



Lightning and surge protection for golf courses

Golf courses by nature extend over large areas and include many facilities such as club houses, caddy/trolley sheds (frequently with integrated driving range), locker/change rooms, halfway houses, shelters and golf cart parking lots/garages (with battery charging units). Widespread irrigation and sprinkler systems ensure the quality of the greens. Golf courses are often located in areas where low-voltage power supply is not readily available and receive power from the distribution network operator (DNO) as medium voltage (compact station).

In general, it is advisable to assess the risk resulting from a lightning strike for all concern areas of the golf course as per IEC 62305-2 (EN 62305-2) and to plan protection measures based on the results of this risk analysis.

Lightning protection measures are a combination of external lightning protection and lightning equipotential bonding for all service lines entering and leaving the building such as the metal gas and water pipes as well as power supply feeder and control lines.

Equipotential bonding measures in accordance with IEC 62305-3 (EN 62305-3) are e.g.

- ➔ Use of type 1 lightning current arresters (e.g. DEHNventil) for electrical lines
- ➔ Direct equipotential bonding of metal systems.

Protection against transients (resulting from indirect lightning interference or switching operations on the electrical supply system) is achieved by using type 2 surge arresters (e.g. DEHNguard), thus increasing system safety and availability. Normative information is given in IEC 62305-4 (EN 62305-4), IEC 60364-4-44 (HD 60364-4-443) as well as EN 50174-2.

Shelters

Shelters, for example on golf courses, must not only protect golfers from storm and rain, but also from lightning interference.

An external lightning protection system in combination with feasible measures to reduce inadmissibly high step and touch potentials at the entrance and in the shelter are required in case of a lightning strike (**Figure 9.23.1**). Shelters should not be installed at exposed locations (on hills, at the edge of a forest, underneath isolated trees). For more detailed information, please refer to chapter 9.28.

Club house

The power supply feeder cable to the main low-voltage distribution board is often located in the basement of the club house together with different sub-distribution boards supplying power to the restaurants, halfway house, offices, shops, and other detached buildings. Regardless of whether an external lightning protection system exists, a type 1 combined arrester should be installed in the main low-voltage distribu-

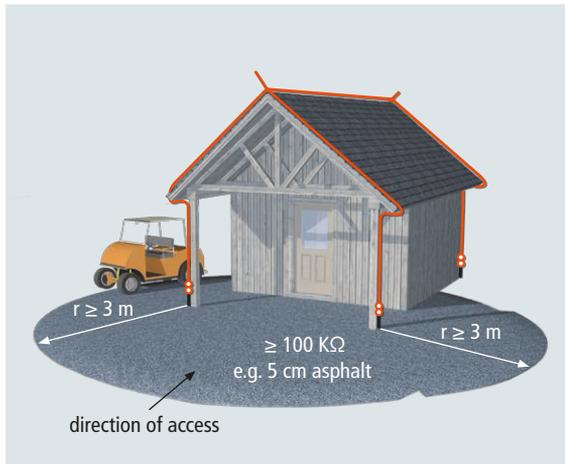


Figure 9.23.1 Protection of a shelter with one entrance and defined direction of access against step and touch voltage

tion board to prevent potentially damaging lightning currents entering via the power supply feeder cable (**Figure 9.23.2**). The sub-distribution boards are equipped with type 2 surge arresters.

Telephone / data lines usually terminate in a dedicated service room of the club house. In the simplest case, several telephone lines and lines for data/internet access (U_{k0} lines) enter the building.

A type 1 combined arrester for IT equipment is installed for the U_{k0} lines near the entrance point into the building.

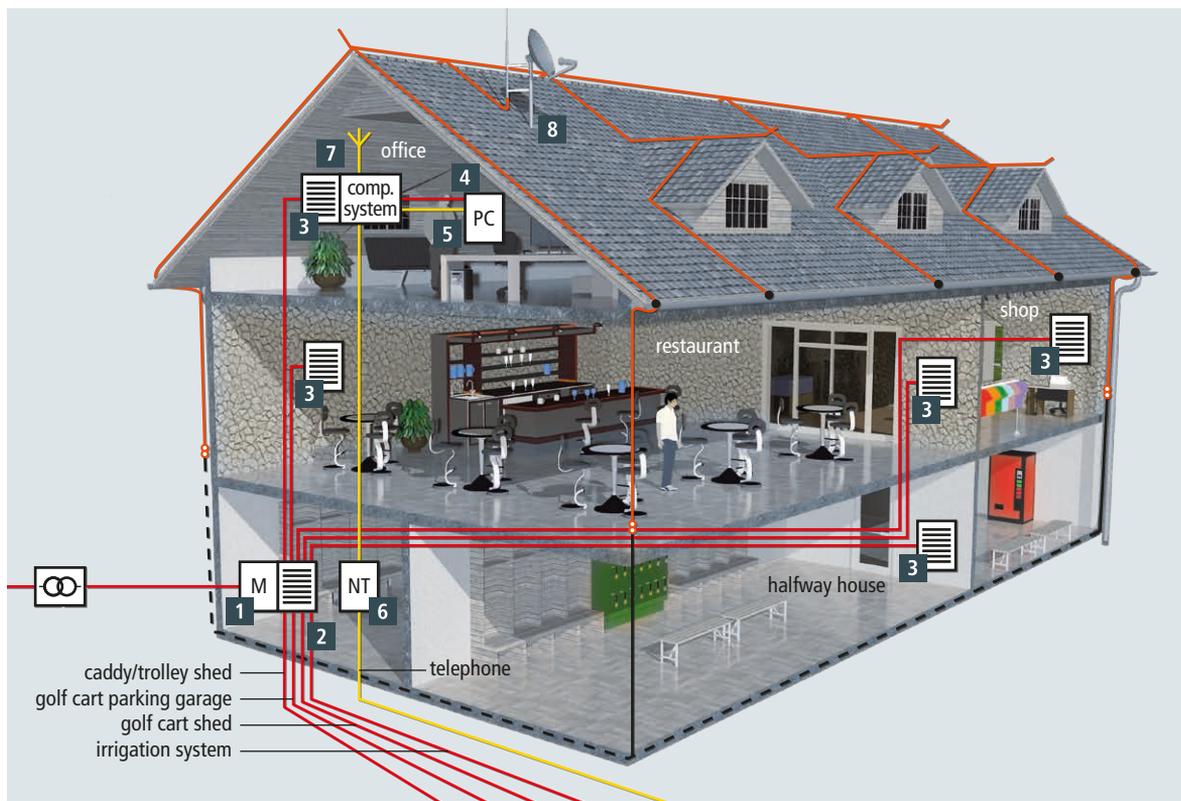
Office communication and RFID systems for ball machines, access control and renting of golf carts play an important function. Therefore, the network card should be protected by a surge arrester for LAN connections and the power supply by a type 3 surge arrester.

It is equally important to protect the protective circuit for the transmit/receive antenna of the RFID system or for the TV and radio satellite antenna near the entrance point into the building.

Caddy/trolley shed with integrated driving range

Measures to avoid inadmissibly high step and touch voltages in case of lightning interference are imperative. Protection measures are to be taken for highly frequented entrance and shelter areas. To this end, numerous measures can be employed, for example keeping a surface resistance $\geq 100 \text{ k}\Omega$ within a limited protective area of 3 m around the down conductor (e.g. 5 cm asphalt).

As described above, lightning equipotential bonding has to be implemented for the different systems directly at the entrance point into the building and, if necessary (depending on the



	Protection measures	System	Type	Part No.
1	Combined arrester (DIN rail)	TN-C system TN-S system TT system	DEHNventil DV M TNC 255 DEHNventil DV M TNS 255 DEHNventil DV M TT 255	951 300 951 400 951 310
	Combined arrester (busbar)	TN-C system TN-S system TT system	DEHNventil DV ZP TNC 255 DEHNventil DV ZP TT 255 DEHNventil DV ZP TT 255	900 390 900 391 900 391
2	$I_{UV} \rightarrow$ building exit < 15 m, lightning current arrester (DIN rail)	TN-S system TT system	4 x DEHNbloc DB M 1 255 3 x DEHNbloc DB M 1 255 + 1 x DEHNgap DGP M 255	961 120 961 120 + 961 101
3	Surge arrester (DIN rail)	TN-S system TT system	DEHNguard DG M TNS 275	952 400
			DEHNguard DG M TT 275	952 310
4	Surge arrester (socket outlet)	All system configurations	DEHNflex DFL M 255	924 396
			STC 230 module for socket outlets	924 350
			SFL Protector SFL PRO 6X	909 250
Interface			Type	Part No.
5	LAN data network		DEHNpatch DPA M CAT6 RJ45S 48	929 100
6	Telephone	1 trunk	BLITZDUCTOR BXT ML2 BD 180 + BXT BAS base part	920 247 + 920 300
		2 trunks	BLITZDUCTOR BXT ML4 BD 180 + BXT BAS base part	920 347 + 920 300
7	WLAN antenna		DEHNgate DGA G BNC + angled fixing plate	929 042 + 106 329
8	Satellite antenna		DEHNgate DGA FF TV	909 703

Figure 9.23.2 Surge protection for the low-voltage and IT supply lines of a club house



	Protection measures	System	Type	Part No.
1	Combined arrester (DIN rail)	TN-S-System TT-System	DEHNventil DV M TNS 255 DEHNventil DV M TT 255	951 400 951 310
2	Surge arrester (socket outlet) Surge arrester (DIN rail)	All system configurations	DEHNflex DFL M 255 DEHNrail DR M 2P 255	924 396 953 200
	Interface		Type	Part No.
3	WLAN antenna		DEHNgate DGA G BNC + angled fixing plate	929 042 + 106 329

Figure 9.23.3 Caddy/trolley shed with integrated driving range protected against surges as well as step and touch voltage

results of the risk analysis), further surge protection measures upstream of the terminal device have to be provided (Figure 9.23.3).

The same protection measures as for the club house or the caddy/trolley shed with driving range have to be taken for the golf cart parking garage and the cart shed.

Irrigation system

Water is mostly pumped from reservoirs. The necessary pumps are installed in underground ducts and are controlled and monitored from a service station (Figure 9.23.4).

The pressurised water pipe runs throughout the entire golf course. Sprinkler systems which are supplied by branch pipes water the individual greens and tees. The water flow is controlled via magnetic valves which are installed either directly at the sprinkler or in ground-level boxes. The magnetic valves

which activate the individual sprinklers are controlled by decoders. Data transmission and power supply for the valves (e.g. 35 V/1 Hz, 1.1 A) is provided by a two-wire ring conductor. In some cases, this two-wire cable can be longer than 10 km. Connecting cables to the magnetic valves, however, do not exceed 150 m to limit any excessive voltage drop.

The long two-wire ring conductor and the extremely long conductors to the magnetic valves provide the highest risk in terms of surges. In practice, therefore corresponding surge protective devices are installed on the two-wire ring conductor at intervals not exceeding 150 m. For locally earthing the surge protective devices, suitable corrosion-resistant earth-termination systems (earth rods or radial earth electrodes) are installed. These should be implemented simultaneously with the installation of the pressurised water reticulation pipe and the two-wire ring conductor.

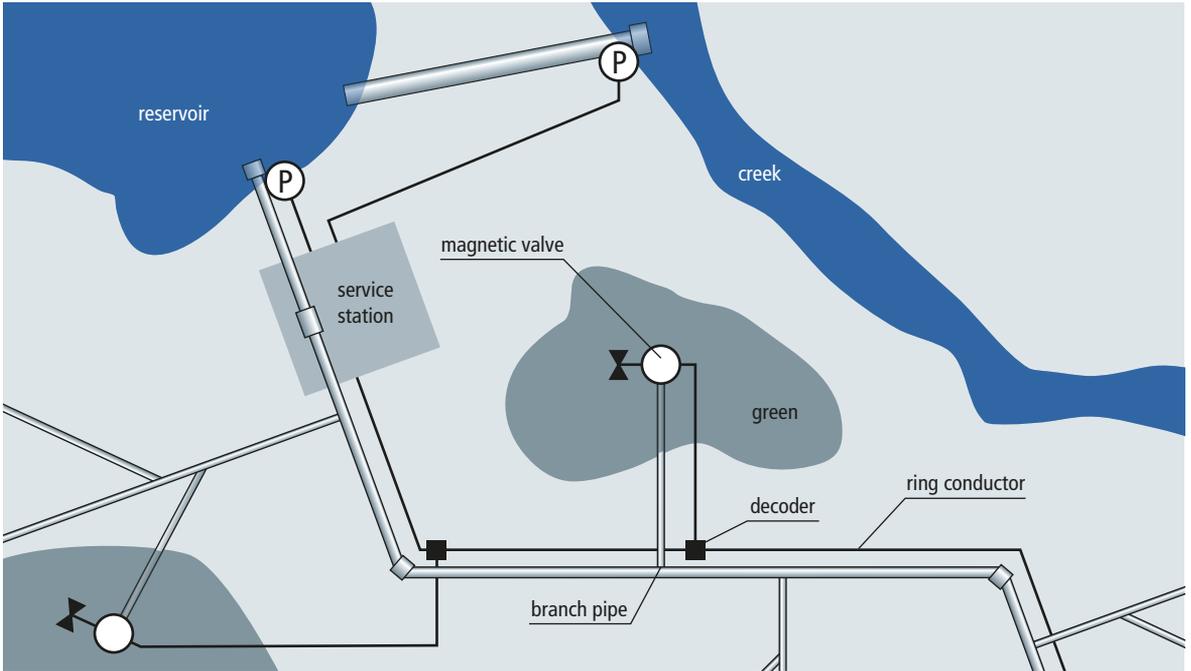


Figure 9.23.4 Pressurised pipe with branch pipes, magnetic valves, two-wire ring conductor and decoders

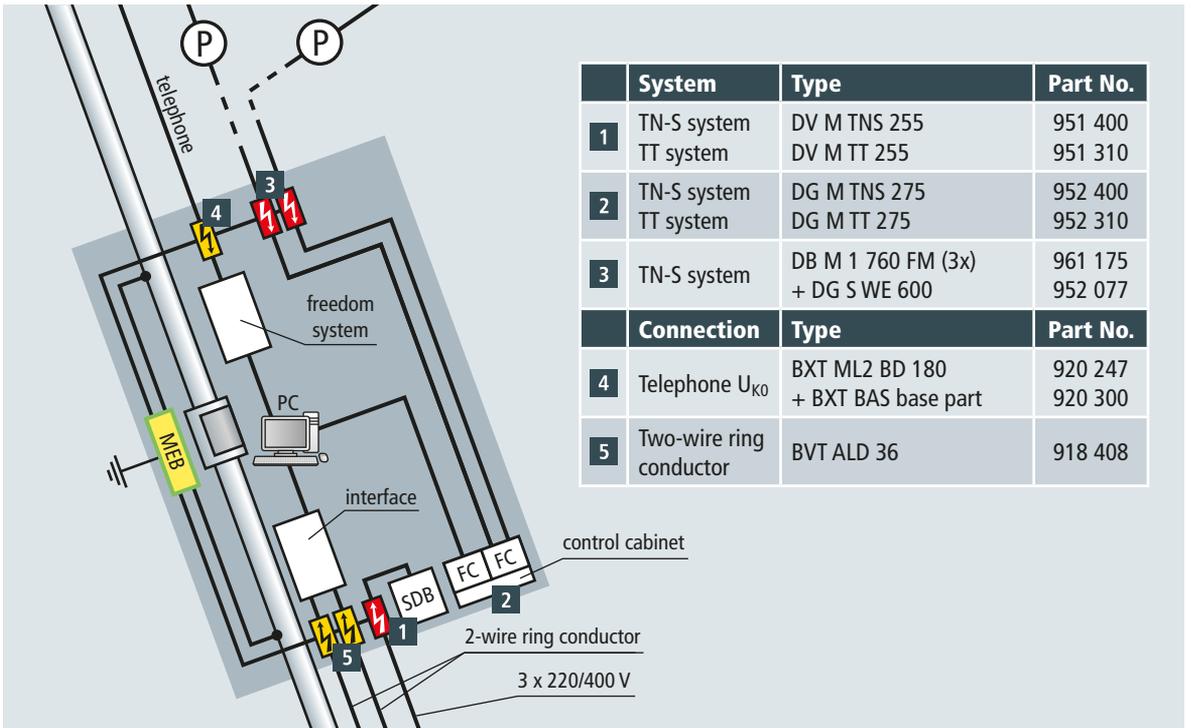


Figure 9.23.5 Service station with power distribution board, control cabinet of the irrigation system, PC, interface and data management system

Service station

Lightning equipotential bonding has to be implemented at the entry point into the service station for the pressurised water pipe, the two-wire ring conductor, the IT and the power supply feeder cable and the pump line.

It depends on the building size whether further surge protection measures are necessary for the internal conductors upstream of the corresponding control systems (**Figure 9.23.5**).

The described practical solutions are just examples. Lightning and surge protection have to be individually adjusted to the natural and structural conditions.