



Properly protected – Safe charging

Protection concepts for the charging infrastructure of electric mobility



The electric mobility megatrend

The number of registered electric vehicles is growing substantially as more and more people recognise the benefits of environmentally friendly mobility. Through the connection of charging infrastructure with power grids, electric mobility is forming an important basis for the energy revolution. Given this background, it is not surprising that the expansion and further development of electric mobility are concerns for the future. However, the handling of electricity entails some danger.

Dangers posed by thunderstorms

If lightning strikes in close proximity, damage to buildings and infrastructure can occur. Not only direct lightning strikes but also those close by and even remote can cause fires or surge damage to electrical devices and systems. Switching

operations in transformer stations or even the switching of electrical energy on a charging post can generate switching surges, which can also involve negative effects. Just a low amount of energy is often enough to cause damage.

Damage during the charging process

Since charging installations are predominantly set up outdoors, a serious danger is posed to them by the effects of lightning discharges. The surges resulting from this exceed the dielectric strength of the installed electronic components inside the charging posts many times over.

Mains-related voltage peaks – that can arise due to switching operations, earth faults or short-circuits, for example – result in defective electronic components and malfunctioning charging posts. If these surges occur during a charging process, damage to the vehicle itself is even possible.

A holistically effective and reliable lightning and surge concept must therefore be ensured in all cases in order to prevent damage and thus the costs of repairs, as well as to ensure the constant reliability and satisfaction of both system operators and users.

Safeguard investments – prevent damage!

With the integrated protection concepts from DEHN, you will always find the right solution for your application – from the Wallbox in single-family houses to AC/DC charging stations right through to high-power charging parks, bus

charging stations, hydrogen filling stations, as well as industrial safety and protection against arc faults for the maintenance and servicing of charging infrastructure.



External lightning protection, e.g. for roofed areas of a charging park

The entire facility must be within the protected range of the external lightning protection system. In the event of a direct lightning strike, the lightning current is safely channelled away into the earthing system through the down conductors without dangerous sparking.



Surge protection for power and data lines

In charging stations, low-voltage main distribution boards and in control and communication technology systems, lightning and surge protection is used to protect sensitive components throughout the charging infrastructure, as well as the connected electric vehicles.



Earthing & equipotential bonding for the entire installation

The lightning current is distributed over a large area through an intermeshed, low-impedance, interconnected earthing system. Overvoltages are reduced. Dangerous step and touch voltages are prevented through additional potential control measures in areas where people may be located.



Protection against arc faults for people and systems

Maximum personal safety with arc-fault-tested, class-2 protective equipment and tested safety equipment for compliance with the five safety rules as per EN 50110. Maximum system protection with an active arc fault protection system for use in a low-voltage switchgear installation.

Basic standards for the charging infrastructure of electric mobility



More information on standards:
<http://de.hn/aeNxn>

IEC 60364-4-44, clause -443, IEC 60364-5-54, clause -534

If the charging infrastructure is non-portable and connected via fixed cabling, it falls under the scope of the IEC 60364 series of standards. These standards must generally be applied to private, semi-public and public areas.

- Standard 60364-4-44, clause -443: states when surge protection is to be installed.
- Standard 60364-5-54, clause -534: states which surge protection is to be chosen and how this is to be installed.

IEC 60364-7-722

Since June 2019, the standard IEC 60364-7-722 mandates that surge protection must be factored in to publicly accessible connecting points during planning and set-up. The selection and installation of surge protective devices is governed by IEC 60364-4-44, clause -443 and IEC 60364-5-54, clause -534.

VDE-AR-N 4100 (German standard)

The standard VDE-AR-N 4100 must also be taken into account as a basic code in Germany when charging posts are directly connected to the low-voltage system. Amongst other things, this describes the requirements for type 1 arresters that are used in the main power supply system.

IEC 62305

The lightning protection standard IEC 62305 must also be observed if:

- the charging infrastructure is installed at installations with an existing external lightning protection system.
- a general risk of a direct lightning strike is to be expected.
- the charging infrastructure or facilities are supplied by buildings that have an external lightning protection system.





Reliably protect the wall box from surges

Modern mobility requires that electric vehicles are available at all times and charging equipment functions without disruption. For users to enjoy independence, charging must also be possible at home. The wall box has therefore

become a megatrend in single-family houses and can also be found more and more frequently in multi-storey car parks.

Overvoltages are a danger that needs to be taken seriously here. They can shut down the entire charging system and damage the connected vehicle. This is why surge protection is so important. Standards also stipulate surge protection to safeguard charging equipment.

You can find information
on the Web:
<http://de.hn/bxxFV>











The following should be taken into account:





- In residential buildings, surge protection according to IEC 60364-4-44, clause -443 has been mandatory since 2016. This includes the wall box.
- Protection measures must be taken in the main distribution board and as close as possible to the feeding point.
- Protection measures in the building's main distribution board conforming to VDE-AR-N 4100 (German standard) are important, as is protection for the data and communication technology.
- For cable lengths of <10 m to the building's main distribution board, the wall box is within the protected range as per IEC 60364-5-54, clause -534. For cable lengths of >10 m, the wall box and thus also the electric vehicle is outside the protected range. In this case, additional protection measures are required for the charging circuit – both for power and data lines – in order to protect the charging circuit and the electric vehicle.
- If a wall box is retrofitted into an existing building without surge protection in place, then at least one type 2 arrester must be introduced to the charging circuit to protect the wall box and the electric vehicle based on normative requirements. This can be installed in sub-distribution boards directly upstream or directly in the wall box. In practice, however, dimensioning protection concepts so that the entire building's electrical installation is protected, including the wall box, is always generally recommended.

Protect charging infrastructure with the type 2 + 3 DEHNcord 3P surge arrester directly in the wall box or in an insulating enclosure directly upstream of the charging point. For the protection of connected Ethernet interfaces, use of the DEHNpatch is ideal as a plug-and-play solution.

More information: <http://de.hn/aa7No>

Main distribution board / SEB (for residential buildings WITH/WITHOUT an external lightning protection system)				Part no.
1		DEHNshield Basic FM for buildings WITHOUT an external lightning protection system	Type 1 + 2 combined arrester with RAC spark gap technology and remote signalling contact; for DIN rails up to 160 A; 230/400 V AC	941 316 TT 941 406 TNS 941 306 TNC
1		DEHNshield FM for buildings WITH an external lightning protection system		941 315 TT 941 405 TNS 941 305 TNC
1		DEHNbox TC B 180	TYPE 1 combined arrester; for protecting telecommunication interfaces	922 220
2		Equipotential bonding bar K12	For connecting to the local earthing system	563 200

Low-voltage main distribution boards (for use in multi-storey car parks)				Part no.
3		DEHNvenCI 255 FM	Single-pole, spark-gap-based, type 1 + 2 combined arrester with remote signalling contact and integrated arrester backup fuse; 230/400 V AC	961 205
3		Earthing clip for DEHNvenCI 255 FM	Single-phase, 4-pole with connection clamp up to 25 mm ² Single-phase, 3-pole with connection clamp up to 25 mm ²	900 417 TT/TNS 900 411 TNC
3		Alternatively: DEHNventil M2 255 FM	Modular, type 1 + 2 + 3 combined arrester with RAC spark gap technology and remote signalling contact; 230/400 V AC	954 315 TT 954 405 TNS 954 305 TNC
3		Industrial equipotential bonding bar	Equipotential bonding bar for protection and equipotential bonding as per IEC 60364-4-41/60364-5-54 and lightning equipotential bonding as per IEC 62305-3	472 207

Wallbox >10-metre cable length to the meter mounting board/LVMDB				Part no.
4		DEHNguard MP 275 FM	Modular, type 2 + 3 surge arrester with remote signalling contact and push-in double terminal; 230/400 V AC	942 315 TT 942 405 TNS
5		DEHNcord 3P TT 275 FM	Compact, type 2 + 3 surge arrester with remote signalling contact and push-in technology; maximum backup fuse 40 A; 230/400 V AC; installation optionally on DIN rail or using screw lugs	900 439 TT
5		DEHNpatch Class EA	Universal surge arrester for the protection of IP-based network applications in structured cabling according to class EA up to 500 MHz	929 161
6		BLITZDUCTORconnect ML2 BD 24	Modular, TYPE 1 combined arrester with push-in connection system, e.g. for protecting RS485 bus systems or 24-V signals	927 244



Lightning and surge protection for AC/DC charging posts

Charging stations are always required where electric vehicles are stationary for long periods of time: at places of work, in park & ride areas, at parking spaces of apartment buildings and medical facilities; but also in places where vehicles make stops so they can charge up. Since more and more charging stations are currently being set up in private, semi-public

and public areas, the need for comprehensive protection concepts is also increasing. This applies both to AC and DC charging facilities. This means that valuable vehicles will simply not be subjected to the risk of damage posed by lightning or surges.

Lightning strikes – a risk to electronics

In addition to choosing suitable lightning current and surge arresters, connecting charging stations to an earthing system is also important so that no risk is posed to sensitive





electronics in the event of a thunderstorm. Satellite systems with interconnected charging points can be destroyed by a single lightning strike.









Damage caused by surges




Even a lightning strike close by often causes damage to infrastructure. Such surges during a charging process have a high probability of also damaging the vehicle. Electric

vehicles usually have a dielectric strength of up to 2.5 kV. However, this can be exceeded significantly as a result of a lightning strike.

- Depending on the location and characteristics of the threat, a customised surge protection concept is required.
- In addition, appropriate earthing and equipotential bonding measures are obligatory.
- According to DIN 18014, using corrosion-resistant stainless steel (V4A) is generally recommended in Germany.

Low-voltage main distribution boards in the building				Part no.
		DEHNvenCI 255 FM	Single-pole, spark-gap-based, type 1 + 2 combined arrester with remote signalling contact and integrated arrester backup fuse; 230/400 V AC	961 205
		DEHNventil M2 255 FM	Modular, type 1 + 2 + 3 combined arrester with RAC spark gap technology and remote signalling contact; 230/400 V AC	954 315 TT 954 405 TNS 954 305 TNC
		BLITZDUCTORconnect ML2 BD 24	Modular, TYPE 1 combined arrester with push-in connection system, e.g. for protecting RS485 bus systems or 24-V signals	927 244
		Industrial equipotential bonding bar	Equipotential bonding bar for protection and equipotential bonding as per IEC 60364-4-41 / IEC 60364-5-54 and lightning equipotential bonding as per IEC 62305-3	472 207

Charging stations for outdoor installation in Zone 0 _A / supply lines in Zone 0 _A				Part no.
1		DEHNvap EMOB 3P 255 FM	Type 1 + 2 combined arrester with RAC spark gap technology and remote signalling contact; maximum backup fuse 250 A; 230/400 V AC; especially for use in supply systems of the charging infrastructure	900 385
1		DEHNpatch Class E _A	Universal surge arrester for the protection of IP-based network applications in structured cabling according to class E _A up to 500 MHz	929 161
2		Equipotential bonding bar K12	For connecting to the local earthing system	563 200
3		StSt earth rod (V4A)	Length: 1500 mm, Diameter: 20 mm; for establishing local earthing	620 902
3		StSt connection clamp (V4A)	Clamping range Rd 8–10 mm; Connection 4–50 mm ² solid/stranded	540 121
4		StSt round steel (V4A)	10 mm Rd.; for setting up a local earthing system	860 020
5		StSt cross clamp (V4A), Rd-Rd / Rd-FI / FI-FI	For clamp connections in the ground; Rd 8–10 mm / FI 30 x 3.5 mm	319 209
5		Anti-corrosion tape	For wrapping around clamp connections in the ground	556 130

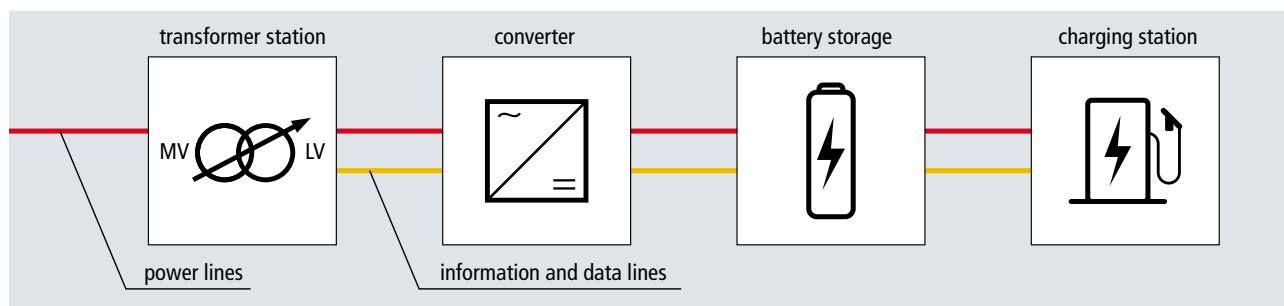
Protection of mast lights and video surveillance				Part no.
6		Mast fuse box EK480	Mast fuse box with type 2 arrester DEHNcord; for protecting the mast LED lighting	900 443
6		DEHNcord L 2P	Universal type 2 surge arrester in IP65 design for retrofitting; for protecting mast LED lighting	900 448
7		DEHNpatch Outdoor	TYPE 2 surge arrester for Ethernet applications; in IP66 version, e.g. for protecting external cameras + tensioning strap for mast mounting	929 221 200 039



Integrated EMC-orientated lightning protection zone concept for charging parks and bus charging stations in public transport

More and more towns and cities are developing new mobility concepts and are electrifying their bus fleets. In this scenario, lightning, surges and arc faults represent a wholly new challenge. It is therefore especially important that the charging


















infrastructure of high-power charging parks and bus charging stations is functioning reliably. Only then can providers ensure reliable operation, guarantee seamless workflows in this way and achieve maximum customer satisfaction.



In public spaces, powerful charging parks (HPC: high-power charging) or bus depots are electrified. Therefore, additional transformer stations, converter units, battery storage systems and, ultimately, DC-supplied charging stations are set up. If just one part of the charging infrastructure is damaged by a surge, the availability of the entire charging park disappears.

This makes it all the more important to ensure an integrated, EMC-orientated lightning protection zone concept based on IEC 62305-4. This consists of an external lightning protection system (to safely manage separation distances, using an

insulated lightning protection system, e.g. HVI, is recommended in practice), a corrosion-resistant, intermeshed, low-impedance, interconnected earthing system, equipotential bonding and surge protection for any component. In the event of danger posed by step and touch voltages in areas where people are located, additional measures are necessary, e.g. potential control using mesh mats tested with lightning currents. Furthermore, the risk of arc faults in low-voltage switchgear assemblies must be assessed. Achieve maximum availability with the DEHNshort active protection against arc faults.

External lightning protection systems and earthing/equipotential bonding concepts				
1		Insulated lightning protection system HVI	High-voltage-resistant, insulated down conductor for maintaining the separation distance from electrically conductive parts as per IEC 62305-3 http://de.hn/45WVS	
2		Earthing systems	Comprehensively intermeshed, low-impedance, interconnected earthing systems; tested with lightning currents and for 50 Hz requirements http://de.hn/6eTmJ	
3		Potential control	Potential control measures, e.g. through tested mesh mats; for preventing dangerous step and touch voltages http://de.hn/cjQw6	
Protection of AC interfaces, e.g. transformer station / LV MDB / AC side of converters				Part no.
For the medium-voltage side, e.g. 20 kV				
4		DEHNmid	Metal oxide arrester for medium-voltage systems up to 51 kV for protecting the medium-voltage side, e.g. in transformer stations	990 010
For 230/400 V AC, 50 Hz in TNC and TN-S and TT systems				
5		DEHNvenCI 255 FM	Single-pole, spark-gap-based, type 1 + 2 combined arrester with remote signalling contact and integrated arrester backup fuse; 230/400 V AC	961 205
4		DEHNrecord SD	Multifunctional measuring and analysis device for power quality monitoring class A as per IEC61000-4-30, load profile and power measurement, measurement of power-frequency overvoltages; Rogowski coils for a measuring range of up to 2,000 A	910 920 910 937
For up to 690 V, 50 Hz for TN and IT systems				
5		DEHNbloc Maxi 1 CI 440 / 760 FM	Single-pole, type 1 lightning current arrester for protecting low-voltage main distribution boards; with integrated arrester backup fuse und remote signalling contact	961 146 961 176
4		DEHNshort active arc fault protection	For low-voltage switchgear assemblies 400–690 V AC, 50 Hz; for the protection of people, systems and system functions, as per IEC 61439-2 detection device + quenching device	782 030 782 002
Protection of DC interfaces, e.g. DC-supplied charging stations, battery storage systems and photovoltaics				Part no.
6		DEHNcombo 1200 FM	Type 1 + 2 combined arrester with remote signalling contact for photovoltaic power supply systems; proof of concept for use in battery storage system applications	900 075
6		DEHNguard ME DC Y 950 FM	Type 1 + 2 combined arrester up to 950 V DC with remote signalling contact; use e.g. in DC-supplied high-power charging stations.	972 146
6		DEHNguard M YPV 1200 FM	Type 2 surge arrester with remote signalling contact for photovoltaic power supply systems up to 1,170 V DC; proof of concept for use in battery storage system applications	952 565
Protection of information and communication technology				Part no.
7		BLITZDUCTORconnect ML2 BD 24	Modular, TYPE 1 combined arrester with push-in connection system, e.g. for protecting RS485 bus systems or 24-V signals	927 244
8		DEHNpatch Outdoor	TYPE-2 surge arrester for Ethernet applications; in IP66 version, e.g. for protecting external cameras + tensioning strap for mast mounting	929 221 200 039
9		DEHNgate G	TYPE 2 surge arrester for protecting coaxial antenna systems in SMA connection systems	929 039

















Protection concept for hydrogen filling stations




Hydrogen is an invisible, odourless and harmless gas. Since it does not appear in this form in nature, it must be produced. For example, during electrolysis, water is broken down into its constituents oxygen and hydrogen with the aid of electric current.



An engine that uses hydrogen as a fuel is more efficient than conventional combustion engines; i.e. further distances can be covered with less fuel. Additional advantages: during movement, only water is generated as a by-product. Hydrogen-powered vehicles produce neither CO₂ nor other harmful gases.

However, the use and processing of hydrogen is not harmless because it is more highly flammable than conventional gases. As a result, an elevated explosion hazard arises. In practical terms, all rooms and areas are at risk in which gases, vapours, mists and dusts can accumulate; this can form explosive mixtures with air. If explosions occur, this endangers people and equipment in equal measure. System operators are therefore obliged to ensure protection.

External lightning protection				
1		Insulated lightning protection system HVI	High-voltage-resistant, insulated down conductor for maintaining the separation distance from electrically conductive parts as per IEC 62305-3 http://de.hn/45WVS	
2		Telescopic lightning protection mast	Air-termination mast for protecting systems from direct lightning strike http://de.hn/7uvkY	

Earthing/equipotential bonding				
3		Earthing systems	Comprehensively intermeshed, low-impedance, interconnected earthing systems; for the entire charging park; tested with lightning currents and for 50 Hz requirements http://de.hn/6eTmJ	
4		Potential control	Potential control measures, e.g. through tested mesh mats; for preventing dangerous step and touch voltages http://de.hn/cjQw6	
5		Equipotential bonding in hazardous areas	Equipotential bonding measures specially for areas at risk of explosion, e.g. equipotential bonding bars, pipe clamps and clamps Non-sparking and secured against self-loosening. http://de.hn/3U15f	
5		Connection clamps for steel girders	Connection clamps specially for the hazardous area zone 2/22. The heavy design is suitable for the connection to steel structures. All connections are secured against self-loosening. http://de.hn/7DSPW	
5		Isolating spark gap EXFS 100	Isolating spark gaps for the indirect earthing and connection of functionally isolated system parts; above-ground and underground installation, http://de.hn/5yQRd	

Power supply system				Part no.
6		DEHNventil M2 255 FM	Modular, type 1 + 2 + 3 combined arrester with RAC spark gap technology and remote signalling contact; 230/400 V AC	954 315 TT 954 405 TNS 954 305 TNC
6		DEHNrecord SD	Multifunctional measuring and analysis device for power quality monitoring class A as per IEC61000-4-30, load profile and power measurement, measurement of power-frequency overvoltages; Rogowski coils for a measuring range of up to 2,000 A	910 920 910 937
7		DEHncord L 2P	Universal type 2 surge arrester in IP65 design for retrofitting; for protecting mast LED lighting	900 448

Protection of information and communication technology				Part no.
5		BLITZDUCTORconnect ML2 BD 24	Modular, TYPE 1 combined arrester with push-in connection system, e.g. for protecting RS485 bus systems or 24-V signals	927 244
5		DEHNpatch Class E _A	Universal surge arrester for the protection of IP-based network applications in structured cabling according to class E _A up to 500 MHz	929 161



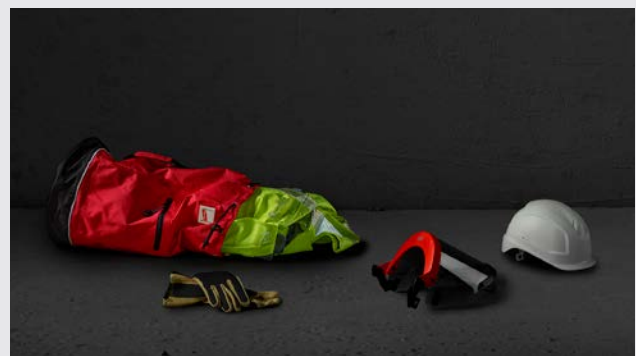
Safe working during the maintenance of charging posts

Personal safety is always the top priority and therefore also plays a key role in the field of electric mobility. Due to the increasing expansion of AC and DC charging infrastructure, the demand for maintenance and servicing work is increasing. The safety of the installers is always the main focus here. Without safety equipment, work on and in electrical

systems – such as charging posts – can be potentially fatal. Therefore, in addition to wearing the correct protective clothing, follow the five safety rules from the EN 50110 series of standards and implement these rules using tested products. In this way, you will protect your workers from electrical accidents and arc faults.

Light-weight package, long-lasting effect









With the quality products from DEHN, you can provide your workers with reliable protection during the maintenance of charging infrastructure. Ideally, you should use the Electrician Set from DEHN. In this way, you have everything that is vital – from eye and face protection to certified protective clothing – and within easy, immediate reach.



You can find information
on the Web:
<http://de.hn/6VHa6>



More safety – step by step

1. Isolation: the electrical installation must be disconnected from live parts on all poles			Part no.
	NH fuse puller with sleeve	For actuating NH fuses of sizes 00, 1, 2 and 3, e.g. for isolating low-voltage installations of public charging stations	785 645
	Fuse tong	For hot stick working when pulling fuses from live equipment	765 042
	Switching stick	For hot stick working when switching live equipment	763 611
2. Secure against re-connection: Prevent the accidental activation of the system.			Part no.
	Lock-out system	Re-powering must be reliably prevented. In the low-voltage installations of the charging infrastructure, replace the removed fuses with closing lock-out systems. Appropriate insulating blades are used in the fuse holders of NH fuses.	785 637
	Insulating plugs for screw inserts		785 640
	Insulating blade for NH fuse holders and distribution blocks		785 641 785 642
3. Verify that the installation is dead: determine a dead condition on all poles with a voltage detector. This task is considered to be live working!			Part no.
	Two-pole SPN voltage detector	Two-pole SPN voltage detector for determining a dead condition at the infeed point to the charging station for low-voltage AC/DC installations; can be used for system voltages of up to 1,000 V!	766 665
	Voltage detector PHE4 30 S	For switchgear installations and overhead lines (up to 30 kV), e.g. for determining a dead condition in the transformer station of the charging park	783 030
4. Earthing and short circuiting: connecting conductors and earthing system with short-circuit-proof earthing and short-circuiting devices. Important: First earth, then short circuit!			Part no.
	Earthing and short-circuit set (partially insulated) for low-voltage cable distributors with a sheet metal case	Earthing and short circuiting electrical systems, e.g. of the integrated service entrance box of a charging station or the upstream low-voltage distribution board; complete set for low-voltage cable distributors (cable distribution cabinets); version no. of the EaS device: VUKMT58.	745 500
	EaS configurator	INFO: You can make longer cable lengths or a tailored configuration of the EaS devices according to the requirements of the charging infrastructure at any time using our online EaS configurator: dehn.de/de/euk	
	Earthing stick	Safe operation when connecting the earthing and short-circuiting device	761 016
5. Cover or enclose adjacent live parts: In the case of parts that are located inside the vicinity zone – meaning close to the work location – and that cannot be disconnected, you must take additional safety precautions (enclosing or covering) prior to starting work.			Part no.
	Insulating protective shutter	In the switchgear installations of bus charging stations, for example, use insulating protective shutters or insulating cloths to protect against accidentally touching live parts.	763 211
	Insulated mat		785 458
	Plastic covering material		785 465

Excellent service for safe charging infrastructure

Reliable technology and comprehensive services – all from one source. As your partner, we are not only at your side in terms of protection solutions, but also with supplementary offers and boundless know-how in the field of e-mobility.

Reliable testing

Our test centre covers an area of 800 m² and provides state-of-the-art devices and technologies for testing products, installations and systems using lightning currents. Find out if your charging equipment, such as wall boxes and charging stations, are reliably protected against lightning currents and surges, so that electric vehicles can also charge safely during thunderstorms.

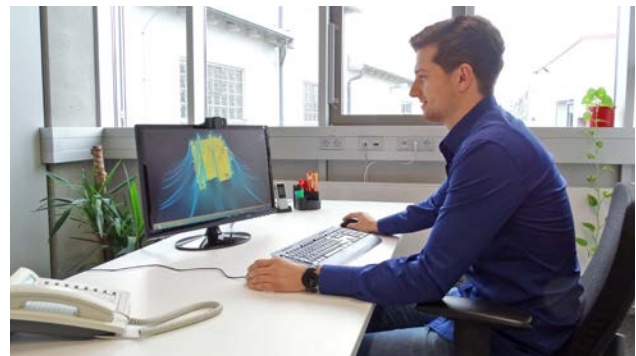
More information: <http://de.hn/amQ9R>



Make planning easy

Planning the charging infrastructure for electric mobility is generally very complex. The issue of lightning protection is just one of many aspects. Save yourself time and make use of the DEHNconcept planning service. In terms of the scope, you can decide whether to have the risk analyses performed to IEC 62305-2 or the entire protection concept created as a module. This makes the planning of an integrated earthing and external lightning protection system for charging parks and bus charging stations easier for you.

More information: <http://de.hn/4LLJe>



Take advantage of our offers

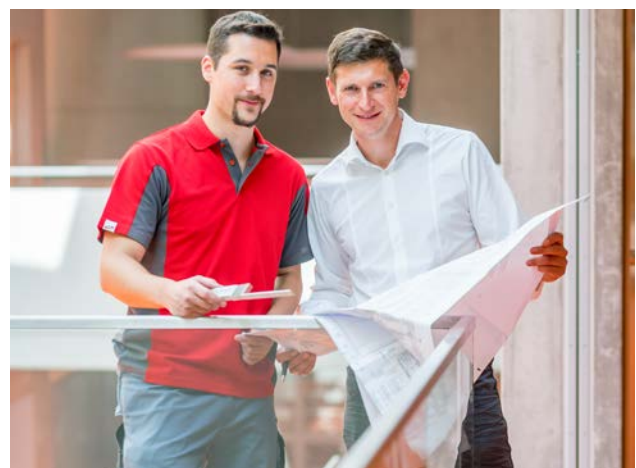
Are you a fleet operator and want to delve deeper into the topic? We are here to help you! On our website, in addition to protection concepts, you will also find appropriate services, e-learning opportunities and information about events.

More information: <http://de.hn/4sP48>

Learn more

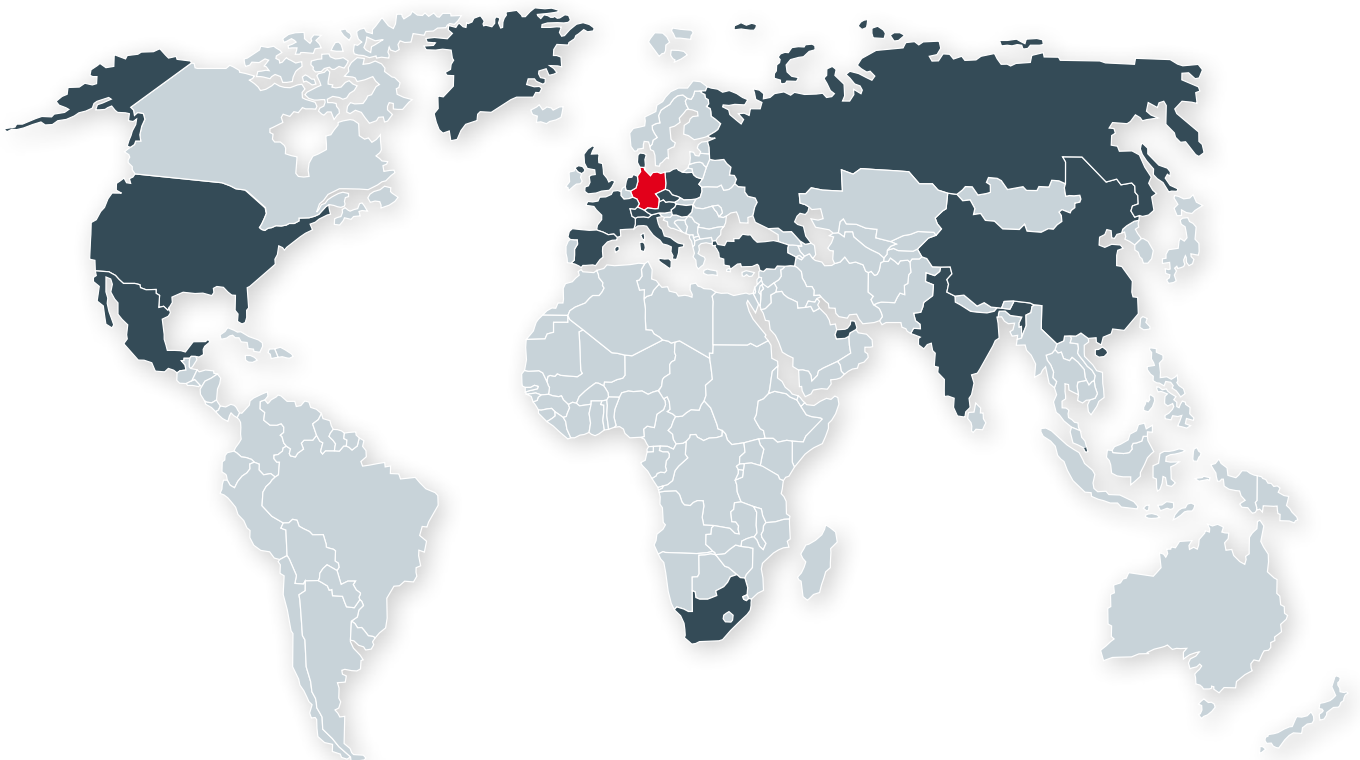
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More information: <http://de.hn/9wqan>



Fair partnership for the best solution

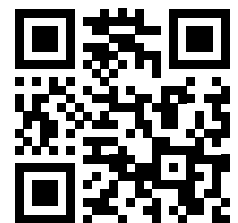
Our goal is to be a reliable, fair partner for our industrial, commercial and technical customers all over the world. To this end, we always focus on the best protection solution. Proximity to and close contact with our customers is of great importance to us, be it on-site support by our experienced team, our telephone hotline or personal contact at trade fairs.



Surge Protection
Lightning Protection/Earthing
Safety Equipment
DEHN protects.

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