Electronic grounding system in hazardous areas

Spring has begun and rains come too. With them the first storms appear. Who can say that have never been fascinated by the power of lightning?
Since ancient times, thunder and lightning evoked fear and respect in men who believed that these phenomena were directly dependent on gods.
Whereas, lightning is a visible phenomenon of the potential difference which is formed between a cloud and earth. It represents the moment of discharge to the ground of the enormous energy that has been formed.
Since the invention of the lightning rod by Benjamin Franklin, all the high buildings, such as towers and steeples, have it, just to create a privileged path for the electrical discharge which goes into the ground preventing damage to buildings, people and animals.
Then, if lightning is an important and dangerous phenomenon, why during the design and construction of a plant built in areas with potentially explosive atmosphere, the grounding system is not often considered such important for safety and security?
In electrical installations in hazardous areas, the grounding system has a great importance that goes far beyond the normal required protection, for example, for a civil or industrial plant where is sufficient to provide the protection of people from voltage when they are working on the installation.
A standard grounding system is not, therefore, sufficient to ensure full protection from temperatures, arcs or sparks that could ignite an explosive atmosphere.
In recent years, numerous standards have been written for the protection from lightning to which refer to. In particular, the EB 62305 series (series CEI 81-10) standards.

MEASURES OF PROTECTION

Designing a grounding system in hazardous areas with presence of explosive atmosphere, it is necessary to take security measures to prevent:

- electrical faults to ground;
- accumulation of electrostatic charges;
- atmospheric discharges;
- overvoltages caused by cathodically protected pipelines.

1. ELECTRICAL FAULTS TO EARTH

In an ex-proof equipment, all the metal parts normally under voltage must be grounded, including inaccessible ones. In fact, due to insulation imperfections or consequently to failures of other metal structures, fault currents can be conveyed to other metal structures with the risk of sparks, arcs or dangerous voltages.
This also applies to plants operating at low security voltage, with fault currents below to 50 V, which though are not ordinarily considered earth, must be linked each other and to the ground with potential equalization.
For example, the subsoil of chemical and petrochemical plants is crossed by a large number of pipes: these are all connected to grounding system at the intersections points and connections must be protected from oxidation.
All ground connections must refer to a single dispersion system and the connection must not be through the neutral wire.

2. ACCUMULATION OF ELECTROSTATIC CHARGES

The methods of protection against accumulation of electrostatic charges are many: air humidification and ionization, connection of metal parts to the earth where static electricity can accumulate. Regarding this last method, all masses and all other metal parts of a plant placed in hazardous areas which may accumulate electrostatic charges must be connected to the earth and made equipotential.
Connections and joints must be carried out with particular care to avoid dangerous slack that may cause sparks or hot spots.
For example, the grounding of tankers must be made through a cable connected to a grounding clamp with “Ex d” protection in order to avoid sparks during the connection of the clamp with the ground connector.

3. ATMOSPHERIC DISCHARGES

All the plants where flammable and explosive substances are produced, processed or stored must be protected against lightning. In general, in these areas are used metal meshing by taking advantage of the Faraday cage phenomenon.

4. OVERVOLTAGES CAUSED BY CATHODICALLY PROTECTED PIPELINES

This protection system is often used to protect from corrosion pipes and buried structures of a plant. All metal structures protected by this method must be connected to the grounding system. Furthermore, metallic structures, placed in a hazardous area, must also be grounded, when they are connected cathodically with protected structures, even if they are located outside the dangerous zone. Designing the plant, therefore, the efficiency of the system must be check by repeating the resistance measurements at least once a year. Furthermore, it’s necessary to predict separate sinks from those used to protect operators from voltage.

CONCLUSIONS

From the above observations we can gather that a grounding system can compromise the safety. Therefore, it is necessary to determine which are the limits of a traditional grounding system and operate so as to avoid that a grounding system constitutes a risk.