EMC PARTNER AG

Is a manufacturer of EMC impulse generators for conducted immunity.

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2022 WORLD OF TECHNOLOGY & SCIENCE

WORLD OF ELECTRONICS

New EMC requirements for lighting equipment

LED lamps

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IEC 61547 - New release (edition 3) per 2020

- Introduction
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Introduction

- Electric lighting was introduced in 19th century: lamps with incandescent bulbs.
- Technical evolution is driven by efficiency.

Introduction

When marketing LED lamps, EMC requirements apply according to the region:

- IEC / EN standards for Europe
- ANSI / IEEE, UL standards for USA
- Other standards may apply in other parts of the world

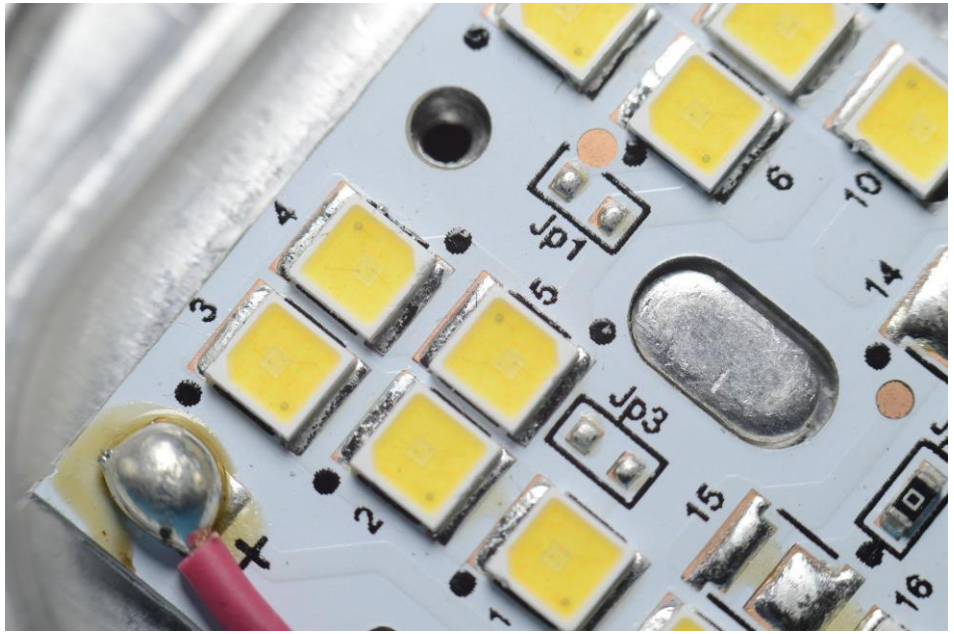
Different types of LED lamps have to meet EMC requirements.

- LED interior lamps
- LED luminaires
- LED outdoor lamps
- LED street lights
- Other LED devices

Relevant changes in IEC 61547

Why / how did the standard change?

It now includes end-user replaceable modules



Relevant changes in IEC 61547

Why / how did the standard change?

Increased ESD and surge test levels for outdoor / street lightning equipment

Possible background:
Large pillars may determine higher surge voltages experienced by lamps

Relevant changes in IEC 61547

Why / how did the standard change?

ESD test covers now normal operation and handling.

Possible background:
The requirement aims to increase reliability under all possible operational and non-operational modes, also when the lamp/module is carried.

Relevant changes in IEC 61547

Why / how did the standard change?

Line to ground surge requirement was removed for self ballasted lamp ≤ 25 W

Possible background:
Low power lightning equipment with included ballasted circuit are increasingly covered by insulating material/plastic, requiring no PE connection anymore.

Overview of the standards

IEC/EN 61547 :2009*	Equipment for general lighting purposes	EMC requirements
IEC/EN 61000-3-2 :2018	EUT current < 16A	Limits for harmonic current emissions
IEC 61000-3-3:2013 + AMDs	EUT current < 16A	Limitation of voltage changes, fluct. and flicker
ANSI C136.2 :2018	Roadway and area lighting equipment	Electrical immunity and dielectric withstand
ANSI C82.77 :2002	Related power quality requirements for lighting equipment	Harmonic emission limits

new release (edition 3) per 2020

IEC 61547

ESD test as per IEC 61000-4-2 (150 pF / 330 Ω)

20 pulses will be applied on all accessible metallic parts,

air discharges will be applied where no contact discharges can be applied.

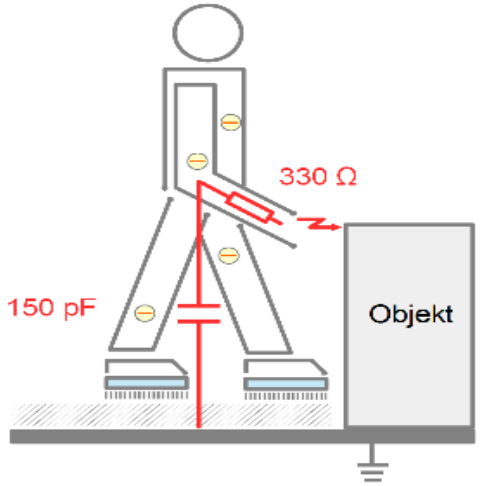
ESD testing	Edition 2.0 (2009)	Edition 3.0 (2019)
General test level	CD ± 4 kV, AD ± 8 kV	CD ± 4 kV, AD ± 8 kV
Road and street lamps	no additional req.	CD ± 8 kV, AD ± 15 kV

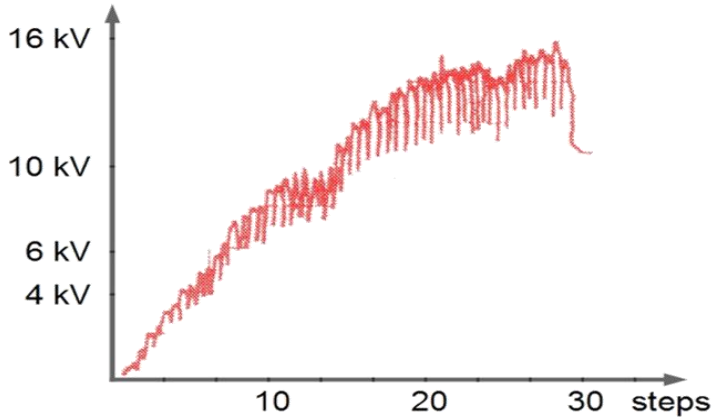
IEC 61547

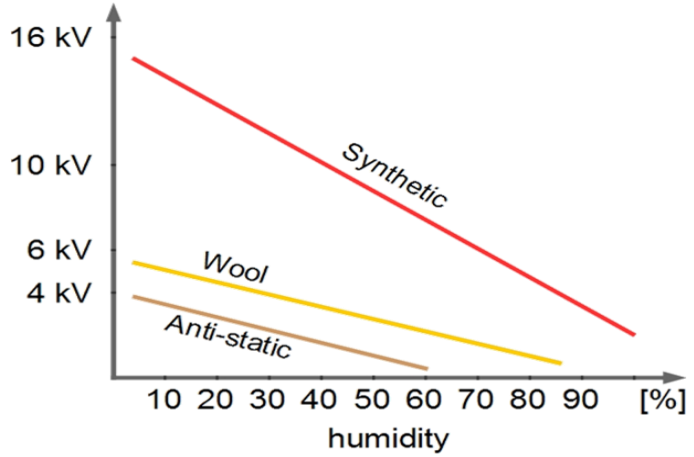
ESD test as per IEC 61000-4-2 (150 pF / 330 Ω)

What is ESD?

ESD as referred to in IEC 61000-4-2 simulates the discharge of a human body (Human Body Model - HBM)







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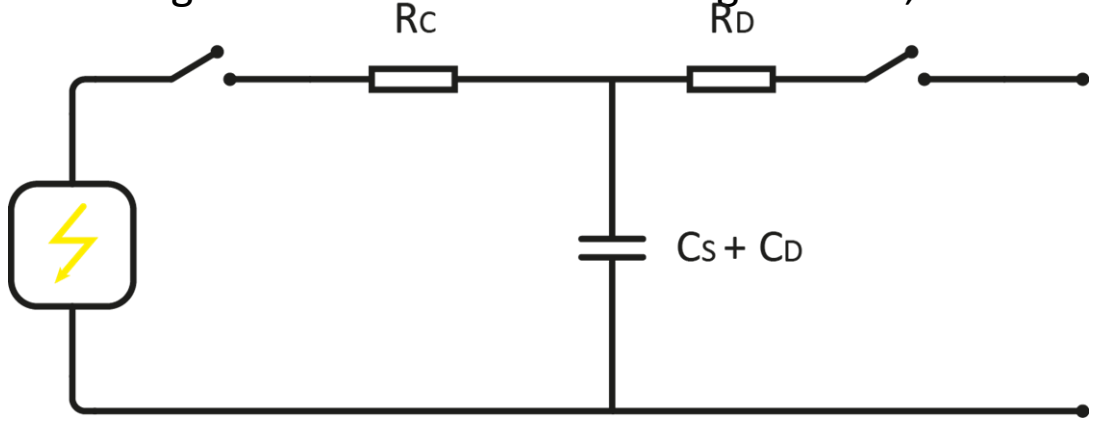
ESD test as per IEC 61000-4-2 (150 pF / 330 Ω)

What is ESD?

Discharge is to be simulated with a generator, as described in the basic standard



Parameter	Requirement
CD voltage	1 – 8 kV
AD voltage	2 – 15 kV
Polarity	Pos. and neg.
Hold time	≥ 5s
Repetition	20 Pulse / s

Cd – stray capacitance, Cs – Discharge capacitor

Cd+Cs = 150 pF typically, Rd = 330 Ω typically

IEC 61547

ESD test as per IEC 61000-4-2 (150 pF / 330 Ω)

What is ESD?

There are two types of discharge, four test levels for each

Voltage contact discharge (CD)		Voltage air discharge (AD)	
Level	[kV]	Level	[kV]
1	2	1	2
2	4	2	4
3	6	3	8
4	8	4	15
x	Special	x	Special

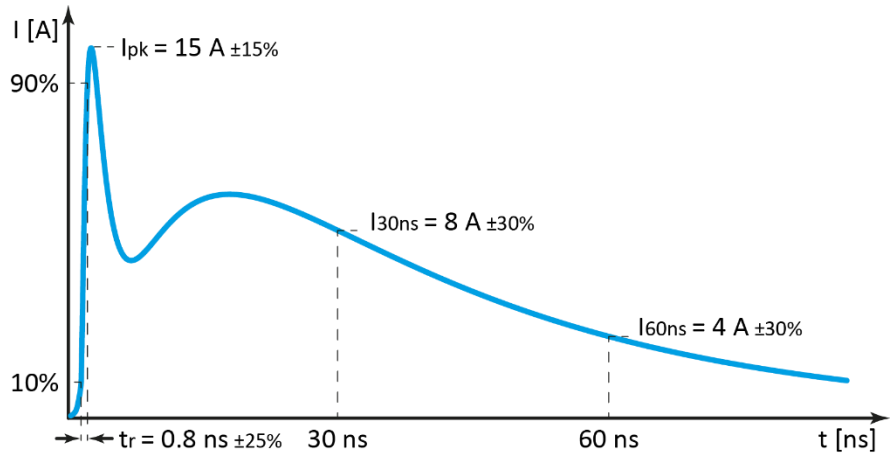
IEC 61547

ESD test as per IEC 61000-4-2 (150 pF / 330 Ω)

What is ESD?

- Discharge at 4 kV(Contact discharge)
- The waveform is discharge current
- Discharge load is a 2 Ω target

Level	V ± 5% [kV]	t_r ± 25% [ns]	1st I_{peak} ± 15% [A]	I_{peak} 30ns ± 30% [A]	I_{peak} 60ns ± 30% [A]
1	2	0.8	7.5	4	2
2	4	0.8	15	8	4
3	6	0.8	22.5	12	6
4	8	0.8	30	16	8



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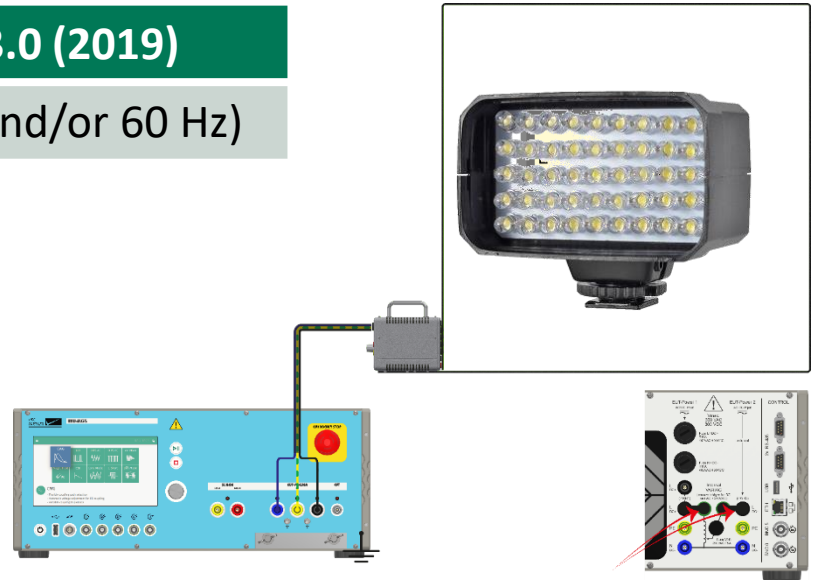
Magnetic field test as per IEC 61000-4-8

Same requirements in existing & new standard.

Magentic field testing	Edition 2.0 (2009)	Edition 3.0 (2019)
Test level	**3 A/m** (50 and/or 60 Hz)	**3 A/m** (50 and/or 60 Hz)



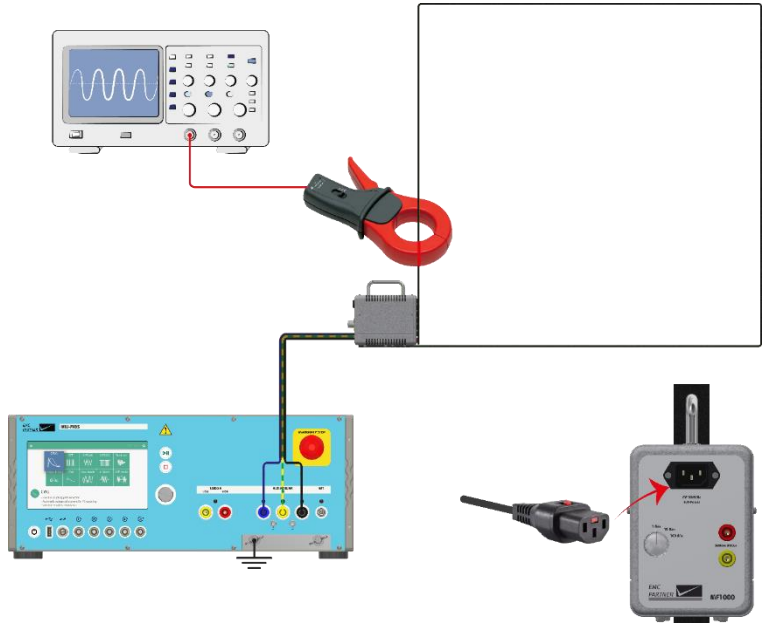
IEC 61547

Magnetic field test as per IEC 61000-4-8

What is a magnetic field?

A magnetic field is created by the flow of current through an electrically conductive body.

Requirement	A/m cont	A/m short term (3s)
Level 1	1	-
Level 2	3	-
Level 3	10	-
Level 4	30	300
Level 5	100	1000



IEC 61547

EFT / Burst test as per IEC 61000-4-4

Same requirements in existing & new standard.

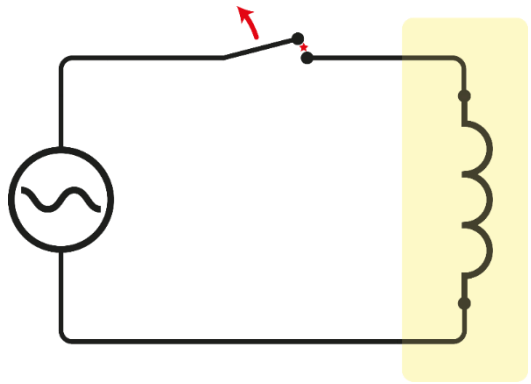
EFT/Burst 5 kHz	Edition 2.0 (2009)	Edition 3.0 (2019) New !
AC lines	**± 1 kV**	**± 1 kV**
DC lines	**± 0.5 kV**	**± 0.5 kV**
I/O lines	**± 0.5 kV**	**± 0.5 kV**

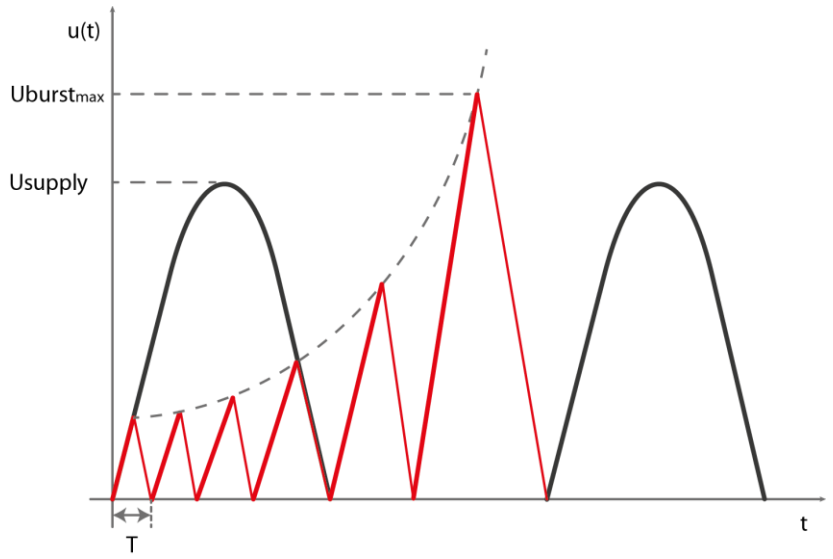
IEC 61547

EFT / Burst test as per IEC 61000-4-4

What is burst?

- Disturbance source: turning on and off inductive loads
- High amplitude, fast rise time, high repetition rate and low impulse energy





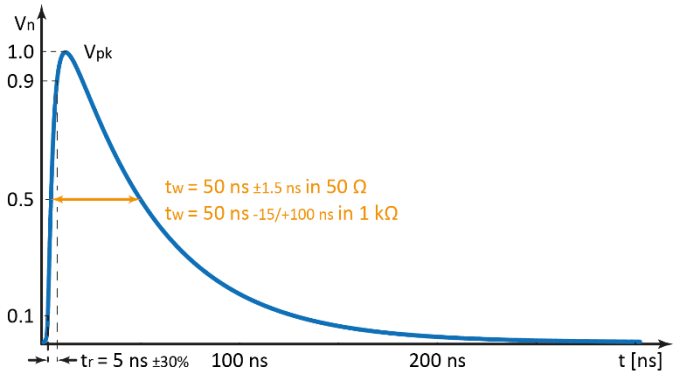
IEC 61547

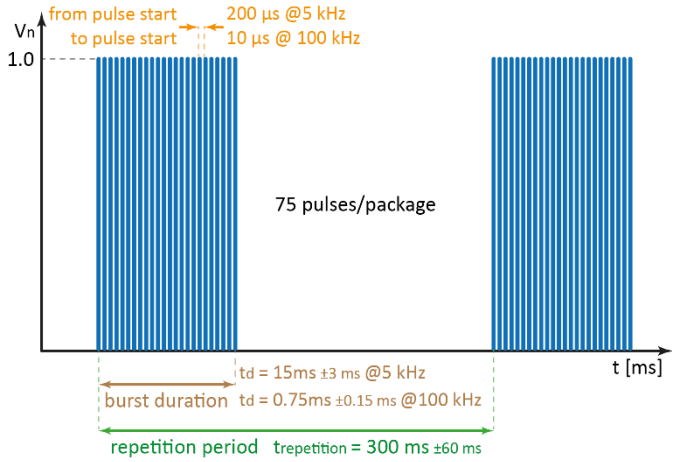
EFT / Burst test as per IEC 61000-4-4

Requirements in IEC 61000-4-4 Ed.3: Calibration at direct output and test levels

Set voltage [kV]	VpOC [kV]	Vp 1 kOhm [kV]	Vp 50 Ohm [kV]	f [kHz]
0.25	0.25	0.24	0.125	5 or 100
0.5	0.5	0.48	0.25	5 or 100
1	1	0.95	0.5	5 or 100
2	2	1.9	1	5 or 100
4	4	3.8	2	5 or 100

Level	Power ports, PE		Signal, I/O ports	
	Upeak [kV]	f [kHz]	Upeak [kV]	f [kHz]
1	0.5	5 or 100	0.25	5 or 100
2	1	5 or 100	0.5	5 or 100
3	2	5 or 100	1	5 or 100
4	4	5 or 100	2	5 or 100
X	special	special	special	special

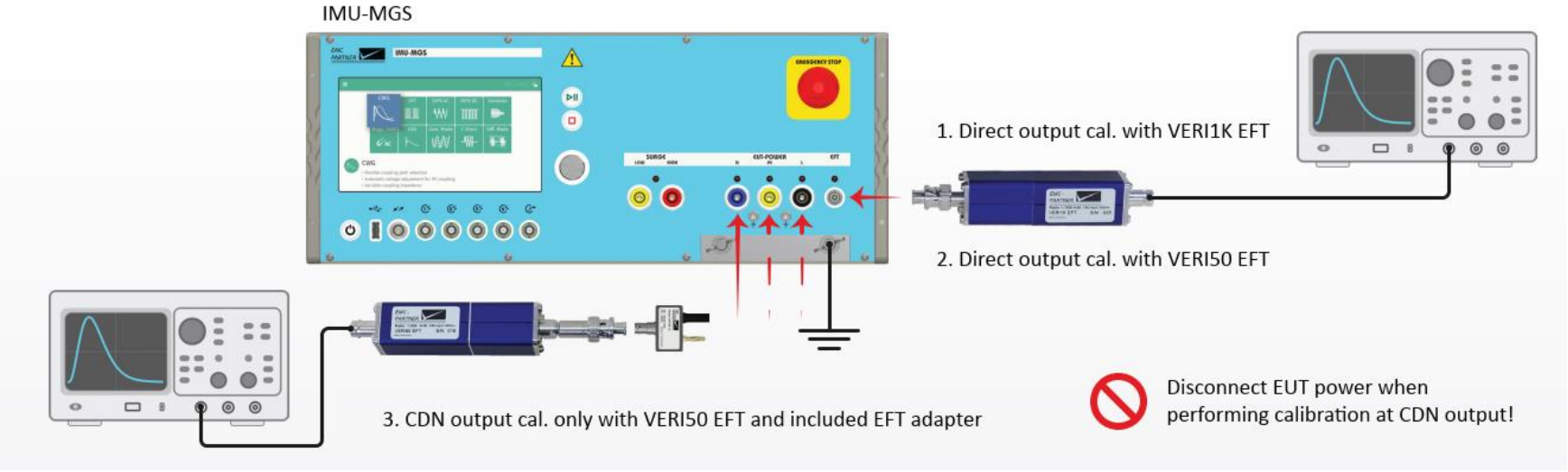




IEC 61547

EFT / Burst test as per IEC 61000-4-4

Requirements in IEC 61000-4-4 Ed.3: Calibration at direct output



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Surge test as per IEC 61000-4-5

What has changed in new edition 2019)?

- Type and power of lamps
- Added street lighting
- Changed test levels

Surge (existing requirements)	Coupling	Edition 2.0 (2009)
Self balasted lamps, semi-luminaires	L-L, L-N	± 0.5 kV
	L-PE, N-PE	± 1 kV
Luminaires, independent auxiliaries **< 25 W**	L-L, L-N	± 0.5 kV
	L-PE, N-PE	± 1 kV
Luminaires, independent auxiliaries **> 25 W**	L-L, L-N	± 1 kV
	L-PE, N-PE	± 2 kV

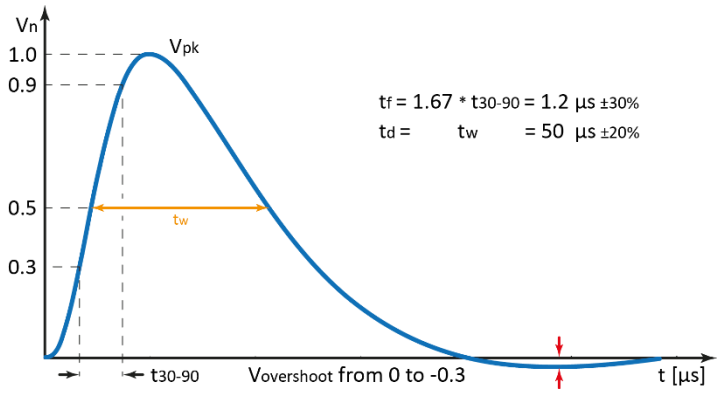
Surge (new requirements / 2019)	Coupling	Edition 3.0 (2019) New !
Self balasted lamps ≤ 25 W	L-L, L-N	± 0.5 kV
	L-PE, N-PE	± 1 kV
Self balasted lamps > 25 W, luminaires, modules in a host	L-L, L-N	± 1 kV
	L-PE, N-PE	± 2 kV
Street lighting	L-L, L-N	± 2 kV
	L-PE, N-PE	± 4 kV

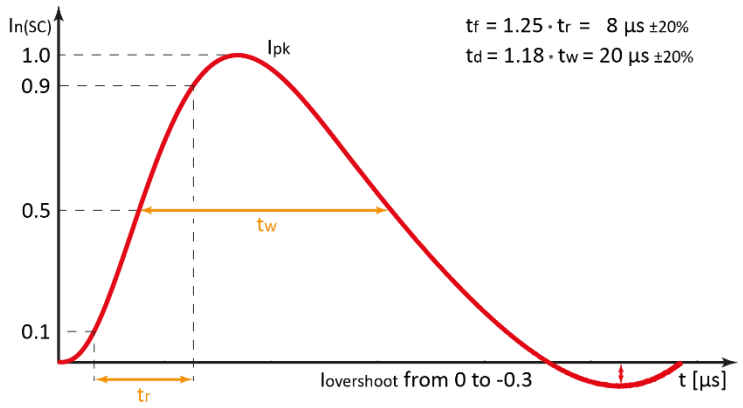
IEC 61547

Surge test as per IEC 61000-4-5

What is a surge? Requirements in IEC 61000-4-5 Ed. 3: waveforms at direct out and test levels

Open circuit voltage	Short circuit current
Upeak [kV] ± 10%	Ipeak [kA] ± 10%
0.5	0.25
1	0.5
2	1
4	2





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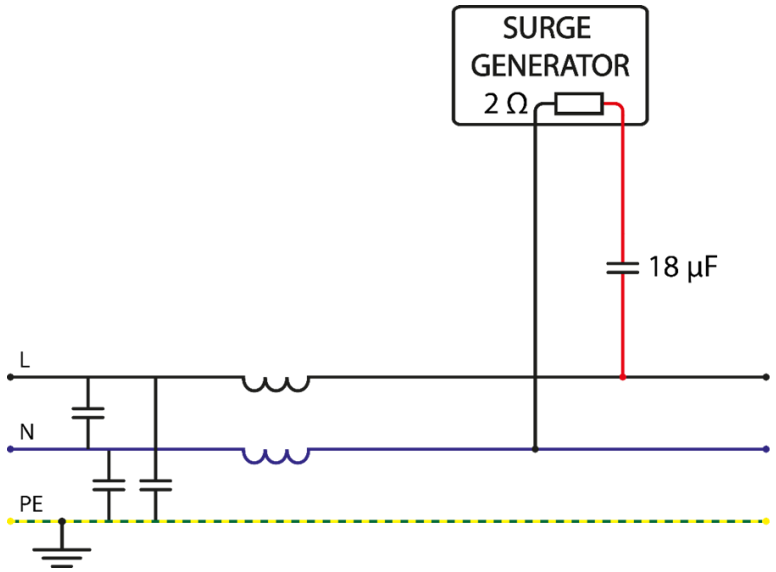
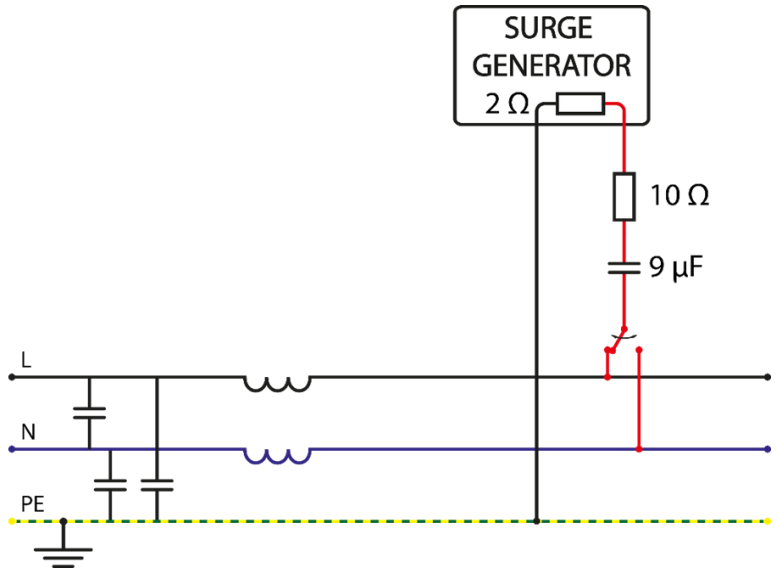
Surge test as per IEC 61000-4-5

Coupling network for single phase EUTs.
Pulses shall be applied to AC voltage 5 positive polarity pulses at 90° phase angle,
5 polarity pulses at 270° phase angle.





IEC 61547

Dips and interruptions as per IEC 61000-4-11

On AC lines (same requirements in old and new edition).

Dips & int.	Duration	Edition 2.0 (2009)	Edition 3.0 (2019)
Level 70 %	10 periods	✓	✓
Level 0 %	0.5 periods	✓	✓

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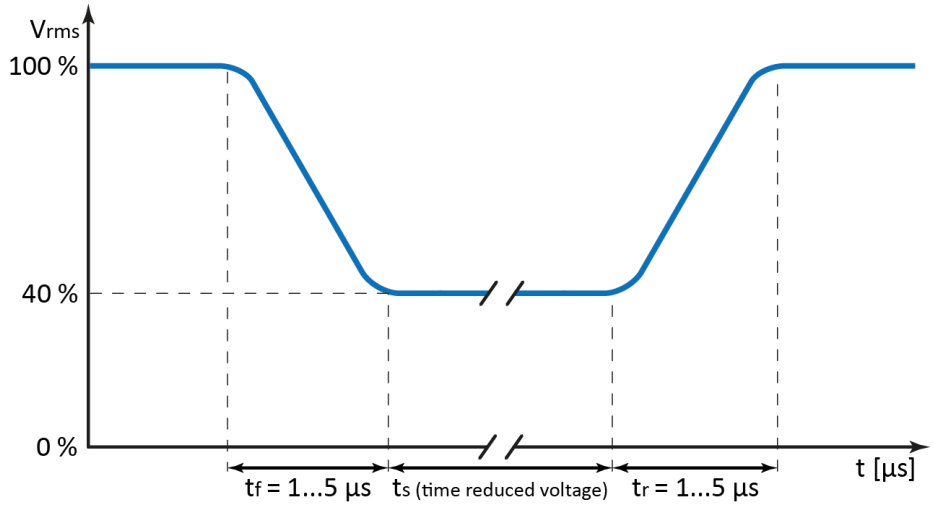
Dips and interruptions as per IEC 61000-4-11

What are dips?



Test level DIPS

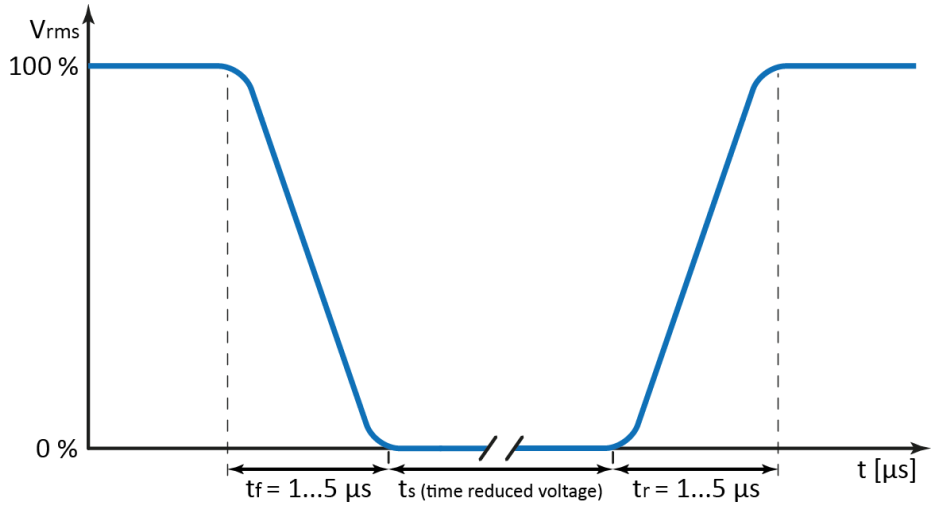
Classes	Dips test levels and duration @ 50 Hz / 60 Hz			
Class 1	Case by case according to requirements			
Class 2	0 % 0.5 cycles	0 % 1 cycle	70% 25 c. @ 50 Hz / 30 c. @ 60 Hz	
Class 3	0 % 0.5 cycles	0 % 1 cycle	70% 25/30 c.	80% 250/300 c.
Class x	x	x	x	x

Sync Angles: 45°, 90°, 135°, 180°, 225°, 270°, 345°
3 dips with an interruption of at least 10s

IEC 61547

Dips and interruptions as per IEC 61000-4-11

What are interruptions?



Test level Interruptions

Classes	Interruptions test levels and duration @ 50 Hz / 60 Hz
Class 1	Case by case according to requirements
Class 2	0% during 250/300 cycles
Class 3	0% during 250/300 cycles

Thank you!

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