IEC 61000-4-2

Edition 3.0 2025-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

BASIC EMC PUBLICATION
PUBLICATION FONDAMENTALE EN CEM

Electromagnetic compatibility (EMC) –
Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test

Compatibilité électromagnétique (CEM) –
Partie 4-2: Techniques d'essai et de mesure – Essai d'immunité aux décharges électrostatiques

IEC 61000-4-2:2025-03(en-fr)

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ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test

FOREWORD

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IEC 61000-4-2 has been prepared by subcommittee 77B: High-frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility. It is an International Standard.

It forms Part 4-2 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

This third edition cancels and replaces the second edition published in 2008. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) added a calibration requirement for ESD generators with air discharge tip;
b) added a normative annex for test setups for particular kind of equipment (see Annex I);

c) added an informative annex for wearable devices (see Annex J);

d) added an informative annex on how to select test points and give guidance on how to specify the number of pulses for direct contact discharges (see Annex E);

e) moved Clause 9 into a new informative annex (see Annex K);

f) improved current calibration procedure;

g) improved measurement uncertainty considerations with examples of uncertainty budgets;

h) moved post-installation tests into a new informative Annex G since they cannot be performed in a controlled environment.

The text of this International Standard is based on the following documents:

Draft	Report on voting
77B/896/FDIS	77B/897/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

IEC 61000-4 is a part of the IEC 61000 series, according to the following structure:

Part 1: General

General consideration (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 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).

This part of IEC 61000 is an International Standard which gives immunity requirements and test procedures related to electrostatic discharge.

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test

1 Scope

This part of IEC 61000 relates to the immunity requirements and test methods for electrical and electronic equipment subjected to static electricity discharges from operators directly and from personnel to adjacent objects. It additionally specifies ranges of test levels which relate to different environmental, and installation conditions and establishes test procedures.

The objective of this document is to establish a common and reproducible basis for evaluating the performance of electrical and electronic equipment when subjected to electrostatic discharges. In addition, it includes electrostatic discharges which can occur from personnel to objects near the equipment.

This document specifies:

– ideal waveform of the discharge current;
– range of test levels;
– test equipment;
– test setup;
– test procedure;
– calibration procedure;
– measurement uncertainty.

This document gives specifications for tests performed in laboratories and guidance to post-installation tests.

This document is not intended to specify the tests to be applied to particular apparatus or systems. The main aim is to give a general basic reference to all concerned product committees. The product committees remain responsible for the appropriate choice of the tests and the severity level to be applied to their equipment.

This document excludes tests intended to evaluate the ESD sensitivity of devices during handling and packaging. It is not intended for use in characterizing the performance of ESD protection circuits.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
accessible
surfaces of the EUT which can be touched by means of the air discharge tip of the ESD generator

[SOURCE: IEC 60050-442:1998, 442-01-15, modified – “part” has been replaced by “surfaces of the EUT” and “standard test finger” has been replaced by “air discharge tip of the ESD generator”.]

3.1.2
air discharge method
method of testing in which the charged tip of the test generator is moved towards the EUT until it touches the EUT

3.1.3
calibration
set of operations which establishes, by reference to standards, the relationship which exists, under specified conditions, between an indication and a result of a measurement

Note 1 to entry: This term is based on the "uncertainty" approach.

Note 2 to entry: The relationship between the indications and the results of measurement can be expressed, in principle, by a calibration diagram.

[SOURCE: IEC 60050-311:2001, 311-01-09]

3.1.4
contact discharge method
method of testing in which the tip of the test generator is kept in contact with the EUT or coupling plane and the discharge is actuated by the discharge switch within the generator

3.1.5
coupling plane
metal sheet or plate, to which discharges are applied to simulate electrostatic discharge to objects adjacent to the EUT

3.1.6
degradation (in performance)
undesired departure in the operational performance of any device, equipment or system from its intended performance

Note 1 to entry: The term "degradation" can apply to temporary or permanent failure.

[SOURCE: IEC 60050-161:1990, 161-01-19]

3.1.7
direct application
application of the discharge directly to the EUT

3.1.8
electromagnetic compatibility
EMC
ability of equipment or a system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

[SOURCE: IEC 60050-161:2018, 161-01-07]

3.1.9
electrostatic discharge
ESD
transfer of electric charge between bodies of different electric potential in proximity or through direct contact

Note 1 to entry: Literature and teaching generally refer to transfers of charge, although strictly speaking charge carriers (IEV 113-06-25) are transferred.

[SOURCE: IEC 60050-161:2014, 161-01-22]

3.1.10
energy storage capacitor
capacitor of the ESD generator representing the capacity of a human body charged to the test voltage value

Note 1 to entry: This element can be provided as a discrete component or a distributed capacitance.

3.1.11
holding time
interval of time within which the decrease of the test voltage due to leakage, prior to the discharge, is not greater than 10 %

3.1.12
immunity (to a disturbance)
ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

[SOURCE: IEC 60050-161:1990, 161-01-20]

3.1.13
indirect application
application of the discharge to a coupling plane in the vicinity of the EUT to simulate personnel discharge to objects which are adjacent to the EUT

3.1.14
reference ground plane
RGP
flat conductive surface that is at the same electric potential as reference ground, which is used as a common reference, and which contributes to a reproducible parasitic capacitance with the surroundings of the equipment under test (EUT)

Note 1 to entry: In some regions, the term 'earth' is used in place of 'ground'.

[SOURCE: IEC 60050-161:2014, 161-04-36, modified – Note 1 has been removed.]

3.1.15
rise time
interval of time between the instants at which the instantaneous value of a pulse first reaches the specified lower and upper limits

Note 1 to entry: Unless otherwise specified, the lower and upper values are fixed at 10 % and 90 % of the pulse magnitude.

[SOURCE: IEC 60050-161:1990, 161-02-05, modified, modified – the domain has been deleted and, in the definition, "value and then a specified upper value" has been deleted and "and upper limits" has been added.]

3.1.16
verification
set of operations which is used to check the test equipment system (e.g. the test generator and the interconnecting cables) and to gain confidence that the test system is functioning

Note 1 to entry: Details of verification are given in 7.2.2.

Note 2 to entry: The methods used for verification can be different from those used for calibration.

Note 3 to entry: For the purpose of this document this definition is different from the definition given in IEV 311-01-13.

3.2 Abbreviated terms

AD Air discharge
AE Auxiliary equipment
CD Contact discharge
EMC Electromagnetic compatibility
ESD Electrostatic discharge
EUT Equipment under test
FT Fourier transform
HCP Horizontal coupling plane
HV High voltage
IC Integrated circuit
IFT Inverse Fourier transform
MU Measurement uncertainty
PE Protective earth
RGP Reference ground plane
VCP Vertical coupling plane
VNA Vector network analyzer

4 General

This document relates to equipment, systems, subsystems and peripherals which can be involved in static electricity discharges as a result of environmental and installation conditions, such as low relative humidity, use of low-conductivity (artificial-fibre) carpets, synthetic-fabric garments, etc., which can exist in all locations classified in standards relevant to electrical and electronic equipment. Detailed information is specified in Annex A.

NOTE From the technical point of view, the precise term for the phenomenon would be static electricity discharge. However, the term electrostatic discharge (ESD) is widely used in the technical world and in technical literature. Therefore, it has been decided to retain the term electrostatic discharge in the title of this document.