

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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

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

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTROMAGNETIC COMPATIBILITY (EMC) –****Part 3-2: Limits –  
Limits for harmonic current emissions  
(equipment input current  $\leq 16$  A per phase)**

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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 third edition of IEC 61000-3-2 cancels and replaces the second edition published in 2000, its amendment 1 (2001) and amendment 2 (2004).

The text of this standard is based on the second edition, amendment 1, amendment 2 and the following documents:

FDIS	Report on voting
77A/503/FDIS	77A/516/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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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

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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 $\leq 16$ 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 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 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 60050(131), *International Electrotechnical Vocabulary (IEV) – Chapter 131: Electric and magnetic circuits*

IEC 60050(161), *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 60065, *Audio, video and similar electronic apparatus – Safety requirements*

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 60268-3, *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 60974-1, *Arc welding equipment – Part 1: Welding power sources*

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

IEC/TS 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 Definitions

For the purpose of this part of IEC 61000, the following definitions apply, as well as the definitions of IEC 60050(161).

#### 3.1

##### **portable tool**

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

#### 3.2

##### **lamp**

a source for producing light

#### 3.3

##### **self-ballasted lamp**

a 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**

an 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****semi-luminaire**

a unit similar to a self-ballasted lamp but designed to utilize a replaceable light source and/or starting device

**3.6****ballast**

a 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)

**3.7****step-down converter for lighting equipment**

a 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

**3.8****lighting unit**

lighting equipment consisting of one self-ballasted lamp or the combination of one control device (ballast, semi-luminaire, transformer or the like) operating one or more lamps

**3.9****reference lamp**

a 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

**3.10****reference ballast**

a 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

**3.11****input current**

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

**3.12****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.)

**3.13****active power**

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

[IEV 131-03-18]

NOTE The active input power is the active power measured at the input supply terminals of the equipment under test.

**3.14****balanced three-phase equipment**

equipment having rated line current modules which differ by no more than 20 %

**3.15****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

**3.16****total harmonic current**

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

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

**3.17****built-in dimmer**

dimmer, including the user control, which is entirely contained within the enclosure of a luminaire

**3.18****partial odd harmonic current**

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

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

**3.19****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;
- dimmers for incandescent lamps.

**3.20****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

## 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/TS 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.

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.

### 6.1 Control methods

Asymmetrical controls according to IECV 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 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 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 are 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.

NOTE 1 An example of a product whose primary purpose is not heating is a photocopier, whereas a cooker is considered to have heating as its primary purpose.

Domestic equipment with symmetrical control used for a short time (for example hair dryers) shall be tested under Class A.

Even though asymmetrical controls and half-wave rectification are permitted under the conditions given above, the equipment shall still comply with the harmonic requirements of this standard.

NOTE 2 The use of asymmetrical controls and half-wave rectification is allowed in the above circumstances; however, in case of fault, the d.c. component of the supplied current may disturb certain types of protection devices. In the same way, this may also happen with the use of symmetrical controls.