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BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

**Electromagnetic compatibility (EMC) –
Part 4-8: Testing and measurement techniques – Power frequency magnetic field
immunity test**

**Compatibilité électromagnétique (CEM) –
Partie 4-8: Techniques d'essai et de mesure – Essai d'immunité au champ
magnétique à la fréquence du réseau**

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

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IEC 61000-4-8

Edition 2.0 2009-09
REDLINE VERSION

INTERNATIONAL STANDARD



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 33.100.20

ISBN 978-2-88910-378-2

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test

FOREWORD

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International Standard IEC 61000-4-8 has been prepared by subcommittee 77A: Low frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

This second edition cancels and replaces the first edition published in 1993 and its Amendment 1 (2000). It forms a technical revision.

This edition includes the following significant technical changes with respect to the previous edition: the scope is extended in order to cover 60 Hz. Characteristics, performance and verification of the test generator and related inductive coils are revised. Modifications are also introduced in the test set-up (GRP) and test procedure.

It forms Part 4-8 of the IEC 61000 series of standards. It has the status of a basic EMC publication in accordance with IEC Guide 107.

The text of this standard is based on the following documents:

FDIS	Report on voting
77A/694/FDIS	77A/706/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 of the IEC 61000 series, under the general title *Electromagnetic compatibility*, can be found on the IEC website.

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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- replaced by a revised edition, or
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INTRODUCTION

This standard is part of the IEC 61000 series of standards, 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 9: Miscellaneous

Each part is further subdivided into several parts, published either as international standards, 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).

This part is an international standard which gives immunity requirements and test procedures related to "power frequency magnetic field".

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test

1 Scope

This part of IEC 61000 relates to the immunity requirements of equipment, only under operational conditions, to magnetic disturbances at power frequencies 50 Hz and 60 Hz related to:

- residential and commercial locations;
- industrial installations and power plants;
- medium voltage and high voltage sub-stations.

The applicability of this standard to equipment installed in different locations is determined by the presence of the phenomenon, as specified in Clause 4. This standard does not consider disturbances due to capacitive or inductive coupling in cables or other parts of the field installation.

Other IEC standards dealing with conducted disturbances cover these aspects.

The object of this standard is to establish a common and reproducible basis for evaluating the performance of electrical and electronic equipment for household, commercial and industrial applications when subjected to magnetic fields at power frequency (*continuous and short duration field*).

The standard defines:

- recommended test levels;
- test equipment;
- test set-up;
- test procedure.

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 (IEV) – Chapter 161: Electromagnetic compatibility*

3 Terms and definitions

For the purposes of this document the following terms and definitions apply to the restricted field of magnetic disturbances as well as the terms and definitions from IEC 60050(161) [IEV].

3.1

current distortion factor

ratio of the root-mean square value of the harmonics content of an alternating current to the root-mean square value of the fundamental current

3.2

EUT

equipment under test

3.3

inductive coil

conductor loop of defined shape and dimensions, in which flows a current, generating a magnetic field of defined constancy in its plane and in the enclosed volume

3.4

inductive coil factor

ratio between the magnetic field strength generated by an inductive coil of given dimensions and the corresponding current value; the field is that measured at the centre of the coil plane, without the EUT

3.5

immersion method

method of application of the magnetic field to the EUT, which is placed in the centre of an inductive coil (see Figure 1)

3.6

proximity method

method of application of the magnetic field to the EUT, where a small inductive coil is moved along the side of the EUT in order to detect particularly sensitive areas

3.7

ground (reference) plane

GRP

flat conductive surface whose potential is used as a common reference for the magnetic field generator and the auxiliary equipment (the ground plane can be used to close the loop of the inductive coil, as in Figure 5)

[IEV 161-04-36, modified]

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3.8

decoupling network, back filter

electrical circuit intended to avoid reciprocal influence with other equipment not submitted to the magnetic field immunity test

4 General

The magnetic fields to which equipment is subjected may influence the reliable operation of equipment and systems.

The following tests are intended to demonstrate the immunity of equipment when subjected to power frequency magnetic fields related to the specific location and installation condition of the equipment (e.g. proximity of equipment to the disturbance source).

The power frequency magnetic field is generated by power frequency current in conductors or, more seldom, from other devices (e.g. leakage of transformers) in the proximity of equipment.

As for the influence of nearby conductors, one should differentiate between:

- the current under normal operating conditions, which produces a steady magnetic field, with a comparatively small magnitude;

- the current under fault conditions which can produce comparatively high magnetic fields but of short duration, until the protection devices operate (a few milliseconds with fuses, a few seconds for protection relays).

The test with a steady magnetic field may apply to all types of equipment intended for public or industrial low voltage distribution networks or for electrical plants.

The test with a short duration magnetic field related to fault conditions, requires test levels that differ from those for steady-state conditions; the highest values apply mainly to equipment to be installed in exposed places of electrical plants.

The test field waveform is that of power frequency.

In many cases (household areas, sub-stations and power plant under normal conditions), the magnetic field produced by harmonics is negligible.

5 Test levels

The preferential range of test levels, respectively for continuous and short duration application of the magnetic field, applicable to distribution networks at 50 Hz and 60 Hz, is given in Table 1 and Table 2.

The magnetic field strength is expressed in A/m; 1 A/m corresponds to a free space magnetic flux density of 1,26 μ T.

Table 1 – Test levels for continuous field

Level	Magnetic field strength A/m
1	1
2	3
3	10
4	30
5	100
x^a	special

^a "x" can be any level, above, below or in-between the other levels. This level can be given in the product specification.

Table 2 – Test levels for short duration: 1 s to 3 s

Level	Magnetic field strength A/m
1	n.a. ^b
2	n.a. ^b
3	n.a. ^b
4	300
5	1 000
x ^a	special
<p>^a "x" can be any level, above, below or in-between the other levels. This level, as well the duration of the test, can be given in the product specification.</p> <p>^b "n.a." = not applicable.</p>	

Information on the selection of the test levels is given in Annex C.

Information on actual levels is given in Annex D.

6 Test equipment

6.1 General

The test magnetic field is obtained by a current flowing in an inductive coil; the application of the test field to the EUT is by the *immersion method*.

An example of application of the immersion method is given in Figure 1.

The test equipment includes the current source (test generator), the inductive coil and auxiliary test instrumentation, that are also given in Figure 3.

6.2 Test generator

6.2.1 Current source

The current source typically consists of a voltage regulator (connected to the mains distribution network, or other sources), a current transformer and a circuit for the control of short duration application. The generator shall be able to operate in continuous mode or short duration mode.

The connection between the current transformer and the inductive coil input should be as short as possible to avoid that the currents which flow in the connection produce magnetic fields that affect the magnetic field in the test volume. Preferably the cables should be twisted together.

The characteristics and performances of the current source or test generator for the different fields and for different inductive coils considered in this standard, are given in 6.2.2.

6.2.2 Characteristics and performances of the test generator for different inductive coils

Table 3 specifies characteristics and performances of the test generator for different inductive coils.