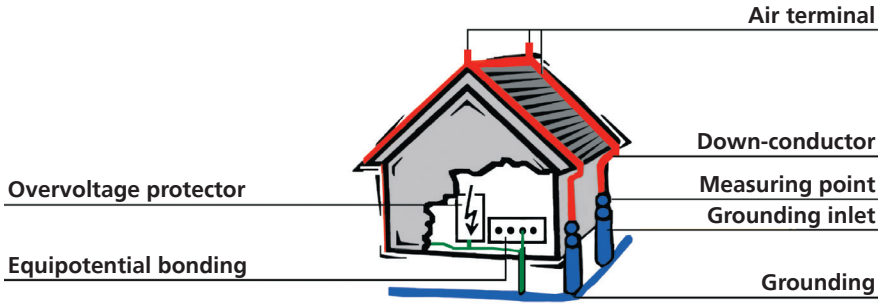
Lightning protection and equipotential bonding

External lightning protection

The task of external lightning protection is to protect the substance of the building in the event of a direct lightning strike by conducting the lightning stroke current to ground. Here, the lightning is ‚caught' by the air terminal (lightning rods and air termination network installed in a mesh configuration on the roof of a building).
The lightning currents are conducted to the grounding system via the down-conduction system. The position and number of down conductors must be selected such that the safety distance is large enough to prevent flashovers from occurring. As a rule the down conductors are connected by measurement test joints in the grounding inlets which in turn connect via grounding lines to the grounding system.



Internal lightning protection

Internal lightning protection must prevent the dangerous formation of sparks within the structure to be protected. Overvoltages arising from lightning strikes hitting the conductors of the external lightning protection system are the cause of dangerous sparking. The main method of providing internal lightning protection is equipotential bonding whereby all external conducting components and incoming lines are connected together.
Pipes and cable screening (passive elements) are connected directly to the equipotential bonding conductor. Conductive wires of the power supply or telecommunications systems (live elements) are connected to the equipotential bonding conductor via arresters.

Lightning protection and high-level tanks

Not only high-level tanks but also water treatment works are often located in exposed positions. Large accumulations of water and metal structures with potential to ground essentially involve a higher risk of lighting strikes. Even metal roofs increase the risk of lightning strike. Lightning protection measures are therefore indispensable since the dependability of the water supply is a prime consideration.
For this reason efforts should be made even during the planning stage to comply with the corresponding regulations. These include in particular DIN 18014 and EN 62305 Parts 1 and 2. Further information about grounding, lightning protection, equipotential bonding and overvoltage protection in water treatment plants may also be found in DVGW publication W 636.
Care should be taken that when the foundation ground is installed that outside the building at least one corrosion-proof connecting lug for connecting the lightning conductor is routed above ground. For this reason, it is a good idea as early as the planning stage to include in discussions the company commissioned with lightning protection in order to achieve the requisite level of coordination required here.

Foundation ground

Technically speaking, the foundation ground is the most effective and economical solution. The foundation ground forms the basis of electrical protective measures as defined by DIN VDE 0100, of lightning protection measures as defined by DIN EN 62303, and of functional reliability for telecommunications and information technology equipment as defined by DIN VDE 0800.

Design and installation of the foundation ground

The standard DIN 18014 ‚Foundation ground' describes requirements applicable to a foundation ground as regards installation and positioning. If the foundation ground is also to be used as a ground termination for lightning protection, it must also satisfy the requirements of DIN EN 62305. Installing the ground in new buildings is stipulated in DIN18015 and in the technical connection conditions of the power supply company..

The foundation ground must take the form of a closed ring and be situated in the foundations of the outer walls beneath the lowest insulating layer (moisture barrier). The same applies if foundation slabs are used. In the case of foundations consisting of reinforced concrete the foundation ground must be installed on the lowest layer of reinforcement.

The grounding capability will be lost if the foundations are isolated or provided with thermal insulation. The same applies to tanking-type designs which are impermeable to water. In such cases the grounding element must be installed in the base course or directly in the ground beneath the base course. In these positions stainless steel V4A (1.4571) must be used for the grounding element in order to provide protection against corrosion.

For reasons of corrosion protection, stainless steel should be used within masonry or in the ground.

In larger buildings cross-connections must be installed which divide the area covered by the foundation ground into sections no larger than approximately 20 x 20 m.

This results in a better potential profile and good potential grading. In this way, a base of poorly conductive material such as concrete is brought to approximately the same potential. The ground may be installed flat if the lowest layer of reinforcement of the structural steel was installed on spacer supports before backfilling and the concrete is compressed (vibrated). Otherwise, it should be bolted or welded to the reinforcement every 2 m in order to hold it in position.

The foundation ground will not be able to do its job unless there is a sufficient number of connecting lugs to which the down conductors and equipotential bonding system can be connected by a short route.

For this reason if a foundation ground is to be used simultaneously as a lightning protection ground it is important to begin planning at a very early stage. Only in this way can all of the detailed requirements, connections and fixed grounding points be included in the installation layout. Correct laying must be proven and documented in photographs.

The grounding system is given the additional task of distributing the lightning current in the ground in such a way that no hazardous overvoltages arise, thereby ensuring the lowest possible voltage differences between any two points in the building. The shape and dimensions of the grounding system are more important than a specific value for the grounding resistance (<10 ohms is regarded as low enough). A single, shared grounding system suitable for all purposes (for example, lightning protection, grounding of low-voltage and high-voltage equipment, and grounding of signalling equipment) is preferable.

(for further information see www.blitzschutz.com)

Conductor ground

A grounding system with a conductor ground uses a conductor (such as 30 x 3.5 mm steel strip or 10 mm round wire) with a conductive connection to ‚ground' over a large surface area. The conductor ground is installed in the soil at a depth of at least 0.5 m. If this is not possible or advisable, individual grounding elements (ground rods) can also be used. If the connecting lugs have been ‚forgotten' or a lightning protection system is being upgraded, a conductor ground electrode may be used, if possible taking the form of a conductor electrode around the building.

Hydro-Elektrik GmbH • Angelestraße 48/50 • D-88214 Ravensburg • Tel.: +49 751 60 09 0 • info@hydrogroup.de
www.hydrogroup.biz