A BRIEF GUIDE TO LIGHTNING PROTECTION & EARTHING

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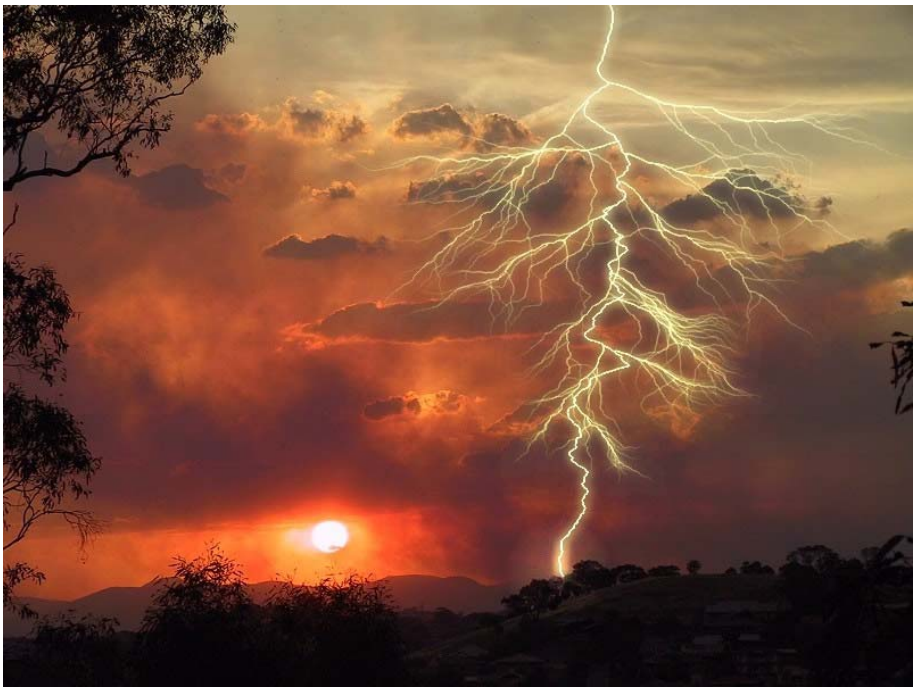

Lightning Protection:

If an unprotected building were to be struck by lightning the result may be fire, structural damage, damage to the electrical systems/equipment and electric shock. The purpose of a lightning protection system is to shield a building, its occupants and contents from these adverse effects. To do this properly the lightning protection system must capture the lightning, lead it safely down to earth, and disperse the energy within the ground.

Whether or not a building needs a lightning protection scheme depends on several factors. The code of practice for Protection of Structures against lightning details these and are used to estimate risk. The risk assessment takes in to account the following factors:

- Soil resistivity
- The external dimensions of the structure (including any adjacent structures that are electrically connected)
- The flash density (in thunderstorm days per year) for the area
- The type of construction
- Height above sea level
- Proximity of other structures such as tall trees
- The length of any overhead cables entering the structure.

In the resulting calculation, if the risk is found to be less than 1:100,000 then no protection is generally required. However, this needs to be assessed in relation to the consequences of a direct strike. For instance, if the building is an explosive store then the highest level of protection will be required even if the risk of a strike is low.

Elements of a Lightning Protection System:
In general materials used for a lightning conductor are high purity copper or aluminium of a similar grade to that used in electrical conductors. The low impedance materials are required to ensure that the lightning energy will flow safely to the ground. The principal parts are detailed below.

Air Termination:
This is made up of vertical air terminals and/or a lattice of conductors on the roof and edges of the structure. Since no part of the roof should be more than 5m from the nearest horizontal conductor, a 10m x 20m lattice is generally used on large buildings. Traditional taper-pointed air terminals are not as frequently used today but when they are they should be positioned near those points where a strike is most likely to hit the building.

Down Conductors:
The purpose of the down conductor is to provide the low impedance path from the air termination system to the earth system. There is typically one down conductor for every 20m or part thereof the building perimeter at roof or ground level. If the building is above 20m in height or of an abnormal risk this distance should be reduced to 10m. Any good conductor which forms part of the building structure can be employed as a down conductor with appropriate connection to the air termination and earthing systems. For down leads not part of the structure, copper and aluminium are the most widely used materials. These are sometimes PVC sheathed for aesthetic purposes only. Where practical they should be routed directly from the air termination to the earth system and be spaced symmetrically around the outside walls of the structure. At all times consideration must be given to the possibility of side flashing. Each down conductor should also be provided with a test point as a means of isolating the earth electrode for test purposes.

Earth Termination:
Each down conductor must have its own earth electrode termination and the resistance to earth of the whole system must not be greater than 10 Ohms without taking into account bonding to other services. The most common terminations are rods driven into the ground. These should be a minimum of 9m for the whole system.
The individual earth electrodes are sometimes interconnected by a 'ring conductor' to help reduce the overall resistance. This should be at least 0.6m below ground level and preferably pass below incoming services. The ring conductor is made from copper tape or cable (aluminium is not permitted for use below ground) and also helps to provide potential equalisation at ground level, in addition to potential grading.
The earth system should be designed as a whole since the complete installation should rise in potential together, to avoid excessive voltage differences. For this reason, the earth termination should be bonded to the rest of the earth electrodes.
Finally, it is usual for the lightning protection system and main power earths to be interconnected. However, where this is not desirable for technical reasons, an earth potential equaliser can be installed between them. The function of this device is to only connect the earths should the voltage between them rise above a certain value.

Bonding:
An important element in the design of a lightning protection system is the consideration of bonding of exposed metalwork on or near the structure. This is to ensure that side flashing does not occur.

If exposed metalwork such as pipes or ducts etc. were not bonded to the system then, when a current flows in the down conductor creating a potential, the metalwork could be initially at a potential nearer that of earth. There would therefore be a potential difference between them. If this potential difference was greater than the breakdown value of the air or material in between, then a side flash could occur resulting in severe damage.
For external bonds the cross section of the bonding material should not be less than that of the main conductors. Internal bonds can however be of smaller cross section since they are mainly for equipotential purposes and are unlikely to carry a proportion of the lightning current.

Earthing:
The various standards for earthing provide design limits to be met and together with codes of practice explain how the earthing system can be designed to meet these. There are differences in the design limits applying to consumer installations and to supply industry installations and reference should be made to the correct standard to check the limits which apply in each situation.
In the past, it was normal practice to design an earthing system to achieve a certain impedance value. The earth electrodes being positioned near the equipment where a fault current was expected to pass. Recently, this has changed towards the approach used in North America. The most important difference is that the earthing system is designed to ensure that potentials in its vicinity are below appropriate limits.
These potentials are referred to as:
i) Step Potential (the potential difference between two points on the surface of the soil which are 1m apart)
ii) Touch Potential (the potential difference during fault conditions between exposed metalwork and a point on the soil surface)
iii) Transfer Potential (the potential difference between as insulated cable connected to a remote earth reference and the earth rod)

A number of factors will determine whether or not a person experiencing any of these potentials will be at risk, and the standards attempt to take these into account to ascertain the limits below which the design will be considered acceptable.

Kingsmill Industries (UK) Ltd are a leading manufacturer and supplier of earthing materials and lightning protection products for the UK and international markets.
Our products are designed, manufactured and tested to meet rigorous standards ensuring high levels of safety and protection for buildings, people, livestock, content and sensitive electronic equipment.
History - We are proud to be a UK owned, family run business, located in the heart of the UK and are pleased to say that we have been supplying excellent service into the industry for the last 15 years. Since our inception in 1999 we have gone from strength to strength and have developed into one of the industry market leaders, we have done this by focusing on service, quality, price, delivery, commitment and trust.
Kingsmill Industries (UK) Ltd is an ISO 9001 registered company and this is where our commitment to quality begins. We aim to provide the highest standard of products, service and customer care without compromising quality or price. This commitment to quality follows throughout all aspects of the company including manufacture, development, customer support and service.
Bespoke Manufacturing - Here at Kingsmill we do not limit ourselves to just our product catalogue items, we are happy to go that extra mile for our clients, we thrive on solving customer products problems. In our dedicated workshop, using a combination of high tech machinery and skilled staff we have the ability to engineer or modify product items to your exact requirements. From a simple modification to a complete new bespoke item. We are pleased to say that we have been manufacturing excellence since 1999!!!

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