When LIGHTNING

LIGHTNING CAN CAUSE SIGNIFICANT DAMAGE TO SENSITIVE, MISSION-CRITICAL SYSTEMS WITHIN A BUILDING IF LIGHTNING PROTECTION MEASURES ARE NOT ADEQUATE. PAUL CONSIDINE OF WIELAND ELECTRIC EXPLAINS HOW THE RISK CAN BE ALIGNED TO THE COST OF PROTECTION

WITH THE increasing use of, and dependence on, technology in just about every business, protecting sensitive equipment is becoming ever more important. In a manufacturing or logistic operation, for example, disruption to processing or handling systems can have a catastrophic effect on productivity. Similarly, in the financial sector, server rooms are mission-critical and any failure can lead to losses of millions of pounds every hour.

Interference-free operation, therefore, is crucial and the integrity of these systems has to be maintained even under relatively extreme circumstances such as thunderstorms. And while safety devices such as fuses will protect against excess current, they are ineffective against the high voltage transients and short-duration spikes that lightning can generate on power supply lines.

This, of course, is all fairly obvious and forms the basis of the lightning protection systems that are incorporated into many buildings. However, despite the clear dangers and the critical nature of many systems, the high volume of insurance claims for lightning damage indicates that many building operators are failing to ensure appropriate lightning measures are taken.

This situation is becoming of increasing concern because climatologists are predicting that climate change will bring about more extreme weather conditions, with an anticipated increase in the frequency and intensity of thunder storms in the UK and other areas of northern Europe.

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It's fairly reasonable to assume that the key reason for the lack of protection on many buildings is that businesses often seek to achieve a balance between the cost of installing lightning protection and the risk of suffering lightning damage. There may also be a feeling that any damage will be covered by insurance. However, while insurance may cover the tangible damage it can't restore the reputation of a company that has let its customers down by not safeguarding its systems adequately.

A sensible compromise is to adopt a zone concept for lightning protection – as described in IEC 62305-4 (DIN EN 62305-4, DIN 0185-305-4). This enables planners, builders and owners to align the protective measures they adopt with the risk levels to the business of damage occurring. In this way, all relevant devices, plants and systems are afforded a level of protection commensurate with their importance to the business.

For all of these reasons electrical engineers need to be aware of the options open to them and the requirements of the relevant standards. To that end, lightning strikes can be divided into two key types – direct strikes and remote strikes.

Direct or close-up lightning strikes are lightning strikes into the lightning protection system of a building, in close proximity to it, or into the electrically conductive systems implemented in the building (e.g. low-voltage supply, telecommunications, control lines).

Remote lightning strikes are lightning strikes that occur far away from the object to be protected as well as lightning strikes into the medium voltage overhead system or in close proximity to it, or lightning discharge from cloud to cloud.

In addition to a lightning protection system in the building, additional measures for an overvoltage protection of electrical and electronic systems are required in order to safeguard the continuous availability of complex power engineering and IT systems even in the case of a direct lightning strike. It is important to consider all the causes for overvoltages.

In terms of lightning protection, BS EN 62305:2006 (Protection against lightning) advises provision of a conventional or Faraday Cage lightning protection system and these systems can be divided into external and internal types.

An external lightning protection system will typically comprise an air termination system, down conductors and an earth termination system. Clearly, all of these elements need to connected effectively so that if lightning strikes the

strikes

wieTAP Three-phase combined arrester, type 1

Table 1: The zones for lightning protection

LIGHTNING PROTECTION ZONES	DESCRIPTION
LPZ 0A	At risk from direct lightning strikes, impulse currents up to the full lightning current and through the full lightning field.
LPZ 0B	Protected against direct lightning strike. At risk from impulse currents up to partial lightning currents and through the full lightning field.
LPZ 1	Impulse currents further limited by current division and SPDs at the zone limits. In most cases, the lightning field is attenuated by shields.
LPZ 2	Impulse currents further limited by current division and SPDs at the zone limits. In most cases, the lightning field is attenuated by local shields.

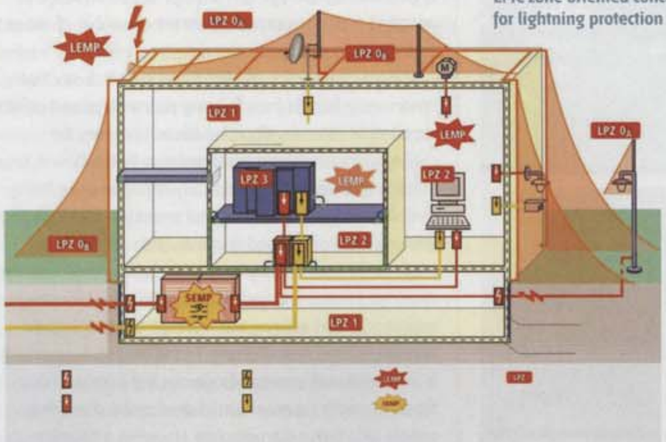
building the current discharge is conveyed safely away and damage to the building is minimised. This is achieved by ensuring that connection components comply with BS EN 50164.

An internal lightning protection system is designed to eliminate the risk of dangerous sparks inside the building or structure, following a lightning strike. Such sparking could be caused by current flowing in the external lightning protection scheme and sparking over to metallic elements inside the building. Or this could happen if current flows through any conductive elements on the outside of the building.

The danger of sparking, therefore, is minimised by creating a sufficient distance between metallic parts or by carrying out appropriate equipotential bonding measures. Equipotential bonding will ensure that no metallic parts are at different voltage potentials, so there is no risk of sparking between them. This can be realised either through bonding between conductive elements or the use of surge protection devices. The latter is particularly appropriate where direct connection would not be appropriate, such as between power and communication lines.

As noted above, the commercial reality is these measures need to be introduced in relation to the level of risk and the criticality of the processes or systems to the business. This is the basis of the zone concept for lightning protection, as it effectively divides a building into different risk zones. The zones for lightning protection are defined in Table 1

In our experience, this zoned approach strikes the right balance between capital outlay and operational risk and proves of great benefit to building operators who are trying to strike the right balance. It is also a very effective way for electrical designers to add value for their customers.



EMC zone oriented concept for lightning protection