



# **Surge protection for smoke and heat extraction systems**

To be able to safely leave a structure in case of fire, escape routes must be kept free of smoke which causes orientation and breathing problems.

Smoke and heat extraction systems are both equipped with manual call points and automatic detectors which detect the smoke or heat produced and extract it from the escape route via electromechanically or pneumatically driven windows or domelights. In addition to this main function, the windows or domelights are also used for ventilation. For this purpose, additional switching devices are available which are capable of issuing switching commands of lower importance. Since the availability of smoke and heat extraction systems must be ensured even in the event of power failure, the fire control panels are equipped with accumulators which supply the smoke and heat extraction systems. Therefore, the actuators of the windows and domelights are dimensioned for d.c. operation.

The surge protective devices in the examples described below are dimensioned based on a voltage of 24 V d.c. which is commonly used in this industry. Moreover, electromechanically driven domelights with a maximum nominal current of less than 1.8 A or 4 A d.c. are used.

### Structure with non-metal roof and external lightning protection system

Embedded or protruding roof-mounted structures on structures with external lightning protection system must be located in the protected volume of air-termination systems as per IEC 62305-3 (EN 62305-3) under consideration of the separation distance  $s$  if the following limit values are exceeded:

Embedded or protruding metal roof-mounted structures:

- ➔ Height above the roof level: 0.3 m
- ➔ Total area of the roof-mounted structure: 1.0 m<sup>2</sup>
- ➔ Length of the roof-mounted structure: 2.0 m

Embedded or protruding non-metal roof-mounted structures:

- ➔ Height above the air-termination system: 0.5 m

Due to the above requirements, domelights of a certain size must be protected against lightning strikes. If air-termination rods are installed, the domelights are located in LPZ 0<sub>B</sub> which means that no lightning current is injected into the equipment

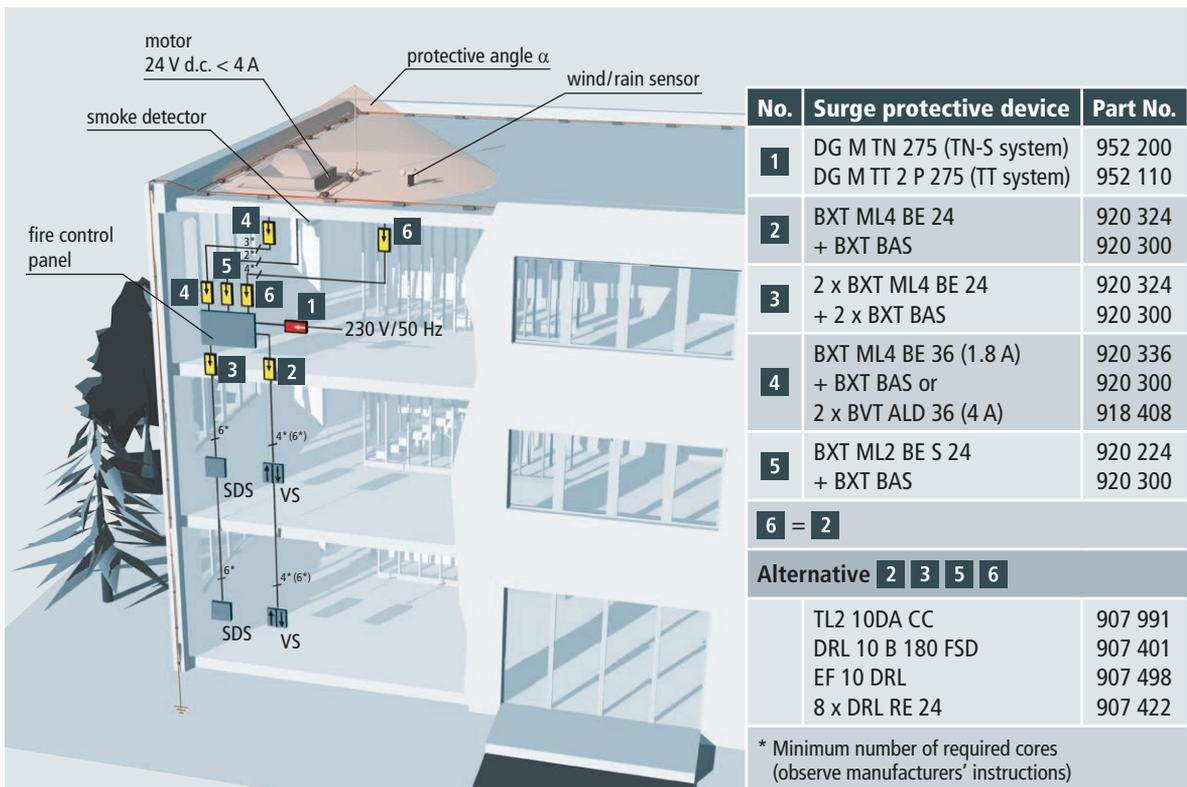


Figure 9.27.1 Domelight located in the protected volume of an air-termination rod on a non-metal roof of a structure with external lightning protection system

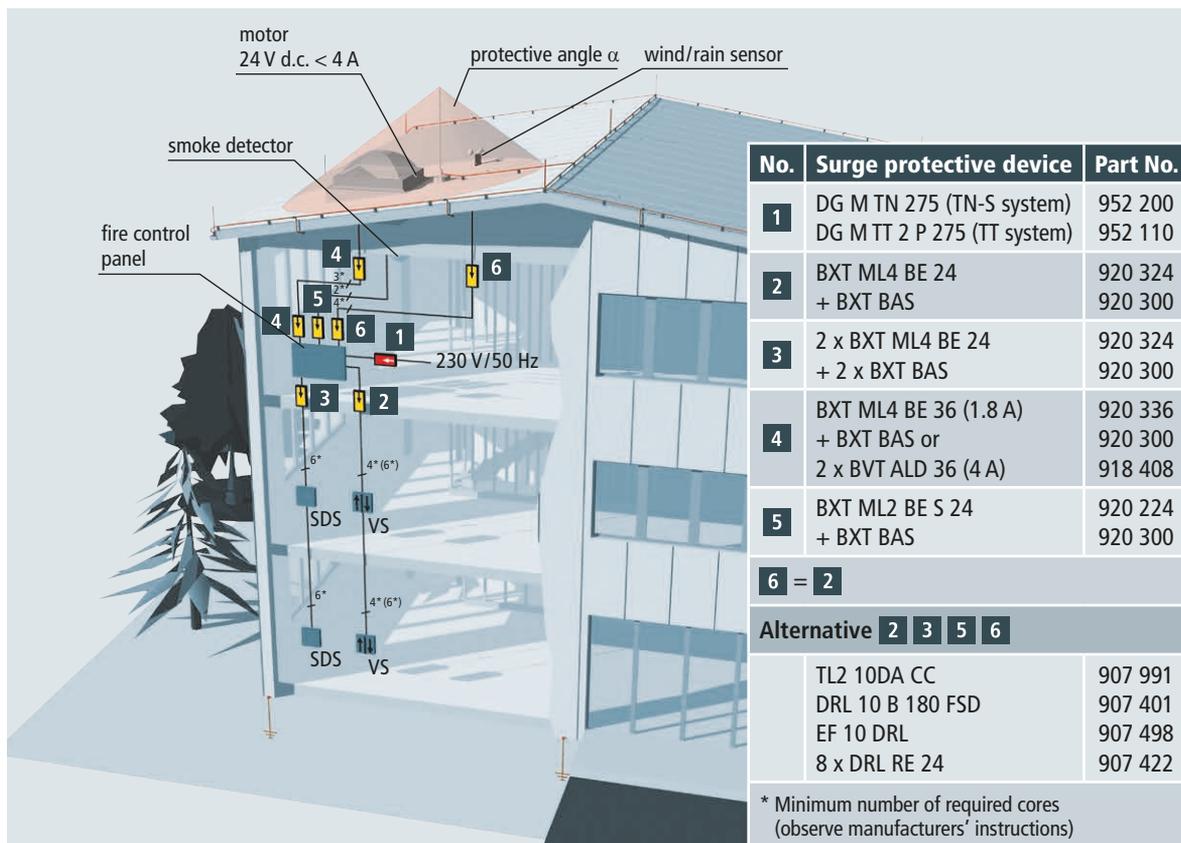


Figure 9.27.2 Domelight located in the protected volume of an air-termination rod on a metal roof of a structure with metal down conductor (steel frame, interconnected reinforced concrete or earthed metal facade)

installed in this zone (Figure 9.27.1). A surge arrester prevents inductive coupling in this zone.

### Structure with metal roof and external lightning protection system

In contrast to structures with non-metal roofs and external lightning protection system, different normative requirements are placed on the lightning current carrying capability of metal roofs which are used as air-termination system:

1. The metal roof can be used as natural air-termination system if the manufacturer confirms that it suited for this purpose (DIN EN 62305-3, Supplement 4).
2. The metal roof does not have the required thickness  $t'$  (IEC 62305-3 (EN 62305-3), Table 3) and must be protected against direct lightning strikes by means of air-termination systems since perforation can cause fire due to the highly flammable materials (or wooden boards) underneath the tin roof and the ingress of water can no longer be prevented. The air-termination systems must

be interconnected by means of lightning current carrying conductors if there is no other lightning current carrying connection (e.g. by means of tested terminals, brazing, welding, squeezing, seaming, screwing or riveting).

3. The metal roof has the required thickness  $t$  (IEC 62305-3 (EN 62305-3), Table 3)

There are two types of down conductors for the metal roofs described before:

- A. The walls consist of an interconnected lightning current carrying steel reinforcement or a steel frame construction. In both cases, the separation distance does not have to be considered since either the current is very low due to the high number of current paths (reinforcements) or the low inductance (steel beams) does not cause puncture to other metal systems. Metal façades which are connected to the earth-termination system at intervals of 15 m at the lowest point (ground) also meet the requirements described above.

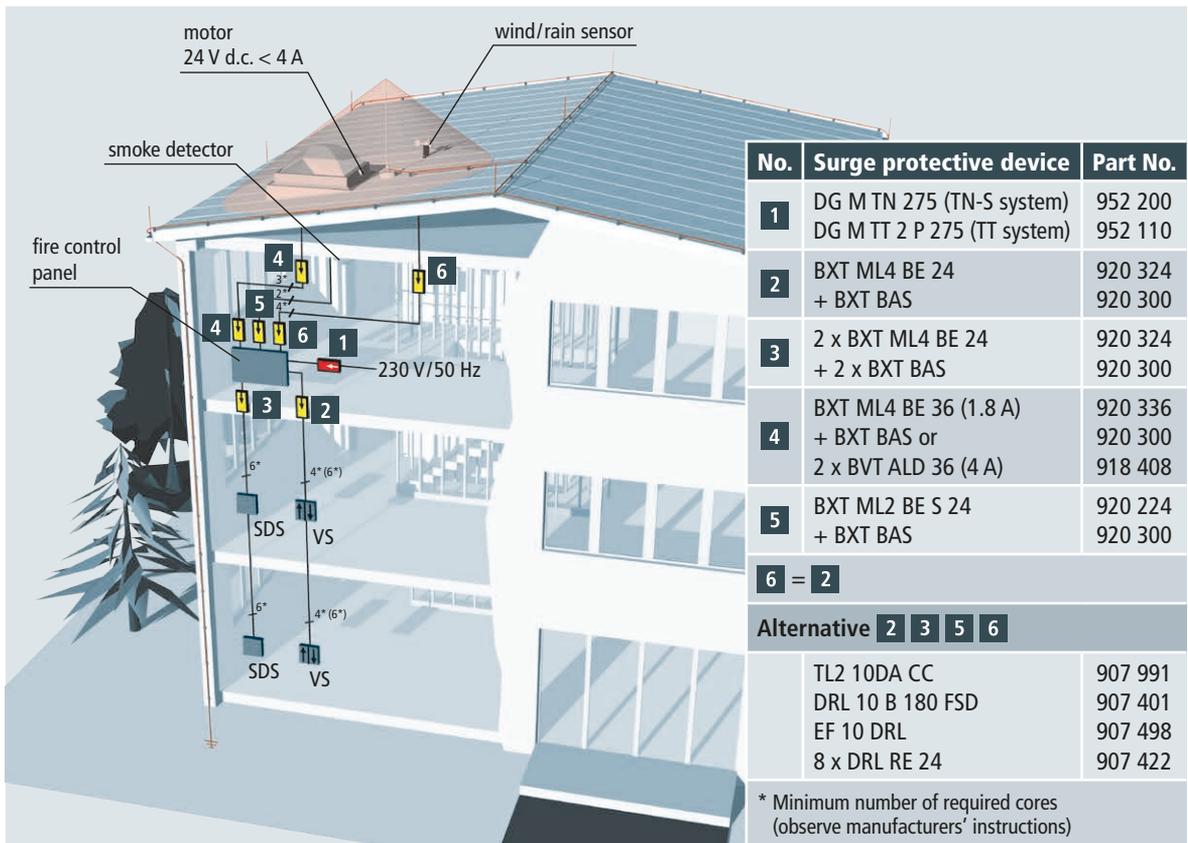


Figure 9.27.3 Domelight located in the protected volume of an air-termination rod on a metal roof of a structure equipped with conventional arresters

B. The walls consist of non-conductive material (bricks, wood, etc.) and the down conductors are connected to the earth-termination system at the intervals required by the class of LPS.

Different combinations of air-termination systems (see 1., 2., 3.) and down conductors (see A., B.) can be used. Ignitable sparkover does not occur in structures with air-termination systems and down conductors in the combinations 1.+A., 2.+A. or 3.+A. Air-termination systems must be installed to prevent lightning strikes to the domelights. Thus, the domelights are protected against direct lightning strikes, however, they are not located in LPZ 0<sub>B</sub> since the air-termination systems directly conduct the lightning current to the metal roof, thus spreading the lightning current over a large area. In view of the fact that lightning may also strike in the vicinity of the domelights, it is recommended to install a lightning current arrester (Figure 9.27.2).

A structure with a metal roof and conventional down conductors is considered to be critical (Figure 9.27.3). In case of a lightning strike, the lightning current will be evenly distributed between the down conductors. Nevertheless, the structure is still at risk and the relevant separation distance must be maintained. Air-termination systems must also be installed to prevent direct lightning strikes to this type of structure, however, the domelight is not located in LPZ 0<sub>B</sub>. Since partial lightning currents may flow into the structure via the cable for the drive of the smoke and heat extraction system, a lightning current arrester must be installed. Due to their size, structures with domelights typically have several down conductors which prevent overload of the lightning current arrester.

#### Structure without external lightning protection system

No distinction has to be made between metal or non-metal roofs since every direct lightning strike to the structure pre-

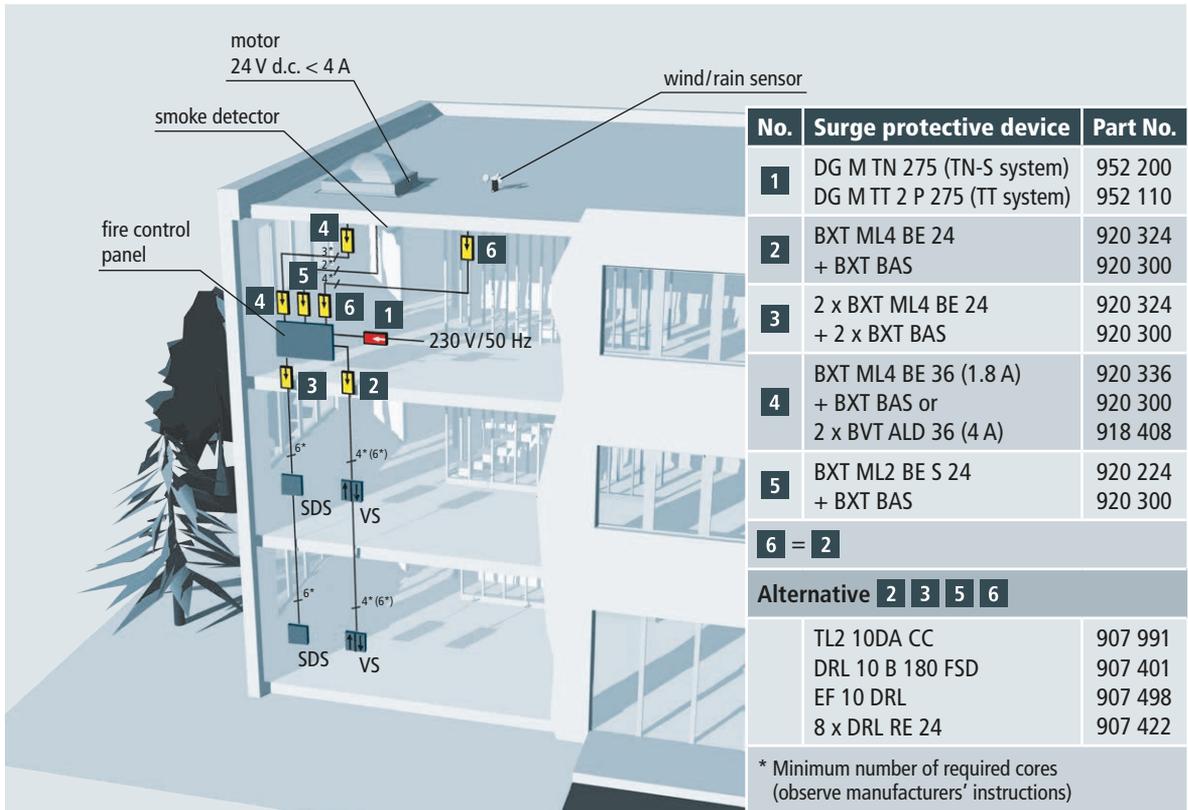


Figure 9.27.4 Domelight located on a non-metal roof of a structure without external lightning protection system

sents a fire hazard. Lightning current arresters are not capable of coping with direct lightning strikes to the domelights.

Therefore, surge arresters must be installed to protect the structure from inductive coupling (**Figure 9.27.4**).

