IEC 61000-3-2

Edition 4.0 2014-05

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 61000-3-2:2014-05(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

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

FOREWORD

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

This fourth edition cancels and replaces the third edition published in 2005, Amendment 1: 2008, Amendment 2:2009 and Corrigendum of August 2009.

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

a) a clarification of the repeatability and reproducibility of measurements;
b) a more accurate specification of the general test conditions for information technology equipment;
c) the addition of optional test conditions for information technology equipment with external power supplies or battery chargers;

d) the addition of a simplified test method for equipment that undergoes minor changes or updates;
e) an update of the test conditions for washing machines;
f) a clarification of the requirements for Class C equipment with active input power ≤ 25 W;
g) an update of the test conditions for audio amplifiers;
h) a clarification of the test conditions for lamps;
i) an update of the test conditions for vacuum cleaners;
j) the addition of test conditions for high pressure cleaners;
k) an update of the test conditions for arc welding equipment;
l) the reclassification of refrigerators and freezers with variable-speed drives into Class D;
m) the addition of test conditions for refrigerators and freezers.

The text of this standard is based on the third edition, Amendment 1, Amendment 2, the Corrigendum of August 2009 and the following documents:

FDIS	Report on voting
77A/846/FDIS	77A/853/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.

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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 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 sections which are to be published either as international standards, technical specifications, or as technical reports.

These standards and reports will be published in chronological order and numbered accordingly (for example, 61000-6-1).

This part is an international standard which gives emission limits for harmonic currents from equipment having an input current up to and including 16 A per phase.

This part is a Product Family Standard.

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 may be produced by equipment tested under specified conditions.

Harmonic components are measured according to Annexes A and B.

This part of IEC 61000 is applicable to electrical and electronic equipment having an 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 input current up to and including 16 A per phase, is included in this standard.

Arc welding equipment intended for professional use, as specified in IEC 60974-1, is excluded from this standard and may be subject to installation restrictions as indicated in IEC/TR 61000-3-4 or IEC 61000-3-12.

The tests according to this standard are type tests. Test conditions for particular equipment are given in Annex C.

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

NOTE The words apparatus, appliance, device and equipment are used throughout this standard. They have the same meaning for the purpose of this standard.

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 60050-131, *International Electrotechnical Vocabulary (IEV) – Part 131: Electric and magnetic circuits*

IEC 60050-161, *International Electrotechnical Vocabulary (IEV) – Part 161: Electro-magnetic compatibility*

IEC 60107-1, *Methods of measurement on receivers for television broadcast transmissions – Part 1: General considerations – Measurements at radio and video frequencies*

IEC 60155, *Glow-starters for fluorescent lamps*

IEC 60268-1:1985, *Sound system equipment – Part 1: General*

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

IEC 60335-2-2, *Household and similar electrical appliances – Safety – Part 2-2: Particular requirements for vacuum cleaners and water-suction cleaning appliances*

IEC 60335-2-14, *Household and similar electrical appliances – Safety – Part 2-14: Particular requirements for kitchen machines*

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 60335-2-79, *Household and similar electrical appliances – Safety – Part 2-79: Particular requirements for high pressure cleaners and steam cleaners*

IEC 60974-1, *Arc welding equipment – Part 1: Welding power sources*

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/TR 61000-3-4, *Electromagnetic compatibility (EMC) – Part 3-4: Limits – Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A*

IEC 61000-3-12, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase*

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*

Recommendation ITU-R BT.471-1, *Nomenclature and description of colour bar signals*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 as well as the following apply.

3.1
portable tool
electrical tool which is hand-held during normal operation and used for a short time (a few minutes) only

3.2
lamp
source for producing light

3.3
self-ballasted lamp
unit which cannot be dismantled without being permanently damaged, provided with a lamp cap and incorporating a light source and any additional element necessary for starting and stable operation of the light source

3.4
luminaire
apparatus (other than a lamp) which distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, fixing and protecting the lamps, and, where necessary, circuit auxiliaries, together with the means for connecting them to the supply

3.5
ballast
device connected between the supply and one or more discharge lamps which serves mainly to limit the current of the lamp(s) to the required value. It may include means for transforming the supply voltage and/or frequency, correcting the power factor and, either alone or in combination with a starting device, provide the necessary conditions for starting the lamp(s)

3.6
step-down converter for lighting equipment
unit inserted between the supply and one or more tungsten halogen or other filament lamps which serves to supply the lamp(s) with its (their) rated voltage, generally at high frequency. The unit may consist of one or more separate components. It may include means for dimming, correcting the power factor and suppressing radio interference

3.7
reference lamp
lamp selected for testing ballasts which, when associated with a reference ballast, has electrical characteristics that are close to the objective values given in the relevant lamp specification

3.8
reference ballast
special inductive-type ballast designed for the purpose of providing comparison standards for use in testing ballasts and for the selection of reference lamps. It is essentially characterized by a stable voltage-to-current ratio, which is relatively uninfluenced by variations in current, temperature, and the magnetic surroundings

3.9
input current
current directly supplied to an equipment or a part of equipment by the a.c. distribution system

3.10
circuit power factor
the circuit power factor is the ratio of the measured active input power to the product of the supply voltage (r.m.s.) and the supply current (r.m.s.)

3.11
active power
mean value, taken over one period, of the instantaneous power

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

[SOURCE: IEC 60050-131:2013, 131-11-42]

3.12
balanced three-phase equipment
equipment having rated line current modules which differ by no more than 20 %

3.13
professional equipment
equipment for use in trades, professions, or industries and which is not intended for sale to the general public. The designation shall be specified by the manufacturer

3.14
total harmonic

3.14.1
total harmonic current
total r.m.s. value of the harmonic current components of orders 2 to 40

$$\text{total harmonic current} = \sqrt{\sum_{n=2}^{40} I_n^2}$$

3.14.2
total harmonic distortion
THD
ratio of the r.m.s. value of the sum of the harmonic components (in this context harmonic current components I_h of orders 2 to 40) to the r.m.s. value of the fundamental component

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

3.15
built-in dimmer
dimmer, including the user control, which is entirely contained within the enclosure of a luminaire

3.16
partial odd harmonic current
total r.m.s. value of the odd harmonic current components of orders 21 to 39

$$\text{partial odd harmonic current} = \sqrt{\sum_{n=21,23}^{39} I_n^2}$$

3.17
lighting equipment
equipment with a primary function of generating and/or regulating and/or distributing optical radiation by means of incandescent lamps, discharge lamps or LED's

Included are:

– lamps and luminaires;
– the lighting part of multi-function equipment where one of the primary functions of this is illumination;
– independent ballasts for discharge lamps and independent incandescent lamp transformers;
– ultraviolet (UV) and infrared (IR) radiation equipment;
– illuminated advertising signs;
– dimmers for lamps other than incandescent.

Excluded are:

– lighting devices built in equipment with another primary purpose such as photocopiers, overhead projectors and slide projectors or employed for scale illuminating 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 separate switch (e.g. a range hood with a built-in lamp);

– dimmers for incandescent lamps.

3.18
stand-by mode
sleep-mode
non-operational, low power consumption mode (usually indicated in some way on the equipment) that can persist for an indefinite time

3.19
repeatability of 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

[SOURCE: IEC 60050-394:2007, 394-40-38, modified[1)]]

3.20
reproducibility of 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 standards.

[SOURCE: IEC 60050-394:2007, 394-40-39, modified]

3.21
variability of 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 standards.

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

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

1) IEC 60050-394:2007, *International Electrotechnical Vocabulary – Part 394: Nuclear instrumentation – Instruments, systems, equipment and detectors*

3.22
variable speed drive
VSD
equipment, based on power electronics, which enables the speed and/or torque of a motor to be continuously controlled

4 General

The objective of this standard 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 standard may 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/TR 61000-3-4 or IEC 61000-3-12.

5 Classification of equipment

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

Class A:

– balanced three-phase equipment;
– household appliances, excluding equipment identified as Class D;
– tools, excluding portable tools;
– dimmers for incandescent lamps;
– audio equipment.

Equipment not specified in one of the three other classes shall be considered as Class A equipment.

NOTE 1 Equipment that can be shown to have a significant effect on the supply system may be reclassified in a future edition of the standard. Factors to be taken into account include:

– 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 6.2.2 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.

6 General requirements

The following restrictions apply even to equipment to which no harmonic current limits apply as defined in Clause 7.

The requirements and limits specified in this clause 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 considered.

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.

6.1 Control methods

Asymmetrical controls according to IEC 60050-161, 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.

Symmetrical control methods which are prone to produce harmonics of low order ($n \leq 40$) in the input current may be used for the control of the power supplied to heating elements provided that the full sine-wave input power is less than or equal to 200 W, or that the limits of Table 3 are not exceeded.

Such symmetrical control methods are also allowed for professional equipment provided that either

a) one of the above conditions is fulfilled, or
b) the relevant limits are not exceeded when tested at the supply input terminals and in addition both the following conditions are fulfilled:
   1) it is necessary to control precisely the temperature of a heater whose thermal time constant is less than 2 s, and
   2) there is no other technique economically available.

Professional equipment whose primary purpose, considered as a whole, is not for heating, shall be tested against the relevant limits.