IEC TR 61000-3-18

Edition 1.0 2024-02

TECHNICAL REPORT

colour inside

Electromagnetic compatibility (EMC) – Part 3-18: Limits – Assessment of network characteristics for the application of harmonic emission limits – Equipment connected to LV distribution systems not covered by IEC 61000-3-2 and IEC 61000-3-12



IEC TR 61000-3-18:2024-02(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 33.100.10

ISBN 978-2-8322-8219-9

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-18: Limits – Assessment of network characteristics for the application of harmonic emission limits – Equipment connected to LV distribution systems not covered by IEC 61000-3-2 and IEC 61000-3-12

FOREWORD

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IEC TR 61000-3-18 has been prepared by subcommittee 77A: EMC – Low frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
77A/1197/DTR	77A/1202/RVDTR

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

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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 document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document 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

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 levels

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: IEC 61000-6-1).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-18: Limits – Assessment of network characteristics for the application of harmonic emission limits – Equipment connected to LV distribution systems not covered by IEC 61000-3-2 and IEC 61000-3-12

1 Scope

This part of IEC 61000, which is a technical report, reports on the development of a methodology for adapting IEC equipment emission limits from IEC 61000-3-2 and IEC 61000-3-12 for use in regions not covered by these documents. It identifies gaps in the existing equipment emission limit standards concerning their international applicability and identifies public power system characteristics important for the evaluation of harmonic voltage performance.

The purpose of adapting the above-mentioned IEC equipment harmonic emission standards in a particular region is to maintain similar electromagnetic compatibility (EMC) of equipment up to 75 A per phase in the public power systems in those regions.

NOTE The boundaries between the various voltage levels differ amongst different countries (see IEC 60050-601:1985, 601-01-28). This document uses the following terms when referring to 50 Hz and 60 Hz system voltages:

– low voltage (LV) refers to $U_n \leq 1$ kV;

– medium voltage (MV) refers to 1 kV < $U_n \leq 35$ kV;

– high voltage (HV) refers to 35 kV < $U_n \leq 230$ kV.

EMC requirements can have economic and societal impacts; these have not been considered in the development of this document. The consideration of these factors generally occurs in the technical committees working on development and maintenance of emission limit standards.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

For the purposes of this document, the following terms and definitions 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 Terms and definitions

3.1.1
distribution system operator
DSO
party operating an electric power distribution system

[SOURCE: IEC 60050-617:2009, 617-02-10, modified – electric power has been added to the definition.]

3.1.2
distributed energy resource
DER
generator (with its auxiliaries, protection and connection equipment), including loads having a generating mode (such as electrical energy storage systems), connected to a low-voltage or a medium-voltage network

[SOURCE: IEC 60050-617:2017, 617-04-20, modified – changed to singular]

3.1.3
electromagnetic compatibility
EMC
ability of equipment or a system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

[SOURCE: IEC 60050-161:2018, 161-01-07]

3.1.4
(electromagnetic) compatibility level
the specified electromagnetic disturbance level used as a reference level for co-ordination in the setting of emission and immunity limits

Note 1 to entry: 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. However electromagnetic compatibility is achieved only if emission and immunity levels are controlled such that, at each location, the disturbance level resulting from the cumulative emissions is lower than the immunity level for each device, equipment and system situated at this same location.

Note 2 to entry: The compatibility level can be phenomenon, time or location dependent.

[SOURCE: IEC 60050-161:1990, 161-03-10]

3.1.5
emission limit (of a disturbing source)
specified maximum permitted emission of a source of electromagnetic disturbance

3.1.6
electric power network
network
particular installations, substations, lines or cables for the transmission and distribution of electricity

Note 1 to entry: Electric power network can also be referred to as electric power system (system).

[SOURCE: IEC 60050-601:1985, 601-01-02]

3.1.7
harmonic (component)
component of order greater than 1 of the Fourier series of a periodic quantity

[SOURCE: IEC 60050-161:1990, 161-02-18]

3.1.8
point of connection
point of interconnection
POC
POI
reference point on the electric power system where the user's electrical facility is connected

[SOURCE: IEC 60050-617:2009, 617-04-01, modified – in the term "point of connection" and "POI" have been added.]

3.1.9
point of common coupling
PCC
point of a power supply network, electrically nearest to a particular load, at which other loads are, or can be, connected

Note 1 to entry: These loads can be either devices, equipment or systems, or distinct customer installations.

Note 2 to entry: In some applications, the term "point of common coupling" is restricted to public networks.

[SOURCE: IEC 60050-161:1990, 161-07-15]

3.1.10
reference network model
RNM
95th percentile representation of a power system by means of one circuit designed with lines, cables, equipment, and loads having specified configurations for an intended study

Note 1 to entry: A reference network model for obtaining the 95th percentile of steady-state voltage performance might be different from a reference network model for obtaining the 95th percentile of voltage harmonic distortion.

3.1.11
network sensitivity
ratio of change produced in a network variable by injection of a known disturbance

Note 1 to entry: The change in harmonic distortion level in a network by injection of harmonic current is one example of sensitivity that can be used for comparative purposes.

3.1.12
system impedance
impedance of the supply system as viewed from the point of common coupling

[SOURCE: IEC 60060-161:1990, 161-07-16, modified – "supply" has been removed from the term.]

3.1.13
topology
<network or power system> relative position of the ideal elements representing an electric network.

[SOURCE: IEC 60050-603:1986, 603-02-04]

3.2 Abbreviated terms

C_{fh}	Conversion factor
CP95	95th percentile
DER	Distributed energy resource
DSO	Distribution system operator
EMC	Electromagnetic compatibility
h	Harmonic of order
LV	Low voltage
MV	Medium voltage
HV	High voltage
NA	North America
PCC	Point of common coupling
POC	Point of connection
POI	Point of interconnection
RNM	Reference network model
$S_{h_{RNM}}$	95th percentile of the harmonic voltage at the POIs of the RNM
$S_{h_{Target}}$	95th percentile of the harmonic voltage at the POIs of the targeted network
S_R	Sensitivity ratio
SSE	Sum-squared error
SWER	Single-wire earth-return
THD	Total harmonic distortion
U_{NEW}	Supply voltage for the new limits
U_R	Voltage ratio
U_{RNM}	Phase-to-neutral European voltage, which is 230,94 V computed from the phase-phase nominal voltage, which is 400 V
xPyW	x-phase y-wire where x and y are numeric

4 General

IEC documents defining equipment harmonic current emission limits are largely based on European power systems having three-phase three-wire (3P3W) MV feeder topologies supplying three-phase four-wire (3P4W) LV distribution networks through delta-wye transformation. Typically, such LV systems serve hundreds of customers via many kilometres of cables, usually in a grounded configuration. This feeder topology results in a significant portion of the voltage total harmonic distortion (THD) at any given LV point of interconnection (POI) being caused by aggregation of harmonic currents flowing through the LV network impedance.