LIGHTNING - "THE PROTECTION MYTH"

Lightning is arguably one of the most dangerous and frequently encountered weather hazards in Australia. There are between 5 and 10 deaths and over 100 severe injuries caused by lightning in Australia year-on-year. Damage to Australian Oil & Gas and Mining infrastructure due to lightning is estimated at $100M per year.

How big is the issue in Australia? Why is it important for electricians to better understand how we "protect" assets in hazardous areas from lightning and how we assess risk in hazardous areas specific to lightning.

Contamination/Rust on bonding lug.

What causes an explosion, fire or death…lightning or the ignorance surrounding lightning.

After reviewing 100+ audits on some of Australia's largest industrial sites specific to Lightning Protection, 96% of the sites were not compliant to Australian standards. 78% did not have an appropriate earth network. 90% did not carry out mandatory earth network checks.

Considering that a lightning protection system is only as good as it's earth network these results were somewhat alarming.

How has as this occurred? How have we got to this point? There seems to be a disconnect in the application of the Lightning Protection Standard - AS1768 In most cases it is the site electrician or electrical contractor who is responsible for the design and specification of the Lightning Protection System. Lightning protection is not taught in any great detail as part of an electrical apprenticeship.

Bond not connected

Lightning terminal facing downwards

So why are we surprised that Electricians find the process challenging or why mistakes are made.

It is also evident that the engineering and design houses responsible for the tender/brief or scope of works fail to provide enough guidance so that the electrical contractor is able specify an appropriate system. In my experience the tender document/scope of works as set out by the engineering company or design team is as limited as"comply to the standard".

This "ass" covering by the engineering/design team "the people with the technical understanding of the site" has to stop.

A clear communication of the brief including all the risks associated is what's required so that the electrical contractor and or electrician can make an informed decision.

Otherwise mistakes are made as electricians and contractors try to find the most cost effective solution as opposed to a solution that is appropriate for the site and the risks associated for that site.

Industrial facilities are hazardous environments and the potential for fire is an ever-present hazard from thunderstorm-generated lightning. Costly consequences that may result from lightning strikes to facilities such as oil and gas tank facilities include lost revenue due to equipment downtime; the costs associated with lightning related equipment damage, facility and equipment repair and replacement costs; and other business interruption costs. Electrical infrastructure at tank facilities is important to ongoing operations reliability.

Once lightning compromises the integrity of a facility's safety systems, the phenomenon has additional potential to become tragic by harming human beings.

Bonding cable with right angle bends

Visualizing, designing and implementing a three-tier comprehensive facility protection approach as a "protection pyramid" is critical in addressing grounding, surge suppression and lightning protection for tanks and associated oil and gas infrastructure.

The base of the protection pyramid begins with the installation of a stable, low resistance and low impedance earth system to bond all electrically conductive surfaces together. Harmful electrical currents are safely redirected to earth and away from storage structures and related equipment, power lines, telephone lines and data systems.

Building upon the grounding tier, the second layer of protection comes from properly installed surge protection devices, which reduce and/or eliminate the magnitude of random, high energy and short duration electrical power anomalies. These occurrences are typically caused by atmospheric phenomena (lightning strikes), utility switching, inductive loads and internally generated transient voltages.

Finally, a well designed, customized and site-specific lightning protection system should be installed to safeguard from direct lightning strikes. Traditional lightning protection methods as well as advanced technologies are available.

Floating Roof Top Tank - Conductive shunt. Contamination/Residue often builds up to form on the shunt creating two surfaces of non equal potential

Retractable Bypass conductors installed to address issues related to conductivity on the shunt of a floating roof top tank

WITHOUT PROPER EARTHING

Whenever evaluating an existing site or considering a new construction build, start at the bottom and work your way up the protection pyramid. Is the bonding and earthing properly implemented (or maintained)? Are there appropriately staged and sized surge protection devices on all critical load paths? Is there direct lightning strike protection in place as required? Are all of the systems in good condition, or has new construction compromised any of the components? If needed, professional and experienced specialists may be consulted to answer these questions.

In addition to proper engineering and design, appropriate materials and installation, provisions for sustained operational oversight and maintenance are required for continued safety. It is important to realize the interrelationship and interdependence of the three tiers of the protection pyramid in protecting any facility.

Without proper earthing, neither the surge suppression nor lightning protection will function correctly. Without surge suppression, equipment is exposed to the secondary effects of lightning as well as internally generated transient voltages. Direct strike lightning protection protects the physical structure and its contents. These three subsystems interlock into a very robust and stable whole, and so provide the best possible solution set for today's lightning protection requirements.

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