

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

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

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



Measurements:  
**10" x 11<sup>-7/16</sup>"**

Weight:  
**14,37 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, tending to avoid the creation of an upward leader on the Dinnteco Marine and on the vessel that protects.

### Introduction

The Dinnteco Marine-BG 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 Dinnteco Marine-BG 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.

### Dinnteco 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 Dinnteco 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.

### Dinnteco Marine limit performance

Dinnteco Marine devices can suffer permanent saturation in certain extreme working conditions.

Dinnteco Marine are certified under the conditions required by the standards described in this technical sheet, but much more extreme conditions can occur in nature than those tested in a laboratory. In the event that working conditions

occur such that the Dinnteco Marine reaches its permanent saturation limit and therefore suffers a permanent short circuit, the Dinnteco Marine will act as a thermal fuse, absorbing part of the energy generated (from an electromagnetic pulse, ionized channel, direct lightning strike or effects of overvoltages induced by earth or sea, etc.). In this case, the Dinnteco Marine can suffer damage up to an extreme situation that causes it to stop working correctly (Insulation resistance test at 1000 Volts with a result of less than 10 Mohm) and even reach its total destruction. In this case, and that can be objectively evidenced (obvious signs of short-circuiting of the equipment with very significant fusions or loss of conductive and insulating material from the equipment), effects, damage or incidents may appear on the general infrastructure of the protected installation that, In any case, they will be outside the warranty coverage of the product.

In any case, the DDCE equipment, in its normal and optimal operation, can suffer punctual and instantaneous saturations. In these cases, the DDCE is designed to generate small instantaneous desaturation electric arcs between both hemispheres (safety system), with the aim of preserving the integrity of the equipment itself and the protected installation at all times. These electric arcs can generate small fusions of the conductive and/or insulating material of the DDCE, typical of its normal and optimal operation.

## Coverage radius

To carry out the Lightning Protection Design (LPS) in all marine vessels, with Dinnteco Marine products, the method of rolling spheres or the angle method with the required Regulatory Protection Level (Level I-IV) will be applied. It is recommended to apply Level I protection ( $R=66$  ft). The conductive structures that are at the same electrical potential as the lower semi-sphere of the DDCE and comply with the requirements set forth in the UNE EN IEC 62305 standard to be part of the LPS or similar requirements in national or international standards where the product is installed (for example, NFPA 780 standard - protection for watercraft), may be part of the LPS provided.

## Example rolling spheres method - Level I of protection

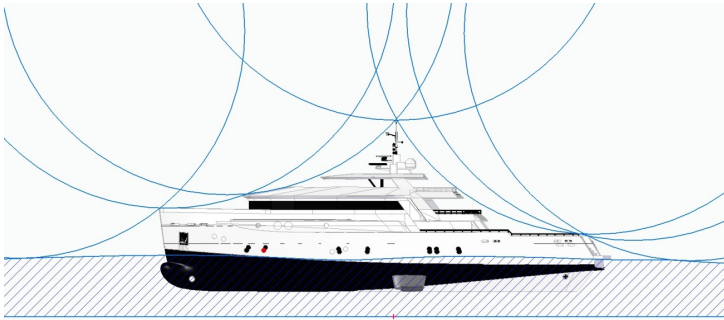


Figure 1. LPS Rolling Spheres Method Level I of Protection ( $R = 66$  ft) in a big boat.

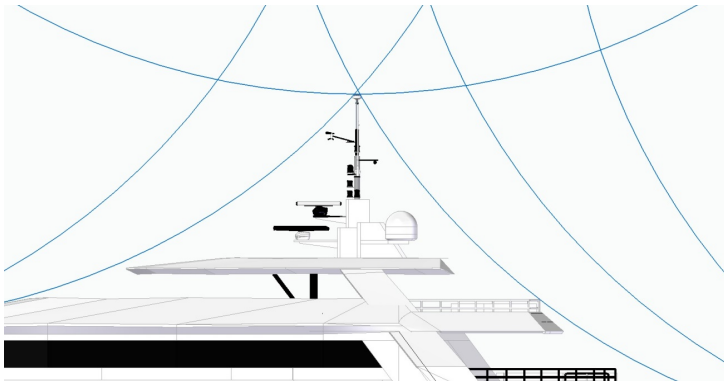


Figure 2. Detail of the Rolling Spheres Method in the upper area of the mast of the boat in figure 1.

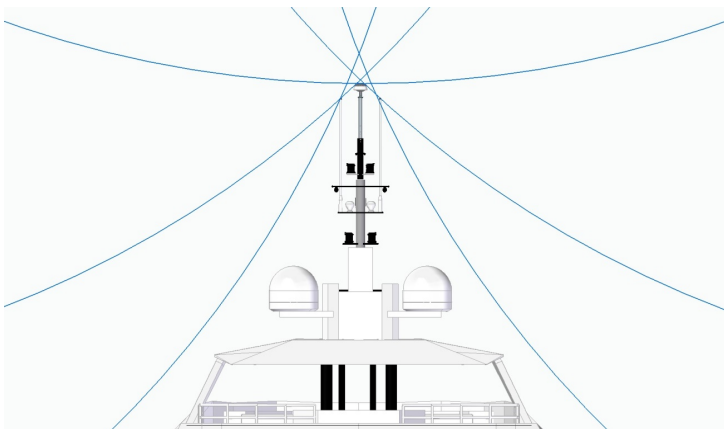


Figure 3. Front detail of the Rolling Spheres Method in the upper area of the mast of the boat in figure 1.

## 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.

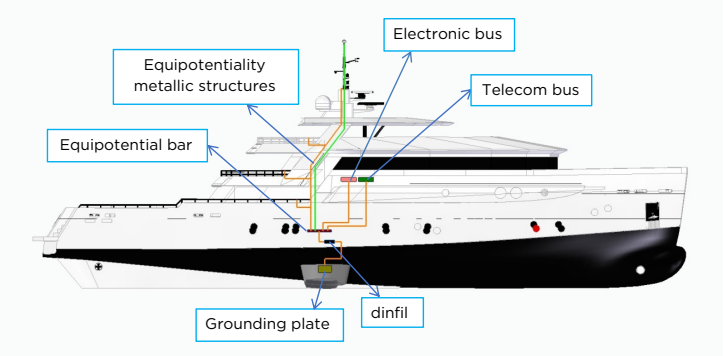


Figure 4. General detail of equipotential system.

## Protection against indirect effects (induced overvoltages)

The Dinnteco Marine prevents the direct impact of lightning on the marine vessel, but does not protect from potential indirect effects (overvoltages induced by ground or through the power supply cable or electromagnetic pulses or ionized channels coming from branches of the main lightning channel in situations of very low clouds and close to the protected structure) from lightning strikes in 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.

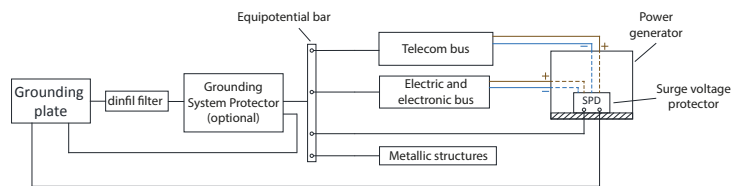


Figure 5. General diagram of protection in a boat.

## Type of protectors to have

### Type 1 protectors:

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

### Type 1 + 2 protectors:

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

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

20 kA

### Type 2 protectors:

Nominal discharge current C2 (8/20  $\mu$ s) 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) 200 kA

In order to protect the Dinnteco Marine 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 4).

The dinfil filter is complementary to the standard surge protectors, which will be necessary and mandatory. In no case replaces the function of the same.

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 carried out and/or reviewed by Dinnteco.

**Installation**

As a general requirement, the top of the DDCE Marine must be high enough so that all mast head fittings of the vessel are below the surface of a 90 degree inverted cone with its apex at the top of the DDCE marine (figure 7). In any case, depending on the required Protection Level (Levels I to IV), the required height of the DDCE Marine must be defined with respect to the defined reference plane, depending on the situation (height and horizontal distance to the location axis of the DDCE) of the predominant ionizing structures that may exist (antennas, vanes and others) with respect to the same plane taken as reference. This calculation is carried out using the rolling sphere method depending on the required Protection Level (Consult with the manufacturer) (Figure 8).

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 120°.

The minimum section of the wire will be 0,03875 sq inch of copper for its correct operation, being recommended 0,0775 sq inch of copper or similar, according to the requirements of the UNE EN IEC 62305 standard.

A ground resistance of less than 10 Ohms is required.

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.

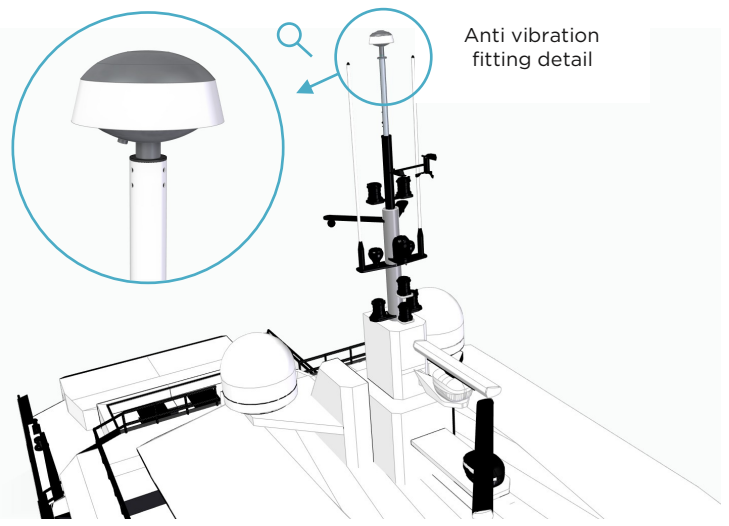


Figure 6. Standard mast installation.

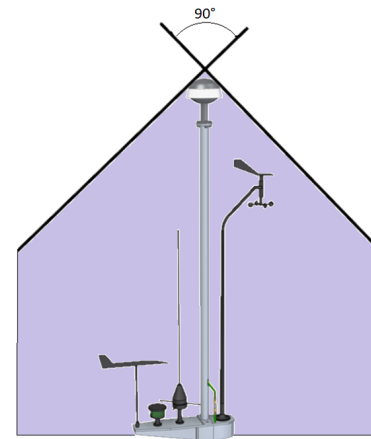


Figure 7. DDCE Marine minimum height requirement respect to installed elements.

Protection level (Sphere: R=65ft)					
Antenna length: 4,9ft (Ionizing structure)					
	Horizontal distance respect to the DDCE				
	1,6ft	4,9ft	8,2ft	11,4ft	14,7ft
DDCE height	6,5ft	8,2ft	9,8ft	11,4ft	14,7ft

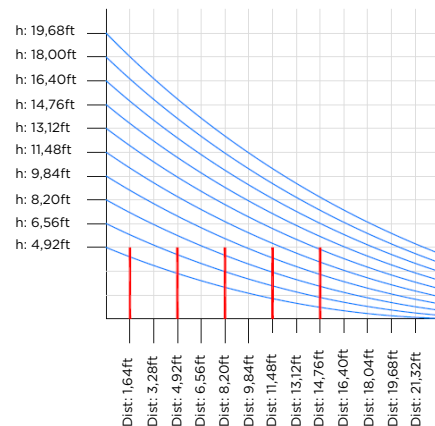


Figure 8. Example of calculation of the height of the DDCE Marine required with respect to the reference plane taken with Level I of protection (R= 65 ft) depending on the situation (height and horizontal distance to the axis of the DDCE location) of an antenna 4,9 ft high with respect to the same reference plane.

## 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 Dinnteco 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 Dinnteco Marine-BG 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)	$t_1$ ( $\mu$ s)	$t_2$ ( $\mu$ s)	Visual inspection
RI15-08	101,5	2463	42,6	29,9	392,4	OK
RI15-09	102,6	2451	42	29,9	378,5	OK
RI15-10	104	2693	45,2	29,9	408,4	OK

Figure 9. Tabulated results of the test.

### DDCE product certificate by Bureau Veritas (ES140752)

Lightning protection (UNE EN IEC 61400-24:2019, the waveforms injected in this test are defined in the UNE EN IEC 62305-1:2011 standard)

**Note:** According to the certified laboratory tests of the product, it meets the requirements that apply to it, as an air terminal, of the standards based on UNE EN IEC 62305, such as, among others: NBR 5419:2018, IRAM 2184:2011, NTC 4552:2008, SANS 10313:2012, AS/NZS1768/2007, JIS Z 9290, etc., as well as CTE-SU8 and NFPA 780. In any case, the protection design and installation of the product must meet the requirements that apply to it, of each of the standards in a particular way.

## 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

Product Safety | Directives 2014/35/EU

Electromagnetic Compatibilty | Directivas 2014/30/EU

Equipment Directive | Directives 2014/53/EU

### Electromagnetic compatibility (Emissions, immunity and disturbances)

UNE-EN-IEC 61000-6-1: 2019

UNE-EN-IEC 61000-6-2: 2019 UNE-EN-IEC 61000-6-3: 2021

UNE-EN-IEC 61000-6-4: 2019

UNE-EN-IEC 61000-4-2/3/4/5/6/8

UNE-EN 55032:2016+AC:2016-07+A11:2020+A1:2021 Clase B

UNE-EN 55035:2017 + A11:2020 UNE EN 301 489-1 V2.2.3 (2020-01-01)

### Electrical safety

UNE-EN-IEC 62368-1:2020/AC2020-05 (Partial)

### Extreme climatic tests (insulation resistance, dielectric strength, earth resistance, leakage current and transient overvoltages) | Product performance tests

### 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

Mandatory maintenance, carried out and certified by the official installer. The maintenance operations described in the

document "Annual Maintenance Protocol for Marine Structures" must be performed and recorded.

### **DDCE Warranty**

The products have a maximum warranty period of 3 years (1 year of start-up plus 2 years of annual maintenance), subject to mandatory compliance with the Dinnteco Marine product warranty protocol.

The application and exclusions of the Dinnteco Marine product warranty are described and updated on the official Dinnteco website.

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."**

