The Striking Facts About Lightning and Surge Protection

Earthing and lightning protection is one aspect of any project often dealt with by consulting engineers. However, among the challenges posed is the fact that this topic includes issues relating to the power supply system right across to the instrumentation and IT system.

Traditionally the role of the electrical engineer has been limited to the electrical installation in the design of lightning and surge protection systems. The brief of the lightning engineer should be holistic and should encompass all aspects of the installation down to a microscopic level. Earthing of cabinets and cable shielding must be considered in the design of an effective system. Many of the systems which do not form part of the engineer's brief are provided with separate earthing systems and the principle of equipotential earthing platforms are not adhered to.

Pitfalls

A number of potential pitfalls await the specifying engineer. These include issues relating to wiring and cabling strategies, the correct use of surge protective devices (SPDs) and proper earthing. These and other issues will now be discussed.

Wiring

Little care is taken by installation crews when installing wiring for IT and communication systems during and after the construction. Inadequate earthing of wireways and installation of different wiring systems adjacent to one another will result in damage due to EMI. It is therefore imperative that the brief of the electrical engineer is extended to cover the coordination of lightning protection and surge protection for all communication, power and IT systems in an installation.

Earthing and the use of SPDs

Quite frequently specifications call for lightning protection and mains earthing. Inadequate surge protection against switching and harmonic distortions present in modern reticulation systems often cause malfunction of, and damage to, sensitive computer equipment. Surge protection is therefore necessary even in areas with low ground flash densities.

Equipotentialisation

It is important to realise that the kA rating of surge protection is not dependent on the fault level of the distribution board in which it is installed. The severity of the strike can be as high as 100 kA. The number of service cables entering the structure is also an important factor in determining the kA rating of the SPD. To illustrate this we assume that the potential peak magnitude of a strike is 100 kA. If the premises are fed with a 4-core supply cable, a data and telephone cable, the strike current will be shared equally and will result in a current level of only 16 kA per phase. Even dedicated earthing systems for computers should be interconnected to the lightning and mains earthing systems to prevent damage to equipment. Earthing of cabinets and cable shielding must be considered in the design of an effective system. Variations of the earth potential between different points in a computer network can often cause variations in the ground potential of the computer hardware and will ultimately lead to crashes in software. Equipotential bonding of all earthing systems installed will not only ensure minimal differentials in earth potential but will also prevent damage during lightning activity.

Lightning protection zones and external protection

Many specifications for lightning and surge protection use a 'one size fits all' philosophy and tend to ignore the aspect of zoning and protection

levels. Zoning of the installation is, however, an important consideration in determining the nature of the SPD to be installed. Most installations in the commercial field fall into protection level 4, as defined by SABS IEC 61024-l. With the increasing dependence on computers in the myriad of IT installations, the application of standards applicable to protection level 3 should be considered. Also, it is seldom sufficient to provide aerial conductors on parapet walls where there are extensive flat roof areas. Lightning can damage waterproofing and the SABS IEC code of practice should be adhered to.

Visual inspection

It is almost impossible to determine the impedance of the earth provided in the installation.

8/20, 10/350 and other constants are used to describe the lightning waveform and are also indicative of the frequency of the wave and concomitant impedance of the earth. Visual inspection of all earthwires is therefore extremely important in ensuring that the systems comply with the recommended values.

UPS Systems

Unless correctly specified, UPS systems will not provide adequate protection to downstream equipment.

Conclusion

The office and home environments are becoming increasingly dependent on computer technology. 'Smart buildings and homes' are no longer considered a luxury and as computer speeds increase, the system operating voltage decreases: it becomes more susceptible to transient voltages. Lightning and surge protection specifications, compiled by suitably qualified engineers, must therefore be holistic and should cover all aspects of the installation down to a microscopic level. Engineers should, in turn, keep themselves appraised of all the latest developments and techniques in the field of lightning and surge protection in order to ensure that they render the best possible service to their clients.