SLOVENSKI STANDARD
SIST EN 61000-4-11:2005/A1:2017

01-oktober-2017

Elektromagnetna združljivost (EMC) – 4-11. del: Preskusne in merilne tehnike – Preskusi odpornosti proti upadom napetosti, kratkotrajnim prekinitvam in napetostnim kolebanjem - Dopolnilo A1

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

Elektromagnetische Verträglichkeit (EMV) - Teil 4-11: Prüf- und Messverfahren - Prüfungen der Störfestigkeit gegen Spannungseinbrüche, Kurzzeitunterbrechungen und Spannungsschwankungen

Compatibilité électromagnétique (CEM) - Partie 4-11: Techniques d'essai et de mesure - Essais d'immunité aux creux de tension, coupures brèves et variations de tension

Ta slovenski standard je istoveten z: **EN 61000-4-11:2004/A1:2017**

ICS:

33.100.20	Imunost	Immunity

SIST EN 61000-4-11:2005/A1:2017 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

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English Version

Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests (IEC 61000-4-11:2004/A1:2017)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 77A/951/FDIS, future IEC 61000-4-11:2004/A1, prepared by SC 77A, "EMC -Low-frequency phenomena", of IEC TC 77, "Electromagnetic compatibility" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61000-4-11:2004/A1:2017.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2018-03-22
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-06-22

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The text of the International Standard IEC 61000-4-11:2004/A1:2017 was approved by CENELEC as a European Standard without any modification.

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AMENDMENT 1
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FOREWORD

This amendment has been prepared by subcommittee 77A: EMC – Low frequency phenomena, of IEC technical committee 77: Electromagnetic compatibility.

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

FDIS	Report on voting
77A/951/FDIS	77A/961/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

Add, after Annex C, the following new Annex D:

Annex D
(informative)

Rationale for generator specification regarding voltage, rise-time and fall-time, and inrush current capability

D.1 Concept of basic standard

The immunity basic standards of the IEC 61000-4-x series are based on the concept of defining a test system in one document representing typically one type of electromagnetic disturbance. The environmental description of the IEC 61000-2-x series (which includes also compatibility levels) together with practical industry experience are the basis for defining the disturbance source simulator, the necessary coupling and decoupling networks and the range of test levels.

Parameters in the basic standard are always compromises selected from a large amount of data derived from the disturbance source. The compromise is assumed to be correct if, once the immunity test is applied, only a few malfunctions occur in the real world.

To keep the immunity test as easy as possible, the generator output shall be verified in a calibration set-up and not with the EUT connected to the output of the generator. The purpose of the calibration is to guarantee comparable test results between different brands of generators.

D.2 IEC 61000-4-11:1994 (first edition)

Data from UNIPEDE report was used which indicated short circuit in terms of voltage reduction and interrupt duration. At that time, rare measurement results were available showing how equipment on the same phase was affected, in the public power network.

Based on this information, IEC 61000-4-11:1994 (first edition) was defined and published in 1994. For the switching time a value of 1 µs to 5 µs was chosen for representing the short circuit's worst case occurring at a distance of up to 50 m between the source and the affected equipment. For example, the equipment used in a laboratory or in an industrial plant has a greater risk of being affected by voltage dips and short interruptions within 50 m.

D.3 Rationale for the need of rapid fall-times

In case of short circuit in the line, the voltage at the input terminals of the equipment might go to zero in less than 5 µs.

If the short circuit originates from the public network, the fall-time will be relatively slow, in the order of hundreds of microseconds to some milliseconds. If, however, the short circuit is at the local premise, for example due to the failure of another equipment installed in close proximity, the mains voltage will go to zero within microseconds, with fall-times shorter than 1 µs reported for some cases.

In this case, the input rectifier diodes of the equipment will be commutated from conduction mode to blocking mode with a sudden high reverse voltage due to that very fast voltage rise-time. As those diodes are usually designed for natural line commutation with a rise-time of the voltage in the range of milliseconds, this event is an increased stress for the rectifier diodes. More generally, fast voltage transients may disturb electronics as well, leading to the damage of the equipment.

Tests performed with a fast fall-time in the range of a few microseconds emulating the short circuit condition can be used to test the robustness of equipment against fast transient short circuits of the line.

D.4 Interpretation of the rise-time and fall-time requirements during EUT testing

In 2010 an interpretation sheet for IEC 61000-4-11:2004 was issued. The content of this sheet is as follows:

1) "In IEC 61000-4-11:2004, Table 4 does not apply to EUT (equipment under test) testing. Table 4 is for generator calibration and design only.
2) With reference to Table 1 and Table 2, there is no requirement in 61000-4-11:2004 for rise-time and fall-time when testing EUT; therefore, it is not necessary to measure these parameters during tests.
3) With reference to Table 4, all of the requirements apply to design and calibration of the generator. The requirements of Table 4 only apply when the load is a non-inductive 100 Ω resistor. The requirements of Table 4 do not apply during EUT testing."

D.5 Main conclusions

With respect to rise-time and fall-time, the main conclusions are the following.

- It is possible, for real-world voltage dips, to have fall-times faster than 5 μs in the case of short circuits close to the equipment. However, for the time being, this standard does not consider the effects of voltage fall times shorter than 1 μs.

- Rise-time depends on several factors including the impedance of the network, cabling and equipment connected in parallel.
- The rise-time and fall-time requirements have remained unchanged and the standard has been used worldwide since its first publication in 1994, but, as in the interpretation sheet, these rise-time and fall-time requirements do not apply during a test of an EUT. They only apply when calibrating a dip generator with a 100 Ω resistive load. These rise-times and fall-times do not necessarily occur during an actual EUT test.
- Most voltage dip and short interruption immunity tests begin and end at 0˚ or 180˚. Published research generally concludes that these are the most severe phase angles for voltage ride-through tests. Note that at 0˚ and at 180˚ the instantaneous waveform voltage is zero, so rise-time and fall-time have no meaning.
- Pre-compliance testing could be considered using a dip generator with a longer rise-time and fall-time up to 200 μs for voltage dip and short interruption tests that begin and end at 0˚ or 180˚, as rise-time and fall-time are not important at these angles. However, full compliance with the test methods of this standard requires to use a generator that, when tested with a 100 Ω resistive load, meets the 1 μs to 5 μs requirement in 6.1.2.

D.6 Rationale for inrush current capability

During the connection of an equipment to a power line, an inrush current flows into it. This inrush current could conceivably damage parts of the equipment, for example an input rectifier with capacitive smoothing. In order to prevent damage, measures for inrush current limitation are usually incorporated inside the equipment.

An inrush current will also occur when the line voltage recovers after a voltage dip or interruption. In this case, the inrush current limitation measures might not be activated in the equipment with disabled pre-charge circuit, so it is possible for the post-dip inrush current to damage the equipment.

For this reason, it is necessary for the voltage dip generator to be capable of supplying sufficient current and that the post-dip inrush current is not limited by the dip generator.

Without this inrush current requirement, it would be possible for the equipment to pass the immunity test performed with the dip generator, but to fail in the real world due to inrush current damage.

In a real installation, this inrush current will be limited by the network impedance. If the short circuit is on the public supply, the network impedance is according to the line reference impedance of the public supply (796 µH according to IEC TR 60725), which is typical for rural low voltage networks, and it will limit the inrush current to about 15 A to 20 A. However, if the short circuit is inside the local premise, in a particular large installation such as an industrial plant, the impedance may be much lower and the inrush current much larger.

In order for the test generator to have adequate capabilities to properly stress the equipment under test, the standard provides guidance in 6.1.2 to assure that the equipment does not demand more current than 70 % of the generator capability, for example 500 A for 220 V to 240 V mains.