White Paper

Surge protection for LED mast lights

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LED mast lights for street, walkway and open space lighting are mounted at light point heights of several metres to ensure a large field of illumination. This, however, is only possible if the luminous flux of the light source is sufficiently high which is no problem for today's highly efficient LEDs. Their long service life, almost independent temperature sensitivity and individual setting of different scenes make them cost-effective and environmentally-friendly.

LED mast lights stand out due to the following special characteristics:

- High luminous efficacy up to 110 lm/W
- The light distribution can be easily adapted to the relevant illumination task by using different lenses
- Different light colours / colour temperatures
- LEDs have a service life between 50,000 and 100,000 h depending on the operating current
- Temperature-independent luminous flux of the LEDs (varies only slightly and is e.g. 115% at -30 °C and 95% at 40 °C)
- Individual scenes (e.g. luminous flux, operating times, dusk dependence) can be pre-set via the LED drivers
- In some cases, individual scenes can be set via a 1-10 V or DALI interface
- LEDs are ideally suited for safety lighting systems due to their high luminous flux without switch on delay

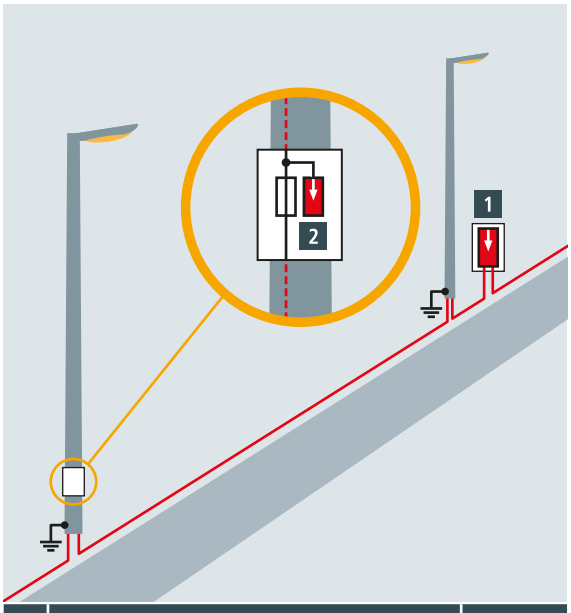
In practice, different LED mast lights are used. All fixture bodies are typically made of metal independent of whether LED mast lights with "double or reinforced insulation" (previously class II) or "automatic disconnection of supply" (previously class I) as per IEC 60364-4-41 are used. The metal housing of the LED mast light dissipates the resulting heat loss over a large area.

The mast frequently consists of metal and the supply voltage flows through a buried cable into the mast. A terminal compartment that can be opened using tools is situated in the lower section of small masts. A rubber hose which is relieved of any strain on both ends connects the terminal compartment with the mast light. This terminal compartment houses the terminals and the overcurrent protective device. Large masts are fitted with a supply distributor and, if this distributor feeds the mains and equivalent power supply, it is physically divided according to the relevant normative requirements.

If LED mast lights or PVC masts are used, electrostatic charge must be observed. This, however, will not be described here.

If you compare the surge-related replacement costs of previously used mast lights with high-pressure lamps with the replacement costs of today's LED mast lights, it can be seen that the illuminant, ignition device and inductive control unit of the previously used high-pressure lamps are damaged, while the LED drivers, their parameterisation and the LEDs of today's LED mast lights entail high costs. Although amortisation is to be expected over a transparent time frame due to the long service life of LED mast lights, the question arises whether the manufacturer gives guarantee for the overall system (LED drivers and LEDs) since surges negatively affect the system-specific service life. The lighting industry already responded to this with a higher dielectric strength of the LED drivers and an impulse current withstand capability of 2 kA and a dielectric strength of 4 kV for new LED mast lights, however, the impulse currents and surges occurring in the mains can exceed these values many times over. It has to be particularly observed that the dielectric strengths L to N considerably differ from that of L/N to PE.

A metal mast in conjunction with a metal LED mast light minimises the probability of field-based injection. Consequently, only surges extending over the cable network must be considered. To this end, a surge arrester can be installed in the terminal compartment / distributor of the mast (**Figure 1**). This



	Surge protective device	Part No.
1	DEHNguard DG M TT 275 or DEHNguard DG M TNS 275	952 310 952 400
2	DEHNguard DG M TT 2P 275 or DEHNguard DG M TN 275	952 110 952 200

Figure 1 Surge arrester installed in the terminal compartment / distributor of the metal mast for protecting the metal LED mast light from conducted surges caused by distant atmospheric events and switching operations

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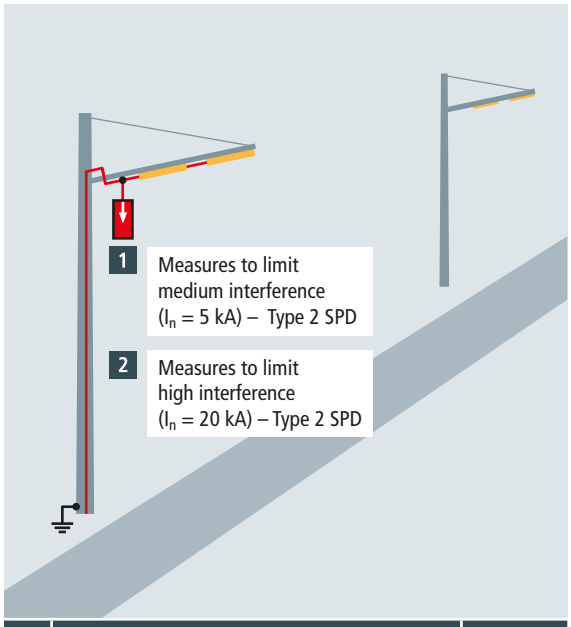
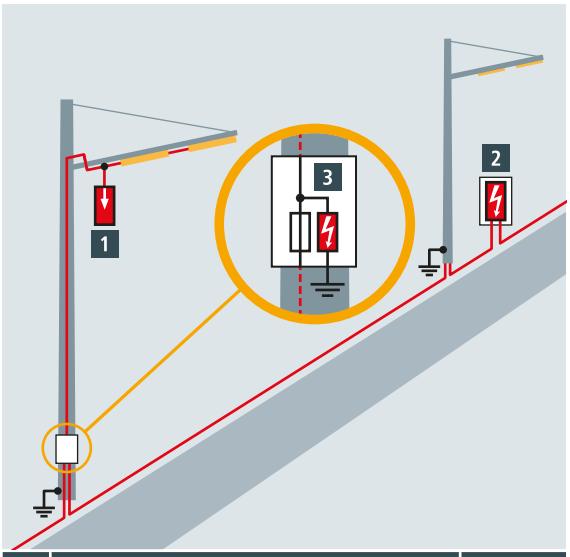


	Surge protective device	Part No.
1	DEHNcord DCOR L 2P 275	900 430
2	DEHNguard DG M TT 2P 275	952 110

Figure 2 Surge arrester installed next to the LED mast light with the feeder cable of the mast light being installed in open space for protecting the LED mast light from field-based injection or as sole protection from conducted surges caused by distant atmospheric events and switching operations



	Surge protective device	Part No.
1	DEHNcord DCOR L 2P 275	900 430
2	DEHNshield DSH TT 255 or DEHNshield DSH TNS 255	941 310 941 400
3	DEHNshield DSH TT 2P 255 or DEHNshield DSH TN 255	941 110 941 200

Figure 3 Combined arrester installed in the terminal compartment/distributor of the metal mast in conjunction with a surge arrester for protecting the LED mast light from nearby atmospheric events and conducted surges caused by switching operations

has the advantage that the surge arrester can be tested without forklift.

If, however, a metal LED mast light and its metal mast do not form a closed system since the feeder cable of the LED mast light was placed in free space at the mast exit point and several LED mast lights are located on a mast arm, a surge arrester must be installed next to the LED mast light (**Figure 2**). If the probability of surges is expected to be low, no additional surge protective devices have to be installed. The relevant protection measure used for the LED mast light must be considered when installing a surge arrester in the LED mast light. Surge arresters with basic insulation (insulation of dangerous live parts as basic protection), for example, must not interfere with the "double or reinforced insulation" (previously class of LPS II) of the LED mast light according to IEC 60364-4-41.

It is advisable to use DEHNcord to limit medium interference (I_n = 5 kA). DEHNguard modular DG M TT 2P 275 should be installed to limit high interference (I_n = 20 kA).

If lightning strikes the metal mast, the mast shields the cable installed in it and the application-optimised combined arrester located at the base of the mast discharges the lightning current (total current up to 50 kA (10/350 µs)) across the distribution networks and protects the LED mast light by means of its low voltage protection level (**Figure 3**). This always requires a vertical or horizontal earth electrode and an additional surge arrester must be installed on the LED mast light according to **Figure 2**, depending on the cable routing.

Basically, the described protection of the LED mast light by means of a combined arrester must be used if a risk analysis requires a higher protection goal than a surge arrester can achieve. This is the case with extremely high masts with large-area LED mast lights on the mast arms (e.g. large parking lots, stadiums, etc.) and LED mast lights that are fed by a building with a lightning protection system since the lightning current is discharged via the lightning equipotential bonding system to the LED mast light.

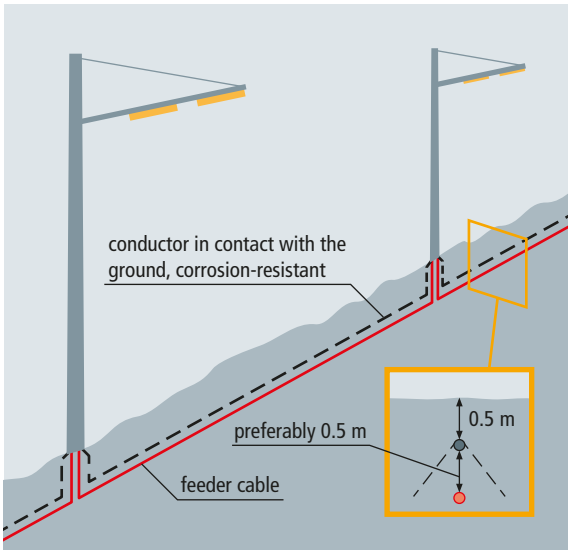


Figure 4 Earthing conductor for protecting the cable route and earthing the mast

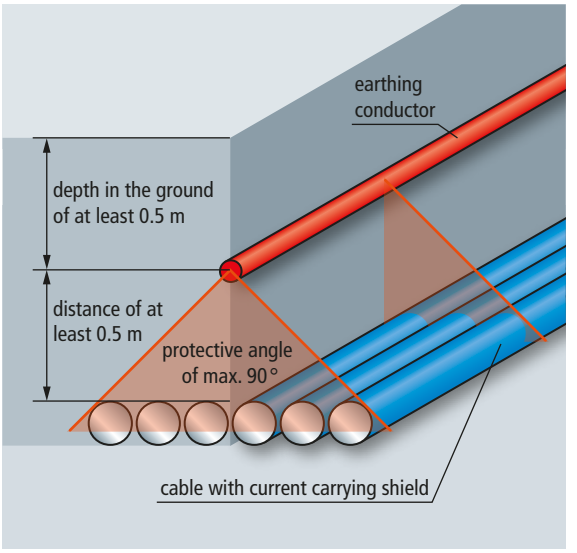


Figure 5 Protected zone of a cable route

In case of new newly installed masts and cables, a bare earthing conductor is to be preferably installed above the cable route.

If lightning hits the mast (not the mast light itself) or the ground, the earthing conductor assumes the function of the required earth electrode and linearises the potential drop, thus preventing flashover to the cable (**Figures 4 and 5**).

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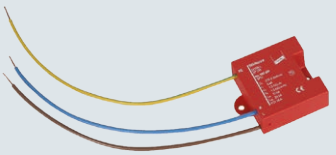
Products and technical data

DEHNcord			
	Type	DCOR L 2P 275	
	Part No.	900 430	
	SPD acc. to EN 61643-11/IEC 61643-11	Type 2/Class II	
	Max. continuous operating a.c. voltage (U_C)	275 V (50/60 Hz)	
	Nominal discharge current (8/20 µs) (I_n)	5 kA	
	Voltage protection level [L-N]/[N-PE] (U_P)	≤ 1.5 kV/≤ 1.5 kV	
DEHNguard			
	Type	DG M TT 2P 275	DG M TT 275
	Part No.	952 110	952 310
	SPD acc. to EN 61643-11/IEC 61643-11	Type 2/Class II	
	Max. continuous operating a.c. voltage (U_C)	275 V	
	Nominal discharge current (8/20 µs) (I_n)	20 kA	
	Voltage protection level [L-N]/[N-PE] (U_P)	≤ 1.5 kV/≤ 1.5 kV	
	Voltage protection level at 5 kA (U_P)	≤ 1 kV	
	Type	DG M TN 275	DG M TNS 275
	Part No.	952 200	952 400
	SPD acc. to EN 61643-11/IEC 61643-11	Type 2/Class II	
	Max. continuous operating a.c. voltage (U_C)	275 V	
	Nominal discharge current (8/20 µs) (I_n)	20 kA	
	Voltage protection level (U_P)	≤ 1.5 kV	
	Voltage protection level at 5 kA (U_P)	≤ 1 kV	
DEHNshield			
	Type	DSH TT 2P 255	DSH TT 255
	Part No.	941 110	941 310
	SPD acc. to EN 61643-11/IEC 61643-11	Type 1/Class I	
	Max. continuous operating a.c. voltage (U_C)	255 V	
	Lightning impulse current (10/350 µs) [L+N-PE] (I_{total})	25 kA	50 kA
	Voltage protection level [L-N]/[N-PE] (U_P)	≤ 1.5 kV/≤ 1.5 kV	
	Type	DSH TN 255	DSH TNS 255
	Part No.	941 200	941 400
	SPD acc. to EN 61643-11/IEC 61643-11	Type 1/Class I	
	Max. continuous operating a.c. voltage (U_C)	255 V	
	Lightning impulse current (10/350 µs) [L+N-PE] (I_{total})	25 kA	50 kA
	Voltage protection level [L-N]/[N-PE] (U_P)	≤ 1.5 kV/≤ 1.5 kV	

Surge Protection
Lightning Protection
Safety Equipment
DEHN protects.

DEHN + SÖHNE
GmbH + Co.KG.

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