

# E.S.E. Lightning rod



The Lightning rod



COMPLIANT TO NF C 17 102  
SEPTEMBER 2011 VERSION





ProtecFoudre is a famous French brand of lightning protection systems. It dedicates to develop and market a range of innovative products and services.

Based on the most recent scientific research outcomes, ProtecFoudre introduces the PrimeR®, the first tip electronic variation technology-powered Early Streamer Emission lightning rod.

**NEW UNIQUE AND PATENTED TECHNOLOGY:  
THE TIP CONFIGURATION ELECTRONIC  
VARIATION**

**TIP SHAPE AND LIGHTNING ROD  
CAPABILITIES CORRELATION.**

Recent lightning research has established that lightning rod performances, when submitted to an intense electrical field – as per thunderstorm conditions - are deviating to a large extent, depending on their tip shapes:

- A rounded tip delays the corona effect outbreak.
- A sharp pointed tip triggers an upward leader more efficiently as soon as the ambient electric field increases, sign of a risk of lightning strike.

**THE PERFECT SHAPE AT THE RIGHT  
TIME.**

An artificially rounded tip will initially prevent the emergence of immature corona pulses. This maintains a clean environment favoring the lightning discharge process. In a second step, the highly-amplified sharp tip triggers corona pulses in line with the electric field evolution ie. once the E Field development can support the propagation of the upward leader. This “blunt to sharp” tip shape construction provides the perfect shape to trigger a timely upward leader.

The PrimeR® daringly innovative design is based on this concept.

**NEW UNIQUE AND PATENTED  
TECHNOLOGY: THE TIP  
CONFIGURATION ELECTRONIC  
VARIATION.**

The PrimeR® working principle is the electronically controlled variation of the tip shape: an auxiliary high voltage is applied on a ring surrounding the tip, distorting the electric field lines. The behaviour of the rod goes from a rounded tip-alike geometry to a sharp one. The lightning rod optimum efficiency is ensured by the synchronisation of its operation with the natural phenomenon.

The auxiliary circuit is fully autonomous and powered by the increasing atmospheric electric field. It comes into action short before the lightning discharge.

This design consolidates the benefits of both tip shapes: the Corona effect development is constantly controlled with a round tip geometry that switches to a sharp-type, ensuring ideal conditions for the upward leader emission development, under mature atmospheric electric field conditions.



## FIRST EARLY STREAMER EMISSION LIGHTNING ROD COMPLIANT TO THE SEPTEMBER 2011 NF C 17-102 STANDARD

The European reference standard for the design and installation of Early Streamer Emission lightning protection systems is the September 2011 version of the NF C 17-102 standard.

The Annex C "ESE Air terminal testing procedures and requirements" is much more compelling including a broader range of new tests that did not feature in previous versions.

The **PrimeR**® is an Early Streamer Emission lightning rod:

- with a simple and very effective working principle based on the latest researches on thunderstorms, lightning and leaders propagation;
- that conforms to the September 2011 NF C 17 102 with complete tests by independent parties according to the Annex C "ESE Lightning Conductor assessment procedures".
- which robust design and construction features ensure full reliability in most severe climatic environment and 100 kA current discharges withstanding (10/350 waveform)

Advantages of the **PrimeR**®:

- Fully autonomous lightning rod (no battery required); thunderstorm electrical field power supplied
- Lightning rod becomes active only when a lightning strike may occur
- Full continuity from the tip to the earthing termination with an active unit installed in parallel to the main rod.



### PRIMER® DATASHEET:

Gain in triggering time	▶ $\Delta T$	45 $\mu s$
Dimensions	▶ Length	457 mm
	▶ Diameter (body)	60 mm
	▶ Diameter (maxi.)	97 mm
	▶ Diameter (rod)	20 mm
Weight		2,5 kg
Connection	▶ Threaded	M 20

## PROTECTION RADIUS

The NF C 17 102 version 2011 is giving two calculation formula for the evaluation of an Early Streamer Emission rod.

The ESE lightning rod protection radius is based on its height (h) above the protected structure, its gain in triggering time and the selected protection level:

$$\text{if } h \geq 5 \text{ m: } R(h) = \sqrt{2rh - h^2 + \Delta(2r + \Delta)}$$

&

$$\text{if } 2 \text{ m} \leq h \leq 5 \text{ m: } R_p = h \times R_p(5) / 5$$

- $R_p(h)$  (m) is the protection radius at the height  $h$  ;
- $h$  (m) is the ESE rod tip height relative to the horizontal plane passing through the top of the structure to be protected.
- $r$  (m) is
  - 20 m for protection level I ;
  - 30 m for protection level II ;
  - 45 m for protection level III ;
  - 60 m for protection level IV ;
- $\Delta$  (m) :
  - $\Delta T \times 10^6$
  - Where  $\Delta T$  is the triggering advance determined by the High Voltage Laboratory assessment tests (NF C 17 102 Annex C).
- for the **PrimeR®** :
  - $\Delta T (\mu s) = 45$
  - (refer to HV Lab test certificate available on request)

### PrimeR® Protection Radii

Height	Protection Level			
	Level I	Level II	Level III	Level IV
$h = 2 \text{ m}$	25	28	32	35
$h = 3 \text{ m}$	37	42	48	53
$h = 4 \text{ m}$	50	56	64	71
<b><math>h = 5 \text{ m}</math></b>	<b>63</b>	<b>70</b>	<b>80</b>	<b>89</b>
$h = 10 \text{ m}$	64	72	83	92
$h = 20 \text{ m}$	64	74	86	97

