté à l'équipement

EXEMPLE Les entrées analogiques, sorties et lignes de commande, les bus de données et les réseaux de communication, etc.

3.4
accès par les bornes de puissance
point auquel un conducteur ou un câble transportant l'énergie électrique d'entrée/de sortie nécessaire au fonctionnement est connecté à l'équipement

3.5
ligne de grande longueur
ligne raccordée à un accès signal/commande et qui à l'intérieur d'un bâtiment est d'une longueur supérieure à 30 m, ou qui sort du bâtiment (y compris une ligne installée à l'extérieur)

3.6
réseau de distribution en courant continu
réseau d'alimentation électrique local en courant continu dans l'infrastructure d'un site ou d'un bâtiment donné destiné à une utilisation flexible par un ou plusieurs types d'équipements et assurant une alimentation continue indépendamment des conditions du réseau public d'alimentation

Note 1 à l'article: La connexion à une batterie locale distante n'est pas considérée comme un réseau de distribution en courant continu, si une telle liaison ne comprend que l'alimentation pour un seul équipement.

3.7
site industriel
site caractérisé par un réseau d'alimentation séparé, alimenté par un transformateur haute ou moyenne tension et dédié à l'alimentation de l'installation