

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



**Electromagnetic compatibility (EMC) –  
Part 4-25: Testing and measurement techniques – HEMP immunity test methods  
for equipment and systems**

**Compatibilité électromagnétique (CEM) –  
Partie 4-25: Techniques d'essai et de mesure – Méthodes d'essai d'immunité à  
l'IEMN-HA des appareils et des systèmes**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTROMAGNETIC COMPATIBILITY (EMC) –****Part 4-25: Testing and measurement techniques –  
HEMP immunity test methods for equipment and systems**

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**IEC 61000-4-25 edition 1.2 contains the first edition (2001-11) [documents 77C/113/FDIS and 77C/117/RVD], its amendment 1 (2012-03) [documents 77C/216/FDIS and 77C/218/RVD] and its amendment 2 (2019-12) [documents 77C/285/CDV and 77C/290/RVC].**

**In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.**



International Standard IEC 61000-4-25 has been prepared by subcommittee 77C: High power transient phenomena, of IEC technical committee 77: Electromagnetic compatibility.

It forms part 4-25 of IEC 61000. It has the status of a basic EMC publication in accordance with IEC Guide 107.

~~Annex D forms an integral part of this standard.~~

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 stability 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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- withdrawn,
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## INTRODUCTION

This standard is part of the 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**

[IEC 61000-4-25:2001](#)

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### **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 4-25: Testing and measurement techniques – HEMP immunity test methods for equipment and systems

#### 1 Scope

This part of IEC 61000 describes the immunity test levels and related test methods for electrical and electronic equipment and systems exposed to high-altitude electromagnetic pulse (HEMP) environments. It defines ranges of immunity test levels and establishes test procedures. Specifications for test equipment and instrumentation test set-up, test procedures, pass/fail criteria, and test documentation requirements are also defined by this standard. These tests are intended to demonstrate the immunity of electrical and electronic equipment when subjected to HEMP radiated and conducted electromagnetic disturbances. For radiated disturbance immunity tests, specifications are defined in this standard both for small test facilities and large HEMP simulators.

This part of IEC 61000 defines specifications for laboratory immunity tests. On-site tests performed on equipment in the final installation to verify immunity are also specified. These verification tests use the same specifications as laboratory tests, except for the climatic environmental specifications.

The objective of this part of IEC 61000 is to establish a common and reproducible basis for evaluating the performance of electrical and electronic equipment, when subjected to HEMP radiated environments and the associated conducted transients on power, antenna, and input/output (I/O) signal and control lines.

#### 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 – Chapter 161: Electromagnetic compatibility*

IEC 60038, *IEC standard voltages*

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

IEC 61000-2-5, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 5: Classification of electromagnetic environments*. Basic EMC publication

IEC 61000-2-9, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 9: Description of HEMP environment – Radiated disturbance*. Basic EMC publication

IEC 61000-2-10:1998, *Electromagnetic compatibility (EMC) – Part 2-10: Environment – Description of HEMP environment – Conducted disturbance*

IEC 61000-2-11, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 11: Classification of HEMP environments*. Basic EMC publication

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test*. Basic EMC Publication

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 11: Voltage dips, short interruptions and voltage variations immunity tests*

~~IEC 61000-4-12, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 12: Oscillatory waves immunity test*~~

IEC 61000-4-13, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests* – Basic EMC Publication <sup>1</sup>

IEC 61000-4-18, *Electromagnetic compatibility (EMC) – Part 4-18: Testing and measurement techniques – Damped oscillatory wave immunity test*

IEC 61000-4-20, *Electromagnetic compatibility (EMC) – Part 4-20: Testing and measurement techniques – Emission and immunity testing in transverse electromagnetic (TEM) waveguides*<sup>4</sup>

IEC 61000-4-33, *Electromagnetic compatibility (EMC) – Part 4-33: Testing and measurement techniques – Measurement methods for high-power transient parameters*

IEC 61000-5-3, *Electromagnetic compatibility (EMC) – Part 5-3: Installation and mitigation guidelines – HEMP protection concepts*

IEC 61000-5-4/TR, *Electromagnetic compatibility (EMC) – Part 5: Installation and mitigation guidelines – Section 4: Immunity to HEMP – Specifications for protective devices against HEMP radiated disturbance*. Basic EMC Publication

IEC 61024-1, *Protection of structures against lightning – Part 1: General principles*

~~ISO 7137, *Aircraft – Environmental conditions and test procedures for airborne equipment*~~

### 3 Definitions

For the purpose of this part of IEC 61000, the following definitions apply.

#### 3.1

##### **compatibility level**

specified electromagnetic disturbance level used as a reference level for co-ordination in the setting of emission and immunity limits

[IEV 161-03-10]

#### 3.2

##### **coupling (HEMP)**

interaction of electromagnetic fields with a system to produce currents and voltages on system surfaces and cables

<sup>1</sup> To be published

### 3.3

#### **coupling clamp**

device of defined dimensions and characteristics for common mode coupling of the disturbance signal to the circuit under test without any galvanic connection to it

### 3.4

#### **coupling network**

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

### 3.5

#### **decoupling network**

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

### 3.6

#### **degradation (of performance)**

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

NOTE The term “degradation” can apply to a temporary or permanent failure.

[IEV 161-01-19]

### 3.7

#### **electromagnetic disturbance**

any electromagnetic phenomenon which may degrade the performance of a device, equipment or system

[IEV 161-01-05, modified]

### 3.8

#### **electromagnetic interference**

degradation of the performance of a device, transmission channel or system caused by an electromagnetic disturbance

[IEV 161-01-06]

### 3.9

#### **electromagnetic susceptibility**

inability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance

NOTE Susceptibility is a lack of immunity.

[IEV 161-01-21]

### 3.10

#### **EUT (equipment under test)**

the equipment under test can be a single unit or multiple units interconnected by cables, data links, etc.

NOTE Multiple units interconnected by cables, etc. are also called a system [see 3.27 below].

### 3.11

#### **fast Fourier transform**

##### **FFT**

mathematical procedure for rapidly computing the direct or inverse Fourier transform of a time domain signal or of a frequency domain spectrum, respectively. It requires  $2^m$  ( $m = \text{integer}$ ) data points that are equally spaced in time or frequency, and involves much less computation time than a standard discrete Fourier transform (DFT)

**3.12****ground reference plane**

flat conductive surface, whose potential is used as a common reference

[IEV 161-04-36]

**3.13****HV transmission line**

power line with a nominal a.c. system voltage equal to or greater than 100 kV

**3.14****short circuit current**

$I_{sc}$

current resulting from an abnormal connection of relatively low resistance between two points of different potentials in a circuit

**3.15****immunity (to a disturbance)**

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

[IEV 161-01-20]

**3.16****immunity level**

maximum level of a given electromagnetic disturbance incident on a particular device, equipment or system for which it remains capable of operating at a required degree of performance

[IEV 161-03-14]

**3.17****immunity test level**

value of an influencing electromagnetic quantity specified for an immunity test

NOTE It is to be noted that the text of this definition is the same as for severity level. A test standard can specify several severity levels according to different immunity levels.

**3.18****large HEMP simulator**

transient electromagnetic pulse test facility with a test volume sufficiently large to test objects with cubical dimensions equal to or greater than 1 m × 1 m × 1 m

**3.19****LV (low-voltage) power circuit**

power circuit with a nominal a.c. voltage between 120 V and 1 000 V

NOTE The standard voltages in this voltage range are presented in IEC 60038.

**3.20****MV (medium voltage) distribution power line**

power line with a nominal a.c. voltage above 1 kV and not exceeding 35 kV used to distribute power within a local area

NOTE The standard voltages in this voltage range are presented in IEC 60038.

**3.21****point-of-entry****port-of-entry****PoE**

the physical location (point/port) on the electromagnetic barrier, where EM energy may enter or exit a topological volume, unless an adequate PoE protective device is provided. A PoE is