

## Marine Grounding System type SEK-2

*For carrying out and monitoring the potential equalization during loading and unloading of oil tankers*

When loading petroleum products and other inflammable liquids into oil tankers an explosive atmosphere occurs at the loading bays.

Due to the physical caused difference of potentials between oil tanker and loading bay (among other things by cathodic protection of the sheet-pile walls) a sufficient low impedance connection must be made for potential equalization, in order to prevent sparking (e.g. when connecting the product hoses or a gangway) effectively. At the same time the electrostatic charges, which are generated by loading fuels, are diverted to a large extent over the potential equalization line in a safe way to eliminate the danger of explosion by an unintentional discharge of static electricity.

The Marine Grounding System type SEK-2 serves to carry out and monitor the potential equalization when loading or unloading inland and sea oil tankers and it is suitable for operation in hazardous areas of zone 1. With this system it is ensured by a special designed grounding clamp that the connection of the grounding clamp is carried out with potential equalization line being first interrupted. The potential equalization is not connected through until the grounding clamp has been tightly fastened which results in low impedance contacting.

As soon as the correct grounding is detected the clearly visible indicator lamps and the potential-free control output for controlling of the pumps are switched over to release.

This ship grounding system consists primarily of a grounding control device, a measuring transducer and a grounding control unit including a power contactor.



The Marine Grounding System type SEK-2 is built by use of components, which are certified in accordance with the European explosions prevention directive ATEX 95 for the operation in hazardous areas of zone 1.

The measuring transducer is specially designed for monitoring of extremely low impedance equipotential bonding lines and controls via the grounding control device the power contactor for connecting through the potential equalization line. Due to the very low impedance monitoring circuit the capacity and hence the length of cable is un-critical. Therefore cables up to a maximum length of 30 m can be used.

### Fields of Application

Our Marine Grounding Systems are in use for more than 15 years world-wide on tank farms and refineries for implementing a supervised potential equalization line during the loading and unloading of sea and inland oil tankers with fuels, fuel oil or other petroleum products.

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**In particular the Marine Grounding System type SEK-2 consists of the following components:**

- Water-jet protected compact switchgear cabinet of stainless steel (Protection class IP 65); therein incorporated and wired ready for operation:
- 1 Grounding Control Device type EKT-3, type of explosion protection: EEx e q [ib] IIB T4
- 1 Measuring Transducer type EKOM-3, type of explosion protection: EEx ib IIB T4  
for controlling of:
  - Clamp circuit* = grounding clamp contact resistance
  - Grounding circuit* = grounding loop resistance (grounding clamp - ship – ground)
  - Potential equalization circuit* = contact resistance (clamp circuit – power contactor – outer potential equalization terminal)
- 1 Grounding Control Unit type ESE-3 with power contactor to switch through the potential equalization line, type of explosion protection: EEx e d m IIB T4; thereto connected:
- 20 m Neoprene Grounding cable of 4 x 10 mm<sup>2</sup>, 3 wires in parallel = 30 mm<sup>2</sup> as potential equalization line, as well as 1 wire as measuring line, mounted on this:
- 1 special grounding clamp of stainless steel with integrated auxiliary contact for connecting through the measuring line with delay.
- 2 built-in indicator lamps with long-life light-bulbs „red“ and „green“ for indicating the present operating status, type of explosion protection: EEx d e IIC T6

## Function and Operation:

The monitoring of the contact resistance in the circuits of grounding clamp and potential equalization as well as of the grounding circuit loop resistance is carried out via the measuring transducer (special oscillator), please refer to Figure 1. The upper resistance threshold value can be adjusted at the measuring transducer for each individual circuit by use of the respective limit adjuster.

At the outset the power contactor is released in idle state, which results in an interrupted potential equalization line. This switching state is indicated by the red indicator lamp.

The 2-pole grounding clamp must be screwed to a blank metallic point at the body of the ship. The special design of the grounding clamp ensures that first only the potential equalization line – still interrupted by the power contactor – is contacted. The measuring line will not be connected through via the auxiliary contact until the screw-spindle is completely turned. As soon as both poles have contact, the grounding clamp circuit is closed via the contact point at the ship.

If the contact resistance is low enough (adjustable approx. 0.5 – 2 Ω, standard 1.5 Ω) the measuring transducer will test the loop resistance of the grounding circuit (clamp contact point - ship - ground of the stationary system; adjustable approx. 20 - 100 Ω, standard 50 Ω). By this method, it is ensured that the contact point selected for the grounding clamp actually has a conducting connection to the ship.

If the loop resistance is low enough the measuring transducer converts the measuring signal via its evaluation electronics into a control signal and switches on the control relay in the grounding control device for approx. 1 second. In this way the green indicator lamp and the power contactor of the grounding control unit are activated. As a result the potential equalization line is connected through via the three parallel contacts of the power contactor to ground. Via an additional contact the potential equalization measuring circuit is connected to ground.

If the resistance in the potential equalization measuring circuit is low enough (adjustable approx. 0,5 - 2 Ω, standard 1.5 Ω) the control relay of the grounding tester and subsequently the power contactor of

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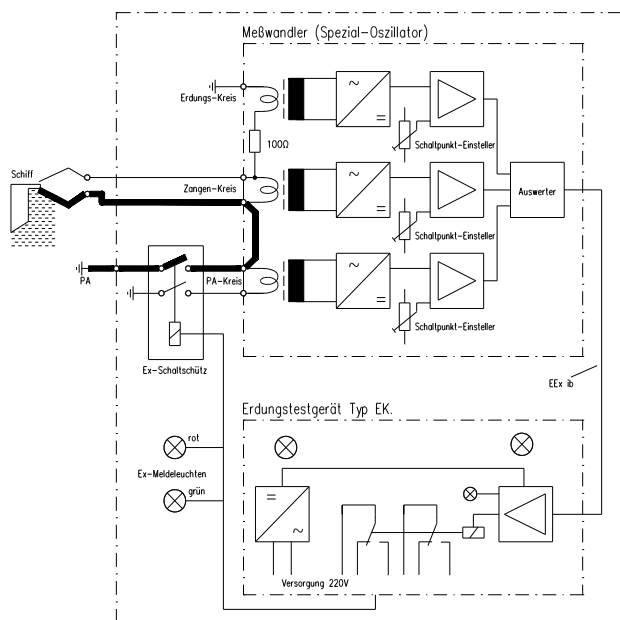
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the grounding control unit are switched on permanently.

If the resistance in the potential equalization measuring circuit exceeds the permitted value (e.g. due to an excessive contact resistance at the terminals or contactor contacts), the control relay and hence the power contactor will be released again with a delay of approx. 1 second. This process will be repeated again so that a permanent switching is generated indicated by the red and green indicator lamp as flashing cycle (approx. 1 second per cycle).

For additional control functions (e.g. control of pumps) a potential-free change over contact (230 V AC, 5 A) is provided at the grounding control device.

When loosening the grounding clamp first only the measuring line is interrupted by the auxiliary contact which is leading now. This results in a release of the power contactor and thus in an interruption of the potential equalization line. Only by further loosening of the grounding clamp the contact will be interrupted completely. This state is indicated by the red indicator lamp.

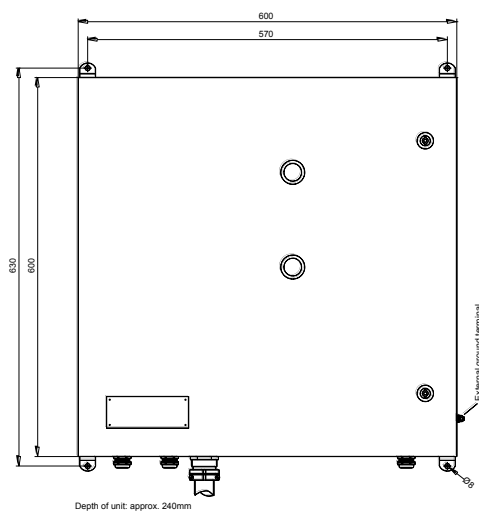


**Figure 1:** Schematic diagram of basic principle

## Technical Data

### Compact switchgear cabinet of stainless steel:

- Power supply: 230 V AC, 50 – 60 Hz, 5.5 A
- Housing protection class: IP 65
- Operating temperature range: - 20°C to +55°C
- Dimensions: 600 x 630 x 210 mm (l x h x d)
- Weight: approx. 38 kg (without cable and clamp)  
approx. 65 kg (incl. cable and clamp)



**Figure 2:** Dimension diagram

### Grounding Control Device type EKT-3:

- Explosion protection: II 2 G EEx e q [ib] IIB T4
- Output circuits:
  - a) Contact circuit:  
explosion protected by "Increased safety" EEx e 1 potential-free switch over contact;  
maximum ratings:  
250 V AC, 5 A, 100 VA or  
250 V AC, 3 A,  $\cos \varphi \geq 0,7$
  - b) Potential-free NAMUR-compatible control output explosion protected by "Intrinsic safety" EEx ib IIC  
for the connection of certified intrinsically safe circuits of explosion category EEx ia/ib IIB/IIC with following maximum ratings:  
 $U_i = 30 \text{ V}$ ,  $I_i = 50 \text{ mA}$ ,  $P_i = 130 \text{ mW}$

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### Measuring Transducer type EKOM-3:

- Explosion protection: II 2 G EEx ib IIB T4
- Supply and control circuit: explosion protected by "Intrinsic safety" EEx ib IIB - only for the connection to the supply and control circuit of the Grounding Control Device EKT-3.

### Grounding Control Unit type ESE-3 with power contactor for switching trough the potential equalisation line:

- Explosion protection: II 2 G EEx e d m IIC T4
- Contact ratings:  
4 potential-free switching contacts; maximum ratings:  
250 V AC, 10 A, 2.500 VA or  
30 V DC, 10 A, 300 W

### E.C.-type-examination Certificate: (selected example )



### Built-in indicator lamps "red" and "green":

- Explosion protection: II 2 G EEx d e IIB T6

### Equipment:

- 20 Neoprene grounding cable 4 x 10 mm<sup>2</sup>, 3 wires in parallel = 30 mm<sup>2</sup> as potential equalization line as well as 1 wire as measuring line.
- Special ship grounding clamp of stainless steel with integrated auxiliary contact for connecting through the measuring line with delay.

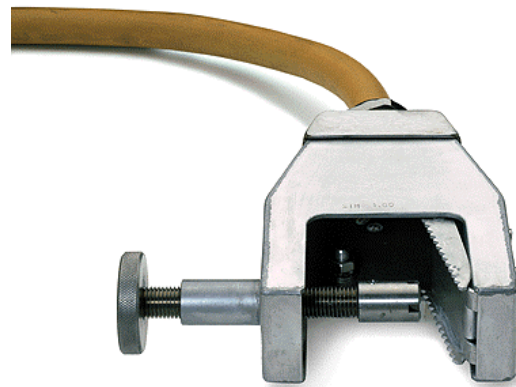


Figure 3: Ship grounding clamp of stainless steel

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