

LIGHTNING AND OVERVOLTAGE PROTECTION FOR TELECOMMUNICATION TOWERS



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Telecommunication towers such as cellular, television or radio repeaters are very high structures, placed in isolated locations and equipped with components that are very sensitive to atmospheric discharges. Their maintenance and reparation usually requires the technicians to move to the remote places where they stand, which means an important cost and out-of-service time. Lightning and overvoltage protection avoids many of these failures and deterioration of electronic components thus enlarging the installation life.

"Lightning and overvoltage protection avoids many of these failures..."

Aplicaciones Tecnológicas, S.A. supplies all the necessary elements for the most efficient lightning protection for the telecommunication towers and the contained equipment. Our technicians study every installation in order to apply the best solution for each case since there is equipment in these structures with different technologies and they are in constant evolution.

AIR TERMINATION SYSTEM

DAT CONTROLER[®] PLUS EARLY STREAMER EMISSION AIR TERMINAL

Telecommunication towers are metallic structures and therefore they may act as natural components of the lightning protection system. However, Aplicaciones Tecnológicas, S.A. recommends the installation of a DAT CONTROLER[®] PLUS Early Streamer Emission Air Terminal at the top of the tower becoming the preferred point for the lightning strike thus avoiding direct impacts on the aerials. The Air Terminal must be always at least 2 meters over any other object within its protected area and therefore over any aerial. The masts of the aerials should be bonded to the lightning protection system, which is usually accomplished since the structure is metallic.

DAT CONTROLER[®] PLUS AIR TERMINAL

An Early Streamer Emission (ESE) Air Terminal is characterized by its response to lightning approach, going ahead any other element within its protection area and thus driving lightning current to earth through a safe path.

DAT CONTROLER[®] PLUS employs the atmospheric electric field as only power supply. It is fully autonomous, maintenance-free and its working can be checked at any moment. For a better

guarantee, DAT CONTROLER[®] PLUS air terminals have been submitted to all the necessary tests in official and independent laboratories.

DAT CONTROLER[®] PLUS should be installed according to the relevant standards (UNE 21186, NF C 17-102 or similar).

DAT CONTROLER[®] PLUS radii of protection (in meters) for h= 5m

| | DC+15 | DC+30 | DC+45 | DC+60 |
|---|-------|-------|-------|-------|
| Level 1 according to UNE-EN62305 Level I according to UNE21186 | 32 | 48 | 63 | 79 |
| Level 2 according to UNE-EN62305 | 37 | 55 | 71 | 86 |
| Level 3 according to UNE-EN62305 Level II according to UNE21186 | 45 | 63 | 81 | 97 |
| Level 4 according to UNE-EN62305 Level III according to UNE21186 | 51 | 72 | 90 | 107 |

h: height of the air terminal over the surface to be protected



DOWN CONDUCTOR AND EARTHING SYSTEM

After lightning strikes the air terminal, then its current will be driven to the ground through the whole metallic structure of the tower. However the standards for ESE air terminal installation specify that at least one down-conductor should be installed for each air terminal in order to assure always a direct and verifiable path.

It is convenient to use tinned-copper tape as down-conductor. Tape has larger surface for the same amount of material than cables and therefore has less resistance, less inductance and generates less electric fields. The conductor has to be fixed to the tower with 3 clamps per meter and to be protected from hits with a guard tube, 2 or 3 meters over the floor. The installation of a lightning event counter is also recommended.

A mesh conductor should be made at the telecommunication tower basement in order to achieve a good grounding for all the equipment even in rocky locations with low conductivity soils. Besides it is advisable to provide the down-conductor with its own earth termination with a proper configuration for a quicker and more efficient the lightning current dissipation.

For high resistivity soils it is recommended to use dynamic electrodes APLIROD®, copper tubes filled with salts that improve the soil conductivity with the time.

It is preferable to use vertical electrodes, 2 or 3 meter long, forming a triangle, since this is the most suitable configuration for dissipating an impulsional current. Each dynamic electrode should be installed inside an inspection pit in order to avoid the obstruction of the breathing holes.





DOWN CONDUCTOR AND EARTHING SYSTEM

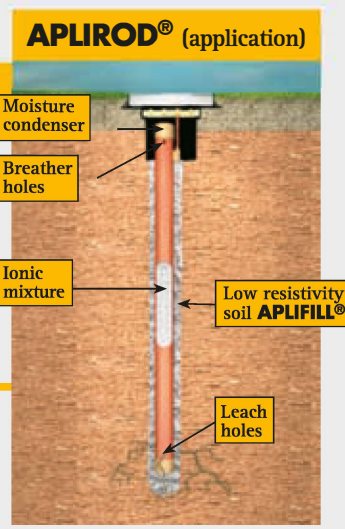
DYNAMIC ELECTRODE AT-025H – APLIROD®

Lightning Protection Systems need an especially stable and low earthing resistance. The absence of free ions in the ground surrounding the electrode has an adverse effect on the functioning of the earthing, thus reducing the efficacy of the whole Lightning Protection System.

Earth Systems with Dynamic or Electrolytic Electrodes are based on the contribution of ions to the ground.

They consist mainly on a hollow copper tube filled with a mixture of ionic compounds. The product absorbs the environmental humidity and is spread in the ground surrounding the electrode, thus adding free ions and gradually reducing earth resistivity. The efficacy of this electrode is enhanced if the electrode is surrounded by a ground conductivity improver.

| AT-025H | |
|-------------------|---------------------|
| External diameter | 28mm |
| Length | 2,5m (vertical) |
| Drilling | Ø40mm x 3m. |
| Filling | 0,5kg de APLIFILL®. |



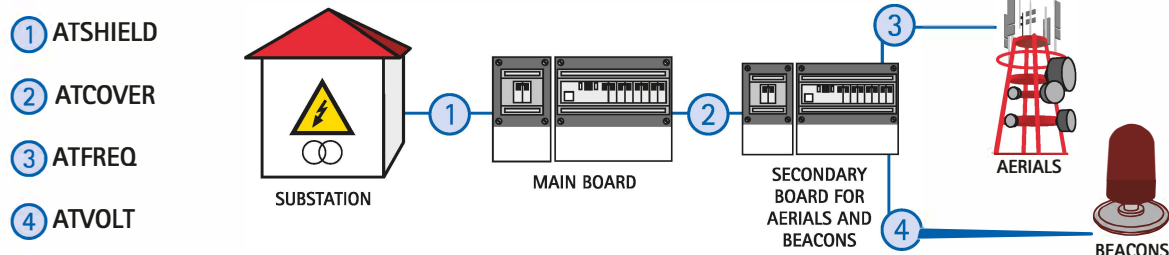
COMPONENTS EMPLOYE IN THE DOWN-CONDUCTRO AND EARTH TERMINATION SYSTEMS

| | | |
|--|---|--|
|  <p>Holdfast to girder.</p> <p>AT-018E</p> |  <p>Metallic clip to tape.</p> <p>AT-028E</p> |  <p>Lightning event counter.</p> <p>AT-001G</p> |
|  <p>Tinned-copper tape, 30x2mm.</p> <p>AT-052D</p> |  <p>Brass clamp for straight, cross, "T" and parallel connection for Ø8-10mm and/or 30x2mm tape.</p> <p>AT-020F</p> |  <p>Brass bonding bar for equipotentialization and testing. To be placed inside an inspection pit. Connectors for Ø8-10mm and/or 30x2mm tape.</p> <p>AT-020H</p> |
|  <p>Dynamic electrode APLIROD, vertical, Ø2500x28 mm.</p> <p>AT-025H</p> |  <p>Spark gap for bonding earth terminations. Ip(10/350µs) of 100kA.</p> <p>AT-050K</p> |  <p>Polypropylene inspection pit, 250x250x250 mm, able to withstand 5000 Kg.</p> <p>AT-010H</p> |

OVERVOLTAGE PROTECTION

The external lightning protection system does not avoid the effects of distant or cloud-to-cloud lightning nor the electromagnetic fields produced by lightning in its path from the air terminal to the grounding. The aerials and the connected equipment should therefore be protected from transient overvoltages.

Protection should be well-coordinated: there should be space enough between the protectors so that they could act at the right moment in such way that the lightning current flows through the most robust protector. Therefore, if there are less than 10 meters between the ATSHIELD and the ATCOVER then it is preferable to install only the first one.



COMPONENTS EMPLOYED IN SURGE PROTECTION



ATSHIELD Series

Three-Phase protector against direct lightning strikes using combined technology, able to withstand a peak current of 30kA per pole with a 10/350μs wave letting a residual voltage lower than 1,5kV.



ATCOVER Series

Three-Phase protector both common and differential protection, able to withstand a peak current of 30kA per pole with a 8/20μs wave letting a residual voltage lower than 900V. With light alarm and remote control connection.



ATVOLT Series

Protector for DC power supply lines in modules containing coordinated protection for one pair of lines. Able to withstand a peak current of 20kA per pole with a 8/20μs wave letting a residual voltage lower than the double of its nominal voltage.



ATFREQ Series

Protector of signal lines for coaxial cables
Protector de línea de señal para cables coaxiales. Able to withstand a peak current of 10kA per pole with a 8/20μs wave.

ATFREQ Series contains a wide range of protectors for all kind of aerials.

| | ATFREQ | Conector | Frequency range | Atenuation | Impedance | Exanged Power | DC Sparkover voltage |
|--|--------|-----------|-----------------|-------------|-----------|---------------|----------------------|
| | AT2104 | TV | TV | 0-1 GHz | <1,2dB | 75 Ω | 50W 90V |
| | AT2103 | SAT | F(SAT) | 0-2 GHz | <0,5dB | 75 Ω | 50W 90V |
| | AT2116 | CCTV | CCTV | 0-1 GHz | <0,15dB | 50 Ω | 50W 50V |
| | AT2105 | 50BNC015 | BNC | 0-1 GHz | <0,15dB | 50 Ω | 50W 90V |
| | AT2115 | 50BNC | BNC | 0-1 GHz | <0,2dB | 50 Ω | 50W 90V |
| | AT2108 | 400BNC015 | BNC | 0-1 GHz | <0,15dB | 50 Ω | 400W 250V |
| | AT2118 | 400BNC | BNC | 0-1 GHz | <0,2dB | 50 Ω | 400W 250V |
| | AT2106 | 50N | N | 0-3 GHz | <0,15dB | 50 Ω | 50W 90V |
| | AT2111 | 400N | N | 0-3 GHz | <0,15dB | 50 Ω | 400W 250V |
| | AT2102 | 3G | UHF | 0-3 GHz | <0,3dB | 50 Ω | 50W 90V |
| | AT2109 | 250V | UHF | 0-3 GHz | <0,3dB | 50 Ω | 400W 250V |
| | AT2110 | 900 | 7/16 | 0,9-2,6 GHz | <0,3dB | 50 Ω | 900W 600V |
| | AT2112 | 2500 | 7/16 | 88-108 MHz | <0,3dB | 50 Ω | 2500W 600V |



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