

INTERNATIONAL STANDARD

NORME INTERNATIONALE

BASIC EMC PUBLICATION

PUBLICATION FONDAMENTALE EN CEM

**Electromagnetic compatibility (EMC) –
Part 4-27: Testing and measurement techniques – Unbalance, immunity test for
equipment with input current not exceeding 16 A per phase**

**Compatibilité électromagnétique (CEM) –
Partie 4-27: Techniques d'essai et de mesure – Essai d'immunité aux
déséquilibres pour des matériels avec un courant appelé n'excédant pas 16 A
par phase**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
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 It also gives information on projects, withdrawn and replaced publications.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

INTERNATIONAL STANDARD

NORME INTERNATIONALE

BASIC EMC PUBLICATION

PUBLICATION FONDAMENTALE EN CEM

**Electromagnetic compatibility (EMC) –
Part 4-27: Testing and measurement techniques – Unbalance, immunity test for
equipment with input current not exceeding 16 A per phase**

**Compatibilité électromagnétique (CEM) –
Partie 4-27: Techniques d'essai et de mesure – Essai d'immunité aux
déséquilibres pour des matériels avec un courant appelé n'excédant pas 16 A
par phase**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.100.20

ISBN 978-2-88910-388-1

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope and object.....	6
2 Normative references.....	6
3 Definitions	7
4 General	7
5 Test levels.....	7
6 Test equipment.....	8
6.1 Test generators	8
6.2 Verification of the characteristics of the test generators.....	9
7 Test set-up	9
8 Test procedures.....	10
8.1 Laboratory reference conditions	10
8.2 Execution of the test.....	10
9 Evaluation of test results.....	11
10 Test report.....	11
Annex A (informative) Sources, effects and measurement of unbalance.....	14
Annex B (informative) Calculation of the degree of unbalance.....	17
Annex C (informative) Information on test levels	18
Annex D (informative) Electromagnetic environment classes	19
Bibliography	20
Figure 1 – Example of unbalanced three-phase supply voltage (Test 3)	12
Figure 2 – Succession of three unbalance sequences of the test (the voltages U_a , U_b , U_c rotate).....	12
Figure 3 – Schematic diagram of test instrumentation for unbalance	13
Figure 4 – Example of test generator verification load.....	9
Figure A.1 – Unbalanced voltage vectors.....	15
Figure A.2 – Components of the unbalanced vectors in figure A.1	15
Table 1 – Test levels	8
Table 2 – Characteristics of the generator	8

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –**Part 4-27: Testing and measurement techniques –
Unbalance, immunity test for equipment with input current
not exceeding 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 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.

International Standard IEC 61000-4-27 has been prepared by subcommittee 77A: Low-frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

It forms part 4-27 of IEC 61000. It has the status of basic EMC publication in accordance with IEC Guide 107.

This consolidated version of IEC 61000-4-27 consists of the first edition (2000) [documents 77A/308/FDIS and 77A/314/RVD] and its amendment 1 (2009) [documents 77A/672/FDIS and 77A/675/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 1.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

Annexes A, B, C and D are for information only.

The committee has decided that the contents of the base publication and its amendments 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.

INTRODUCTION

This standard is part of IEC 61000 series, 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 completed by a second number identifying the subdivision (example: 61000-6-1).

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-27: Testing and measurement techniques – Unbalance, immunity test for equipment with input current not exceeding 16 A per phase

1 Scope and object

This part of IEC 61000 is a basic EMC (electromagnetic compatibility) publication. It considers immunity tests for electric and/or electronic equipment (apparatus and system) in its electromagnetic environment. Only conducted phenomena are considered, including immunity tests for equipment connected to public and industrial networks.

The object of this standard is to establish a reference for evaluating the immunity of electrical and electronic equipment when subjected to unbalanced power supply voltage.

This standard applies to 50 Hz/60 Hz three-phase powered electrical and/or electronic equipment with rated line current up to 16 A per phase.

This standard does not apply to equipment with three-phase plus neutral connection if that equipment operates as a group of single-phase loads connected between phase and neutral.

This standard does not apply to electrical and/or electronic equipment connected to a.c. 400 Hz distribution networks.

This standard does not include tests for the zero-sequence unbalance factor.

The immunity test levels required for a specific electromagnetic environment together with performance criteria are indicated in the product, product family or generic standards as applicable. This immunity test should be included in product, product family or generic standards when equipment is likely to show reduced performance or function when exposed to a supply voltage with voltage unbalance.

The verification of the reliability of electrical components (capacitors, motors, etc.) and long-term effects (greater than a few minutes) is not considered in this standard.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61000. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61000 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

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

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