The terminals are as follows: wider area. The advance time must be measured in a high voltage microseconds between the emission time of an early streamer emission and provide the lightning current with a path to earth avoiding damage to the structure.

This advance time determines the protection radius of each air terminal. The standards define this characteristic within its protected area. The standards define this characteristic using a parameter called advance time (ΔT): "Difference expressed in microseconds between the emission time of an early streamer emission and the conditions defined in the reference standard."

The main feature of Early Streamer Emission (ESE) air terminals is the generation of the continuous upward leader before any other object generation of the continuous upward leader before any other object on the ground, any of them can be struck. The objective of an down-conductor which spreads in any direction. Once it approaches the structure, it will preferably be on different external walls of the building. Each down-conductor should be installed such that its routing is as straight as possible and takes the shortest path to earth without sharp bends or upward sections. Care should also be taken to avoid crossing or running conductors in close proximity to electrical cables.

When external routing is impracticable, the down-conductor may be internally routed. However, this is not recommended as it reduces the effectiveness of the lightning protection system, makes maintenance difficult and increases the risk of voltage surges.

The number of down-conductor fixings is determined by considering 3 clips per metre as a reference.

Operation of early streamer emission air terminals is based on the electric characteristics of lightning formation. Lightning begins with a down-conductor which spreads in any direction. Once it approaches the objects on the ground, any of them can be struck. The objective of an external lightning protection system is to control the lightning strike point and provide the lightning current with a path to earth avoiding damage to the structure.

The components for a lightning protection system using ESE air terminals are as follows:

**EXTERNAL LIGHTNING PROTECTION SYSTEM**
- One or more air terminals.
- Two or more down-conductors.
- An earth termination system.

**INTERNAL LIGHTNING PROTECTION SYSTEM**
- A suitable surge protection installation.
- Other measures minimizing the destructive effects of lightning (equipotential bonding, screening etc.).

The installation of the LPS using ESE air terminals must follow the relevant standards (NF C 17-122, UNE 21186 or similar):

**PROTECTION RADIUS (R)***

Calculated according to UNE 21186:2011, NF C 17-102:2011 and NP 4426:2013

**PROTECTION LEVEL I**
- AT-1515
- AT-1530
- AT-1545
- AT-1560

**PROTECTION LEVEL II**
- AT-2515 (D=20 m)
- AT-2530 (D=30 m)
- AT-2545
- AT-2560

**PROTECTION LEVEL III**
- AT-2515
- AT-2530
- AT-2545
- AT-2560

**PROTECTION LEVEL IV**
- AT-2515
- AT-2530
- AT-2545
- AT-2560

**DOWN-CONDUCTORS**
- Each air terminal must be earthed using two down-conductors located outside the structure. They will preferably be on different external walls of the building.
- Each down-conductor should be installed such that its routing is as straight as possible and takes the shortest path to earth without sharp bends or upward sections.
- Care should also be taken to avoid crossing or running conductors in close proximity to electrical cables.
- When external routing is impracticable, the down-conductor may be internally routed. However, this is not recommended as it reduces the effectiveness of the lightning protection system, makes maintenance difficult and increases the risk of voltage surges.
- The number of down-conductor fixings is determined by considering 3 clips per metre as a reference.

**EARTHING**
- Each down-conductor must have an earth termination system. Earth termination systems should be located outside the building, except where this is absolutely impossible.
- The resistance of the earth termination system measured by conventional means must be lower than 10 Ω, when separated from other conductive elements.
- Connection with the earth terminal system must be made directly at the bottom of each down-conductor, using a device that allows the disconnection of the earth electrode and should be placed inside an inspection pit marked with the earth symbol.
- The inductance of the earth termination system must be as low as possible. The recommended arrangement is vertical electrodes forming a triangle with a minimum total length of 6 m. The vertical electrodes must be bonded with a conductor buried 50 cm deep and separated by a greater distance than their length.
- The use of a soil conductivity improver is recommended in high resistivity ground.
- All earth termination systems should be bonded together and to the general earthing system of the building.
- It is recommended to use a spark gap to connect the lightning earth termination system to the general earth system, as well as the lightning air terminal mast to any aerials.
- All elements of the lightning rod earth termination system must always be at least 5 m from any buried metal or electrical pipes.