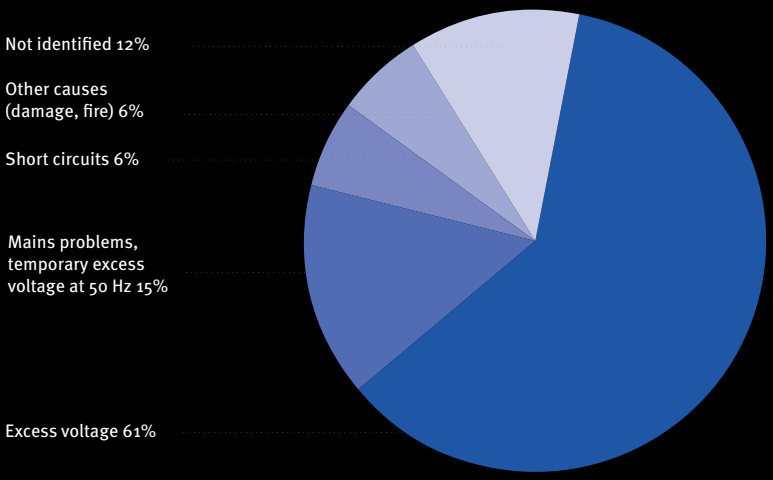
PROTECTION AGAINST EXCESS VOLTAGE FOR OUTDOOR LED ILLUMINATIONS

The use of light-emitting diodes (LEDs) and electronics in lighting equipment has highlighted the problem of excessive voltage caused by direct or indirect electrical charges. In the case studied, most refer to electronic power supplies which have problems of electrical insulation of components destroyed by electrical discharges. The LED is a diode which works on constant current and with a relatively low fall of voltage to its heads, so it is particularly sensitive to electrostatic discharges and disturbances based on impulses.



Damage to electronic equipment. Study conducted in France for the residential sector on behalf of AVIVA, the sixth largest insurance company in the world (www.aviva.com)

These problems may arise from:

- Disturbances inherent in the electricity mains; insertion or removal of strongly reactive charges, faults in the cables, or a strong harmonic distortion in the mains;
- Excessive charges arising from the environment: direct or indirect atmospheric discharges or unexpected and excessive accumulation of electrostatic charges on the equipment..

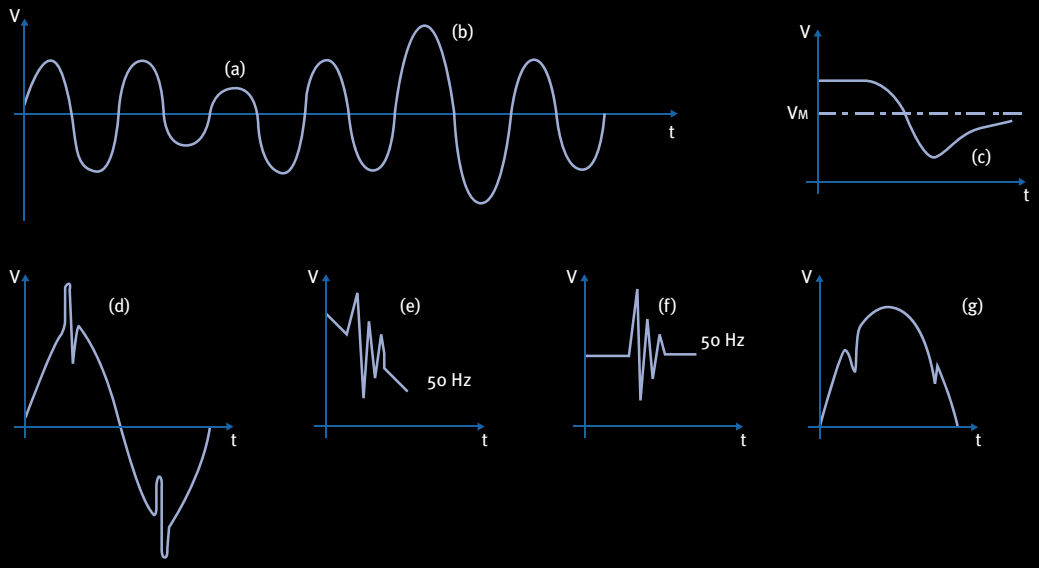
These phenomena have been known about for a long time and on strong circuits, such as discharge lamps or fluorescent ones, the effect is wholly marginal. But LED circuits are extremely sensitive to these phenomena on account of their being made with semiconductors and with micrometric thicknesses.

Using power supplies which are able to stand this type of disturbance does not produce total immunity, and so it is important for the plant designer to bear in mind the idea of using extra protection on the basis of:

- The type of plant (with cables in the air or buried, and the length of the installation).
- The location of the installation (an insulated area, subject or otherwise to frequent atmospheric phenomena, especially discharges.
- Type of installation (on poles, on the wall, on the ground).
- System insulation class.

EXCESSIVE VOLTAGE IN THE MAINS

Excessive mains voltage results from transitory impulses varying in intensity and spreading through electricity cables, which can damage the lighting fixture up to failure. The disturbances are mainly differential in mode (the disturbance shows up between supply conductors, for example between phase and neutral) generated by the ignition of large electric motors (pumps, lifting equipment, compressors...) which are capo in the same electricity link as that of the illumination or near residential areas (with the same electricity distribution station).



Types of variation in voltage amplitude.

(a) Voltage holes;
(b) Non-impulsive excessive voltage;
(c) Slow variations;
(d) Long-term impulsive excessive voltage;
(e) Medium-term impulsive excessive voltage;
(f) Short-term impulsive excessive voltage;
(g) Commutating transients

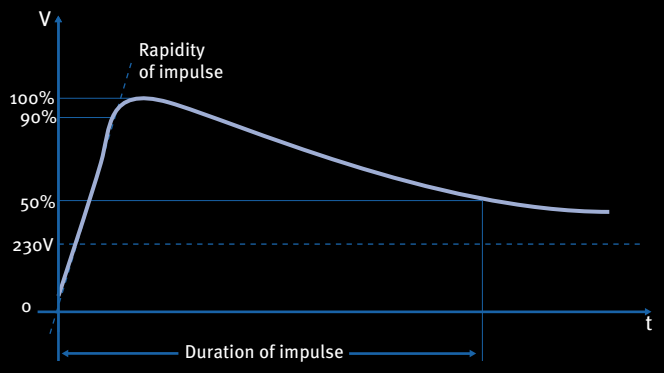
The use of supplementary suppression systems from the panel (dischargers) helps a lot in safeguarding all the electronic devices in the house, LED appliances included.

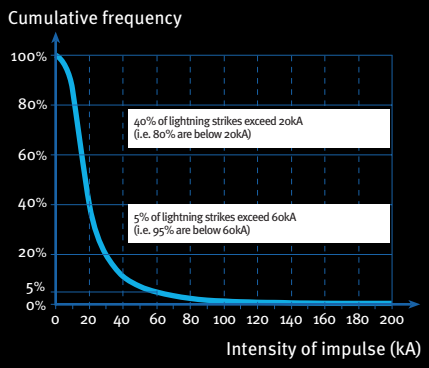
EXCESSIVE VOLTAGE OF ATMOSPHERIC ORIGIN

This excessive voltage is also of an impulse type and can be caused by direct or indirect lightning strikes (the latter possibly at some distance from the place where the lighting fixture is installed). In some cases the accumulation of electrostatic impulses (for example, a continuous flow of dry air through poles insulated from the earth) may also cause damages from discharges.

Phenomena of this type mainly concern pole-based equipment (functioning as antennas) as well as aerial electricity lines positioned in insulated areas. Class II appliances, especially, are more sensitive to this type of problem because they do not provide an immediate discharge path to earth. Voltage peaks for this type of excessive voltage may be differential (between phase and neutral) or common (between phase and earth or between neutral and earth).

All of these situations are characterized by violent and instantaneous voltage peaks and may be differential (between phase and neutral) or common (between phase and earth or between neutral and earth). They differ in rapidity, intensity (kA) and duration.





From a study conducted in central Europe on a sample of 5.4 million lightning strikes in the course of a ten-year period, it has been estimated that:

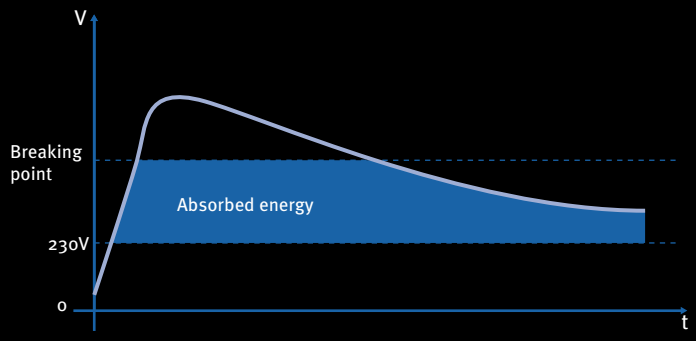
- Only 5% had an intensity equal to or greater than 60kA;
- 35% had an intensity between 20kA and 60kA;
- 60% had an intensity below 20kA.

DIRECT LIGHTNING STRIKE
This happens when the lightning strikes the lighting fixture directly, and in this event it is not likely to survive.

INDIRECT LIGHTNING STRIKE
This happens when the lightning strikes at a certain distance from the installation setting, but passes through the electricity cables on account of the localized increase in the magnetic field. In this case, the insertion of star protection systems (phase/neutral, phase/earth and neutral/earth) either along the electricity cables or on the appliance itself offers good protection against the phenomenon.

ELECTRICAL DISCHARGES OF AN ELECTROSTATIC NATURE
The accumulation of electrostatic discharges, especially on Class II appliances with metallic superstructures, and where the charges cannot be lost though an earth connection, presents a further problem in that the excess (and therefore the exceeding of the dielectric potential) causes the inner electronic components to be perforated; the use of common-type supplementary protection systems is extremely useful for safeguarding the appliance.

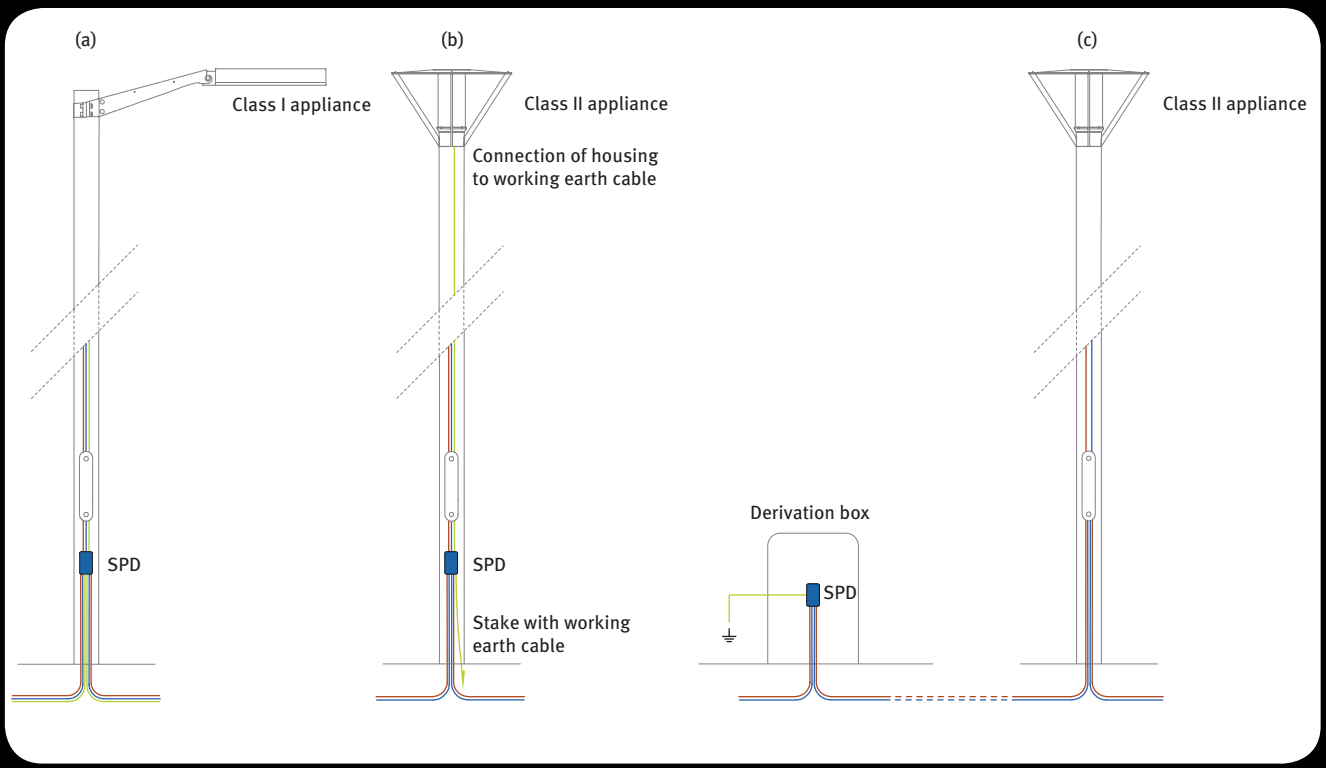
ARES offers an SPD (Surge Protector Device) which can be connected near the appliances requiring protection or above the derivation box
(if the line is not particularly long).



This device functions in common and differential manner at the same time, by absorbing any excessive voltage and discharging it, depending on its nature, towards earth or neutral.
The closer it is installed to the appliances requiring protection, the more effective this type of protection is, and it should be remembered that an earth connection is needed to protect the appliance effectively.

In the case of Class I appliances, the SPD may be installed near the appliance or in the electrical panel if this is not possible (see fig. A). For Class II appliances, however, two different situations should be considered:

- If possible, make sure that the metallic housing of the appliance is in contact with the earth and then implement the SPD, considering this connection as a PE terminal (fig. b).
- If that is not possible, install the SPD above the appliance, in the derivation box, and ensure that the panel at least is earthed so that it can offer, albeit less effectively, some common-type protection against any discharges (fig. c).



ARES *shall not be held liable for the installation of plants not complying with the regulation in force.*