# Lightning Strikes Near, But Not To, Lightning Rods

Do Lightning Master® Ultra Sharp Point™ air terminals protect only themselves, allowing direct lightning strikes to the protected structure near, but not to, the lightning protection system? No. In fact, experience has shown that this is more of a problem with conventional Franklin lightning rods than with ultra-sharp point air terminals.

## GENESIS OF THE TECHNOLOGY

To understand this technology, it helps to know its history. Until the mid-1980's, the only lightning rod technology meeting the requirements of NFPA 780 and UL 96 was the conventional Franklin rod. At that time, Lightning Master specialized in providing lightning protection for tall broadcast towers and communications facilities. We were well known throughout that industry and enjoyed quite a bit of positive exposure in the press. As a result, we were contacted by the facilities engineer at Bay Pines Veterans Administration Hospital in Bay Pines, Florida.

One of their buildings had suffered a direct lightning strike to the roof between lightning rods near the helipad. The strike damaged the roofing material.

Facilities engineering contacted us and asked us if we could develop a solution to their problem. In response, we developed an air terminal employing ultra sharp point technology that slipped over and crimped on to a Franklin lightning rod.

Early Slip-Over Ultra Sharp Point Air Terminal

## MEETING INDUSTRY STANDARDS

After developing the slip-over and crimp-on air terminal, and in order to obtain a UL Listing, we modified the device so it no longer slipped over, but replaced a Franklin lightning rod. We concurrently obtained a US patent on the design and UL listing on the products.

Lightning Master air terminals meet the requirements of National Fire Protection Association NFPA 780 and are Underwriters Laboratories Listed to UL 96. The air terminals provide a zone of protection exactly the same as any other lightning rod and are designed and intended to be used as components in a NFPA 780 or UL 96A system. As such, a completed installation is eligible for a UL Master Label, the gold standard in lightning protection. In oilfield applications, grounding requirements of American Petroleum Institute API 2003 and API 545 are applied.

In keeping with industry trends to use blunt-tipped air terminals for personnel safety, the tip of a Lightning Master air terminal elevation conductor into which the electrodes are inserted is blunt.

## REAL WORLD EXPERIENCE

Several years after the VA Hospital project, a Franklin lightning rod system was installed on a data center in Lake Mary, Florida. This system was designed by a well-known and influential engineering company specializing in the design of lightning rod systems. Because the data center was considered critical, the system was designed and installed with decreased spacing between lightning rods to enhance its level of protection. Sometime after the installation was completed, the structure suffered a direct lightning strike to its roof near, but not to, a Franklin lightning rod. After an investigation, no one could explain why it occurred or how to keep it from happening again. The installer of the original system suggested replacing the Franklin lightning rods with Lightning Master air terminals. The customer did so, and there have been no incidents since.

In the words of a Project Manager at a large chemical plant in the southeast US, "After our installation was complete, several company personnel were skeptical of the performance of the "fuzzy ball™" lightning rods. Perhaps the strongest indication of the effectiveness of your system was when it did not work. In one area of our plant, we had a particularly corrosive environment. That caused the stainless steel dissipation electrodes at the tip of the air terminals to corrode away, turning the air terminals into the equivalent of blunt lightning rods. We immediately started experiencing damage to microprocessor equipment in that block of the plant. You worked with us to change the air terminal material to titanium, going so far as to change NFPA 780 to allow its use. When we changed out the air terminals to titanium, the problems stopped."

A large company operates a paper plant located in the salt marshes of northeast Florida. The commercial AC power to the plant runs across the marshes and suffered numerous lightning strikes causing equipment damage and unacceptable downtime at the plant. The operator installed Lightning Master air terminals on each of the utility poles leading across the marsh. Their incidence of damage and outages dropped so dramatically that they published an article in their company newsletter explaining to its employees the decrease in lightning outages.

An operator of a south Louisiana plant experienced numerous fires atop their inherently self-protecting hydrogen stacks during electrical storms causing numerous plant shutdowns. One engineer commented that after a storm, the production area "looked like Kuwait" (this was after the first Gulf War). After installing Lightning Master systems on their stacks, they suffered only two stack fires in the following years with a significant reduction in down time.

The instrument and electronics engineers at petroleum production sites in the northern US experienced multiple failures of their guided-wave tank level sensors. The sensors were not physically damaged; they were just confused by transients and required a manual reset by a technician. Another division of the company installed Lightning Master lightning and static control systems on their sites as part of a separate project. The I&E engineers noted an immediate and drastic improvement in the reliability of the level sensors. It turned out that static had been causing the problems, and the Lightning Master system, in addition to its role in lightning protection, also solved static-related issues.

The attraction profile of any particular lightning rod will be related to its ability to control ground charge dissipation to the atmosphere and to emit a streamer. Under a thunderstorm cloud, an ultra-sharp lightning rod will break down into corona under a relatively low potential, that is, it will start to leak ground charge off the sharp points into the air in the form of corona. A conventional Franklin pointed rod will break down into corona under a higher potential. A blunt Franklin rod will tend to accumulate ground charge, not breaking into corona but rather into streamer formation, thus attracting the strike. The preferred performance as provided by the Lightning Master air terminal is to break down into corona under a low potential to delay streamer formation, then to transition into streamer formation before objects other than the air terminal emit a streamer. As the air terminals dissipate ground charge to the atmosphere, that charge will be replaced by other ground charge on the structure. As it is dissipating off into the atmosphere, the potential will always be higher on the Lightning Master air terminal than on the adjacent structure. Therefore, if anything on the protected structure is going to emit a streamer, it will be the air terminal, as that is where the ground charge is available to constitute the streamer. This assures that there will be no unnecessary lightning strikes to the protected structure, yet there will be no strikes to the structure that do not attach to the air terminal.