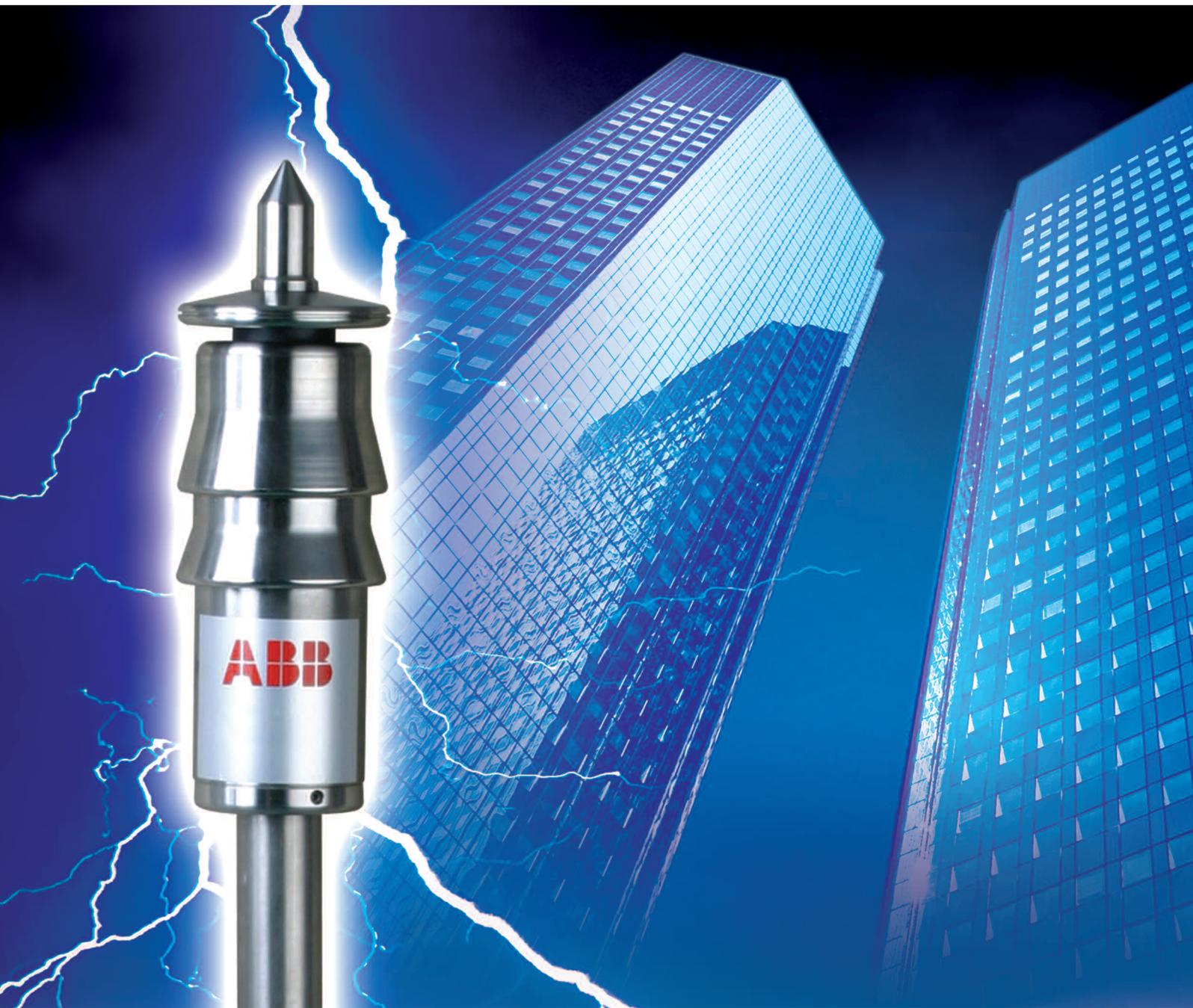


Lightning Protection



ABB

OPR Range

▶ The high pulse voltage E.S.E lightning conductor

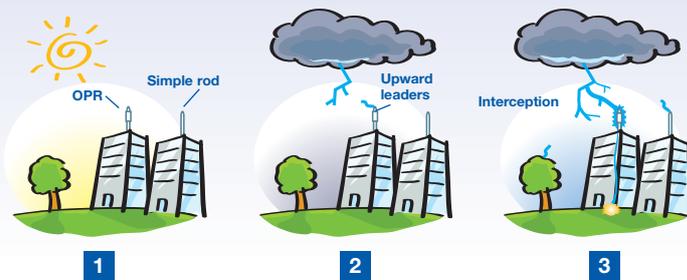
In ongoing collaboration with its Research Centerlab, ABB continues to innovate, and has developed a new generation of lightning devices.

The new OPR (Optimized Pulse Rod) range with increased initiation advance performances, represents further progress in terms of protection, operating autonomy and ease of maintenance.

These advancements reinforce ABB's position as international leader in direct lightning protection.



▶ The advantage of initiation advance



The unique efficiency of the OPR lightning conductor is based on a specific initiation advance ; well before the natural formation of an upward leader, the OPR generates a leader that rapidly propagates to capture the lightning and direct it to earth.

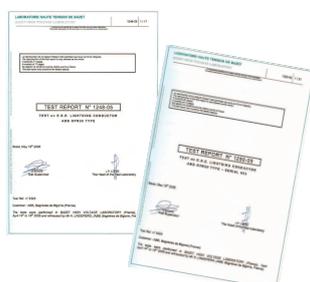
Validated in laboratory, this gain in time relative to the simple rod provides additional essential protection.

▶ Complete autonomy

During a storm the ambient electric field may rise to between 10 to 20 kV/m. As soon as the field exceeds a threshold representing the minimum risk of a lightning strike, the OPR lightning terminal is activated. It draws its energy from the ambient electric field the energy required to generate high voltage pulses, creating and propagating an upward leader. No other power sources are required, and no radioactive components are used.

▶ Proven efficiency

ABB has proven commitment to research and development and continuously sets new benchmarks for the efficiency of lightning conductors.

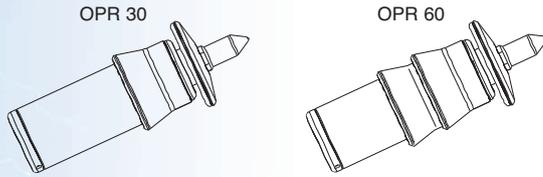


▶ OPR certificates.

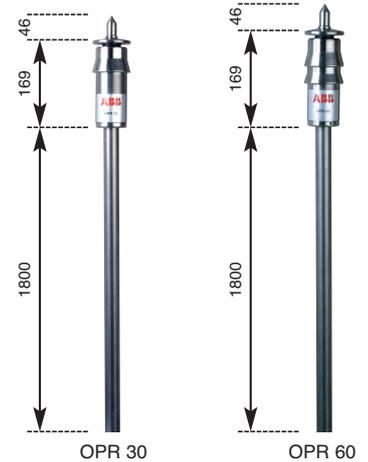
Ascending discharge on an OPR during the test procedure in WHVRI (Wuhan High Voltage Research Institute).



▶ OPR References

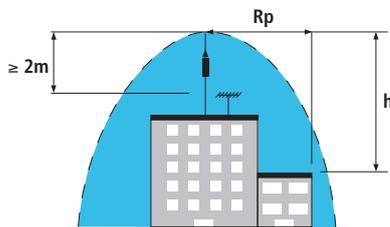


Δt (μs)	Description	Order code	Reference	L(m)	Weight (kg)
30	OPR 30 stainless steel	2CTB899800R7000	OPR30	2,015	2,19
60	OPR 60 stainless steel	2CTB899800R7100	OPR60	2,015	2,36



▶ Calculation of protected areas

The radius of protection R_p of a OPR is given by the French standard NF C 17-102 of July 1995. It depends on the initiation advance ΔT of the OPR measured in the high voltage Laboratory, on the levels of protection I, II, III calculated according to the lightning risk assessment guide (Appendix B of the French standard NF C 17-102) and the height h of the lightning conductor over the area to be protected (minimum height = 2m).



R_p : radius of protection in a horizontal plane located at a vertical distance h from the OPR tip.

h : height of the OPR tip above the surface(s) to be protected.

D : standardised striking distance.

$\Delta L = 10^6 \cdot \Delta T$ (initiation advance)

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

For $h < 5m$, see the radius of protection table opposite.

ΔT = initiation advance measured during efficiency tests according to appendix C of the French standard NF C 17-102

OPR radius of protection

Level of protection	I (D = 20 m)		II (D = 45 m)		III (D = 60 m)	
	OPR 30	OPR 60	OPR 30	OPR 60	OPR 30	OPR 60
OPR						
$h(m)$	Radius of protection R_p (m)					
2	19	32	25	40	28	44
3	28	48	38	59	42	65
4	38	64	50	78	57	87
5	48	79	63	97	71	107
6	48	79	64	97	72	107
8	49	79	65	98	73	108
10	49	79	66	99	75	109
15	50	80	69	101	78	111
20	50	80	71	102	81	113
45	50	80	75	105	89	119
60	50	80	75	105	90	120

The level of protection is calculated according to appendix B of the French standard NF C 17-102.

For the OPR 60, limiting the value of ΔT , that used in the radius of protection calculation, to 60 μs has been validated by the experiment conducted by the members of Gimelec (Group of Industries for Materials for Electrical Equipment and associated Industrial Electronics).

▶ ABB Manufacturing Quality

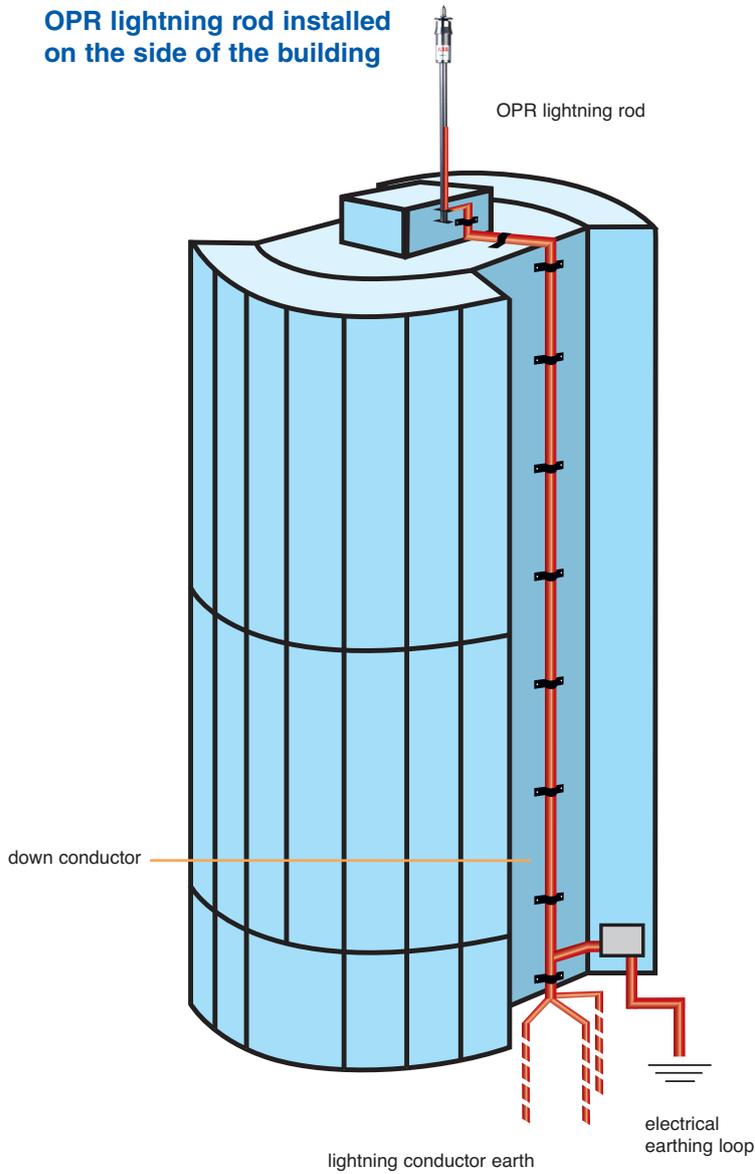
The reputation of the OPR has been earned through maintaining a consistently high quality in manufacturing. Before leaving the factory, each OPR has been tested for insulation breakdown at high voltage,

and subjected to a current test that ensures its performance when conducting lightning discharges. The high voltage output pulses at the OPR are also examined to verify correct amplitude and frequency.

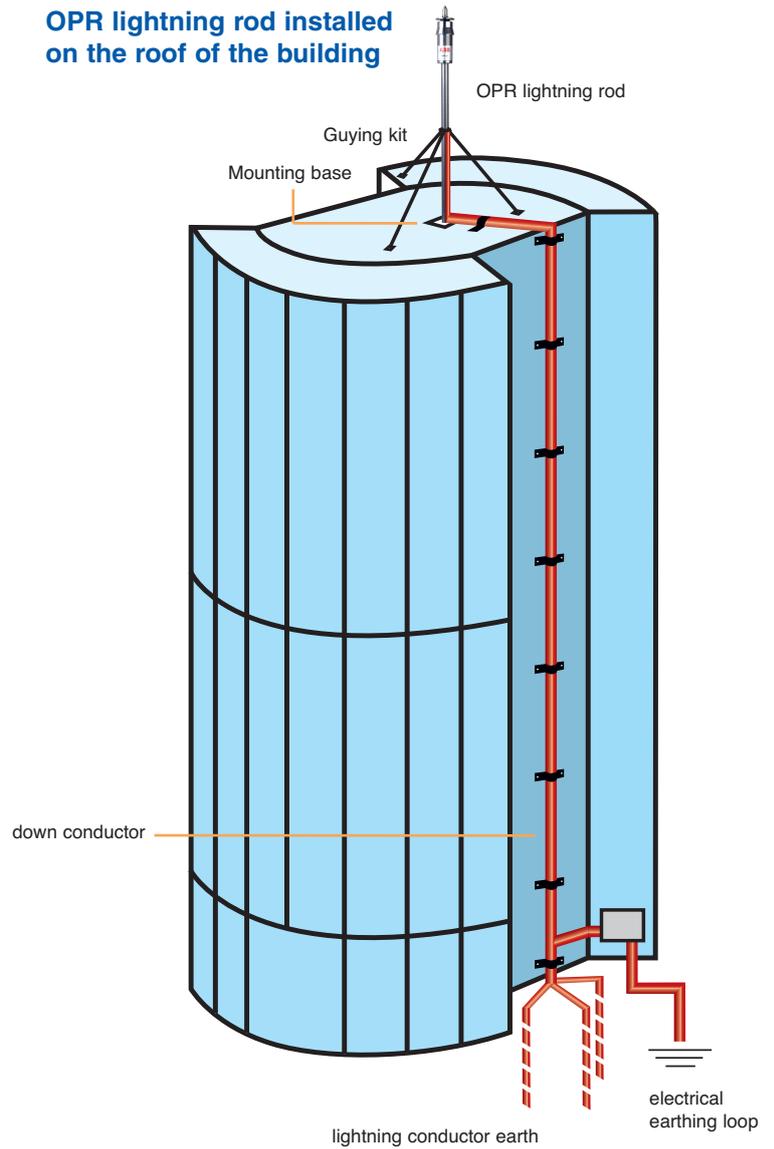
The OPR is built to withstand the arduous conditions encountered in service, and its ongoing performance can be monitored simply and quickly using the OPR test set.

▶ Early Streamer Emission lightning conductor : OPR

OPR lightning rod installed on the side of the building



OPR lightning rod installed on the roof of the building



ABB

ABB Lightning protection group

1, Avenue des victimes du 11 Juin 1944
65203 - Bagnères de Bigorre / France
Tél : + 33 (0) 5 62 91 45 60
Fax : + 33 (0) 5 62 95 42 99