



CONTINUOUS RESEARCH FOR OPTIMUM RELIABILITY

At France Paratonnerres, our objective is to ensure that the equipment we offer you is totally reliable, which is why research goes on all the time. The perfection of the IONIFLASH air terminal based on the development of the ionising system, is the culmination of many years of research. Experiments carried out in the Electricity of France (EDF) Very High Voltage research laboratory provided the information necessary for the creation of the First IONIFLASH. Other trials are regularly carried out to enhance the performance of equipment, which is becoming increasingly reliable.

It is thanks to this innovative spirit that France Paratonnerres have won the confidence of such prestigious clients as France Telecom - EDF - The French Army - CEA - The National Centre for Space Research - the Ministry of Culture - TDF - the Bank of France, etc.

CONVINCING TRIALS

- 1988-1989:

An on-site comparative test, between an IONIFLASH and a simple air terminal on a France Telecom pylon.

In one year, 7 lightning strikes occurred on the IONIFLASH, none on the simple air terminal of the same length.

« To date, no other air terminal has managed to equal this test ».

Communication Mr. Damour France Telecom in RGE N° 7 - July 1991.

- 1996:

Very High Voltage Laboratory in the University of Pau; basic research carried out over 3 months, focusing on the operation of different early streamer emission air terminal systems.

This research made it clear that in the present state of knowledge, only the IONIFLASH system can significantly improve the performance of the simple air terminal, regardless of trial conditions.

EXPERTISE BASED ON UNDERSTANDING

To understand the action of a lightning conductor, it is essential to know how lightning is formed. The lightning stroke begins with the creation in the depths of the cloud of a leader tracer, which travels in leaps towards the earth.

This is the downward tracer.

The presence of the stormy cloud increases the electrical field of the atmosphere at ground level.

This variation causes a "crown effect" to appear at the point of all geometrical structures; it is this natural ionisation which brings about the formation of the upward tracer.

The lightning stroke, born of the downward tracer, makes a direct strike on the earth, a building or a person, causing considerable damage to property and living creatures. In the average negative lightning stroke, the maximum intensity of the current is 25,000 amperes.

Racing circuit Les 24 heures du Mans



TECHNOLOGY AT THE SERVICE OF SAFETY

The purpose of the lightning conductor is to emit a rising electrical discharge to deflect the effect of the downward tracer. As it is transmitted towards the cloud, this rising discharge creates a field which is sufficient to modify the path of the downward tracer: the lightning current is thus dispersed into the earth. This process can occur naturally, but the action of the IONIFLASH triggers it more rapidly and therefore ensures more effective protection.

This is the concept of early streamer emission.



Disneyland Paris



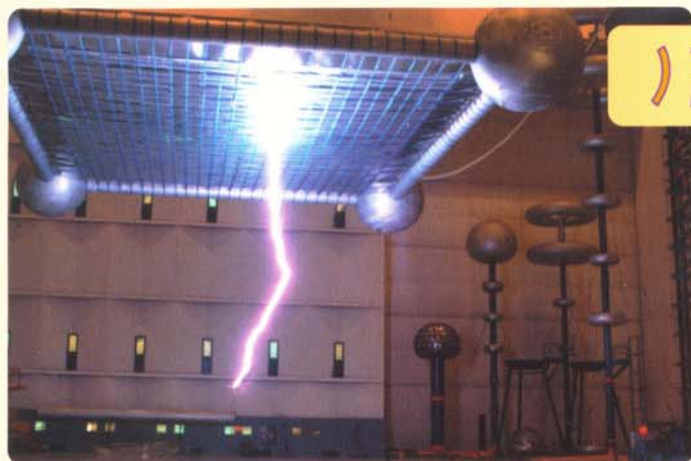
IONIFLASH: THE CHOICE OF RELIABILITY

Reliability is the essential quality of the IONIFLASH.

This is provided by the following:

- The operating principle of the early streamer emission, which does not require any fragile components (so no risk of failure).
- The unparalleled accuracy of the ionisation; we are talking about millionths of a second.
- The materials used in its manufacture: copper and stainless steel are chosen for their excellent resistance to corrosion.
- Its qualities of independent operation and reliability mean that it can even be installed in places which are difficult to reach, such as church towers and spires.

Example of a shock created in the EDF Very High Voltage Laboratory at "Les Renardières"



TEST REPORTS ON THE IONIFLASH AIR TERMINAL

Since July 1995, the results of the early streamer emission air terminals (E.S.E.) have been determined according to laboratory obtained results, using the evaluation procedure of the NF C 17-102 standard. France Paratonnerres chose the Electrical Discharge Laboratory in the University of Pau (France) to characterise the performances of the IONIFLASH according to this procedure.

Procedure for standardised tests:

The evaluation of the average value of dT must be carried out on series of 100 shocks, respectively on 2 configurations corresponding to the

early streamer emission air terminal (E.S.E.) and the simple air terminal. The natural field conditions are simulated in the laboratory by the superposition of a permanent electrical field and of an impulse field associated with an electrode in the form of a plate situated at distance H from the ground.

The permanent field conditions resulting from the distribution of the charges into the cloud are established by a continuous negative polarity voltage applied to the plate electrode, producing a field of 10 to 20 kV/m.

The impulse field resulting from the approach of the downward tracer is simulated by a bi-exponential negative polarity voltage wave applied to the plate. The rise time is defined at 30% - 90% is 650 microseconds and the slope of the wave during the development phase of the discharge is situated at around 10 GV/m/s.

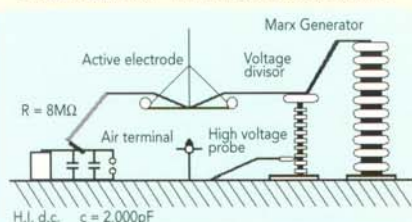
TEST'S RESULT

IONIFLASH air terminal early streamer emission time approved: 129 μ s

IONIFLASH Benjamin air terminal early streamer emission time approved: 120 μ s

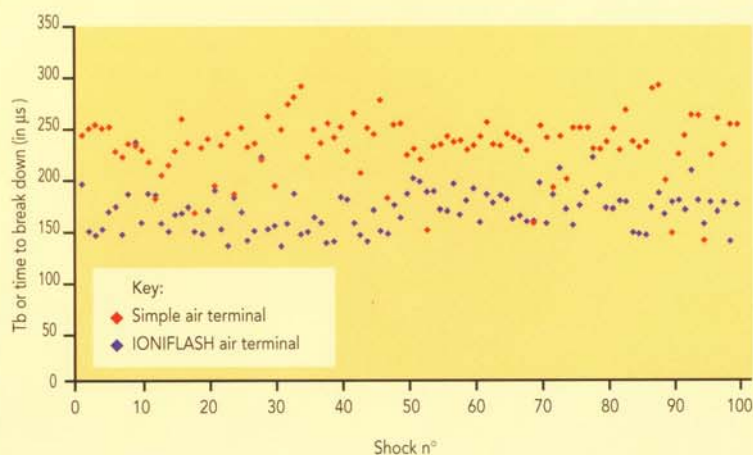
The version of the NF C 17-102 standard from December 2001 has favoured the installations' security by weighting the early streamer emission time to 60 μ s for all powerful E.S.E. air terminals, which exceed this value. From now on both IONIFLASH models use this value of 60 μ s for the calculation of protection radiuses.

DIAGRAM OF THE TEST ASSEMBLY



Plan of mass

COMPARATIVE STUDY OF THE EVOLUTION IN TIME OF T_b



RADIUS OF PROTECTION OF THE IONIFLASH AIR TERMINAL

The radius of protection of an E.S.E. air terminal depends on its height (h) in relation to the surface to be protected, its early streamer emission time and the level of protection chosen.

$$R_p = \sqrt{h(2D - h)} + \Delta L(2D + \Delta L) \text{ for } h \geq 5 \text{ m}$$

For $h < 5 \text{ m}$, the graphic method is used, with the abacuses 2.2.3.3. a, b and c of the NF C 17-102 standard.

R_p : protection radius.

h: height of the point of the E.S.E. air terminal in relation to the horizontal point passing through the top of the element to be protected.

D: 20 m for protection level I

45 m for protection level II

60 m for protection level III

$$\Delta L: \Delta L_{(m)} = V_{(m/\mu s)} \Delta T_{(\mu s)}$$

ΔT : early streamer emission time from the evaluation tests of the E.S.E. air terminal.

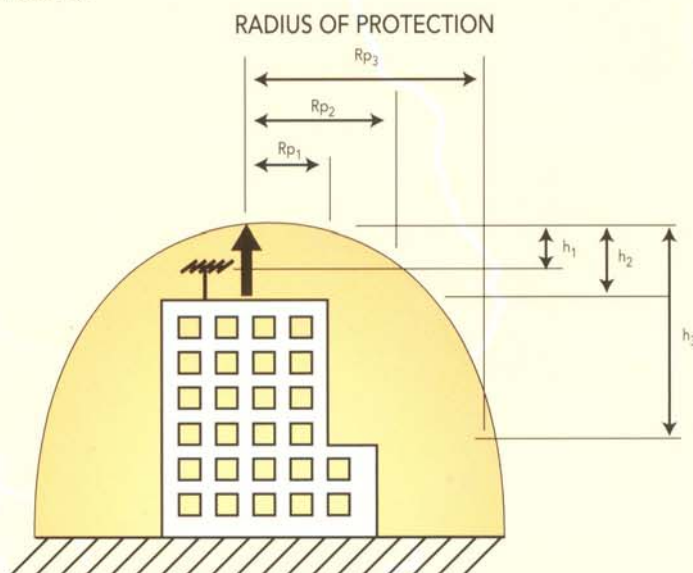
PROTECTED AREA

The protected area is delimited by the revolution enclosure of the same axis as the E.S.E. air terminal and defined by the protection radius corresponding to the different heights h considered (see diagram below):

Lightning rod height	PROTECTION RADIUS OF AIR TERMINALS IONIFLASH AND IONIFLASH BENJAMIN in meters ⁽¹⁾ (according to standards)		
	Level 1 ⁽²⁾	Level 2 ⁽²⁾	Level 3 ⁽²⁾
h (m)			
2	32	40	44
3	48	59	65
4	65	78	86
5	79	97	107
6	79	97	107
8	79	98	108
10	79	99	109
20	80	102	113
40	77	105	118
60	69	104	120

(1) If there is a risk for environment (C5 = 10), the protection radius is reduced to 40 % according to the interpretation sheet of the NF C 17-102 standard from December 2001.

(2) The protection level is determined up to NF C 17-102 standard (enclosure B).



h_n : height of the point of the E.S.E. air terminal in relation to the horizontal plane passing through the top of the element to be protected.

R_{p_n} : protection radius of the E.S.E. air terminal for the height under consideration.

FRANCE PARATONNERRES PROPOSE FOR YOU:

- IONIFLASH technical documentation and general catalogue for protection against lightning in French, English or Spanish.
- A Research and Advice Department.
- Installation and Inspection of equipment.
- Worldwide distribution.