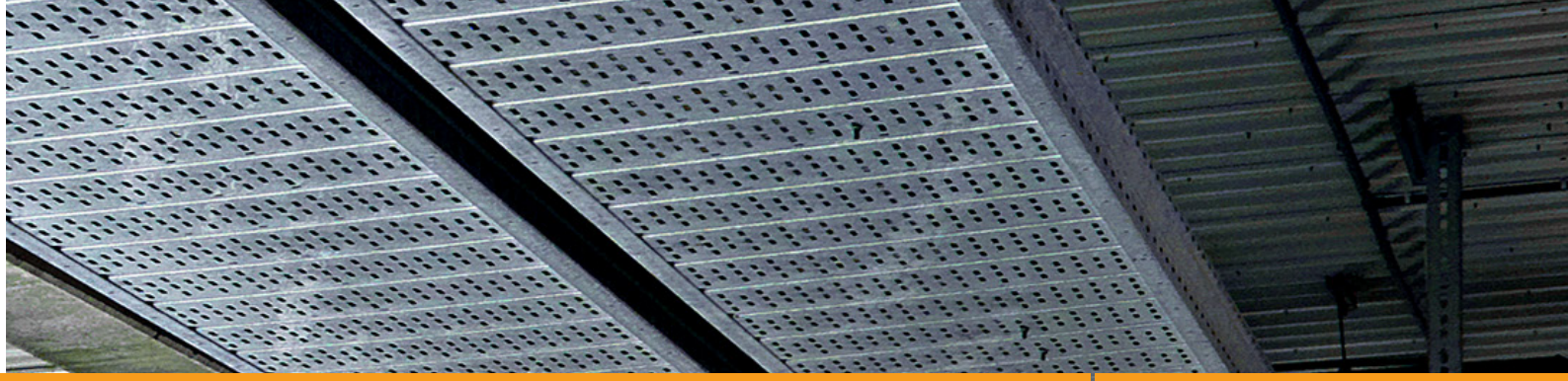

Guide:
Lightning and surge protection for lighting systems

Date: 09/2015

OBO BETTERMANN

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Chapter 1. Lightning and surge protection for lighting systems

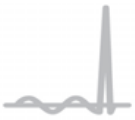
Chapter 1.1 Basic

Hall lighting is primarily created using fluorescent tubes with electronic ballasts or mercury vapour lamps (HQL luminaires). The HQL luminaires have a lifespan of approx. 20,000 hours. To reduce energy consumption and improve illumination, many lighting systems are currently being turned into modern LED luminaire systems. Modern LED luminaires save up to 70 per cent of energy requirements and, at the same time, offer a lifespan of up to 100,000 hours. This means that the investment has often been amortised after about 2 years.

Chapter 1.2 Risks

In power supply systems, surge voltages can be caused by several things. The highest energy level is provided by lightning strikes, which can destroy electronic devices within a radius of up to 2 km through surge voltages. To protect them, the voltage resistance of the lighting system must be coordinated with the surge protection. These new luminaires, with electronic LED drivers and the LED module, are designed for significantly lower voltage resistances compared to the old HQL luminaires. LED luminaires are primarily classified in the surge voltage category II and are tested with a surge voltage (Surge Test) of 2 kV to 4 kV. However, when fluorescent tubes or HQL luminaires are started, there are high switching voltages of up to 5,000 volts. In addition, lightning and switching actions in industrial networks can create high surge voltages of up to several tens of thousands of volts. If continuous, these loads can lead to a reduction in the luminous intensity or to the destruction of the LED drivers and LED modules. There is the risk of failure and of high repair costs, as well as an extension of the amortisation time. Accordingly, suitable external surge protection is recommended.

Lightning creates surge voltages within a radius of 2 km of the strike location, due to galvanic and inductive coupling.



Surge voltages from switching actions in the energy network or when starting inductive loads, such as motors or welding machines, cause hazardous voltage peaks.

Chapter 1.3 Risk analysis

A risk analysis according to the lightning protection standard VDE 0185-305 (IEC 62305) can determine the necessity for a lightning protection system. For protection purposes, in a lightning protection system, all the supply lines at the entrance to the building must be included in the equipotential bonding using suitable protection devices.

Independently of this, a multi-level surge protection system should be installed for the entire lighting system. At the entrance to the building, lightning protection equipotential bonding with type 1 lightning current arresters or type 1+2 combination arresters should be installed. In the subsequent distribution and control cabinets, local equipotential bonding with type 2 surge protection devices should be installed. On decentral distributors, type 2 or type 3 local surge protection offers sufficient protection. Device protection should be installed in the appropriate circuit upstream of the luminaires to be protected.

Commercial systems are required to use surge protection (type 2 or type 3) by VDE 0100-443 (IEC 60364-4-44), section 443.3.2.2. A risk analysis can be carried out for all systems, according to the existing power supply system.

Long supply lines and light strips offer a high potential for inductions and potential differences. A reduction of the induced surge voltages can be created using a shielded installation with a metallic and earthed cable duct and a metallic luminaire housing.

Chapter 1.4 Decision-making aid

Surge protection should be installed when one of these conditions is true:

- The building possesses an external lightning protection system.
- The lighting circuit supplies various lighting installations, such as HQL luminaires, whose starting voltage is around 4,500 volts.
- Larger consumers, such as motors or welding devices, are connected to the same circuit, meaning that surge voltages can be generated.
- LED luminaires have already failed. Damage from surge voltages cannot be excluded.

To minimise risks, stepped surge protection should be installed upstream of the LED luminaires or transition boxes. To minimise the repair costs of defective electronic components, these safety measures should be taken. Surge voltages are hazardous to LED lighting, and an efficient protection circuit is therefore essential.

Chapter 1.5 Installation location of the lightning and surge protection

The use of surge protection is required for safe operation. However, of decisive importance for the protection action is that the protection level of the surge protection device is below the surge voltage resistance of the lights and the LED driver.

In the luminaire standard VDE 0711-1 (EN 60598-1) Luminaires – Part 1:, Point 4.32 specifies:

“Surge protection devices must meet the testing standard IEC 61643.”

According to this testing standard, surge protection devices must be able to arrest surge currents of several thousand amps multiple times without destruction. Each protection device must have thermal monitoring and must be isolated safely if there is a defect.

Image 1: Combination arrester type 1+2 in the main distributor, V50 3+NPE-280

Image 2: Surge protection type 2 in the control cabinet, V20 3+NPE-280

Image 3: Surge protection type 2 in the junction box, mounted on the cable support system, ÜSM-LED 230

When refitting of the surge protection, the cast protection device ÜSM-LED 230-65, which has the IP 65 protection rating, can be used. The connection cable allows mounting of the protection device in or on distributor cabinets, even under difficult ambient conditions.

Image 4: ÜSM-LED 230-65

Figure	Installation location	Protection device	Description	Article no.
	Main distributor			
①	Supply	V50 3+NPE-280	Type 1+2 combination arrester	5093 526
	Control cabinet/distributor			
②	3-phase + NPE	V20 3+NPE-280	Type 2 surge protection	5095 253
	1-phase + NPE	V20 1+NPE-280	Type 2 surge protection	5095 251
	Distributor housing/junction box			
③	Upstream of the luminaires	ÜSM-LED 230	Type 2+3 surge protection	5092 480
④	Distributor (IP 65)	ÜSM-LED 230-65	Type 2+3 surge protection	5092 478

Table 1: Selection of the protection devices

Chapter 1.6 Connection of the surge protection device

The protection device ÜSM-LED 230 can be installed in series with or in parallel to the luminaires.

Parallel connection

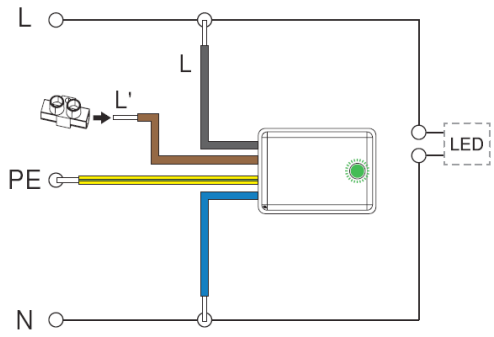


Image 5: In the case of parallel connection, the surge protection device is located upstream of the LED luminaire.

Failure behaviour:

- The display on the ÜSM LED goes out. The surge protection is disconnected. The LED luminaire remains lit without protection.

Serial connection

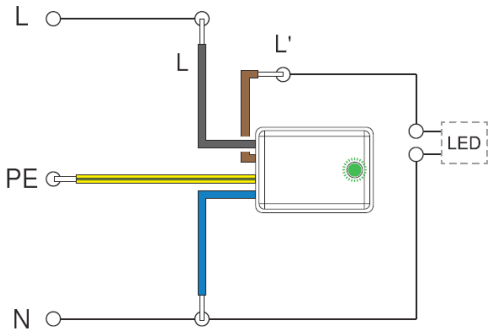


Image 6: In the case of serial connection, the surge protection device is switched in series to the LED luminaire.

Failure behaviour:

- The display on the ÜSM LED goes out. The surge protection and the circuit (L') are disconnected. The failure is signalled by the LED luminaire switching off.

Chapter 1.7 Conclusion

A suitable protection device upstream of the electronic LED drivers is a safe barrier against surge voltages. This guarantees the lifespan of the LED luminaires, securing the investment.

The OBO ProtectPlus range offers secure solutions for lighting systems.

OBO BETTERMANN GmbH & Co. KG

PO Box 1120

58694 Menden

Germany

Customer Service Germany

Tel.: +49 (0)2373 89-0

Fax: +49 (0)2373 89-1238

E-mail: export@obo.de

www.obo-bettermann.com

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