CMCE100 Radius of Protection Calculation Methods

Provided calculation methods were validated through the study and observation of actual installations throughout the world on different types of structures, at different heights, in the high seas, in mountains, and areas with high levels of activity.

The calculation of the overage radius is based on the requirements of standard UNE-EN-IEC 62305part 1.

According to laboratory impulse tests of short and long currents (10/350), mandatory for devices used to protect against lightning, results show that in the first impulse of short current of 103 KA, that the device did not suffer any flaw.

According to standard UNE-EN-IEC 623051(part 1) age 40, point A4, the efficiency of capture of a Lightning Protection System (LPS) depends on the minimum values of the lightning current and the radius of coverage of the corresponding theoretical sphere. The geometrical boundaries of protected areas against direct discharges can be determined by the **Rolling Sphere Method**. Following the electromagnetic model, the radius of the theoretical sphere is correlated with the current crest value of the first short impact, as follows:

$$R_{fic} + 10 \cdot I^{0.65}$$

R_{fic} = radius of the fictitious sphere (m)
I = Value of the current slope (kA)

- The CMCE 100, in high voltage laboratory tests (640 KV), the beam does not appear.
- On a conventional tip (variable data) the beam appears at $\pm$ 540 KV (medium).
- We can ensure that with a minimum of 20% more electric field is needed for it to saturate (greater ionization surface).
- Taking into account that at 103 KA of short impulse, the CMCE 100 passes without defects.

$$R_{fic} = 10 \cdot I^{0.65} = 10 \cdot 103^{0.65} = 203{,}39 \approx 203 \text{ m}$$

When we apply the Rolling Sphere Method the value yields a radius of 101.5 m.

This is the radius of coverage (101.5) in the worst possible conditions, that is, counting a saturation field value similar to that of a conventional tip and taking into account a compensating power of the CMCE field electricity limited to average operating conditions (medium earth resistance conditions and average absorption capacity).

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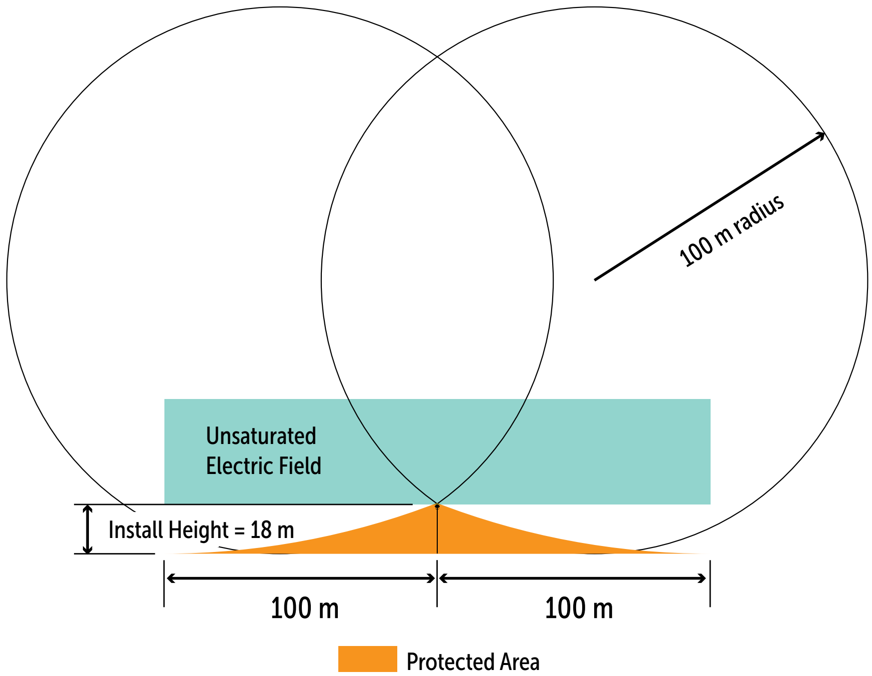

Calculation of the coverage radius using the Rolling Sphere Method according to UNE 21186 and NFC 17.102. Because there is no defined standard for deionizing devices like ours, we theoretically short-circuited a CMCE Device to emulate a conventional Franklin-type system.

The UNE 21186 Standard explains how the protection radius (R_p) of a lightning arrester is calculated according to its height. This equation can be used for h≥5 m.

Taking into account the CMCE 100 priming advance time (**Δt=32μs),** according to tests carried out in several high voltage laboratories and applying the corresponding equation:

$$R_p = \sqrt{2Dh - h^2 + \Delta L(2D+\Delta L)}$$

R_p: Protection radius

h: Height of the collector above the reference plane of the area to be protected

D: Radius of the rolling sphere depending on the class of LPS

ΔL: V(m/μs) x Δt(μs)

V: Speed of propagation of plotters **(m/μs)**

Note: For an estimated calculation, the tracer speed **V=1m/μs** is on average.