IEC 61000-3-2

Edition 5.0 2018-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

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

IEC 61000-3-2:2018-01(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - webstore.iec.ch/advsearchform
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org
Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC 61000-3-2

Edition 5.0 2018-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.100.10

ISBN 978-2-8322-5250-5

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61000-3-2 has been prepared by sub-committee 77A: EMC – Low frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

It forms part 3-2 of the IEC 61000 series. It has the status of a product family standard.

This fifth edition cancels and replaces the fourth edition published in 2014. This edition constitutes a technical revision.

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

a) an update of the emission limits for lighting equipment with a rated power ≤ 25 W to take into account new types of lighting equipment;
b) the addition of a threshold of 5 W under which no emission limits apply to all lighting equipment;

c) the modification of the requirements applying to the dimmers when operating non-incandescent lamps;

d) the addition of test conditions for digital load side transmission control devices;

e) the removal of the use of reference lamps and reference ballasts for the tests of lighting equipment;

f) the simplification and clarification of the terminology used for lighting equipment;

g) the classification of professional luminaires for stage lighting and studios under Class A;

h) a clarification about the classification of emergency lighting equipment;

i) a clarification for lighting equipment including one control module with an active input power ≤ 2 W;

j) an update of the test conditions for television receivers;

k) an update of the test conditions for induction hobs, taking also into account the other types of cooking appliances;

l) for consistency with IEC 61000-3-12, a change of the scope of IEC 61000-3-2 from equipment with an input current ≤ 16 A to equipment with a rated input current ≤ 16 A.

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

FDIS	Report on voting
77A/986/FDIS	77A/990/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

- 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

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 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

1 Scope

This part of IEC 61000 deals with the limitation of harmonic currents injected into the public supply system.

It specifies limits of harmonic components of the input current which can be produced by equipment tested under specified conditions.

This part of IEC 61000 is applicable to electrical and electronic equipment having a rated input current up to and including 16 A per phase, and intended to be connected to public low-voltage distribution systems.

Arc welding equipment which is not professional equipment, with a rated input current up to and including 16 A per phase, is included in this document. Arc welding equipment intended for professional use, as specified in IEC 60974-1, is excluded from this document and can be subject to installation restrictions as indicated in IEC 61000-3-12.

The tests according to this document are type tests.

For systems with nominal voltages less than but not equal to 220 V (line-to-neutral), the limits have not yet been considered.

NOTE The words apparatus, appliance, device and equipment are used throughout this document. They have the same meaning for the purposes 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 60050-161, *International Electrotechnical Vocabulary (IEV) – Part 161: Electromagnetic compatibility* (available at www.electropedia.org)

IEC 60155, *Glow-starters for fluorescent lamps*

IEC 60268-3, *Sound system equipment – Part 3: Amplifiers*

IEC 60335-2-24:2010, *Household and similar electrical appliances – Safety – Part 2-24: Particular requirements for refrigerating appliances, ice-cream appliances and ice makers*

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/AMD1:2008

3 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
portable tool
electrical tool which is hand-held during normal operation and used for a short time (a few minutes) only

Note 1 to entry: Hand-held means that no part of the tool, except the power cord, rests on the floor during normal operation.

3.2
lamp
source intended to produce an optical radiation, usually visible

Note 1 to entry: For the purposes of this document, a lamp can also be a solid state lighting module which can contain further components, for example optical, electrical, mechanical and/or electronic components.

3.3
self-ballasted lamp
unit which cannot be dismantled without being permanently damaged, is provided with a lamp cap and incorporates a light source and the lighting control gear necessary for the operation of the light source

3.4
luminaire
apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes, except the lamps themselves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electric supply

[SOURCE: IEC 60050-845:1987, 845-10-01, modified – the existing notes have been removed]

3.5
input current
current directly supplied to an equipment or a part of equipment by the AC distribution system

3.6
circuit power factor
ratio of the measured active input power to the product of the RMS supply voltage and the RMS supply current

3.7
active power
mean value of the instantaneous power, taken over 10 (50 Hz systems) or 12 (60 Hz systems) fundamental periods and measured in accordance with IEC 61000-4-7

Note 1 to entry: The active input power is the active power measured at the input supply terminals of the equipment under test.

3.8
balanced three-phase equipment
equipment having rated line current modules which differ by no more than 20 %

3.9
professional equipment
equipment for use in trades, professions or industries and which is not intended for sale to the general public, as designated by the manufacturer

[SOURCE: IEC 60050-161:1990, 161-05-05, modified – the existing Note has been replaced by the text added at the end of the definition]

3.10
total harmonic current
THC
total RMS value of the harmonic current components of orders 2 to 40, expressed as:

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

Note 1 to entry: This note applies to the French language only.

3.11
total harmonic distortion
THD
ratio of the RMS value of the sum of the harmonic components (in this context, harmonic current components I_h of orders 2 to 40) to the RMS value of the fundamental component, expressed as:

$$THD = \sqrt{\sum_{h=2}^{40} \left(\frac{I_h}{I_1} \right)^2}$$

Note 1 to entry: This note applies to the French language only.

3.12
partial odd harmonic current
POHC
total RMS value of the odd harmonic current components of orders 21 to 39, expressed as:

$$POHC = \sqrt{\sum_{h=21,23}^{39} I_h^2}$$

Note 1 to entry: This note applies to the French language only.

3.13
lighting equipment
equipment with a primary function of generating and/or regulating and/or distributing optical radiation

Note 1 to entry: See also 5.2.

3.14
stand-by mode
non-operational, low power consumption mode (usually indicated in some way on the equipment) that can persist for an indefinite time

3.15
repeatability
<results of measurements> closeness of the agreement between the results of measurements of harmonic currents on the same equipment under test, carried out with the same test system, at the same location, under identical test conditions

3.16
reproducibility
<results of measurements> closeness of the agreement between the results of measurements of harmonic currents on the same equipment under test, carried out with different test systems under conditions of measurement intended to be the same in each case

Note 1 to entry: The test system and test conditions are assumed to fulfil all normative requirements in the applicable standards.

3.17
variability
<results of measurements> closeness of the agreement between the results of measurements of harmonic currents on different samples of the same type of equipment under test, having no intentional differences, carried out with different test systems under conditions of measurement intended to be the same in each case

Note 1 to entry: The test system and test conditions are assumed to fulfil all normative requirements in the applicable standards.

Note 2 to entry: In the context of this document, the meaning of the terms can be summarized as follows:

Term	Meaning
Repeatability	Same equipment under test (EUT), same test system, same test conditions, repeated tests
Reproducibility	Same equipment under test (EUT), different but normative test systems, different but normative test conditions
Variability	Different equipments under test (EUTs) of the same type, having no intentional differences, different but normative test systems, different but normative test conditions

3.18
variable speed drive
VSD
equipment, based on power electronics, which enables the speed and/or torque of a motor to be continuously controlled

3.19
lighting control gear
device connected between the supply and one or more lamps, enabling the lamp(s) to operate as intended

Note 1 to entry: The lighting control gear can consist of one or more separate components. It can include means for dimming, correcting the power factor and suppressing radio interference, and further control functions.

Note 2 to entry: The lighting control gear can be partly or totally integrated in some lamps, such as in the case of self-ballasted lamps. Any references to lighting control gear include any such integrated lamps.

Note 3 to entry: Examples of lighting control gear are ballasts or electronic control gear for discharge lamps, step-down converters for incandescent lamps, drivers for solid state lighting modules.

Note 4 to entry: For the purposes of this document, independent phase control dimmers as defined in 3.23 and 3.24 are not considered to be lighting control gear.

Note 5 to entry: Mechanical switches and relays, and other simple devices providing on/off control only, do not produce distorted currents and are not considered to be lighting control gear.

3.20
digital load side transmission lighting control device
DLT control device
device to control lighting parameters of electronic lighting equipment, such as light level and light colour, using data transmission over its load side mains wiring in accordance with IEC 62756-1

Note 1 to entry: A DLT control device is wired like a phase control dimmer, but does not directly make the supply power delivered to the connected dedicated lighting equipment vary. It transmits digital signals over the power cable on the load side to the dedicated lighting equipment, which contains means for receiving and interpreting control signals as well as built-in means for dimming, colour variation, etc.

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

3.21
dimmer
device to control the light output level of lighting equipment

3.22
built-in dimmer
dimmer which is either contained within the enclosure of a luminaire or mounted in its supply cable

3.23
independent dimmer
dimmer other than a built-in dimmer

3.24
phase control dimmer
electronic switch producing a leading edge (forward phase) or a trailing edge (reverse phase) AC waveform

Note 1 to entry: This AC waveform is supplied to one or more loads and its conduction angle is adjustable.

3.25
universal phase control dimmer
phase control dimmer which is capable of switching, automatically or manually, between producing a leading edge or a trailing edge AC waveform

3.26
professional luminaire for stage lighting and studios
luminaire (outdoor or indoor) for stage lighting or for television, film or photographic studios within the scope of IEC 60598-2-17 and which is professional equipment

4 General

The objective of this document is to set limits for harmonic emissions of equipment within its scope, so that, with due allowance for the emissions from other equipment, compliance with the limits ensures that harmonic disturbance levels do not exceed the compatibility levels defined in IEC 61000-2-2.

Professional equipment that does not comply with the requirements of this document can be permitted to be connected to certain types of low voltage supplies, if the instruction manual contains a requirement to ask the supply utility for permission to connect. Recommendations concerning this aspect are contained in IEC 61000-3-12.

5 Classification of equipment

5.1 General

For the purpose of harmonic current limitation, equipment is classified as follows:

Class A:

Equipment not specified as belonging to Class B, C or D shall be considered as Class A equipment.

Some examples of Class A equipment are:

– balanced three-phase equipment;
– household appliances, excluding those specified as belonging to Class B, C or D;
– vacuum cleaners;
– high pressure cleaners;
– tools, excluding portable tools;
– independent phase control dimmers;
– audio equipment;
– professional luminaires for stage lighting and studios.

NOTE 1 Equipment that can be shown to have a significant effect on the supply system might be reclassified in a future edition of this document, taking into account the following factors:

– number of pieces of equipment in use;
– duration of use;
– simultaneity of use;
– power consumption;
– harmonic spectrum, including phase.

Class B:

– portable tools;
– arc welding equipment which is not professional equipment.

Class C:

– lighting equipment.

Class D:

Equipment having a specified power according to 6.3.2, less than or equal to 600 W, of the following types:

– personal computers and personal computer monitors;
– television receivers;
– refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

NOTE 2 Class D limits are reserved for equipment that, by virtue of the factors listed in note 1, can be shown to have a pronounced effect on the public electricity supply system.

5.2 Description of lighting equipment

In this document, lighting equipment as defined in 3.13 includes:

– lamps and luminaires;

– the lighting part of multi-function equipment where one of the primary functions of this is illumination;
– independent lighting control gear;
– ultraviolet (UV) and infrared (IR) radiation equipment;
– illuminated advertising signs;
– independent dimmers, other than phase control types, for lighting equipment;
– DLT control devices.

In this document, lighting equipment as defined in 3.13 excludes:

– lighting devices built in equipment with another primary purpose, such as photocopiers, overhead projectors and slide projectors, or employed for scale illumination or indication purposes;
– household appliances whose primary function is not for generating and/or regulating and/or distributing optical radiation but which contain one or more lamps with or without a separate switch (e.g. a range hood with a built-in lamp);
– independent phase control dimmers;
– professional luminaires for stage lighting and studios;
– emergency luminaires that emit light only during emergency mode.

6 General requirements

6.1 General

The restrictions specified in 6.2 also apply to the categories of equipment listed in 7.1 for which no harmonic current limits apply.

The requirements and limits specified in this document are applicable to the power input terminals of equipment intended to be connected to 220/380 V, 230/400 V and 240/415 V systems operating at 50 Hz or 60 Hz. Requirements and limits for other cases are not yet specified.

A simplified test method is permitted for equipment that undergoes minor changes or updates, provided that, in previous full compliance tests, it has been shown to have current emissions below 60 % of the applicable limits and the *THD* of the supply current is less than 15 %. The simplified test method consists of verifying that the updated equipment has an active input power within ±20 % of that of the originally tested product, and that the *THD* of the supply current is less than 15 %. Products that fulfill these requirements are deemed to comply with the applicable limits, but in case of doubt the result of a full compliance test according to Clauses 6 and 7 takes precedence over this simplified method.

6.2 Control methods

Asymmetrical controls according to IEC 60050-161:1990, 161-07-12, and half-wave rectification directly on the mains supply may only be used in the following circumstances:

a) where they are the only practical solution permitting the detection of unsafe conditions, or
b) where the controlled active input power is less than or equal to 100 W, or
c) where the controlled appliance is a portable equipment fitted with a two-core flexible cord and is intended for use for a short period of time, i.e. for a few minutes only.

If one of these three conditions is fulfilled, half-wave rectification may be used for any purpose, whereas asymmetrical controls may only be used for the control of motors.

NOTE 1 Such equipment includes, but is not limited to, hair dryers, electrical kitchen appliances and portable tools.