IEC/TR 61000-3-6

Edition 2.0 2008-02

TECHNICAL REPORT

BASIC EMC PUBLICATION

Electromagnetic compatibility (EMC) – Part 3-6: Limits – Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems

IEC/TR 61000-3-6:2008(E)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: 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.

- Catalogue of IEC publications: www.iec.ch/searchpub
The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, withdrawn and replaced publications.
- IEC Just Published: www.iec.ch/online_news/justpub
Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.
- Electropedia: www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.
- Customer Service Centre: www.iec.ch/webstore/custserv
If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:
Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) 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 CEI

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

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm
Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,…). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.
- Just Published CEI: www.iec.ch/online_news/justpub
Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.
- Electropedia: www.electropedia.org
Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.
- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:
Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

IEC/TR 61000-3-6

Edition 2.0 2008-02

TECHNICAL REPORT

BASIC EMC PUBLICATION

Electromagnetic compatibility (EMC) – Part 3-6: Limits – Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE
CODE PRIX XA

ICS 33.100.10

ISBN 2-8318-9605-3

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-6: Limits – Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
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.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC/TR 61000-3-6, which is a technical report, has been prepared by subcommittee 77A: Low frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

This Technical Report forms Part 3-6 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107 [29][1].

This second edition cancels and replaces the first edition published in 1996 and constitutes a technical revision.

---

1 Figures in square brackets refer to the Bibliography.

This edition is significantly more streamlined than first edition, and it reflects the experiences gained in the application of the first edition. As part of this streamlining process, this second edition of IEC/TR 61000-3-6 does not address communications circuit interference. Clause 9 on this (section 10) was removed, as this did not suitably address emission limits for telephone interference. The scope has been adjusted to point out that IEC/TR 61000-3-6 does not address communications circuit interference. This edition has also been harmonised with IEC/TR 61000-3-7 [30] and IEC/TR 61000-3-13 [31].

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
77A/575/DTR	77A/637/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

A list of all parts of the IEC 61000 series, under the general title *Electromagnetic compatibility (EMC)*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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

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).

ACKNOWLEDGMENT

In 2002, the IEC subcommittee 77A made a request to CIGRE Study Committee C4 and CIRED Study Committee S2, to organize an appropriate technical forum (joint working group) whose main scope was to prepare, among other tasks, the revision of the technical report IEC 61000-3-6 concerning emission limits for harmonics for the connection of distorting installations to public supply systems at MV, HV and EHV.

To this effect, joint working group CIGRE C4.103/ CIRED entitled ''*Emission Limits for Disturbing Installations*'' was appointed in 2003. Some previous work produced by CIGRE JWG C4.07-Cired has been used as an input to the revision, in particular the planning levels and associated indices. In addition, using experience since the technical report IEC 61000-3-6 was initially published in 1996, WG C4.103 reviewed the procedure used to determine emission limits and the assessment methods used to evaluate emission levels for installations.

Subsequent endorsement of the document by IEC was the responsibility of SC 77A.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 3-6: Limits – Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems

1 Scope

This Technical Report, which is informative in its nature, provides guidance on principles which can be used as the basis for determining the requirements for the connection of distorting installations to MV, HV and EHV public power systems (LV installations are covered in other IEC documents). For the purposes of this report, a distorting installation means an installation (which may be a load or a generator) that produces harmonics and/or interharmonics. The primary objective is to provide guidance to system operators or owners on engineering practices, which will facilitate the provision of adequate service quality for all connected customers. In addressing installations, this document is not intended to replace equipment standards for emission limits.

The report addresses the allocation of the capacity of the system to absorb disturbances. It does not address how to mitigate disturbances, nor does it address how the capacity of the system can be increased.

Since the guidelines outlined in this report are necessarily based on certain simplifying assumptions, there is no guarantee that this approach will always provide the optimum solution for all harmonic situations. The recommended approach should be used with flexibility and judgment as far as engineering is concerned, when applying the given assessment procedures in full or in part.

The system operator or owner is responsible for specifying requirements for the connection of distorting installations to the system. The distorting installation is to be understood as the customer's complete installation (i.e. including distorting and non-distorting parts).

Problems related to harmonics fall into two basic categories.

- Harmonic currents that are injected into the supply system by converters and harmonic sources, giving rise to harmonic voltages in the system. Both harmonic currents and resulting voltages can be considered as conducted phenomena.
- Harmonic currents that induce interference into communication systems. This phenomenon is more pronounced at higher order harmonic frequencies because of increased coupling between the circuits and because of the higher sensitivity of the communication circuits in the audible range.

This report gives guidance for the co-ordination of the harmonic voltages between different voltage levels in order to meet the compatibility levels at the point of utilisation. The recommendations in this report do not address harmonic interference phenomena in communication circuits (i.e. only the first of the above categories is addressed). These disturbances need to be addressed in terms of international directives concerning the Protection of Telecommunication Lines against Harmful Effects from Electric Power and Electrified Railway Lines, International Telecommunication Union, ITU-T Directives [1][2] or in terms of locally applicable standards such as [2], [3] or [4].

---

2 Figures in square brackets refer to the bibliography.

NOTE The boundaries between the various voltage levels may be different for different countries (see IEV 601-01-28 [32]). This report uses the following terms for system voltages:

– low voltage (LV) refers to Un ≤ 1 kV;

– medium voltage (MV) refers to 1 kV < Un ≤ 35 kV;

– high voltage (HV) refers to 35 kV < Un ≤ 230 kV;

– extra high voltage (EHV) refers to 230 kV < Un.

In the context of this report, the function of the system is more important than its nominal voltage. For example, a HV system used for distribution may be given a "planning level" which is situated between those of MV and HV systems.

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

3 Terms and definitions

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

3.1
agreed power
value of the apparent power of the disturbing installation on which the customer and the system operator or owner agree. In the case of several points of connection, a different value may be defined for each connection point

3.2
customer
person, company or organisation that operates an installation connected to, or entitled to be connected to, a supply system by a system operator or owner

3.3
(electromagnetic) disturbance
any electromagnetic phenomenon which, by being present in the electromagnetic environment, can cause electrical equipment to depart from its intended performance

3.4
disturbance level
the amount or magnitude of an electromagnetic disturbance measured and evaluated in a specified way

3.5
distorting installation
an electrical installation as a whole (i.e. including distorting and non-distorting parts) which can cause distortion of the voltage or current into the supply system to which it is connected

NOTE For the purpose of this report, all references to distorting installations not only include linear and non-linear loads, but generating plants, and any source of non-sinusoidal current emissions such as regenerative braking systems,