



LightningMaster
Corporation

Lightning Strike Completion Mechanism

Various mechanisms create a stratified charge in a storm cloud. The charge on the base of the cloud induces an opposite charge on the surface of the earth beneath it. (Remember playing with magnets as a kid? Like charges repel and opposite charges attract.) As the storm cloud builds, it increases the potential difference between the cloud base charge and the ground charge, with the cloud base charge trying to pull the ground charge off the surface of the earth.

As the charged storm cloud travels through the atmosphere, it drags its ground charge along beneath it. When the ground charge reaches a structure, the attraction of the cloud charge pulls it up onto the structure, and concentrates the ground charge on the structure. If, before it moves away, the charge on the cloud base manages to concentrate enough ground charge potential on and around the structure beneath it to overcome the dielectric of the intervening air, an arc, or lightning strike, occurs.

When the dielectric of the air is overcome and lightning is going to strike, the process begins with the formation of stepped leaders branching down from the cloud. These stepped leaders propagate in jumps of about one hundred and fifty feet. The next set of stepped leaders propagate through the first set and jump another hundred and fifty feet, and so on towards the ground. These stepped leaders are the tendril-like branches extending down from the cloud which are visible in a photograph of a lightning strike. We see a lightning strike in two dimensions, but the field of stepped leaders is three dimensional, it has depth too.

When the stepped leaders are within five hundred feet or so of the ground, the electric field intensity on the ground becomes so strong that objects and structures on the ground begin to break down electrically and respond by shooting off streamers up toward the stepped leaders. When a streamer connects with a stepped leader, the ionized path becomes the channel for the main lightning discharge. The other streamers and stepped leaders never mature.

2100-A Palmetto St., Clearwater, FL 33765
800-749-6800

lightningmaster.com

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For the purposes of this discussion, it is not critical whether the cloud base charge is positive or negative. Indeed, it can vary, and the entire process can occur in the opposite direction.

Change in streamer initiation time is a concept describing the influence air terminals have on the formation of streamers. ΔT is the change in time, as compared to a conventional lightning rod, of the release of the streamer from a particular air terminal. ΔL is the change in length, or more importantly height, of the streamer, and is derived from ΔT . The earlier a streamer is emitted, the longer it is relatively, and the more of a head start it has over other streamers from the same area. Therefore it has a better chance of reaching the stepped leaders first, and completing the strike to the air terminal. This positive ΔT is the basis of early streamer emitting technology, technology designed to attract lightning to a preferred point. Conversely, an air terminal that delays the formation of streamers, or exhibits a negative ΔT and ΔL , is less likely to complete the strike to itself.



MAGS TYP (X) PLACES

SRAT TYP STAG PATTERN
AROUND CATWALK ON
TANK SHELL AND HANDRAIL

About Lightning Master Corporation

Established in 1984, Lightning Master® is a global, full service, static solutions, lightning and surge protection manufacturing company. We serve a wide range of customers including oil, gas, chemical and other industrial facilities. Our complete line of products, systems and consulting services are backed by our worldwide customer service. Our track record of success in the Americas, Asia, Africa, Europe and the Middle East has established LMC as a global authority on lightning and static protection.

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We wrote the book on Static Solutions and Lightning Protection.