MORGAN SYSTEMS

Technical Bulletin

Modern Coaxial Lightning Arrestors
Alpha Delta Vs. Morgan Systems

This is a comparison report between coaxial lightning arrestor units manufactured by Alpha Delta Corp. and Morgan Systems. Both companies make a variety of such protective devices and are sold worldwide. The Morgan Systems design described in this report was originally patented by the U.S. Bureau of Patents and Trademarks in Washington, D.C.

Alpha Delta's primary configuration is a one part system consisting of a gas discharge breakdown unit connected in a shielded enclosure between the coaxial center conductor and an insulated, external ground terminal fitting protruding through the case. The gas discharge unit (GDU) has a rated breakdown voltage in the 400-1000 volt range to allow the transmission of an-RF waveform through the unit without creating a sufficient voltage potential referenced to ground to ignite the conductor referenced to ground the gas unit ignites, creating a temporary low resistance path to ground, thus neutralizing the potential.

While this arrangement may be suitable protection in a few cases it suffers from numerous limitations that we believe to be serious. Among them:

1. The unit uses a pass-through center conductor. Although the gas discharge assembly will ignite when the breakdown potential is reached many hundreds of volts are presented to the input of the radio equipment before the arrestor action occurs. In modem solid state terms it means that the radio will nearly always be damaged or destroyed before the arrestor activates to neutralize the income electromagnetic wavefront.
2. The use of a gas discharge unit as a sole-source mechanism for neutralizing lightning currents delivered by heavy coaxial cable line conductors is controversial. Gas units have only a small dissipative power rating, seldom exceeding, I watt. While the devices can handle large jolts of thousands of amperes of current, they can perform that service only if the entire impact event lasts only a few microseconds. Lightning currents, especially slowed down by time constants due to the inductance of transmission line conductors are much slower to rise, endure, and dissipate. The result is frequent rupture and failure of the GDU, requiring

down time and parts replacement. Additionally, it's difficult to determine the condition of a GDU in service, notably after they have taken a few suspected "hits." They don't always go short circuit, but they sometimes fracture and separate.

3. No constant drain method is employed to leak static development from cables. A coaxial line often acts like a large capacitor, storing electrical charge which can only leak off the line through antenna joint connections or through the insulated dielectric region between the conductors. When this occurs it nearly always causes receiver "hash" noise during electrical activity.

The Morgan Systems design, shown below on the right side, took these characteristics into account during development and testing. Our arrangement uses a central high voltage rated blocking capacitor which allows the free flow of RF energy through the arrestor device but blocks DC voltage and low frequency AC voltage. The heavy inductor on the antenna side of the unit is the primary neutralizing agent. Voltage development is quickly shunted to ground through the DC shorting nature of the inductor/RF choke. If large currents of a fast-rising nature are presented to the arrestor in such a way that a back-EMF develops across the inductor then the companion paralleled gas discharge unit ignites, but its only workload is to collapse the short-lived magnetic field of the inductor., The result is an arrestor that is constantly active, requires no predetermined voltage to activate, and whose GDU workload is so low that is will probably last forever. To date not a single replacement gas unit has been sold by us. The added resistance on the equipment side of the arrestor was inserted to provide a similar drain function on the user side of the arrestor, shunting away tiny currents that may appear from capacitor dielectric leakage during an impact event.

Schematic diagrams of the two designs appear below: