

Electromagnetic compatibility (EMC) —

Part 2-12: Environment — Compatibility levels for low-frequency conducted disturbances and signalling in public medium-voltage power supply systems

The European Standard EN 61000-2-12:2003 has the status of a
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National foreword

This British Standard is the official English language version of EN 61000-2-12:2003. It is identical with IEC 61000-2-12:2003.

The UK participation in its preparation was entrusted by Technical Committee GEL/210, EMC, to Subcommittee GEL/210/8, EMC — Low frequency standards, which has the responsibility to:

- aid enquirers to understand the text;
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Summary of pages

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Electromagnetic compatibility (EMC)
Part 2-12 : Environment –
Compatibility levels for low-frequency conducted disturbances and
signalling in public medium-voltage power supply systems
(IEC 61000-2-12:2003)

Compatibilité électromagnétique (CEM)
Partie 2-12: Environnement –
Niveaux de compatibilité pour
les perturbations conduites à basse
fréquence et la transmission des signaux
sur les réseaux publics d'alimentation
moyenne tension
(CEI 61000-2-12:2003)

Elektromagnetische Verträglichkeit
Teil 2-12: Umgebungsbedingungen -
Verträglichkeitspegel für niederfrequente
leitungsgeführte Störgrößen und
Signalübertragung in öffentlichen
Mittelspannungsnetzen
(IEC 61000-2-12:2003)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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Foreword

The text of document 77A/404/FDIS, future edition 1 of IEC 61000-2-12, prepared by SC 77A, Low frequency phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61000-2-12 on 2003-06-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-06-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annex ZA is normative and annexes A and B are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61000-2-12:2003 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60038	NOTE	Harmonized as HD 472 S1:1989 (modified).
IEC 60868	NOTE	Harmonized as HD 498 S1:1987 (not modified).
IEC 60868-0	NOTE	Harmonized as EN 60868-0:1993 (not modified).
IEC 61000-3-2	NOTE	Harmonized as EN 61000-3-2:2000 (modified).
IEC 61000-3-3	NOTE	Harmonized as EN 61000-3-3:1995 (not modified).

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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 (in so far 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

Part 6: Generic standards

Part 9: Miscellaneous

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

Detailed information on the various types of disturbances that can be expected on public power supply systems can be found in IEC 61000-2-1.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 2-12: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public medium-voltage power supply systems

1 Scope and object

This part of IEC 61000 is concerned with conducted disturbances in the frequency range from 0 kHz to 9 kHz, with an extension up to 148,5 kHz specifically for mains signalling systems. It gives compatibility levels for public medium voltage a.c. distribution systems having a nominal voltage between 1 kV and 35 kV and a nominal frequency of 50 Hz or 60 Hz (see IEC 60038).

Compatibility levels are specified for electromagnetic disturbances of the types which can be expected in public medium voltage power supply systems, for guidance in:

- a) the limits to be set for disturbance emission into public power supply systems (including the planning levels defined in 3.1.5);
- b) the immunity limits to be set by product committees and others for the equipment exposed to the conducted disturbances present in public power supply systems.

The disturbance phenomena considered are:

- voltage fluctuations and flicker;
- harmonics up to and including order 50;
- inter-harmonics up to the 50th harmonic;
- voltage distortions at higher frequencies (above 50th harmonic);
- voltage dips and short supply interruptions;
- voltage unbalance;
- transient overvoltages;
- power frequency variation;
- d.c. components;
- mains signalling.

Most of these phenomena are described in IEC 61000-2-1. In cases where it is not yet possible to establish compatibility levels, some information is provided.

The medium-voltage systems covered by this standard are public distribution systems supplying either:

- a) private installations in which equipment is connected directly or through transformers, or
- b) substations feeding public low-voltage distribution systems.

The compatibility levels specified in this standard apply at the point of common coupling in the case of (a) and at the medium-voltage terminals of the substation in the case of (b). See Clause 4.

2 Normative references

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

IEC 60071(all parts), *Insulation co-ordination*

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 61000-2-2, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 61000-2-4, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 61000-4-7, *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto*

3 Terms and definitions

For the purpose of this present document, the following definitions apply.

3.1 General definitions

3.1.1

(electromagnetic) disturbance

any electromagnetic phenomenon which, by being present in the electromagnetic environment, can cause electrical equipment to depart from its intended performance

[IEV 161-01-05 modified]

3.1.2

disturbance level

the amount or magnitude of an electromagnetic disturbance, measured and evaluated in a specified way

[IEV 161-03-01 modified]

3.1.3

electromagnetic compatibility

EMC (abbreviation)

ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

NOTE 1 Electromagnetic compatibility is a condition of the electromagnetic environment such that, for every phenomenon, the disturbance emission level is sufficiently low and immunity levels are sufficiently high so that all devices, equipment and systems operate as intended.

NOTE 2 Electromagnetic compatibility is achieved only if emission and immunity levels are controlled such that the immunity levels of the devices, equipment and systems at any location are not exceeded by the disturbance level at that location resulting from the cumulative emissions of all sources and other factors such as circuit impedances. Conventionally, compatibility is said to exist if the probability of the departure from intended performance is sufficiently low. See Clause 4 of IEC 61000-2-1.

NOTE 3 Where the context requires it, compatibility may be understood to refer to a single disturbance or class of disturbances.

NOTE 4 Electromagnetic compatibility is a term used also to describe the field of study of the adverse electromagnetic effects which devices, equipment and systems undergo from each other or from electromagnetic phenomena.

[IEV 161-01-07 modified]

3.1.4 **(electromagnetic) compatibility level**

specified electromagnetic disturbance level used as a reference level in a specified environment for co-ordination in the setting of emission and immunity limits

NOTE By convention, the compatibility level is chosen so that there is only a small probability that it will be exceeded by the actual disturbance level.

[IEV 161-03-10 modified]

3.1.5 **planning level**

level of a particular disturbance in a particular environment, adopted as a reference value for the limits to be set for the emissions from large loads and installations, in order to co-ordinate those limits with all the limits adopted for equipment intended to be connected to the power supply system

NOTE The planning level is locally specific, and is adopted by those responsible for planning and operating the power supply network in the relevant area. (For further information, see Annex A.)

3.1.6 **point of common coupling** **PCC**

point on a public power supply network, electrically nearest to a particular load, at which other loads are, or could be, connected

[IEV 161-07-15 modified]

3.2 Phenomena related definitions

The definitions below that relate to harmonics are based on the analysis of system voltages or currents by the Discrete Fourier Transform method (DFT). This is the practical application of the Fourier transform as defined in IEC 101-13-09. See Annex B.

NOTE The Fourier Transform of a function of time, whether periodic or non-periodic, is a function in the frequency domain and is referred to as the frequency spectrum of the time function, or simply spectrum. If the time function is periodic the spectrum is constituted of discrete lines (or components). If the time function is not periodic, the spectrum is a continuous function, indicating components at all frequencies.

Other definitions related to harmonics or interharmonics are given in the IEC and other standards. Some of those other definitions, although not used in this standard, are discussed in Annex B.

3.2.1**fundamental frequency**

frequency in the spectrum obtained from a Fourier transform of a time function, to which all the frequencies of the spectrum are referred. For the purpose of this standard, the fundamental frequency is the same as the power supply frequency

NOTE 1 In the case of a periodic function, the fundamental frequency is generally equal to the frequency of the function itself. (See Annex B.1).

NOTE 2 In case of any remaining risk of ambiguity, the power supply frequency should be referred to the polarity and speed of rotation of the synchronous generator(s) feeding the system.

[IEV 101-14-50, modified]

3.2.2**fundamental component**

component whose frequency is the fundamental frequency

3.2.3**harmonic frequency**

frequency which is an integer multiple of the fundamental frequency. The ratio of the harmonic frequency to the fundamental frequency is the *harmonic order* (recommended notation: “*h*”)

3.2.4**harmonic component**

any of the components having a harmonic frequency. Its value is normally expressed as an r.m.s. value

For brevity, such a component may be referred to simply as an harmonic

3.2.5**interharmonic frequency**

any frequency which is not an integer multiple of the fundamental frequency

NOTE 1 By extension from harmonic order, the interharmonic order is the ratio of an interharmonic frequency to the fundamental frequency. This ratio is not an integer. (Recommended notation “*m*”).

NOTE 2 In the case where $m < 1$ the term subharmonic frequency may be used.

3.2.6**interharmonic component**

component having an interharmonic frequency. Its value is normally expressed as an r.m.s. value

For brevity, such a component may be referred to simply as an “interharmonic”

NOTE For the purpose of this standard and as stated in IEC 61000-4-7, the time window has a width of 10 fundamental periods (50 Hz systems) or 12 fundamental periods (60 Hz systems), i.e. approximately 200 ms. The difference in frequency between two consecutive interharmonic components is, therefore, approximately 5 Hz.

3.2.7**total harmonic distortion****THD**

ratio of the r.m.s. value of the sum of all the harmonic components up to a specified order (recommended notation “*H*”) to the r.m.s. value of the fundamental component

$$THD = \sqrt{\sum_{h=2}^{h=H} \left(\frac{Q_h}{Q_1} \right)^2}$$