

INTERNATIONAL STANDARD

NORME INTERNATIONALE

GENERIC EMC STANDARD
NORME GÉNÉRIQUE EN CEM

**Electromagnetic compatibility (EMC) –
Part 6-7: Generic standards – Immunity requirements for equipment intended
to perform functions in a safety-related system (functional safety) in industrial
locations**

[IEC 61000-6-7:2014](#)

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**Compatibilité électromagnétique (CEM) –
Partie 6-7: Normes génériques – Exigences d'immunité pour les équipements
visant à exercer des fonctions dans un système lié à la sécurité (sécurité
fonctionnelle) dans des sites industriels**





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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

**Part 6-7: Generic standards – Immunity requirements
for equipment intended to perform functions in a safety-related
system (functional safety) in industrial locations**

FOREWORD

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International Standard IEC 61000-6-7 has been prepared by TC 77: Electromagnetic compatibility.

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

FDIS	Report on voting
77/462/FDIS	77/468/RVD

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

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

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

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

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- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

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

Part 1: General

General considerations (introduction, fundamental principles)

Definitions, terminology

Part 2: Environment

Description of the environment

Classification of the environment

Compatibility levels

Part 3: Limits

Emission limits

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

Part 4: Testing and measurement techniques

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines

Installation guidelines

Mitigation methods and devices

[IEC 61000-6-7:2014](#)

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Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into several parts, published either as International Standards or technical reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and completed by a second number identifying the subdivision (example: IEC 61000-3-11).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 6-7: Generic standards – Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations

1 Scope and object

This part of IEC 61000 is intended to be used by suppliers when making claims for the immunity of equipment intended for use in safety-related systems against electromagnetic disturbances.

This standard should also be used by designers, integrators, installers, and assessors of safety-related systems to assess the claims made by suppliers. It provides guidance to product committees.

This part of IEC 61000 applies to electrical and electronic equipment intended for use in safety-related systems and that is

- intended to comply with the requirements of IEC 61508 and/or other sector-specific functional safety standards, and
- intended to be operated in industrial locations as described in 3.1.15.

NOTE 1 The final safety-related system is designed by a system integrator (or equivalent) that has the responsibility to assess the adequacy of the equipment for the particular application. This process is described in Annex D of IEC/TS 61000-1-2:2008.

The object of this standard is to define immunity test requirements for equipment in relation to continuous and transient, conducted and radiated disturbances, including electrostatic discharge. These requirements apply only to functions intended for use in functional safety applications. Test requirements are specified for each port considered.

NOTE 2 The immunity requirements of this standard do not, however, cover extreme cases, which can occur at any location, but with an extremely low probability of occurrence. In consequence, a designer of a safety-related system checks whether the requirements of this standard cover the expected electromagnetic phenomena within the intended application.

2 Normative references

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

IEC 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at www.electropedia.org)

IEC/TS 61000-1-2:2008, *Electromagnetic compatibility (EMC) – Part 1-2: General – Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena*

IEC 61000-1-6:2012, *Electromagnetic compatibility (EMC) – Part 1-6: General – Guide to the assessment of measurement uncertainty*

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

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

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

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

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

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

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

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

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

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

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61784-3, *Industrial communication networks – Profiles – Part 3: Functional safety fieldbuses – General rules and profile definitions*

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

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, as well as the following apply.

NOTE Other definitions, not included in IEC 60050-161 and in this standard, but nevertheless necessary for the application of the different tests, are given in the EMC basic publications of the IEC 61000 series.

3.1.1

auxiliary equipment

AE

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

3.1.2

dangerous failure

failure of an element and/or subsystem and/or system that plays a part in implementing the safety function that:

- a) prevents a safety function from operating when required (demand mode) or causes a safety function to fail (continuous mode) such that the EUC (equipment under control) is put into a hazardous or potentially hazardous state; or
- b) decreases the probability that the safety function operates correctly when required

[SOURCE: IEC 61508-4:2010, 3.6.7]

3.1.3

DC distribution network

local DC electricity supply network in the infrastructure of a certain site or building intended for connection of any type of DC-powered equipment

Note 1 to entry: Connection to a local or remote battery/power supply/PELV/SELV/UPS is not regarded as a DC distribution network if such a link comprises only the power source mentioned above for a single piece of equipment. These lines are considered as signal lines.

3.1.4

electrical/electronic/programmable electronic E/E/PE

based on electrical (E) and/or electronic (E) and/or programmable electronic (PE) technology

EXAMPLE Electrical/electronic/programmable electronic devices include

- electro-mechanical devices (electrical);
- solid-state non-programmable electronic devices (electronic);
- electronic devices based on computer technology (programmable electronic);

Note 1 to entry: The term is intended to cover any and all devices or systems operating on electrical principles.

[SOURCE: IEC 61508-4:2010, 3.2.13]

3.1.5

enclosure port

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

3.1.6

equipment

electrical and electronic subsystems, apparatus, modules, devices and other assemblies of products intended to be used to construct safety-related systems, and which are

- intended to comply with the requirements of IEC 61508 and/or other sector-specific functional safety standards, and
- intended to be operated in industrial locations as described in 3.1.15

3.1.7

equipment under control

EUC

equipment, machinery, apparatus or plant used for manufacturing, process, transportation, medical or other activities

Note 1 to entry: The EUC control system is separate and distinct from the EUC.

Note 2 to entry: This note applies to the French language only.

[SOURCE: IEC 61508-4:2010, 3.2.1, modified – note 2 has been added.]

**3.1.8
equipment under test
EUT**

equipment (products, devices, appliances and systems) subjected to immunity tests

**3.1.9
extra-low voltage
ELV**

any voltage not exceeding the relevant voltage limit specified in IEC 61201

[SOURCE: IEC 61140:2009, 3.26]

**3.1.10
functional earth port**

cable port other than signal/control or power port, intended for connection to earth for purposes other than electrical safety

**3.1.11
functional safety**

part of the overall safety relating to the EUC and the EUC control system that depends on the correct functioning of the E/E/PE safety-related systems and other risk reduction measures

[SOURCE: IEC 61508-4:2010, 3.1.12]

**3.1.12
functional safety application**

system, equipment or product that is intended for use in a safety-related system but is not itself a complete safety-related system

Note 1 to entry: This definition refers to aspects of the safety functions of the safety-related system within which it will be used.

**3.1.13
harm**

physical injury or damage to the health of people, or damage to property or the environment

[SOURCE: IEC 60050-351:2013, 351-57-02]

**3.1.14
hazard**

potential source of harm

Note 1 to entry: The term includes dangers to persons arising within a short time scale (for example, fire and explosion) and also those that have a long-term effect on a person's health (for example, release of a toxic substance).

[SOURCE: IEC 60050-351:2013, 351-57-01, modified – the note has been modified.]

**3.1.15
industrial location**

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

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

- items of equipment installed and connected together and working simultaneously;
- significant amount of electrical power is generated, transmitted and/or consumed;

- 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)

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

Note 2 to entry: Examples of industrial locations are metalworking, pulp and paper, chemical plants, car production.

3.1.16

PELV system

electric system in which the voltage cannot exceed the value of extra low voltage and is connected to PE

- under normal conditions and
- under single fault conditions, except earth faults in other electric circuits

Note 1 to entry: PELV is the abbreviation for protective extra low voltage.

[SOURCE: IEC 60050-826:2004, 826-12-32]

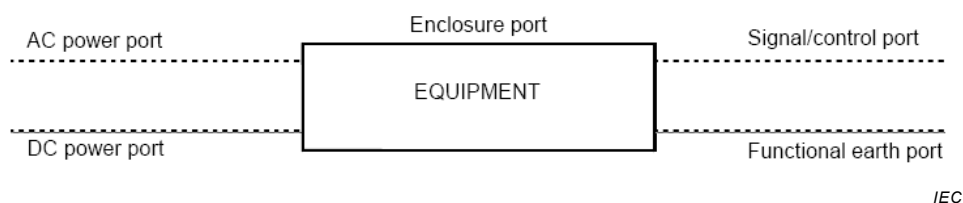
3.1.17

port

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

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

Note 2 to entry: Though Figure 1 describes the situation for equipment, it applies to products and systems as well.



IEC

Figure 1 – Equipment ports

3.1.18

power port

port at which a conductor or cable carrying the primary electrical power (AC or DC) needed for the operation (functioning) of equipment or associated equipment is connected to the equipment

Note 1 to entry: Different types and numbers of power ports are possible on one item of equipment.

3.1.19

product

item that is commercially available on the market, from manufacturers or their agents

3.1.20

safety function

function to be implemented by an E/E/PE safety-related system or other risk reduction measures, that is intended to achieve or maintain a safe state for the EUC, in respect of a specific hazardous event

[SOURCE: IEC 61508-4:2010, 3.5.1]

3.1.21 safety extra low voltage SELV

AC voltage the r.m.s. value of which does not exceed 50 V or ripple-free DC voltage the value of which does not exceed 120 V, between conductors, or between any conductor and reference earth, in an electric circuit which has galvanic separation from the supplying electric power system by such means as a separate-winding transformer

Note 1 to entry: Maximum voltage lower than 50 V AC or 120 V ripple-free DC may be specified in particular requirements, especially when direct contact with live parts is allowed.

Note 2 to entry: The voltage limit should not be exceeded at any load between full load and no-load when the source is a safety isolating transformer.

Note 3 to entry: Ripple-free qualifies conventionally an r.m.s. ripple voltage not more than 10 % of the DC component; the maximum peak value does not exceed 140 V for a nominal 120 V ripple-free DC system and 70 V for a nominal 60 V ripple-free DC system.

[SOURCE: IEC 60050-851:2008, 851-15-08]

3.1.22 safety integrity level SIL

discrete level (one out of a possible four), corresponding to a range of safety integrity values, where safety integrity level 4 has the highest level of safety integrity and safety integrity level 1 has the lowest

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[SOURCE: IEC 61508-4:2010, 3.5.8]

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

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

3.1.24 system

combination of apparatus and/or active components constituting a single functional unit and intended to be installed and operated to perform (a) specific task(s)

Note 1 to entry: "Safety-related systems" are specifically "designed" equipment that both

- implement the required safety functions necessary to achieve or maintain a safe state for controlled equipment;
- are intended to achieve on their own or with other safety-related equipment or external risk reduction facilities, the necessary safety integrity for the safety requirements.

3.1.25 type test

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

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

3.2 Abbreviations

AE	auxiliary equipment
DS	(performance criterion) "defined state", see 5.1
E/E/PE	electrical/electronic/programmable electronic
ELV	extra-low voltage

EUC	equipment under control
EUT	equipment under test
ISM	Industrial, scientific and medical
PELV	protective extra low voltage
SELV	safety extra low voltage
SIL	safety integrity level
SRS	safety requirements specification

4 General

4.1 Conformance to IEC Guide 107

This generic standard is applicable in the absence of relevant dedicated product-family or product standard(s) that address electromagnetic influences on functional safety. Since a product family/product standard usually gives more specific requirements, it is generally considered that it takes precedence over the corresponding generic standard. Where a product family/product standard detailing electromagnetic influences on functional safety specifies less stringent test values for a phenomenon or if a phenomenon is only partially covered (e.g. the product family/product standard only covers a subset of the recommended frequency range), a technical justification shall be given in that standard.

NOTE 1 IEC 61508 does not necessarily require that the proof of sufficient immunity is done by means of immunity tests. There might be other approaches to demonstrate sufficient immunity, e.g. by means of design and/or analysis.

NOTE 2 If fail-safe happens too often in real life operation it becomes a significant nuisance to the owner or operator and might result in a higher level of risk.

4.2 Conformance to IEC/TS 61000-1-2

This part of IEC 61000 specifies immunity testing taking into account the principles of Clause 9 of IEC/TS 61000-1-2:2008. It is important to note that this standard and the process described herein shall only be applied in accordance with the processes detailed in IEC/TS 61000-1-2.

For clarity, this standard only applies in reference to the verification phase of the functional safety process detailed in IEC/TS 61000-1-2. The achievement of tolerable functional safety risks shall only be achieved by fully applying the requirements of IEC/TS 61000-1-2. These requirements include: consideration of the safety lifecycle; the development of a safety requirements specification (SRS) that includes safety function requirements and safety integrity requirements; consideration of EMC specific steps that include more than EMC immunity testing; and the management of EMC for functional safety.

In the same way that immunity testing is considered of great value during the verification phase, additional immunity testing should be considered to take into account the effects of aging. This type of testing could be performed on an accelerated lifetime basis.

Due to the wide variety of equipment that may be used and consequently the wide variety of electromagnetic environments in industrial locations, the type of electromagnetic disturbances and the associated immunity levels specified herein for functional safety might not adequately represent the totality of the electromagnetic environment or significantly over prescribe the same for certain applications. In either case, the applicable test requirements for functional safety shall reflect the expected or specified electromagnetic environment for the equipment.

NOTE 1 The applicable test requirements for known applications are discussed and agreed with the end-user, where at all possible (see Annex F of IEC/TS 61000-1-2:2008 for more details).

NOTE 2 Any practical amount of testing alone cannot demonstrate that equipment within the scope of this standard is safe. However, increased confidence can be achieved if equipment within the scope of this standard fails to a