

INTERNATIONAL STANDARD

IEC 61000-4-11

Edition 1.1
2001-03

Edition 1:1994 consolidated with amendment 1:2000

BASIC EMC PUBLICATION

Electromagnetic compatibility (EMC) –

Part 4-11:

Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests

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*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Reference number
IEC 61000-4-11:1994+A1:2000(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –**Part 4-11: Testing and measurement techniques –
Voltage dips, short interruptions and
voltage variations immunity tests**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61000-4-11 has been prepared by sub-committee 77B: High-frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

It forms part 4-11 of IEC 61000. It has the status of a Basic EMC Publication in accordance with IEC Guide 107.

This consolidated version of IEC 61000-4-11 is based on the first edition (1994) [documents 77B(CO)17 and 77B(CO)20] and its amendment 1 (2000) [documents 77B/291+293/FDIS and 77B/298+300/RVD].

It bears the edition number 1.1.

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

Annex A forms an integral part of this standard.

Annexes B and C are for information only.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until 2002. At this date, the publication will be

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

Withdrawing

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INTRODUCTION

This section of part 4 belongs to the IEC 61000 series, *Electromagnetic compatibility (EMC)*, 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 sections which are to be published either as international standards or as technical reports.

These standards and reports will be published in chronological order and numbered accordingly.

This part is an international standard which gives immunity requirements and test procedures related to voltage dips, short interruptions and voltage variations.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests

1 Scope

This section of IEC 61000-4 defines the immunity test methods and range of preferred test levels for electrical and electronic equipment connected to low-voltage power supply networks for voltage dips, short interruptions, and voltage variations.

The standard applies to electrical and electronic equipment having a rated input current not exceeding 16 A per phase.

It does not apply to electrical and electronic equipment for connection to d.c. networks or 400 Hz a.c. networks. Tests for these networks will be covered by future IEC standards.

The object of this standard is to establish a common reference for evaluating the immunity of electrical and electronic equipment when subjected to voltage dips, short interruptions, and voltage variations.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 61000-4. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 61000-4 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEV 60050(161):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 61000-2-1:1990, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 1: Description of the environment – Electromagnetic environment for low-frequency conducted disturbances and signalling in public power supply systems*

IEC 61000-2-2:1990, *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 61000-4-1:1992, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 1: Overview of immunity tests – Basic EMC publication*

3 General

Electrical and electronic equipment may be affected by voltage dips, short interruptions or voltage variations of power supply.

Voltage dips and short interruptions are caused by faults in the network, in installations or by a sudden large change of load. In certain cases, two or more consecutive dips or interruptions may occur. Voltage variations are caused by the continuously varying loads connected to the network.

These phenomena are random in nature and can be characterized in terms of the deviation from the rated voltage and duration. Voltage dips and short interruptions are not always abrupt, because of the reaction time of rotating machines and protection elements connected to the power supply network. If large mains networks are disconnected (local within a plant or wide area within a region) the voltage will only decrease gradually due to the many rotating machines, which are connected to the mains networks. For a short period, the rotating machines will operate as generators sending power into the network. Some equipment is more sensitive to gradual variations in voltage than to abrupt change. Most data-processing equipment has built-in power-fail detectors in order to protect and save the data in the internal memory so that after the mains voltage has been restored, the equipment will start up in the correct way. Some power-fail detectors will not react sufficiently fast on a gradual decrease of the mains voltage. Therefore, the d.c. voltage to the integrated circuits will decrease to a level below the minimum operating voltage before the power-fail detector is activated and data will be lost or distorted. When the mains voltage is restored, the data-processing equipment will not be able to restart correctly before it has been re-programmed.

Consequently, different types of tests are specified in this standard to simulate the effects of abrupt change voltage, and, optionally, for the reasons explained above, a type test is specified also for gradual voltage change. This test is to be used only for particular and justified cases, under the responsibility of product specification or product committees.

It is the responsibility of the product committees to establish which phenomena among the ones considered in this standard are relevant and to decide on the applicability of the test.

4 Definitions

For the purpose of this section of IEC 61000-4, the following definitions apply:

4.1

basic EMC standard (ACEC)¹⁾

standard giving general and fundamental conditions or rules for the achievement of EMC, which are related or applicable to all products and systems, and serve as reference documents for product committees

4.2

immunity (to a disturbance)

the ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance
[IEV 161-01-20]

¹⁾ Advisory Committee on Electromagnetic Compatibility.

4.3

voltage dip

(definition used for the purpose of this standard). A sudden reduction of the voltage at a point in the electrical system, followed by voltage recovery after a short period of time, from half a cycle to a few seconds
[IEV 161-08-10, modified]

4.4

short interruption

the disappearance of the supply voltage for a period of time typically not exceeding 1 min. Short interruptions can be considered as voltage dips with 100 % amplitude (see also 8.1, IEC 61000-2-1)

4.5

voltage variation

a gradual change of the supply voltage to a higher or lower value than the rated voltage. The duration of the change can be short or long with regard to the period

4.6

malfunction

the termination of the ability of an equipment to carry out intended functions or the execution of unintended functions by the equipment

5 Test levels

The voltages in this standard use the rated voltage for the equipment (U_T) as a basis for voltage test level specification.

Where the equipment has a rated voltage range the following shall apply:

- if the voltage range does not exceed 20 % of the lower voltage specified for the rated voltage range, a single voltage from that range may be specified as a basis for test level specification (U_T);
- in all other cases, the test procedure shall be applied for both the lower and upper voltages declared in the voltage range;
- guidance for the selection of test levels and durations is given in annex B.

5.1 Voltage dips and short interruptions

The change between U_T and the changed voltage is abrupt. The step can start and stop at any phase angles on the mains voltage. The following test voltage levels (in % U_T) are used: 0 %, 40 % and 70 %, corresponding to dips and interruptions of 100 %, 60 % and 30 %.

The preferred test levels and durations are given in table 1, and an example is shown in figure 1. The levels and durations shall be given in the product specification. A test level of 0 % corresponds to a total supply voltage interruption. In practice, a test voltage level from 0 % to 20 % of the rated voltage may be considered as a total interruption.

Shorter durations in the table, in particular the half-cycle, should be tested to be sure that the equipment under test (EUT) works in its intended performance.