

DEHN PROTECTS PHOTOVOLTAIC (PV) SYSTEMS

Information from Surgetek

Highly excessive voltages and currents can threaten the operation of a PV plant. Such surges are mainly caused by lightning, but can also be due to faults in the grid. To ensure a path to earth for any lightning strike, or currents caused by overvoltage, is an extremely important factor in PV plant protection.

The probability of indirect lightning effects occurring is significantly higher than that of a direct lightning strike. This is because every lightning strike within a 1 km radius can generate a current flow in the modules, module cables and in the main DC cable by means of induction. Conductive and capacitive coupling are also possible and can equally cause overvoltage.

Since direct current and DC voltage are generated in a PV plant, there is a danger that non self-extinguishing arcs could be created, which in turn, could cause a fire in the system. The electrical connections in the DC circuit of a PV plant must, therefore, be extremely secure, as a loose connection could lead to sparking and, consequently, trigger an electric arc.

Before installing a PV system, it must be decided whether the installation will be on a building with or without lightning protection. For public buildings such as halls or churches, schools or hospitals, some countries' building regulations request lightning protection systems for safety reasons. For this purpose, buildings or structures are differentiated according to their location, construction type, or utilisation, and whether a lightning strike could easily have severe consequences. Such buildings or structures in need of protection have to be provided with a permanently effective lightning protection system.

The rapidly growing PV industry, now generating at DC voltages of 600 and 1 000 V, has placed exceptional demands on the present and previously available SPD products intended to protect systems components such as inverters, arrays, or combiner box components from the effects of lightning caused surges and transients.

Responding to this demand DEHN has developed and introduced a new product, specifically designed to function under the issues associated with these DC voltages. The new DEHNguard M YPV and PV-SCI addresses those issues by incorporating a switched fused circuit in parallel to the MOV discharge circuit, permitting the disconnect to operate arc free.

DEHN's product offering now includes a broader range of voltages and product configuration. These unique SPD products are now available for 150 V, 600 V, 1 000 V, 1 200 V and 1 500 V DC applications and are configured in both a 'Y' (three-pole) configuration for floating systems, and a two-pole design for grounded systems. DEHN's unique SPDs are UL 1449 3rd edition compliant for the applicable rated DC voltage applications.

IEC 62305-2 (EN 62305-2) states procedures and data for the calculation of the risk resulting from lightning strikes into structures and for the choice of lightning protection systems. For this purpose DEHN offers the DEHNsupport software. The risk analysis presented ensures that it is possible to draw up a lightning protection concept, which is understood by all parties involved, and which meets optimum technical and economic requirements, i.e. the necessary protection can be guaranteed with as little expenditure as possible.

A lightning protection system (LPS) designed for Class III meets the usual requirements for PV and solar thermal systems. Photovoltaic systems on buildings must not interfere with the existing lightning protection measures. Photovoltaic systems shall be protected by isolated air-termination systems according to 5.2 and 6.3 of IEC 62305-3 (EN 62305-3) against direct lightning strikes. If a direct connection cannot be avoided, the effects of partial lightning currents entering the building have to be taken into consideration.

According to IEC 62305-3 the dc conductors have to be protected by Type 1 surge protective devices (SPDs). Up to now, surge protective devices Type 1, in conjunction with a spark gap, for use on the dc voltage side, were not available. The problem was that the spark gap once being tripped, could not be quenched again and hence the arc persisted.

With the combined lightning current and surge arrester DEHNlimit PV 1000 DEHN has succeeded in developing a direct current extinguishing spark gap arrester. Thus DEHNlimit PV 1000 is the ideal arrester for use in photovoltaic power plants. The encapsulated creeping spark gap technology provides a safe protection of the PV generator and the inverter also in case of direct lightning currents. This combined arrester is applicable for PV systems up to 1 000 V UOC STC. DEHNlimit PV 1000 has a high lightning current discharge capability of 50 kA 10/350 μ s.

The inner structure of the Type 2 DEHNguard PV 500 SCP surge arrester sets new patterns for safety. With this arrester the proven double effect of the monitoring and disconnecting device Thermo Dynamic Control has been combined with an additional short-circuiting device. This completely new method of arrester monitoring ensures operation safety without the risk of a fire hazard, even if the devices are overloaded for example at insulation faults in the PV generator circuit.

An essential part of a lightning protection system is the lightning equipotential bonding for all conductive systems entering the building from the outside. The requirements of lightning equipotential bonding are met by direct connection of all metal systems and by indirect connection of all live systems via lightning current arresters.

The lightning equipotential bonding should be performed preferably near the entrance of the structure in order to prevent a penetration of partial lightning currents into the building. The low voltage power supply of the building is protected by a DEHNventil ZP, a multi-pole combined lightning current and surge arrester with spark gap technology. It is designed for installation on 40 mm DIN rails in the electrical distribution board. The surge protective device has to be chosen according to the type of power supply system. This combined lightning current and surge arrester has no interaction limiting reactor and is available as a complete pre-wired unit for every low voltage system (TN-C, TN-S, TT).

There is sufficient protection without additional protective devices between DEHNventil and terminal equipment up to a cable length of < 5 m. For greater cable lengths SPDs Type 2 or 3 have to be used in addition. If the distance between the ac output of the inverter and the application site of DEHNventil is not greater than 5 m, no further protective devices are required for the ac side.

At the dc input of the inverter each of the incoming string conductors has to be protected to earth by a DEHNguard surge protective device Type PV500 SCP installed between plus and minus.

Wherever photovoltaic systems have to be protected against the consequences from surge and lightning damage, DEHN has the answer.