SURGE PROTECTION FOR LED LIGHTING
An overvoltage is a voltage pulse or wave which is superimposed on the rated voltage of the network:
The overvoltage is characterized by:
- the rise time $t_f$ (in $\mu$s)
- the gradient $S$ (in kV/$\mu$s)
types of overvoltage

**Switching surges**: high-frequency overvoltage or burst disturbance caused by a change in the steady state in an electrical network (during operation of switchgear).
types of overvoltage

**Electrostatic:** caused by the discharge of accumulated electric charges.
types of overvoltage

Lightning:

• The lightning discharge is an event of great uncertainty in:
  • TIME
  • LIFESPAN
  • INTENSITY
  • PLACE
SURGE

LED MODULE
Surge protection level **standard requirement** (Ref. EN 61547, P>25W):

**Pulse type:** 1.2 – 50µs

**Pulse level:**
- 1000Vac Line-Neutral (DIFFERENTIAL MODE - DM)
- 2000Vac Line-PE / Neutral-PE (COMMON MODE – CM)

**Pulse number:** 5 positive pulses + 5 negative pulses synchronized to 90° and 270° of the input voltage sinewave

**Pulse frequency:** 1 pulse/minute

**Pass criteria:** No breaking damage during the test
Requirements

Statements:

1) The requirement from the EN 61547 Standard are not enough for the majority of the cases

2) Luminaires which withstands the mimimun requirements of the EN 61547 can be Legally commercialised

3) Every luminaire manufacturer had different approach to increase the protection levels

4) Component manufacturer are offering solutions to increase the protection levels
1) Commercial Drivers can reach withstanding to 8kV

2) 8kV is the max withstanding overvoltage of the driver before the failure

3) 8kV is tested in Differential Mode (between phase and Neutral) since is NOT tested in an earthed case. Tested out of the destination luminaire between L and N (DM)

4) There is NO overvoltage control to the LED module side
**SURGE PROTECTION DEVICE**

- **Type II, \( I_n = 5kA \)**
  - \( I_{max} = 10kA \), \( U_{oc} = 10kV \)
  - Optionally integrated protection fuse
  - Luminaire Switch off at the end of SPD life
COORDINATE PROTECTIONS

[Diagram showing SPD and LED Module]
IS THE COMPLETE SYSTEM PROTECTED

10kV?
**Common Mistake 1**

«The protection level of the luminaire is the protection level of the power supply or of the SPD»

**Common Mistake 2**

«It’s enough to add an SPD to protect the luminaire»
Functioning of SPD in case of overvoltage

Insulation: **Class I**
Functioning of SPD in case of overvoltage

Insulation:  Class I
Surge:  Differential Mode
Functioning of SPD in case of overvoltage

Insulation: Class I
Surge: Common Mode

- Type II, $I_n = 5kA$
- $I_{max} = 10kA$, $U_{oc} = 10kV$
Functioning of SPD in case of overvoltage

Insulation: Class II
Surge: Common Mode
Differential Mode
Functioning of SPD in case of overvoltage

Insulation: Class II
Surge: Differential Mode
Functioning of SPD in case of overvoltage

Insulation: Class II
Surge: Differential Mode
Functioning of SPD in case of overvoltage

Insulation: Class II
Surge: Common Mode
SURGE PROTECTIONS TEST

SURGE TEST STATION
- Full compliance to EMC standard
- Up to 15 kV – 12kA
SURGE PROTECTIONS

Functioning of a protection device in case of Overvoltage
SURGE PROTECTION

To coordinate the protections!

Feeder pillar with SPD

Luminarie in class I with integrated SPD

Earthing Conductor (PE)
### ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
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<th>Description</th>
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| Rated voltage | 220–240V 50/60Hz  
* (Standard tolerance +/-10%, other voltages and tolerances upon request)* |
| LED current | 525mA | 700mA |
| Power factor | >0.9 (at full load - PLM)  
>0.95 (at full load - F, DA, DAC) |
| On-load switch | Included, with integrated cable clamp. |
| Mains connection | For cables max section 4mm² |
| Surge protection | SPD integrated 10kV-10kA, type II, with LED signal and thermo fuse to disconnect load at the end of life. |
## SURGE PROTECTION LEVEL

<table>
<thead>
<tr>
<th>LUMINAIRE</th>
<th>LED Current (mA)</th>
<th>OPTICS</th>
<th>INRUSH CURRENT Duration 50%pk (µs)</th>
<th>INRUSH CURRENT Peak (A)</th>
<th>MCB B-Type 10A / 16A / 25A</th>
<th>SURGE PROTECTION CLI (CM / DM, kV)</th>
<th>SURGE PROTECTION CLI.II (CM / DM, kV)</th>
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Requirements

Statements:

1) Is not enough to be in compliance with minimum requirements

2) Component for protection must be coordinated

3) Without SPD the whole overvoltage is effecting the Driver AND LED modules

4) With SPD the connection to the PE (Class1) is maximizing the protection and minimising the “Stress” of the electronic components
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