



# IMPROVING SAFETY DURING LOADING AND UNLOADING OPERATIONS OF VESSELS

**A**lthough marine grounding systems have been in use for more than 30 years, there is still a lack of knowledge about the merits of their use.

Timm Elektronik has conducted research and embarked on long-term studies to enhance knowledge of the physical effects that can create an unsafe environment in hazardous areas.

The main reason is a potential difference between ship and loading bay, caused by the galvanic effect. The ship, the metal construction of the loading bay and the water as electrolyte in between form a galvanic cell. Between the electrodes of this cell a voltage difference exists. Any conductive connection between the electrodes will lead to an indefinite electrical current flow. This effect takes place as soon as the ship is docked, and not only during loading and unloading.

## PHYSICAL BACKGROUND

Typically ships are insulated from shore to take the physical effect into consideration however, errors can still occur.

There are risks of sparking or hotspots in all areas, where a conductive connection might be created by mistake or by chance, e.g. at staircases, with metal ropes and tools. These hotspots could lead to a fatal ignition in hazardous areas.

Marine grounding creates a higher level of safety on the vessel and the loading bay by means of a monitored bonding connection. The



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marine grounding system is attached to the ship directly after the vessel has berthed and before any loading equipment is mounted.

The potential difference between ship and shore will be reduced to a safe level by the conductive bonding line. As long as safe conditions are detected, the signal light at the marine grounding system shows status green. The impact of errors in handling and operating with metal equipment on board or on the loading bay will not create a hazardous situation.

The research – in conjunction with University of Hamburg Harburg – over the last couple of years formed the basis for the development of a new marine grounding system SEK-3, which was brought to market in 2016.

## SYSTEM SOLUTION

The SEK-3 has new safety and operational features and has an explosion protection design.

Research shows that conductive connections made between ship and shore are the most critical aspect at loading bays.

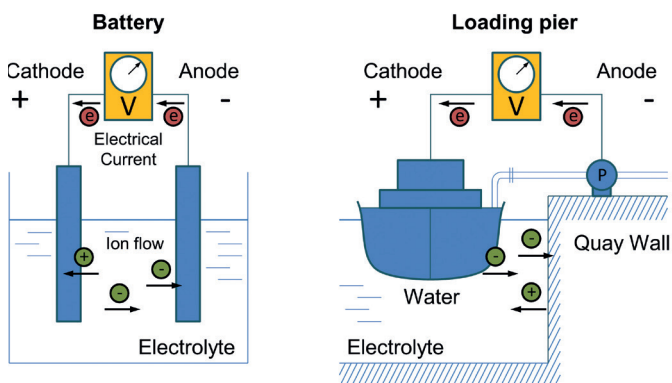
While on the one hand dangerous situations caused by undefined connections are defused by the installed marine grounding system beforehand, on the other, serious attention must be paid to the design of the connecting elements of the marine grounding system as well as the monitoring of the electrical conditions when the bonding between ship and shore is established.

This is one important reason why simple bonding lines or grounding control devices for electrostatics are inappropriate for use at marine applications.

The marine grounding system SEK-3 has several technological features:

By attaching the clamp to the ship, three autonomous measurements will be realised to ensure it is connected properly. These measurements comprise the mechanical position of the clamping jaws, the electrical connection to metal construction by the clamp and the resistance of the bonding cable.

After the low-ohmic attachment of the clamp is measured and secured, the ship



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- 02 Battery effect
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- 04 Marine grounding clamp



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itself and the electrical conditions between ship and shore will be detected. Proper clamp contacting, object detection and electrical conditions within specifications are requirements for the safe interconnection of the bonding line between ship and shore. In addition, before every interconnection by the marine grounding system the actual functioning of the switching and internal electronic is checked.

In case of an unintended loosening of the clamp or any change of the electrical conditions between ship and shore apart from safe specification, the marine grounding system SEK-3 will immediately interrupt the bonding connection. Any remaining or induced voltage

difference at the cable will be dissipated securely inside the system and kept away from the connection point at the ship.

#### USABILITY AND APPLICATION

To improve usability, the SEK-3 features a grounding clamp with additional status LEDs. The operator at the attachment point gets informed directly whether the clamp is attached properly or in need for retightening. Two clearly visible signal lights at the front of the SEK-3 housing indicate the operational status widely. Detailed status information, e.g. for error diagnosis, are available inside the housing at an additional LED display.

The system is designed under the intelligent explosion protection concept. This concept features a user-friendly combination of protection methods allowing the housing to be opened in hazardous areas for easy access to inside display, to change cables or connection wires.

Future-proof process integration is possible by six control outputs. Filling release is given by a potential-free and internally monitored contact output or by an intrinsically safe electronic output. This makes compulsive grounding possible. Two configurable changing contacts, one configurable electronic output and one additional alarm contact are available. The configurable contacts can be set to indicate different operating states for evaluation at the control room. The alarm contact signals potentially unsafe situations, e.g. overvoltage or overcurrent at the bonding line, internal failures as well as a deactivated marine grounding to warn immediately and to prevent from using the system when safe conditions cannot be assured.

#### FOR MORE INFORMATION

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