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Your Boats Against Lightning
Protection and Grounding



1. PREFACE

This study is not a standard, especially in Turkey and in the World "small boat and general application on the subjects of "protection and grounding of yachts against lightning".describes the precautions and procedures.

Nova Lightning Rod Grounding Construction and Industry. Trade Ltd. Sti. as we have done We are pleased to share this detailed study and the solution proposals we offer with our customers.we are happy.

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1.2. BOAT TERMINOLOGY

The terms explained below refer to lightning protection and grounding of boats. There are terms that can be encountered on the subject and it is useful to know them.

Arma : The equipment that provides the sail-hull relationship on a boat is called "ARMA". pole and wires, ropes, pulleys, etc., holding the sails. parts are examples.

Cunda: It means fly. An example can be given as "mast cunda".

Istralya : Fixed equipment descending from the poles to the fore and aft. (Wire rope)

Cross : From the mast cunda and the gurgata-pole connection points, descending to the sides of the boat fixed hardware. (Wire rope)

Gurgata : Horizontal bars through which crosses pass (sometimes tied). both sides of the pole they stretch. Their main purpose is to help the crosses hold the pillar stronger.

Mast Catch : Given to the slots where the lower ends and heels of the ship's masts sit. is the name.

Hull: The wet part (outer) of a boat that is submerged under water.

Mushir : The metal on the hull that reflects the speed and depth conditions to the indicator.piece.

Keel : It is the weight under the sailing boats, which basically serves to balance.

Bile : To adjust the balance of the ship or to sink more when the ship is empty and to increase the efficiency of the propeller.The sea water taken into tanks in different parts of the ship to ensure its operation is called ballast.



2. LIGHTNING PROTECTION MEASURES

Every boat waiting or in motion is at risk of lightning. The degree of this threat is directly related to the material from which the boat is made. Backbone metal (steel or aluminum) A natural "Faraday Cage" is formed in boats with a lightning protection. In wooden boats, by following the metal and electrically charged parts, the lightning There are thoughts that it will discharge from the shaft towards the sea. But arma's conductive metal The impact, which will be directed towards the water from its components, will burst the pavement boards and the boat. It can cause the keel to puncture, burn and eventually sink the boat.

In fiberglass boats, just like wooden boats, "metal and electrically charged the idea that lightning will discharge from the shaft towards the sea by following the axle. Risk As for the metal parts on the fiber boats to which the legs of the cross are attached. the possibility of effects that may explode the body due to lightning, There is a possibility of igniting fiberglass and emitting toxic gases from burning fiberglass.

Lightning is thought to rarely flow over the wires of the cross and Israel. Usually large cross-section and it will pass over the low resistance aluminum pole and reach the pole grab, and from there it will be directed to the electrical installation of the boat and discharged over the engine and motor shaft. is assumed. In this case, the starter motor, dynamo and shaft bearings will be damaged. likely.

In some boats, metal bars placed in the highest position as a protection measure, it is thought that lightning can reach the water by means of a conductor connected to it. Some In boats, on the other hand, there is continuous electricity from an anode released into the water at the bow to the anode released at the stern. It is known that it is tried to protect from lightning by creating a current. Still lightning in the water The most effective protection against the "Faraday Cage" is the "Faraday Cage", as it is on land, and this cage is formed. boats are considered to be safer. However, due to the structure of many boats, As it does not have this natural defense mechanism in the sea, as on land. the need for a lightning protection system (Lightning Rods) has emerged. Because any A vessel without a safeguard will be at constant risk of lightning.

Figure 1 "NOVA" Active Lightning Rod, specially developed for boats



3. GROUNDING MEASURES

While grounding in marine vehicles, firstly the grounding of the devices inside starts. The ground lines of the devices are connected to the ground busbar in the sub-panels, and the earth lines of the sub-panels busbars are connected to the earth busbar of the main distribution board. From here, the waterline of the boat connected to the grounding plate mounted underneath. This plate is salt water resistant. and should never be painted. Because some boats are painted even if the hull is metal not fully conductive.

Another type of grounding is grounding against "static electricity". Tanks, machinery shafts, rudder etc. parts are connected to the same grounding plate.

Navigation etc. A second plate can be used for grounding electronic devices. It is important in order to eliminate interference that may occur in devices.

Figure 2: "LICON" low impedance grounding conductor specially developed for boats



Figure 3: "GR-MARINE" grounding plate specially developed for boats



4. OVERVOLTAGE PROTECTION MEASURES

The components most frequently affected by lightning on boats are "communication antenna systems". known. For this, it is necessary to have technical values compatible with the boat electrical-electronics. and “surgery”, which is expected to have the capacity to protect the equipment it is connected to.arrester” products should be used.

It is produced by the Australian antenna manufacturer “Moonraker”.

Figure 4: Surge protection products specially developed for boats

Coaxial Shielding



Type CSS

RF Coaxial Surge Suppressor



Radio transmitters, receivers, high frequency LANs and all high frequency cable systems require protection from transient over voltage due to lightning strikes causing direct induction or potential differences due to earth potential rise caused by spikes to buildings and towers.

Transient over voltage appearing between the inner conductor of the coaxial cable and its screen can directly damage receiver and line driver chips of communications equipment connected via coaxial cables.

The coaxial cable surge protectors contain fast response gas filled arrestors to provide low let through voltage for fast rise time transients. The use of low capacitance gas filled arrestors ensures operation at high frequencies with low insertion loss. The coaxial cable protector consists of a fast acting gas filled arrestor enclosed in an in line mounting with coaxial connectors on either end. The device is configured to minimise circuit capacitance and present a 50Ω characteristic impedance so that performance up to 20GHz is assured. Standard models provide protection for receivers and transmitters up to a 1kW power level. Models for higher power levels are readily available. A range of connectors is available

Installation is easily effected by connecting the protector in the coaxial line as close to the equipment to be protected as is practical. The essential aim of these protectors is to provide electrical clamping between the inner and outer conductors of coaxial cables. Normal precautions such as earthing coaxial cable sheaths at building points of entry are still vitally important. The N bulkhead models are specifically designed to be mounted at cable entry points. The bulkhead mount allows a secure earth connection to the cable entry plate and provides a convenient cable termination point. This is the preferred method of installation.

Specifications	
Description	Gas arrestor over voltage surge protector for coaxial cable systems
Clamping Voltage	1000V line to screen (DC)
Impulse Clamping	<1400v (1kV/us)
RF Power Level	1kW PEP (higher power versions available)
Protection Stages	Gas filled surge arrestor
Insulation Resistance	>10 ¹² Ω
Capacitance	<1.5pF
Surge Withstand	20kA (8/20us)
Insertion Loss	<0.2dB at 2 GHz
VSWR	1.07:1 to 10GHz, 1.1:1 to 20GHz
Cable Impedance	Suitable for 50Ω systems, F connector types 75Ω
Dimensions	70mm (max) x 25mm x 25mm
Connectors	50Ω and 75Ω types available. Please specify

Specifications subject to change – Issued 01/09/13



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AC/DC Shielding Product



Type DCL/ACL

DC and AC Line Lightning Protection for vessels at sea



Lightning generated transients or overvoltages appearing across DC or AC cables and between them and earth are likely to be damaging to connected equipment. DC and AC external cables feeding navigation lights, wind speed and direction indicators, etc., can also carry these transient over voltages via the ships DC or AC wiring to other instruments and electronic devices such as chart plotters, computers, radios and the like, to cause damage.

Moonraker DCL/ACL line protectors provide high quality protection from these potentially damaging transients by clamping the voltage and conducting surges safely to ground. The use of solid-state transient clamping devices connected between each cable and earth, ensures virtually instantaneous protection is achieved. With a rating of 10 amps continuous current, a single DCL or ACL protector will, for instance, support the navigation lights in. For higher current drain two units should be used.

The protectors should be fitted at the point of entry of the cables to the interior of the vessel. Connection in the type DC or type AC cable is via sealed cable glands and internal screw terminals. The lid of the housing is fitted with an O ring seal. The housing is mounted via two bolts (not supplied) through the mounting plate.

The protectors are housed in safe all metal enclosures so that they are intrinsically safe. In the event of a prolonged overvoltage they will not catch fire or explode. The housing is constructed from cast aluminium, being finished with a high durability epoxy based coating, highly resistant to chemical attack, abrasion and the effects of ozone and ultra-violet radiation, and sealed to IP65 rating for waterproofing.

Specifications	
Operating Voltage	type DCL suitable for 12, 24 and 32 volts DC; type ACL suitable for 110 and 240 volts AC, 50 or 60 Hz
Operating Current	10 Amps maximum (split the system and use extra units for higher currents)
Earth Leakage Current	less than 500µA (micro amp)
Operating Temperature	-40°C to +80°C
Housing Dimensions	60W x 58H x 114mm long (163 including cable glands)
Earth Terminal	M8 stainless steel stud on side of housing
Maximum Surge Current	type DCL 10kA; type ACL 50kA
Response Time	<5NS
Connection	via cable glands to screw terminals (16mm OD maximum cable)
Mounting	via 2 bolts (not supplied) through base plate 6.5mm (0.26 inches)
Weight	550g (1.2 lbs)
Packed Weight	1 kg (2.2 lbs)

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MF/HF antenna shielding



Type LPU

MF to HF Lightning Protection Unit for marine and land based antenna systems



The Moonraker LPU is a horn gap overvoltage lightning protection system designed to be placed in MF/HF open wire antenna feeders. It gives an easy path to earth for high voltage static charges, such as those induced in the antenna system by lightning induction and other electromagnetic disturbances. When used with the CSS Coaxial Surge Suppressor, the range is extended to cover all frequencies from MF to 2 GHz.

The solid copper, nickel plated horns are mounted upon special ribbed high voltage insulators which facilitate easy horn gap adjustment. The device is completely enclosed in an IP66 rated (weatherproof) cast aluminium housing, finished with a high durability epoxy based coating, highly resistant to chemical attack, abrasion and the effects of ozone and ultra violet radiation. It is designed to be back mounted externally; close to the antenna feed point. The LPU metal housing ensures it is intrinsically safe from fire and explosion.

The unit exhibits low capacitance to earth in order to cause minimal effect upon antenna tuning. As most antenna tuning units (ATUs) provide little resistance to high reverse voltages, we also recommend that a Coaxial Surge Suppressor be fitted in the 50Ω coaxial cable between the ATU and the transmitter for HF installations.

Specifications	
LPU	Tested in accordance with ANSI C6241 Category B, ie 45kV 1.2/50 micro second (rise/fall times) voltage pulse, 5kA 8/20 microsecond current pulse; observed breakdown with continuous RF at 3.3 MHz 1.5mm gap, 3.5kV rms (refer to installation instructions)
Housing Dimensions	58W x 120W x 170Lmm L (215mm including cable glands)
Maximum RF Power	1.2kW PEP
Adjustment	Screwdriver clamps on horns using feeler (thickness) gauges (refer to installation instructions)
Connection	Twelve Moonraker HV silicone insulated antenna cable supplied at each end for connection to antenna feed stud, ATU and to earth
Weight	910g (2 lbs)
Packed Weight	1.5 kg (3.3 lbs)

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5. LIVE EVENTS

5.1.Examples from Turkey

- **İsmail Korkut** – Polyester (Beneteau) sailboat captain
- **Year : 2006**
- **Location : Marmaris/Türkiye**

"The place is Marmaris, the air is hose, I can't see my surroundings. Water column everywhere. He has a boat I'm trying to be I can't see 1 meter. I went to the top. I shook the iron. my purpose owning the boat. I had barely run to the back and took the helm when a yellow light turned the entire mast, the chamber engulfed him. A noise. Lightning strike, mast, inner mast, crucible and keel link reached the sea via All electronics and electrical equipment have been reset. Alternator ripped from its stud. Both sides in the bathroom are shattered like bullets, the engine continues to run. I jumped off the helm. Women in the boat and The children began to cry in panic. There were no casualties or injuries. However, all parts renewed."

5.2.Examples from the World

- **Henk de Velde** – the famous Dutch sailor with his 17-meter sheet metal boat named "Campina"...
- **Year : 2002**
- **Location : Off Hawaii-Alaska**

"As I went north, the weather forecasts said that storms were waiting for me.About 700 miles from Hawaii, I got into a strong storm. The wind is too strongnot, but the air was very electric. Suddenly I heard a big thud. The whole boat is a fire It was as if he was surrounded by a ball. My body contracted under the shock and I felt aches and pains. I was lucky that this The situation lasted only a second or two and I came to my senses. When I can take care of the boat I saw that the fuses were blown. When I changed the fuses, the electrical system worked. But my computer was not working. Check that the dynamo is not charging the batteries when you try to start the engine. I noticed. So I turned on my generator, but it didn't work properly and the current did not produce. Even though I spent one night fixing the electrical system, the batteries kept charging. I was not able to do. When I saw that the wind generator was also damaged, I went back. I decided. It is good sailing to continue navigating without the possibility of recharging the batteries. I believe it will not happen, because it ensures the safety of all navigation, autopilot and boat.systems were powered by batteries..."

6. DID YOU KNOW?

- 10% of fatal cases encountered by yachtsmen are caused by lightning strikes. has arrived.
- Wet sails conduct electricity well. Yet in stormy weather It is recommended that the sails be closed.
- Even if the boat power is cut off with the main switch, the lightning strike switch jumping over it may damage electronic devices.

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