

Electromagnetic compatibility (EMC) —

Part 4-5: Testing and measurement techniques — Surge immunity test

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Committees responsible for this British Standard

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- Association of Consulting Scientists
- Association of Control Manufacturers [TACMA (BEAMA Ltd.)]
- Association of Manufacturers of Domestic Electrical Appliances
- Association of Manufacturers of Power Generating Systems and Association of British Generating Set Manufacturers
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- Rotating Electrical Machines Association (BEAMA Ltd.)
- Society of British Gas Industries
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National foreword

This British Standard has been prepared by Technical Committee GEL/110 and is the English language version of EN 61000-4-5 *Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques — Surge immunity tests* including amendment A1:2001, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 61000-4-5:1995, including amendment 1:2000, published by the International Electrotechnical Commission (IEC).

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both system.

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Summary of pages

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(includes amendment A1:2001)
(IEC 61000-4-5:1995 + A1:2000)

Compatibilité électromagnétique (CEM) —
Partie 4-5: Techniques d'essai et de mesure —
Essai d'immunité aux ondes de choc
(inclut l'amendement A1:2001)
(CEI 61000-4-5:1995 + A1:2000)

Elektromagnetische Verträglichkeit (EMV) —
Teil 4-5: Prüf- und Meßverfahren —
Prüfung der Störfestigkeit gegen
Stoßspannungen
(enthält Änderung A1:2001)
(IEC 61000-4-5:1995 + A1:2000)

This European Standard was approved by CENELEC on 1995-03-06. Amendment A1 was approved by CENELEC on 2000-12-01. 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
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Foreword

The text of document 65A/77B(CO)41/25, future edition 1 of IEC 1000-4-5, prepared by SC 65A, System aspects, of IEC TC 65, Industrial-process measurement and control, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61000-4-5 on 1995-03-06.

The following dates were fixed:

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- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-03-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Annex A and Annex ZA are normative and Annex B and Annex C are informative. Annex ZA has been added by CENELEC.

Foreword to amendment A1

The text of documents 77B/291+293/FDIS, future amendment 1 to IEC 61000-4-5:1995, prepared by SC 77B, High-frequency phenomena, of IEC TC 77, Electromagnetic compatibility, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A1 to EN 61000-4-5:1995 on 2000-12-01.

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Introduction

This standard is part of the IEC 1000 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 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.

This section is an International Standard which gives immunity requirements and test procedures related to surge voltages and surge currents.

1 Scope and object

This section of IEC 1000-4 relates to the immunity requirements, test methods, and range of recommended test levels for equipment to unidirectional surges caused by overvoltages from switching and lightning transients. Several test levels are defined which relate to different environment and installation conditions. These requirements are developed for and are applicable to electrical and electronic equipment. The object of this section is to establish a common reference for evaluating the performance of equipment when subjected to high-energy disturbances on the power and interconnection lines.

This standard defines:

- range of test levels;
- test equipment;
- test set-up;
- test procedure.

The task of the described laboratory test is to find the reaction of the EUT under specified operational conditions caused by surge voltages from switching and lightning effects at certain threat levels.

It is not intended to test the capability of the insulation to withstand high-voltage stress. Direct lightning is not considered in this standard.

This standard does not intend to specify the tests to be applied to particular apparatus or systems. Its main aim is to give a general basic reference to all concerned product committees of the IEC. The product committees (or users and manufacturers of equipment) remain responsible for the appropriate choice of the tests and the severity level to be applied to their equipment.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 1000-4. 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 1000-4 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.

IEC 50(161):1990, *International Electrotechnical Vocabulary (IEV) — Chapter 161: Electromagnetic compatibility*.

IEC 60-1:1989, *High-voltage test techniques — Part 1: General definitions and test requirements*.

IEC 469-1:1987, *Pulse techniques and apparatus — Part 1: Pulse terms and definitions*.

3 General

3.1 Switching transients

System switching transients can be separated into transients associated with:

- a) major power system switching disturbances, such as capacitor bank switching;
- b) minor switching activity near the instrumentation or load changes in the power distribution system;
- c) resonating circuits associated with switching devices, such as thyristors;
- d) various system faults, such as short-circuits and arcing faults to the earthing system of the installation.

3.2 Lightning transients

The major mechanisms by which lightning produces surge voltages are the following:

- a) a direct lightning strike to an external circuit (outdoor) injecting high currents producing voltages by either flowing through earth resistance or flowing through the impedance of the external circuit;
- b) an indirect lightning strike (i.e. a strike between or within clouds or to nearby objects which produces electromagnetic fields) that induces voltages/currents on the conductors outside and/or inside a building;
- c) lightning earth current flow resulting from nearby direct-to-earth discharges coupling into the common earth paths of the earthing system of the installation.

The rapid change of voltage and flow of current which may occur when a protector is excited may couple into internal circuits.

3.3 Simulation of the transients

- a) The characteristics of the test generator are such that it simulates the above-mentioned phenomena as closely as possible;
- b) if the source of interference is in the same circuit, e.g. in the power supply network (direct coupling), the generator may simulate a low impedance source at the ports of the equipment under test;
- c) if the source of interference is not in the same circuit (indirect coupling) as the ports of the victim-equipment, then the generator may simulate a higher impedance source.

4 Definitions

For the purposes of this section of IEC 1000-4, the following definitions together with those in IEC 50(161) apply, unless otherwise stated.

4.1

balanced lines

a pair of symmetrically driven conductors with a conversion loss from differential to common mode of less than 20 dB

4.2

coupling network

electrical circuit for the purpose of transferring energy from one circuit to another

4.3**decoupling network**

electrical circuit for the purpose of preventing surges applied to the EUT from affecting other devices, equipment or systems which are not under test

4.4**duration**

the absolute value of the interval during which a specified waveform or feature exists or continues
[IEC 469-1]

4.5**EUT**

equipment under test

4.6**front time****surge voltage**

the front time T_1 of a surge voltage is a virtual parameter defined as 1,67 times the interval T between the instants when the impulse is 30 % and 90 % of the peak value (see Figure 2)

current surge

the front time T_1 of a surge current is a virtual parameter defined as 1,25 times the interval T , between the instants when the impulse is 10 % and 90 % of the peak value (see Figure 3)
[IEC 60-1 modified]

4.7**immunity**

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

4.8**electrical installation**

an assembly of associated electrical equipment to fulfil a specific purpose or purposes and having coordinated characteristics
[IEV 826-01-01]

4.9**interconnection lines** consist of:

- I/O lines (input/output lines);
- communication lines;
- balanced lines

4.10**primary protection**

the means by which the majority of stressful energy is prevented from propagating beyond the designated interface

4.11**rise time**

the interval of time between the instants at which the instantaneous value of a pulse first reaches a specified lower value and then a specified upper value

NOTE Unless otherwise specified, the lower and upper values are fixed at 10 % and 90 % of the pulse magnitude.
[IEV 161-02-05]

4.12**secondary protection**

the means by which the let-through energy from primary protection is suppressed. It may be a special device or an inherent characteristic of the EUT