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INTERNATIONAL STANDARD

colour inside

Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements

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ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – EMC REQUIREMENTS –

Part 1: General requirements

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 61326-1 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition, published in 2012. This edition constitutes a technical revision.

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

– the immunity test levels and performance criteria have been reviewed;
– requirements for portable test and measurement equipment have been clarified and amended;
– the description of the electromagnetic environments has been improved.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65A/975/FDIS	65A/985/RVD

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

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

In this document, the following print types are used:

- Terms used throughout this document which have been defined in Clause 3: SMALL CAPITALS

A list of all parts of the IEC 61326 series under the general title *Electrical equipment for measurement, control and laboratory use – EMC requirements*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document 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- withdrawn,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 document using a colour printer.

INTRODUCTION

Instruments and equipment within the scope of this document may often be geographically widespread and hence operate under a wide range of environmental conditions.

The limitation of undesired electromagnetic emissions ensures that no other equipment installed nearby is unduly influenced by the equipment under consideration. The limits are more or less specified by, and therefore taken from, IEC and International Special Committee on Radio Interference (CISPR) publications.

However, the equipment should function without undue degradation in an electromagnetic environment typical for the locations where it is intended to be operated. In this respect, the document specifies three different types of electromagnetic environment and the levels for immunity. More detailed information about issues related to electromagnetic environments are given in IEC TR 61000-2-5. Special risks, involving for example nearby or direct lightning strikes, circuit-breaking, or exceptionally high electromagnetic radiation in close proximity, are not covered.

Complex electric and/or electronic systems should require EMC planning in all phases of their design and installation, taking into consideration the electromagnetic environment, any special requirements, and the severity of failures.

This part of IEC 61326 specifies the EMC requirements that are generally applicable to all equipment within its scope. For certain types of equipment, these requirements will be supplemented or modified by the special requirements of one, or more than one, particular part IEC 61326-2 (all parts). These should be read in conjunction with the IEC 61326-1 requirements.

ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – EMC REQUIREMENTS –

Part 1: General requirements

1 Scope

This part of IEC 61326 specifies requirements for immunity and emissions regarding electromagnetic compatibility (EMC) for electrical equipment, operating from a supply or battery of less than 1 000 V AC or 1 500 V DC or from the circuit being measured. Equipment intended for professional, industrial-process, industrial-manufacturing and educational use is covered by this part. It includes equipment and computing devices for

– measurement and test;
– control;
– LABORATORY use;
– accessories intended for use with the above (such as sample handling equipment),

intended to be used in industrial and non-industrial locations.

Computing devices and assemblies and similar equipment within the scope of information technology equipment (ITE) and complying with applicable ITE EMC standards ~~may~~ can be used in systems within the scope of this part of IEC 61326 without additional testing, if they are suitable for the intended electromagnetic environment.

It is generally considered that this product family standard takes precedence over the corresponding generic EMC standards.

The following equipment is covered by this document.

a) Electrical measurement and test equipment

This is equipment which, by electrical means, measures, indicates or records one or more electrical or non-electrical quantities, also non-measuring equipment such as signal generators, measurement standards, power supplies and transducers.

b) Electrical control equipment

This is equipment which controls one or more output quantities to specific values, with each value determined by manual settings, by local or remote programming, or by one or more input variables. This includes industrial process measurement and control (IPMC) equipment, which consists of devices such as:

– process controllers and regulators;
– programmable controllers;
– power supply units for equipment and systems (centralized or dedicated);
– analogue/digital indicators and recorders;
– process instrumentation;
– transducers, positioners, intelligent actuators, etc.

~~c) Electrical laboratory equipment~~

~~This is equipment which measures, indicates monitors or analyses substances, or is used to prepare materials, and includes In Vitro Diagnostic (IVD) equipment. This equipment~~

~~may also be used in areas other than laboratories, for example self-test IVD equipment may be used in the home.~~

c) Electrical LABORATORY equipment, including In Vitro Diagnostic (IVD) medical equipment

This is equipment used to prepare or analyse materials, or measure, indicate or monitor physical quantities. This equipment might also be used in areas other than laboratories.

d) Equipment a), b) or c) as above when being equipped with components having radio functionality, for example for wireless communication.

Equipment within the scope of this document might be operated in different electromagnetic environments; depending on the electromagnetic environment different emission and immunity test requirements are applicable.

This document considers three types of electromagnetic environments:

- BASIC ELECTROMAGNETIC ENVIRONMENT;
- INDUSTRIAL ELECTROMAGNETIC ENVIRONMENT;
- CONTROLLED ELECTROMAGNETIC ENVIRONMENT.

Corresponding immunity test requirements are described in Clause 6.

In terms of emission requirements, equipment shall be classified in Class A or Class B equipment, as per the requirements and procedure of CISPR 11. The corresponding emission requirements are described in Clause 7.

The specified emission and immunity requirements aim at achieving electromagnetic compatibility between equipment covered in this document and other equipment that might operate at locations with electromagnetic environments considered in this document. Guidance for an assessment concerning the risk for achieving EMC is given in Annex B.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Part 161: Electromagnetic compatibility*
IEC 60050-161:1990/AMD1:1997
IEC 60050-161:1990/AMD2:1998
IEC 60050-161:1990/AMD3:2014
IEC 60050-161:1990/AMD4:2014
IEC 60050-161:1990/AMD5:2015
IEC 60050-161:1990/AMD6:2016
IEC 60050-161:1990/AMD7:2017
IEC 60050-161:1990/AMD8:2018
(available at <http://www.electropedia.org>)

IEC 61000-3-2:~~2005~~2018, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤16 A per phase)*
~~Amendment 1:2008~~
~~Amendment 2:2009~~

IEC 61000-3-3:~~2008~~2013, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection*
IEC 61000-3-3:2013/AMD1:2017

IEC 61000-3-11:~~2000~~2017, *Electromagnetic compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems –Equipment with rated current ≤75 A and subject to conditional connection*

IEC 61000-3-12:2011, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤75 A per phase*

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:~~2004~~2012, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*
~~Amendment 1:2010~~

IEC 61000-4-5:~~2005~~2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*
IEC 61000-4-5:2014/AMD1:2017

IEC 61000-4-6:~~2008~~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~~2020, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

CISPR 11:~~2009~~2015, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*
~~Amendment 1:2010~~
CISPR 11:2015/AMD1:2016
CISPR 11:2015/AMD2:2019

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
basic electromagnetic environment
environment existing at locations characterized by being supplied directly at low voltage from the public mains network

EXAMPLES

– residential properties, for example houses, apartments;

– retail outlets, for example shops, supermarkets;

– business premises, for example offices, banks;

– areas of public entertainment, for example cinemas, public bars, dance halls;

– outdoor locations, for example petrol stations, car parks, amusement and sports centres;

– light-industrial locations, for example workshops, laboratories, service centres.

3.1.2
class A equipment
equipment suitable for use in all ~~establishments~~ locations other than ~~domestic~~ those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes

[SOURCE: derived from CISPR 11:~~2009~~2015, 5.~~3~~2]

3.1.3
class B equipment
equipment suitable for use in ~~domestic establishments~~ locations in residential environments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes

[SOURCE: derived from CISPR 11:~~2009~~2015, 5.~~3~~2]

3.1.4
controlled electromagnetic environment
environment usually characterized by recognition and control of EMC threats by users of the equipment or by design of the installation

~~**3.5**~~
~~**d.c. distribution network**~~
~~local d.c. electricity supply network in the infrastructure of a certain site or building intended for connection to the d.c. power port of any type of equipment~~

3.1.5
enclosure port
physical boundary of equipment through which electromagnetic fields may radiate or impinge

3.1.6
functional performance
operational performance characteristics ~~specified by the manufacturer of the equipment,~~ defining the ability of equipment to achieve the intended functions

Note 1 to entry: Characteristics can be based on the related technical documentation.

3.1.7
industrial electromagnetic environment
environment existing at locations characterized by a separate power network, in most cases supplied from a high- or medium-voltage transformer, dedicated for the supply of installations feeding manufacturing or similar plants with one or more of the following conditions:

– frequent switching of heavy inductive or capacitive loads;

– high currents and associated magnetic fields;

– presence of Industrial, Scientific and Medical (ISM) equipment (for example, welding machines)

3.1.8
laboratory
test and measurement ~~area~~
area that is specifically used for analysis, testing and servicing and where equipment is operated by trained personnel

3.1.9
long-distance lines
lines within a building which are longer than 30 m, or which leave the building (including lines of outdoor installations)

3.1.10
port
any particular interface of the specific ~~device~~ equipment or system with the external electromagnetic environment

EXAMPLE See Figure 1 for an example of Equipment Under Test (EUT).

Note 1 to entry: I/O PORTS are input, output or bi-directional, measurement, control, or data PORTS.

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.

Note 3 to entry: Within this document, the protective earth PORT (if any) is considered as part of the POWER PORT.

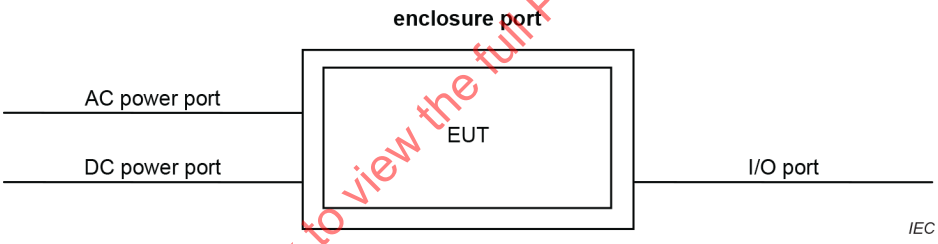

Figure 1 – Examples of ports

3.1.11
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

~~**3.12**~~
~~**portable (measuring) instrument**~~
~~measuring instrument designed to be easily carried by hand and to be connected and disconnected by the user~~

~~[SOURCE: IEC 60050-300:2001, 312-02-18]~~

3.1.12
portable test and measurement equipment
test and/or measuring equipment designed to be easily carried by hand and to be connected and disconnected by the user

3.1.13
type test
conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-151:2001, 151-16-16]

3.1.14
auxiliary equipment
equipment necessary to provide the equipment under test (EUT) with the signals required for normal operation and equipment to verify the performance of the EUT

3.1.15
performance level
specified operation of equipment under conditions of intended use

3.1.16
degradation (in performance)
an undesired departure in the operational performance of any device, equipment or system from its intended performance

Note 1 to entry: The term "degradation" can apply to temporary or permanent failure.

[SOURCE: IEC 60050-161:1990, 161-01-19]

3.1.17
loss of performance
operation of equipment outside a specified PERFORMANCE LEVEL

3.1.18
loss of function
operation of equipment with one (or more) of the equipment's function unusable

3.2 Abbreviations

AE	AUXILIARY EQUIPMENT
EMC	electromagnetic compatibility
ESD	electrostatic discharge
EUT	equipment under test
I/O	input/output
RF	radio frequency
UPS	uninterruptable power supply

4 General

Equipment and systems within the scope of this document can be subjected to various kinds of electromagnetic disturbances, ~~conducted by~~ sources of which include power, measurement or control lines or those radiated from the environment. The types and levels of disturbances depend on the particular conditions in which the systems, subsystems or equipment are installed and operated.

Equipment ~~and individual devices of a system~~ within the scope of this document can also be a source of electromagnetic disturbances over a wide frequency range. These disturbances can be conducted through power and signal lines, or be directly radiated, and can affect the performance of other equipment, or influence the external electromagnetic environment.

For emissions, the objective of the requirements given in this document is to ensure that the disturbances generated by the equipment and systems, when operated normally, do not exceed a level which could prevent other systems from operating as intended. The emission limits are considered in 7.2.

~~The manufacturer shall give information that emissions, which exceed the levels required by this standard, can occur when equipment is connected to a test object.~~

NOTE 1 Higher immunity levels~~, different number of tests and different performance criteria~~ than those specified can be necessary for particular applications (for example, when reliable operation of the equipment is essential for safety) or when the equipment is intended for use in harsher electromagnetic environments. Also, additional tests and different performance criteria can be necessary for particular applications.

NOTE 2 In special cases, for example when highly susceptible equipment is being used ~~in close proximity~~ near the EUT, additional mitigation measures ~~may~~ could have to be employed to reduce the influencing electromagnetic emission further below the specified limits.

~~NOTE 3~~ The manufacturer may select to perform all tests on either a single EUT or ~~more than one~~ divide the tests among multiple EUTs. If the latter, each test result shall be traceable to the EUT tested. The testing sequence is optional.

5 EMC test plan

5.1 General

An EMC test plan shall be established prior to testing. At a minimum, it shall contain~~, as a minimum,~~ the elements ~~given~~ defined in 5.2 to 5.5.

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

5.2 Configuration of EUT during testing

5.2.1 General

Measurement, control and LABORATORY equipment often consists of systems with no fixed configuration. The kind, number and installation of different subassemblies within the equipment may vary from system to system. Thus, it is reasonable, and also recommended, not to test every possible arrangement.

To realistically simulate EMC conditions (related both to emission and immunity), the equipment assembly shall represent a typical installation as specified by the manufacturer. Such tests shall be carried out as TYPE TESTS under normal conditions as specified by the manufacturer.

5.2.2 Composition of EUT

All ~~devices~~ equipment, racks, modules, boards, etc. significant to EMC and belonging to the EUT shall be documented. If relevant, the software version shall be documented.

5.2.3 Assembly of EUT

If an EUT has a variety of internal and external configurations, the TYPE TESTS shall be made with one or more typical configurations that represent normal use in the intended environment. All types of modules shall be tested at least once. The rationale for this selection shall be documented in the EMC test plan.

5.2.4 I/O PORTS

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.

~~If not otherwise specified in more specific parts of the IEC 61326 series, electrostatic discharges shall not be applied to inner pins of plug-in ports or cable connectors (but to connected connectors accessible during the intended use of the EUT).~~

5.2.5 AUXILIARY EQUIPMENT

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

5.2.6 Cabling and earthing (grounding)

The cables and earth (ground) shall be connected to the EUT in accordance with the manufacturer's specifications. There shall be no additional earth connections.

5.3 Operation conditions of EUT during testing

5.3.1 Operation modes

A selection of representative operation modes shall be made, taking into account that not all functions, but only the most typical functions of the electronic equipment can be tested. The estimated worst-case operating modes for normal application shall be selected.

5.3.2 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. The requirements of IEC 61000-4-2 for environmental conditions shall take precedence over those of the EUT specification (for example the humidity requirements for ESD).

5.3.3 EUT software during test

The software/firmware and its version used for ~~simulating the different modes of~~ the operation of the EUT shall be documented. This software shall represent the estimated worst-case operating mode for normal application.

5.4 Specification of FUNCTIONAL PERFORMANCE

For immunity tests, FUNCTIONAL PERFORMANCE for each operating mode and test shall be specified, where possible, as quantitative values, as well as for non-operational states such as 'standby' or 'battery charging', when an unintended change of state could occur through electromagnetic disturbances. If that is not possible, the FUNCTIONAL PERFORMANCE should be described in the test plan with supporting justification.

5.5 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 6.2 and 7.2. Additional information needed for the practical implementation of the tests is given in this document. The contents of the referenced standards need not be reproduced in the test plan. In some cases, the EMC test plan shall specify the application in detail.

NOTE Not all known disturbance phenomena have been specified for testing purposes in this document, but only those which are considered as most critical.

6 Immunity requirements

6.1 Conditions during the tests

The configuration of the EUT and the modes of operation used during the ~~tests~~ execution of each test shall be precisely noted in the test report.

Tests shall be applied to the relevant PORTS in accordance with Table 1, Table 2 or Table 3~~, as applicable~~.

~~The tests shall be conducted in accordance with the basic standards. The tests shall be carried out one at a time. If additional measures not described in the basic standards are required, these measures and their rationale shall be documented in the test report.~~

The tests shall be conducted in accordance with the basic standards listed in the relevant table for one phenomenon at a time. If additional test conditions or configurations not described in the basic standards are required, these conditions or configurations, and their rationale, shall be documented in the test report.

6.2 Immunity test requirements

Table 1 gives the immunity requirements for equipment intended to be used in a BASIC ELECTROMAGNETIC ENVIRONMENT.

Table 2 gives the immunity requirements for equipment intended to be used in an INDUSTRIAL ELECTROMAGNETIC ENVIRONMENT.

Table 3 gives the immunity requirements for equipment intended to be used in a CONTROLLED ELECTROMAGNETIC ENVIRONMENT.

Annex A gives the immunity requirements for PORTABLE TEST AND MEASUREMENT EQUIPMENT that is powered by battery or from the circuit being measured.

The performance criteria A, B, and C that are mentioned in the following tables are described in 6.4.

Table 1 – Immunity test requirements for equipment intended to be used in a BASIC ELECTROMAGNETIC ENVIRONMENT

Port	Phenomenon	Basic standard	Test value	Performance criterion
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact discharge 8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	3 V/m (80 MHz to 1 GHz) 3 V/m (1,4 GHz to 2 GHz) 1 V/m (2,0 GHz to 2,7 GHz)	A A A
	Power frequency magnetic field	IEC 61000-4-8	3 A/m (50 Hz, 60 Hz) [f]	A
AC power (including protective earth)	Voltage dip	IEC 61000-4-11	0 % during half cycle 0 % during 1 cycle 70 % during 25/30[e] cycles	B B C
	Short interruptions	IEC 61000-4-11	0 % during 250/300[e] cycles	C
	Burst	IEC 61000-4-4	1 kV (5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	0,5 kV[a]/1 kV[b]	B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A
DC power[d, g] (including protective earth)	Burst	IEC 61000-4-4	1 kV(5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	0,5 kV[a]/1 kV[b]	B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A
I/O signal/control (including functional earth)	Burst	IEC 61000-4-4	0,5 kV[d](5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	1 kV[b, c]	B
	Conducted RF	IEC 61000-4-6	3 V[d] (150 kHz to 80 MHz)	A
I/O signal/control connected directly to mains supply	Burst	IEC 61000-4-4	1 kV(5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	0,5 kV[a]/1 kV[b]	B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A

[a] Line to line.

[b] Line to ground.

[c] Only in the case of long distance lines (see 3.10).

[d] Only in the case of lines >3 m.

[e] For example "25/30 cycles" means "25 cycles for 50 Hz test" or "30 cycles for 60 Hz test".

[f] Only to magnetically sensitive equipment. CRT display interference is allowed above 1 A/m.

[g] DC connections between parts of equipment/system which are not connected to a d.c. distribution network are treated as I/O signal/control ports.

PORT	Phenomenon	Basic standard	Test value	Perform-ance criterion
ENCLOSURE	ESD	IEC 61000-4-2	±4 kV contact discharge ±8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	3 V/m (80 MHz to 1 GHz; 1,4 GHz to 6 GHz) [a]	A
	Power frequency magnetic field [b]	IEC 61000-4-8	3 A/m (50 Hz, 60 Hz)	A
AC power (including protective earth)	Burst	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±0,5 kV line-to-line ±1 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A
	Voltage dip	IEC 61000-4-11	0 % during half cycle 0 % during 1 cycle 70 % during 25/30 cycles [c]	B B C
	Short interruptions	IEC 61000-4-11	0 % during 250/300 cycles [c]	C
DC power [d, e] (including protective earth)	Burst	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±0,5 kV line-to-line ±1 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A
I/O signal/control [e] (including functional earth)	Burst [d]	IEC 61000-4-4	±0,5 kV (5 kHz or 100 kHz)	B
	Surge [f]	IEC 61000-4-5	±1 kV line-to-ground	B
	Conducted RF [d]	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A
I/O signal/control [e] connected directly to mains supply	Burst [d]	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge [f]	IEC 61000-4-5	±0,5 kV line-to-line ±1 kV line-to-ground	B B
	Conducted RF [d]	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A

[a] In case testing is performed also in the frequency range from 1 GHz to 1,4 GHz, the same test level is recommended.

[b] Only to magnetically sensitive equipment.

[c] For example, "25/30 cycles" means "25 cycles for 50 Hz test" or "30 cycles for 60 Hz test".

[d] Only in the case of lines >3 m.

[e] DC POWER PORTS intended to be connected to a low voltage DC supply (≤ 60 V), where secondary circuits (isolated from the AC mains supply) are not subject to transient overvoltages (i.e. reliably-grounded, capacitively-filtered DC secondary circuits) shall be regarded as I/O signal/control PORTS.

[f] Only in the case of LONG-DISTANCE LINES.

Table 2 – Immunity test requirements for equipment intended to be used in an INDUSTRIAL ELECTROMAGNETIC ENVIRONMENT

Port	Phenomenon	Basic standard	Test value	Perform-ance criterion
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact discharge 8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	10 V/m (80 MHz to 1 GHz) 3 V/m (1,4 GHz to 2 GHz) 1 V/m (2,0 GHz to 2,7 GHz)	A A A
	Power frequency magnetic field	IEC 61000-4-8	30 A/m (50 Hz, 60 Hz) [e]	A
AC power (including protective earth)	Voltage dip	IEC 61000-4-11	0 % during 1 cycle 40 % during 10/12 [g] cycles 70 % during 25/30 [g] cycles	B C C
	Short interruptions	IEC 61000-4-11	0 % during 250/300 [g] cycles	C
	Burst	IEC 61000-4-4	2 kV(5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	1 kV [a] /2 kV [b]	B
	Conducted RF	IEC 61000-4-6	3 V [f] (150 kHz to 80 MHz)	A
DC power [f] (including protective earth)	Burst	IEC 61000-4-4	2 kV (5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	1 kV [a] /2 kV [b]	B
	Conducted RF	IEC 61000-4-6	3 V [f] (150 kHz to 80 MHz)	A
I/O signal/ control (including functional earth)	Burst	IEC 61000-4-4	1 kV (5/50 ns, 5 kHz) [d]	B
	Surge	IEC 61000-4-5	1 kV [b, c]	B
	Conducted RF	IEC 61000-4-6	3 V [d, f] (150 kHz to 80 MHz)	A
I/O signal/ control connected directly to mains supply	Burst	IEC 61000-4-4	2 kV (5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	1 kV [a] /2 kV [b]	B
	Conducted RF	IEC 61000-4-6	3 V [f] (150 kHz to 80 MHz)	A

[a] Line to line.

[b] Line to ground.

[c] Only in the case of long-distance lines (see 3.10).

[d] Only in the case of lines > 3 m.

[e] Only to magnetically sensitive equipment. CRT display interference is allowed above 1 A/m.

[f] DC connections between parts of equipment/system which are not connected to a d.c. distribution network are treated as I/O signal/control ports.

[g] For example "25/30 cycles" means "25 cycles for 50 Hz test" or "30 cycles for 60 Hz test".

PORT	Phenomenon	Basic standard	Test value	Perform-ance criterion
ENCLOSURE	ESD	IEC 61000-4-2	±4 kV contact discharge ±8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	10 V/m (80 MHz to 1 GHz) 3 V/m (1,4 GHz to 6 GHz) [a]	A A
	Power frequency magnetic field [b]	IEC 61000-4-8	30 A/m (50 Hz, 60 Hz)	A
AC power (including protective earth)	Burst	IEC 61000-4-4	±2 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±1 kV line-to-line ±2 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz), see NOTE	A
	Voltage dip	IEC 61000-4-11	0 % during 1 cycle 40 % during 10/12 cycles [c] 70 % during 25/30 cycles [c]	B C C
	Short interruptions	IEC 61000-4-11	0 % during 250/300 cycles [c]	C
DC power [d, e] (including protective earth)	Burst	IEC 61000-4-4	±2 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±1 kV line-to-line ±2 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz) see NOTE	A
I/O signal/control [e] (including functional earth)	Burst [d]	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge [f]	IEC 61000-4-5	±1 kV line-to-ground	B
	Conducted RF [d]	IEC 61000-4-6	3 V (150 kHz to 80 MHz) see NOTE	A
I/O signal/control [e] (connected directly to mains supply)	Burst [d]	IEC 61000-4-4	±2 kV (5 kHz or 100 kHz)	B
	Surge [f]	IEC 61000-4-5	±1 kV line-to-line ±2 kV line-to-ground	B B
	Conducted RF [d]	IEC 61000-4-6	3 V (150 kHz to 80 MHz) see NOTE	A

NOTE Equipment considered in this table is typically used in industrial installations with the cabling arranged on metallic structures. This reduces coupling of electromagnetic fields into cables and hence justifies a lower immunity level compared to that given in the generic immunity standard IEC 61000-6-2. The level of 3 V is used for more than 15 years without immunity issues and hence proved to be sufficient.

[a] In case testing is performed also in the frequency range from 1 GHz to 1,4 GHz, the same test level as above 1,4 GHz is recommended.

[b] Only to magnetically sensitive equipment.

[c] For example, “25/30 cycles" means "25 cycles for 50 Hz test" or "30 cycles for 60 Hz test”.

[d] Only in the case of lines > 3 m.

[e] DC power PORTS intended to be connected to a low voltage DC supply (≤ 60 V), where secondary circuits (isolated from the AC mains supply) are not subject to transient overvoltages (i.e. reliably-grounded, capacitively-filtered DC secondary circuits) shall be regarded as I/O signal/control PORTS.

[f] Only in the case of LONG-DISTANCE LINES.

Table 3 – Immunity test requirements for equipment intended to be used in a CONTROLLED ELECTROMAGNETIC ENVIRONMENT

Port	Phenomenon	Basic standard	Test value	Performance criterion
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact discharge 8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	1 V/m (80 MHz to 1 GHz) 1 V/m (1,4 GHz to 2 GHz) 1 V/m (2,0 GHz to 2,7 GHz)	A A A
AC power (including protective earth)	Voltage dip	IEC 61000-4-11	0 % during half cycle	B
	Burst	IEC 61000-4-4	1 kV (5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	0,5 kV[a]/1 kV[b]	B
	Conducted RF	IEC 61000-4-6	1 V (150 kHz to 80 MHz)	A
DC power[c, d] (including protective earth)	Burst	IEC 61000-4-4	1 kV (5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	Not required	-
	Conducted RF	IEC 61000-4-6	1 V (150 kHz to 80 MHz)	A
I/O signal/ control (including functional earth)	Burst	IEC 61000-4-4	0,5 kV[c] (5/50 ns, 5 kHz)	B
	Surge	IEC 61000-4-5	Not required	-
	Conducted RF	IEC 61000-4-6	1 V[c] (150 kHz to 80 MHz)	A

[a] Line to line.

[b] Line to ground.

[c] Only in the case of lines >3 m.

[d] DC connections between parts of equipment/system which are not connected to a d.c. distribution network are treated as I/O signal/control ports.

PORT	Phenomenon	Basic standard	Test value	Perform-ance criterion
ENCLOSURE	ESD	IEC 61000-4-2	±4 kV contact discharge ±8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	1 V/m (80 MHz to 1 GHz; 1,4 GHz to 6 GHz) [a]	A
AC power (including protective earth)	Burst	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±0,5 kV line-to-line ±1 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	1 V (150 kHz to 80 MHz)	A
DC power [b, c] (including protective earth)	Burst	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Conducted RF	IEC 61000-4-6	1 V (150 kHz to 80 MHz)	A
I/O signal/control [c] (including functional earth)	Burst [b]	IEC 61000-4-4	±0,5 kV (5 kHz or 100 kHz)	B
	Conducted RF [b]	IEC 61000-4-6	1 V (150 kHz to 80 MHz)	A

[a] In case testing is performed also in the frequency range from 1 GHz to 1,4 GHz, the same test level is recommended.

[b] Only in the case of lines > 3 m.

[c] DC power PORTS intended to be connected to a low voltage DC supply (≤ 60 V), where secondary circuits (isolated from the AC mains supply) are not subject to transient overvoltages (i.e. reliably-grounded, capacitively-filtered DC secondary circuits) shall be regarded as I/O signal/control PORTS.

~~The manufacturer shall state that equipment fulfilling the requirements in Table 3 is designed to operate in a controlled electromagnetic environment, i.e. where RF transmitters such as mobile telephones may not be used in close proximity.~~

NOTE In general, analysis, test and service laboratories have CONTROLLED ~~EM~~ ELECTROMAGNETIC ENVIRONMENTS, and personnel in these areas are usually trained to ~~be able to~~ interpret results. Such environments ~~normally~~ typically contain equipment which requires protection by devices ~~like Uninterruptible Power Supplies (~~ such as UPS~~)~~, filters, or surge suppressers. Hence, the test values shown in Table 3 are relaxed from those in Table 1.

6.3 Random aspects

The duration of each test and/or the number of tests shall be sufficient to ensure that the performance criterion is met consistently. Due care shall be taken to avoid a false test pass due to random effects, for example, due to a timing relationship between the test stimulus and the operation of the EUT.

NOTE This is of particular concern for EUTs with functionality that can be defined or controlled by software or firmware.

For instance, in the case of electrostatic discharge testing of ~~a~~ digital ~~device~~ equipment, the EUT should be exposed to at least 10 discharges at each polarity, test point and test level to exclude random effects. In case of burst testing, it may be advisable to extend the testing time to more than 1 minute.

6.4 Performance criteria

6.4.1 General

The general principles (performance criteria) for the evaluation of the immunity test results are the following. Permissible LOSSES OF PERFORMANCE are allowed only if specified in the test plan before testing, and clearly provided to the user in the product specification. If the PERFORMANCE LEVEL or the permissible LOSS OF PERFORMANCE is not specified, either of these may be derived from the product specification or user documentation and what the user may reasonably expect from the equipment if used as intended.

6.4.2 Performance criterion A

~~The equipment 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 equipment 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 may be derived from the product description and documentation and what the user may reasonably expect from the equipment if used as intended.~~

The equipment 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 in the user documentation, when the equipment is used as intended. In the case of applying immunity tests with continuous electromagnetic phenomena, the PERFORMANCE LEVEL may be replaced by a permissible LOSS OF PERFORMANCE which shall recover, without user intervention. A permissible LOSS OF PERFORMANCE is allowed within the PERFORMANCE LEVEL only when this information is clearly provided to the end user via documentation, such as the product user manual. No change in the operating state is allowed nor is loss of data.

6.4.3 Performance criterion B

~~The equipment 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 equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. 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.~~

~~EXAMPLE 1 A data transfer is controlled/checked by parity check or by other means. In the case of malfunctioning, such as caused by a lightning strike, the data transfer will be repeated automatically. The reduced data transfer rate at this time is acceptable.~~

~~EXAMPLE 2 During testing, an analogue function value may deviate. After the test, the deviation vanishes.~~

~~EXAMPLE 3 In the case of a monitor used only for man-machine monitoring, it is acceptable that some degradation takes place for a short time, such as flashes during the burst application.~~

~~EXAMPLE 4 An intended change of the operating state is allowed if self-recoverable.~~

The equipment shall continue to operate as intended after the test. No DEGRADATION OF PERFORMANCE or LOSS OF FUNCTION is allowed below a PERFORMANCE LEVEL specified in the user documentation, when the equipment is used as intended. During the test, the equipment PERFORMANCE LEVEL may be replaced by a permissible LOSS OF PERFORMANCE if such LOSS OF PERFORMANCE is detailed in the EMC test plan. A permissible LOSS OF PERFORMANCE is allowed within the PERFORMANCE LEVEL only when this information is clearly provided to the end user via documentation, such as the product user manual. An unintended change of the operating state is allowed if self-recoverable. No loss of stored data is allowed.

The following are examples of performance criterion B:

- Data transfer is controlled or checked by parity check or by other means. In the case of malfunction, such as caused by a surge impulse, the data transfer will be repeated automatically. A reduced data transfer rate at this time is allowable degradation.
- During testing, an analogue function value may deviate in excess of the specified limits. After the test, the deviation vanishes.
- In the case of a monitor used only for man-machine monitoring, it is allowable that some degradation takes place, such as momentary display interference during the application of burst impulses.

6.4.4 Performance criterion C

~~Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.~~

~~EXAMPLE 1 In the case of an interruption in the mains longer than the specified buffer time, the power supply unit of the equipment is switched off. The switch-on may be automatic or carried out by the operator.~~

~~EXAMPLE 2 After a programme interruption caused by a disturbance, the processor functions of the equipment stops at a defined position and is not left in a "crashed state". The operator's decision prompts may be necessary.~~

~~EXAMPLE 3 The test results in an opening of an over-current protection device that is replaced or reset by the operator.~~

LOSS OF FUNCTION is allowed, provided the function is self-recoverable or can be restored by the operation of the controls. Recovery procedure shall be included in the user documentation. No permanent damage to the equipment is allowed.

The following are examples of performance criterion C:

- In the case of an interruption in the mains longer than the specified buffer time, the power supply unit of the equipment is switched off. The switch-on may be automatic or carried out by the operator.
- After a programme interruption caused by a disturbance, the processor functions of the equipment stops at a defined position and is not left in a "crashed state". An operator's action may be necessary.
- The test results in an opening of an over-current protection equipment that can be reset by the operator.

7 Emission requirements

7.1 Conditions during measurements

The measurements shall be made in the operating mode in accordance with the EMC test plan (see Clause 5).

The description of the tests, the test methods, and the test set-ups are given in the reference standards as stated in 7.2. The contents of the reference standards are not reproduced here; however, modifications or additional information needed for the practical implementation of application of the tests may be given in the ~~different~~ other parts of IEC 61326 (all parts).

7.2 Emission limits

The equipment shall be classified, and respective information shall be provided ~~per~~ for the applicable group and class as specified in CISPR 11:~~2009~~2015/AMD1:2016/AMD2:2019, Clause 5. Equipment classification and choice of respective limits shall be determined after taking into account the intended environment and emission requirement in the areas of use.

Annex H ('Statistical assessment of series produced equipment against the requirements of CISPR standards') of CISPR 11:2015 does not apply.

~~For Class A equipment, the limits, the measuring methods and the provisions given in CISPR 11 apply.~~

~~For Class B equipment, the limits, the measuring methods and the provisions given in CISPR 11, IEC 61000-3-2 (or IEC 61000-3-12) and IEC 61000-3-3 (or IEC 61000-3-11) apply.~~

~~For equipment using frequencies in the ISM bands, see CISPR 11.~~

For Group 1 CLASS A EQUIPMENT, the limits, the measuring methods and the provisions given in CISPR 11:2015/AMD1:2016/AMD2:2019 Subclause 6.2 apply. For Group 2 CLASS A EQUIPMENT, the limits, the measuring methods and the provisions given in CISPR 11:2015/AMD1:2016/AMD 2:2019, Subclause 6.3 apply.

For Group 1 CLASS B EQUIPMENT, the limits, the measuring methods and the provisions given in CISPR 11:2015/AMD1:2016/AMD2:2019 Subclause 6.2 apply. For Group 2 CLASS B EQUIPMENT, the limits, the measuring methods and the provisions given in CISPR 11:2015/AMD1:2016/AMD2:2019 Subclause 6.3 apply. In addition, for CLASS B EQUIPMENT with input current up to 16 A, IEC 61000-3-2 and IEC 61000-3-3 apply. For higher input currents up to 75 A per phase, IEC 61000-3-12 and IEC 61000-3-11 apply.

8 Test results and 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:

– EUT description (plus EUT identifier);
– test facility name and location;
– EMC test plan;
– test requirements, i.e. which type of electromagnetic environment is considered;
– performance criteria;
– test data and results;
– if applicable, characteristics of equipment operation deviation from FUNCTIONAL PERFORMANCE encountered during testing;
– modifications to the EUT (if any);
– test equipment and test set-up.

9 Instructions for use

The manufacturer shall indicate the electromagnetic environment for which the EUT is intended to be used and the standard(s) that was/were applied.

~~If the manufacturer has specified a minimum performance level or any permissible performance loss (as allowed in 6.4), valid under the electromagnetic immunity conditions (see 6.2), then the related performance level shall be described in the instructions for use.~~

The manufacturer shall give information that emissions, which exceed the levels required by this document, can occur when the EUT is connected to a test object.

If a PERFORMANCE LEVEL or any permissible performance loss (as allowed in 6.4) is valid under the electromagnetic immunity conditions (see 6.2), then this level shall be described in the user documentation.

Annex A
(normative)

Immunity test requirements for PORTABLE TEST AND MEASUREMENT EQUIPMENT powered by battery or from the circuit being measured

Equipment covered within this annex is PORTABLE TEST AND MEASUREMENT EQUIPMENT that is powered by battery or from the circuit being measured. Equipment that can be operated while charging is excluded from this annex.

NOTE 1 Test and measurement ~~instruments~~ equipment within the scope of this annex can be used in a wide range of locations, but by personnel capable of interpreting the results obtained. If these instruments are connected to a mains supply, it is normally only by their test or measurement leads and only for a short duration of the test. Hence, the number of electromagnetic phenomena shown in Table A.1 is reduced in relation to Table 1.

NOTE 2 Examples for equipment included in the scope of this annex but not limited to, are: equipment covered by ~~the scope~~ other parts of IEC 61326~~-2-2,~~ (all parts), such as digital multi-meters, stand alone current clamps, LABORATORY equipment, programmers, on-site calibration units. Such equipment is intended to be operated by skilled personal and for a short duration of measuring time only.

NOTE 3 Examples for equipment excluded from the scope of this annex are: monitoring equipment, control equipment, energy meters, power meters, power analyzers, power quality instruments, oscilloscopes. Such equipment is typically operated over a longer duration of measuring time.

NOTE 4 If RF transmitters are used in close proximity, they ~~may~~ could disturb equipment within the scope of this document.

Table A.1 – Immunity test requirements for PORTABLE TEST AND MEASUREMENT EQUIPMENT

~~Port~~	~~Phenomenon~~	~~Basic standard~~	~~Test value~~	~~Performance criterion~~
~~Enclosure~~	~~Electrostatic discharge (ESD)~~	~~IEC 61000-4-2~~	~~4 kV contact discharge~~ ~~8 kV air discharge~~	~~B~~ ~~B~~
	~~Electromagnetic field~~	~~IEC 61000-4-3~~	~~3 V/m (80 MHz to 1 GHz)~~ ~~3 V/m (1,4 GHz to 2 GHz)~~ ~~1 V/m (2,0 GHz to 2,7 GHz)~~	~~A~~ ~~A~~ ~~A~~
	~~Power-frequency magnetic field [a]~~	~~IEC 61000-4-8~~	~~3 A/m at 50 Hz, 60 Hz [b]~~	~~A~~
~~[a] Only to magnetically sensitive equipment. CRT display interference is allowed above 1 A/m.~~ ~~[b] 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~~				

PORT	Phenomenon	Basic standard	Test value	Performance criterion
ENCLOSURE	ESD	IEC 61000-4-2	±4 kV contact discharge ±8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	3 V/m (80 MHz to 1 GHz) 3 V/m (1,4 GHz to 2 GHz) [a] 1 V/m (2,0 GHz to 6 GHz)	A A A
	Power frequency magnetic field [b]	IEC 61000-4-8	3 A/m (50 Hz, 60 Hz) [c]	A
[a] In case testing is performed also in the frequency range from 1 GHz to 1,4 GHz, the same test level as in the frequency range 1,4 GHz to 2 GHz is recommended. [b] Only to magnetically sensitive equipment. [c] The test shall be carried out at the frequencies appropriate to mains supply. Equipment intended for use in areas supplied only at one of these frequencies need only be tested at that frequency.				

A battery charger used by the products within the scope of this annex shall be tested according to the requirements given in one of the Table 1, Table 2 or Table 3 depending on the intended electromagnetic environment.

Annex B
(informative)

Guide for analysis and assessment for electromagnetic compatibility

B.1 General

This document follows the approach given in IEC Guide 107 by means of giving EMC requirements for the product families described in Clause 1. In this respect, it specifies requirements for the emissions caused by equipment and for the immunity to be achieved by equipment. However, when operating equipment in the scope of this document at actual installations, there might be a risk that the specified requirements do not ensure a sufficient degree of electromagnetic compatibility.

NOTE 1 Definitions used in the area of EMC, such as electromagnetic compatibility, emissions, immunity, are explained in IEC Guide 107.

NOTE 2 The term risk as used in this annex is not meant in the sense of ISO/IEC Guide 51, i.e. in the context of harms (physical injury or damage to the health of people, or damage to property or the environment). Here it is limited to the risk of possibly not achieving the state of electromagnetic compatibility.

B.2 Risk analysis

The analysis of the risk that equipment in the scope of this document could affect electromagnetic compatibility with respect to other equipment and systems identifies two situations:

a) the electromagnetic disturbance generated by equipment does exceed a level above which radio and telecommunications equipment or other equipment cannot operate as intended;

b) equipment does not have a level of immunity to the electromagnetic disturbance to be expected in its intended environment which allows it to operate without unacceptable degradation of its intended use.

B.3 Risk assessment

In order to address those risks, requirements have been specified for the equipment in the scope of this document. These requirements are intended to minimize the occurrences of the above mentioned two situations and hence consider emission as well as immunity issues.

The emission requirements are specified in Clause 7. They follow the well-established approach to categorize equipment depending on the location where it is intended to be used. It distinguishes between CLASS A EQUIPMENT and CLASS B EQUIPMENT using the equipment categories as given in the product family standard CISPR 11. The emission limits of this document have been applied for several decades and are proved to be appropriate for the equipment in the scope of this document as long as the assignment between equipment category and location of later usage are aligned.

The immunity requirements are specified in Clause 6. Three sets of immunity test levels and performance criteria are specified depending on the electromagnetic environment (basic, industrial, controlled; see relevant definitions in Clause 3) for which the equipment is intended to be used. All three sets consider immunity against those electromagnetic phenomena relevant for the electromagnetic environments considered. The phenomena comprise:

– electrostatic discharge;

– electromagnetic fields in the frequency range from 150 kHz to 1 GHz and 1,4 GHz to 6 GHz (whereas in the frequency range from 150 kHz to 80 MHz the effect of electromagnetic fields is simulated by conducted phenomena);

– magnetic fields with power frequency;

– supply voltage dips and interruptions;

– transients (electrical fast transients as well as surges caused by lightning or power switching) acting on the relevant PORTS of equipment.

NOTE 1 The above electromagnetic phenomena are simulated by means of immunity test methods.

NOTE 2 This document considers all immunity tests which are specified in the generic immunity standards IEC 61000-6-1 and IEC 61000-6-2 and hence follows in this respect IEC Guide 107.

This risk assessment covers the situation in those types of electromagnetic environments which are covered in this document. It shall be noted that there might be installations where very rarely electromagnetic phenomena occur not covered here or where electromagnetic environments exist which deviate from those considered here. Hence manufacturers are requested to check the possibility that equipment might be installed under such conditions and to complement this general risk assessment by a more specific one.

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements

Matériel électrique de mesure, de commande et de laboratoire – Exigences relatives à la CEM – Partie 1: Exigences générales

IEC 61326-1:2020-10(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – EMC REQUIREMENTS –

Part 1: General requirements

FOREWORD

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International Standard IEC 61326-1 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition, published in 2012. This edition constitutes a technical revision.

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

– the immunity test levels and performance criteria have been reviewed;
– requirements for portable test and measurement equipment have been clarified and amended;

– the description of the electromagnetic environments has been improved.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65A/975/FDIS	65A/985/RVD

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

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

In this document, the following print types are used:

- Terms used throughout this document which have been defined in Clause 3: SMALL CAPITALS

A list of all parts of the IEC 61326 series under the general title *Electrical equipment for measurement, control and laboratory use – EMC requirements*, can be found on the IEC website.

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

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

INTRODUCTION

Instruments and equipment within the scope of this document may often be geographically widespread and hence operate under a wide range of environmental conditions.

The limitation of undesired electromagnetic emissions ensures that no other equipment installed nearby is unduly influenced by the equipment under consideration. The limits are more or less specified by, and therefore taken from, IEC and International Special Committee on Radio Interference (CISPR) publications.

However, the equipment should function without undue degradation in an electromagnetic environment typical for the locations where it is intended to be operated. In this respect, the document specifies three different types of electromagnetic environment and the levels for immunity. More detailed information about issues related to electromagnetic environments are given in IEC TR 61000-2-5. Special risks, involving for example nearby or direct lightning strikes, circuit-breaking, or exceptionally high electromagnetic radiation in close proximity, are not covered.

Complex electric and/or electronic systems should require EMC planning in all phases of their design and installation, taking into consideration the electromagnetic environment, any special requirements, and the severity of failures.

This part of IEC 61326 specifies the EMC requirements that are generally applicable to all equipment within its scope. For certain types of equipment, these requirements will be supplemented or modified by the special requirements of one, or more than one, particular part IEC 61326-2 (all parts). These should be read in conjunction with the IEC 61326-1 requirements.

ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – EMC REQUIREMENTS –

Part 1: General requirements

1 Scope

This part of IEC 61326 specifies requirements for immunity and emissions regarding electromagnetic compatibility (EMC) for electrical equipment, operating from a supply or battery of less than 1 000 V AC or 1 500 V DC or from the circuit being measured. Equipment intended for professional, industrial-process, industrial-manufacturing and educational use is covered by this part. It includes equipment and computing devices for

– measurement and test;
– control;
– LABORATORY use;
– accessories intended for use with the above (such as sample handling equipment),

intended to be used in industrial and non-industrial locations.

Computing devices and assemblies and similar equipment within the scope of information technology equipment (ITE) and complying with applicable ITE EMC standards can be used in systems within the scope of this part of IEC 61326 without additional testing, if they are suitable for the intended electromagnetic environment.

It is generally considered that this product family standard takes precedence over the corresponding generic EMC standards.

The following equipment is covered by this document.

a) Electrical measurement and test equipment

This is equipment which, by electrical means, measures, indicates or records one or more electrical or non-electrical quantities, also non-measuring equipment such as signal generators, measurement standards, power supplies and transducers.

b) Electrical control equipment

This is equipment which controls one or more output quantities to specific values, with each value determined by manual settings, by local or remote programming, or by one or more input variables. This includes industrial process measurement and control (IPMC) equipment, which consists of devices such as:

– process controllers and regulators;
– programmable controllers;
– power supply units for equipment and systems (centralized or dedicated);
– analogue/digital indicators and recorders;
– process instrumentation;
– transducers, positioners, intelligent actuators, etc.

c) Electrical LABORATORY equipment, including In Vitro Diagnostic (IVD) medical equipment

This is equipment used to prepare or analyse materials, or measure, indicate or monitor physical quantities. This equipment might also be used in areas other than laboratories.

d) Equipment a), b) or c) as above when being equipped with components having radio functionality, for example for wireless communication.

Equipment within the scope of this document might be operated in different electromagnetic environments; depending on the electromagnetic environment different emission and immunity test requirements are applicable.

This document considers three types of electromagnetic environments:

- BASIC ELECTROMAGNETIC ENVIRONMENT;
- INDUSTRIAL ELECTROMAGNETIC ENVIRONMENT;
- CONTROLLED ELECTROMAGNETIC ENVIRONMENT.

Corresponding immunity test requirements are described in Clause 6.

In terms of emission requirements, equipment shall be classified in Class A or Class B equipment, as per the requirements and procedure of CISPR 11. The corresponding emission requirements are described in Clause 7.

The specified emission and immunity requirements aim at achieving electromagnetic compatibility between equipment covered in this document and other equipment that might operate at locations with electromagnetic environments considered in this document. Guidance for an assessment concerning the risk for achieving EMC is given in Annex B.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Part 161: Electromagnetic compatibility*
IEC 60050-161:1990/AMD1:1997
IEC 60050-161:1990/AMD2:1998
IEC 60050-161:1990/AMD3:2014
IEC 60050-161:1990/AMD4:2014
IEC 60050-161:1990/AMD5:2015
IEC 60050-161:1990/AMD6:2016
IEC 60050-161:1990/AMD7:2017
IEC 60050-161:1990/AMD8:2018
(available at <http://www.electropedia.org>)

IEC 61000-3-2:2018, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤16 A per phase)*

IEC 61000-3-3:2013, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection*
IEC 61000-3-3:2013/AMD1:2017

IEC 61000-3-11:2017, *Electromagnetic compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤75 A and subject to conditional connection*

IEC 61000-3-12:2011, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤75 A per phase*

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 61000-4-5:2014/AMD1:2017

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 61000-4-11:2020, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

CISPR 11:2015, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*
CISPR 11:2015/AMD1:2016
CISPR 11:2015/AMD2:2019

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
basic electromagnetic environment
environment existing at locations characterized by being supplied directly at low voltage from the public mains network

EXAMPLES

– residential properties, for example houses, apartments;

– retail outlets, for example shops, supermarkets;

– business premises, for example offices, banks;

– areas of public entertainment, for example cinemas, public bars, dance halls;

– outdoor locations, for example petrol stations, car parks, amusement and sports centres;

– light-industrial locations, for example workshops, laboratories, service centres.

3.1.2
class A equipment
equipment suitable for use in all locations other than those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes

[SOURCE: derived from CISPR 11:2015, 5.2]

3.1.3
class B equipment
equipment suitable for use in locations in residential environments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes

[SOURCE: derived from CISPR 11:2015, 5.2]

3.1.4
controlled electromagnetic environment
environment usually characterized by recognition and control of EMC threats by users of the equipment or by design of the installation

3.1.5
enclosure port
physical boundary of equipment through which electromagnetic fields may radiate or impinge

3.1.6
functional performance
operational performance characteristics defining the ability of equipment to achieve the intended functions

Note 1 to entry: Characteristics can be based on the related technical documentation.

3.1.7
industrial electromagnetic environment
environment existing at locations characterized by a separate power network, in most cases supplied from a high- or medium-voltage transformer, dedicated for the supply of installations feeding manufacturing or similar plants with one or more of the following conditions:

– frequent switching of heavy inductive or capacitive loads;

– high currents and associated magnetic fields;

– presence of Industrial, Scientific and Medical (ISM) equipment (for example, welding machines)

3.1.8
laboratory
test and measurement area that is specifically used for analysis, testing and servicing and where equipment is operated by trained personnel

3.1.9
long-distance lines
lines within a building which are longer than 30 m, or which leave the building (including lines of outdoor installations)

3.1.10
port
any particular interface of the specific equipment or system with the external electromagnetic environment

EXAMPLE See Figure 1 for an example of Equipment Under Test (EUT).

Note 1 to entry: I/O PORTS are input, output or bi-directional, measurement, control, or data PORTS.

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.

Note 3 to entry: Within this document, the protective earth PORT (if any) is considered as part of the POWER PORT.

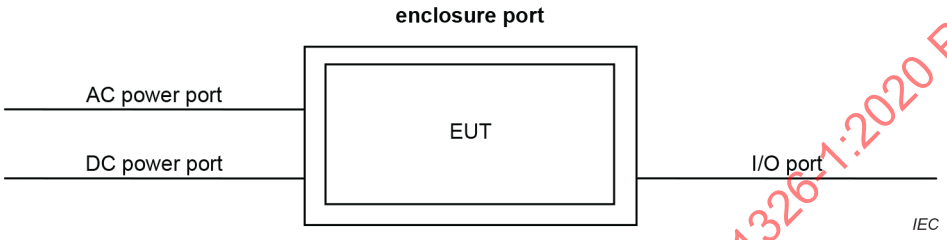

Figure 1 – Examples of ports

3.1.11
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

3.1.12
portable test and measurement equipment
test and/or measuring equipment designed to be easily carried by hand and to be connected and disconnected by the user

3.1.13
type test
conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-151:2001, 151-16-16]

3.1.14
auxiliary equipment
equipment necessary to provide the equipment under test (EUT) with the signals required for normal operation and equipment to verify the performance of the EUT

3.1.15
performance level
specified operation of equipment under conditions of intended use

3.1.16
degradation (in performance)
an undesired departure in the operational performance of any device, equipment or system from its intended performance

Note 1 to entry: The term "degradation" can apply to temporary or permanent failure.

[SOURCE: IEC 60050-161:1990, 161-01-19]

3.1.17
loss of performance
operation of equipment outside a specified PERFORMANCE LEVEL

3.1.18
loss of function
operation of equipment with one (or more) of the equipment's function unusable

3.2 Abbreviations

AE	AUXILIARY EQUIPMENT
EMC	electromagnetic compatibility
ESD	electrostatic discharge
EUT	equipment under test
I/O	input/output
RF	radio frequency
UPS	uninterruptable power supply

4 General

Equipment and systems within the scope of this document can be subjected to various kinds of electromagnetic disturbances, sources of which include power, measurement or control lines or those radiated from the environment. The types and levels of disturbances depend on the particular conditions in which the systems, subsystems or equipment are installed and operated.

Equipment within the scope of this document can also be a source of electromagnetic disturbances over a wide frequency range. These disturbances can be conducted through power and signal lines, or be directly radiated, and can affect the performance of other equipment, or influence the external electromagnetic environment.

For emissions, the objective of the requirements given in this document is to ensure that the disturbances generated by the equipment and systems, when operated normally, do not exceed a level which could prevent other systems from operating as intended. The emission limits are considered in 7.2.

NOTE 1 Higher immunity levels than those specified can be necessary for particular applications (for example, when reliable operation of the equipment is essential for safety) or when the equipment is intended for use in harsher electromagnetic environments. Also, additional tests and different performance criteria can be necessary for particular applications.

NOTE 2 In special cases, for example when highly susceptible equipment is being used near the EUT, additional mitigation measures could have to be employed to reduce the influencing electromagnetic emission further below the specified limits.

The manufacturer may select to perform all tests on either a single EUT or divide the tests among multiple EUTs. If the latter, each test result shall be traceable to the EUT tested. The testing sequence is optional.

5 EMC test plan

5.1 General

An EMC test plan shall be established prior to testing. At a minimum, it shall contain the elements defined in 5.2 to 5.5.

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

5.2 Configuration of EUT during testing

5.2.1 General

Measurement, control and LABORATORY equipment often consists of systems with no fixed configuration. The kind, number and installation of different subassemblies within the equipment may vary from system to system. Thus, it is reasonable, and also recommended, not to test every possible arrangement.

To realistically simulate EMC conditions (related both to emission and immunity), the equipment assembly shall represent a typical installation as specified by the manufacturer. Such tests shall be carried out as TYPE TESTS under normal conditions as specified by the manufacturer.

5.2.2 Composition of EUT

All equipment, racks, modules, boards, etc. significant to EMC and belonging to the EUT shall be documented. If relevant, the software version shall be documented.

5.2.3 Assembly of EUT

If an EUT has a variety of internal and external configurations, the TYPE TESTS shall be made with one or more typical configurations that represent normal use in the intended environment. All types of modules shall be tested at least once. The rationale for this selection shall be documented in the EMC test plan.

5.2.4 I/O PORTS

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.

5.2.5 AUXILIARY EQUIPMENT

When a variety of equipment is provided for use with the EUT, at least one of each type of equipment shall be selected to simulate actual operating conditions. AUXILIARY EQUIPMENT may be simulated.

5.2.6 Cabling and earthing (grounding)

The cables and earth (ground) shall be connected to the EUT in accordance with the manufacturer's specifications. There shall be no additional earth connections.

5.3 Operation conditions of EUT during testing

5.3.1 Operation modes

A selection of representative operation modes shall be made, taking into account that not all functions, but only the most typical functions of the electronic equipment can be tested. The estimated worst-case operating modes for normal application shall be selected.

5.3.2 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. The requirements of IEC 61000-4-2 for environmental conditions shall take precedence over those of the EUT specification (for example the humidity requirements for ESD).

5.3.3 EUT software during test

The software/firmware and its version used for the operation of the EUT shall be documented. This software shall represent the estimated worst-case operating mode for normal application.

5.4 Specification of FUNCTIONAL PERFORMANCE

For immunity tests, FUNCTIONAL PERFORMANCE for each operating mode and test shall be specified, where possible, as quantitative values, as well as for non-operational states such as 'standby' or 'battery charging', when an unintended change of state could occur through electromagnetic disturbances. If that is not possible, the FUNCTIONAL PERFORMANCE should be described in the test plan with supporting justification.

5.5 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 6.2 and 7.2. Additional information needed for the practical implementation of the tests is given in this document. The contents of the referenced standards need not be reproduced in the test plan. In some cases, the EMC test plan shall specify the application in detail.

NOTE Not all known disturbance phenomena have been specified for testing purposes in this document, but only those which are considered as most critical.

6 Immunity requirements

6.1 Conditions during the tests

The configuration of the EUT and the modes of operation used during the execution of each test shall be precisely noted in the test report.

Tests shall be applied to the relevant PORTS in accordance with Table 1, Table 2 or Table 3.

The tests shall be conducted in accordance with the basic standards listed in the relevant table for one phenomenon at a time. If additional test conditions or configurations not described in the basic standards are required, these conditions or configurations, and their rationale, shall be documented in the test report.

6.2 Immunity test requirements

Table 1 gives the immunity requirements for equipment intended to be used in a BASIC ELECTROMAGNETIC ENVIRONMENT.

Table 2 gives the immunity requirements for equipment intended to be used in an INDUSTRIAL ELECTROMAGNETIC ENVIRONMENT.

Table 3 gives the immunity requirements for equipment intended to be used in a CONTROLLED ELECTROMAGNETIC ENVIRONMENT.

Annex A gives the immunity requirements for PORTABLE TEST AND MEASUREMENT EQUIPMENT that is powered by battery or from the circuit being measured.

The performance criteria A, B, and C that are mentioned in the following tables are described in 6.4.

Table 1 – Immunity test requirements for equipment intended to be used in a BASIC ELECTROMAGNETIC ENVIRONMENT

PORT	Phenomenon	Basic standard	Test value	Perform-ance criterion
ENCLOSURE	ESD	IEC 61000-4-2	±4 kV contact discharge ±8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	3 V/m (80 MHz to 1 GHz; 1,4 GHz to 6 GHz) [a]	A
	Power frequency magnetic field [b]	IEC 61000-4-8	3 A/m (50 Hz, 60 Hz)	A
AC power (including protective earth)	Burst	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±0,5 kV line-to-line ±1 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A
	Voltage dip	IEC 61000-4-11	0 % during half cycle 0 % during 1 cycle 70 % during 25/30 cycles [c]	B B C
	Short interruptions	IEC 61000-4-11	0 % during 250/300 cycles [c]	C
DC power [d, e] (including protective earth)	Burst	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±0,5 kV line-to-line ±1 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A
I/O signal/control [e] (including functional earth)	Burst [d]	IEC 61000-4-4	±0,5 kV (5 kHz or 100 kHz)	B
	Surge [d]	IEC 61000-4-5	±1 kV line-to-ground	B
	Conducted RF [d]	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A
I/O signal/control [e] connected directly to mains supply	Burst [d]	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge [f]	IEC 61000-4-5	±0,5 kV line-to-line ±1 kV line-to-ground	B B
	Conducted RF [d]	IEC 61000-4-6	3 V (150 kHz to 80 MHz)	A

[a] In case testing is performed also in the frequency range from 1 GHz to 1,4 GHz, the same test level is recommended.

[b] Only to magnetically sensitive equipment.

[c] For example, "25/30 cycles" means "25 cycles for 50 Hz test" or "30 cycles for 60 Hz test".

[d] Only in the case of lines >3 m.

[e] DC POWER PORTS intended to be connected to a low voltage DC supply (≤ 60 V), where secondary circuits (isolated from the AC mains supply) are not subject to transient overvoltages (i.e. reliably-grounded, capacitively-filtered DC secondary circuits) shall be regarded as I/O signal/control PORTS.

[f] Only in the case of LONG-DISTANCE LINES.

Table 2 – Immunity test requirements for equipment intended to be used in an INDUSTRIAL ELECTROMAGNETIC ENVIRONMENT

PORT	Phenomenon	Basic standard	Test value	Perform-ance criterion
ENCLOSURE	ESD	IEC 61000-4-2	±4 kV contact discharge ±8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	10 V/m (80 MHz to 1 GHz) 3 V/m (1,4 GHz to 6 GHz) [a]	A A
	Power frequency magnetic field [b]	IEC 61000-4-8	30 A/m (50 Hz, 60 Hz)	A
AC power (including protective earth)	Burst	IEC 61000-4-4	±2 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±1 kV line-to-line ±2 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz), see NOTE	A
	Voltage dip	IEC 61000-4-11	0 % during 1 cycle 40 % during 10/12 cycles [c] 70 % during 25/30 cycles [c]	B C C
	Short interruptions	IEC 61000-4-11	0 % during 250/300 cycles [c]	C
DC power [d, e] (including protective earth)	Burst	IEC 61000-4-4	±2 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±1 kV line-to-line ±2 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	3 V (150 kHz to 80 MHz) see NOTE	A
I/O signal/control [e] (including functional earth)	Burst [d]	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge [f]	IEC 61000-4-5	±1 kV line-to-ground	B
	Conducted RF [d]	IEC 61000-4-6	3 V (150 kHz to 80 MHz) see NOTE	A
I/O signal/control [e] (connected directly to mains supply)	Burst [d]	IEC 61000-4-4	±2 kV (5 kHz or 100 kHz)	B
	Surge [f]	IEC 61000-4-5	±1 kV line-to-line ±2 kV line-to-ground	B B
	Conducted RF [d]	IEC 61000-4-6	3 V (150 kHz to 80 MHz) see NOTE	A

NOTE Equipment considered in this table is typically used in industrial installations with the cabling arranged on metallic structures. This reduces coupling of electromagnetic fields into cables and hence justifies a lower immunity level compared to that given in the generic immunity standard IEC 61000-6-2. The level of 3 V is used for more than 15 years without immunity issues and hence proved to be sufficient.

[a] In case testing is performed also in the frequency range from 1 GHz to 1,4 GHz, the same test level as above 1,4 GHz is recommended.

[b] Only to magnetically sensitive equipment.

[c] For example, “25/30 cycles" means "25 cycles for 50 Hz test" or "30 cycles for 60 Hz test”.

[d] Only in the case of lines > 3 m.

[e] DC power PORTS intended to be connected to a low voltage DC supply (≤ 60 V), where secondary circuits (isolated from the AC mains supply) are not subject to transient overvoltages (i.e. reliably-grounded, capacitively-filtered DC secondary circuits) shall be regarded as I/O signal/control PORTS.

[f] Only in the case of LONG-DISTANCE LINES.

Table 3 – Immunity test requirements for equipment intended to be used in a CONTROLLED ELECTROMAGNETIC ENVIRONMENT

PORT	Phenomenon	Basic standard	Test value	Perform-ance criterion
ENCLOSURE	ESD	IEC 61000-4-2	±4 kV contact discharge ±8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	1 V/m (80 MHz to 1 GHz; 1,4 GHz to 6 GHz) [a]	A
AC power (including protective earth)	Burst	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Surge	IEC 61000-4-5	±0,5 kV line-to-line ±1 kV line-to-ground	B B
	Conducted RF	IEC 61000-4-6	1 V (150 kHz to 80 MHz)	A
DC power [b, c] (including protective earth)	Burst	IEC 61000-4-4	±1 kV (5 kHz or 100 kHz)	B
	Conducted RF	IEC 61000-4-6	1 V (150 kHz to 80 MHz)	A
I/O signal/control [c] (including functional earth)	Burst [b]	IEC 61000-4-4	±0,5 kV (5 kHz or 100 kHz)	B
	Conducted RF [b]	IEC 61000-4-6	1 V (150 kHz to 80 MHz)	A

[a] In case testing is performed also in the frequency range from 1 GHz to 1,4 GHz, the same test level is recommended.

[b] Only in the case of lines > 3 m.

[c] DC power PORTS intended to be connected to a low voltage DC supply (≤ 60 V), where secondary circuits (isolated from the AC mains supply) are not subject to transient overvoltages (i.e. reliably-grounded, capacitively-filtered DC secondary circuits) shall be regarded as I/O signal/control PORTS.

NOTE In general, analysis, test and service laboratories have CONTROLLED ELECTROMAGNETIC ENVIRONMENTS, and personnel in these areas are usually trained to interpret results. Such environments typically contain equipment which requires protection by devices such as UPS, filters, or surge suppressers. Hence, the test values shown in Table 3 are relaxed from those in Table 1.

6.3 Random aspects

The duration of each test and/or the number of tests shall be sufficient to ensure that the performance criterion is met consistently. Due care shall be taken to avoid a false test pass due to random effects, for example, due to a timing relationship between the test stimulus and the operation of the EUT.

NOTE This is of particular concern for EUTs with functionality that can be defined or controlled by software or firmware.

For instance, in the case of electrostatic discharge testing of digital equipment, the EUT should be exposed to at least 10 discharges at each polarity, test point and test level to exclude random effects. In case of burst testing, it may be advisable to extend the testing time to more than 1 minute.

6.4 Performance criteria

6.4.1 General

The general principles (performance criteria) for the evaluation of the immunity test results are the following. Permissible LOSSES OF PERFORMANCE are allowed only if specified in the test plan before testing, and clearly provided to the user in the product specification. If the PERFORMANCE LEVEL or the permissible LOSS OF PERFORMANCE is not specified, either of these may be derived from the product specification or user documentation and what the user may reasonably expect from the equipment if used as intended.

6.4.2 Performance criterion A

The equipment 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 in the user documentation, when the equipment is used as intended. In the case of applying immunity tests with continuous electromagnetic phenomena, the PERFORMANCE LEVEL may be replaced by a permissible LOSS OF PERFORMANCE which shall recover, without user intervention. A permissible LOSS OF PERFORMANCE is allowed within the PERFORMANCE LEVEL only when this information is clearly provided to the end user via documentation, such as the product user manual. No change in the operating state is allowed nor is loss of data.

6.4.3 Performance criterion B

The equipment shall continue to operate as intended after the test. No DEGRADATION OF PERFORMANCE or LOSS OF FUNCTION is allowed below a PERFORMANCE LEVEL specified in the user documentation, when the equipment is used as intended. During the test, the equipment PERFORMANCE LEVEL may be replaced by a permissible LOSS OF PERFORMANCE if such LOSS OF PERFORMANCE is detailed in the EMC test plan. A permissible LOSS OF PERFORMANCE is allowed within the PERFORMANCE LEVEL only when this information is clearly provided to the end user via documentation, such as the product user manual. An unintended change of the operating state is allowed if self-recoverable. No loss of stored data is allowed.

The following are examples of performance criterion B:

- Data transfer is controlled or checked by parity check or by other means. In the case of malfunction, such as caused by a surge impulse, the data transfer will be repeated automatically. A reduced data transfer rate at this time is allowable degradation.
- During testing, an analogue function value may deviate in excess of the specified limits. After the test, the deviation vanishes.
- In the case of a monitor used only for man-machine monitoring, it is allowable that some degradation takes place, such as momentary display interference during the application of burst impulses.

6.4.4 Performance criterion C

LOSS OF FUNCTION is allowed, provided the function is self-recoverable or can be restored by the operation of the controls. Recovery procedure shall be included in the user documentation. No permanent damage to the equipment is allowed.

The following are examples of performance criterion C:

- In the case of an interruption in the mains longer than the specified buffer time, the power supply unit of the equipment is switched off. The switch-on may be automatic or carried out by the operator.
- After a programme interruption caused by a disturbance, the processor functions of the equipment stops at a defined position and is not left in a "crashed state". An operator's action may be necessary.

- The test results in an opening of an over-current protection equipment that can be reset by the operator.

7 Emission requirements

7.1 Conditions during measurements

The measurements shall be made in the operating mode in accordance with the EMC test plan (see Clause 5).

The description of the tests, the test methods, and the test set-ups are given in the reference standards as stated in 7.2. The contents of the reference standards are not reproduced here; however, modifications or additional information needed for the practical implementation of application of the tests may be given in the other parts of IEC 61326 (all parts).

7.2 Emission limits

The equipment shall be classified, and respective information shall be provided for the applicable group and class as specified in CISPR 11:2015/AMD1:2016/AMD2:2019, Clause 5. Equipment classification and choice of respective limits shall be determined after taking into account the intended environment and emission requirement in the areas of use.

Annex H ('Statistical assessment of series produced equipment against the requirements of CISPR standards') of CISPR 11:2015 does not apply.

For Group 1 CLASS A EQUIPMENT, the limits, the measuring methods and the provisions given in CISPR 11:2015/AMD1:2016/AMD2:2019 Subclause 6.2 apply. For Group 2 CLASS A EQUIPMENT, the limits, the measuring methods and the provisions given in CISPR 11:2015/AMD1:2016/AMD 2:2019, Subclause 6.3 apply.

For Group 1 CLASS B EQUIPMENT, the limits, the measuring methods and the provisions given in CISPR 11:2015/AMD1:2016/AMD2:2019 Subclause 6.2 apply. For Group 2 CLASS B EQUIPMENT, the limits, the measuring methods and the provisions given in CISPR 11:2015/AMD1:2016/AMD2:2019 Subclause 6.3 apply. In addition, for CLASS B EQUIPMENT with input current up to 16 A, IEC 61000-3-2 and IEC 61000-3-3 apply. For higher input currents up to 75 A per phase, IEC 61000-3-12 and IEC 61000-3-11 apply.

8 Test results and 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:

– EUT description (plus EUT identifier);
– test facility name and location;
– EMC test plan;
– test requirements, i.e. which type of electromagnetic environment is considered;
– performance criteria;
– test data and results;
– if applicable, characteristics of equipment operation deviation from FUNCTIONAL PERFORMANCE encountered during testing;
– modifications to the EUT (if any);
– test equipment and test set-up.

9 Instructions for use

The manufacturer shall indicate the electromagnetic environment for which the EUT is intended to be used and the standard(s) that was/were applied.

The manufacturer shall give information that emissions, which exceed the levels required by this document, can occur when the EUT is connected to a test object.

If a PERFORMANCE LEVEL or any permissible performance loss (as allowed in 6.4) is valid under the electromagnetic immunity conditions (see 6.2), then this level shall be described in the user documentation.

Annex A
(normative)

Immunity test requirements for PORTABLE TEST AND MEASUREMENT EQUIPMENT powered by battery or from the circuit being measured

Equipment covered within this annex is PORTABLE TEST AND MEASUREMENT EQUIPMENT that is powered by battery or from the circuit being measured. Equipment that can be operated while charging is excluded from this annex.

NOTE 1 Test and measurement equipment within the scope of this annex can be used in a wide range of locations, but by personnel capable of interpreting the results obtained. If these instruments are connected to a mains supply, it is normally only by their test or measurement leads and only for a short duration of the test. Hence, the number of electromagnetic phenomena shown in Table A.1 is reduced in relation to Table 1.

NOTE 2 Examples for equipment included in the scope of this annex but not limited to, are: equipment covered by other parts of IEC 61326 (all parts), such as digital multi-meters, stand alone current clamps, LABORATORY equipment, programmers, on-site calibration units. Such equipment is intended to be operated by skilled personal and for a short duration of measuring time only.

NOTE 3 Examples for equipment excluded from the scope of this annex are: monitoring equipment, control equipment, energy meters, power meters, power analyzers, power quality instruments, oscilloscopes. Such equipment is typically operated over a longer duration of measuring time.

NOTE 4 If RF transmitters are used in close proximity, they could disturb equipment within the scope of this document.

Table A.1 – Immunity test requirements for PORTABLE TEST AND MEASUREMENT EQUIPMENT

PORT	Phenomenon	Basic standard	Test value	Performance criterion
ENCLOSURE	ESD	IEC 61000-4-2	±4 kV contact discharge ±8 kV air discharge	B B
	Electromagnetic field	IEC 61000-4-3	3 V/m (80 MHz to 1 GHz) 3 V/m (1,4 GHz to 2 GHz) [a] 1 V/m (2,0 GHz to 6 GHz)	A A A
	Power frequency magnetic field [b]	IEC 61000-4-8	3 A/m (50 Hz, 60 Hz) [c]	A

[a] In case testing is performed also in the frequency range from 1 GHz to 1,4 GHz, the same test level as in the frequency range 1,4 GHz to 2 GHz is recommended.

[b] Only to magnetically sensitive equipment.

[c] The test shall be carried out at the frequencies appropriate to mains supply. Equipment intended for use in areas supplied only at one of these frequencies need only be tested at that frequency.

A battery charger used by the products within the scope of this annex shall be tested according to the requirements given in one of the Table 1, Table 2 or Table 3 depending on the intended electromagnetic environment.

Annex B
(informative)

Guide for analysis and assessment for electromagnetic compatibility

B.1 General

This document follows the approach given in IEC Guide 107 by means of giving EMC requirements for the product families described in Clause 1. In this respect, it specifies requirements for the emissions caused by equipment and for the immunity to be achieved by equipment. However, when operating equipment in the scope of this document at actual installations, there might be a risk that the specified requirements do not ensure a sufficient degree of electromagnetic compatibility.

NOTE 1 Definitions used in the area of EMC, such as electromagnetic compatibility, emissions, immunity, are explained in IEC Guide 107.

NOTE 2 The term risk as used in this annex is not meant in the sense of ISO/IEC Guide 51, i.e. in the context of harms (physical injury or damage to the health of people, or damage to property or the environment). Here it is limited to the risk of possibly not achieving the state of electromagnetic compatibility.

B.2 Risk analysis

The analysis of the risk that equipment in the scope of this document could affect electromagnetic compatibility with respect to other equipment and systems identifies two situations:

a) the electromagnetic disturbance generated by equipment does exceed a level above which radio and telecommunications equipment or other equipment cannot operate as intended;

b) equipment does not have a level of immunity to the electromagnetic disturbance to be expected in its intended environment which allows it to operate without unacceptable degradation of its intended use.

B.3 Risk assessment

In order to address those risks, requirements have been specified for the equipment in the scope of this document. These requirements are intended to minimize the occurrences of the above mentioned two situations and hence consider emission as well as immunity issues.

The emission requirements are specified in Clause 7. They follow the well-established approach to categorize equipment depending on the location where it is intended to be used. It distinguishes between CLASS A EQUIPMENT and CLASS B EQUIPMENT using the equipment categories as given in the product family standard CISPR 11. The emission limits of this document have been applied for several decades and are proved to be appropriate for the equipment in the scope of this document as long as the assignment between equipment category and location of later usage are aligned.

The immunity requirements are specified in Clause 6. Three sets of immunity test levels and performance criteria are specified depending on the electromagnetic environment (basic, industrial, controlled; see relevant definitions in Clause 3) for which the equipment is intended to be used. All three sets consider immunity against those electromagnetic phenomena relevant for the electromagnetic environments considered. The phenomena comprise:

– electrostatic discharge;

– electromagnetic fields in the frequency range from 150 kHz to 1 GHz and 1,4 GHz to 6 GHz (whereas in the frequency range from 150 kHz to 80 MHz the effect of electromagnetic fields is simulated by conducted phenomena);

– magnetic fields with power frequency;
– supply voltage dips and interruptions;
– transients (electrical fast transients as well as surges caused by lightning or power switching) acting on the relevant PORTS of equipment.

NOTE 1 The above electromagnetic phenomena are simulated by means of immunity test methods.

NOTE 2 This document considers all immunity tests which are specified in the generic immunity standards IEC 61000-6-1 and IEC 61000-6-2 and hence follows in this respect IEC Guide 107.

This risk assessment covers the situation in those types of electromagnetic environments which are covered in this document. It shall be noted that there might be installations where very rarely electromagnetic phenomena occur not covered here or where electromagnetic environments exist which deviate from those considered here. Hence manufacturers are requested to check the possibility that equipment might be installed under such conditions and to complement this general risk assessment by a more specific one.

Bibliography

IEC 60050-151:2001, *International Electrotechnical Vocabulary (IEV) – Part 151: Electrical and magnetic devices*
IEC 60050-151:2001/AMD1:2013
IEC 60050-151:2001/AMD2:2014
IEC 60050-151:2001/AMD3:2019
IEC 60050-151:2001/AMD4:2020
(available at <http://www.electropedia.com>)

IEC 60359, *Electrical and electronic equipment – Expression of performance*

IEC 60488-1:2004, *Higher performance protocol for the standard digital interface for programmable instrumentation – Part 1: General*

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

IEC 61000-6-1:2016, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments*

IEC 61000-6-2:2016, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61010 (all parts), *Safety requirements for electrical equipment for measurement, control, and laboratory use*

IEC 61326-2 (all parts), *Electrical equipment for measurement, control and laboratory use – EMC requirements – Particular requirements*

ISO/IEC Guide 51:2014, *Safety aspects – Guidelines for their inclusion in standards*

IEC Guide 107:2014, *Electromagnetic compatibility – Guide to the drafting of electromagnetic compatibility publications*

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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MATÉRIEL ÉLECTRIQUE DE MESURE, DE COMMANDE ET DE LABORATOIRE – EXIGENCES RELATIVES À LA CEM –

Partie 1: Exigences générales

AVANT-PROPOS

1) La Commission Electrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
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La Norme internationale IEC 61326-1 a été établie par le sous-comité 65A: Aspects systèmes, du comité d'études 65 de l'IEC: Mesure, commande et automation dans les processus industriels.

Cette troisième édition annule et remplace la deuxième édition parue en 2012. Cette édition constitue une révision technique.

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

– les niveaux d'essai d'immunité et les critères de performance ont été revus;
– les exigences concernant le matériel d'essai et de mesure portable ont été clarifiées et modifiées;
– la description des environnements électromagnétiques a été améliorée.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
65A/975/FDIS	65A/985/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 internationale.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

Dans le présent document, les caractères d'imprimerie suivants sont utilisés:

- Termes définis à l'Article 3 et utilisés dans tout ce document: PETITES MAJUSCULES

Une liste de toutes les parties de la série IEC 61326, publiées sous le titre général *Matériel électrique de mesure, de commande et de laboratoire – Exigences relatives à la CEM*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document 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 au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

INTRODUCTION

Les instruments et matériels relevant du domaine d'application du présent document peuvent souvent être très dispersés géographiquement et fonctionnent donc dans un large éventail de conditions environnementales.

La limitation des émissions électromagnétiques indésirables permet d'éviter qu'un autre matériel, installé à proximité, soit soumis à l'influence du matériel à l'étude. Les limites sont plus ou moins spécifiées dans les publications de l'IEC et du Comité international spécial des perturbations radioélectriques (CISPR) et proviennent donc de ces documents.

Toutefois, il convient que le matériel fonctionne sans dégradation excessive dans un environnement électromagnétique type pour les sites d'utilisation prévus. À cet effet, le document spécifie trois types différents d'environnements électromagnétiques ainsi que les niveaux d'immunité. L'IEC TR 61000-2-5 donne des informations plus détaillées en ce qui concerne les problèmes associés aux environnements électromagnétiques. Les risques particuliers, dus par exemple à des coups de foudre proches ou directs, à l'ouverture d'un circuit ou à un rayonnement électromagnétique exceptionnellement élevé à proximité immédiate, ne sont pas couverts.

Il convient que les systèmes électriques et/ou électroniques complexes exigent tout au long de leur conception et de leur installation une planification de la CEM prenant en compte l'environnement électromagnétique, les exigences particulières et la gravité des défauts.

Cette partie de l'IEC 61326 spécifie les exigences relatives à la CEM qui sont généralement applicables à tout matériel relevant de son domaine d'application. Pour certains types de matériels, ces exigences sont complétées ou modifiées par les exigences particulières d'une ou plusieurs des parties de l'IEC 61326-2 (toutes les parties). Il convient de lire celles-ci conjointement avec les exigences de l'IEC 61326-1.

MATÉRIEL ÉLECTRIQUE DE MESURE, DE COMMANDE ET DE LABORATOIRE – EXIGENCES RELATIVES À LA CEM –

Partie 1: Exigences générales

1 Domaine d'application

La présente partie de l'IEC 61326 spécifie les exigences relatives à l'immunité et aux émissions concernant la compatibilité électromagnétique (CEM) pour les matériels électriques fonctionnant à partir d'une source d'alimentation ou d'une batterie inférieure à 1 000 V en courant alternatif ou 1 500 V en courant continu ou à partir du circuit mesuré. Elle concerne les matériels prévus pour un usage professionnel, pour les processus industriels et pour l'enseignement. Cela comprend les matériels et les dispositifs informatiques pour

– le mesurage et les essais;
– la commande;
– les applications en LABORATOIRE;
– les accessoires prévus pour être utilisés dans les cas susmentionnés (par exemple, matériel de manipulation d'échantillons),

dans un usage en milieu industriel ou non industriel.

Les dispositifs informatiques et les matériels similaires relevant du domaine d'application des appareils de traitement de l'information (ATI) et répondant aux normes de CEM des ATI peuvent être utilisés dans les systèmes relevant du domaine d'application de la présente partie de l'IEC 61326, sans essais supplémentaires s'ils sont adaptés à l'environnement électromagnétique prévu.

En règle générale, la présente norme de famille de produits prévaut sur les normes CEM génériques correspondantes.

Les matériels cités ci-après sont traités dans le présent document.

a) Matériels électriques de mesure et d'essai

Matériels électriques permettant de mesurer, d'indiquer ou d'enregistrer une ou plusieurs grandeurs électriques ou non électriques, et également des matériels qui ne sont pas des matériels de mesure, tels que générateurs de signaux, étalons, alimentations et transducteurs.

b) Matériels électriques de commande

Matériels servant à commander une ou plusieurs grandeurs de sortie spécifiques, chacune de ces grandeurs étant déterminée par des réglages manuels, par une programmation locale ou à distance, ou par une ou plusieurs variables d'entrée. Cette catégorie comprend les matériels de mesure et de commande dans les processus industriels (IPMC - industrial process measurement and control), tels que:

– les régulateurs et contrôleurs de processus;
– les automates programmables;
– les blocs d'alimentation des matériels et des systèmes (centralisés ou spécialisés);
– les indicateurs et les enregistreurs analogiques/numériques;
– les instruments de processus;
– les transducteurs, positionneurs, organes de commande intelligents, etc.

c) Matériels électriques de LABORATOIRE, y compris le matériel médical de diagnostic in vitro (IVD – In Vitro Diagnostic)

Ces matériels servent à préparer ou analyser des matières, ou à mesurer, indiquer ou contrôler les grandeurs physiques. Ces matériels peuvent être aussi utilisés dans des emplacements autres que des laboratoires.

d) Matériels a), b) ou c) ci-dessus équipés de composants ayant une fonction radioélectrique, par exemple pour les communications sans fil.

Les matériels relevant du domaine d'application du présent document peuvent être utilisés dans des environnements électromagnétiques différents; selon l'environnement électromagnétique, différentes exigences concernant les émissions et les essais d'immunité sont applicables.

Le présent document prend en considération trois types d'environnements électromagnétiques:

- l'ENVIRONNEMENT ELECTROMAGNETIQUE ORDINAIRE;
- l'ENVIRONNEMENT ELECTROMAGNETIQUE INDUSTRIEL;
- l'ENVIRONNEMENT ELECTROMAGNETIQUE CONTROLE.

Les exigences correspondantes relatives aux essais d'immunité sont décrites à l'Article 6.

En matière d'exigences relatives aux émissions, les matériels doivent être classés en matériels de classe A ou de classe B, conformément aux exigences et à la procédure de la CISPR 11. Les exigences correspondantes relatives aux émissions sont décrites à l'Article 7.

Les exigences spécifiées relatives aux émissions et à l'immunité ont pour objet d'assurer la compatibilité électromagnétique entre le matériel couvert par le présent document et d'autres matériels susceptible de fonctionner dans des environnements électromagnétiques pris en considération dans le présent document. L'Annexe B donne des recommandations pour une appréciation du risque relatif à l'obtention de la CEM.

2 Références normatives

Les documents suivants, cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. 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).

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IEC 61000-3-2:2018, *Compatibilité électromagnétique (CEM) – Partie 3-2: Limites – Limites pour les émissions de courant harmonique (courant appelé par les appareils ≤16 A par phase)*

IEC 61000-3-3:2013, *Compatibilité électromagnétique (CEM) – Partie 3-3: Limites – Limitation des variations de tension, des fluctuations de tension et du papillotement dans les réseaux publics d'alimentation basse tension, pour les matériels ayant un courant assigné ≤16 A par phase et non soumis à un raccordement conditionnel*
IEC 61000-3-3:2013/AMD1:2017

IEC 61000-3-11:2017, *Compatibilité électromagnétique (CEM) – Partie 3-11: Limites – Limitation des variations de tension, des fluctuations de tension et du papillotement dans les réseaux publics d'alimentation basse tension – Équipements ayant un courant assigné ≤75 A et soumis à un raccordement conditionnel*

IEC 61000-3-12:2011, *Compatibilité électromagnétique (CEM) – Partie 3-12: Limites – Limites pour les courants harmoniques produits par les appareils connectés aux réseaux publics basse tension ayant un courant appelé >16 A et ≤75 A par phase*

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 – Essais 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 61000-4-5:2014/AMD1:2017

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 61000-4-11:2020, *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 pour les appareils à courant d'entrée inférieur ou égal à 16 A par phase*

CISPR 11:2015, *Appareils industriels, scientifiques et médicaux – Caractéristiques de perturbations radioélectriques – Limites et méthodes de mesure*
CISPR 11:2015/AMD1:2016
CISPR 11:2015/AMD2:2019

3 Termes, définitions et abréviations

3.1 Termes et définitions

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

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1.1
environnement électromagnétique ordinaire
environnement existant sur des sites caractérisés par une alimentation directe en basse tension par le réseau électrique public

EXEMPLES

– zones résidentielles, par exemple maisons, appartements;

– commerce de détail, par exemple boutiques, supermarchés;

– locaux commerciaux, par exemple bureaux, banques;

– lieux de divertissement, par exemple, cinémas, bars, discothèques;

– sites en extérieur, par exemple stations-service, parcs de stationnement, centres de loisirs et sportifs;

– sites industriels légers, par exemple ateliers, laboratoires, centres de services.

3.1.2
appareils de classe A
appareils prévus pour être utilisés dans tous les emplacements autres que ceux alloués dans les environnements résidentiels et ceux directement connectés à un réseau d'alimentation électrique à basse tension alimentant des bâtiments à usage domestique

[SOURCE: tirée de la CISPR 11:2015, 5.2]

3.1.3
appareils de classe B
appareils prévus pour être utilisés dans les environnements résidentiels et dans les établissements connectés directement à un réseau d'alimentation électrique à basse tension alimentant des bâtiments à usage domestique

[SOURCE: tirée de la CISPR 11:2015, 5.2]

3.1.4
environnement électromagnétique contrôlé
environnement caractérisé d'ordinaire par la reconnaissance et le contrôle de dangers de compatibilité électromagnétique par les utilisateurs du matériel ou par la conception de l'installation

3.1.5
accès par l'enveloppe
frontière physique d'un matériel à travers laquelle les champs électromagnétiques peuvent rayonner ou à laquelle ils peuvent se heurter

3.1.6
performance fonctionnelle
caractéristiques de performances opérationnelles définissant l'aptitude du matériel à réaliser les fonctions prévues

Note 1 à l'article: Les caractéristiques peuvent se fonder sur la documentation technique correspondante.

3.1.7
environnement électromagnétique industriel
environnement existant sur des sites caractérisés par la présence d'un réseau séparé de distribution électrique, alimenté dans la plupart des cas par un transformateur haute ou moyenne tension, destiné à fournir l'énergie à des installations alimentant les usines de fabrication ou similaires, avec l'une ou plusieurs des conditions suivantes:

– commutation fréquente de fortes charges inductives ou capacitives;
– intensités et champs magnétiques associés importants;
– présence d'appareils industriels, scientifiques et médicaux (ISM) (par exemple, poste de soudure)

3.1.8
laboratoire
zone d'essai et de mesure qui est spécifiquement consacrée à l'analyse, l'essai et l'entretien et dans laquelle le matériel est utilisé par un personnel qualifié

3.1.9
lignes à grande distance
lignes se trouvant à l'intérieur d'un bâtiment et dont la longueur dépasse 30 m, ou lignes sortant du bâtiment (y compris les lignes des installations extérieures)

3.1.10
accès
interface particulière du matériel ou du système spécifique avec l'environnement électromagnétique extérieur

EXEMPLE Voir la Figure 1 pour un exemple de matériel en essai (EST).

Note 1 à l'article: Les ACCES E/S sont des ACCES d'entrée, de sortie ou bidirectionnels, de mesure, de commande ou de données.

Note 2 à l'article: Dans le cadre du présent document, les ACCES raccordés à la terre pour des raisons fonctionnelles (ACCES fonctionnels à la terre) sont considérés comme des ACCES E/S.

Note 3 à l'article: Dans le cadre du présent document, l'ACCES de protection à la terre (le cas échéant) est considéré comme appartenant à l'ACCES PAR L'ALIMENTATION.

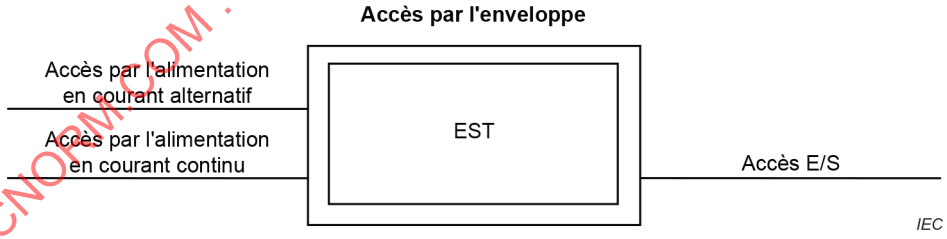

Figure 1 – Exemples d'accès

3.1.11
accès par l'alimentation
accès auquel un conducteur ou câble transportant l'énergie électrique d'entrée/sortie primaire nécessaire au fonctionnement est connecté au matériel

3.1.12
matériel d'essai et de mesure portable
matériel d'essai et/ou de mesure conçu pour être facilement transporté à la main et pour être branché et débranché par l'utilisateur