

# Electromagnetic compatibility (EMC) —

**Part 3-12: Limits — Limits for harmonic  
currents produced by equipment  
connected to public low-voltage systems  
with input current  $> 16\text{ A}$  and  $\leq 75\text{ A}$   
per phase**

The European Standard EN 61000-3-12:2005 has the status of a  
British Standard

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# National foreword

This British Standard is the official English language version of EN 61000-3-12:2005. It is identical with IEC 61000-3-12:2004.

The UK participation in its preparation was entrusted by Technical Committee GEL/210, EMC, to Subcommittee GEL/210/8, EMC — Low frequency standards, which has the responsibility to:

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- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
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**Electromagnetic compatibility (EMC)****Part 3-12: Limits -****Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current  $> 16\text{ A}$  and  $\leq 75\text{ A}$  per phase  
(IEC 61000-3-12:2004)**

Compatibilité électromagnétique (CEM)

Partie 3-12: Limites -

Limites pour les courants harmoniques  
produits par les appareils connectés  
aux réseaux publics basse tension  
ayant un courant appelé  $> 16\text{ A}$  et  $\leq 75\text{ A}$   
par phase  
(CEI 61000-3-12:2004)

Elektromagnetische Verträglichkeit (EMV)

Teil 3-12: Grenzwerte -

Grenzwerte für Oberschwingungsströme,  
verursacht von Geräten und Einrichtungen  
mit einem Eingangsstrom  $> 16\text{ A}$  und  
 $\leq 75\text{ A}$  je Leiter, die zum Anschluss  
an öffentliche Niederspannungsnetze  
vorgesehen sind  
(IEC 61000-3-12:2004)

This European Standard was approved by CENELEC on 2005-02-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 77A/470/FDIS, future edition 1 of IEC 61000-3-12, prepared by SC 77A, Low frequency phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61000-3-12 on 2005-02-01.

The following dates were fixed:

- latest date by which the EN has to be implemented  
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- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2008-02-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directives 89/336/EEC and 1999/5/EC. See Annex ZZ.

Annexes ZA and ZZ have been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 61000-3-12:2004 was approved by CENELEC as a European Standard without any modification.

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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 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: 61000-6-1).

This International Standard is a Product Family Standard.

## 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 $\leq 75$ A per phase

#### 1 Scope

This part of IEC 61000 deals with the limitation of harmonic currents injected into the public supply system. The limits given in this International Standard are applicable to electrical and electronic equipment with a rated input current exceeding 16 A and up to and including 75 A per phase, intended to be connected to public low-voltage a.c. distribution systems of the following types:

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

Other distribution systems are excluded. The limits given in this edition apply to equipment when connected to 230/400 V, 50 Hz systems. See also Clause 5.

NOTE The limits for the other systems will be added in a future edition of this standard.

This standard applies to equipment intended to be connected to low-voltage systems interfacing with the public supply at the low-voltage level. It does not apply to equipment intended to be connected only to private low-voltage systems interfacing with the public supply only at the medium- or high-voltage level.

NOTE 1 The scope of this standard is limited to equipment connected to public low voltage systems because emissions from equipment installed in private low voltage systems can be controlled in aggregate at the MV point of common coupling using procedures defined in IEC 61000-3-6 and/or by means of contractual agreements between the distribution network operator and the customer. It is expected that operators of private systems will manage the EMC environment in a manner that ensures compliance with the provisions given in IEC 61000-3-6 and/or the contractual agreements.

NOTE 2 If the equipment is intended to be connected only to private systems, the manufacturer should make this very clear in the product documentation.

NOTE 3 Professional equipment with input current  $\leq 16$  A per phase and that does not comply with the requirements and limits of standard IEC 61000-3-2 may be permitted to be connected to certain types of low voltage supplies, in the same way as equipment with input current  $> 16$  A per phase and that does not comply with the requirements and limits of the present standard IEC 61000-3-12 (see Annex C).

NOTE 4 The limits in this standard are not applicable to stand-alone harmonic filters.

This standard defines:

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

Tests according to this International Standard are type tests of complete pieces of equipment.

Conformity with this standard can also be determined by validated simulations.

## 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 60038, *IEC standard voltages*

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

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 61000-2-4, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current  $\leq 16$  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*

## 3 Terms and definitions

For the purposes of this document, the definitions given in IEC 60050(161) and the following definitions apply.

### 3.1 total harmonic distortion *THD*

ratio of the r.m.s. value of the harmonics (in this context harmonic currents  $I_n$  of the order  $n$ ) to the r.m.s. value of the fundamental, viz.

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

NOTE This definition has been chosen in accordance with the relevant standard, IEC 61000-2-2.

### 3.2 partial weighted harmonic distortion *PWHD*

ratio of the r.m.s. value of a selected group of higher order harmonics (in this International Standard beginning from the fourteenth harmonic), weighted with the harmonic order  $n$ , to the r.m.s. value of the fundamental:

$$PWHD = \sqrt{\sum_{n=14}^{40} n \left( \frac{I_n}{I_1} \right)^2}$$

The partial weighted harmonic distortion is employed in order to ensure that the effects of the higher order harmonic currents on the results are reduced sufficiently and individual limits need not be specified.

### 3.3

#### **point of common coupling**

##### **PCC**

point in the public system which is closest to the customer concerned and to which other customers are or may be connected

### 3.4

#### **single-phase equipment**

equipment which is connected between one line conductor and the neutral conductor

NOTE This includes equipment in which separate loads are connected from one or more line conductors to the neutral conductor

### 3.5

#### **interphase equipment**

equipment which is connected between two line conductors (phases)

The neutral conductor is not used as a current-carrying conductor under normal operating conditions.

### 3.6

#### **three-phase equipment**

equipment which is connected to the three line conductors

The neutral conductor is not used as a current-carrying conductor under normal operating conditions.

NOTE Equipment intended to be connected to all three phases and to the neutral and where the neutral conductor is used as a current-carrying conductor, is considered as three separate single-phase items.

#### 3.6.1

##### **balanced three-phase equipment**

three-phase equipment which is connected to the three line conductors of a three-phase supply and in which the three line or phase currents are designed to be identical in amplitude and wave-shape, each being displaced from the other two by one-third of a fundamental period

#### 3.6.2

##### **unbalanced three-phase equipment**

three-phase equipment which is connected to the three line conductors of a three-phase supply and in which the three line or phase currents are not designed to be identical in amplitude or wave-shape, or the displacement between any two is other than one-third of a fundamental period

### 3.7

#### **hybrid equipment**

combination of a balanced three-phase load and one or more loads connected between phase and neutral or between phases

**3.8****short-circuit power** **$S_{sc}$** 

value of the three-phase short-circuit power calculated from the nominal interphase system voltage  $U_{nominal}$  and the line impedance  $Z$  of the system at the PCC:

$$S_{sc} = U_{nominal}^2 / Z$$

where  $Z$  is the system impedance at the power frequency

**3.9****rated apparent power of the equipment** **$S_{equ}$** 

value calculated from the rated line current  $I_{equ}$  of the piece of equipment stated by the manufacturer and the rated voltage  $U_p$  (single phase) or  $U_i$  (interphase) as follows:

- a)  $S_{equ} = U_p I_{equ}$  for single-phase equipment and the single-phase part of hybrid equipment;
- b)  $S_{equ} = U_i I_{equ}$  for interphase equipment;
- c)  $S_{equ} = \sqrt{3} U_i I_{equ}$  for balanced three-phase equipment and the three-phase part of hybrid equipment;
- d)  $S_{equ} = 3 U_p I_{equ \max}$  for unbalanced three-phase equipment, where  $I_{equ \max}$  is the maximum of the r.m.s. currents flowing in any one of the three phases

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-line for three-phase).

**3.10****short-circuit ratio** **$R_{sce}$** 

characteristic value of a piece of equipment defined as follows:

- a)  $R_{sce} = S_{sc} / (3 S_{equ})$  for single-phase equipment and the single-phase part of hybrid equipment;
- b)  $R_{sce} = S_{sc} / (2 S_{equ})$  for interphase equipment;
- c)  $R_{sce} = S_{sc} / S_{equ}$  for all three-phase equipment and the three-phase part of hybrid equipment

NOTE 1  $R_{sce}$  may be related directly to basic known quantities by means of the equations:

$R_{sce} = UI(\sqrt{3} \times Z \times I_{equ})$  for single-phase equipment and the single phase part of hybrid equipment;

$R_{sce} = UI(2 \times Z \times I_{equ})$  for interphase equipment;

$R_{sce} = UI(\sqrt{3} \times Z \times I_{equ})$  for balanced three-phase equipment and the three-phase part of hybrid equipment;

$R_{sce} = UI(\sqrt{3} \times Z \times I_{equ \max})$  for unbalanced three-phase equipment

where  $U = U_{nominal}$ , and is assumed to be equal to  $U_i$  or  $\sqrt{3} \times U_p$ , whichever is relevant.

NOTE 2  $R_{sce}$  is not the same as  $R_{sc}$ , as defined in IEC 61000-2-6.

NOTE 3 For hybrid equipment, the method of calculating a single  $R_{sce}$  value is given in 5.2.

**3.11****reference fundamental current** **$I_1$** 

r.m.s. value of the fundamental component of the rated line current  $I_{equ}$  of the equipment (see also 4.1)