EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61547

August 2009

ICS 29.020; 29.140; 33.100.10

Supersedes EN 61547:1995 + A1:2000

English version

Equipment for general lighting purposes - EMC immunity requirements

(IEC 61547:2009)

Equipements pour l'éclairage à usage général - Exigences concernant l'immunité CEM (CEI 61547:2009)

Einrichtungen für allgemeine Beleuchtungszwecke - EMV-Störfestigkeitsanforderungen (IEC 61547:2009)

CENELEC

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

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 61547:2009 E

Foreword

The text of document 34/127/FDIS, future edition 2 of IEC 61547, prepared by IEC TC 34, Lamps and related equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61547 on 2009-07-01.

This European Standard supersedes EN 61547:1995 + A1:2000.

The main reason for this revision is to update the dates of the references to the basic standards which also required some editorial changes in the tables. Other changes are:

1 Scope: clearly excludes multimedia equipment with lamps (e.g. TV);

3.2 Enclosure port: removal of the “earth port” in Figure 1 as in the generic EMC standards; the note below Figure 1 in EN 61547:1995 relates to a requirement and moved to the main text under 5.1 General;

5.6 Injected currents: update of the names of the example CDN’s;

5.7 Surges: test only at the peak of the mains voltage by deleting the requirement to test at zero crossings;

5.8 Voltage dips and interruptions: clarifying that the voltage level changes at the zero crossing;

6.3.2 Independent auxiliaries: Table 14 has been simplified because most independent auxiliaries have identical performance criteria;

6.3.3 Luminaires: Table 15 has been simplified because most luminaires have identical performance criteria; correcting the error in the injected current column by changing the B into A for luminaires with electronic ballast for discharge lamps; additionally, the requirements for emergency luminaires operating in high risk task areas are updated to meet the levels specified in EN 60598-2-22;

7 Conditions during testing: the “under consideration” for the operating conditions for starting devices has been deleted; the supply voltage and frequency during the test are clearly stated; shortening the immunity test for equipment incorporating a regulating control by testing at one light output level (50 % ± 10 %) instead of testing at three light output levels which are difficult to adjust and do not provide extra protection.

This standard is to be read in conjunction with the relevant basic and/or product standard(s).

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2010-04-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2012-07-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive EMC (2004/108/EC). See Annex ZZ.

Annexes ZA and ZZ have been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61547:2009 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050-161	-[1)]	International Electrotechnical Vocabulary (IEV) - Chapter 161: Electromagnetic compatibility	-	-
IEC 60050-845	-[1)]	International Electrotechnical Vocabulary (IEV) - Chapter 845: Lighting	-	-
IEC 60598-1 (mod)	2008	Luminaires - Part 1: General requirements and tests	EN 60598-1 A11	2008 2009
IEC 60598-2-22 (mod)	-[1)]	Luminaires - Part 2-22: Particular requirements - Luminaires for emergency lighting	EN 60598-2-22 + corr. October	1998[2)] 2007
IEC 61000-4-2	2008	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test	EN 61000-4-2	2009
IEC 61000-4-3 A1	2006 2007	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test	EN 61000-4-3 A1 IS1	2006 2008 2009
IEC 61000-4-4	2004	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	EN 61000-4-4	2004
IEC 61000-4-5	2005	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	2006
IEC 61000-4-6	2008	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	EN 61000-4-6	2009
IEC 61000-4-8 A1	1993 2000	Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	EN 61000-4-8 A1	1993 2001

[1)] Undated reference.

[2)] Valid edition at date of issue.

Publication	Year	Title	EN/HD	Year
IEC 61000-4-11	2004	Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	EN 61000-4-11	2004
IEC 61000-6-1	2005	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments	EN 61000-6-1	2007

Annex ZZ
(informative)

Coverage of Essential Requirements of EC Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in Annex I of the EC Directive 2004/108/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.

IEC 61547

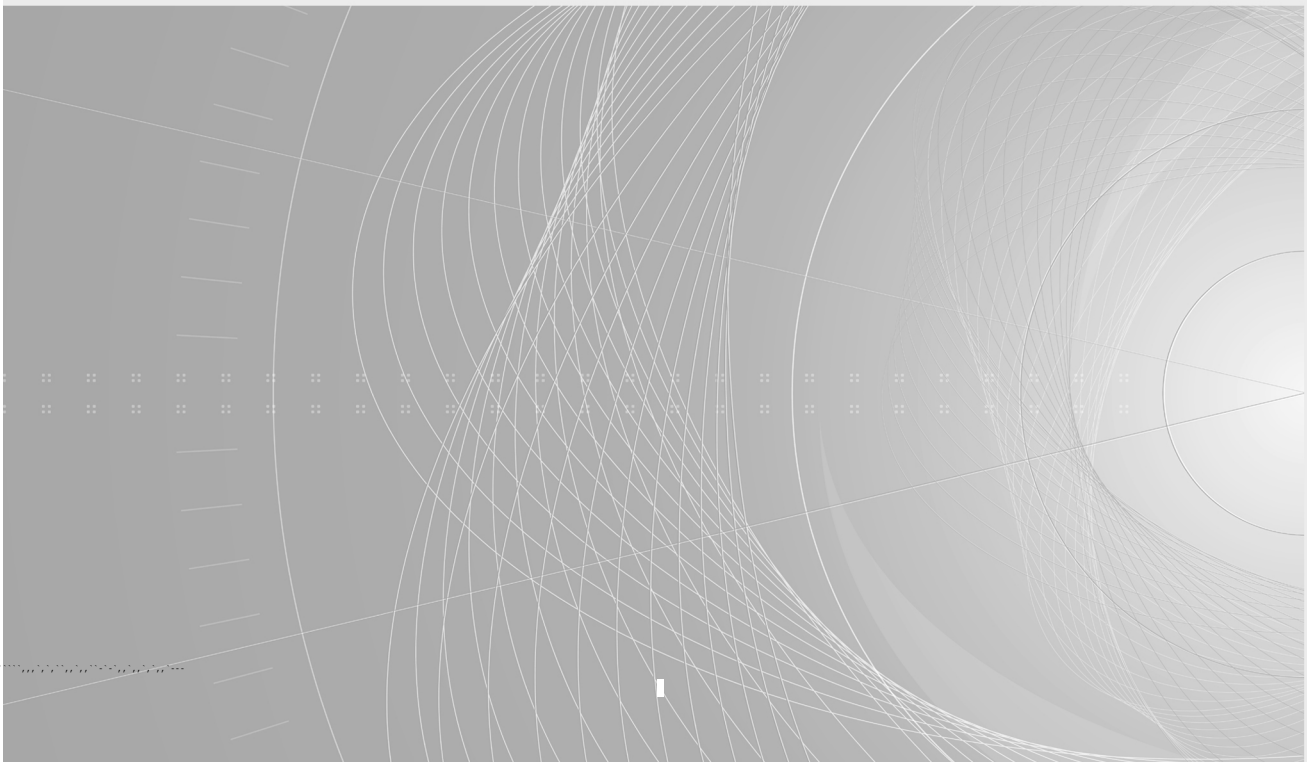
Edition 2.0 2009-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Equipment for general lighting purposes – EMC immunity requirements

Équipements pour l'éclairage à usage général – Exigences concernant l'immunité CEM



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EQUIPMENT FOR GENERAL LIGHTING PURPOSES – EMC IMMUNITY REQUIREMENTS

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61547 has been prepared by IEC technical committee 34: Lamps and related equipment.

This second edition cancels and replaces the first edition, published in 1995, and its Amendment 1 (2000). It constitutes a technical revision

The main reason for this revision is to update the dates of the references to the basic standards which also required some editorial changes in the tables. Other changes are:

1 Scope: clearly excludes multimedia equipment with lamps (e.g. TV);

3.2 Enclosure port: removal of the "earth port" in Figure 1 as in the generic EMC standards; the note below Figure 1 in the first edition relates to a requirement and moved to the main text under 5.1 General;

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7 Conditions during testing: the ”under consideration” for the operating conditions for starting devices has been deleted; the supply voltage and frequency during the test are clearly stated; shortening the immunity test for equipment incorporating a regulating control by testing at one light output level (50 % ± 10 %) instead of testing at three light output levels which are difficult to adjust and do not provide extra protection.

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

FDIS	Report on voting
34/127/FDIS	34/130/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This standard is to be read in conjunction with the relevant basic and/or product standard(s).

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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

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

EQUIPMENT FOR GENERAL LIGHTING PURPOSES – EMC IMMUNITY REQUIREMENTS

1 Scope

This International Standard for electromagnetic immunity requirements applies to lighting equipment which is within the scope of IEC technical committee 34, such as lamps, auxiliaries and luminaires, intended either for connecting to a low voltage electricity supply or for battery operation.

Excluded from the scope of this standard is equipment for which the immunity requirements are formulated in other IEC or CISPR standards such as:

– lighting equipment for use in transport vehicles;
– entertainment lighting control equipment for professional purposes;
– lighting devices built into other equipment such as:
  - scale illumination or indicators;
  - photocopiers;
  - slide and overhead projectors;
  - multimedia equipment.

However, in multi-function equipment where the lighting part operates independently from other parts, the electromagnetic immunity requirements of this standard apply to the lighting part.

The requirements of this standard are based on the requirements for domestic, commercial and light-industrial environments as given in IEC 61000-6-1, but modified to lighting engineering practice.

It can be expected that lighting equipment complying with the requirements of this standard will operate satisfactorily in other environments. In some special cases, measures have to be taken to provide higher immunity. It is impracticable to deal with all these possibilities. Such requirements may be established by contractual agreement between supplier and purchaser.

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 60050-845, *International Electrotechnical Vocabulary – Chapter 845: Lighting*

IEC 60598-1:2008, *Luminaires – Part 1: General requirements and tests*

IEC 60598-2-22, *Luminaires – Part 2-22: Particular requirements – Luminaires for emergency lighting*

IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio frequency, electromagnetic field immunity test* [1]
Amendment 1 (2007)

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity tests*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2008, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:1993, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 8: Power frequency magnetic field immunity test* [2]
Amendment 1 (2000)

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

IEC 61000-6-1:2005, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

3 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 60050(161) and IEC 60050(845) apply, together with the following.

3.1
port
particular electrical interface of the specified equipment with the external electromagnetic environment

3.2
enclosure port
the physical boundary of the equipment through which electromagnetic fields may radiate or penetrate (see Figure 1)

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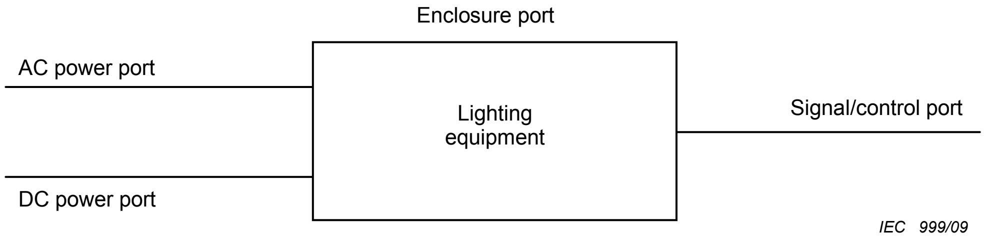
1 There exists a consolidated edition 3.1 (2008) that comprises IEC 61000-4-3 and its Amendment 1.

2) There exists a consolidated edition 1.1 (2001) that comprises IEC 61000-4-8 and its Amendment 1.



NOTE AC/DC power port may include the protective earth conductor.

Figure 1 – Examples of ports

4 Performance criteria

4.1 A functional description of performance criteria, during or as a consequence of the immunity testing, shall be provided by the manufacturer and noted in the test report.

The performance of lighting equipment shall be assessed by monitoring:

– the luminous intensity of the luminaire or of the lamp(s);
– the functioning of the control in the case of equipment which includes a regulating control or concerns the regulating control itself;
– the functioning of the starting device, if any.

4.2 The performance criteria given hereafter apply to lighting equipment.

a) Performance criterion A

During the test, no change of the luminous intensity shall be observed and the regulating control, if any, shall operate during the test as intended.

b) Performance criterion B

During the test, the luminous intensity may change to any value. After the test, the luminous intensity shall be restored to its initial value within 1 min. Regulating controls need not function during the test, but after the test, the mode of the control shall be the same as before the test provided that during the test no mode changing commands were given.

c) Performance criterion C

During and after the test, any change of the luminous intensity is allowed and the lamp(s) may be extinguished. After the test, within 30 min, all functions shall return to normal, if necessary by temporary interruption of the mains supply and/or operating the regulating control.

Additional requirement for lighting equipment incorporating a starting device: After the test, the lighting equipment is switched off. After half an hour, it is switched on again. The lighting equipment shall start and operate as intended.

4.3 A change of luminous intensity may be checked by visual observation but, in case of doubt, the following applies.

The luminous intensity of a luminaire or of the lamp(s) shall be measured by means of a illuminance (lux) meter which is positioned in an axis perpendicular to the main plane of the

luminaire or lamp(s), in its centre and at a distance for proper operation of the lux meter. The luminous intensity shall be deemed to be unchanged if the measured intensities do not deviate by more than 15 %.

Care shall be taken to ensure the ambient light level does not influence the measurement results.

Precautions to achieve reproducible results given in the relevant lamp performance standards shall be observed.

4.4 The effects of electromagnetic phenomena (as described in this standard) upon the life of the equipment under test are excluded from this standard.

5 Test specifications

5.1 General

Immunity requirements for equipment defined within the scope concern:

– electrostatic discharges;
– continuous and transient disturbances;
– radiated and conducted disturbances;
– mains supply-related disturbances.

They are given in Subclauses 5.2 to 5.9 on a port by port basis.

Tests are applied to the relevant ports of the equipment as indicated in the respective subclauses. For the purposes of this standard, d.c. power ports for supplying regulating controls are considered to be signal ports. Tests shall be conducted in a well-defined and reproducible manner. Tests shall be carried out as single tests in sequence. The sequence of testing is optional.

It may be determined from consideration of the electrical characteristics and usage of particular equipment that some of the tests are inappropriate and therefore unnecessary. In such cases it is required that the decision not to test be recorded in the test report.

The description of the test, the test generator, the test methods and the test set-up are given in the basic standards, which are referred to in the relevant subclauses.

Test levels are generally based on level 2 values as recommended in the basic standards.

5.2 Electrostatic discharges

These tests are carried out according to IEC 61000-4-2, with test levels as given in Table 1 of this standard. Contact discharge is the preferred test method. Twenty discharges (10 with positive and 10 with negative polarity) shall be applied on each accessible metallic part of the enclosure (terminals are excluded). Air discharges shall be used where contact discharges cannot be applied. Discharges shall be applied on the horizontal or vertical coupling planes, as specified in IEC 61000-4-2.

NOTE "Accessible" means accessible under normal operating conditions including user maintenance.

Table 1 – Electrostatic discharges – Test levels at enclosure port

Characteristics	Test levels
Air discharge	±8 kV
Contact discharge	±4 kV

5.3 Radio-frequency electromagnetic fields

These tests are carried out according to IEC 61000-4-3, with test levels as given in Table 2 of this standard.

Table 2 – Radio-frequency electromagnetic fields – Test levels at enclosure port

Characteristics	Test levels
Frequency range	80 MHz to 1 000 MHz
Test level	3 V/m (unmodulated)
Modulation	1 kHz, 80 % AM, sine wave

5.4 Power frequency magnetic fields

These tests are carried out according to IEC 61000-4-8, with test levels as given in Table 3 of this standard and need only to be applied to equipment containing components susceptible to magnetic fields, such as Hall elements or magnetic field sensors. In case of mains-operated devices, the test frequency shall be locked to the mains frequency.

Table 3 – Power frequency magnetic fields – Test levels at enclosure port

Characteristics	Test levels
Field frequency	50/60 Hz
Test level	3 A/m

5.5 Fast transients

These tests are carried out according to IEC 61000-4-4, with test levels as given in Tables 4 to 6 of this standard. Fast transients are carried out with a minimum duration of 2 min with a positive polarity and a minimum of 2 min with a negative polarity.

Table 4 – Fast transients – Test levels at ports for signal and control lines

Characteristics	Test levels
Test level	±0,5 kV (peak)
Rise time/hold time	5/50 ns
Repetition frequency	5 kHz
NOTE 1 Only applicable to ports interfacing with cables whose total length, according to the manufacturer's specification, may exceed 3 m. NOTE 2 Change of state commands are not applied during the test.	

Table 5 – Fast transients – Test levels at input and output d.c. power ports

Characteristics	Test levels
Test level	±0,5 kV (peak)
Rise time/hold time	5/50 ns
Repetition frequency	5 kHz
NOTE Not applicable to equipment not connected to the mains while in use.	

Table 6 – Fast transients – Test levels at input and output a.c. power ports

Characteristics	Test levels
Test level	±1 kV (peak)
Rise time/hold time	5/50 ns
Repetition frequency	5 kHz

5.6 Injected currents (radio-frequency common mode)

These tests are carried out according to IEC 61000-4-6, with test levels as given in Tables 7 to 9 of this standard. Example coupling and decoupling devices are:

AC mains: CDN – Mn

Screened signal cables: CDN – Sn

Unscreened signal cables: CDN – AFn / CDN – Tn

Table 7 – Radio-frequency common mode – Test levels at ports for signal and control lines

Characteristics	Test levels
Frequency range	0,15 MHz to 80 MHz
Test level	3 V r.m.s. (unmodulated)
Modulation	1 kHz, 80 % AM, sine wave
Source impedance	150 Ω
NOTE Only applicable to ports interfacing with cables whose total length, according to the manufacturer's specification, may exceed 3 m.	

Table 8 – Radio-frequency common mode – Test levels at input and output d.c. power ports

Characteristics	Test levels
Frequency range	0,15 MHz to 80 MHz
Test level	3 V r.m.s. (unmodulated)
Modulation	1 kHz, 80 % AM, sine wave
Source impedance	150 Ω
NOTE Only applicable to equipment that is connected to the mains while in use.	

Table 9 – Radio-frequency common mode – Test levels at input and output a.c. power ports

Characteristics	Test levels
Frequency range	0,15 MHz to 80 MHz
Test level	3 V r.m.s. (unmodulated)
Modulation	1 kHz, 80 % AM, sine wave
Source impedance	150 Ω
NOTE Only applicable to ports interfacing with cables whose total length, according to the manufacturer's specification, may exceed 3 m.	

5.7 Surges

These tests are carried out according to IEC 61000-4-5, with test levels as given in Table 10 of this standard. Lower levels need not to be tested. Pulses shall be applied to the a.c. voltage wave as follows; five positive polarity pulses at the 90º phase angle, five negative polarity pulses at the 270º phase angle. Two test levels are given for different types of lighting equipment.

Table 10 – Surges – Test levels at input a.c. power ports

Characteristics		Test levels		
		Device		
		Self-ballasted lamps and semi-luminaires	Luminaires and independent auxiliaries	
			Input power	
			≤25 W	>25 W
Wave-shape data		1,2/50 µs	1,2/50 µs	1,2/50 µs
Test levels	line to line	±0,5 kV	±0,5 kV	±1,0 kV
	line to ground	±1,0 kV	±1,0 kV	±2,0 kV
NOTE In addition to the specified test level, all lower test levels as detailed in IEC 61000-4-5 should also be satisfied.				

5.8 Voltage dips and short interruptions

These tests are carried out according to IEC 61000-4-11, with test levels as given in Tables 11 and 12 of this standard. Changes to the voltage level shall occur at a zero crossing point in the a.c. voltage waveform.

Table 11 – Voltage dips – Test levels at input a.c. power ports

Characteristics	Test levels
Test voltage level	70 %
Number of periods	10

Table 12 – Voltage short interruptions – Test levels at input a.c. power ports

Characteristics	Test levels
Test voltage level	0 %
Number of periods	0,5

5.9 Voltage fluctuations

Tests regarding voltage fluctuations are part of equipment product standards.

6 Application of test specifications

6.1 General

The test requirements apply to the following lighting equipment:

– self-ballasted lamps and semi-luminaires;
– independent auxiliaries;
– luminaires or equivalent appliances.

Immunity requirements do not apply to lamps other than self-ballasted lamps, nor to auxiliaries incorporated in luminaires, in self-ballasted lamps or in semi-luminaires. However, if separate tests have proven that built-in auxiliaries such as ballasts or convertors comply with the requirements set for independent auxiliaries, the luminaire is deemed to comply and need not be tested.

6.2 Non-electronic lighting equipment

Lighting equipment, with the exception of emergency lighting luminaires, in which the light source is mains frequency or battery-operated and which does not contain any active electronic component, is deemed to fulfil the immunity requirements without testing.

6.3 Electronic lighting equipment

6.3.1 General

For lighting equipment containing active electronic components which, for example, convert or regulate the operating voltage and/or the frequency of the light source, the requirements are given in Subclauses 6.3.2 to 6.3.4.

6.3.2 Self-ballasted lamps

Electronic self-ballasted lamps shall be tested in accordance with Clause 5 and comply with the performance criteria of Table 13.

Table 13 – Application of tests for self-ballasted lamps

	Test (subclause) and performance criterion							
	5.2	5.3	5.4	5.5	5.6	5.7	5.8 Table 11	5.8 Table 12
Self-ballasted lamps	B	A	A	B	A	C	C	B

6.3.3 Independent auxiliaries

Those auxiliaries which are independent as defined in their relevant product standard shall be tested in accordance with Clause 5 and comply with the performance criteria of Table 14.

Table 14 – Application of tests for independent auxiliaries

	Test (subclause) and performance criterion							
	5.2	5.3	5.4	5.5	5.6	5.7	5.8 Table 11	5.8 Table 12
Independent electronic auxiliary	B	A	A	B	A	C	C	B[a]

[a] For ballasts where the lamp is not able to restart within 1 min, due to the physical constraints of the lamp, performance criterion C applies.

6.3.4 Luminaires

Luminaires shall be tested in accordance with Clause 5 and comply with the performance criteria of Table 15.

Table 15 – Application of tests for luminaires

	Test (subclause) and performance criterion							
	5.2	5.3	5.4	5.5	5.6	5.7	5.8 Table 11	5.8 Table 12
Luminaire including active electronic components	B	A	A	B	A	C	C	B[a]
Luminaire for emergency lighting[c]	B[b]	A	A	B[b]	A	B[b]	[d]	[d]

[a] For luminaires where the lamp is not able to restart within 1 min, due to the physical constraints of the lamp, performance criterion C applies.

[b] For emergency luminaires designed to operate in high-risk task areas, after the test, the luminous intensity shall be restored to its initial value within 0,5 s.

[c] Luminaires for emergency lighting shall be tested in both the normal and emergency mode of operation.

[d] These tests do not apply as they are covered by the test in IEC 60598-2-22.

7 Conditions during testing

The test shall be applied while the equipment is operated as intended under the normal operating conditions as laid down in the relevant product standard at stabilized luminous (radiant) flux and at normal laboratory conditions. Testing is only required at one combination of supply voltage and frequency, as specified by the manufacturer.

Equipment including a regulating control shall be tested at a light output level of 50 % ± 10 %. The lamp load of the equipment under test shall be the maximum allowed.

Luminaires and independent auxiliaries shall be tested with lamps for which they are intended. Where equipment can operate with lamps of different wattages, lamps of maximum wattage shall be applied. Lamps shall be test lamps as described in Annex B of IEC 60598-1.

For independent auxiliaries, the length of the cables between device and lamp shall be 3 m unless the manufacturer prescribes another length.

The configuration and mode of operation during the tests shall be precisely noted in the test report.

8 Assessment of conformity

Equipment manufactured in series shall be verified by performing type-testing on one representative model, or on one series-produced equipment. The manufacturer or supplier shall ensure by means of his quality control system that the tested model or equipment is representative of the series-produced equipment.

All equipment not produced in series shall be tested on an individual basis.

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