

TECHNICAL SPECIFICATION

**Electromagnetic compatibility (EMC) –
Part 3-16: Limits – Limits for harmonic currents produced by the inverter of
inverter-type electrical energy-supplying equipment with a reference current less
than or equal to 75 A per phase connected to public low-voltage systems**

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-16: Limits – Limits for harmonic currents produced by the inverter of inverter-type electrical energy-supplying equipment, with a reference current less than or equal to 75 A per phase, connected to public low-voltage systems

FOREWORD

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IEC 61000-3-16 has been prepared by subcommittee 77A EMC – Low frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility. It is a Technical Specification.

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

Draft	Report on voting
77A/1167/DTS	77A/IRVDTS

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 Specification 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/standardsdev/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.

This document has the status of a product family standard.

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- withdrawn,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.

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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 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

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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 3-16: Limits – Limits for harmonic currents produced by the inverter of inverter-type electrical energy-supplying equipment, with a reference current less than or equal to 75 A per phase, connected to public low-voltage systems

1 Scope

This part of IEC 61000 deals with the limits for harmonic (including grouped interharmonic) currents produced by the inverter of inverter-type electrical energy-supplying equipment (ESE) as defined in 3.2, but which does not include energy storage. The limits given in this document are applicable to inverters with a reference current as defined in 3.3 (see also 5.2.3) less than or equal to 75 A per phase, intended to be connected to public low-voltage AC distribution systems of the following types:

- single-phase, two or three wires; nominal voltage up to 240 V
- three-phase, three or four wires; nominal voltage up to 690 V
- nominal frequency of 50 Hz or 60 Hz.

This document specifies:

- a) requirements and emission limits for equipment;
- b) methods for type tests and simulations.

Tests in accordance with this document are type tests of complete pieces of equipment.

Equipment which mainly absorbs energy but which is capable of supplying energy to the public supply as a secondary function is out of the scope of this document.

EXAMPLE An elevator motor drive returning energy during braking.

This document provides limits and testing procedures for equipment in the range up to harmonic order 40 (h_{40}), i.e. 2 000 Hz or 2 400 Hz depending on line frequency.

NOTE 1 It is possible that limits for frequencies in the range from 2 kHz to 9 kHz will be added in a future edition of this document.

NOTE 2 It is possible that limits and procedures for storage systems will be added in a future edition of this document.

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 60038:2009, *IEC standard voltages*

IEC 61000-2-2:2002, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 61000-2-2:2002 AMD1:2017

IEC 61000-2-2:2002 AMD2:2018

IEC 61000-4-7:2002, *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*
IEC 61000-4-7:2002 AMD:2008

IEC TR 60725:2012, *Consideration of reference impedances and public supply network impedances for use in determining the disturbance characteristics of electrical equipment having a rated current ≤ 75 A per phase*

3 Terms and definitions

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 electrical energy-supplying equipment ESE

equipment or system whose main function is to supply electrical energy into public power supply systems

Note 1 to entry: An ESE can also include an energy storage system.

3.2 inverter-type electrical energy-supplying equipment

ESE that includes an inverter taking a DC supply from an energy source but does not include an energy storage system

3.3 reference current

I_{ref}

RMS output current stated in the equipment specification

Note 1 to entry: See 5.2.2 and 5.2.3 for the conditions for determining I_{ref} .

3.4 short-circuit power

S_{sc}

value of the three-phase short-circuit power calculated from the nominal interphase system voltage U_n and the line impedance Z of the system at the point of connection of the ESE:

$$S_{\text{sc}} = U_n^2 / Z$$

3.5 rated apparent power

S_{equ}

<of the ESE inverter> apparent power value calculated from the reference output current I_{ref} of the ESE inverter stated by the manufacturer and the rated voltage U_p (single phase) or U_i (interphase) as follows:

- a) $S_{\text{equ}} = U_p I_{\text{ref}}$ for single-phase equipment;

b) $S_{\text{equ}} = \sqrt{3}U_i I_{\text{ref}}$ for three-phase equipment;

Note 1 to entry: In the case of a voltage range, U_p or U_i is a nominal system voltage according to IEC 60038 (for example: 120 V or 230 V for single-phase or 400 V line-to-line for three-phase).

3.6 short-circuit ratio

R_{sce}

characteristic value of a piece of ESE defined as follows:

$R_{\text{sce}} = S_{\text{sc}} / (3 S_{\text{equ}})$ for single-phase ESE

$R_{\text{sce}} = S_{\text{sc}} / S_{\text{equ}}$ for three-phase ESE

3.7 partial harmonic current

PHC

total RMS value of the harmonic current components of orders 14 to 40

$$PHC = \sqrt{\sum_{h=14}^{40} I_h^2}$$

3.8 total harmonic current

THC

total RMS value of the harmonic current components of orders 2 to 40

$$THC = \sqrt{\sum_{h=2}^{40} I_h^2}$$

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3.9 partial triplen harmonic current

PHC_{triplen}

total RMS value of the harmonic current components of the 15th, 18th, 21st, 24th, 27th, 30th, 33rd, 36th and 39th harmonic

$$PHC_{\text{triplen}} = \sqrt{\sum_{h=15,18\dots}^{39} I_h^2}$$

3.10 partial zero-sequence harmonic current

PHC_{zero}

total RMS value of the modulus of the harmonic zero-sequence current components of orders 14 to 40

$$PHC_{\text{zero}} = \sqrt{\sum_{h=14}^{40} \left(\frac{I_{h,L1} + I_{h,L2} + I_{h,L3}}{3} \right)^2}$$

where $I_{h,L1}$, $I_{h,L2}$ and $I_{h,L3}$ are the complex vectors of the harmonic phase currents

Note 1 to entry: PHC_{zero} is only applicable to three-phase equipment.