

LIGHTNING PROTECTION FOR VESSELS

Introduction

Several thousand thunderstorms are in progress in any given hour throughout the world, a good portion of which can be over water ways, rivers and oceans. Unlike structures on land, any vessel on water presents as a very likely strike point in a thunderstorm due to its electric field enhancement with little “competition” from adjacent points.

When lightning enters a vessel, it tries to find a low-impedance path to the water. Hence, it will damage whatever comes between it and the water. Damage commonly seen in lightning strikes to vessels include:

- Electrical failures – electrical components such as the battery, refrigeration controls, air conditioning, instruments, sensors and controls;
- Mast damage – particularly sailboats with non-metallic masts;
- Hull problems – particularly those made of fibreglass, but a hole in any hull is possible;
- Catastrophic events – lightning is well-known to start fires on unprotected vessels.

The principals of Lightning Protection International Pty Ltd (“LPI”) have collective experience of over one century in dealing with the protection of assets against lightning strikes. LPI is a highly innovative company with a wide range of patent covering its unique products. The majority of LPI’s products are manufactured in fully-automated in-house facilities which have full quality and environmental accreditations¹.

LPI has developed a successful, cost-effective and unobtrusive lightning protection system (LPS) for vessels. This LPS is described in more detail below.

Comprehensive Lightning Protection System

LPI strongly recommends a “holistic” approach to lightning protection for vessels. This approach revolves around Earthing and Bonding, Surge Protection and Direct Strike Protection. In essence, there are three major steps that need to be followed, each of which is important in the overall protection plan. These steps are as follows:

1. Direct-strike protection of the vessel and occupants;
2. Establishing a well-bonded earthing system throughout the vessel; and
3. Protection of all power, communication and signal lines.

¹ ISO 9001 and 14001 Certification



Lightning Protection International Pty Ltd operates a certified management system that complies with the requirements of ISO 9001:2015 and ISO 14001:2014. The scope of certification encompasses the design, manufacture, assembly, sales, installation and commissioning of lightning and surge protection equipment and earthing materials.

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For Step 1, LPI recommends the STORMASTER ESE air terminal range. These air terminals are fully accredited to international standards IEC 62561-2 and NF C 17-102. The STORMASTER terminal intercepts the lightning strike to a preferred point in order to ultimately convey the lightning current safely into the water. The latter is handled with LPI's HVSC Plus lightning downconductor cable, which has a world-leading voltage withstand rating of ≥ 500 kV and is designed to minimise the risk of side flashes, sparking and uncontrolled discharges that can catastrophically affect the vessel's operations and injure or kill its occupants.

For Step 2, all conductive elements of the vessel should be bonded together, particularly the "earths" of all components of the electrical and electronics systems. This approach is essential for prevention of side flashes, sparking and arcing, all of which can start a fire on the vessel. For discharging the lightning strike into the water, an earthing plate should be installed under the vessel, below the water line.

For Step 3, LPI recommends the use of suitable surge and transient protection for electrical and electronic systems. Surge protection is crucial for sensitive electronics such as communication equipment.

Figure 1 is a simplified installation sketch for lightning protection of vessels using the principles outlined above.

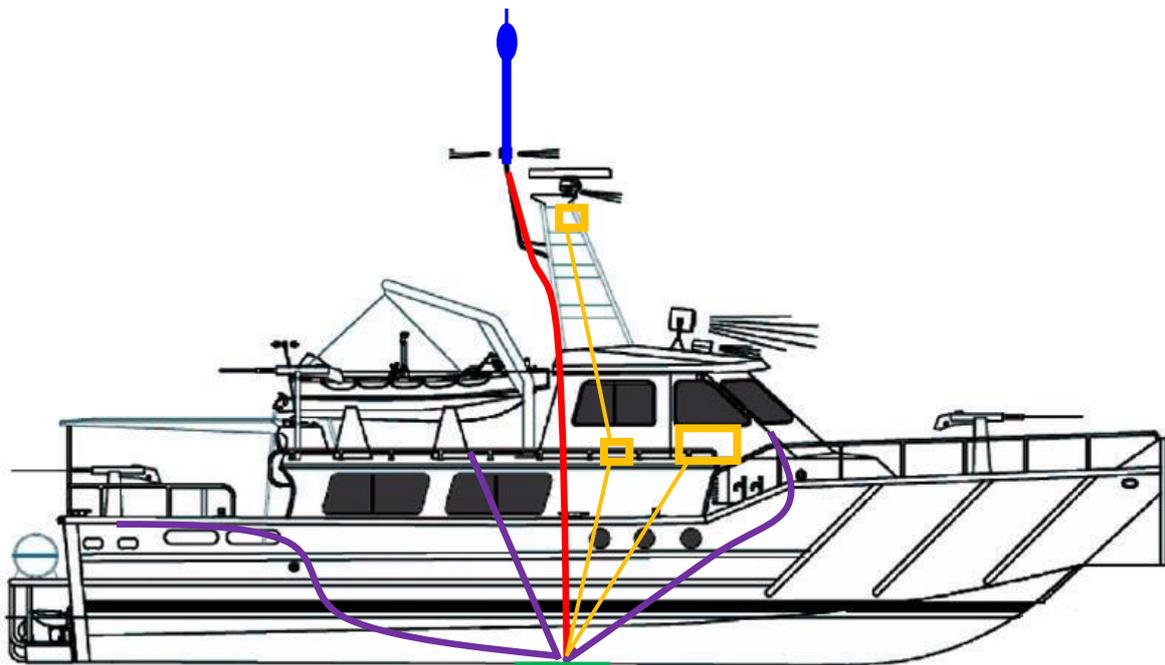


Figure 1: Simple installation example for vessels. Key: Blue = Stormaster ESE air terminal and FRP insulated support mast; Red = HVSC Plus lightning downconductor cable; Green = earthing plate / zinc anode; Purple = bonding conductors (representative only); Orange = surge protection.

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Major LPS Components

Step 1: Direct Strike Protection

	<p>Component: Air Terminal Product Code: STORMASTER-ESE-15-SS Product Description: Stainless steel STORMASTER ESE terminal meeting French National Standard NF C 17-102:2011.</p>
	<p>Component: Fibreglass Reinforced Plastic (FRP) Mast Product Code: FRP-3M Product Description: The FRP mast provides the necessary electrical insulation and mounting strength for the STORMASTER terminal.</p>
	<p>Component: U-Bolt Set Product Code: U-BOLT Product Description: The U-Bolt is designed to secure the FRP mast on to a suitable support structure of the vessel.</p>
	<p>Component: Saddle Fixings Product Code: SAD FIX Product Description: LPI® SAD FIX are specially designed for securing of the HVSC Plus downconductor</p>
	<p>Component: High Voltage Shielded Cable Product Code: HVSCPLUS-PM Product Description: The HVSC Plus lightning downconductor cable is purpose-designed for handling fast lightning transients. It is designed to safely conduct large lightning currents into the water, preventing dangerous side flashes and sparking.</p>
	<p>Component: Upper Termination Kit Product Code: UTERMKIT-MK3 Product Description: The Upper Termination Kit is designed for use with the HVSC Plus downconductor cable, effectively connecting the cable to the STORMASTER air terminal whilst maintaining insulation integrity.</p>
	<p>Component: Lower Termination Kit Product Code: LTERMKIT-MK3 Product Description: The Lower Termination Kit is designed for use with the HVSC Plus downconductor cable, terminating it to the dedicated lightning earth.</p>

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Step 2: Earthing and Bonding

Please contact LPI for details, as these components will depend on your particular vessel type and size.

Step 3: Surge Protection

	<p>Component: 1DR100KA-385-NE100 Application: Single-phase AC Power Supply Product Description: Surge protection with Bluetooth capability for single-phase power supply</p>
	<p>Component: 3DR100KA-385-NE100 Application: Three-phase AC Power Supply Product Description: Surge protection with Bluetooth capability for three-phase power supply</p>
	<p>Component: DD range Application: DC Power Supply Product Description: Surge protection for DC power supply</p>

Bill of Materials

No.	Product Code	Description	Quantity
1	STORMASTER-ESE-15-SS	Stormaster, ESE 15, Air Terminal, Stainless Steel	1
2	FRP-3M	FRP Support Mast - 3m	1
3	U-BOLT	Two-plate U-Bolt	1
4	HVSCPLUS-PM	High Voltage Shielded Cable (Plus) – per metre	≥ 10 m
5	UTERM-FACTOUTSIDE-MK3	Factory Completed Upper Termination Mk2 – Outside of drum	1
6	LTERMKIT-MK3	Lower Termination Kit	1
7	<i>Power line and comms protection</i>	TBD (type and quantity of SPDs depend on the equipment installed on the vessel).	TBD

For more information, please contact LPI or one of its authorised distributors.

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Examples of LPS Installations



LPI's holistic lightning protection solution has been applied successfully to hundreds of vessels in these categories:

- 1) Coast Guard Vessels
- 2) Naval and combat boats
- 3) Oil & Gas vessels
- 4) Merchant vessels
- 5) Leisure boats

LIGHTNING PROTECTION FOR VESSELS

CASE STUDY: FARSTAD SHIPPING PTE LTD

THE PROJECT

LPI were contacted to help protect the customer’s service vessels because they dock and sail in extreme lightning prone areas.

A lightning protection solution was needed to prevent the customer’s vessels from being struck directly by lightning and also provide a safe path where dangerous lightning currents can be discharged safely to the hull of the vessel.



The solution also needs to prevent the lightning current from inducing damaging surges onto power and signal lines outside and inside the vessel, especially antennas installed on top of the vessels.

THE CHALLENGE

In the past, the radio communication equipment was badly damaged by lightning surges. This resulted in significant investment loss for the company.

THE SOLUTION

LPI proposed a complete solution including power and signal SPDs to protect the customer’s communication equipment and direct strike protection using a corona-reducing air terminal with special HVSC Plus lightning cable. This ensured the lightning current travelled safely into the hull of the vessel for discharge into the water.

THE RESULT

Since installation of LPI’s comprehensive lightning protection solution, there have been no surge or lightning damage incidents recorded.

For more details on LPI’s product range or project references, please contact info@lpi.com.au or +61 3 6281 2475.