

Protection System against Atmospheric Discharges and Electromagnetic Pulses avoiding direct lightning strike on all marine boats

Manufactured with:  
**STAINLESS STEEL & POM & SALINE PROTECTOR**

Packaging:  
**Recycled cardboard & LDPE**  
10" x 10" x 18"



Measurements:  
**5" x 10"**

Weight:  
**5,4 lb**

Passive Collector System of electrostatic currents on time, that takes them to the ground, whose operating principle is based on balancing or compensating the variable electric field on it's surroundings, avoiding the creation of an upward leader on the DDCE Marine and on the vessel that protects.

**Introduction**

The DDCE Marine-LT has been specially designed for the protection against direct lightning strike of all types of marine vessels. All the materials that compose it comply the requirements of maritime salinity and corrosion, ensuring their correct operation and enduring shape. The design of the DDCE Marine-LT provides adequate protection against electromagnetic pulses derived from potential lightning strikes in nearby areas, acting as a thermal fuse and minimizing its effects on the device itself and on the vessel it protects.

**DDCE Marine performance**

Tests carried out in the Official INTA laboratory (National Institute of Aerospace Technology) belonging to the Ministry of Defense of Spain, which certify the optimal operation of the DDCE Marine in the spectrum between 0.4 to 2 GHz as a compensator for variable electric fields, behaving as a sink of variable radio frequency electric fields without emitting radiant electric fields in this frequency spectrum.

**Coverage radius**

To carry out the design of the Lightning Protection System (LPS) in all vessels and / or structures located at sea (off shore, various platforms, boats of all kinds), using DDCE Marine products (models BG, MD and LT) the Rolling Spheres

method or the angle method will be applied, always with Level I of protection (R = 66 ft).

1. All metal structures meet the requirements described in the UNE EN IEC 62305 (Part III) standard, to be accepted as part of the LPS.
2. All metallic structures are at the same electric potential as the lower hemisphere of the DDCE-Marine.

**RADIUS OF PROTECTION OF DDCE Marine-LT**

ROLLING SPHERE METHOD

h (ft)	r (ft)
16	144
33	205
49	249
66	286
82	318
88	328
98	328
131	328
164	328



ANGLE OF PROTECTION METHOD

h (ft)	α (degrees)	r (ft)
16	80,37	97
33	76,36	135
49	73,26	164
66	70,63	187
82	68,30	206
98	66,19	223
115	64,23	238
131	62,39	251
148	60,66	263
164	59,01	273
180	57,43	283
197	55,91	291

Figure 1. Protection radius of the DDCE Marine-LT.

## Example rolling spheres method – Level I of protection

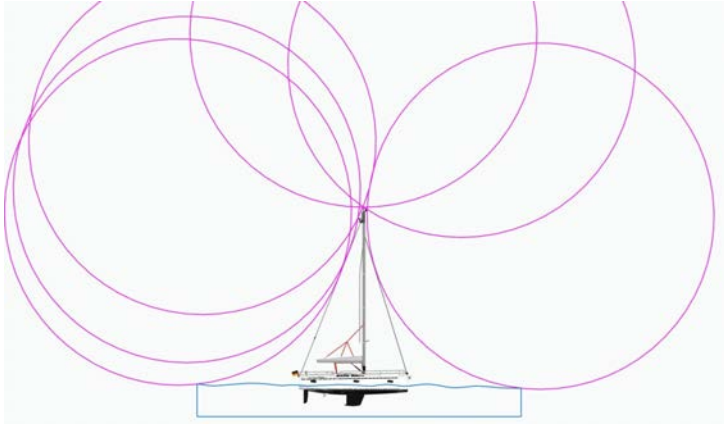


Figure 2. SPCR Rolling Spheres Method Level I of Protection (R = 66 ft) in a boat with a height of 56 ft.

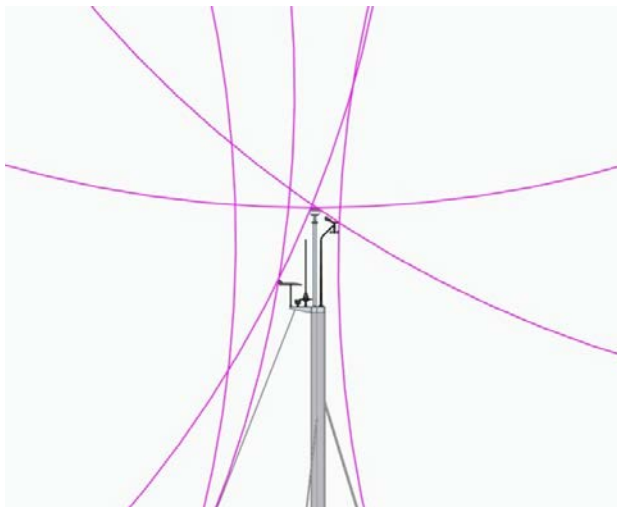


Figure 3. Detail of the Rolling Spheres Method in the upper area of the mast of the boat in figure 2.

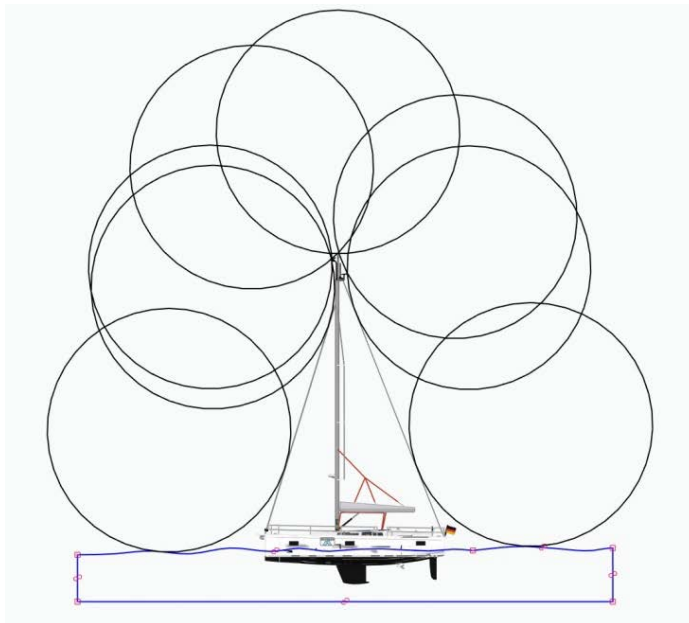


Figure 4. LPS Rolling Spheres Method Level I of Protection (R = 66 ft) in a boat with a height of 131 ft.

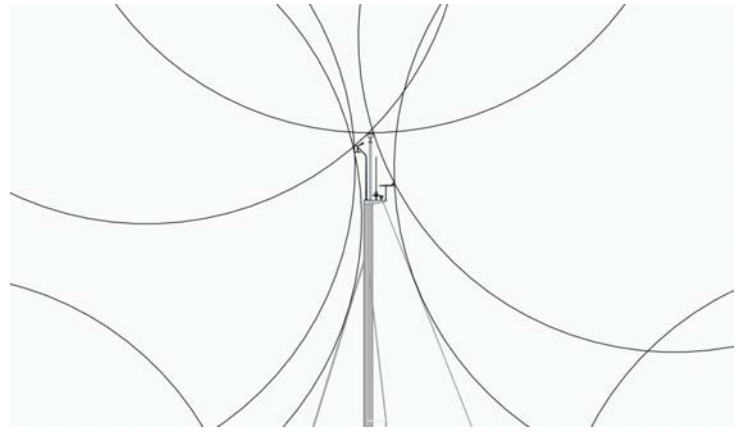


Figure 5. Detail of the Rolling Spheres Method in the upper area of the mast of the boat in figure 4.

### Equipotential of metallic structures

There must be an equipotential system of all the metallic structures of the protected boat.

For this, the metallic structures will be connected by groups. The equipotential bar will be connected to the hull or directly to the sacrificial anodes (in the case that they have been installed for galvanic protection of the hull), in the case of being metallic and to the ground plate, in the case of non-metallic hulls. The ground plates can be arranged bolted to the hull or to a support, reinforcement or bench.

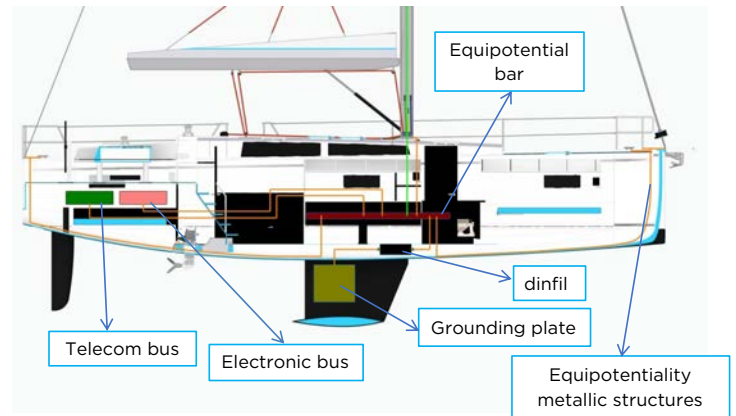


Figure 6. General detail of equipotential system.

### Protection against indirect effects (induced overvoltages)

The DDCE Marine protects from the direct impact of lightning on the marine vessel, but not from the potential indirect effects (external induced surges from ground or through the power supply wire or electromagnetic pulses "EMP") coming from lightning strikes on its surroundings.

For this reason, in marine vessels, the electrical installation must be protected against overvoltages and short circuits by fuses or circuit breakers activated by overloads.

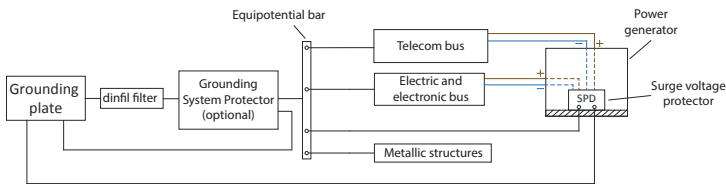


Figure 7. General diagram of protection in a boat.

## Type of protectors to have

### Type 1 protectors:

For nominal voltage 230 V, 50 kA,  $\leq 4\text{kV F+N}$

### Type 1 + 2 protectors:

For nominal voltage 230/400 V, 50 kA,  $\leq 4\text{ kV 3F+N}$

### Protection for telephone line or ADSL Type 1:

20 kA

### Type 2 protectors:

Nominal discharge current C2 (8/20 us) 2,5 kA

### Protector for TV / SAT antenna Type 1 + Type 3:

Nominal discharge current C2 (8/20 us) 10 kA

### High frequency surge protector

Dinfil filter model DNNFT (10/350us) 100 kA

In order to protect the DDCE and the electrical and electronic equipment of marine vessels from possible high-frequency overvoltages induced by ground, the dinfil high-frequency filters will be placed between the ground connections and the overvoltage protectors (See Figure 7).

To protect the installation of vessels from overvoltages induced by the port or marina electrical outlet, it is recommended to have an isolation transformer or an isolation potential filter (galvanic isolation). If this is not possible, the neutral of the boat will be disconnected from the grounding of the port socket (or a dinfil filter will be installed), in order to minimize the effect of overvoltage.

## Applications

For all types of boats, prior mandatory technical study.

Vessels with predominant masts sensitive to weights greater than 6,61 lb in their upper part.

## Installation

The DDCE Marine must be placed at the appropriate height according to the requirements of figure 9. The DDCE drop wire will go inside the holding mast and the mast of the boat until it is grounded. The path of the wire will always be downward and as direct as possible to its ground connection or plate, always avoiding curves less than radius of 7". The minimum section of the wire will be 0,03875 SF of copper for its correct operation, being recommended 0,0775 SF of copper or similar, according to the requirements of the UNE EN IEC 62305 standard.

The dinco protection connector will be placed just at the downward wire fixing outlet. The dinfil filter will be installed just before the connection of the wire to the ground plate.



Figure 8. Standard mast installation.

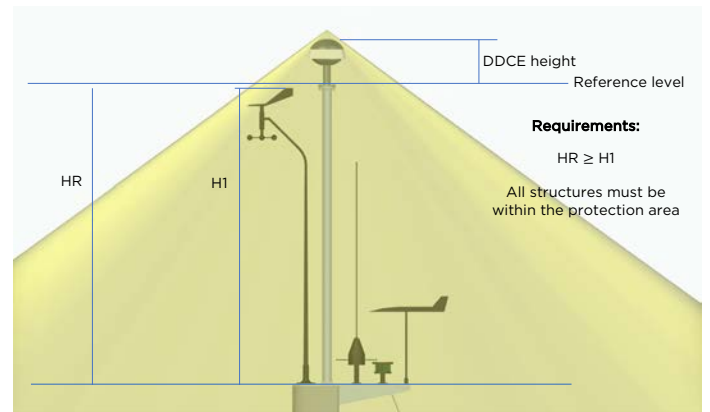


Figure 9. Height requirements for the DDCE in respect with the rest of the installed elements.

## Maximum working voltage without lightning discharge

### Progressive voltage increase

705 kV are applied at 4 ft progressively without lightning discharge (maximum applied in the laboratory). According to the high voltage tests carried out in the Electrical Engineering Laboratory of the University of P a u (University Center for Scientific Research).

### Instantaneous tension application (comparison with Franklin Point)

With Peak Voltage (kV) U100 of 427.6 KV at 4 ft, it always appears primed at the Franklin tip.

With Peak Voltage (kV) U50 of 530.8 KV at 4 ft, it appears primed on the ground or base of the mast, but always outside the DDCE Marine.

According to the high voltage tests of the Official Central Laboratory of Electrotechnics (LCOE) of Getafe (Madrid).

## Current impulses of 100 kA. Waveform 10 / 350us

The DDCE Marine-LT has passed the 100 kA current impulse tests with a 10 / 350us waveform according to the UNE EN IEC 62305:2011, NFC 17-102:2011 y UNE 21186:2011 (section C3.4). The waveforms applied correspond to the UNE-EN 62561 standard.

$I_p$  (kA) = 100 kA  $\pm$  10 %

W/R = 2500 kJ/  $\Omega$   $\pm$  35%

Q = 50 C  $\pm$  20 %

Duration < 10 ms

Carried out at the Official Central Laboratory of Electrotechnics (LCOE) in Getafe (Madrid) with satisfactory results.

Test	$I_{peak}$ (kA)	W/R (kJ/ $\Omega$ )	Q (C)	t1 ( $\mu$ s)	t2 ( $\mu$ s)	Visual Inspection
RI15-01	117,1	2667	45,1	25,3	311,3	OK
RI15-02	116,5	2650	43,1	25,2	312,5	OK
RI15-03	106,4	802	2,4	25,2	52,8	OK
RI15-04	117,3	2680	43,4	25,2	309,1	OK

Figure 10. Tabulated results of the test.

## Bureau Veritas Certification (Es036861)

Lightning protection | UNE-EN (IEC 62305:2012)

Lightning strike risk security | TBC (Technical Building Code): SU8

NBR 5419:2015 | IRAM 2184:2011

NTC 4552:2008 | SANS 10313:2012

AS/NZS1768/2007

NFPA 780:2011 | CAN/CSA-B72-M87(R2013)

## NATO Certification

The DDCE is officially certified by NATO in the concept of "Lightning Protection System and Electromagnetic Protector" with the NATO code DDCE:NCAGE:SYN37.

The DDCE has been selected to be part of the NATO Cataloguing System (NCS), by which it is guaranteed that a same article is known within the logistics field of the countries members of the system by one and sole denomination and a sole NATO Catalog Number (NOC).

## CE Labeling

The DDCE device is compliant with General Law of Security Products and working limits of Electromagnetic Compatibility, under EC Labeling requirements:

Product Safety | Directives 2001/95/CE

Electromagnetic Compatibility | Directives 2004/108/CE

## Quality Management System

Dinnteco International works with the Quality Management System according to international standards ISO 9001: 2015 applied to: design, manufacture and sale of compensating devices for variable electric fields, variable radio frequency electromagnetic shield and electrostatic charge deionizers: DDCE models, DDCE Plus, dineol and PDCE. Design, manufacture and sale of dinfil high frequency earth filters and dinco protection connector.

## Labor Risk Prevention

The DDCE is compliant with the requirements of preventive action (Article 5) of the Law 31/1995 of November 8th of Labor Risk Prevention, as well as RD 614/2001 of June 8th about health and safety protection of workers from electric risk.

## Environmental Protection

Metallic materials comply with Rohs regulations.

## Maintenance

Annual mandatory, executed and certified by the official installer.

## DDCE Warranty

3 years product warranty (DDCE), subject to compliance with the official warranty protocol of the Marine model.

The guarantee applies to the DDCE models manufactured by **Dinnteco Factory S.L.**

## Pantaenius statement on the DDCE system

Holger Flindt, Head of Claims Department of Pantaenius (Europe's leading specialist for yacht insurance) is convinced of the DDCE System:

"Damage caused by lightning is increasing. In recent years the number corresponding events at Pantaenius tripled. Although the effects of a direct or indirect lightning strike can vary greatly, they often mean considerable danger for man and material. Whether and how a boat survives a thunderstorm, is not only a question of luck. A properly installed lightning protection system such as the Dinnteco DDCE system protects people and material.

**The DDCE system is therefore supported by us and a compliant protective measure for us. And it also exempts the customer from an excess in the event of a lightning strike in particularly endangered shipping areas."**

