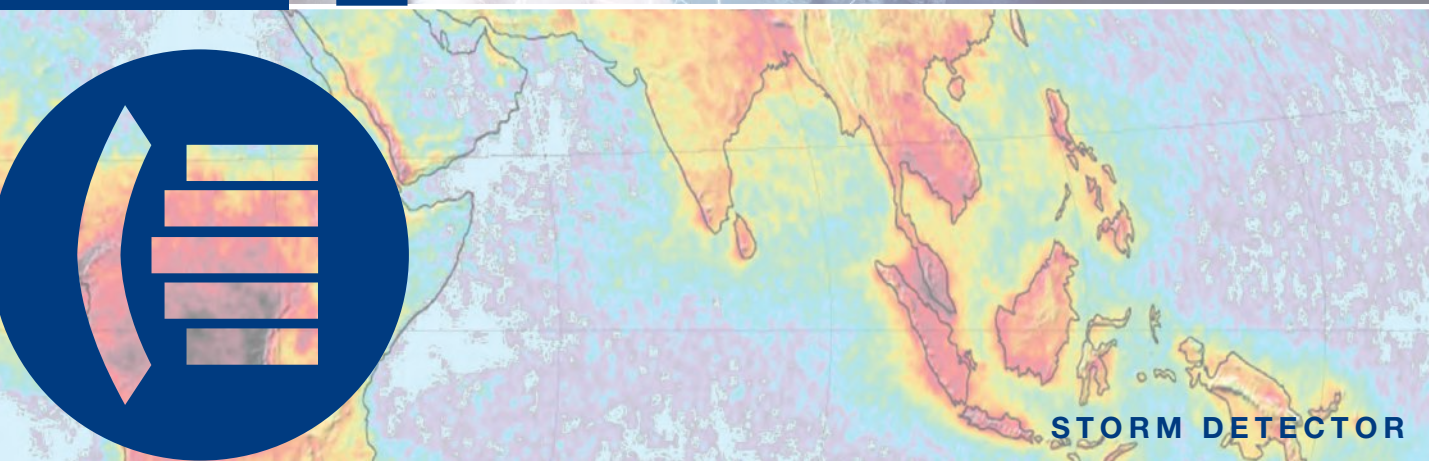




INGESCO

LIGHTNING SOLUTIONS



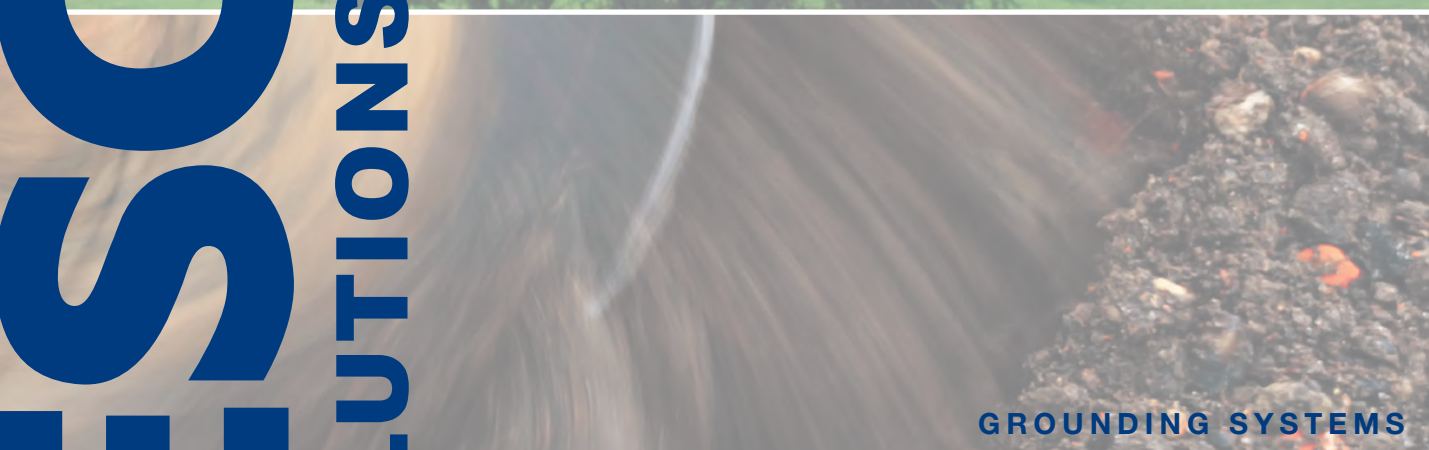
STORM DETECTOR



SURGE ARRESTORS



CONTROL SYSTEMS



GROUNDING SYSTEMS



EXTERNAL LIGHTNING PROTECTION

INGESCO

LIGHTNING SOLUTIONS



PRODUCTS & SERVICES • 2018

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“A commitment to a world where
heaven and earth are united in balance”

Since 1973, INGESCO has been a specialist in solutions for the prevention and protection against lightning.

Reference

We are the leading company in the design, manufacture and control systems for the prevention and protection against lightning.

International vocation

We export to over 50 countries worldwide. Our comprehensive and analytical view has made us one of the most advanced companies in the sector worldwide.

Comprehensive and transversal

We offer a comprehensive and transversal service. We cover all stages, from research and development to installation and certification.

Tailored Solutions

We offer a personalized service tailored to all needs, with prompt answers to your queries. We assist in the search and implementation of safe and effective solutions.

Training

We share the news and current events of lightning protection and prevention systems in a multidisciplinary field. Because knowledge improves your safety.

Research and innovation

Our engineering team works daily on new materials and devices for more efficient integrated solutions. Our challenge is to improve your lightning safety.

Design and manufacture

We manufacture lightning rods and capture meshes, surge protectors and preventive protection products. We test all our products in the LABLEC, high voltage laboratory accredited by ENAC, as well as actual test conditions in the natural environment. Our offer fits your needs to guarantee safety.

Certification and control

Our inspection body is accredited by ENAC and certifies all phases of the process: design and construction management, installation and periodic inspection of facilities. We offer an impartial and objective assessment of any protection system.





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ACTIVE RODS: PDC (ESE) LIGHTNING RODS

► standards

Implementing rules for an effective person and property protection system:

- **UNE 21186:2011:** Lightning protection - Lightning rods with priming device.
- **NF C 17-102:2011:** Early streamer emission lightning protection systems.
- **NP 4426:2013:** Lightning protection - systems with non-radioactive ionization device.

In addition to these, there may be legislation or rules of each country that must be taken into account.

► risk index calculation

Annex A (risk analysis) of the UNE 21186: 2011 determines the need or not to install external lightning protection and the level of protection applied to reduce the risk of damage caused by lightning.

INGESCO has an online tool which allows the calculation of risk and the implementation of protective measures quickly and easily. Introducing the characteristics of the structure to be protected, geographical location, activity, etc ..., provides protection levels to be applied, and generates a report of the information provided.

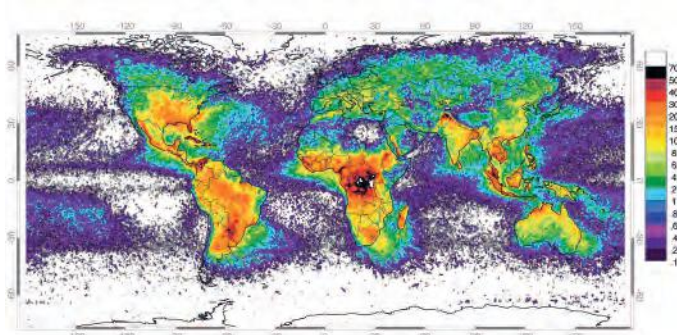


Fig. 1 - Lightning distribution map.



Fig. 2 - www.ingesco.com/estudios

► protection radius calculation

Lightning rods with an early streamer emission priming device (ESE), have a protection radius depending on the necessary protective level to be obtained by performing tests in accordance with UNE 21186: 2011 or NF C 17102: 2011, and must be certified by an accredited high voltage laboratory.

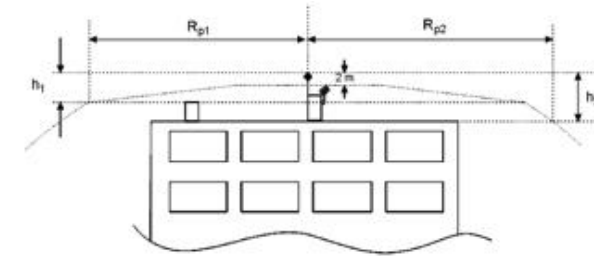
Model	PDC 3.1	PDC 3.3	PDC 4.3	PDC 5.3	PDC 6.3	PDC 6.4
Ref.	101000	101001	101003	101005	101008	101009
Δt	15μs	25μs	34μs	43μs	54μs	60μs

Tabla 1 - Early streamer ΔT(μs) INGESCO ESE lightning rods.

UNE 2118: 2011 (paragraph C.2.2) indicates that a ESE lightning rod must obtain an early streamer emission ΔT > 10 μs minimum.

Also, the maximum permissible value is 60μs although tests were obtained with superior results.

The area to be protected by a ESE arrester is delimited by a surface of revolution that is defined by the radius of the corresponding protection to different heights (h) considered, whose axis is the same ESE arrester.



Protection Level	Notional sphere radius (r)
I	20 m
II	30 m
III	45 m
IV	60 m

Table 2 - The notional sphere radius r based on the level of protection.

$$a) \text{ If } 2\text{m} \leq h \leq 5\text{m}: R_p = \frac{h \cdot R_p(5)}{5}$$

$$b) \text{ If } \geq 5\text{m}: R_p = \sqrt{[(2 \cdot r \cdot h) - (h^2)] + [\Delta \cdot (2 \cdot r + \Delta)]}$$

Whereas:

R_p: Resulting protection radius.

r: The radius of the notional sphere. Predetermined standard value according to the applicable security level (see Table 2).

h: The height from the tip of the ESE to the point where we want to calculate the radius of protection.

Δ: Advance arrester priming considered (ΔT) in meters.

► example radius protection calculation R_p (model INGESCO PDC 3.1):

To calculate the different radii of protection of a ESE lightning rod, we must know the variables involved in the formulation:

- INGESCO PDC 3.1 model has ΔT=15 μs and thus **Δ=15 m**.
- Apply level II protection, the notional sphere radius corresponds to **r = 30m**.
- Consider the height **h = 20m**.

Each R_{p_n} radii are calculated, for each reference point, using the formula:

$$R_{p_n} = \sqrt{[(2 \cdot r \cdot h_n) - (h_n^2)] + [\Delta \cdot (2 \cdot r + \Delta)]}$$

For the given model the radii are shown in table 3:

h (m)	Radius (m) Level II
2	15
4	30
6	38
10	40
20	43

The total volume of protection can be represented graphically (See Fig.3).

Once each radius is calculated R_p, verify that the building remains within the lightning rod protection radius (see Fig.4).

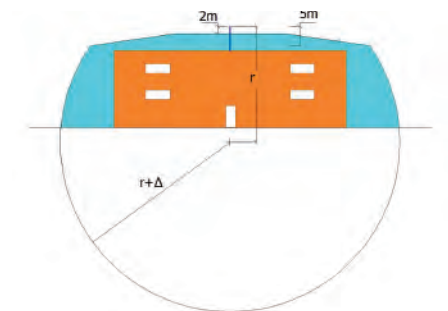


Fig. 3 - Volume protected with ESE lightning rod.



Fig. 4 - ESE protection volume.

PASSIVE SYSTEMS: FRANKLIN RODS – CAPTURE MESHES

► standards

In order to design an effective lightning protection system with Franklin rods or capturing meshes, the following rules shall apply:

- **IEC 62305:2013** Lightning protection (Parts 1, 2, 3 y 4).
- **UNE - EN 62305:2011** Protection against lightning (Parts 1, 2, 3 y 4).
- **NFPA 780:2014** Standard for the installation of lightning protection systems.

In addition to these rules, legislation may exist in each country to be taken into account.

► risk calculation

INGESCO has an online tool that allows the risk calculation according to IEC 62305 (Part 2), which allows the calculation of risk and the implementation of protective measures quickly and easily (see Fig.2).

► calculation methods of the protection zone

Accepted methods for determining the area of passive protection systems according to IEC 62305 (Part 3) are:

• Protective angle method

It is best suited method for buildings with simple shapes, although it is limited to a maximum height to the level of protection applied (Fig.5).

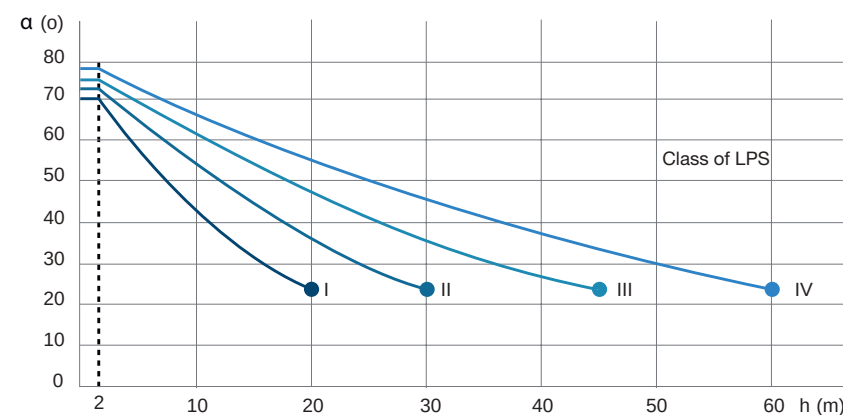


Fig. 5 – Angles α corresponding to protection classes of IEC 62305-3 LPS.

The volume of protection resulting from the application of the protection angle method in a termination rod is shown in Fig.6.

Once calculated, the different angles of protection of the termination rods that make up the system verifies that the building is fully protected (Fig 7).

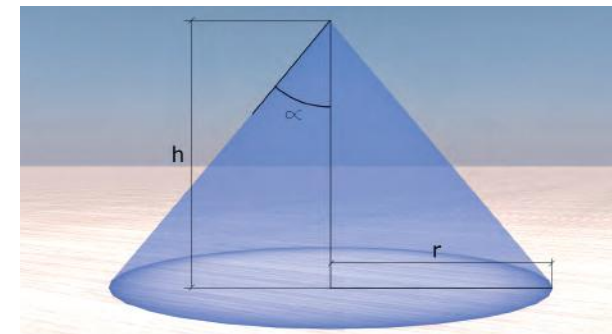


Fig. 6 – Protected volume by a vertical point. IEC 62305-3.



Fig. 7 – Protection volume angles α_1 and α_2 depending on heights h_1 and h_2 .

• Rolling sphere method and the mesh method

When a structure has a height higher than indicated in Figure 5, the protection angle method is not applicable. For these cases, IEC 62305-3 indicates to use: **rolling sphere method** (valid for all types of buildings), or **mesh method** (indicated when flat surfaces are protected) (see Fig.9).

Protection method		
Class of LPS	Radius of rolling sphere r (m)	Size of the mesh W_m (m)
I	20	5x5
II	30	10x10
III	45	15x15
IV	60	20x20

Table 4 – Maximum values of rolling sphere and mesh size for each class of LPS.

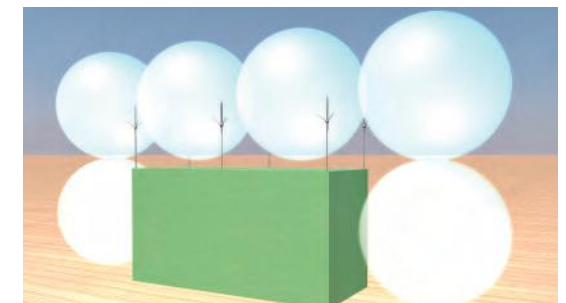


Fig. 8 – Protected volume by the rolling sphere method.

Applying the rolling sphere method. The location of the capture system (point or mesh) is adequate if any point of the protected structure comes into contact with a notional sphere of radius r (see Table 4).

Taller structures remaining above the Faraday cage should be protected with lightning rods (see Fig. 10).



LEVEL I



LEVEL II



LEVEL III



LEVEL IV

Fig. 9 – Protection grids based on the levels of protection.

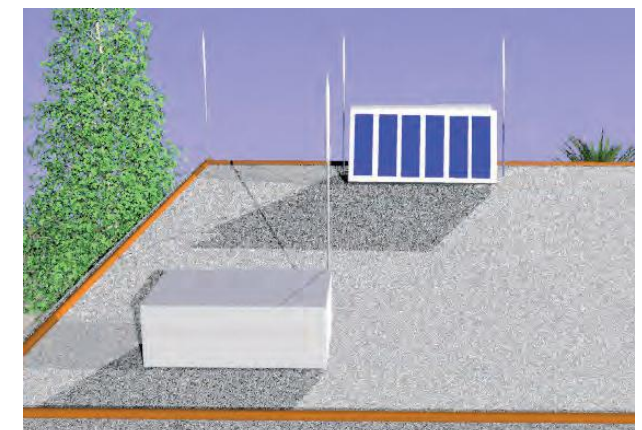


Fig. 10 – Protection of protruding structures with a capture mesh system by lightning rods.

DOWN CONDUCTORS

► ESE down conductors

The down conductors are intended to conduct lightning current from the collection devices to the grounding.

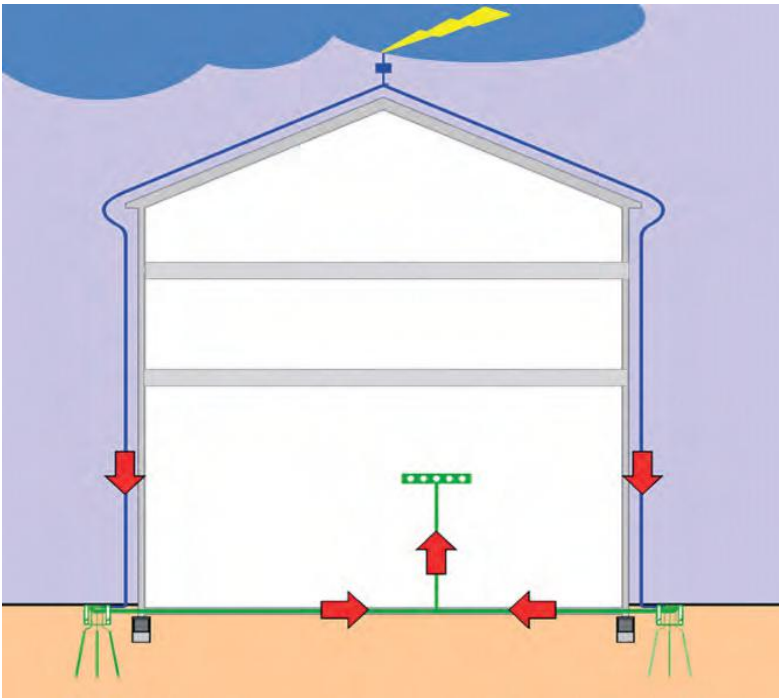


Fig. 11 – Down conductors of LPS by ESE.

The lightning rod is connected to ground with at least two down conductors located on opposite facades whenever possible (Fig.11).

The down conductors must be installed outside the building, avoiding the proximity of electrical cables and gas. Its path must be as straight as possible, using the shortest path to earth, avoiding any sharp bend or lift.

When several ESEs are installed on the same building they can share down conductors.

Due to the nature of the lightning strike, down conductors should respect the materials and dimensions specified in IEC 62561-2. Those indicated in table 5 are the most recommended materials.

Material	Format	Minimum section mm²
Copper	Cable	50 (Ø1,7 mm per cable)
Copper	Round	50 (Ø8 mm)
Copper	Tape	50 (Minimum thickness 2 mm)

Table 5 – Material Table IEC 62561-2.

The downspout ground shall be properly secured and tightened, with reference driver three clips per meter.

Protect the bottom of the downspout by a protective tube of at least 2 m.

The installation of a lightning counter above the protective tube is recommended to perform the verification and maintenance of the facility.

► LPS passive down conductors

In order to reduce the likelihood of damage due to lightning currents circulating in the LPS, down conductors must be arranged so that from the point of impact grounding is:

Protection Level	Distance between conductors
I	10 m
II	10 m
III	15 m
IV	20 m

Table 6 – Distance between down conductors IEC 62305-3.

It is also advisable to place the down conductors on exposed corners of the building whenever constructively possible.

The dimensions and materials of the ground down conductors, must meet the requirements contained in IEC 62561-2 (Table 5).

The conductors that form the mesh must be properly set, taking as reference 1 conductor clamp per meter.

Protect the bottom of the downspout with a protective tube of at least 2 m.

Install section elements in each of the down conductors to allow for measurement of the ground (see Fig. 12).

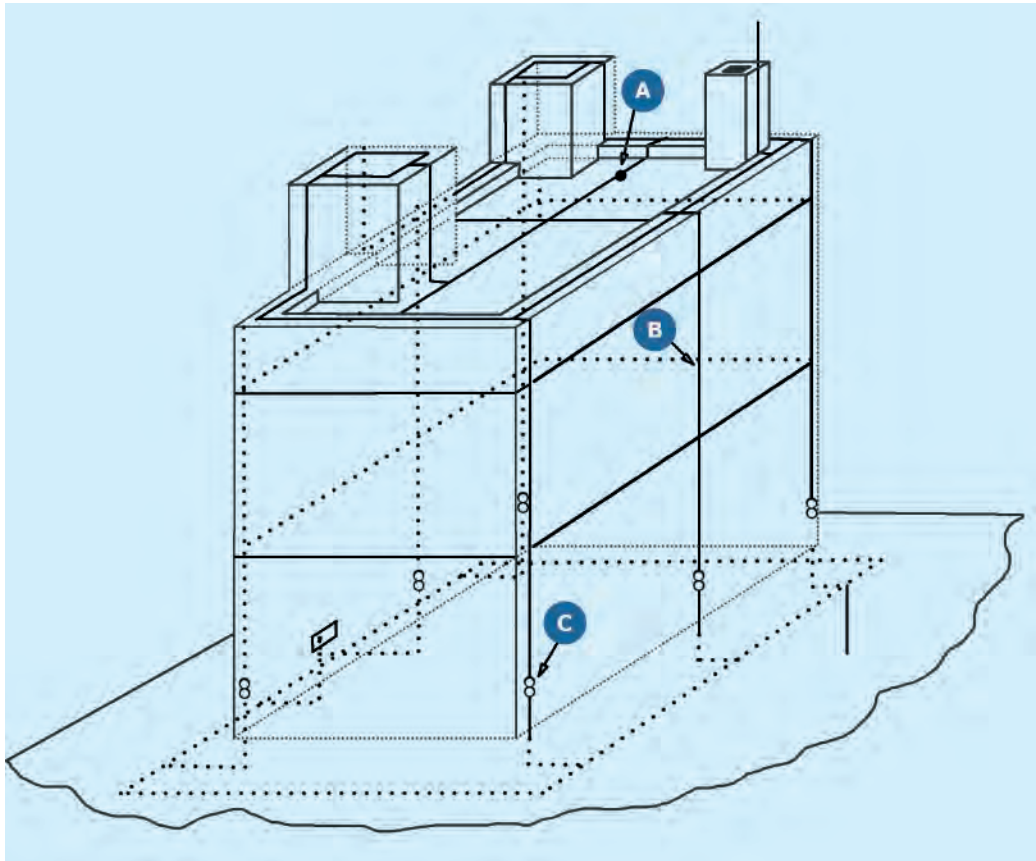


Fig. 12 – LPS passive scheme:
A: Horizontal conductor cover
B: Grounded conductor
C: Down conductor isolator

INGESCO® PDC (ESE)
LIGHTNING RODS



- Non-expendable
- 5 year warranty
- Natural field trials
- Max. current 200kA
- No maintenance
- Stainless steel 316 L
- UNE 21186:2011
- NFC 17-102:2011
- NP 4426:2013

► technical specifications

- Lightning rod with **non-electronic** streaming.
- Suitable for external lightning protection of all types of structures and open areas.
- **Level of protection rated very high.**
 - **100% effective in discharge.**
 - Guaranteed **electrical continuity.**
 - **Retains all its initial properties after each discharge so does not require specific maintenance.**
 - No batteries or external power. No electronic. **Not fungible.**
 - **Operation guaranteed** in any atmospheric condition.
 - Made of **AISI 316L** stainless steel and polyamide (PA66).

► standards | tests | specifications

INGESCO® PDC, meets the requirements in the following standards:

- CTE SUA 8
- UNE 21.186:2011
- NFC 17-102:2011
- IEC 62305
- IEC 62.561/1
- NP 4426:2013

Evaluation tests of ESE (Annex C UNE 21186: 2011) in the LABELEEC High Voltage Laboratory.

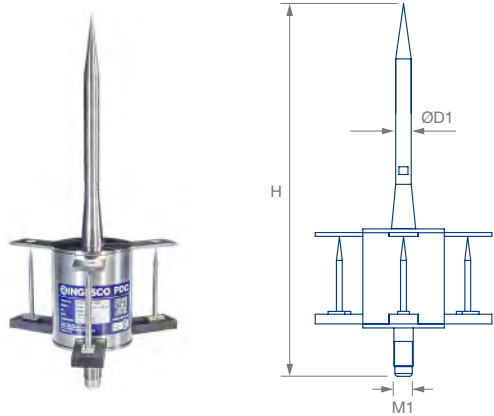
Certificate of current supported IEC 62561/1, issued by the LABELEEC High Voltage Laboratory.

Certificate product issued by the international certification organization Bureau Veritas.

► coverage radius by protection level

Model	PDC 3.1	PDC 3.3	PDC 4.3	PDC 5.3	PDC 6.3	PDC 6.4
Ref.	101000	101001	101003	101005	101008	101009
Δt	15µs	25µs	34µs	43µs	54µs	60µs
LEVEL I	35 m	45 m	54 m	63 m	74 m	80 m
LEVEL II	43 m	54 m	63 m	72 m	83 m	89 m
LEVEL III	54 m	65 m	74 m	84 m	95 m	102 m
LEVEL IV	63 m	75 m	85 m	95 m	106 m	113 m

Protection radius calculated according to UNE 21.186: 2011, NFC 17.102: 2011 and NP 4426: 2013. (Calculated as a difference in height between the tip of the lightning rods and the considered horizontal plane 20 m.).



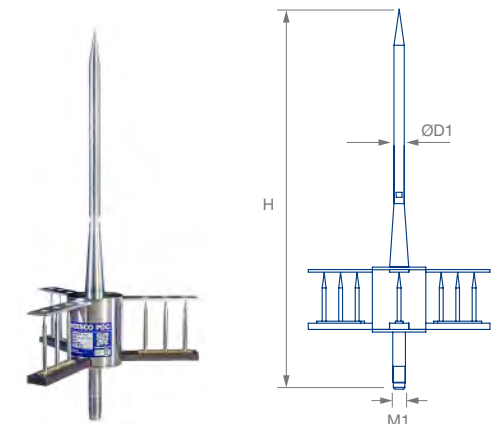
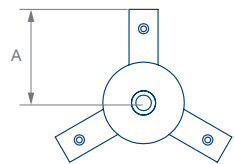
INGESCO® PDC 3.1
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC 3.1 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	M1 (mm)	A (mm)	Weight (g)
101000	SST	387	16	M20	95	2350

h (m)	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
2	13	15	18	20
4	25	30	36	41
6	32	38	46	52
10	34	40	49	56
20	35	43	54	63

Δt : 15μs
D: Streaming distance
L-I : D = 20 m
L-II : D = 30 m
L-III : D = 45 m
L-IV : D = 60 m



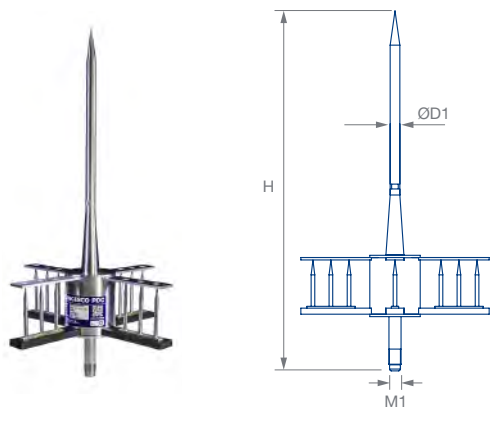
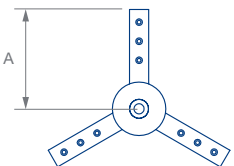
INGESCO® PDC 3.3
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC 3.3 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	M1 (mm)	A (mm)	Weight (g)
101001	SST	598	16	M20	156	3200

h (m)	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
2	17	20	23	26
4	34	39	46	52
6	43	49	58	66
10	44	51	61	69
20	45	54	65	75

Δt : 25μs
D: Streaming distance
L-I : D = 20 m
L-II : D = 30 m
L-III : D = 45 m
L-IV : D = 60 m



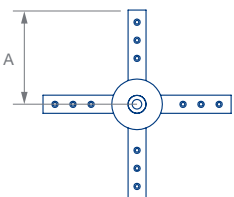
INGESCO® PDC 4.3
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC 4.3 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	M1 (mm)	A (mm)	Weight (g)
101003	SST	598	16	M20	156	3400

h (m)	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
2	21	24	27	30
4	41	47	54	61
6	52	59	69	77
10	53	61	71	80
20	54	63	74	85

Δt : 34μs
D: Streaming distance
L-I : D = 20 m
L-II : D = 30 m
L-III : D = 45 m
L-IV : D = 60 m



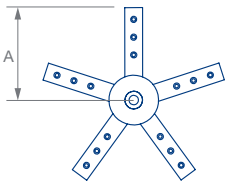
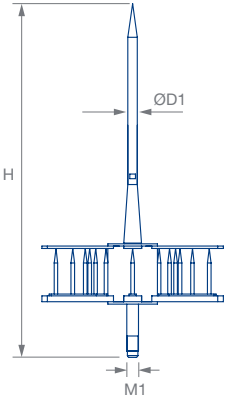
INGESCO® PDC 5.3
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC 5.3 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	M1 (mm)	A (mm)	Weight (g)
101005	SST	598	16	M20	156	3600

h (m)	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
2	24	27	31	35
4	49	55	63	70
6	61	69	79	88
10	62	70	81	90
20	63	72	84	95

Δt : 43μs
D: Streaming distance
L-I : D = 20 m
L-II : D = 30 m
L-III : D = 45 m
L-IV : D = 60 m



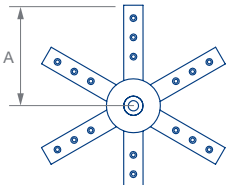
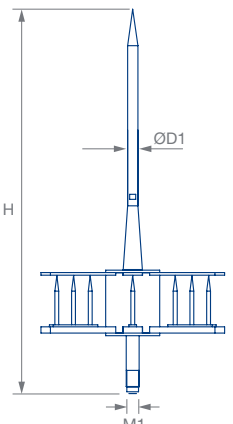
INGESCO® PDC 6.3
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC 6.3 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	M1 (mm)	A (mm)	Weight (g)
101008	SST	598	16	M20	156	3800

h (m)	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
2	29	32	36	40
4	58	64	72	80
6	73	80	91	100
10	73	82	93	102
20	74	83	95	106

Δt : 54μs
D: Streaming distance
L-I : D = 20 m
L-II : D = 30 m
L-III : D = 45 m
L-IV : D = 60 m



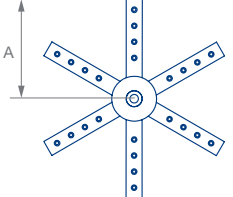
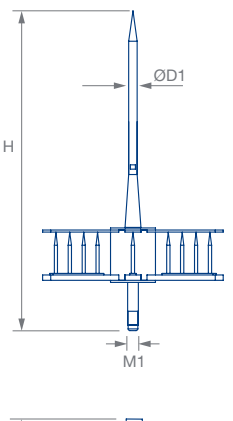
INGESCO® PDC 6.4
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC 6.4 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	M1 (mm)	A (mm)	Weight (g)
101009	SST	598	16	M20	186	4150

h (m)	NIVEL I	NIVEL II	NIVEL III	NIVEL IV
2	31	35	39	43
4	63	69	78	85
6	79	87	97	107
10	79	88	99	109
20	80	89	102	113

Δt : 60μs
D: Streaming distance
L-I : D = 20 m
L-II : D = 30 m
L-III : D = 45 m
L-IV : D = 60 m



INGESCO® PDC.E
LIGHTNING ROD



5 year warranty

Natural field trials

Testable

Stainless steel 316 L

UNE 21186:2011

NFC 17-102:2011

NP 4426:2013

► technical specifications

- Lightning rod with **ELECTRONIC** streaming.
- Suitable for external lightning protection of all types of structures and open areas.
- **Level of protection rated very high.**
 - **100% effective in discharge. Maximum durability.**
 - Requires no external power source.
 - **Guaranteed operation** after lightning strike and in any weather condition.
 - Made of **AISI 316L** stainless steel.

► standards | tests | specifications

INGESCO® PDC.E, meets the requirements in the following standards:

- CTE SUA 8
- IEC 62305
- NP 4426:2013
- UNE 21.186:2011
- IEC 62.561/1
- NFC 17-102:2011
- IEC 62.561/3

Evaluation tests of ESE (Annex C UNE 21186: 2011) in the LABELEEC High Voltage Laboratory.

Mechanical test (traction and flexing until breakage).

Certificate of current supported IEC 62561/1, issued by the LABELEEC High Voltage Laboratory.

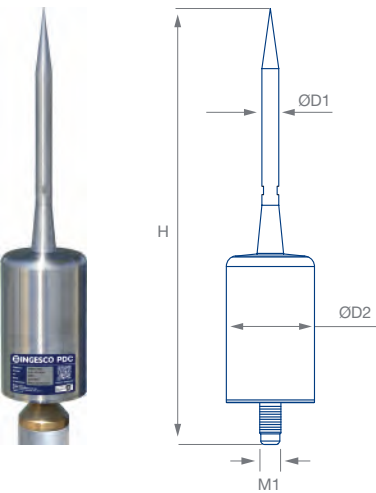
Certificate product issued by the international certification organization Bureau Veritas.

► coverage radius by protection level

Model	PDC.E 15	PDC.E 30	PDC.E 45	PDC.E 60
Ref.	102004	102005	102006	102007
Δt	15μs	30μs	45μs	60μs
LEVEL I	35 m	50 m	65 m	80 m
LEVEL II	43 m	59 m	74 m	89 m
LEVEL III	54 m	70 m	86 m	102 m
LEVEL IV	63 m	81 m	97 m	113 m

Protection radius calculated according to UNE 21.186: 2011, NFC 17.102: 2011 and NP 4426: 2013. (Calculated as a difference in height between the tip of the lightning rods and the considered horizontal plane 20 m.).

Model PDC.E 60



INGESCO® PDC.E 15
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC.E 15 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	D2 (mm)	M1 (mm)	Weight (g)
102004	SST	412	16	83	M20	3775

h (m)	LEVEL I	LEVEL II	LEVEL III	LEVEL IV	
2	13	15	18	20	Δt : 15 μ s D: Streaming distance N-I: D = 20 m N-II: D = 30 m N-III: D = 45 m N-IV: D = 60 m
4	25	30	36	41	
6	32	38	46	52	
10	34	40	49	56	
20	35	43	54	63	

INGESCO® PDC.E 30
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC.E 30 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	D2 (mm)	M1 (mm)	Weight (g)
102005	SST	412	16	83	M20	3770

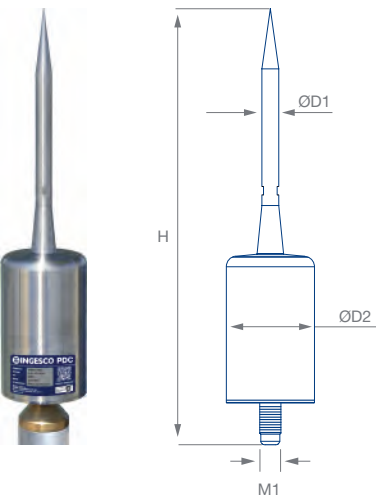
h (m)	LEVEL I	LEVEL II	LEVEL III	LEVEL IV	
2	19	22	25	28	Δt : 30 μ s D: Streaming distance N-I: D = 20 m N-II: D = 30 m N-III: D = 45 m N-IV: D = 60 m
4	38	44	51	57	
6	48	55	64	72	
10	49	57	66	75	
20	50	59	70	81	

INGESCO® PDC.E 45
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC.E 45 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	D2 (mm)	M1 (mm)	Weight (g)
102006	SST	412	16	83	M20	3765

h (m)	LEVEL I	LEVEL II	LEVEL III	LEVEL IV	
2	25	28	32	36	Δt : 45 μ s D: Streaming distance N-I: D = 20 m N-II: D = 30 m N-III: D = 45 m N-IV: D = 60 m
4	51	57	64	72	
6	63	71	81	90	
10	64	72	83	92	
20	65	74	86	97	

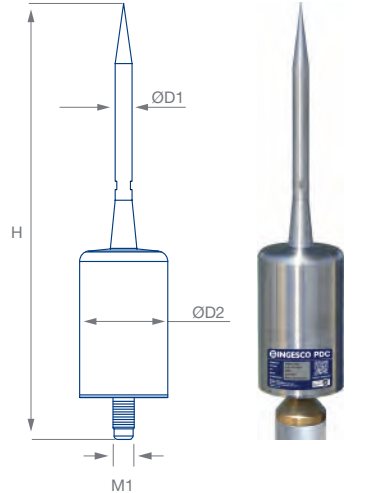


INGESCO® PDC.E 60
LIGHTNING ROD

► Coverage radius (m) INGESCO® PDC.E 60 according to protection level and height (UNE 21.186:2011, NFC 17.102:2011 and NP 4426:2013)

Ref.	Material	H (mm)	D1 (mm)	D2 (mm)	M1 (mm)	Weight (g)
102007	SST	412	16	83	M20	3760

h (m)	LEVEL I	LEVEL II	LEVEL III	LEVEL IV	
2	31	35	39	43	Δt : 60 μ s D: Streaming distance N-I: D = 20 m N-II: D = 30 m N-III: D = 45 m N-IV: D = 60 m
4	63	69	78	85	
6	79	87	97	107	
10	79	88	99	109	
20	80	89	102	113	



INGESCO ADVANCED
ESE TESTER

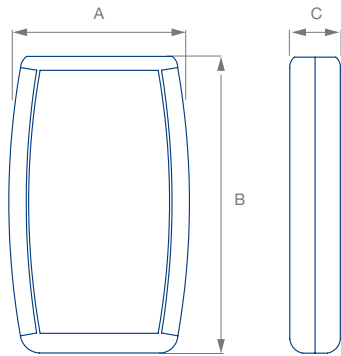
Ref.	Material	A (mm)	B (mm)	C (mm)	Weight (g)
102051	ABS	89	147	25	320

The INGESCO Advanced ESE Tester is a portable device for testing electronic lightning rods for ohmic contact.

The INGESCO Advanced ESE Tester is designed exclusively for evaluating INGESCO electronic ESE arrester. ESE future electronic models INGESCO and lightning rods from other manufacturers may not be compatible with the technology of the INGESCO Advanced ESE Tester.

► technical specifications

- Temperature range: -10°C a 40°C
- Power consumption: 30mA
- Power: Battery 9V IEC6LR61/IEC6F22/USA PP3
- Test terminals 1m long and 9V battery



LIGHTNING RODS



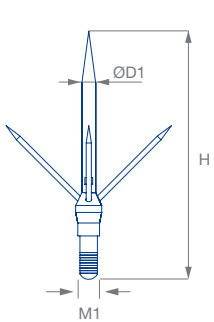
Termination rods suitable for external lightning protection. It can be used as single sensor element or part of passive protection, complementing the protection conductive mesh (Faraday cages).
Made of AISI 316L stainless steel or copper.
Please consult for other materials or dimensions.

Simple rods
Multiple rods
IEC 62305

MULTIPLE RODS

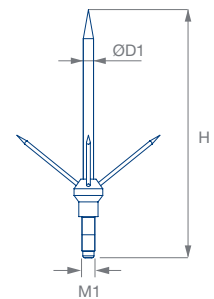
COPPER multiple lightning rod

Model	Ref.	Material	H (mm)	D1 (mm)	M1 (mm)	Weight (g)
Multiple CU	110002	Cu	384	20	M20	855



STAINLESS STEEL multiple lightning rod

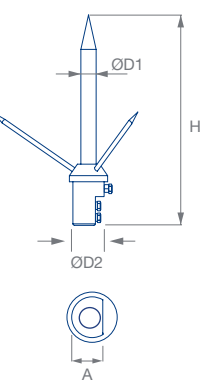
Model	Ref.	Material	H (mm)	D1 (mm)	M1 (mm)	Weight (g)
Multiple IN	110001	SST	384	20	M20	795



MULTIPLE RODS WITH MAST ADAPTOR

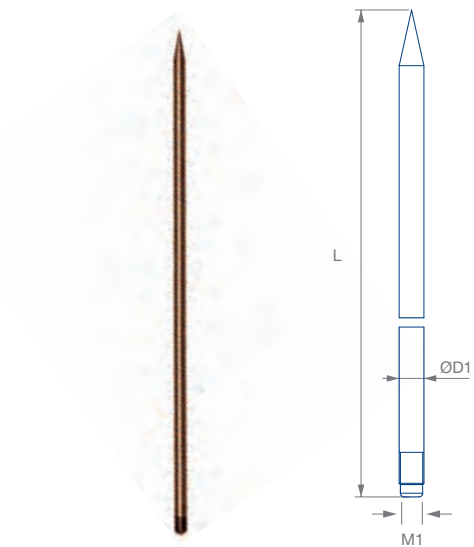
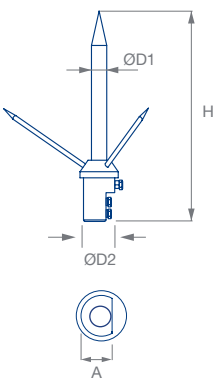
COPPER multiple lightning rods with ROUND - FLAT conductor mast adaptor

Modelo	Ref.	Mat.	H (mm)	D1 (mm)	D2 (mm)	D3 (mm)	A (mm)	Weight (g)
Multiple CU 1'1/4"	110226	Cu	344	20	35,5	12	19	1200
Multiple CU 1'1/2"	110227	Cu	344	20	41	12	19	1350



STAINLESS STEEL multiple lightning rods with ROUND - FLAT conductor mast adaptor

Modelo	Ref.	Mat.	H (mm)	D1 (mm)	D2 (mm)	D3 (mm)	A (mm)	Peso (g)
Punta múltiple IN 1'1/4"	110228	Inox.	344	20	35,5	12	19	1100
Punta múltiple IN 1'1/2"	110229	Inox.	344	20	41	12	19	1300



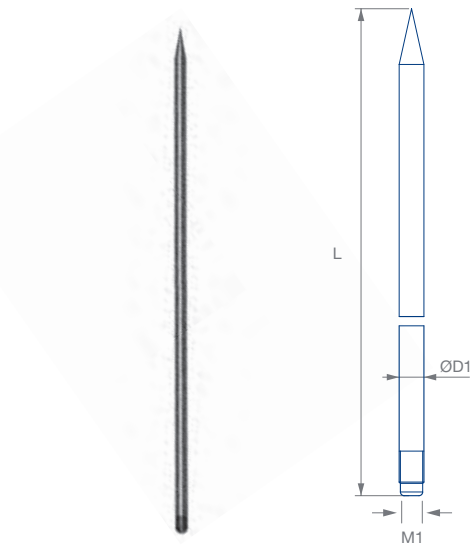
SIMPLE RODS

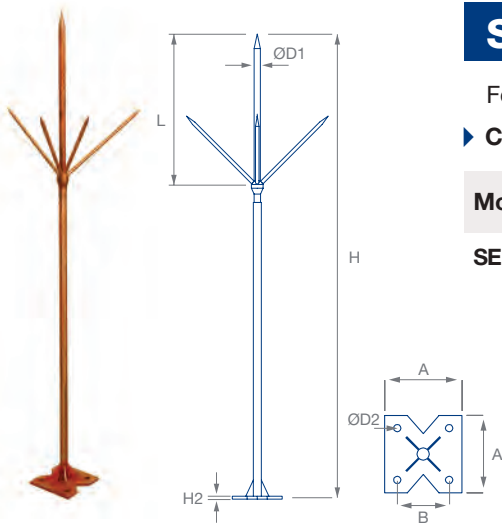
COPPER simple lightning rods

Model	Ref.	Material	L (mm)	D1 (mm)	M1 (mm)	Weight (g)
CU300-16	110081	Cu	300	16	M16	440
CU500-16	110083	Cu	500	16	M16	800
CU1000-16	110035	Cu	1000	16	M16	1700
CU2000-16	110034	Cu	2000	16	M16	3500
CU300-20	110089	Cu	300	20	M20	740
CU500-20	110091	Cu	500	20	M20	1310
CU1000-20	110093	Cu	1000	20	M20	2710
CU2000-20	110095	Cu	2000	20	M20	5530

STAINLESS STEEL simple lightning rods

Model	Ref.	Material	L (mm)	D1 (mm)	M1 (mm)	Weight (g)
IN300-16	110080	SST	300	16	M16	420
IN500-16	110082	SST	500	16	M16	740
IN1000-16	110084	SST	1000	16	M16	1530
IN2000-16	110086	SST	2000	16	M16	3110
IN300-20	110088	SST	300	20	M20	690
IN500-20	110090	SST	500	20	M20	1180
IN1000-20	110092	SST	1000	20	M20	2420
IN2000-20	110031	SST	2000	20	M20	4880



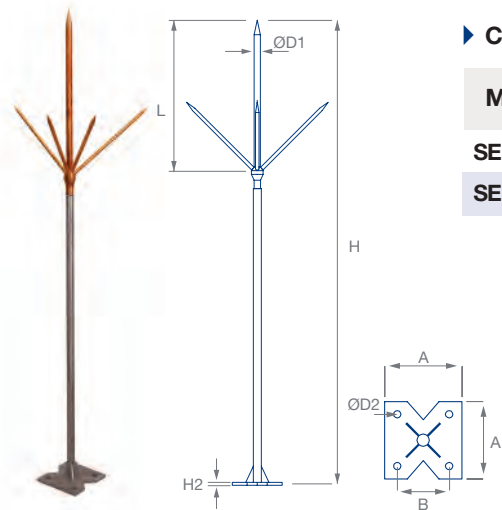


SPECIAL LIGHTNING RODS

For application in electrical substations and others.

COPPER lightning rods with COPPER-PLATED STEEL horizontal support

Model	Ref.	Mat.	H (mm)	L (mm)	H2 (mm)	D1 (mm)	D2 (mm)	A (mm)	B (mm)	Weight (g)
SE 1000 CU	110003	Cu/ST Cu.	1600	480	10	20	18	170	113	5500



COPPER lightning rods with GALVANIZED STEEL horizontal support

Model	Ref.	Mat.	H (mm)	L (mm)	H2 (mm)	D1 (mm)	D2 (mm)	A (mm)	B (mm)	Weight (g)
SE 1000 CU/AZ	110096	Cu/G.ST	1600	480	10	20	18	170	113	5600
SE 2000 CU/AZ	110100	Cu/G.ST	2600	480	10	20	18	170	113	5600



CAPTURE SYSTEM ACCESSORIES

Adaptor parts

Masts

Fastening

CTE SUA 8

IEC 62305

IEC 62561

Accessories for installing the capture system. Adaptor parts, masts and anchoring systems.

Adjustment parts for lightning rods made by INGESCO (simple tips, multiple and ESE) of Ø16mm or 20mm. It facilitates the connection of the lightning rod to the conductive network.

Masts for fastening and support for termination rods to structures by anchors or baseplates.

Fastening systems for masts 1 1/4, 1 1/2 and 2” in diameter. Different solutions according to the construction needs.

Made of resistant materials such as brass, copper, galvanized iron and stainless steel.

Please consult for custom manufacturing and other construction.

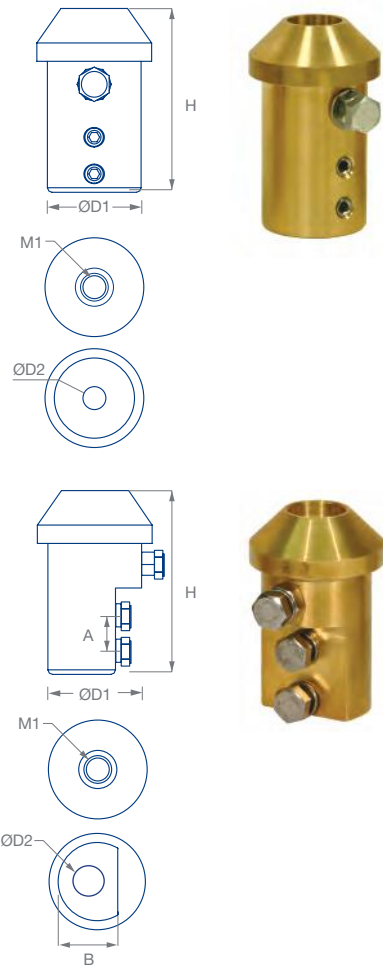
LIGHTNING ROD ADAPTER PIECES

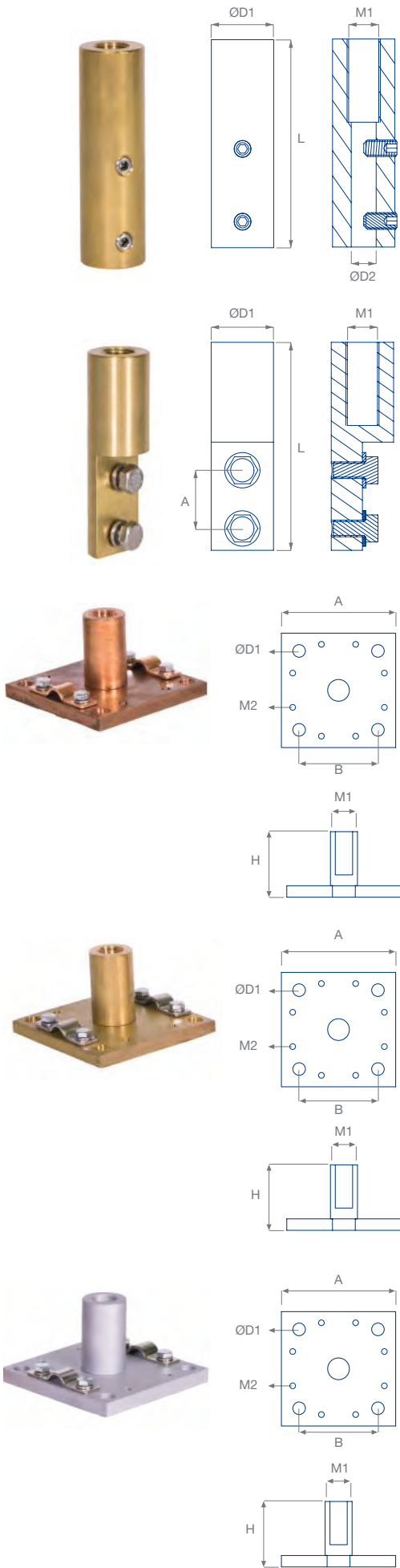
Adapter parts for lightning rod to ROUND conductor mast

Model	Ref.	Mat.	H (mm)	D1 (mm)	D2 (mm)	M1 (mm)	Weight (g)
1” Ø16 round	111033	Cu/Zn	80	26	12	M16	316
1 1/4” Ø16 round	111032	Cu/Zn	80	35,5	12	M16	664
1 1/2” Ø16 round	111022	Cu/Zn	80	41	12	M16	815
2” Ø16 round	111025	Cu/Zn	80	53	12	M16	1341
1” Ø20 round	111019	Cu/Zn	80	26	12	M20	286
1 1/4” Ø20 round	111011	Cu/Zn	80	35,5	12	M20	628
1 1/2” Ø20 round	111012	Cu/Zn	80	41	12	M20	777
2” Ø20 round	111013	Cu/Zn	80	53	12	M20	1306

Adapter parts for lightning rod to ROUND and FLAT conductor mast

Model	Ref.	Mat.	H (mm)	D1 (mm)	D2 (mm)	M1 (mm)	A (mm)	B (mm)	Weight (g)
1 1/4” Ø16 tape	111053	Cu/Zn	80	35,5	12	M16	19	25	645
1 1/2” Ø16 tape	111054	Cu/Zn	80	41	12	M16	19	30	765
2” Ø16 tape	111055	Cu/Zn	80	53	12	M16	19	45	1295
1 1/4” Ø20 tape	111051	Cu/Zn	80	35,5	12	M20	19	25	630
1 1/2” Ø20 tape	111056	Cu/Zn	80	41	12	M20	19	30	750
2” Ø20 tape	111057	Cu/Zn	80	53	12	M20	19	45	1280





LIGHTNING ROD-CONDUCTOR CONNECTOR

► Lightning rod - ROUND conductor connector

Model	Ref.	Mat.	L (mm)	D1 (mm)	D2 (mm)	M1 (mm)	Weight (g)
Ø16 round cond. 50-70 mm	111024	Cu/Zn	100	30	12	M16	970
Ø20 round cond. 50-70 mm	111038	Cu/Zn	100	30	12	M20	955

► Lightning rod - FLAT conductor connector

Model	Ref.	Mat.	L (mm)	D1 (mm)	A (mm)	M1 (mm)	Weight (g)
Ø16 flat cond. 30x2-4 mm	111039	Cu/Zn	100	30	28	M16	810
Ø20 flat cond. 30x2-4 mm	111040	Cu/Zn	100	30	28	M20	795

LIGHTNING ROD SUPPORTS

► Horizontal supports Ø16mm or Ø20mm lightning rods

Model	Ref.	Mat.	H (mm)	M1 (mm)	D1 (mm)	M2 (mm)	A (mm)	B (mm)	Weight (g)
CU16	110047	Cu	60	M16	11	M6	100	80	1150
CU20	110076	Cu	60	M20	11	M6	100	80	1145

Model	Ref.	Mat.	H (mm)	M1 (mm)	D1 (mm)	M2 (mm)	A (mm)	B (mm)	Weight (g)
CU/ZN16	110048	Cu/Zn	60	M16	11	M6	100	80	1095
CU/ZN20	110077	Cu/Zn	60	M20	11	M6	100	80	1090

Model	Ref.	Mat.	H (mm)	M1 (mm)	D1 (mm)	M2 (mm)	A (mm)	B (mm)	Weight (g)
AZ16	110097	G ST	60	M16	11	M6	100	80	1130
AZ20	110098	G ST	60	M20	11	M6	100	80	1125

LIGHTNING ROD SUPPORTS

► Vertical supports Ø16mm or Ø20mm lightning rods

Model	Ref.	Mat.	No. pieces	L (mm)	A (mm)	H (mm)	Weight (g)
Stainless steel rods Ø16 - Ø20	112078	SST	1	175	40	42	212

Model	Ref.	Mat.	No. pieces	A (mm)	B (mm)	H (mm)	D1 (mm)	D2 (mm)	Weight (g)
Simple fastening rods Ø16	112110	Zn	1	56	20	20	16	27	60
Simple fastening rods Ø20	112111	Zn	1	56	20	20	20	27	82

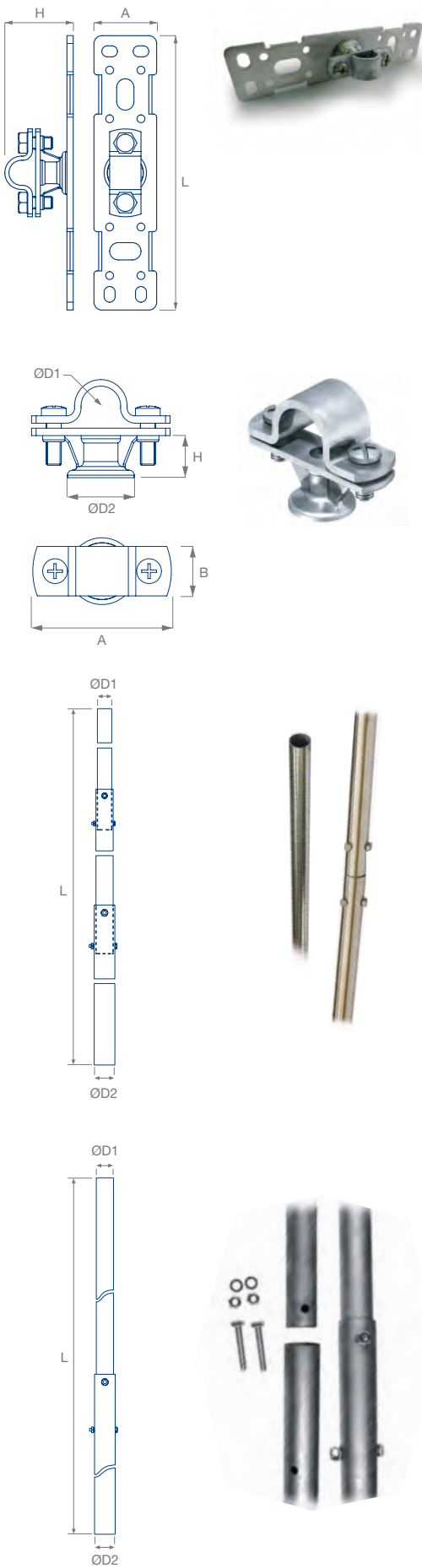
MASTS

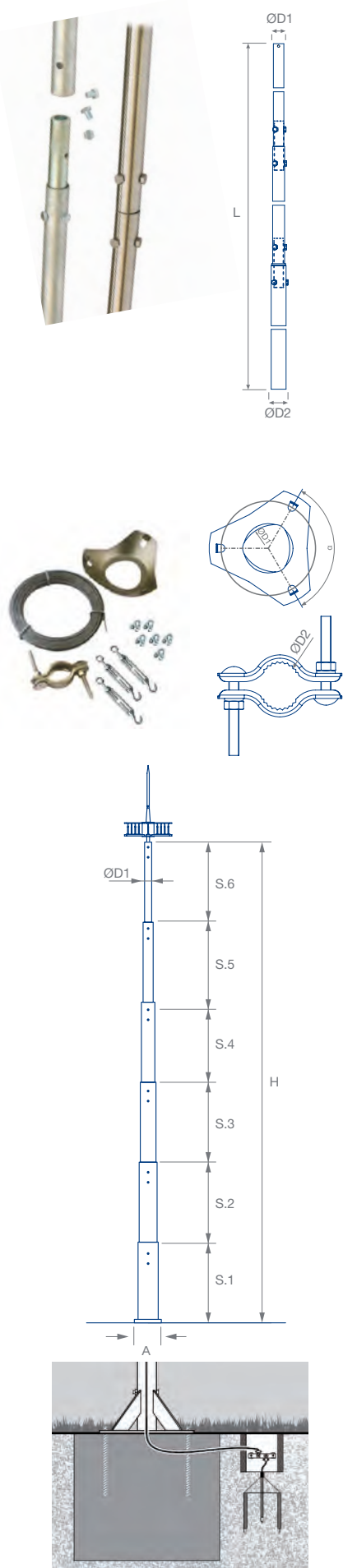
► Stainless Steel masts

Model	Ref.	Mat.	L (mm)	No. parts	D1 (mm)	D2 (mm)	Weight (kg)
3m Ø1'1/2" IN	114045	SST	3000	1	48	48	9
6m Ø1'1/2" inner union IN	114042	SST	6000	2	48	48	22

► Telescopic hot dip galvanized steel masts

Model	Ref.	Mat.	L (mm)	No. parts	D1 (mm)	D2 (mm)	Weight (kg)
1 m Ø1'1/4"	114079	HDG	1000	1	42,5	42,5	2,6
2 m Ø1'1/4"	114061	HDG	2000	1	42,5	42,5	5,2
3 m Ø1'1/4"	114052	HDG	3000	1	42,5	42,5	7,75
1 m Ø1'1/2"	114063	HDG	1000	1	48	48	3,3
2 m Ø1'1/2"	114056	HDG	2000	1	48	48	6,6
3 m Ø1'1/2"	114043	HDG	3000	1	48	48	10
4 m Ø 1'1/2"+ Ø 1'1/4	114097	HDG	4000	2	42,5	48	12,2
5,8 m Ø1'1/2"+ Ø1'1/4	114065	HDG	5800	2	42,5	48	18
7,6 m Ø2+Ø1'1/2"+ Ø1'1/4	114066	HDG	7600	3	42,5	60	30,2
8,6 m Ø2+Ø1'1/2"+ Ø1'1/4	114067	HDG	8600	3	42,5	60	33,8





MASTS

► Hot dip galvanized steel masts with internal junction

Model	Ref.	Mat.	L (mm)	No. parts	D1 (mm)	D2 (mm)	Weight (kg)
4 m Ø 1'1/2" u. int.	114053	HDG	4	2	48	48	16,3
6 m Ø1'1/4" inner union	114048	HDG	6	2	42,5	42,5	16,8
6 m Ø1'1/2" inner union	114041	HDG	6	2	48	48	23
8 m Ø2+Ø1'1/2"+ Ø1'1/4 inner union	114068	HDG	8	3	42,5	60	33,8
9 m Ø2+Ø1'1/2"+ Ø1'1/4 inner union	114069	HDG	9	3	42,5	60	36,9

WIND KIT

► Wind kit for fastening masts

Model	Ref.	Mat.	D1 (mm)	D2 (mm)	α	m.steel cable	No. tighteners	No. cable ties	Weight (g)
Wind kit fastening masts	114197	HDG	40	45	120°	25	3	6	500

FREE-STANDING FOLDING MASTS

► Free-standing hot dip galvanized steel masts

Self-supporting folding mast. Attachable sections, folding hinged baseplate. Easy transport and assembly. Dimensioned to withstand winds up to 144 Km / h.

Model	Ref.	Mat.	Secc.	Øtubes (inches)	L parts (m)	H (mm)	D1 (mm)	A (mm)	Weight (kg)
6 m	114201	HDG	S.1	3"	3	6	48	500	85
			S.2	2'1/2"	2,5				
			S.3	1'1/2"	0,5				
8 m	114200	HDG	S.1	3"	3	8	48	500	92
			S.2	2'1/2"	2,5				
			S.3	1'1/2"	2,5				
10 m	114075	HDG	S.1	4"	3	10	48	500	125
			S.2	3"	2,5				
			S.3	2'1/2"	2,5				
			S.4	1'1/2"	2				
12 m	114076	HDG	S.1	5"	3	12	48	500	160
			S.2	4"	2,5				
			S.3	3"	2,5				
			S.4	2'1/2"	2,5				
			S.5	1'1/2"	1,5				
14 m	114078	HDG	S.1	6"	3	14	48	500	212
			S.2	5"	2,5				
			S.3	4"	2,5				
			S.4	3"	2,5				
			S.5	2'1/2"	2,5				
			S.6	1'1/2"	1				

ANCHORS AND SUPPORTS FOR MASTS

► Anchors for vertically embedded wall mounting

Model	Ref.	Mat.	Nº pieces	L (mm)	A (mm)	B (mm)	C (mm)	Weight (kg)
work anchor 15 mast Ø1'1/4"	112087/1	HDG	1	240	46	35	110	1,8
	112087		2					3,6
	112087/3		3					5,4
work anchor 15 mast Ø1'1/2"	112071/1	HDG	1	240	60	35	110	1,9
	112071		2					3,8
	112071/3		3					5,7
work anchor 15 mast Ø2"	112096/1	HDG	1	240	72	35	110	2
	112096		2					4
	112096/3		3					6

Model	Ref.	Mat.	Nº pieces	L (mm)	A (mm)	B (mm)	C (mm)	Weight (kg)
work anchor 30 mast Ø1'1/4"	112088/1	HDG	1	395	46	35	100	2,5
	112088		2					5
	112088/3		3					7,5
work anchor 30 mast Ø1'1/2"	112021/1	HDG	1	395	60	35	100	2,6
	112021		2					5,2
	112021/3		3					7,8
work anchor 30 mast Ø2"	112038/1	HDG	1	395	72	35	100	2,7
	112038		2					5,4
	112038/3		3					8,1

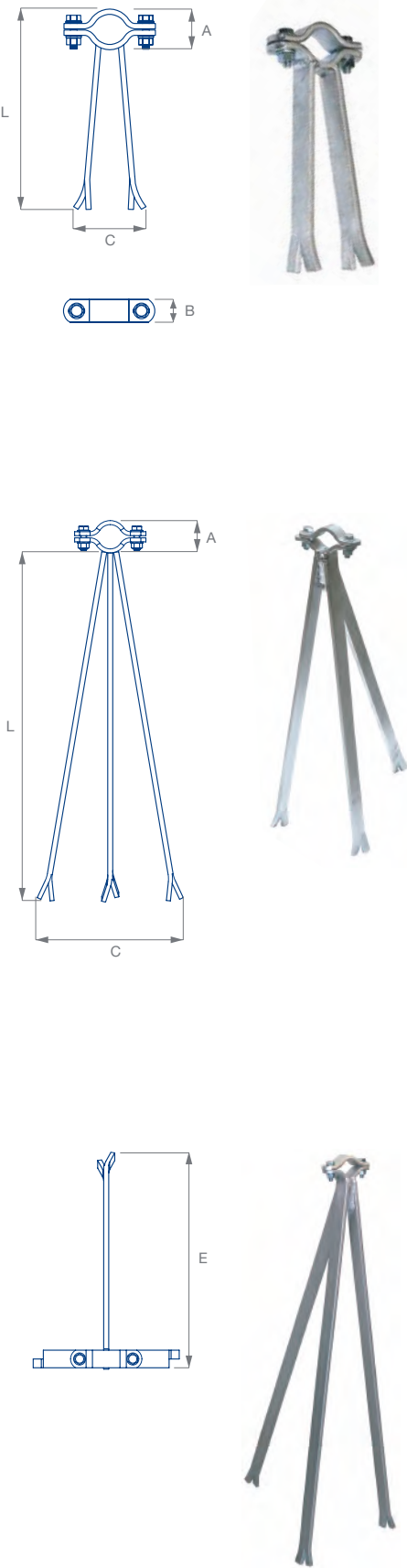
Model	Ref.	Mat.	Nº pieces	L (mm)	A (mm)	B (mm)	C (mm)	E (mm)	Weight (kg)
work anchor 60 mast Ø1'1/4"	112089/1	HDG	1	700	46	35	270	395	7,1
	112089		2						11,6
	112089/3		3						16,1
work anchor 60 mast Ø1'1/2"	112022/1	HDG	1	700	60	35	270	395	7,2
	112022		2						11,8
	112022/3		3						16,4

work anchor 60 mast Ø2"	112040/1	HDG	1	700	72	35	270	395	7,4
	112040		2						12,2
	112040/3		3						17,0

Model	Ref.	Mat.	Nº pieces	L (mm)	A (mm)	B (mm)	C (mm)	E (mm)	Weight (kg)
work anchor 100 mast Ø1'1/4"	112090/1	HDG	1	1095	46	35	365	460	11,7
	112090		2						23,4
	112090/3		3						35,1

work anchor 100 mast Ø1'1/2"	112023/1	HDG	1	1095	60	35	365	460	11,8
	112023		2						23,6
	112023/3		3						35,4

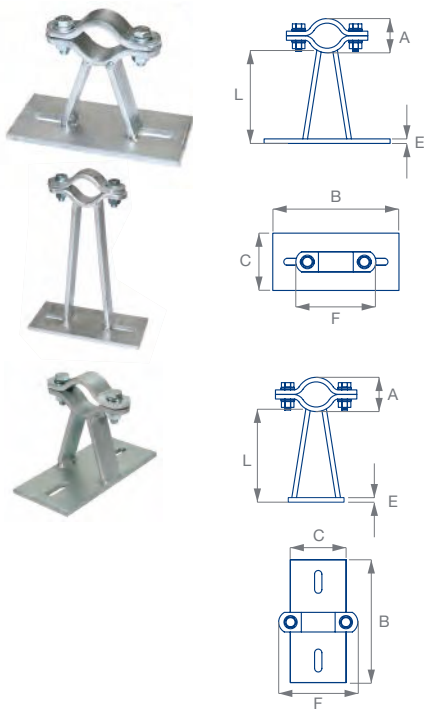
work anchor 100 mast Ø2"	112042/1	HDG	1	1095	72	35	365	460	11,9
	112042		2						23,8
	112042/3		3						35,7



ANCHORS AND SUPPORTS FOR MASTS

► Anchor plate for vertical wall mounting

Model	Ref.	Mat.	No. pieces	L (mm)	A (mm)	B (mm)	C (mm)	E (mm)	F (mm)	Weight (kg)
plate anchor 15 mast Ø1"1/4"	112086/1		1							2,8
	112086	HDG	2	153	46	220	100	8	141	5,6
	112086/3		3							8,4
plate anchor 15 mast Ø1"1/2"	112024/1		1							2,9
	112024	HDG	2	153	60	220	100	8	141	5,8
	112024/3		3							8,7
plate anchor 15 mast Ø2"	112037/1		1							3
	112037	HDG	2	153	72	220	100	8	141	6
	112037/3		3							9
plate anchor 15 inv. mast Ø1"1/4"	112091/1		1							2,8
	112091	HDG	2	153	46	220	100	8	141	5,6
	112091/3		3							8,4
plate anchor 15 inv. mast Ø1"1/2"	112070/1		1							2,9
	112070	HDG	2	153	60	220	100	8	141	5,8
	112070/3		3							8,7
plate anchor 15 inv. mast Ø2"	112095/1		1							3
	112095	HDG	2	153	72	220	100	8	141	6
	112095/3		3							9
Model	Ref.	Mat.	No. pieces	L (mm)	A (mm)	B (mm)	C (mm)	E (mm)	F (mm)	Weight (kg)
plate anchor 30 mast Ø1"1/4"	112092/1		1							3,5
	112092	HDG	2	302	46	220	100	8	141	7
	112092/3		3							10,5
plate anchor 30 mast Ø1"1/2"	112025/1		1							3,6
	112025	HDG	2	302	60	220	100	8	141	7,2
	112025/3		3							10,8
plate anchor 30 mast Ø2"	112039/1		1							3,7
	112039	HDG	2	302	72	220	100	8	141	7,4
	112039/3		3							11,1
plate anchor 30 inv. mast Ø1"1/4"	112099/1		1							3,5
	112099	HDG	2	302	46	220	100	8	141	7
	112099/3		3							10,5
plate anchor 30 inv. mast Ø1"1/2"	112100/1		1							3,6
	112100	HDG	2	302	60	220	100	8	141	7,2
	112100/3		3							10,8
plate anchor 30 inv. mast Ø2"	112101/1		1							3,7
	112101	HDG	2	302	72	220	100	8	141	7,4
	112101/3		3							11,1

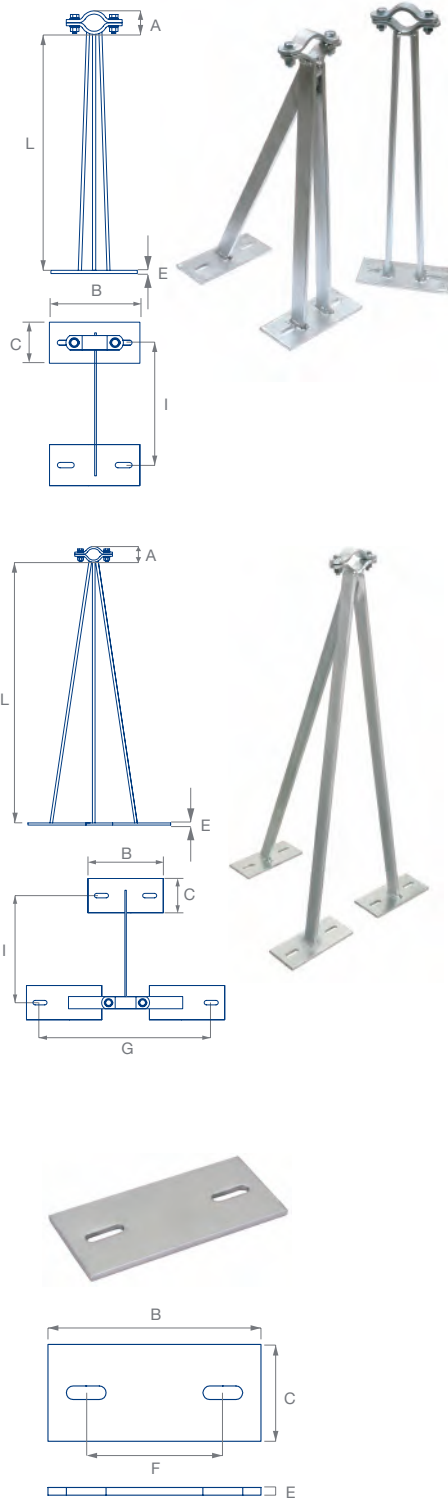


ANCHORS AND SUPPORTS FOR MASTS

► Anchor plate for vertical wall mounting

Model	Ref.	Mat.	No. pieces	L (mm)	A (mm)	B (mm)	C (mm)	E (mm)	F (mm)	I (mm)	Weight (kg)	
plate anchor 60 mast Ø1'1/4"	112093/1		1								7,75	
	112093	HDG	2	603	46	220	100	8	141	340	15,50	
	112093/3		3								23,25	
plate anchor 60 mast Ø1'1/2"	112027/1		1								7,85	
	112027	HDG	2	603	60	220	100	8	141	340	15,70	
	112027/3		3								23,55	
plate anchor 60 mast Ø2"	112041/1		1								7,95	
	112041	HDG	2	603	72	220	100	8	141	340	15,90	
	112041/3		3								23,85	
Model	Ref.	Mat.	No. pieces	L (mm)	A (mm)	B (mm)	C (mm)	E (mm)	F (mm)	G (mm)	I (mm)	Weight (kg)
plate anchor 100 mast Ø1'1/4"	112094/1		1									15,3
	112094	HDG	2	991	46	220	100	8	141	506	460	30,6
	112094/3		3									45,9
plate anchor 100 mast Ø1'1/2"	112030/1		1									15,4
	112030	HDG	2	991	60	220	100	8	141	506	460	30,8
	112030/3		3									46,2
plate anchor 100 mast Ø2"	112043/1		1									15,3
	112043	HDG	2	991	72	220	100	8	141	506	460	30,6
	112043/3		3									45,9
► Accessory anchor plate for snap fastening												
Model	Ref.	Mat.	No. pieces		B (mm)	C (mm)	E (mm)	F (mm)			Weight (kg)	
fastening plate for plate anchor	112044/1		1								1,3	
	112044	HDG	2		220	100	8	141			2,7	
	112044/3		3								3,9	

► Accessory anchor plate for snap fastening



ANCHORS AND SUPPORTS
FOR MASTS

► Anchoring double clamp for round profile attachment

Model	Ref.	Mat.	No. pieces	A (mm)	B (mm)	C (mm)	E (mm)	F (mm)	G (mm)	Weight (kg)
double clamp 1 1/4"-1 1/4"	112102/1		1							1,3
	112102	HDG	2	92	46	46	147	147	35	2,6
	112102/3		3							3,9
double clamp 1 1/4"-1 1/2"	112036/1		1							1,4
	112036	HDG	2	106	46	60	147	142	35	2,8
	112036/3		3							4,2
double clamp 1 1/4"-2"	112104/1		1							1,5
	112104	HDG	2	118	46	72	147	160	35	3
	112104/3		3							4,5
double clamp 1 1/2"-1 1/2"	112026/1		1							1,5
	112026	HDG	2	120	60	60	142	142	35	3
	112026/3		3							4,5
double clamp 1 1/2"-2"	112035/1		1							1,6
	112035	HDG	2	132	60	72	142	160	35	3,2
	112035/3		3							4,8
double clamp 2"-2"	112034/1		1							1,7
	112034	HDG	2	144	72	72	160	160	35	3,4
	112034/3		3							5,1

► Anchoring double inverted clamp for round profile attachment

Model	Ref.	Mat.	No. pieces	A (mm)	B (mm)	C (mm)	E (mm)	F (mm)	G (mm)	Weight (kg)
double cross clamp 1 1/4"-1 1/4"	112105/1		1							1,3
	112105	HDG	2	92	46	46	147	147	35	2,6
	112105/3		3							3,9
double cross clamp 1 1/4"-1 1/2"	112106/1		1							1,4
	112106	HDG	2	106	46	60	147	142	35	2,8
	112106/3		3							4,2
double cross clamp 1 1/4"-2"	112107/1		1							1,5
	112107	HDG	2	118	46	72	147	160	35	3
	112107/3		3							4,5
double cross clamp 1 1/2"-1 1/2"	112032/1		1							1,5
	112032	HDG	2	120	60	60	142	142	35	3
	112032/3		3							4,5
double cross clamp 1 1/2"-2"	112108/1		1							1,6
	112108	HDG	2	132	60	72	142	160	35	3,2
	112108/3		3							4,8
double cross clamp 2"-2"	112109/1		1							1,7
	112109	HDG	2	144	72	72	160	160	35	3,4
	112109/3		3							5,1

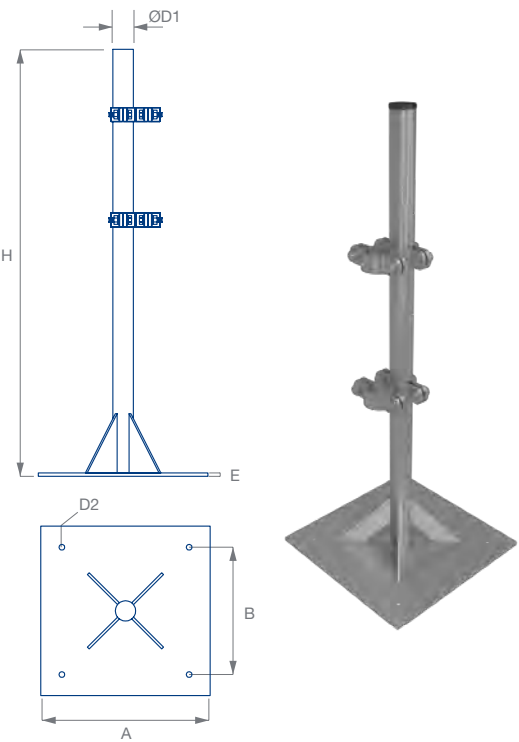
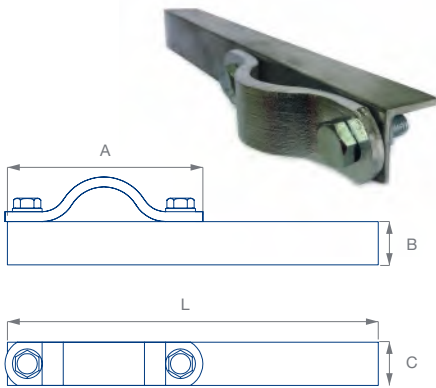
ANCHORS AND SUPPORTS
FOR MASTS

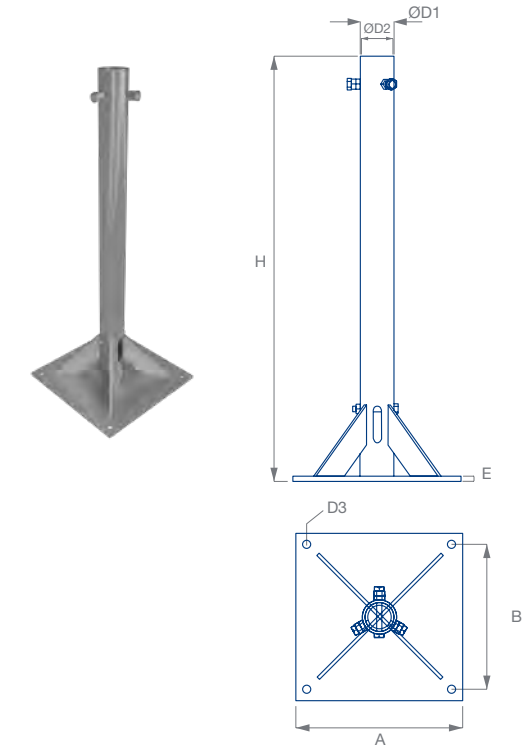
► Angle anchors for welding on metal structures

Model	Ref.	Mat.	No. pieces	A (mm)	B (mm)	C (mm)	L (mm)	Weight (kg)
attachment angle 30 Ø1"-1 1/4" - 1 1/2"-2"	112080/1		1					1
	112080	HDG	2	160	35	35	300	2
	112080/3		3					3
attachment angle 60 Ø1"-1 1/4" - 1 1/2"-2"	112103/1		1					2
	112103	HDG	2	160	35	35	600	4
	112103/3		3					6

► Horizontal surfaces baseplate support for fastening mast via brackets

Model	Ref.	Mat.	H (mm)	D1 (mm)	D2 (mm)	A (mm)	B (mm)	E (mm)	Weight (kg)
Ø1 1/2" double clamps Ø1 1/2"-Ø1 1/4"	113034	HDG	1015	48	14	400	300	8	17,5
	113031	HDG	1015	48	14	400	300	8	17,7
	113033	HDG	1015	48	14	400	300	8	17,9
Ø2" double clamps Ø2"-Ø1 1/4"	113043	HDG	1015	60	14	400	300	8	18,1
	113035	HDG	1015	60	14	400	300	8	18,3
	113032	HDG	1015	60	14	400	300	8	18,5





ANCHORS AND
SUPPORTS FOR MASTS

► Horizontal surfaces baseplate support for fastening mast up to 3m in length

Model	Ref.	Mat.	H (mm)	D1 (mm)	D2 (mm)	D3 (mm)	A (mm)	B (mm)	E (mm)	Weight (kg)
Simple base plate support Ø1 1/2"	113037	HDG	758	60	53	14	300	260	8	12,5



CONDUCTORS

UNE 21.186
NFC 17-102
IEC 62.305
CTE SUA 8
R.E.B.T
IEC 62.561-2
NP 4426
VDE 0185-305

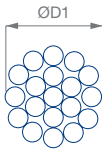
Among its many applications as a conductive element, it is used to build capture meshes, down conductor connections in lightning protection systems and for building grounding systems.
Made of different materials and dimensions for all types of installations.

CONDUCTORS

► Copper braided cable

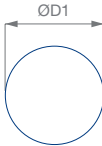
Model	Ref.	Mat.	D1 (mm)	Weight (g/m)
35 mm² section	117071	Cu	7,5	315
50 mm² section	117072	Cu	8,5	500
70 mm² section	117073	Cu	9,5	600
95 mm² section	117074	Cu	11,5	830

* Coil approx. 50m. Other mesures consult.



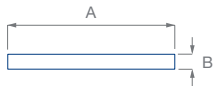
► Round steel conductor

Model	Ref.	Mat.	L (m)	D1 (mm)	Weight (g/m)
Spool Rd 8 galvanized steel (150m)	117081	HDG	125	8	312



► Tinned copper flat conductor

Model	Ref.	Mat.	L (m)	A (mm)	B (mm)	Weight (g/m)
Spool 30x2 mm Cu tinned tape coil (50 m) <i>*consult for other lengths</i>	117082	Tinned copper	50	30	2	537



FASTENING AND
CONNECTING ACCESSORIES

Accessories for the installation of conductive meshes and down-conductors in external lightning protection systems.

Clamps for fastening round conductors 35 to 95 mm² sections, or flat conductors of 30x2 mm.

Connection elements for round conductors of 35-95 mm² sections or flat conductor 30x2-4 mm. Facilitates installation and connection to external lightning protection and grounding systems.

Made of different materials and dimensions for all types of facilities.

Consulting for other custom manufacturing and construction solutions.



Clamps

Connectors

IEC 62.305

IEC 62.561-4

UNE 21.186

NFC 17-102

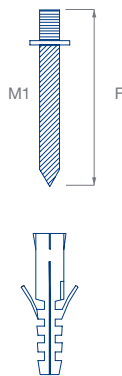
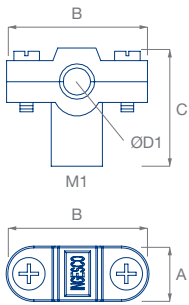
CONDUCTOR FASTENING
BRACKETS IEC62561-4

► Cu / Zn (brass) alloy cable clamp

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	D1 (mm)	Weight (g)
M6 clamp for 35 mm ² cable	118187	Cu/Zn	M6	17	44	36	7,1	104
M6 clamp for 50 mm ² cable	118185	Cu/Zn	M6	17	44	36	9	101,5
M6 clamp for 70 mm ² cable	118188	Cu/Zn	M6	17	44	36	10,4	97,6
M6 clamp for 95 mm ² cable	118189	Cu/Zn	M6	17	44	36	11	93,9
M8 clamp for 35 mm ² cable	118152	Cu/Zn	M8	17	44	36	7,1	101,2
M8 clamp for 50 mm ² cable	118153	Cu/Zn	M8	17	44	36	9	99,6
M8 clamp for 70 mm ² cable	118154	Cu/Zn	M8	17	44	36	10,4	94,8
M8 clamp for 95 mm ² cable	118155	Cu/Zn	M8	17	44	36	11	91

► Cu / Zn (brass) alloy cable clamp with lag screw

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	F (mm)	D1 (mm)	Weight (g)
Lag screw M6 35 mm ² cable	118150	Cu/Zn	M6	17	44	36	37,5	7,1	106,6
Lag screw M6 50 mm ² cable	118099	Cu/Zn	M6	17	44	36	37,5	9	105
Lag screw M6 70 mm ² cable	118000	Cu/Zn	M6	17	44	36	37,5	10,4	102
Lag screw M6 95 mm ² cable	118100	Cu/Zn	M6	17	44	36	37,5	11	96
Lag screw M8 35 mm ² cable	118151	Cu/Zn	M8	17	44	36	80	7,1	121,2
Lag screw M8 50 mm ² cable	118083	Cu/Zn	M8	17	44	36	80	9	119
Lag screw M8 70 mm ² cable	118093	Cu/Zn	M8	17	44	36	80	10,4	116
Lag screw M8 95 mm ² cable	118092	Cu/Zn	M8	17	44	36	80	11	110



CONDUCTOR FASTENING
BRACKETS IEC62561-4

► Cu / Zn (brass) alloy cable clamp with spike

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	G (mm)	D1 (mm)	Weight (g)
Spike M6 35 mm ² cable	118148	Cu/Zn	M6	17	44	36	40	7,1	115,6
Spike M6 50 mm ² cable	118082	Cu/Zn	M6	17	44	36	40	9	114
Spike M6 70 mm ² cable	118091	Cu/Zn	M6	17	44	36	40	10,4	111
Spike M6 95 mm ² cable	118090	Cu/Zn	M6	17	44	36	40	11	105
Spike M8 35 mm ² cable	118149	Cu/Zn	M8	17	44	36	40	7,1	123,6
Spike M8 50 mm ² cable	118081	Cu/Zn	M8	17	44	36	40	9	122
Spike M8 70 mm ² cable	118089	Cu/Zn	M8	17	44	36	40	10,4	119
Spike M8 95 mm ² cable	118088	Cu/Zn	M8	17	44	36	40	11	113

► Cu / Zn (brass) alloy cable clamp with leg

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	E (mm)	I (mm)	J (mm)	K (mm)	D1 (mm)	D2 (mm)	Weight (g)
W/leg 35 mm ² cable	118130	Cu/Zn	M8	17	44	36	5	20	25	40	7,1	4	146,6
W/leg 50 mm ² cable	118084	Cu/Zn	M8	17	44	36	5	20	25	40	9	4	145
W/leg 70 mm ² cable	118095	Cu/Zn	M8	17	44	36	5	20	25	40	10,4	4	142
W/leg 95 mm ² cable	118094	Cu/Zn	M8	17	44	36	5	20	25	40	11	4	136

► Cu / Zn (brass) alloy tape clamp

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	Weight (g)
M6 for 30x2mm tape	118156	Cu/Zn	M6	10	50	15	60

► Cu / Zn (brass) alloy tape clamp with lag screw

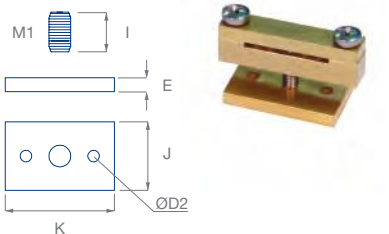
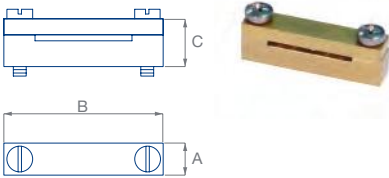
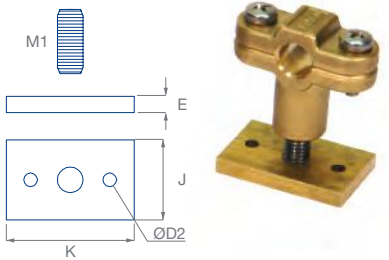
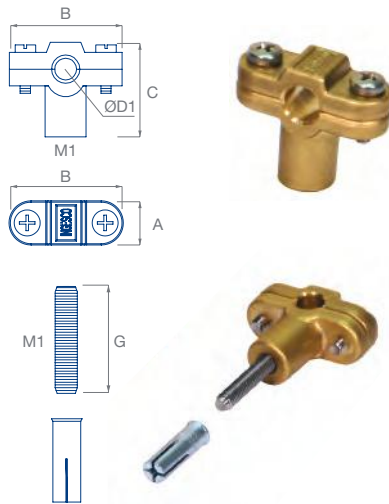
Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	F (mm)	Weight (g)
Lag screw M6 for 30x2 mm tape	118103	Cu/Zn	M6	10	50	15	37,5	63

► Cu / Zn (brass) alloy tape clamp with spike

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	G (mm)	Weight (g)
Spike M6 for 30x2 mm tape	118104	Cu/Zn	M6	10	50	15	40	72

► Cu / Zn (brass) alloy tape clamp with leg

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	E (mm)	I (mm)	J (mm)	K (mm)	D2 (mm)	Weight (g)
W/leg for 30x2 mm tape	118105	Cu/Zn	M6	10	50	15	5	12	25	40	4	101



CONDUCTOR FASTENING BRACKETS

► Zn folding clamp for round conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	Weight (g)
Folding clamp M8 50-70mm² cable	118109	Zn	M8	20	56	30	77

► Zn folding clamp w/lag screw for round conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	F (mm)	Weight (g)
Folding clamp w/lag screw M8 50-70mm² cable	118113	Zn	M8	20	56	30	80	93

► Zn folding clamp w/spike for round conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	G (mm)	Weight (g)
Folding clamp w/spike M8 50-70 mm² cable	118114	Zn	M8	20	56	30	40	97

► Zn folding clamp w/leg for round conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	E (mm)	I (mm)	J (mm)	K (mm)	D2 (mm)	Weight (g)
Folding clamp w/leg 50-70 mm² cable	118136	Zn	M8	20	56	30	5	20	25	40	4	117

► Zn folding clamp for flat conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	Weight (g)
Folding clamp M8 30 mm tape	118118	Zn	M8	20	56	30	77

► Zn folding clamp w/lag screw for flat conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	F (mm)	Weight (g)
Folding clamp w/lag screw M8 30 mm tape	118119	Zn	M8	20	56	30	80	93

► Zn folding clamp w/spike for flat conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	G (mm)	Weight (g)
Folding clamp w/spike M8 30 mm tape	118120	Zn	M8	20	56	30	40	97

► Zn folding clamp w/leg for flat conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	C (mm)	E (mm)	I (mm)	J (mm)	K (mm)	D2 (mm)	Weight (g)
Folding clamp w/leg M8 30 mm tape	118157	Zn	M8	20	56	30	5	20	25	40	4	117

CONDUCTOR FASTENING BRACKETS

► Insulate clamping bracket for round conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	D1 (mm)	Weight (g)
PA M8 50 mm² cable	118106	PA	M8	22	30	24	7,2

► Insulate clamping bracket w/lag screw for round conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	D1 (mm)	F (mm)	Weight (g)
PA w/lag screw M8 50 mm² cable	118117	PA	M8	22	30	24	80	10,4

► Insulate clamping bracket w/spike for round conductors

Model	Ref.	Mat.	M1	A (mm)	B (mm)	D1 (mm)	G (mm)	Weight (g)
PA w/spike M8 50 mm² cable	118158	PA	M8	22	30	24	40	27,2

► Insulate clamping bracket for fixing to tube

Modelo	Ref.	Mat.	A (mm)	B (mm)	D1 (mm)	D2 (mm)	G (mm)	Weight (g)
PA 50mm² tube	118177	PA	22	30	24	30	30	26,8

► Light clamps for round conductors

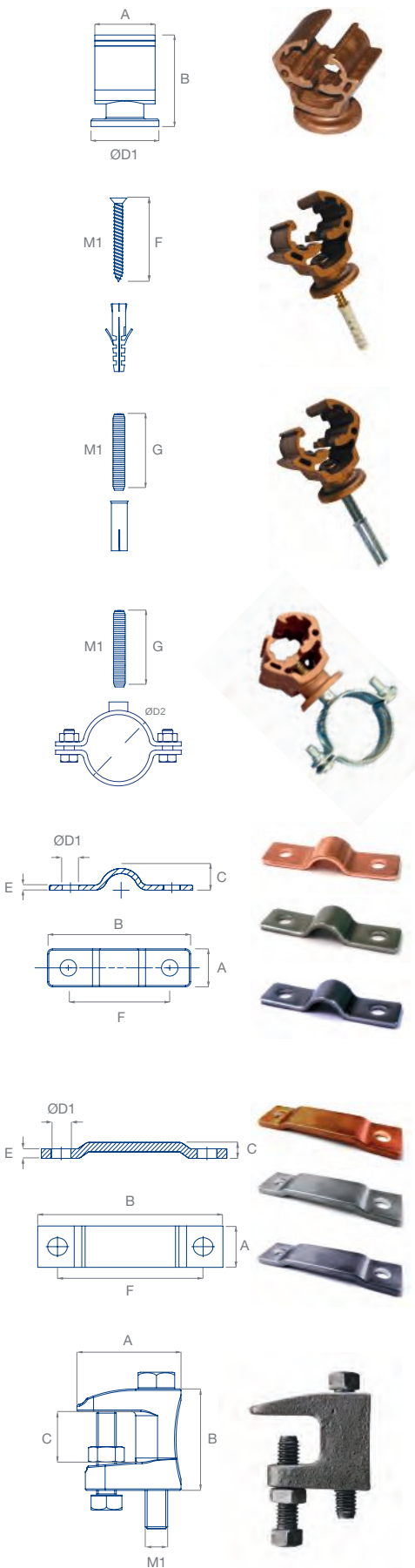
Model	Ref.	Mat.	A (mm)	B (mm)	C (mm)	E (mm)	F (mm)	D1 (mm)	Weight (g)
Light clamp Cu Ø8-10 mm	118125	Cu	15	56,5	8,6	2	40	6,5	21
Light clamp CuSn Ø8-10 mm	118129	CuSn	15	56,5	8,6	2	40	6,5	21,1
Light clamp SST Ø8-10 mm	118146	SST	15	56,5	8,6	2	40	6,5	20

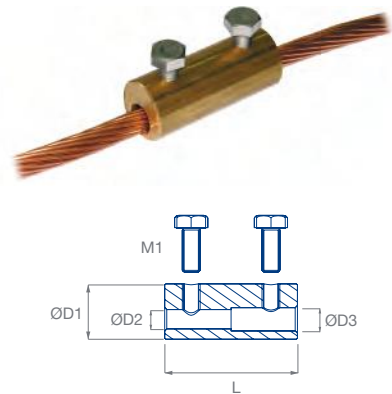
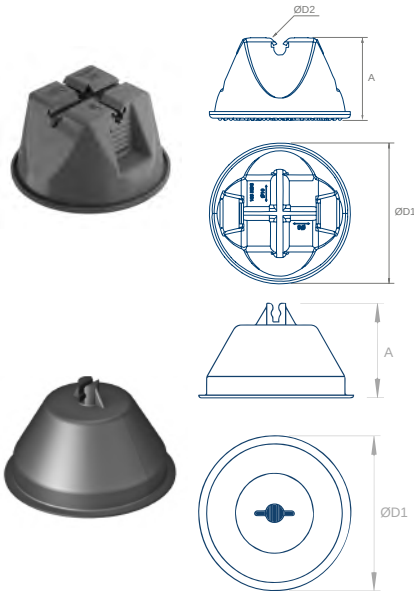
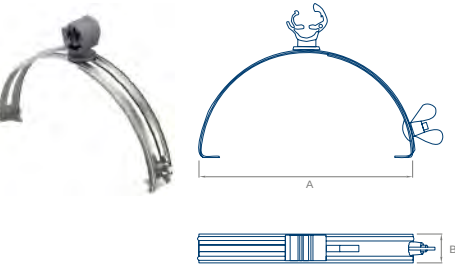
► Light clamps for flat conductors

Model	Ref.	Mat.	A (mm)	B (mm)	C (mm)	E (mm)	F (mm)	D1 (mm)	Weight (g)
Light clamp Cu 30x2 mm	118122	Cu	15	61,5	5	3	49	6,5	27,5
Light clamp CuSn 30x2 mm	118128	CuSn	15	61,5	5	3	49	6,5	27,6
Light clamp SST 30x2 mm	118167	SST	15	61,5	5	3	49	6,5	26

► Profile clamping bracket

Model	Ref.	Mat.	A (mm)	B (mm)	C (mm)	M1	Weight (g)
Profile clamping bracket	118108	Zn	37	36	18	M8	80





CONDUCTOR FASTENING BRACKETS

Roof file support bracket

Model	Ref.	Mat.	A (min-max) (mm)	B (mm)	Weight (g)
With clamp PA round conductor Ø8 mm	118242	Inox/PA	185-260	25	109

Concrete support for flat roofs

Model	Ref.	Mat.	A (mm)	D1 (mm)	D2 (mm)	Weight (g)
Concrete support Ø8-10 mm round cond.	800237	PP/PE	78	133	8-10	1000
Support for self-filling with concrete Ø8 mm	800168	PE	85	140	8	55

Flat conductor adapter

Model	Ref.	Mat.	Weight (g)
Flat conductor adapter (30x2-3,5 mm) for concret support	800067	PP	7

CONNECTORS

Linear sleeve connectors

Model	Ref.	Mat.	D1 (mm)	D2 (mm)	D3 (mm)	L (mm)	M1	Weight (g)
Linear 35 x 35 mm²	115067	Cu/Zn	25	8,5	8,5	60	M8	230
Linear 35 x 50 mm²	115070	Cu/Zn	25	8,5	10,5	60	M8	220
Linear 35 x 70 mm²	115141	Cu/Zn	25	8,5	12,5	60	M8	210
Linear 35 x 95 mm²	115142	Cu/Zn	30	8,5	15,5	60	M8	310
Linear 50 x 50 mm²	115051	Cu/Zn	25	10,5	10,5	60	M8	220
Linear 50 x 70 mm²	115072	Cu/Zn	25	10,5	12,5	60	M8	200
Linear 50 x 95 mm²	115076	Cu/Zn	30	10,5	15,5	60	M8	300
Linear 70 x 70 mm²	115074	Cu/Zn	25	12,5	12,5	60	M8	200
Linear 70 x 95 mm²	115078	Cu/Zn	30	12,5	15,5	60	M8	290
Linear 95 x 95 mm²	115080	Cu/Zn	30	15,5	15,5	60	M8	270

CONNECTORS

“T” sleeve connectors (1 piece)

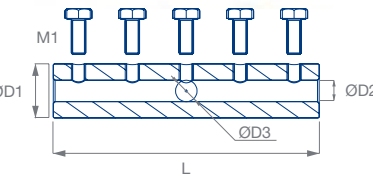
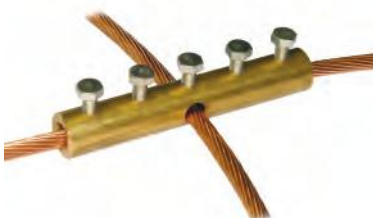
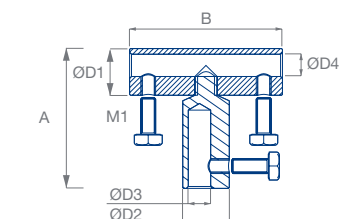
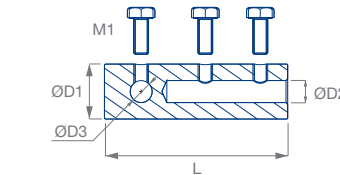
Model	Ref.	Mat.	D1 (mm)	D2 (mm)	D3 (mm)	L (mm)	M1	Weight (g)
“T” 1 piece 35 x 35 mm²	115143	Cu/Zn	25	8,5	8,5	100	M8	385
“T” 1 piece 35 x 50-70 mm²	115144	Cu/Zn	25	8,5	12,5	100	M8	380
“T” 1 piece 35 x 95 mm²	115145	Cu/Zn	30	8,5	15,5	100	M8	365
“T” 1 piece 50 x 35 mm²	115146	Cu/Zn	25	10,5	8,5	100	M8	360
“T” 1 piece 50 x 50-70 mm²	115052	Cu/Zn	25	10,5	12,5	100	M8	355
“T” 1 piece 50 x 95 mm²	115147	Cu/Zn	30	10,5	15,5	100	M8	545
“T” 1 piece 70 x 35 mm²	115148	Cu/Zn	25	12,5	8,5	100	M8	325
“T” 1 piece 70 x 50-70 mm²	115081	Cu/Zn	25	12,5	12,5	100	M8	320
“T” 1 piece 70 x 95 mm²	115149	Cu/Zn	30	12,5	15,5	100	M8	515
“T” 1 piece 95 x 35 mm²	115150	Cu/Zn	30	15,5	8,5	100	M8	455
“T” 1 piece 95 x 50-70 mm²	115151	Cu/Zn	30	15,5	12,5	100	M8	450
“T” 1 piece 95 x 95 mm²	115082	Cu/Zn	30	15,5	15,5	100	M8	440

“T” sleeve connectors (2 pieces)

Model	Ref.	Mat.	D1 (mm)	D2 (mm)	D3 (mm)	D4 (mm)	A (mm)	B (mm)	M1	Weight (g)
“T” 2 pieces 35 x 35 mm²	115152	Cu/Zn	25	25	8,5	8,5	75	82	M8	495
“T” 2 pieces 35 x 50-70 mm²	115153	Cu/Zn	25	25	8,5	12,5	75	82	M8	455
“T” 2 pieces 35 x 95 mm²	115154	Cu/Zn	25	30	8,5	15,5	75	82	M8	555
“T” 2 pieces 50 x 35 mm²	115155	Cu/Zn	25	25	10,5	8,5	75	82	M8	485
“T” 2 pieces 50 x 50-70 mm²	115056	Cu/Zn	25	25	10,5	12,5	75	82	M8	445
“T” 2 pieces 50 x 95 mm²	115156	Cu/Zn	25	30	10,5	15,5	75	82	M8	545
“T” 2 pieces 70 x 35 mm²	115157	Cu/Zn	25	25	12,5	8,5	75	82	M8	475
“T” 2 pieces 70 x 50-70 mm²	115083	Cu/Zn	25	25	12,5	12,5	75	82	M8	435
“T” 2 pieces 70 x 95 mm²	115158	Cu/Zn	25	30	12,5	15,5	75	82	M8	535
“T” 2 pieces 95 x 35 mm²	115159	Cu/Zn	30	25	15,5	8,5	80	82	M8	535
“T” 2 pieces 95 x 50-70 mm²	115160	Cu/Zn	30	25	15,5	12,5	80	82	M8	495
“T” 2 pieces 95 x 95 mm²	115084	Cu/Zn	30	30	15,5	15,5	80	82	M8	595

Cross sleeve connectors

Model	Ref.	Mat.	D1 (mm)	D2 (mm)	D3 (mm)	L (mm)	M1 (mm)	Weight (g)
Cross 35 x 35 mm²	115161	Cu/Zn	25	8,5	8,5	148	M8	566
Cross 35 x 50-70 mm²	115162	Cu/Zn	25	8,5	12,5	148	M8	546
Cross 35 x 95 mm²	115163	Cu/Zn	30	8,5	15,5	148	M8	801
Cross 50 x 35 mm²	115164	Cu/Zn	25	10,5	8,5	148	M8	526
Cross 50 x 50-70 mm²	115053	Cu/Zn	25	10,5	12,5	148	M8	450
Cross 50 x 95 mm²	115165	Cu/Zn	30	10,5	15,5	148	M8	761
Cross 70 x 35 mm²	115166	Cu/Zn	25	12,5	8,5	148	M8	476
Cross 70 x 50-70 mm²	115085	Cu/Zn	25	12,5	12,5	148	M8	456
Cross 70 x 95 mm²	115167	Cu/Zn	30	12,5	15,5	148	M8	711
Cross 95 x 35 mm²	115168	Cu/Zn	30	15,5	8,5	148	M8	665
Cross 95 x 50-70 mm²	115169	Cu/Zn	30	15,5	12,5	148	M8	646
Cross 95 x 95 mm²	115086	Cu/Zn	30	15,5	15,5	148	M8	631



CONNECTORS

▶ Round conductors - grounding rod connectors

Model	Ref.	Mat.	D1 (mm)	D2 (mm)	D3 (mm)	L (mm)	M1	Weight (g)
Ø14 mm rod-35 mm² cable	115170	Cu/Zn	25	14,5	8,5	60	M8	200
Ø14 mm rod-50-70 mm² cable	115055	Cu/Zn	25	14,5	12,5	60	M8	180
Ø14 mm rod-95 mm² cable	115171	Cu/Zn	30	14,5	15,5	60	M8	220
Ø18 mm rod-35 mm² cable	115172	Cu/Zn	30	18,5	8,5	60	M8	290
Ø18 mm rod-50-70 mm² cable	115095	Cu/Zn	30	18,5	12,5	60	M8	270
Ø18 mm rod-95 mm² cable	115173	Cu/Zn	30	18,5	15,5	60	M8	250

▶ Flat conductors - grounding rod connectors

Model	Ref.	Mat.	D1 (mm)	D2 (mm)	L (mm)	M1	Weight (g)
Ø14 mm rod-30x2-4 mm tape	115174	Cu/Zn	30	14,5	70	M8	280
Ø18 mm rod-30x2-4 mm tape	115094	Cu/Zn	30	18,5	70	M8	250

▶ Universal switch connector

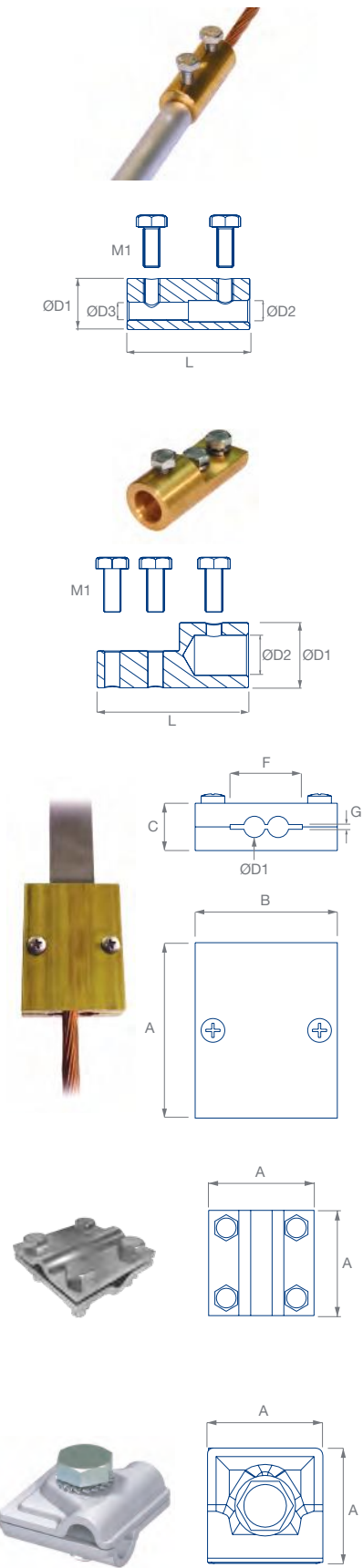
Model	Ref.	Mat.	A (mm)	B (mm)	C (mm)	F (mm)	G (mm)	D1 (mm)	Weight (g)
Universal connector	112115	Cu/Zn	74	60	20	30,5	2	9	650

▶ Cross connector

Model	Ref.	Mat.	A (mm)	Weight (g)
Cross connector Ø8-10 mm round cond.	115098	HDG	60	110

▶ Adaptable connector

Model	Ref.	Mat.	A (mm)	Weight (g)
Adaptable connector Ø8-10 mm round cond.	115100	ac. galv.	40	94



CONNECTORS

▶ Flat terminal

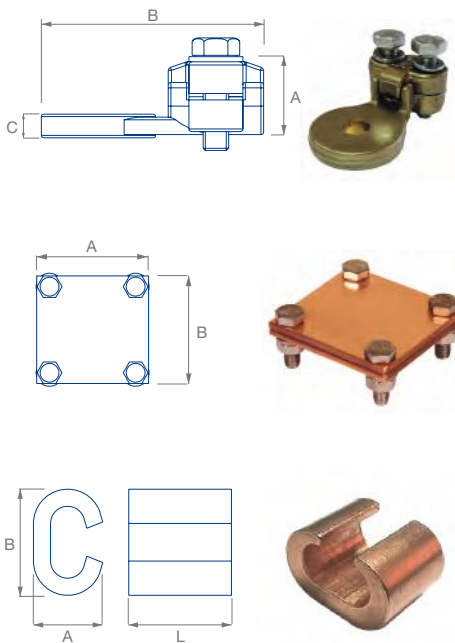
Model	Ref.	Mat.	A (mm)	B (mm)	C (mm)	Weight (g)
Toothed flat terminal 35-120 mm² cable	115097	Cu/Zn	42	68	8	186

▶ Cross-connector for tape

Model	Ref.	Mat.	A (mm)	B (mm)	Weight (g)
Cross connector tape	115093	Cu	52	50	164

▶ “C” pressure connection

Model	Ref.	Mat.	L (mm)	A (mm)	B (mm)	Weight (g)
“C” connector 35 - 95 mm²	115104	Cu	30	20,5	31	78



DOWN-CONDUCTOR PROTECTION

Mechanical protection of the lower section of down conductors of an external lightning protection system.
Fastening material includes: clamps and / or screws.
Made of galvanized steel and PVC.



Tubes
Profiles
IEC 62.305
UNE 21.186
NFC 17-102

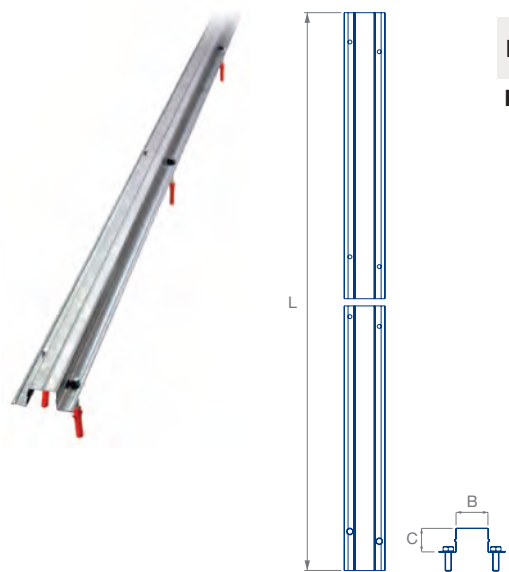
PROTECTION TUBE FOR CONDUCTORS

Protection tube for round conductors

Model	Ref.	Mat.	L (mm)	D1 (mm)	Weight (g)
Galv. steel-PVC shielded tube	119091	HDG-PVC	3000	40	5000
Reticulated polyethylene 3mm tube.	119110	PE	2500	32	625
Galv. Steel tube	119109	HDG	2000	30	1900

Protection profile for flat conductor

Model	Ref.	Mat.	L (mm)	B (mm)	C (mm)	Weight (g)
Profile for flat conductor	119095	HDG	3000	40	32	2600



SPARK GAPS

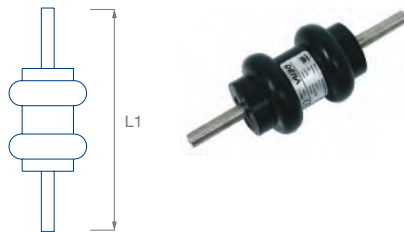
IEC 62.561-3
IEC 62.305
UNE 21.186
NFC 17-102

Suitable for connecting antennas (TV, communication, etc ...) to external lightning protection systems to ensure bonding and prevent the formation of dangerous sparks between nearby metal masses.
Bonding between grounding systems, operating separately under normal conditions, and ensuring their union if they suffer an overvoltage of a system.
Its use is recommended by current regulations to ensure equipotentiality of metallic structures on the roof of a building, or for interconnection between ground systems.

SPARK GAPS

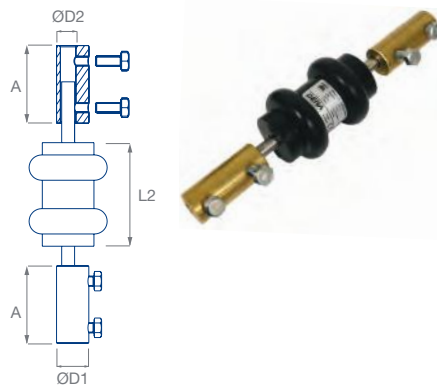
Spark gap protector

Model	Ref.	L1 (mm)	Weight (g)
VX-1 spark gap protector	116061	174	360



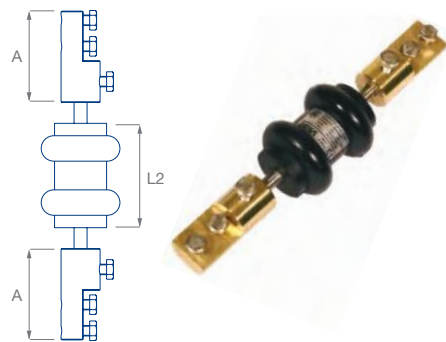
Spark gap with round conductor connection sleeves

Model	Ref.	L2 (mm)	A (mm)	D1 (mm)	D2 (mm)	Weight (g)
VX-1 spark gap protector 50 mm² cable	116062	80	60	25	10,5	795
VX-1 spark gap protector 70 mm² cable	116063	80	60	25	12,5	785
VX-1 spark gap protector 95 mm² cable	116064	80	60	30	15,5	750



Spark gap with flat conductor connection sleeves

Model	Ref.	L2 (mm)	A (mm)	Weight (g)
VX-1 Spark gap protector 30x2 mm tape	116071	80	70	970





GROUNDING SYSTEMS

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GENERAL FEATURES

► grounding system

The grounding system is established with the main objective of limiting the voltage with respect to ground, which can occur at a given moment in the metal frames, and prevent dangerous potential differences over allowing ground fault currents or discharge or atmospheric origin.

The grounding system of a lightning protection system is one of the most important parts of the system, as this the lightning currents and all its energy charge is dissipated.

The recommendations set by regulations such as **IEC 623 053, NF C 17-102: 2011** and **UNE 21186: 2011**, indicate that grounding must have a low ohmic value (less than $10\ \Omega$ when the measurement is made at isolated low frequency any conductor element).



Fig. 13 – Grounding System cross section.

► grounding standards

Depending on the protection system, they have indications marked by **IEC 62305-3: 2011** for Franklin rods or Faraday cage or by **UNE 21186: 2011** and **NF C 17-102: 2011** for the PDC lightning rod.

• Grounding for PDC Lightning Rods:

The dimensions of the ground will depend on the resistivity $\rho = (\Omega \cdot m)$ of the terrain.

Grounding must be done for each down conductor and there are 2 types:

TYPE A GROUNDING TYPE: can be type **A1** or **A2**.

TYPE A1: It consists of a crow's foot configuration (see Fig. 15).

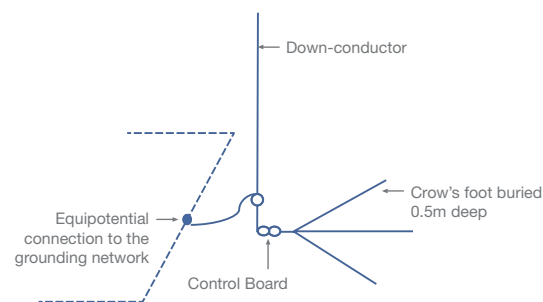


Fig. 15 – Example of grounding of type A1: 3 horizontal conductors (deep: 50cm, length: 7 to 8m).

TYPE A2: Formed by the union of many inline or triangle vertical stakes and separated by a distance of at least equal to its length (see Fig. 16).

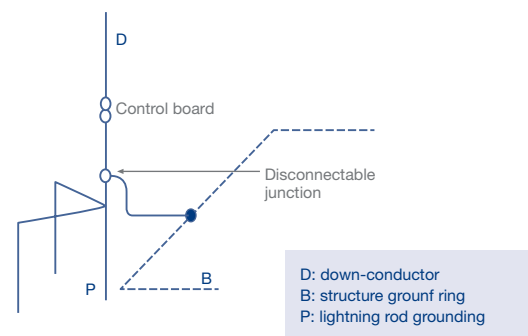


Fig. 16 – Example of grounding of type A2. The stakes will be linked by a conductor with the same characteristics and section of the down-conductor.

GROUND TYPE B: ring electrode, this arrangement is a conductive ring in contact with the ground 80% of its length. It may be external to the electrode structure or foundation. Each down conductor, besides being connected to the ring, is to be further connected to a horizontal electrode at either at least a 4 m vertical electrode or to a minimum length of 2 m (see Fig.17).

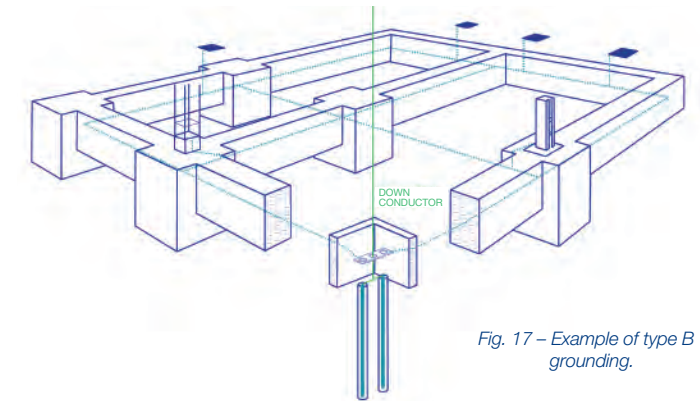


Fig. 17 – Example of type B grounding.

• Grounding for Franklin rod systems or Farady cage:

According to layout, 2 grounding systems exist:

TYPE A: formed by horizontal or vertical electrodes installed outdoors and connected to each down conductor. In type, the number of electrodes should not be less than 2, and should be distributed evenly.

Minimum length of each earth electrode must be:

- L1 for horizontal electrodes.
- 0,5 L1 for vertical or inclined electrodes.

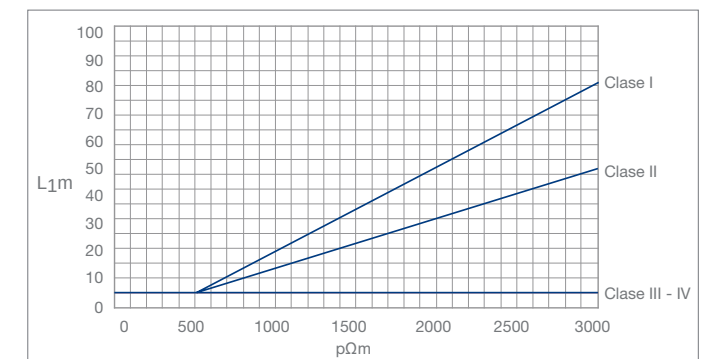


Fig. 18. – Minimum length (L1) of each ground electrode according to the class of LPS.
NOTE: III and IV classes are independent of the resistivity.

L1 being the minimum length of horizontal electrodes shown in Fig. 18.

In case we can not achieve these requirements, we will use the type B configuration.

TYPE B: It is formed by an outer conductor ring to the structure to be protected, in contact with the ground at least 80% of its length, installed at 0.5 m deep and 1 m separation from the structure.

It is recommended that the electrode number not be less than the number of down conductors with a minimum of two. A ring that would connect additional electrodes at points where the down-conductors are connected.

This Type B arrangement is recommended for rocky terrain, and is preferable to use with electronic systems or structures with a high danger of fire.

STEP VOLTAGES:

To minimize the risk of passing currents, and to protect people, you should:

- Perform equipotentialization by using a grounding mesh.
- Physical access restrictions to 3 m of the down conductor or warning signs.
- A layer of insulating material, for example 5 cm asphalt or 15 cm gravel.

GROUND ELECTRODES

Material for building grounding systems. Spike and place grounding electrodes, sacrificial anodes, graphite electrodes, ground resistivity enhancers and accessories.

Made of different materials and dimensions for all kinds of construction solutions.

Please consult for custom manufacturing and other construction solutions.



Spikes

Plates

Quibacsol

IEC 62.305

IEC 62.561-2

UNE 21.186

NFC 17-102

GROUND ELECTRODES

▶ Electrode with tongued connection coupling

Model	Ref.	Mat.	L (mm)	A (mm)	B (mm)	D1 (mm)	Weight (g)
GST l:1500mm Ø18 mm	252020	GST	1500	112	50	18	3270
SST l:1500mm Ø18 mm	252030	SST	1500	112	50	18	3220
GST l:2000mm Ø18 mm	252053	GST	2000	112	50	18	4270
SST l:2000mm Ø18 mm	252054	SST	2000	112	50	18	4220

▶ Copper-plated grounding rod

Model	Ref.	Mat.	L (mm)	D1 (mm)	Weight (g)
CCS l:2500 mm Ø18 mm	252027	CCS	2500	18	4500
CCS l:2000 mm Ø18 mm	252032	CCS	2000	18	4000
CCS l:1500 mm Ø18 mm	252033	CCS	1500	18	2400
CCS l:2000 mm Ø14 mm	252029	CCS	2000	14	2550
CCS l:1500 mm Ø14 mm	252024	CCS	1500	14	1860

GROUND ELECTRODES

▶ Spliceable grounding rods

Model	Ref.	Mat.	L1 (mm)	D1 (mm)	L2 (mm)	D2 (mm)	Weight (g)
l:1500mm Ø18 mm Galv. Steel spliceable rods	252025	HDG	1500	18	-	-	3190
Piercing tip	252026	ST	-	-	110	18	160

▶ Grounding plate with connection sleeve

Model	Ref.	Mat.	A (mm)	E (mm)	D1 (mm)	Weight (kg)
Cu plate with Cu/Zn sleeve	251011	Cu	500	2	12,5	4,7
Galv. steel plate with SST sleeve	251015	HDG	500	2	12,5	6,2
Stainless steel plate with SST sleeve	251012	SST	500	2	12,5	4,3

▶ Copper grounding plate with “U” connection

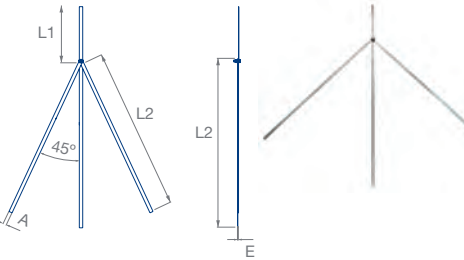
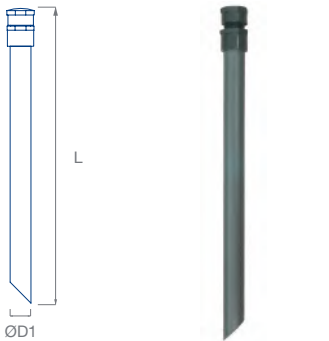
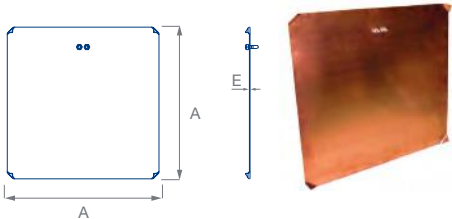
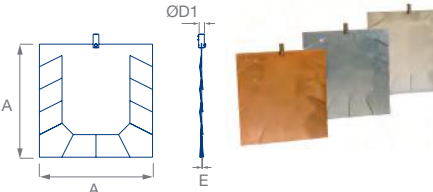
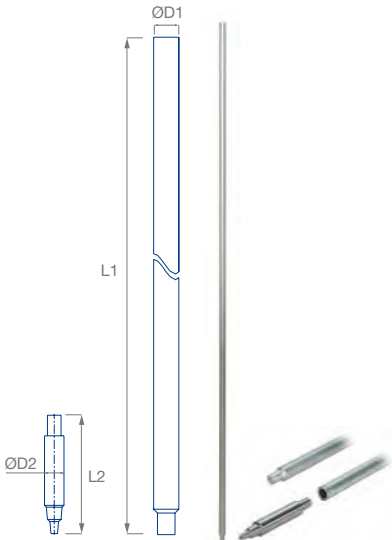
Model	Ref.	Mat.	A (mm)	E (mm)	Weight (kg)
Plate Cu 500 conexión “U”	251021	Cu	500	2	4,7
Plate Cu 600 conexión “U”	251024	Cu	600	3	9,8

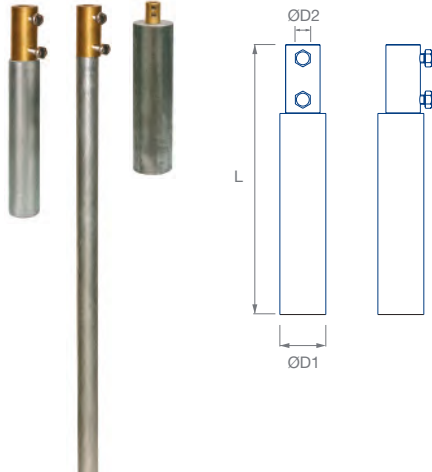
▶ Humidification tube

Model	Ref.	Mat.	L (mm)	D1 (mm)	Weight (g)
Humidification tube	119094	PVC	700	50	570

▶ Grounding kit - ‘Crow’s feet’

Model	Ref.	Mat.	L1 (mm)	L2 (mm)	A (mm)	E (mm)	Weight (kg)
Crow’s feet kit galv. steel l:1500 mm	252034	HDG	500	1500	30	3	4,5
Crow’s feet kit galv. steel l:3000 mm	252035	HDG	500	3000	30	3	8,3
Crow’s feet kit Cu Sn l:1500 mm	252051	Cu Sn	500	1500	30	2	4,3
Crow’s feet kit Cu Sn l:3000mm	252052	Cu Sn	500	3000	30	2	8,1

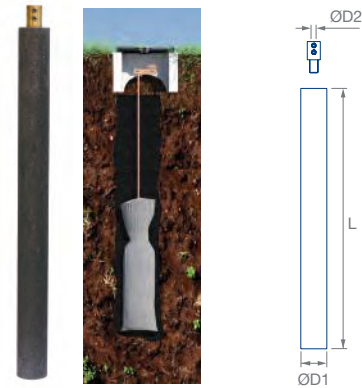




GROUNDING ELECTRODES

► **Sacrificial anodes**
Anodes for cathodic protection of ground electrodes or metal masses.

Model	Ref.	Mat.	D1 (mm)	D2 (mm)	L (mm)	Weight (g)
Model HC 200 mm in length	251017	Zn	40	12,5	260	2420
Modelo MC 600 mm in length	251018	Zn	25	12,5	660	2790
Modelo LC 260 mm in length	251019	Mg	66	12,5	330	920



► **Graphite electrode**
Graphite electrodes suitable for highly corrosive soils.

Model	Ref.	Mat.	D1 (mm)	D2 (mm)	L (mm)	Weight (kg)
Graphite electrode	252039	Graphite	50	12,5	500	8

QUIBACSOL MINERAL COMPOUND

► **QUIBACSOL mineral compound**

Model	Ref.	L (mm)	D1 (mm)	Weight (kg)
QUIBACSOL 10 kg	254041	255	267	10,4



EQUIPOTENCIAL CONNECTION /
CHECK-SWITCHING BRIDGES

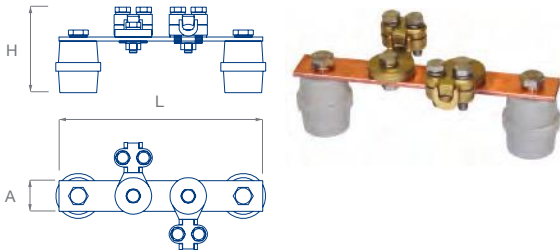
Switching bridges
Registry systems
IEC 62.305
IEC 62.561-1
UNE 21.186
NFC 17-102

Grounding and potential compensation connecting bars, control and recording systems.
Made of copper alloy Cu / Zn (brass), bronze with stainless steel screw set.
Refer to custom manufacturing and other constructive solutions.

EQUIPOTENTIAL BONDING BARS

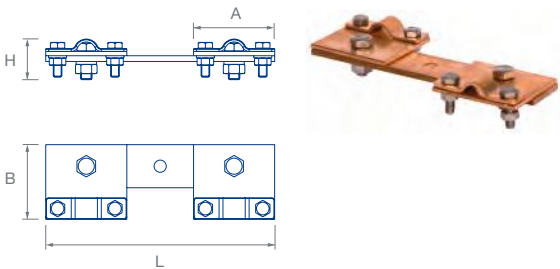
► **Equipotential bonding bars with insulators**

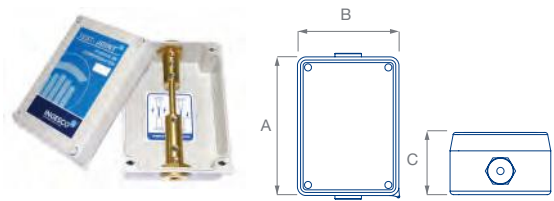
Model	Ref.	Mat.	L (mm)	A (mm)	H (mm)	Weight (g)
2 pole equipotential bar	250001	Cu	200	30	84	940
3 pole equipotential bar	250007	Cu	254	30	84	1215
4 pole equipotential bar	250008	Cu	308	30	84	1490
5 pole equipotential bar	250009	Cu	362	30	84	1750



► **Equipotential bar for registry case (round-flat conductor)**

Model	Ref.	Mat.	L (mm)	A (mm)	B (mm)	H (mm)	Weight (g)
2 pole case equipotential bar	250026	Cu	159,5	56,5	50	28,2	405
3 pole case equipotential bar	250027	Cu	159,5	56,5	50	28,2	525
4 pole case equipotential bar	250028	Cu	211	56,5	50	28,2	696
5 pole case equipotential bar	250029	Cu	262,5	56,5	50	28,2	870





TEST JOIN CASE

► In-box testing-switching bridge

Model	Ref.	Mat.	A (mm)	B (mm)	C (mm)	Weight (g)
In-box testing-switching bridge 50mm² cable	250006	PVC	165	115	71	610

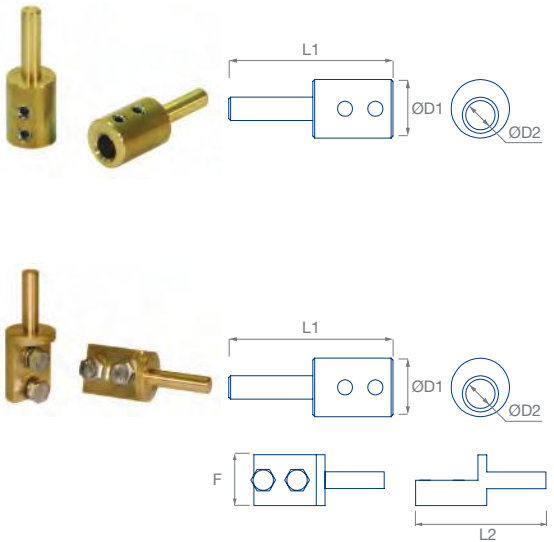
ADAPTERS FOR TEST JOIN CASE

► Adapters for round conductor

Model	Ref.	Mat.	L1 (mm)	D1 (mm)	D2 (mm)	Weight (g)
Adapter Kit cable 70 mm²	250010	Cu/Zn	70	25	12,5	260
Adapter Kit cable 95 mm²	250011	Cu/Zn	70	30	15,5	226

► Adapters for flat conductor

Model	Ref.	Mat.	L2 (mm)	F (mm)	Weight (g)
Adapter Kit 30x2 mm flat conductor	250012	Cu/Zn	77	30	392



REGISTRATION CHAMBERS

Cases

IEC 62.305

UNE-EN 124

UNE 21.186

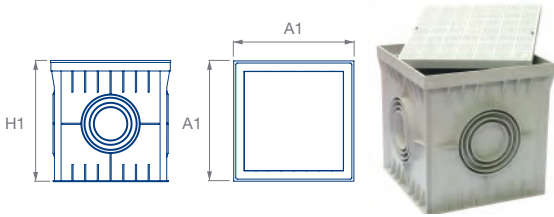
NFC 17-102

Polypropylene and concrete registration system chambers. Polypropylene, PVC, aluminum and cast iron chamber covers. Down-conductor signs for lightning protection and grounding in PVC or aluminum. Made of different materials and dimensions for all kinds of constructive solutions. Consult for other construction solutions.

REGISTRATION CASES AND COVERS

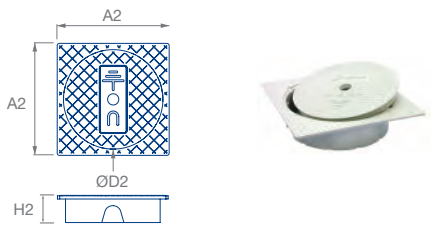
► Polypropylene chamber

Model	Ref.	Mat.	A1 (mm)	H1 (mm)	Weight (g)
Square PP chamber with cover	253058	PP	300	300	3000
Square PP chamber with PVC cover	253057	PP/PVC	300	300	2600



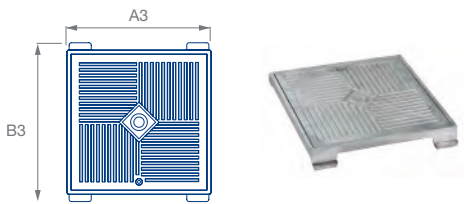
► Circular Polypropylene chamber

Model	Ref.	Mat.	A2 (mm)	D2 (mm)	H2 (mm)	Weight (g)
Circular PP chamber	253032	PP	250	222	63	775



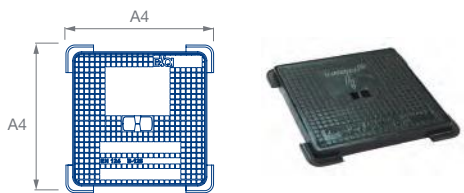
► Cover and aluminum frame

Model	Ref.	Mat.	A3 (mm)	B3 (mm)	Weight (g)
Aluminum cover and frame	253037	Al	305	330	2220



► Cast iron cover and frame

Model	Ref.	Mat.	A4 (mm)	Weight (g)
Cast iron cover and frame	253033	Fe	337	4950



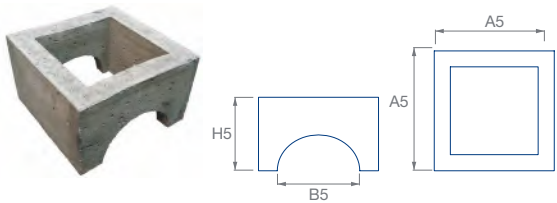
REGISTRY CHAMBERS AND COVERS

Concrete chambers

Model	Ref.	Mat.	A5 (mm)	B5 (mm)	H5 (mm)	Weight (kg)
Square concrete chambers	253059	Concrete	335	230	205	22

Down-conductor signage

Model	Ref.	Mat.	Dimensions	Weight (g)
PVC grounding sign	256001	PVC	DINA4	864
Aluminum grounding sign	256002	Al	DINA4	888
PVC lightning rod sign	256003	PVC	DINA4	864



ALUMINOTHERMIC WELDING

- Molds
- Load cartridge
- Ignition devices
- Accessories

Aluminothermic welding is a method in which, due to the reaction caused by the copper oxide reduction by aluminum, a durable two metal element (copper-copper or copper-steel) bond two metal elements (copper-copper or copper-steel) is obtained.

The reaction takes place in a graphite mold in which the elements to be welded have previously been introduced and at the required load. This results in a durable, compact and homogeneous bonding between the elements.

The conductivity of the welding connection is equal to or greater than two joined conductors.

The connection is resistant to overloads or surges.

GRAPHITE MOLDS

The molds were machined from a block of refractory materials (graphite). Its average duration, in normal use is 70 to 100 welds. A lid protects projections at the time of ignition.

A mold for each type of welding and joining element. Check references of the molds and the list of connections types.

Because of the multitude of connections that can be made, the different materials, conductors and structures that can occur in a system, this catalog only reflects the most common connections (copper-copper and copper-steel). Consult for any other connection.

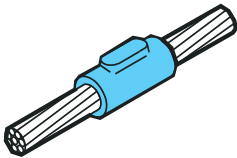


TYPES OF CONNECTIONS BY ALUMINOTHERMIC WELDING

Cable-cable (CC) welding

Linear cable-cable (LCC)

Model	Trunk cable (mm ²)	Secondary cable (mm ²)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Linear connection cable-cable 35-35	35	35	LCC35/35	500005	C4	500001
Linear connection cable-cable 50-35	50	35	LCC50/35	500006	C4	500001
Linear connection cable-cable 50-50	50	50	LCC50/50	500007	C4	500001
Linear connection cable-cable 70-35	70	35	LCC70/35	500008	C4	500001
Linear connection cable-cable 70-50	70	50	LCC70/50	500009	C5	500002
Linear connection cable-cable 70-70	70	70	LCC70/70	500010	C5	500002



Cable-cable (CC) welding

► “T” horizontal cable-cable (TH-CC)

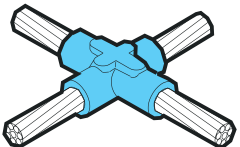
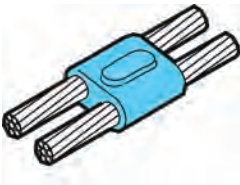
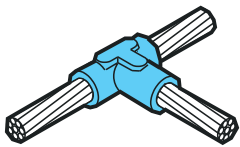
Model	Trunk cable (mm²)	Secondary cable (mm²)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
“T” horiz. connection cable-cable 35-35	35	35	TH-CC35/35	500011	C4	500001
“T” horiz. connection cable-cable 35-50	35	50	TH-CC35/50	500012	C5	500002
“T” horiz. connection cable-cable 35-70	35	70	TH-CC35/70	500013	C5	500002
“T” horiz. connection cable-cable 50-35	50	35	TH-CC50/35	500014	C5	500002
“T” horiz. connection cable-cable 50-50	50	50	TH-CC50/50	500015	C6	500003
“T” horiz. connection cable-cable 50-70	50	70	TH-CC50/70	500016	C6	500003
“T” horiz. connection cable-cable 70-35	70	35	TH-CC70/35	500017	C5	500002
“T” horiz. connection cable-cable 70-50	70	50	TH-CC70/50	500018	C6	500003
“T” horiz. connection cable-cable 70-70	70	70	TH-CC70/70	500019	C6	500003

► Parallel cable-cable (LP-CC)

Model	Trunk cable (mm²)	Secondary cable (mm²)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Parallel connection cable-cable 35-35	35	35	LP-CC35/35	500020	C6	500003
Parallel connection cable-cable 35-50	35	50	LP-CC35/50	500021	C6	500003
Parallel connection cable-cable 35-70	35	70	LP-CC35/70	500022	C6	500003
Parallel connection cable-cable 50-35	50	35	LP-CC50/35	500023	C6	500003
Parallel connection cable-cable 50-50	50	50	LP-CC50/50	500024	C6	500003
Parallel connection cable-cable 50-70	50	70	LP-CC50/70	500025	C6	500003
Parallel connection cable-cable 70-35	70	35	LP-CC70/35	500026	C6	500003
Parallel connection cable-cable 70-50	70	50	LP-CC70/50	500027	C6	500003
Parallel connection cable-cable 70-70	70	70	LP-CC70/70	500028	C7	500004

► Cross cable-cable (X-CC)

Model	Trunk cable (mm²)	Secondary cable (mm²)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Cross connection cable-cable 35-35	35	35	X-CC35/35	500029	C6	500003
Cross connection cable-cable 35-50	35	50	X-CC35/50	500030	C6	500003
Cross connection cable-cable 35-70	35	70	X-CC35/70	500031	C6	500003
Cross connection cable-cable 50-35	50	35	X-CC50/35	500032	C6	500003
Cross connection cable-cable 50-50	50	50	X-CC50/50	500033	C6	500003
Cross connection cable-cable 50-70	50	70	X-CC50/70	500034	C6	500003
Cross connection cable-cable 70-35	70	35	X-CC70/35	500035	C6	500003
Cross connection cable-cable 70-50	70	50	X-CC70/50	500036	C6	500003
Cross connection cable-cable 70-70	70	70	X-CC70/70	500037	C7	500004



Earthing rod-cable (PC) welding

► “T” spike-cable (TPC)

Model	Øspike (mm)	Secondary cable (mm²)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
“T” connection rod-cable 14-35	14	35	TPC14/35	500038	C6	500003
“T” connection rod-cable 14-50	14	50	TPC14/50	500039	C6	500003
“T” connection rod-cable 14-70	14	70	TPC14/70	500040	C7	500004
“T” connection rod-cable 18-35	18	35	TPC18/35	500041	C6	500003
“T” connection rod-cable 18-50	18	50	TPC18/50	500042	C7	500004
“T” connection rod-cable 18-70	18	70	TPC18/70	500043	C7	500004

► Linear rod-cable (LPC)

Model	Øspike (mm)	Secondary cable (mm²)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Linear connection rod-cable 14-35	14	35	LPC14/35	500044	C5	500002
Linear connection rod-cable 14-50	14	50	LPC14/50	500045	C6	500003
Linear connection rod-cable 14-70	14	70	LPC14/70	500046	C6	500003
Linear connection rod-cable 18-35	18	35	LPC18/35	500047	C6	500003
Linear connection rod-cable 18-50	18	50	LPC18/50	500048	C6	500003
Linear connection rod-cable 18-70	18	70	LPC18/70	500049	C6	500003

Round-cable (RC) welding

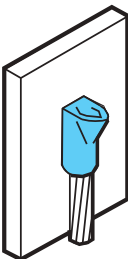
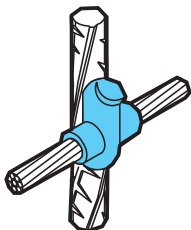
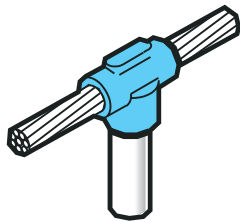
► Cross round-cable (X-RC)

Model	Ørod (mm)	Secondary cable (mm²)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Cross connection round-cable 10/35	10	35	X-RC10/35	500050	C6	500003
Cross connection round-cable 10/50	10	50	X-RC10/50	500051	C7	500004
Cross connection round -cable 10/70	10	70	X-RC10/70	500052	C7	500004
Cross connection round-cable 16/35	16	35	X-RC 16/35	500053	C6	500003
Cross connection round-cable 16/50	16	50	X-RC 16/50	500054	C7	500004
Cross connection round-cable 16/70	16	70	X-RC 16/70	500055	C7	500004

Cable-plate (CCH) welding

► Vertical cable-plate (V-CCH)

Model	Trunk cable (mm²)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Vertical connection plate-cable 35	35	V-CCH35	500056	C5	500002
Vertical connection plate-cable 50	50	V-CCH50	500057	C6	500003
Vertical connection plate-cable 70	70	V-CCH70	500058	C7	500003



Cable-tape (CPL) welding

▶ Linear cable-tape (L-CPL)

Model	Trunk cable (mm ²)	Tape dimensions (mm)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Linear connection cable-tape 35/25x3	35	25x3	L-CPL35/25X3	500059	C4	500001
Linear connection cable-tape 50/25x3	50	25x3	L-CPL50/25X3	500060	C5	500002
Linear connection cable-tape 70/25x3	70	25x3	L-CPL70/25X3	500061	C6	500003

Tape-tape (PL) welding

▶ Linear tape-tape (L-PL)

Model	Tape dimensions (mm)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Linear tape-tape 25x3	25x3	L-PL25x3	500062	C5	500002

▶ “T” horizontal tape-tape (TH-PL)

Model	Tape dimensions (mm)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
“T” connection horizontal tape-tape 25x3	25x3	TH-PL25x3	500063	C5	500002

▶ Cross tape-tape (X-PL)

Model	Tape dimensions (mm)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Cross connection tape-tape 25x3	25x3	X-PL25x3	500064	C5	500002

▶ Parallel tape-tape (P-PL)

Model	Tape dimensions (mm)	Type of mold	Mold ref.	Type of cartridge	Cartridge ref.
Parallel connection tape-tape 25x3	25x3	P-PL25x3	500065	C6	500003

LOADS

▶ Load cartridges

Solder powder for connection. It comes in a plastic container containing thermite charge (cap color) on one side and on the opposite side (black cap), dust ignition. A metal disc used to seal the nozzle before depositing the load is also supplied.

Model	Reference	Lid color	u./package
C4 45 load	500001	white	20
C5 65 load	500002	yellow	10
C6 90 load	500003	orange	10
C7 115 load	500004	red	10

ACCESSORIES

▶ Support tweezers

Designed to handle safely molds, allowing opening and closing when the mold is hot. Their size can vary depending on the mold dimensions.

Model	Reference
Tweezer T-80	500066

▶ Wire brush and brush

Use the wire brush for cleaning the cables or elements to be welded.
Use the brush to clean the inside of the mold after each weld.

Model	Reference
Wire brush	500067
Brush	500068

▶ Mold scraper

Its shape is especially designed for cleaning the mold loading chute.

Model	Reference
Scraper R-4 (for C4 and C5 loads)	500069
Scraper R-9 (for C6 and C7 loads)	500070

▶ Ignition gun

It is used for igniting ignition powder.
Supports normal replacement lighter flints.

Model	Reference
Ignition gun	500071

▶ Remote ignition system

System used for igniting ignition powder remotely.
For this ignition system, it requires that the molds are manufactured with a special cover. If it is a conventional mold, an auxiliary cap should be placed to hold the system. The device works with commercial batteries, and features a bright LED that indicates if the batteries are exhausted or requires replacement fuse. Safer and cleaner process.

Model	Reference
Remote ignition device	500072
Long distance ignition consumable	500073
Quick clamping auxiliary cover	500074



CONTROL SYSTEMS

LIGHTNING COUNTERS	62
CDR UNIVERSAL	65
CDR-11	66
CDR-HS	66
EOLOS	67



CONTROLS SYSTEMS: LIGHTNING COUNTERS

overview

Lightning counters are control systems designed to detect the electric current that is directed to ground through the down conductor when a lightning strike hits the system.

The installation of the lightning meter on down conductors of external lightning protection systems (LPS) is indicated by the regulations for the control and immediate verification of the status of the protection system after any lightning strike recorded on the structure.

standards

- **UNE 21186:2011:** Protección contra el rayo. Pararrayos con dispositivo de cebado.
- **NF C 17-102:2011:** Protection contre la foudre. Systèmes de protection contre la foudre à dispositif d’amorçage.
- **NP 4426:2013:** Proteção contra descargas atmosféricas - Sistemas com dispositivo de ionização não radioativo.
- **IEC 62.561/6:2011:** Lightning protection system components (LPSC) Part 6. Requeriments for lightning strike counters.
- **IEC 62.561/1:2012:** Lightning protection system components (LPSC) Part 1. Requeriments for connection components.

INGESCO counters range

			
	CDR-11	CDR UNIVERSAL	CDR-HS
Waveform	8-20µs 10-350µs	8-20µs 10-350µs	8-20µs 10-350µs
Minimum current registration	1 kA	1 kA	0,1 kA
Maximum current	100 kA	100 kA	100 kA
Rise time	from 8 to 10µs	from 8 to 10µs	from 8 to 10µs
Mount	Serial	Parallel, without electrical contact	Serial
Accessories	Adapter plate	-	Adapter plate
Application	SPECR	ELPS (round or flat conductor)	ELPS, mesh reticular, metallic structures
Bootable to zero	NO	YES	NO

• LPS via ESE lightning rods & conventional rods.

Place a **CDR UNIVERSAL** or **CDR-11** lightning counter on one of the ground down-conductors

The system requires no external power or batteries. Its electromechanical 3 digit dial counter registers whenever a lightning discharge flows through the down conductor (minimum intensity 1kA).

They can be placed on flat or round conductors, including the **CDR UNIVERSAL** has the advantage that it is not necessary to cut the down-conductor as it is placed in parallel and does not require ohmic contact to record discharges.



• LPS with mesh systems or arrestor down-conductors in contact with metal structures.

This type of construction systems are characterized by current drifts that hinder detection of low and medium intensity lightning. The **CDR-HS** is a high sensitivity counter to detect impacts from 100 A, well below the minimum range in the regulations (1 kA). This makes the control system suitable for this type of protective systems, allowing us to track and verify the proper operation of the system.



LIGHTNING
COUNTERS



Control and recording equipment of lightning on external lightning protection systems (special active rod or passive rod systems) as well as structures (high rise towers, wind turbines, etc ...).

CDR UNIVERSAL

CDR-11

CDR-HS

IEC 62.561/6:2011

UNE 21.186

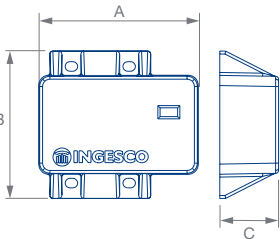
NFC 17-102:2011

CDR UNIVERSAL

Lightning counter for external lightning protection installations (ESE lightning rod, Franklin, conductor mesh ...).
Valid for round conductors (50-70 mm² or Ø8-10 mm sections), or flat conductors (30x2 - 4mm).
Detection without ohmic contact. Resettable model.

CDR Universal

Model	Ref.	A (mm)	B (mm)	C (mm)	Weight (g)
CDR UNIVERSAL	432028	109	101	42	490
Parameters					
Functioning temp range:	from -20° to 65°C				
Current range:	from 1kA (8/20µs) to 100kA (10/350µs)				
Counter range:	from 0 to 999 strikes				
Degree of protection:	IP65				
Resettable:	YES				

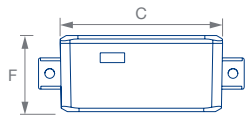


CDR-11

Lightning counter for external lightning protection installations.
Valid for round conductors (50-70 mm² or Ø8-10 mm sections).
Adapter kit available for plate or flat braid down-conductors.

CDR-11

Model	Ref.	A (mm)	B (mm)	C (mm)	F (mm)	D1 (mm)	Weight (g)
CDR-11	430019	105	52	83	40	14	290
Parameters							
Functioning temp range:	from -20° to 65°C						
Current range:	from 1kA (8/20µs) to 100kA (10/350µs)						
Counter range:	from 0 to 999 strikes						
Degree of protection:	IP65						
Resettable:	NO						

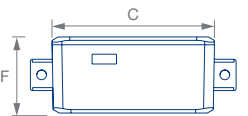


CDR-HS

High sensitivity lightning counter for external lightning protection installations with multiple down-conductors (passive systems conductor mesh ...) and / or protection down-conductors in contact metal structures.
Valid for round conductors (50-70mm² or Ø8-10mm sections).
Adapter kit available for plate or flat braid down-conductors.

CDR-HS

Model	Ref.	A (mm)	B (mm)	C (mm)	F (mm)	D1 (mm)	Weight (g)
CDR-HS	432027	105	52	83	40	14	300
Parameters							
Functioning temp range:	from -20° to 65°C						
Current range:	from 100A (8/20µs) to 100kA (10/350µs)						
Counter range:	from 0 to 999 strikes						
Degree of protection:	IP65						
Resettable:	NO						



LIGHTNING STRIKE COUNTERS FOR ELEVATED STRUCTURES



The Hight sensitivity of this product allows it to record and report different types of lightning impact in elevated structures that are not detectable by other lightning counters existing in the market.

The use of the **DL EOLOS K15FO** counter in wind turbines helps to considerably reduce the maintenance costs because it informs you exactly which blade has received the lightning impact.

DL EOLOS
IEC 62.305
IEC 62.561/6:2011
IEC 61.400-24
UNE 21.186
NFC 17-102:2011

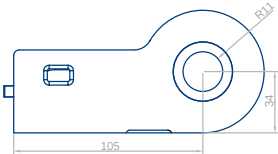
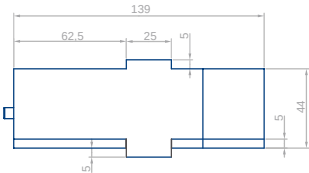
DL EOLOS K15FO

Bandwidth lightning discharge counter with fiber optic output for wind turbines.

The event notification signals generated by the **DL EOLOS K15FO** counter can be received by the fiber optical **DL EOLOS FO-RCVR-3CH** receiver.

DL EOLOS K15FO

Model	Ref.
DL EOLOS K15FO	430022
Parameters	
Temperature range:	-20° to 60°C
Current range:	±180A a ±200kA
Counting range:	Up to 999 events (rolls down to 000)
Protection grade:	IP65



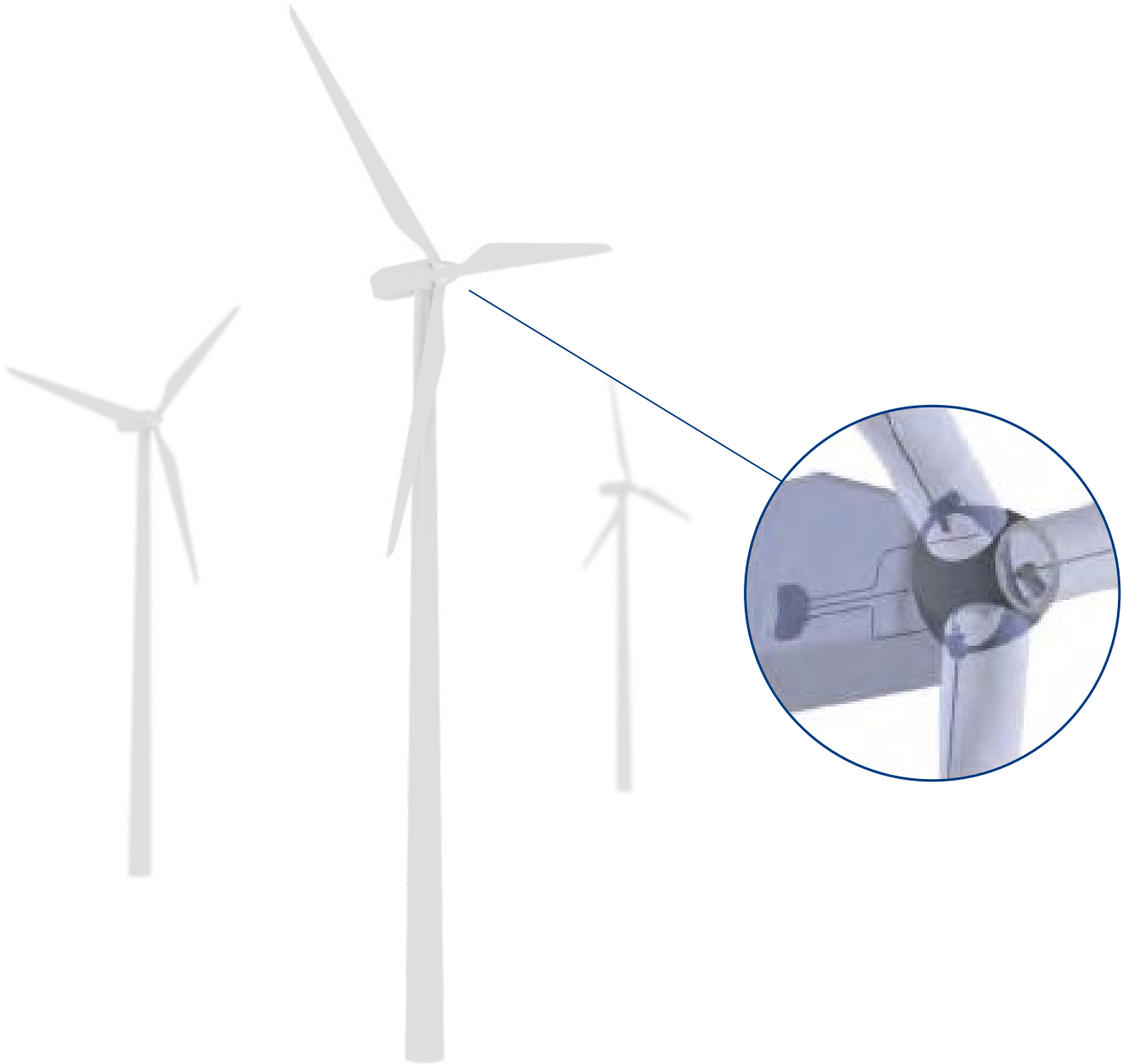
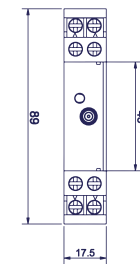
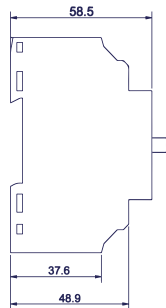
DL EOLOS FO-RCVR

Fiber optic communications receiver for real-time notification of the lightning strikes occurrence on wind turbine blades.

This device operates with **DL EOLOS K15FO** lightning strike counters.

DL EOLOS FO-RCVR-3CH

Model	Ref	Number of outputs
DL EOLOS FO-RCVR-3CH	432023	3
DL EOLOS FO-RCVR-1CH	432025	1
Parameters		
DC power input:	de 18V a 28V(*),24V recomendados.	
Optical fibre type:	POF, conector SMA	
Terminals protection:	IP20	
Enclosure material:	UL94-V0 (flame retardant)	





SURGE ARRESTORS

**INTERNAL
PROTECTION –
TRANSIENT SURGES** **70**

**SURGE PROTECTORS
POWER LINE** **75**

**SURGE ARRESTERS
FOR PHOTOVOLTAIC
PLANTS** **79**



INTERNAL PROTECTION - TRANSIENT SURGES

overview

The voltage surges are elevations in voltage that can occur in electrical distribution, data communications and telephony lines resulting in a premature aging of components and / or damage to the equipment connected to the network.

Overvoltages caused by direct lightning (Fig. 19), indirect (Fig. 20), disconnection of inductive loads (coils, motors, etc ...), network switches and / or defects in them (Fig occur. 21).

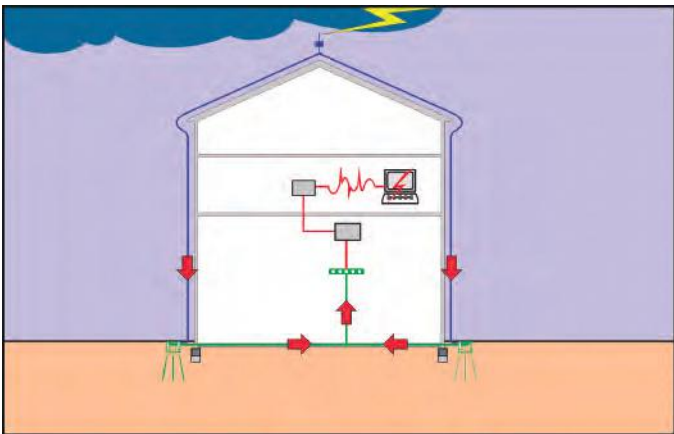


Fig. 19 – Direct discharge.

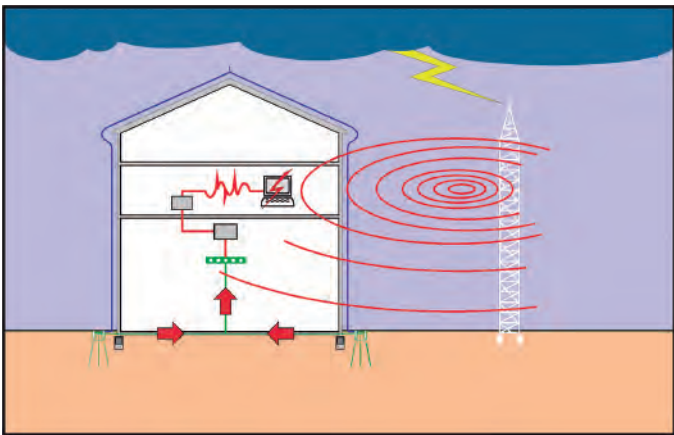


Fig. 20 – Nearby indirect discharge.

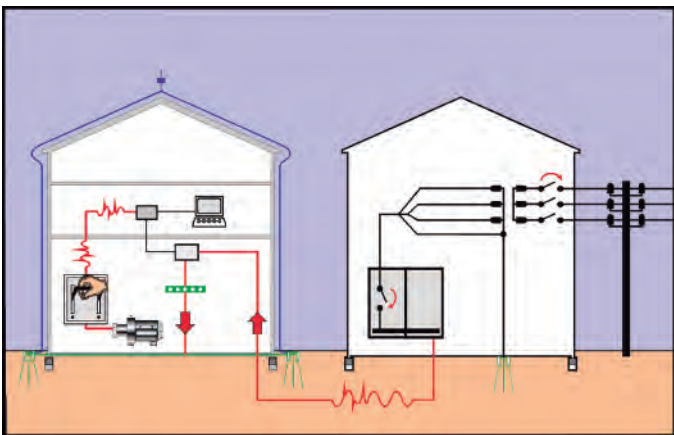


Fig. 21 – Switching networks.

Overvoltage surges are large spikes have with a slope and are short-lived, yet the strong effects on sensitive electronic equipment are devastating.

The level of the voltage that can appear on the network is a function of isoceraúnico area level (lightning / year • Km²), the type of attack, aerial or underground, and the proximity of the MV / LV transformer.

For proper protection of the equipment against power surges, a system must perform grounding of low ohmic value and connect equipotentially with an external protection system. Moreover, you should install protection against surges on supply lines (power, telephone, data, etc.).

Installation of external lightning protection (according to IEC 62305-3) and surge arresters (according to IEC 62305-4) significantly reduces the risk of damage caused by lightning in structures, equipment and people (calculation risks according to IEC 62305-2).

protection zones (LPZ)

External areas:

LPZ 0_A: area exposed to direct lightning strike (current and total magnetic field)).

LPZ 0_B: area exposed to indirect impact (partial flow and total magnetic field).

Internal areas:

LPZ 1: area exposed to overvoltage (induced current CIDA and attenuated magnetic field).

LPZ 2...n: area exposed to overvoltage (current induced).

SPD: Surge Protectors.

Sources of damage:

S1: Direct discharge on the structure

S2: Indirect discharge near the structure

S3: The discharge on service lines connected to the structure

S4: Indirect discharge near service lines connected to the structure.

r: rolling sphere radius

1: Structure

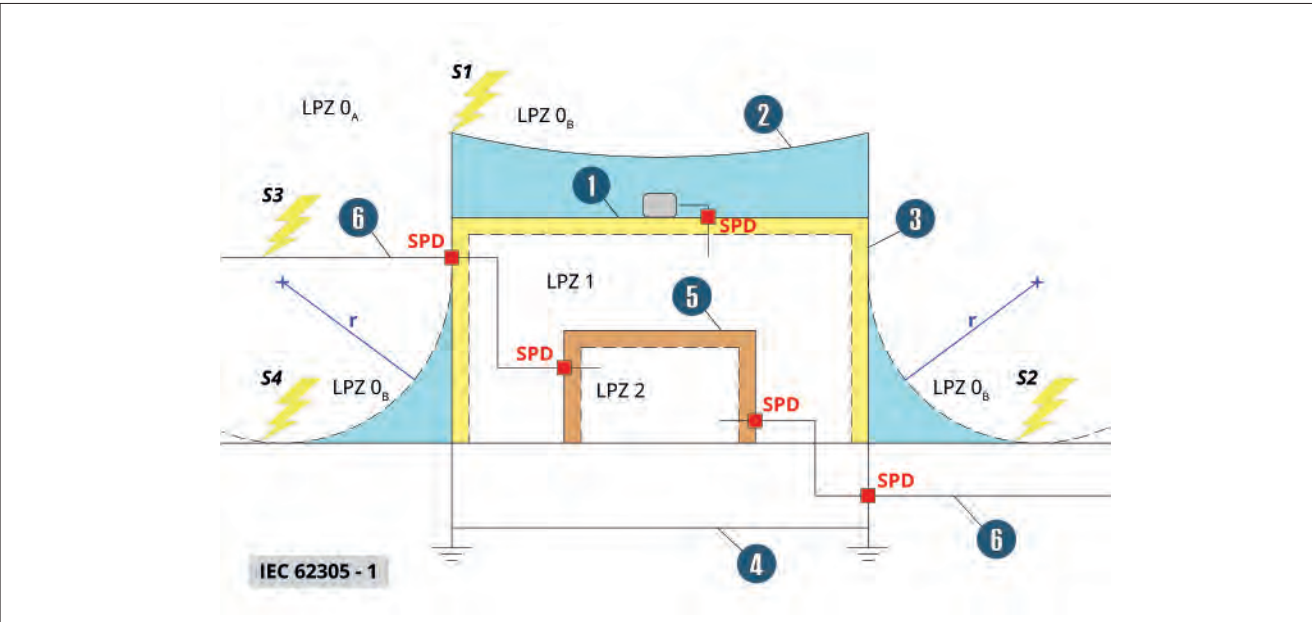
2: Lightning rods

3: Down-conductors

4: Grounding systems

5: Incoming services

6: Services connected to the structure



INTERNAL PROTECTION - TRANSIENT SURGES

► surge categories

The categories indicate what the value of voltage shock wave to withstand for the equipment and determine the maximum value of residual voltage U_p which should have surge protectors in each area.

The purpose of installing surge protectors is to avoid the devastating effects of surges on electrical and / or electronic equipment, cutting these peaks to permissible values as per RBT ITC-23, depending on the category that has the equipment want to be protected (Fig. 22).

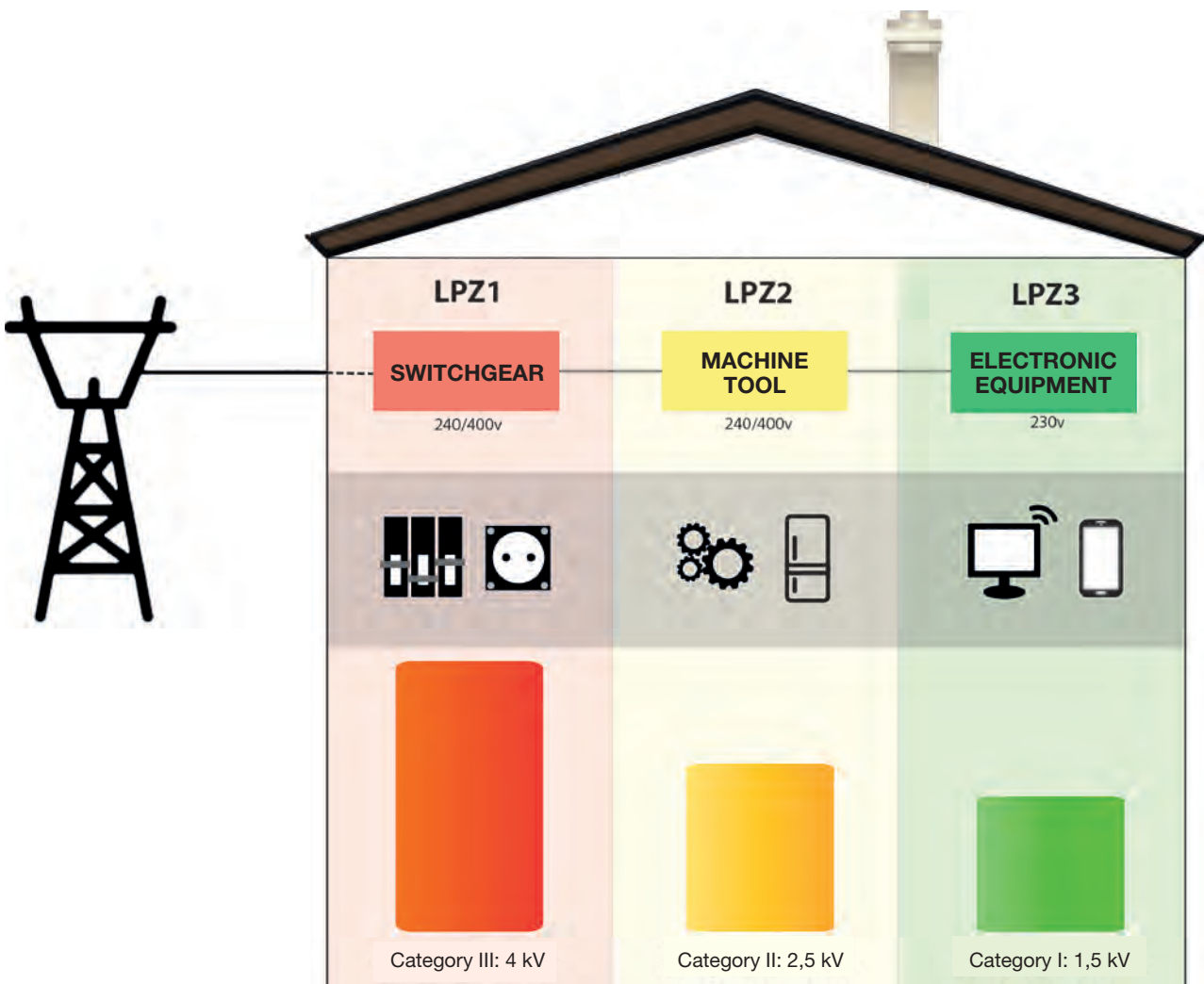


Fig. 22 – Surge categories

► selection of surge protectors

Surge protectors are connected between an active conductor (phase) and ground, upstream of the equipment they protect.

Normal impedance is high, but when the voltage exceeds the threshold voltage, the protector becomes a low-impedance ground to dissipate the surge, protecting the equipment.

To select which protector to install, we must consider:

- Nominal line voltage.
- Number of phases to be protected.
- Type of network (TT, TN, TNC, SCNT).
- Category of equipment to be protected.
- Level of exposure to surges (I_{max}).

► standards

Surge protection devices must conform to the following standards:

- UNE EN 61643-11:2013 Low voltage surge protection devices.
- IEC 62305 series – Lightning protection:
 - IEC 62305-1: Protection against lightning - General principles.
 - IEC 62305-2: Protection against lightning –Risk management.
 - IEC 62305-3: Protection against lightning – Physical damage to structure and life hazard.
 - IEC 62305-4: Protection against lightning – Electrical and electronic systems within structures.
- UNE 21186:2011 /NF C 17-102:2011 Protection against lightning: Lightning rods with early stream emitters.
- UNE EN 60664-1 Isolation coordination for low voltage equipment systems (networks).

POWER LINE
SURGE PROTECTORS



General protection against lightning and surges of low-voltage on electrotechnical facilities

Effective protection of main lines, branch lines, switchboards and equipment.

Three-phase and single-phase protectors, type 1+2 and type 2.

Easily replaceable, pluggable and blocking system modules

Base and modules configured for secure mounting.

Easy maintenance through local fault locator.

For protection of other lines (voice, data) or other such facilities (electrical installations with different voltage, etc ..) please consult.

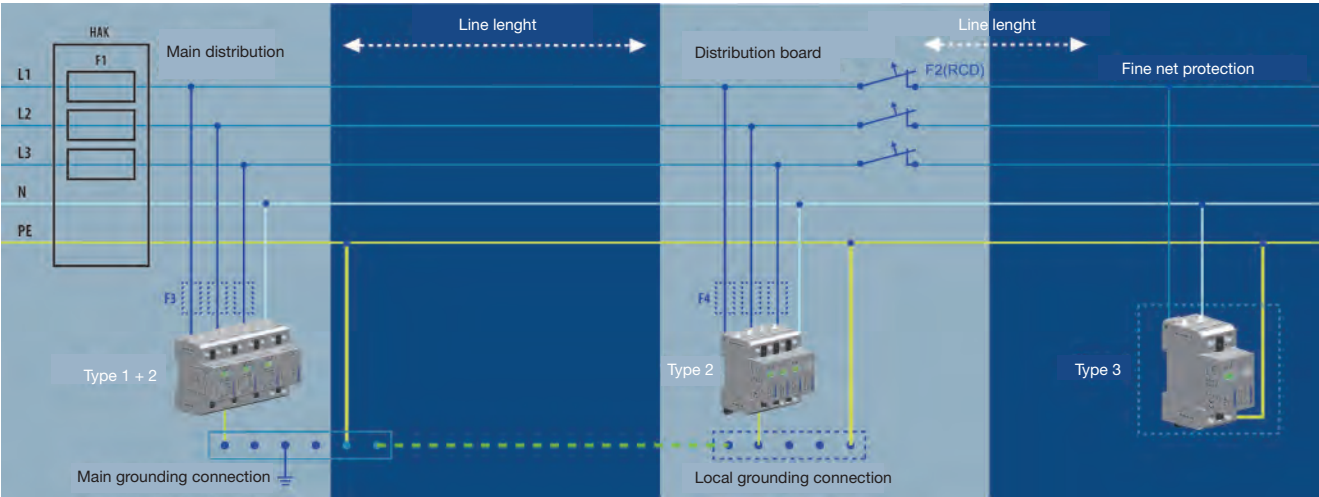
IEC 62305-1, 2, 3 y 4

IEC 61643-11

EN-60664-1

UNE 21.186:2011

NFC 17-102:2011



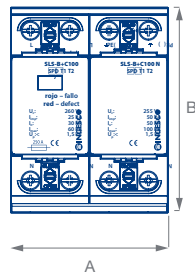
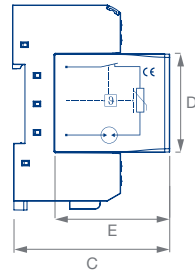
SLS-B+C100/1+1

Combined lightning discharger for low voltage networks of type T1 and T2.
220V monophasic lines.

SLS-B+C100/1+1

Description	Ref.	N° Phases	Protection grade	Working temp. range	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Weight (g)
SLS-B+C100/1+1	370213	F+N	IP20	from -40° to 80°C	72	90	72	45	48	670
SLS-B+C100/0	370215	-	IP20	from -40° to 80°C	-	-	-	45	48	300

Parameters				L-N	NPE
Rated voltage	U _n	230 V AC	-		
Maximum working voltage	U _c	260 V AC	255 V AC		
Peak value of lightning current (10/350µs)	I _{imp}	25 kA	50 kA		
Nominal discharge current (8/20µs)	I _n	30 kA	50 kA		
Maximum discharge current (8/20µs)	I _{max}	60 kA	100 kA		
Protection level	U _p	<1,50 kV			
Maximum fuse protection		250A gL/gG	-		
Response time	t _A	100 ns			
Min-max section rigid conductor connection		2,5-50 mm²			
Min-max section multi-strand conductor connection		2,5-35 mm²			
Local fault indicator		yes	no		
Installation		DIN rail			



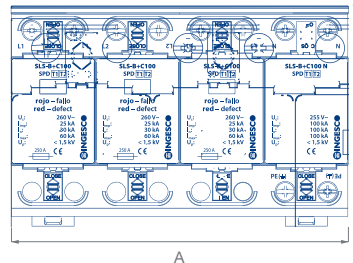
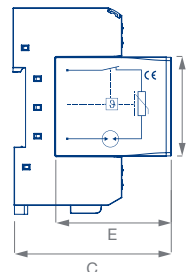
SLS-B+C100/3+1

Combined lightning to low voltage discharger for networks of type T1 and T2.
380V three-phase lines.

SLS-B+C100/3+1

Description	Ref.	N° Phases	Protection grade	Working temp. range	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Weight (g)
SLS-B+C100/3+1	370214	3F+N	IP20	from -40° to 80°C	144	90	72	45	48	1300
SLS-B+C100/0	370215	-	IP20	from -40° to 80°C	-	-	-	45	48	300

Parameters				L-N	NPE
Rated voltage	U _n	230 V AC	-		
Maximum working voltage	U _c	260 V AC	255 V AC		
Peak value of lightning current (10/350µs)	I _{imp}	25 kA	100 kA		
Nominal discharge current (8/20µs)	I _n	30 kA	100 kA		
Maximum discharge current (8/20µs)	I _{max}	60 kA	100 kA		
Protection level	U _p	<1,50 kV			
Maximum fuse protection		250A gL/gG	-		
Response time	t _A	100 ns			
Min-max section rigid conductor connection		2,5-50 mm²			
Min-max section multi-strand conductor connection		2,5-35 mm²			
Local fault indicator		yes	no		
Installation		DIN rail			



SLS-B+C50/1+1

Combined low-voltage surge protector for type T1 and T2.
230V single phase lines.

SLS-B+C50/1+1

Description	Ref.	Nº Phases	Protection grade	Working temp. range	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Weight (g)
SLS-B+C50/1+1	370241	F+N	IP20	de -40° a 80°C	36	82	72	45	48	240
SLS-B+C50/0	370247	-	IP20	de -40° a 80°C	-	-	-	45	48	95

Parameters

		L-N	NPE
Rated voltage	U _n	230 V AC	-
Maximum working voltage	U _c	275 V AC	255 V AC
Peak value of lightning current (10/350µs)	I _{imp}	12,5 kA	25 kA
Nominal discharge current (8/20µs)	I _n	30 kA	30 kA
Maximum discharge current (8/20µs)	I _{max}	60 kA	60 kA
Protection level	U _p	<1,2 kV	<1,5 kV
Maximum fuse protection		160A gL/gG	-
Response time	t _A	25 ns	100 ns
Min-max section rigid conductor connection		1-35 mm ²	
Min-max section multi-strand conductor connection		1-25 mm ²	
Local fault indicator		yes	no
Installation		DIN rail 35mm	

SLS-B+C50/3+1

Combined low-voltage surge protector for type T1 and T2.
Three-phase lines 230/400V.

SLS-B+C50/3+1

Description	Ref.	Nº Phases	Protection grade	Working temp. range	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Weight (g)
SLS-B+C50/3+1	370242	3F+N	IP20	de -40° a 80°C	72	82	72	45	48	460
SLS-B+C50/0	370247	-	IP20	de -40° a 80°C	-	-	-	45	48	95

Parameters

		L-N	NPE
Tensión nominal	U _n	230 V AC	-
Máxima tensión de trabajo	U _c	275 V AC	255 V AC
Valor cresta corriente de rayo (10/350µs)	I _{imp}	12,5 kA	50 kA
Intensidad nominal de descarga (8/20µs)	I _n	30 kA	50 kA
Intensidad máxima de descarga (8/20µs)	I _{max}	60 kA	100 kA
Nivel de protección	U _p	<1,2 kV	<1,5 kV
Máxima protección previa por fusibles		160A gL/gG	-
Tiempo de respuesta	t _A	25 ns	100 ns
Sección min-max de conexión, conductor rígido		1-35 mm ²	
Sección min-max de conexión, conductor multifilar		1-25 mm ²	
Indicador local de defecto		yes	no
Montaje		DIN rail 35mm	

SLS-C20/1+1

Low-voltage surge protector for type T2, class C. 220V single phase lines.

SLS-C20/1+1

Description	Ref.	Nº Phases	Protection grade	Working temp. range	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Weight (g)
SLS-C20/1+1	370219	F+N	IP20	from -40° to 80°C	36	82	72	45	48	230
SLS-C20/0	370221	-	IP20	from -40° to 80°C	-	-	-	45	48	95

Parameters

		L-N	NPE
Rated voltage	U _n	230 V AC	-
Maximum working voltage	U _c	275 V AC	255 V AC
Peak value of lightning current (10/350µs)	I _{imp}	-	12 kA
Nominal discharge current (8/20µs)	I _n	20 kA	20 kA
Maximum discharge current (8/20µs)	I _{max}	40 kA	40 kA
Protection level	U _p	<1'5 kV	
Maximum fuse protection		160 A gL/gG	-
Response time	t _A	25 ns	
Min-max section rigid conductor connection		1-35 mm ²	
Min-max section multi-strand conductor connection		1-25 mm ²	
Local fault indicator		yes	no
Installation		DIN rail	

SLS-C20/3+1

Low-voltage surge protector for type T2, class C. 380V three-phase lines.

SLS-C20/3+1

Description	Ref.	Nº Phases	Protection grade	Working temp. range	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Weight (g)
SLS-C20/3+1	370220	3F+N	IP20	from -40° to 80°C	72	82	72	45	48	450
SLS-C20/0	370221	-	IP20	from -40° to 80°C	-	-	-	45	48	95

Parameters

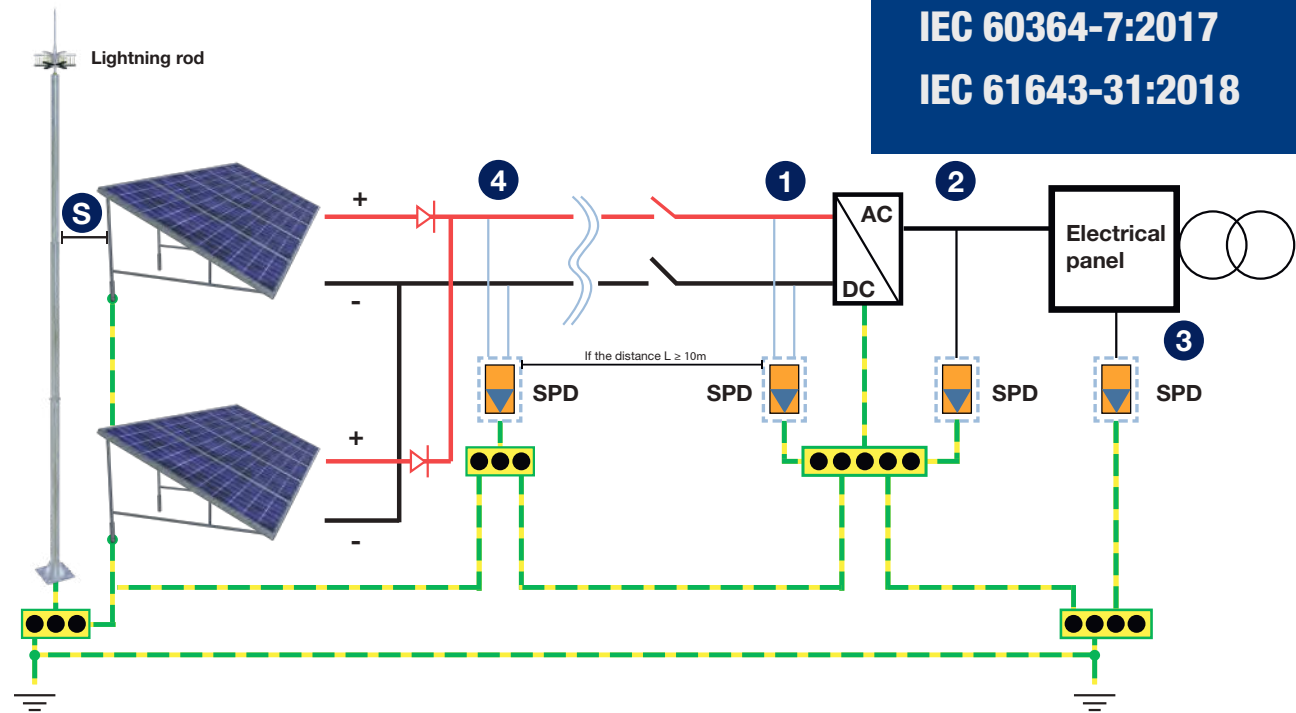
		L-N	NPE
Rated voltage	U _n	230 V AC	-
Maximum working voltage	U _c	275 V AC	255 V AC
Peak value of lightning current (10/350µs)	I _{imp}	-	12 kA
Nominal discharge current (8/20µs)	I _n	20 kA	20 kA
Maximum discharge current (8/20µs)	I _{max}	40 kA	40 kA
Protection level	U _p	<1,35 kV	<1,50 kV
Maximum fuse protection		160A gL/gG	-
Response time	t _A	25 ns	100 ns
Min-max section rigid conductor connection		1-35 mm ²	
Min-max section multi-strand conductor connection		1-25 mm ²	
Local fault indicator		yes	no
Installation		DIN rail	

SURGE ARRESTERS FOR PHOTOVOLTAIC PLANTS



Protection against lightning and transient overvoltage in photovoltaic panels
SPD type 2 with Y connection
Pluggable arresters , easily replaceable modules with locking system
Easy maintenance through a local fault indicator.
For another type of protection of photovoltaic installations, consult.

IEC 62305-1, 2, 3 y 4
IEC 61643-11
EN-60664-1
UNE 21.186:2011
NFC 17-102:2011
RBT ITC-23
EN 50539-11:2013
IEC 61643-32:2017
IEC 60364-7:2017
IEC 61643-31:2018



Types of surge protection devices (SPD) IEC61643-32:2017			
Situation	Location 3	Location 2	Locations 1 and 4
	Without external LPS	SPD class I (IEC61643-11) or SPD class II (IEC61643-11)	SPD class II (IEC61643-31)
	With external LPS with separation distance S	SPD class I (IEC61643-11)	SPD class II (IEC61643-31)
	With external LPS without separation distance S	SPD class I (IEC61643-11)	SPD class I (IEC61643-31)

SLS-PV1000/3Y

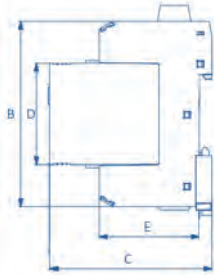
Three-phases type T2 surge arrester for 1000 V photovoltaic panels.

SLS-PV1000/3Y

Description	Ref.	Nº Phases	Protection grade	Working temp. range	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Weight (g)
SLS-PV1000/3Y	370222	3F	IP20	-40° to 80°C	54	82	72	45	44	340

Parameters

Maximun operating voltage	1020V DC	
Nominal discharge current (8/20 µs)	I _n	15kA
Maximum discharge current (8/20 µs)	I _{max}	40 kA
Voltage protection level	U _p	4,0 kV
Response time	t _A	25 ns
Cross-section of connected conductors solid	1/35 mm²	
Cross-section of connected conductors stranded	1/25 mm²	
Fault indication	yes	
Mounting	DIN rail	



SLS-PV700/3Y

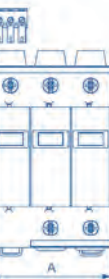
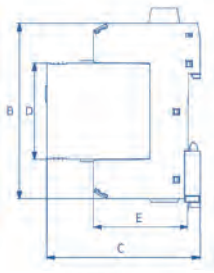
Three-phases type T2 surge arrester 700 V photovoltaic panels.

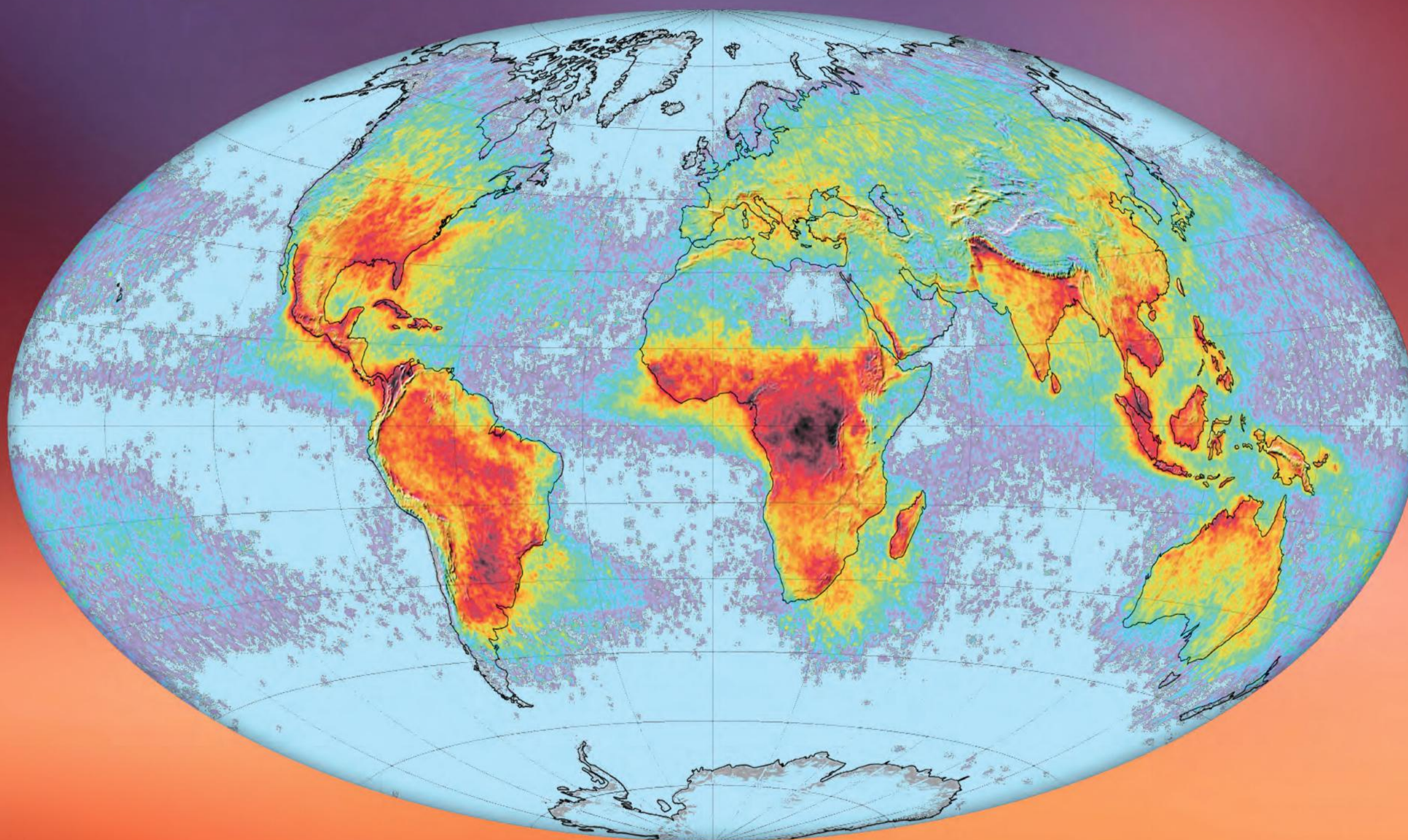
SLS-PV700/3Y

Description	Ref.	Nº Phases	Protection grade	Working temp. range	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	Weight (g)
SLS-PV700/3Y	370239	3F	IP20	-40° a 80°C	54	82	72	45	44	340

Parámetros

Maximun operating voltage	750V DC	
Nominal discharge current (8/20 µs)	I _n	20 kA
Maximum discharge current (8/20 µs)	I _{max}	40 kA
Voltage protection level	U _p	3,6 kV
Response time	t _A	25 ns
Cross-section of connected conductors solid	1/35 mm²	
Cross-section of connected conductors stranded	1/25mm²	
Fault indication	yes	
Mounting	DIN rail	





Lightning flashes (Km²/year)



STORM DETECTORS

THUNDERSTORM WARNING 82

PREVISTORM 88

LINET Network 88

PREVISTORM.net 88

STORM DETECTORS: THUNDERSTORM WARNING SYSTEMS

► overview

Certain industrial and social activities are sensitive to the effects of lightning. For example, companies where hazardous activities are performed and / or work outside, telecommunications systems, power generation companies, transportation and many others. Activities such as sports, outdoor events, etc. require lightning hazard warning information.

To cover these needs, in the European Union there is the European standard **EN 50536-1: 11** and the in rest of the world, the international standard **IEC 62793**. These standards define the hazard warning system and how to implement lightning alarm systems.



Wind turbines



Industry



Leisure



Research



Communications



Sports

► PREVISTORM solutions

INGESCO offers a wide range of solutions adapted to these rules. On the one front, the **PREVISTORM STORM DETECTOR** system sets an isolated system capable of detecting the formation of storm clouds from the early stages.

Furthermore, the system **PREVISTORM.net** by detecting lightning and precise location in real time, enables the generation of alarms when the storm approaches dangerously (in areas where the network **LINET** is already operating).

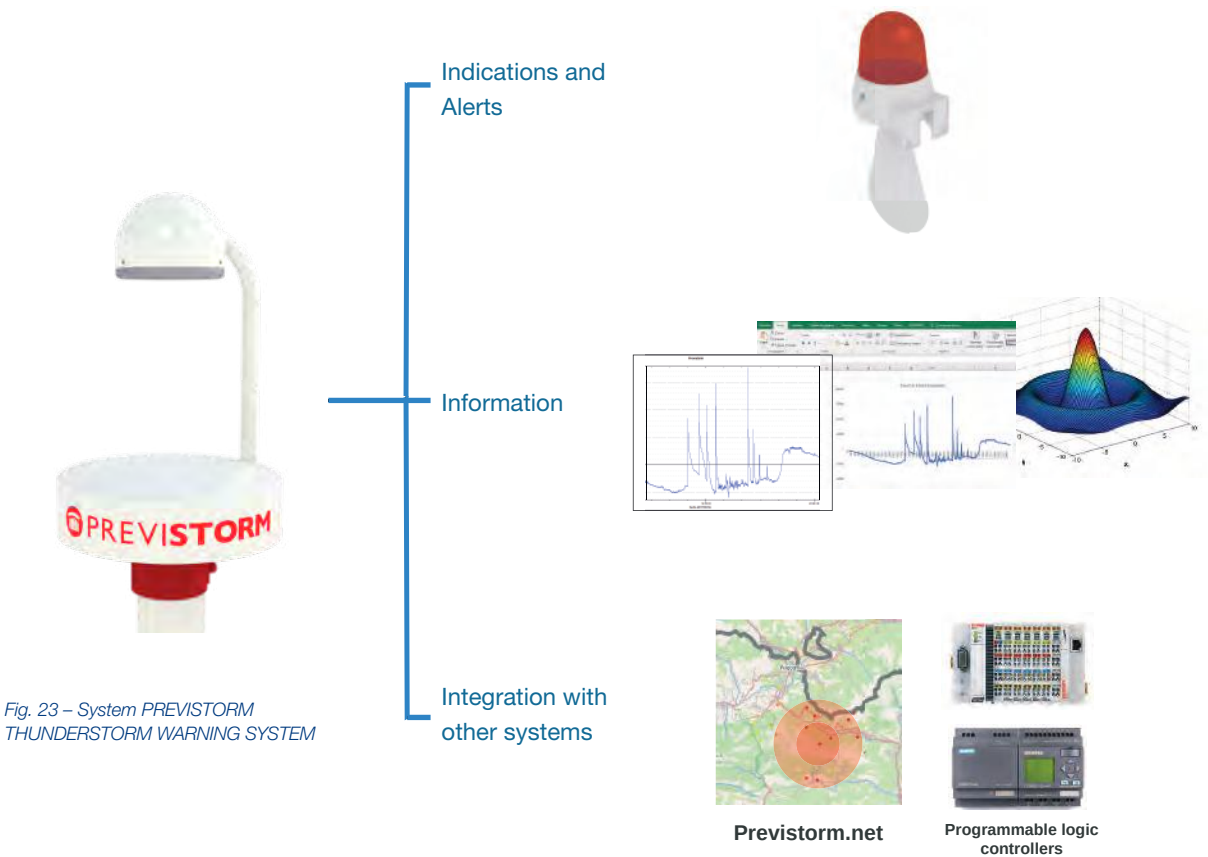
As well as the implementation of new **LINET** networks for large companies or state institutions interested in having its own network of lightning detection.

► PREVISTORM THUNDERSTORM WARNING SYSTEM:

Electric field sensor for early warnings and alerts generation.

Electrostatic field measurement system to know in-situ when the lightning risk has increased. It acts in a localized way, allowing to know in advance the possibility of lightning strikes in a location.

It is not necessary a lightning strike to detect the storm activity.



PREVISTORM THUNDERSTORM WARNING SYSTEM is composed of:

- An external sensor PREVISTORM R-Field Sensor that allows to measure the electrostatic field evolution.
- An indoor connection box:
 - Protection of data lines and sensor power.
 - Connection of external automation and signaling devices.
 - Connection to a computer.
- A management software that provides MCE sensor remote control functions ,display functions, historical data, analysis of the evolution of the electrostatic field and alarm configuration by the user.

STORM DETECTORS: THUNDERSTORM WARNING SYSTEMS

► LINET: High precision lightning detection network

An unique system of extraordinary efficiency for detecting lightning that allows customers to purchase and operate their own independent network with highly reliable lightning location. A network focused on the needs of businesses for quality of prevention against lightning.

This system detects both intra-cloud as well as cloud to ground lightning, and records the characteristics of each of the lightning strikes.



Fig. 24 – LINET field antenna sensor.

• Who benefits from LINET systems?

Large companies or public institutions interested in having its own network of lightning detection, as LINET systems deliver more lightning data more accurately than those obtained from commercial networks. Lightning information is easily visualized with exclusive applications.

Energy companies, from controlling pipelines to electricity distribution networks or wind power generation parks in places where there is no quality lightning information available.

National meteorological services, airport systems or military prefer to have their own lightning and detection systems and use LINET systems.

• LINET System advantages:

- High detection efficiency.
- Great location accuracy (accuracy < 100m).
- 3D detection.
- Continuous real-time operation.
- Easy installation.

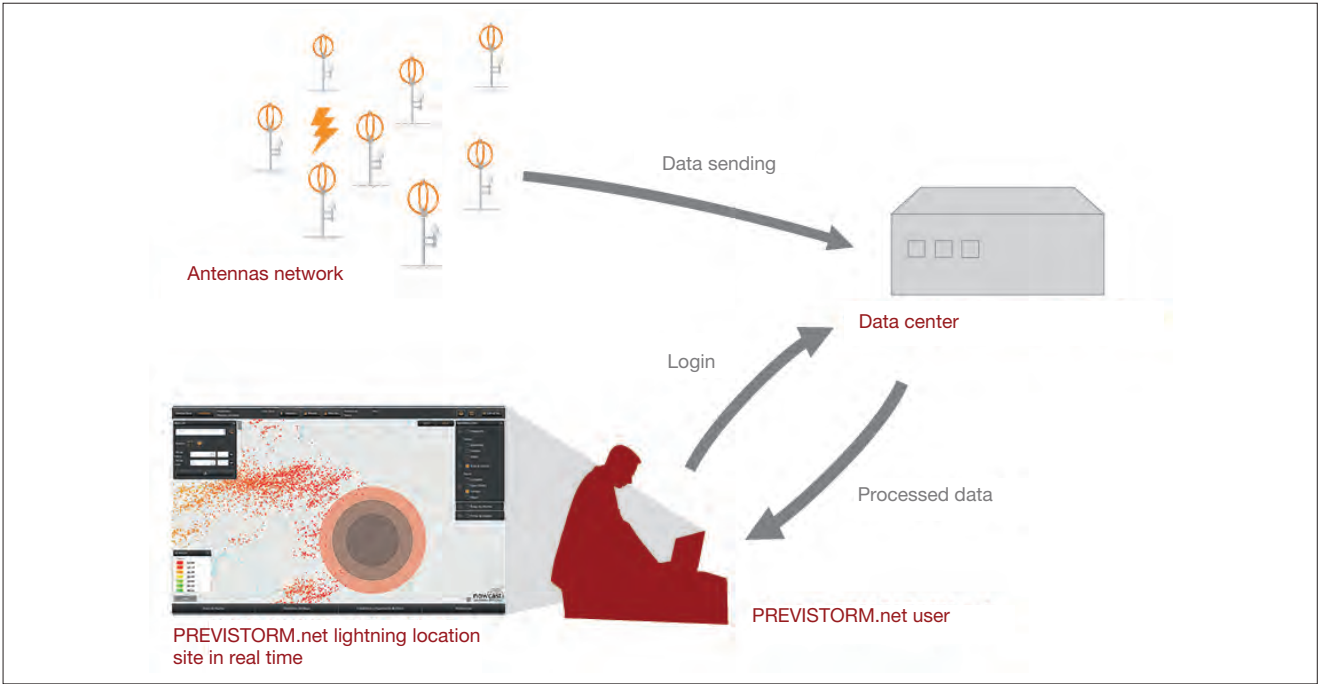


Fig. 25 – LINET network.

► PREVISTORM.net

Lightning information can be stored in databases. Each strike is characterized by: Date, Time, Latitude, Longitude, polarity, current, lightning type (cloud-to-ground, or intra-cloud) and height (in case of intra-cloud). However, the user has applications that allow access to information in a more accessible manner with applications such as:

PREVISTORM.net: the professional application that allows a global view on the current situation of thunderstorm activity, visualizing the present and historical lightning strikes. There are defined alarm areas around the points / areas of interest (you can insert any form) and the operator can receive early risk warnings of the approach of a storm. The main features are:

- Warning of nearby storms through SMS and e-mail.
- Monitoring and analysis of detected lightning.
- Automatic list of lightning in areas of interest.
- Statistics
- Online access from any computer.
- Ability to export data in text format to Google Earth.
- Grouping and prediction of lightning storm cells.
- Auto alarm settings.
- Generating predictive cells.
- Alarm log file.



Fig. 26 – PREVISTORM.net display image

STORM DETECTORS:
THUNDERSTORM WARNING SYSTEMS



Preventive detection of storms standard, **IEC 62793:2016** (Protection against lightning storm warning systems) was published in May 2016, in order to avoid risks for humans and property involved in this destructive atmospheric phenomenon.

Each year, due to the direct or indirect effects of lightning strikes, property damage occurs, affecting the continuity of service in the public and private sectors. Also, lightning causes injury or serious human deaths worldwide throughout the year.

PREVISTORM

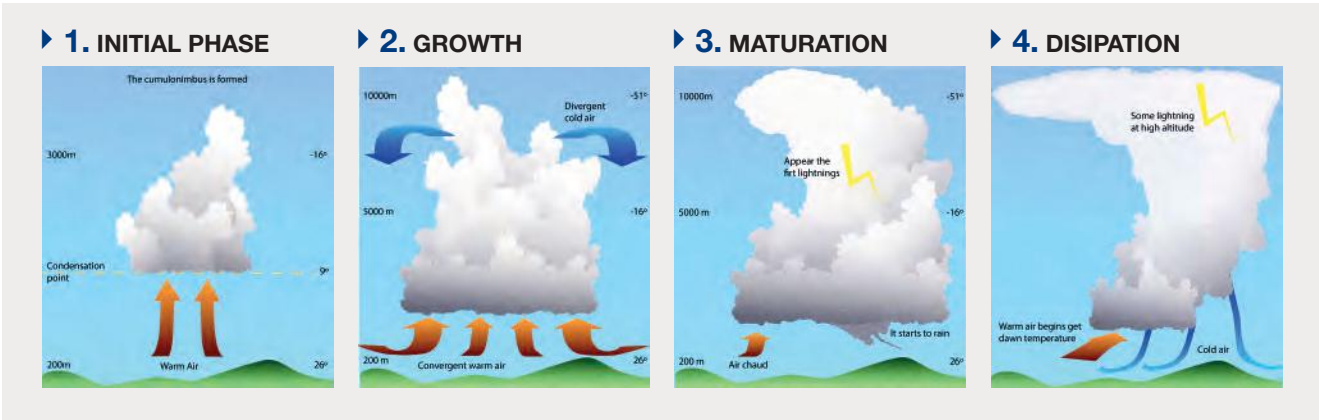
RED LINET

PREVISTORM.net

EN 50536-1:2011

IEC 62793:2016

► storm phases



► storm detectors classification (IEC 62793:2016)

- **Class A:** Detects the storm throughout its life cycle (Phase 1 through 4).
 - **Class B:** Detects IC (cloud-to-cloud) and CG (cloud-to-ground) lightning (Phase 2 through 4).
 - **Class C:** Detects CG (cloud-to-ground) lightning (Phase 3 to 4).
 - **Class D:** Detects CG (cloud-to-ground) lightning (Phase 3) and other electromagnetic sources with limited efficiency.
- **PREVISTORM solutions**
- Storm and possible lightning strike warning systems to end users by way of **electrostatic field sensors** (immediate response time).
 - Storm and possible lightning strike warning systems to end users in an area of 30 km by **web application**.
 - **Real-time** service.

PREVISTORM STORM DETECTOR

Storm detector, electrostatic field sensor.
Class A (IEC 62793: 2016) storm detector.

Modelo	Ref.
Previstorm PVS 24S Low power consumption	700031
Previstorm PVS 48S Heaters for de-icing	700032



LINET NETWORK

High-precision detection network. Storm detector Class II (EN 50536-1: 2011).

Projects for the implementation of detection networks. It is necessary to conduct an implementation study, the installation of at least five sensors (antennae) located about 200 km for another sensor being necessary.

For data of smaller areas please consult.

In countries where the LINET network is already operating, lightning information can be only be provided (PREVISTORM.NET) without installing sensors.

Check LINET countries with active networks.

Model	Ref.
LINET Network project	700906



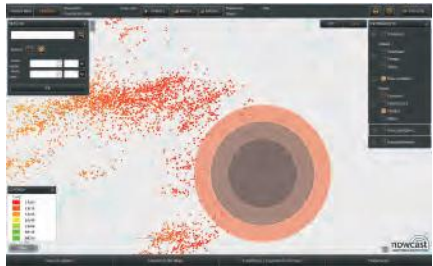
PREVISTORM.net

Lightning location system, real-time display and record. Storm detector Class II (EN 50536-1: 2011).

Via internet connection. Does not require the installation of any sensor equipment. Information of lightning in an area of 30km radius, centered on the chosen location.

Setting of alarms and warnings via SMS or e-mail. PREVISTORM.net operates throughout Europe. Please consult for other countries.

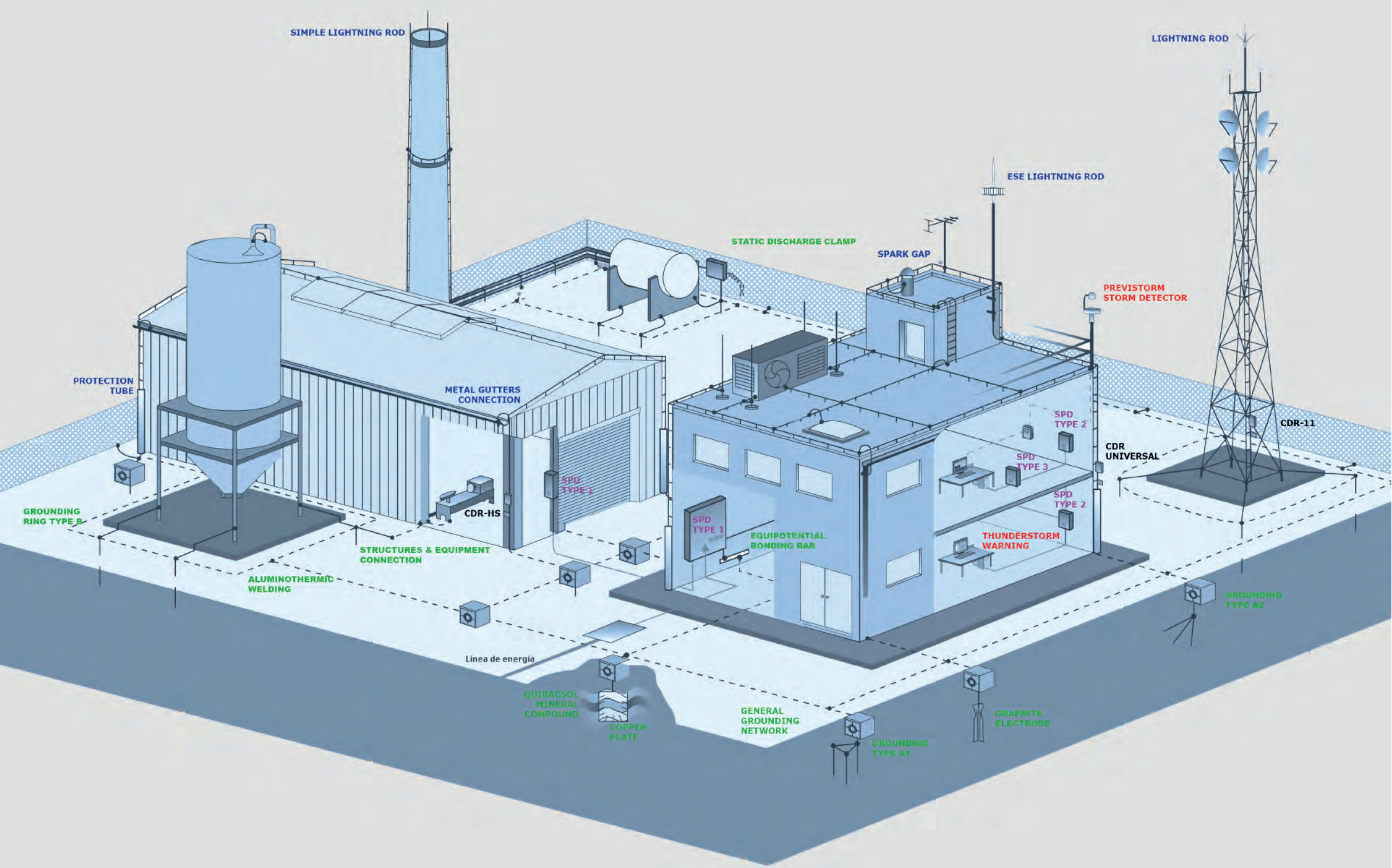
Model	Ref.
PREVISTORM.net SLR	700918
PREVISTORM.net AR	700919
PREVISTORM.net SLR	700920



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- SURGE ARRESTORS
- EXTERNAL LIGHTNING PROTECTION
- PREVENTION
- CONTROL SYSTEMS

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1 EXTERNAL LIGHTNING PROTECTION

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430019	CDR-11	66	500061	L-CPL70/25X3	59
430022	DL EOLOS K15FO	68	500062	L-PL25x3	59
430023	DL EOLOS FORCVR-3CH	68	500063	TH-PL25x3	59
430025	DL EOLOS FORCVR-1CH	68	500064	X-PL25x3	59
432027	CDR-HS	66	500065	P-PL25x3	59
432028	CDR UNIVERSAL	65	500066	T-80 tong	60
500001	C4 45 load	59	500067	Wire brush	60
500002	C5 65 load	59	500068	Brush	60
500003	C6 90 load	59	500069	R-4 scraper (C4 and C5 load cartridge)	60
500004	C7 115 load	59	500070	R-9 scraper (C6 and C7 load cartridge)	60
500005	LCC35/35	56	500071	Ignition gun	60
500006	LCC50/35	56	500072	Remote ignition device	60
500007	LCC50/50	56	500073	Long distance ignition consumable	60
500008	LCC70/35	56	500074	Quick fastening auxiliary cap	60
500009	LCC70/50	56	700031	TWS 24S	88
500010	LCC70/70	56	700032	TWS 48S	88
500011	TH-CC35/35	57	700906	Red LINET project	88
500012	TH-CC35/50	57	700907	PREVISTORM.net SLR	88
500013	TH-CC35/70	57	800067	30x2-3,5 mm tape adaptor	39
500014	TH-CC50/35	57	800168	Support self-filling with concrete Ø8 mm	39
500015	TH-CC50/50	57	800237	Concrete support for Ø8-Ø10mm	39
500016	TH-CC50/70	57			
500017	TH-CC70/35	57			
500018	TH-CC70/50	57			
500019	TH-CC70/70	57			
500020	LP-CC35/35	57			
500021	LP-CC35/50	57			
500022	LP-CC35/70	57			
500023	LP-CC50/35	57			
500024	LP-CC50/50	57			
500025	LP-CC50/70	57			
500026	LP-CC70/35	57			
500027	LP-CC70/50	57			
500028	LP-CC70/70	57			
500029	X-CC35/35	57			
500030	X-CC35/50	57			
500031	X-CC35/70	57			
500032	X-CC50/35	57			
500033	X-CC50/50	57			
500034	X-CC50/70	57			
500035	X-CC70/35	57			
500036	X-CC70/50	57			
500037	X-CC70/70	57			
500038	TPC14/35	58			
500039	TPC14/50	58			
500040	TPC14/70	58			
500041	TPC18/35	58			
500042	TPC18/50	58			
500043	TPC18/70	58			



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