Installation instructions for oily water separator system SKIT/S-DEB-SPS 1.8

RWO GmbH ● Marine Water Technology ● Bremen ● Germany

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Installation instructions
Oily water separator SKIT/S-DEB

acc. to IMO Resolution MEPC.107(49)
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1. Safety

1.1. Risk potential of the oily water separator system
The oily water separator has been subject to a safety inspection and acceptance test. Faulty installation or improper use can cause danger to
• life and limb of the installation staff,
• the oily water separator and other assets of the ship equipment,
• the efficient functioning of the oily water separator.
All persons involved in installing the electric and hydraulic supply of the oil separator must
• be qualified, and
• comply with these installations instructions.

1.2. Safety information and tips
The following warnings are used in these installation instructions:

Denotes an immediate danger. Nonobservance of this warning may result in death or severe physical injury.

Voltage  Danger of crushing  Danger of tumbling  Hot surface

Denotes a potentially dangerous situation. Nonobservance of this warning could result in death or severe physical injury.

Denotes a potentially dangerous situation. Nonobservance of this warning may result in minor physical injuries.

Denotes notes for application and other useful information.

1.3. Proper use
This system must be used according to the regulations by the IMO only for separating dispersed or emulsified oil-water-mixtures!

The system and the pump may not be used to pump oil or sludge. Pollution hazard!

1.4. Emissions
The A-rated equivalent permanent sound pressure level of the oily water separator is below 70 dBi(A).
1.5. Sources of danger

Electrical voltage > 42 V
Direct contact with live parts can lead to severe injury or death.
Before working on electric equipment, interrupt the voltage supply
(main switch off, fuses removed or switched off).

Danger

The oily water separator operates with an eccentric spiral pump. Do
not touch the rotating shaft in the area of the transmission bell
housing / stuffing box packing! Danger of most severe finger injuries.

Warning

The valves item 4, 5 and 15, up to rated width R 1", are closed by
means of a pre-tensioned spring. On dismounting the valve drive, the
spring can eject forcefully and cause injuries.

Warning

The oil separator can be heated by a heater (electrically or e.g. by
steam). In the upper area, temperatures up to approx. 50 degrees
Celsius can occur. Danger of burns.

Caution

1.6. Safety measures at the point of installation

The oily water separator must be erected stable on a flat and firm surface. A tumbling oily
water separator causes risk of life.

2. Important technical information

The RWO bilge water oil separator type SKIT/S DEB also meets the
requirements of the class notation “Clean Design”. For this purpose the
alarm point are set to: Alarm 2 5ppm (recirculation) and Alarm 1 4ppm
(adsorber by-pass) (values in parentheses in the documentation)

Information

- The oil separator should be installed according to these installation instructions in order to
operate trouble-free. RWO does not accept any responsibility for damages resulting from
improper installation of the system.
- We do not assume any liability for damages due to failure to comply with these installation
instructions and improper use.
- Comply with the connection voltage as indicated on the automatic control system.
- The oily water separator is designed for a water mix temperature between min. +2°C and
max. +45°C.

Important

The oil-separation pump is designed to operate at a maximum
temperature of +45°C. At temperatures higher than +45°C, excessive
starting torque occurs in the motor due to thermal expansion of the
materials of the rotating parts which means that the motor is in
danger of being damaged beyond repair.
• The rotational direction of the pump is "CLOCKWISE" when viewed from the motor.

Dry running protection for bilge pump is not necessary: During operation of the pump the coalescer stage at suction side of bilge pump is filled up with water/oil. The bilge water inlet is fitted with a non-return valve which prevents the system from emptying. The bilge pump take suction direct from coalescer stage, so that dry running is impossible. The sensor electrode on top measures the oil level inside the coalescer unit. If there is no oil or/and no water the alarm device will be activated which stops bilge pump motor automatically and starts deaeration through the oil discharge valve.

During commissioning!
Incorrect sense of rotation causes the pump to run dry and can destroy the stator by overheating already after a few revolutions.

• Compressed air 6-8 bar and flushing water with max. 4.5 bar are required for proper operation of the oily water separator. The water flow pressure should not fall below 0.5 bar.

• The system must be kept free from solid matter.

• Avoid emulsions!
Use separation-friendly cleaning agents. The lower the content of emulsified oil in the bilge water, the longer the service life of your adsorber elements.

• If the installation point of the system can be subject to frost, the system must be completely drained after each use or be heated permanently.

• Prior to commissioning clean pipelines and bilge.

<table>
<thead>
<tr>
<th>Department</th>
<th>Telephone</th>
<th>Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair and service</td>
<td>49-421-537050</td>
<td>49-421-53705440</td>
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<tr>
<td>Spare part service</td>
<td>49-421-53705228</td>
<td>49-421-53705442</td>
</tr>
<tr>
<td>System sale</td>
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**Internet**

<table>
<thead>
<tr>
<th>e-mail</th>
<th><a href="mailto:rwo@veoliawater.com">rwo@veoliawater.com</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>homepage</td>
<td><a href="http://www.rwo.de">www.rwo.de</a></td>
</tr>
</tbody>
</table>

**IMPORTANT!**

When ordering spare parts, please provide us with the serial number of the oil separator (see cover page of the operating instructions or type plate of the oil separator).

3. Important general information

The IMO Resolution MEPC. 107(49) has come into effect on 18th of July 2004 and refers to all bilge water separators and 15ppm alarm devices installed on ships after the 1st of January 2005.

The IMO Resolution MEPC. 107(49) describes the individual issues of the type test for oil separators and 15pm oil content alarm devices. The main difference to the old resolution MEPC.60 (33) lies in the fact that the new MEPC. 107(49) includes oil in water emulsions. The emulsion is generated by mixing the different test oils with a specified emulsified chemical substance and an iron oxide powder under controlled conditions for an hour by means of
a centrifugal pump with high speed. The bilge water oil separator must be capable of separating the emulsion and precipitate oil residue.

An emulsion is a mixture of two or more components. In this case it includes oil and water. This mixture contains small oil particles which, however, do not form larger drops or connect to such. Generating an emulsion requires mechanical energy. This can be achieved by a rotary pump or by higher pressure and turbulent flow speed in a pipe system. In this process, present oil drops are divided into many very small oil particles. This type of mechanical emulsion can easily be separated by means of an efficient coalescer. But if emulsifying chemicals are present, the oil particles become hydrophobe by means of ionic and anionic tensides on the oil particle surface. The same micro-electric load of all particles in a stable chemical emulsion renders agglomeration impossible.

Mechanic emulsions can normally be easily separated by means of a mechanic coalescer. Stable chemical emulsions can not be separated this way, however.

Stable chemical emulsions can be separated by means of:

- heat treatment in a vaporiser
- chemical processes by using an adequate coagulation agent
- membrane - ultrafiltration which retains the oil molecules
- adsorption by means of suitable materials

### 3.1. Excerpt from the IMO Resolution MEPC.107(49)

The following contains an excerpt from the IMO Resolution MEPC. 107(49). The excerpts are quoted in the original language (English).

*Revised Guidelines and Specification for Pollution Prevention Equipment for Machinery Space Bilges of Ships: Background*

#### 3.2. MARPOL 73/78 Annex I

The requirements of Annex I of the International Convention for Prevention of Pollution from ships MARPOL 73/78 relating to pollution prevention equipment for ships are set out in regulation 16, which stipulates that ships of 400 gross tonnage and above should be installed with approved equipment.

#### 3.3. Regulation 16(5)

Regulation 16(5) stipulates that the oil content of the 15 ppm Bilge Separators should not exceed 15 ppm. The 15 ppm Bilge Alarm shall activate to indicate when this level cannot be maintained and initiate automatic stop of overboard discharge of oily mixtures where applicable.

3.3.1 15 ppm Bilge Separator;
3.3.2 15 ppm Bilge Alarm
3.3.3 Automatic stopping device

#### 3.4. MEPC.107(49)

The resolution MEPC. 107(49) supersedes the recommendations contained in Resolution MEPC.60 (33).

#### 3.5. Equipment requirements

3.5.1 Bilge separator

15 ppm Bilge Separators are considered to be applicable for use in conjunction with oily bilge-water and ballast water from fuel oil tanks, as these are of a low or medium capacity, and are conditioned by the need to avoid discharging oil mixtures with an oil content more than 15 ppm of the mixture. It should be understood that a 15 ppm Bilge Separator must be capable of handling any oily mixtures from the machinery space bilges and be expected to be effective over the complete range of oils which might be carried on board ship, and deal satisfactorily with oil of very high relative density, or with a mixture presented to it as an emulsion. Cleansing agents, emulsifiers, solvents or surfactants used for cleaning purposes may cause the bilge water to emulsify. Proper measures should be taken to minimize the presence of these substances in the bilges of a ship. With the possibility of emulsified bilge water always present the 15 ppm
Bilge Separator must be capable of separating the oil from the emulsion to produce an effluent with an oil content not exceeding 15 ppm.

3.5.2 Bilge Alarm
The 15 ppm Bilge Alarm should record date, time and alarm status, and operating status of the 15 ppm Bilge Separator. The recording device should also store data for at least eighteen months and should be able to display or print a protocol for official inspections as required. In the event the 15 ppm Bilge Alarm is replaced, means should be provided to ensure the data recorded remains available on board for 18 months (computer unit).
To avoid wilful manipulation of 15 ppm Bilge Alarms, the following items should be included:
1. Every access of the 15 ppm Bilge Alarm beyond the essential requirements of paragraph 4.2.8 requires the breaking of a seal and
2. The 15 ppm Bilge Alarm should be so constructed that the alarm is always activated whenever clean water is used for cleaning or zeroing purposes.

3.5.3 Automatic stopping device
The automatic stopping device is a device used, where applicable, to automatically stop any discharge overboard of oily mixture when the oil content of the effluent exceeds 15 ppm. The automatic stopping device should consist of a valve arrangement installed in the effluent outlet line of the 15 ppm Bilge Separator which automatically diverts the effluent mixture from being discharged overboard back to the ship’s bilges or bilge tank when the oil content of the effluent exceeds 15 ppm.
The accuracy of the 15 ppm Bilge Alarms should be checked at IOPP (International Oil Pollution Prevention) Certificate renewal surveys according to the manufacturers instructions. Alternatively the unit (measuring block) may be replaced by a calibrated 15 ppm Bilge Alarm. The calibration certificate for the 15 ppm Bilge Alarm, certifying date of last calibration check, should be retained onboard for inspection purposes. The accuracy checks can only be done by the manufacturer or persons authorized by the manufacturer.

3.6 Installation requirements
15 ppm Bilge Separator
For future inspection purposes on board ship, a sampling point should be provided in a vertical section of the water effluent piping as close as is practicable to the 15 ppm Bilge Separator outlet. Re-circulating facilities (manual 3 way valve) should be provided, after and adjacent to the overboard outlet of the stopping device to enable the 15 ppm Bilge Separator system, including the 15 ppm Bilge Alarm and the automatic stopping device, to be tested with the overboard discharge closed (see Fig. 1).
The re-circulating facility should be so configured as to prevent under all operating conditions any by-pass of the oily-water-separator. The 15 ppm Bilge Separator should be based in a non-hazardous area.

3.7 Instructions
A vessel fitted with a 15 ppm Bilge Separator should, at all times, have onboard a copy of the Operating and Maintenance manuals.
All routine and repair maintenance have to be recorded, see “Routine and repair maintenance record” table in “Operation and maintenance instruction”.

3.8 Training
Ship staff training should include familiarization in the operation and maintenance of the equipment.
3.9. Applicability

These guidelines and specifications apply:

- to installations fitted to ships, the keel of which are laid or which are at a similar stage of construction on or after 1 January 2005 and
- to new installations fitted on or after 1 January 2005 to ships, the keel of which were laid or which were at a similar stage construction before 1 January 2005 in so far as is reasonable and practicable

3.10. Separation-friendly cleaning agents

Cleaning agents often cause stable emulsions in oil-water mixtures which cannot be separated by gravity and coalescence. We carried out extensive test runs with different cleaning agents under conditions that were as close to normal operation as possible. From the vast range of cleaning agents on the market, we tested some products out of which the following agents have proven to be relatively suitable for use in our systems:

1. Drewclean 2000, Drew Ameroid Marine Division Ashland Chemical, Inc
2. Tegeral Des Flüssig, Tegee-Chemie GmbH
3. Tegeral Forte, Tegee-Chemie GmbH
4. Carclin Außenreiniger F, Henkel KGaA
5. Carclin Veri, Henkel KGaA

3.11. Type test

The type test for the 15 ppm bilge water oil separator and the 15 ppm alarm monitor has been carried out successfully and in compliance with the IMO Resolution MEPC. 107(49) Annex

Part 1 - Test and performance specifications for type approval of 15 ppm bilge separators
Part 2 - Test and performance specifications for type approval of 15 ppm bilge alarms
Part 3 - Specifications for environmental testing for type approval of pollution prevention equipment
Part 4 - Method for the determination of the oil content
Part 5 - Documentation of approval

APPENDIX 1 – Certificate of type approval for 15 ppm bilge separator
APPENDIX 2 – Certificate of type approval for 15 ppm bilge alarm

The following type test certificates are present:

<table>
<thead>
<tr>
<th></th>
<th>Oil separator SKIT/S-DEB 0.1.....10 m³/h</th>
<th>Bilge Alarm OMD-2005</th>
<th>Bilge Alarm OMD-24</th>
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<tbody>
<tr>
<td>EC-conformity acc. to</td>
<td></td>
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<td>Marine Equipment</td>
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<td>Acceptance Confirmation USA</td>
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Table 1
4. Process description of RWO bilge water oil separator type SKIT/S DEB

The RWO bilge water oil separator type SKIT/S DEB meets the requirements of the latest IMO Resolution MEPC. 107(49). The function bases on the operation principle of the open porous coalescer which has already been proven and tested in the oil separator system SKIT/S. In a second stage, the system breaks up the emulsion and removes the oil from the emulsion.

4.1. Oil water separation

An eccentric spiral pump (item 14) draws the mixture through the SKIT aquaclean “S-DEB” out of the bilge. This flow conduction avoids unnecessary additional mixing of oil and water due to pump turbulences upstream of the gravity oil separator. The 1st stage of the SKIT aquaclean “S-DEB” comprises much improved rough separation using the different densities of water and oil. A very open porous coalescer causes, due to its extremely oleophile surface, fine separation of even the smallest oil drops. This system provides excellent efficiency of the SKIT aquaclean “S-DEB” oil separator.

4.2. Flushing

In the upper calming zone of the oil separator the separated oil is collected. The RWO sensor electrode (item 9) measures the cumulative oil level. As soon as a specified amount of oil has been collected, the RWO automatic level system (item 3) opens the oil drain valve (item 4) and the flushing water inlet valve (item 15) so that the oil is discharged to the oil collector tank by means of the flushing water pressure. This stage is followed by the backflush process. The high-performance coalescer is flushed with clean water by opening both the flushing water inlet valve (item 15) and the flushing water outlet valve (item 5). The oil separation interval and the flush cycle are aligned in such a way to allow the SKIT aquaclean “S-DEB” to operate maintenance-free.

4.3. Adsorber bypass

The adsorber stage comprises a specific adsorption capacity. In order to increase the service life of the adsorber cartridges, an automatic adsorber bypass has been installed. The 15ppm (5ppm) oil alarm monitor checks the water quality periodically at the outlet of the first oil separator stage. If the value is below 15ppm (5ppm), the adsorber stage is bypassed. If the value is above 15ppm (5ppm), the adsorber stage is activated. This process control ensures a significantly increased service life of the adsorber cartridges.

The adsorption elements remove all types of hydrocarbons from the water. The adsorption capacity is mainly limited by the amount of hydrocarbons in solution or emulsified in the water, but larger amounts of dirt particles can also block the adsorber. To increase the adsorber service life, avoid heavy emulsions with high oil concentration by using quickly separating cleaning agents in the engine room. Emulsions from compressor condensate and cleaner sludge should be collected separately. If mixed into the bilge water, most of these emulsions are hard to break and could reduce adsorber lifetime significantly.
4.4. Bilge alarm monitor OMD

The oil separator system is equipped with a 15ppm (5ppm) oil content measuring device OMD. The device has been tested according to IMO Resolution MEPC. 107(49). The new resolution requires:

The excerpts are quoted in the original language (English).

The oily water separating system is equipped with the 15ppm oil content alarm device OMD, type tested and approved in accordance with IMO Resolution MEPC.107 (49). The new resolution requires:

The 15ppm Bilge Alarm should record date, time alarm status and operating status of the 15ppm Bilge Separator. The recording device should also store data for at least eighteen months and should be able to display or print a protocol for official inspections as required. In the event that the 15ppm Bilge Alarm is replaced, procedures should be put in place to ensure the recorded data remain accessible on board for 18 months. To prevent tempering with the 15ppm Bilge Alarms, the following precautions should be taken:

- Every access of the 15ppm Bilge Alarm beyond the essential requirements of paragraph 4.2.8 of the MEPC.107(49), requires the breaking of a seal.
- The 15ppm Bilge Alarm should be so constructed that the alarm is always activated whenever clean water is used for cleaning or zeroing purposes.

The Bilge Alarm Monitor OMD complies with the above rules. The measuring cell can be removed for calibration while the control device remains on the oily water separator to keep the recorded data on board for at least 18 months.

A 3-way valve for flushing is fitted with a contact to ensure that during flushing of the alarm monitor a overboard discharge of polluted water is not possible.

5. Standard scope of delivery

The standard version of the oil separators series SKIT aquaclean "S-DEB" shows the following characteristics:

- The entire oily water separator (as of type SKIT S-DEB 0.25) is bolted to a base (item 16) which can be welded on in the engine room of a ship.
- The second stage is equipped with adsorber cartridges. The pump (item 14) is attached to the container, rigid tubed and wired (as of type SKIT S-DEB 0.25).
- All piston valves (figure 4, item 4, 5, 15, 23, 58) are equipped with the required control solenoid valves and rigid tubed and wired.
- The automatic control box (item 3) is attached to the system and wired to the solenoid valves, the sensor electrode, the electric heater, pump and alarm monitor OMD.
- The bilge alarm monitor is attached to the oil separator. The sample water pipes and the electric system are connected.
- The system (as of type SKIT S-DEB 0.25) is equipped with an electric heater (item 10) in the oil separator part to keep the separated oil liquid. A thermoelement limits the temperature; it is factory-set to 40°C. It is controlled by a contactor in the automatic control box (item 3). The heater can also be switched off manually via a switch.
- Optionally, the oily water separator can be equipped with a steam or thermal heating and a temperature control valve instead of the electric heater.
- The oily water separators are coated with two-component epoxy-resin on the inside.
- The structure of the outer coating consists of a universal primer and a machine varnish.

(see our order confirmation for possibly different scope of delivery)
6. **Compressed air, electric and water supply**

The RWO oily water separator SKIT aquaclean "S-DEB" requires per design supply of the following media.

### 6.1. Compressed air

Lines under pressure bear the risk of injuries.

**Warning**

Prior to work on compressed air lines check and ensure that these are pressure-free.

The oily water separator is equipped with pneumatic piston valves. 3/2-way solenoid valves control the compressed air supply. The compressed air lines to all valves are laid by factory default. They are fed via a cutting-ring screw connection (item 6). This is to be finished on site with a tube Ø8x1 mm and an air pressure of approx. 6-8 bar. We recommend to provide the compressed air line with a filter and maintenance unit.

### 6.2. Flushing water

Lines under pressure bear the risk of injuries.

**Warning**

Prior to work on water air lines check and ensure that these are pressure-free.

The standard system requires clean water with a pressure of max. 4.5 bar at the flushing water inlet valve (item 15) for the oil discharge and the backflush of the coalescer. For the 15ppm (5ppm) alarm device (item 17), another flush connection (tube Ø8x1 mm) is provided. Both sea water and desalted water are suitable for this purpose. The amount of consumption is low, it mainly depends on the oil amount to be separated and on the flushing water pressure. A rough estimate for systems up to 0.25 m3 gives approx. 10% and for systems from 0.5 m3 onwards approx. 5% of the oil separator hourly output per oil discharge process.

### 6.3. Electricity

**Electricity**

Electrical voltage > 42 V

Direct contact with live parts can lead to severe injury or death.

**Danger**

The fixed connection to the mains supply may only be established by qualified staff (electrician)

Risk of explosion

Standard systems may not be installed in explosive areas

**Important**

The on-board voltage must be given upon ordering. Before connecting the oily water separator, check if it matches the information on the adhesive label on the automatic control box.

**Incorrect connection voltage can destroy electric components!**

All system parts are wired by factory default; they are controlled and supplied via the automatic control box. Standard systems use three-phase alternating current. The supply point is item 2 (cable entry point: DIN 89280; 1430-W 18; shape K). The automatic system is installed in a robust steel housing IP 55 with MS naval cable screw connections according to DIN 89280 (the max. cable diameter is 18 mm).
6.4. Electric consumption

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<tr>
<td>Power output of the heater [kW]</td>
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<tr>
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<td>Total output with steam heater [kW]</td>
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<tr>
<td>Fuse factory default [ A ]</td>
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Table 2

6.5. Supply service consumption list

<table>
<thead>
<tr>
<th>Components</th>
<th>Consumption per oil flow control and flush process</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SKIT/S-DEB</td>
</tr>
<tr>
<td>*1 1 Fresh water</td>
<td>3.5</td>
</tr>
<tr>
<td>*2 2 Compressed air - litre</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Table 3

*1 Average water amount for a complete flow control process at a flow pressure between 0.6 and 1 bar.

*2 Average air amount for a complete flow control process at a pressure of 6 bar

7. Installation instructions

Please observe the following information for installing the RWO oil separator system SKIT aquaclean "S-DEB".

7.1. Pump

In order not to overcharge the attached monopump (item 14), install the oil separator at a low point of the engine room. The pump is designed for a suction height of 6 - 7 m at media temperatures up to approx. 30°C and a delivery height up to 30 mWS (3 bar).

The pump is a displacement pump; it must not be operated upstream of closed fittings.

The rotational direction of the pump is "CLOCKWISE" when viewed from the motor. If the rotational direction is incorrect, there is acute danger that the pump will run dry!

The pump must never run dry, this must be avoided at all costs!

You can avoid this danger by ensuring that the rotational direction is correct. The control system will only start the pump once the oil-separator housing is filled with water.

The oil-separation pump is designed to operate at a maximum temperature of +45°C. At temperatures higher than +45°C, excessive starting torque occurs in the motor due to thermal expansion of the materials which means that the motor is in danger of being damaged beyond repair.

Important

Revision 02.08.2010
7.2. Suction line

The suction line from the bilge must be equipped with a suitable dirt filter to protect oil separator and fittings from rough contamination. We recommend a sieve basket with a perforation of approx. 2 mm at sufficient free sieve area. Upon request, we provide the appropriately dimensioned sieve basket filter for every oily water separator. Please contact our sales department.

A non-return valve (figure 4, item 1) is installed at the entry point of the oil separator (inside the container for Skit S-DEB 0.1-2.5) which prevents a self-drainage of the system. In case of long suction lines or larger dimensioned pipelines, another non-return or foot valve should be installed to prevent permanent drainage of the suction line. In order to maintain the suction power of the system, the recommended pipe cross-sections of the suction line should be met.

If the ship uses a fuel with very high viscosity and/or if extremely low bilge temperatures are to be expected, we recommend a heated bilge water tank.

The suction line must be airtight because the oil separator operates with negative pressure.

In cause of leaks in the suction line, the oil separator sucks air. The oil separator then enters a permanent cycle (air suction, air discharge, a.s.o.).

7.3. Flushing water inlet

Lines under pressure bear the risk of injuries.

Prior to work on water air lines check and ensure that these are pressure-free.

The oily water separator requires clean water with a pressure of 4.5 bar at the flushing water inlet valve (item 15) for oil discharge and coalescer backflush. In addition to the flushing water connection establish a connection from the 3-way ball cock at the oil monitor (item 25) to the seawater cooling system, to the seawater hydrophor system or to the fresh water hydrophor system for the monitor zero compensation and for cleaning purposes. The consumption is low and depends on the oil amount to be separated and the flushing water pressure. The approximate consumption amounts to 3% of the OWS capacity.

7.4. Oil outlet

The tubes from the oil outlet (item 4) to the oil collection tank must be laid pressure-free.

The oil collection tank must be equipped with suitable ventilation.

7.5. Flushing water outlet

The tubes from the flushing water outlet (figure 4 item 5) back to the bilge or the bilge water tank must be laid pressure-free.

7.6. Clean water outlet

The clean water outlet is the connection point at the 3-way valve (item 23) towards outboard.

According to IMO MEPC 107 (49), the outboard-bound tubes must be equipped with a 3-way valve (item 55) and non-return fittings (item 24).

Please also observe the corresponding material regulations of the respective classification body for fittings at the ship's side. Operation of the SKIT aquaclean "S-DEB" does not require any special fillings in the outboard line, but the outboard exit point should be above the upper edge of the oil separator.
7.7. Recirculation outlets
The tubes from the recirculation outlet at the 3-way valve (item 23) and at the manual 3-way valve (item 55) back to the bilge or the bilge water tank must be laid pressure-free and equipped with a ventilation tube.

7.8. Compressed air connection
The compressed air supply (item 6) for operation of the pneumatic piston valves is established via a cutting ring screw connection for tube Ø8x1 mm. The air pressure should be 6-8 bar.

7.9. Pipelines
To connect the SKIT aquaclean "S-DEB" oil separator system we recommend the following tube cross-sections:

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>SKIT aquaclean &quot;S-DEB&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.1</td>
<td>0.25</td>
</tr>
<tr>
<td>1 [mm]</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>4 [mm]</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>5 [mm]</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>15 [mm]</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>12 [inch]</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>22 [mm]</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>23b [mm]</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>25b [inch]</td>
<td>1/4</td>
<td>1/4</td>
</tr>
<tr>
<td>27 [inch]</td>
<td>1/2</td>
<td>1</td>
</tr>
<tr>
<td>28 [inch]</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>43 [inch]</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>55a [mm]</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>55b [mm]</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>
7.10. Automatic control box

Electrical voltage > 42 V
Direct contact with live parts can lead to severe injury or death.
The fixed connection to the mains supply may only be established by qualified staff (electrician)

Danger

Figure 2 shows the control elements of the automatic control:
All system components are connected to the automatic control (item 3) by factory default (as of type SKIT/S-DEB 0.25).
The housing consist of steel sheet metal and is classified as protection class IP 56. The supply (item 2) is done via 1 Ms cable screw connection.
The line cross-section has to be dimensioned and fused according to chapter 6.4 and the oil separator output.
The 4 LEDs in the control box door indicate the basic functions. The oily water separator can be started and the operational modes selected by a main switch and the switch "Hand"."Zero"."Auto".

There are terminals for two level switches in the bilge. With such switches installed and automatic mode activated, the system can start or be switched off depending on the level. By factory default, the terminals for the floating switches are bridged.

Meaning of the indicators.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Colour</th>
<th>Condition</th>
<th>Meaning / cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>white</td>
<td>Main switch &quot;On&quot;</td>
<td>The power supply is enabled, voltage is present</td>
<td></td>
</tr>
<tr>
<td>red</td>
<td>One or more alarm states pending</td>
<td>The alarm trigger is shown as a text message on the display</td>
<td></td>
</tr>
<tr>
<td>green</td>
<td>Floating switch in the bilge or the bilge water tank signal &quot;wastewater present&quot;</td>
<td>Display for the wastewater level! If no floating switches are connected, the corresponding terminals must be bridged, else the automatic operation of the oily water separator cannot start.</td>
<td></td>
</tr>
<tr>
<td>green</td>
<td>System in operation The display shows &quot;WATER DISCHARGE&quot;</td>
<td>Cleaned water is pumped</td>
<td></td>
</tr>
<tr>
<td>red</td>
<td>System in operation The display shows &quot;OIL DISCHARGE&quot;</td>
<td>Oil or air is driven to the oil collector tank Pump and electric heater are switched off Valve 4 and 15 are open</td>
<td></td>
</tr>
<tr>
<td>orange</td>
<td>System in operation The display shows &quot;FLUSHING&quot;</td>
<td>The backflush is in progress Pump and electric heater are switched off Valve 5 and 15 are open</td>
<td></td>
</tr>
</tbody>
</table>

For a detailed description of the oil separator control with microprocessor see item 9.
7.11. Electric connections of the oil separator control
See supplied connection diagram.

8. Installation diagram

8.1. P&ID (pipeline and instrument diagram)
See annex
### List of items

<table>
<thead>
<tr>
<th>Item</th>
<th>Designation</th>
<th>Flange connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non-return valve</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>3</td>
<td>Control box</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Oil discharge valve (outlet)</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>5</td>
<td>Flush valve (outlet)</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>6</td>
<td>Compressed air connection D= 8 mm, 6-8 bar</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>13</td>
<td>Overboard line</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>14</td>
<td>Mono pump with drive motor</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Flush valve (inlet)</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>17</td>
<td>Monitor</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Suction line from the bilge (bilge water tank)</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>21</td>
<td>Sieve basket (option)</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>23</td>
<td>3-way valve</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>23b</td>
<td>Return to bilge, bilge water tank</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Outboard valve (option)</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>3-way ball cock R ¼ &quot;</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Funnel R 1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>3-way valve, manually actuated</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>58</td>
<td>3-way valve</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>65</td>
<td>Lock valve</td>
<td>R-thread or DIN 2633 PN16</td>
</tr>
<tr>
<td>77</td>
<td>Flow monitoring R ¼&quot; (option)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4

#### 8.2. Installation plan - suggestion

![Diagram](image)
9. Operating instructions for programmable oil separator control
(as of software version 1.8)

9.1. General:
Operation of the oil separator control involves 4 buttons. The backlit display has two lines with 20 characters each. The operational modes are displayed with 4 LEDs.

9.2. Elements of the control and display field
a) On - Off – Main switch
Switch for the supply voltage of the oily water separator (on or off)
b) Hand – 0 – Auto – Switch
Switch for the operation mode of the oily water separator control (manual, zero or automatic operation).
c) Position "Hand"
The oily water separator operates independently from the level in the bilge or bilge water tank.
d) Position "Zero"
The oily water separator does not operate.
e) Position "Automatic"
The oily water separator starts automatically when the level in the bilge or bilge water tank switches the upper level sensor and stops automatically when the level switches the lower level sensor.
f) On - Off – Switch electric heater (optional)
If the oily water separator is equipped with an electric heater, this button switches it on or off.

9.3. LEDs
The display contains 4 LEDs which permanently indicate special operating states. Some of the 4 LEDs are multicoloured.

a) White LED (Power)
Indicates readiness for operation. This LED illuminates as soon as the voltage supply of the control is activated and the control is ready for operation.
b) Red LED (Failure)
This LED indicates a failure state. The cause of the failure can be found on the display.
c) Red/orange/green LED (Status)
This LED indicates the operational state of the oil separator. Green indicates oil separation in progress. Red indicates oil discharge in progress. Orange indicates flushing in progress.
d) Green LED (Bilge level)
The green LED indicates that the level in the bilge tank is high and that the oil separator can start operation.

9.4. Buttons
The control panel comprises 4 buttons. With these buttons you can enter information and query operating states.
a) ESC button
This button is enabled in all operating states. It serves to undo the previous operation step. In the menu structure, pressing the ESC button exits one menu level and returns to the previous menu level. All settings remain. After pressing the button repeatedly, you reach the start level, the operating status display.
b) - button, + button
With these buttons you can modify settings. They are only active in the menus in which settings can be defined. They can be identified by words or numbers highlighted by flashing. If words are highlighted, select the left word with the –button. Accordingly select the right word with the +button in these menus. If numbers are highlighted, you can set them by the digit with the -/+ buttons. To jump from one digit to the other, use the Enter button (see below).

NOTE!
A special function allows for an oil simulation with the -/+ buttons. Press both buttons simultaneously for at least 2 seconds to run an oil simulation. The evaluation electronics receives a fake interruption signal at both electrodes.

c) Enter button
The Enter button serves as "Continue" or "Confirm" button. In the menu structure, pressing the Enter buttons switches to the next menu item or confirms a selection done right before with the –/+ buttons.

9.5. LCD
The twenty-digit, two-line LCD can display operating states and menu guidance either in German or in English. The start message shows: RWO Water Technology and a software version number.

The display motherboard contains a potentiometer to adjust the contrast of the LCD to the lighting conditions.
9.6. Menu structure

a) Start message

When the control unit is switched on, a Start message appears. It indicates the version of the control software and the software variant:

```
RWO WATER TECHNOLOGY
Version Nr 1.8 OP00?
```

b) Operation mode

After 3 seconds of showing the start message, the operation mode automatically appears. The operation mode display indicates the state of the control unit.

Under normal conditions, the operation mode display only contains the status text of the oil separator. But if special messages are pending, they appear cyclically (e.g. MOTOR FAILURE OVER CURRENT). The display then shows alternating the oil separator status for approx. 5 seconds and then the special message for approx. 3 seconds.

Display of the status:

The status of the oil separator is displayed in two lines. The first line displays, depending on the operation selector switch, HAND, STOP or AUTO. The second line shows the function of the oil separator: STAND BY, SEPARATE, OIL DISCHARGE or FLUSHING.

If the selector switch is in "0" position, the following display appears:

```
BETRIEB STOP
STAND BY
```
```
OPERATION STOP
STAND BY
```

In the "STOP" position, the oil separator remains in STAND BY function.

In "Hand" position, the following displays are possible:

```
BETRIEB HAND
STAND BY
```
```
OPERATION HAND
STAND BY
```

If the oil separator is in standby while in manual operation, a special status must be present. This display only appears alternating with the corresponding message (see Display of alternating messages).

Further displays in manual mode include:

```
BETRIEB HAND
ENTOELEN
```
```
OPERATION HAND
WATER DISCHARGE
```

```
BETRIEB HAND
ABSTEUERN
```
```
OPERATION HAND
OIL DISCHARGE
```

```
BETRIEB HAND
SPUELEN
```
```
OPERATION HAND
FLUSHING
```

Only for oil separators with adsorber:

```
BETRIEB HAND
ENTOELT MIT ADSORBER
```
```
OPERATION HAND
WATER PASS ADSORBER
```
In "Automatic" position, the following displays are possible:

<table>
<thead>
<tr>
<th>BETRIEB AUTO STAND BY</th>
<th>OPERATION AUTO STAND BY</th>
</tr>
</thead>
</table>

If the oil separator is in standby while in automatic operation, a special status is present. This display only appears alternating with the corresponding message (see Display of alternating messages).

Further displays in automatic mode include:

<table>
<thead>
<tr>
<th>BETRIEB AUTO ENTOELEN</th>
<th>OPERATION AUTO WATER DISCHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETRIEB AUTO ABSTEUERN</td>
<td>OPERATION AUTO OIL DISCHARGE</td>
</tr>
<tr>
<td>BETRIEB AUTO SPUELEN</td>
<td>OPERATION AUTO FLUSHING</td>
</tr>
</tbody>
</table>

Only for oil separators with adsorber:

| BETRIEB HAND ENTOELT MIT ADSORBER | OPERATION HAND WATER PASS ADSORBER |

Display of alternating messages:

| ! LANGZEIT- | ! BETRIEBSALARM |
| ! BILGENLEVEL | ! NIEDRIG |
| ! FERNAUSSCHALTUNG | ! OELTANK |
| ! UEBERLAUF | ! OILTANK |
| ! MOTORSTOERUNG | ! OEL-ALARM |
| ! UEBERSTROM | ! SEPARATOR |
| ! ENTOELER | ! OIL-ALARM |
| ! OEL-ALARM | ! DIFFERENZDRUCK |
| ! UEBERSCHREITUNG | ! DIFFERENCIAL |
| ! ENTOELER | ! SEPARATOR |
| ! TROCKENLAUF | ! RUN DRY |
| ! OEL-SENSOR | ! OIL-SENSOR |
| ! FEHLER | ! FAILURE |
| ! BILGEN-SENSOR | ! BILGE-SENSOR |
| ! FEHLER | ! FAILURE |
c) Displays triggered by menu control

As described above, the control unit first shows the start message and then switches to the operation mode. By means of the menu control you can now call up other displays to query values or to modify parameters. The menu control is called up via the Enter button. Pressing the Enter button again will then consecutively call up the main items in the menu structure. After the last main item, the operation mode display is called up again. You can repeat this cycle navigation by means of the Enter button at will. Pressing the ESC button while in one of the main items guides you directly back to the operation mode display:

Operation mode display (e.g. automatic operation / separating):

<table>
<thead>
<tr>
<th>BETRIEB</th>
<th>AUTO</th>
<th>OPERTION</th>
<th>SEPARATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTOELEN</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After pressing the Enter button:

Language selection (see 9.6.d)

<table>
<thead>
<tr>
<th>SPRACHE:</th>
<th>LANGUAGE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEUTSCH</td>
<td>GERMANY</td>
</tr>
<tr>
<td>ENGLISCH</td>
<td>ENGLISH</td>
</tr>
</tbody>
</table>

After pressing the Enter button:

Input image (see note on input image 9.6.e)

<table>
<thead>
<tr>
<th>EING:</th>
<th>IN:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0110.1011.0001.1000</td>
<td>0110.1011.0001.1000</td>
</tr>
</tbody>
</table>

After pressing the Enter button:

Output image (see note on output image 9.6.f)

<table>
<thead>
<tr>
<th>AUSGANG:</th>
<th>OUT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000.0111.00</td>
<td>1000.0111.00</td>
</tr>
</tbody>
</table>

After pressing the Enter button:

Query for branching to the user settings (see 9.6.g)

<table>
<thead>
<tr>
<th>RUNDENPARAMETER</th>
<th>USER SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AENDERN?</td>
<td>MODIFY?</td>
</tr>
<tr>
<td>NEIN</td>
<td>NO</td>
</tr>
<tr>
<td>JA</td>
<td>YES</td>
</tr>
</tbody>
</table>

After pressing the Enter button:

Query for branching to the factory settings (only for RWO service)

<table>
<thead>
<tr>
<th>WERKSPARAMETER</th>
<th>FACTORY SETTINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AENDERN?</td>
<td>MODIFY?</td>
</tr>
<tr>
<td>NEIN</td>
<td>NO</td>
</tr>
<tr>
<td>JA</td>
<td>YES</td>
</tr>
</tbody>
</table>

After pressing the Enter button:

back to operation mode display
d) Language selection
In the display "language selection" select English with the +button and German with the –button. Confirm the selection with Enter and move on to the next main item in the menu structure. Use ESC to interrupt the language selection without changes.

e) Notes on the input image:

The first line contains 4 numbers separated by points. The value range of each number is between 0 and 102. The first two numbers belong to the two analogue inputs of the sensor electrodes and mirror the percentage threshold of the input parameter for maximum modulation. In case of a 0-10V input, the value 48 indicates approx. 4.8 V. The 3rd and 4th digit mirror the resistance measured by the sensor electrode inputs. 0 indicates no or very low resistance (water). High numbers (e.g. 65) indicate a high resistance (oil).

Important note!
The threshold value of the sensor electrode is pre-set by factory default to common bilge waters and oils, normally it does not need to be adjusted. If special cases on board require an adjustment to different conditions, contact RWO service first.
The second line contains the On/Off state of the inputs, indicated by 0 or 1. A total of 16 input data are displayed. For better overview, the 16 data are separated by points into blocks of 4. 14 of the 16 data derive from input 1 to 14. The last two input data derive from the sensor electrodes. If the measured resistance exceeds the threshold for oil detection, the input is shown as "1". If the measured resistance is below the threshold for oil detection, the input is shown as "0".

f) Notes on the output image:
The output image displays the state of the 10 output relays. "0" indicates that the relay is switched off. "1" indicates that the relay is switched on. For better overview, the 10 states are divided by points into blocks of 4.
g) Branching to the user settings

In the submenu user settings you can view and modify these settings. First you need to go one level down. To do so, activate the field "YES" in the main item with the +button.

Display of main menu item after pressing the +button ("YES" flashes)

<table>
<thead>
<tr>
<th>RUNDENPARAMETER</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>USER SETTING</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>YES</th>
<th>MODIFY?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>

After pressing the Enter button:

Query of the user password (PIN = 7963)

<table>
<thead>
<tr>
<th>RUNDENPASSWORT:</th>
<th>0000</th>
<th>USER PASSWORD</th>
<th>0000</th>
</tr>
</thead>
</table>

First the first digit of the password is activated (flashes). Use the +/ -buttons to set the digit. If the digit is set as desired, activate the next digit with the Enter button. Pressing the Enter button after setting the forth digit will check the password. If the password is incorrect, the following message appears:

<table>
<thead>
<tr>
<th>PASSWORT FALSCH!</th>
<th>BITTE NEU EINGEBEN!</th>
<th>WRONG PASSWORD!</th>
<th>PLEASE RETYPE PASSWD</th>
</tr>
</thead>
</table>

If the password is correct, the display jumps to the user settings level, and there to the query to change the first parameter. The selected default response is "NO". Pressing the Enter button therefore automatically jumps to the next parameter. That change query is also set to "NO" by default. This way, you can quickly navigate to the parameter you want to modify.

(If you accidentally skip the desired parameter, you can press the ESC button once while still in the user settings. This will go back one level in the menu and thus to the query if you want to change user settings. If you answer this question with "Yes", you get back to the beginning of the user settings.)

See Important note under 9.6.e

<table>
<thead>
<tr>
<th>OEL-ERKENNUNG &gt; %</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>OIL IDENT &gt; %</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>YES</th>
<th>MODIFY?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>

See Important note under 9.6.e

<table>
<thead>
<tr>
<th>WASSER-ERKENNUNG &lt; %</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>WATER IDENT &lt; %</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>YES</th>
<th>MODIFY?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SPUELZEIT SEK.</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>FLUSHING TIME SEC.</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>YES</th>
<th>MODIFY?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LANGZEIT ALARM MIN.</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>LONG TIME ALARM MIN.</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>YES</th>
<th>MODIFY?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>WERKSEINSTELL. HOLEN</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>RESTORE DEFAULTS</th>
<th>AENDERN?</th>
<th>NEIN</th>
<th>JA</th>
<th>YES</th>
<th>MODIFY?</th>
<th>NO</th>
<th>YES</th>
</tr>
</thead>
</table>

After the last parameter you leave the user settings level and go back to the main level. The next stage in the main level is the question about changing factory settings.
h) Changing user settings

If you navigated to the user settings as described above, you must select "YES" for every single parameter you want to change (+button). For example for the oil detection threshold, this means:

**WARNING!**

The values for oil and water detection must not be changed without consulting RWO service!

Incorrect settings can cause severe functional failures!

See **Important note** under 9.6.e

<table>
<thead>
<tr>
<th>ÖL-ERKENNUNG &gt; %</th>
<th>OIL IDENT &gt; %</th>
</tr>
</thead>
<tbody>
<tr>
<td>AENDERN? NEIN JA</td>
<td>MODIFY? NO YES</td>
</tr>
</tbody>
</table>

After pressing the Enter button, the set value and the possible value range are displayed. The first digit of the value flashes and can be modified with the +/-buttons. The process is the same as in entering the password.

<table>
<thead>
<tr>
<th>ÖL-ERKENNUNG &gt; %</th>
<th>OIL IDENT &gt; %</th>
</tr>
</thead>
<tbody>
<tr>
<td>WERT :053 (000..100)</td>
<td>VALUE:053 (000..100)</td>
</tr>
<tr>
<td>WASSER-ERKENNUNG &gt; %</td>
<td>WATER IDENT &gt; %</td>
</tr>
<tr>
<td>WERT :048 (000..100)</td>
<td>VALUE:048 (000..100)</td>
</tr>
</tbody>
</table>

After entering the last digit and pressing the Enter button, the display prompts for confirmation to save the new value.

<table>
<thead>
<tr>
<th>ÖL-ERKENNUNG &gt; %</th>
<th>OIL IDENT &gt; %</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPEICHERN? NEIN JA</td>
<td>STORE? NO YES</td>
</tr>
</tbody>
</table>

Use the +/-buttons to switch to "YES". Pressing with Enter button will confirm the new value (if the entered value is beyond the permissible range, it will automatically be set to the limit value). This exits the function to change this setting, the next user setting is queried for changes.

You can cancel the changes to the user settings any time without changes by pressing the ESC button. The menu then goes up to the level where the prompt asks for changes to the user settings.

<table>
<thead>
<tr>
<th>SPUELZEIT SEK.</th>
<th>FLUSHING TIME SEC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AENDERN? NEIN JA</td>
<td>MODIFY? NO YES</td>
</tr>
</tbody>
</table>

The flush times depend on oil separator output and factory settings:

<table>
<thead>
<tr>
<th>SKIT</th>
<th>0.1</th>
<th>0.25</th>
<th>0.5</th>
<th>1.0</th>
<th>1.5</th>
<th>2.5</th>
<th>5.0</th>
<th>10.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>sec.</td>
<td>8</td>
<td>12</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LANGZEIT ALARM MIN.</th>
<th>LONG TIME ALARM MIN.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AENDERN? NEIN JA</td>
<td>MODIFY? NO YES</td>
</tr>
</tbody>
</table>

The set value results from the maximum bilge water volume on board; it can be calculated by this formula: Minutes = maximum bilge water volume in m³ divided by pump output in m³/h * 60 plus 15 %. If the oil separator has not processed the bilge water within that time, the LONG TIME ALARM is triggered.

Search for the cause, e.g. a leak in the suction line. The oil separator would then permanently suck air.
These displays to select changes, set values and save values are available for every user setting.

The only exception is the item "Restore defaults".

<table>
<thead>
<tr>
<th>WERKSEINSTELL. HOLEN.</th>
<th>RESTORE DEFAULTS.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AENDERN?</td>
<td>MODIFY?</td>
</tr>
<tr>
<td>NEIN</td>
<td>NO</td>
</tr>
<tr>
<td>JA</td>
<td>YES</td>
</tr>
</tbody>
</table>

If you select "YES" in the item "Restore defaults", you will not see a submenu to set the values. Instead all parameters (except the flush time) are set to the general initialisation settings.

**Important note!**

If you had set values (e.g. for LONG TIME ALARM) individually, these must be set again to the previously set values after selecting "Restore defaults".

**In general:**

If you have changed user settings or restored the default, the control software must be reset by switching the system off and then on again accept the changes.

### 9.7. Control functions

**a) Oil detection and oil discharge**

In the upper calming zone of the oil separator the separated oil is collected. The RWO level automatic measures the accumulated oil level with a three-rod sensor electrode (item 9). During the oil collection phase, the status LED is green.

As soon as a specified amount of oil has been collected, the RWO automatic level system (item 3) opens the oil drain valve (item 4) and the flushing water inlet valve (item 15) so that the oil is discharged to the oil collector tank by means of the flushing water pressure. During this time, the status LED is red.

This stage is followed by the backflush process. The high-performance coalescer is flushed with clean water by opening both the flushing water inlet valve (item 15) and the flushing water outlet valve (item 5). During this time, the status LED is orange.

If the RWO automatic level system detects an illogical signal input, e.g. the short rod electrode detects a conductive medium (water) while the long rod electrode detects a non-conductive medium (oil), the system switches to standby mode and activates the alarm output.

The oil separation interval and the flush cycle are aligned in such a way that the SKIT aquaclean "S-DEB" can operate largely without requiring attendance and maintenance.

During oil discharge and flushing, the pump (item 14) and the optional electric heater (item 10) switch off automatically!

**b) Additional control functions**

**b) 1 Level detection in the bilge or the bilge water tank (option)**

By factory default, the terminals X2-1 and X2-2 as well as X2-3 and X2-4 are bridged. To enable level detection, two level switches must be connected instead of the bridges. Oil separation starts and the green LED (bilge level) illuminates when the bilge water level has reached the upper level switch. When the bilge water level has reached the lower level switch, oil separation stops and the LED (bilge level) goes off.

If the control unit detects an illogical signal input, e.g. upper level present and lower level not present, the system switches into standby mode and activates the alarm output.

**Important note!**

If the level control is to be implemented with one floating switch only, remove both bridges. The level switch must be connected as NOC to terminals X2-1 and X2-2, additionally set a bridge between X2-2 and X2-4.
b) 2 Oil separator remote control (option)
By factory default, the terminals X2-5 and X2-6 (NC) are bridged. The user can connect a remote switch "On - Off" or "Emergency Stop" there. These can switch the system into standby mode.

b) 3 Oil tank overflow (option)
with software variant OP000 / OP001 / OP002 or OP003 activated!
By factory default, the terminals X2-7 and X2-8 (NC) are bridged. The user can connect a level switch there. In case of oil tank overflow, the system switches into standby mode and activates the alarm output.

b) 3 Monitor flow controller (alternatively option)
with software variant OP004 / OP005 / OP006 or OP007 activated!
By factory default, the terminals X2-7 and X2-8 (NC) are connected to the flow controller. In case of insufficient flow, the display shows a corresponding message and the alarm output is activated.

b) 4 Oil alarm by means of capacitive probe in the oil separator (option)
By factory default, the terminals X2-9 and X2-10 (NC) are bridged. Optionally you can install and connect a capacitive probe in the oil separator. If special oils in the bilge water (e.g. hygroscopic oils) are not detected by the conductivity probe, the oil separator will slowly fill with oil. Once the oil layer reaches the capacitive probe it switches into standby mode and activates the alarm output.

b) 5 Pressure difference switch (option)
By factory default, the terminals X2-11 and X2-12 (NC) are bridged. The user can connect a pressure difference switch there. If the maximum pressure difference, e.g. between upstream and downstream of the adsorber, is exceeded for at least 10 seconds, the system switches into standby mode and activates the alarm output. This state requires a reset (selector switch in "0" position).

b) 6 Dry run protection (option)
By factory default, the terminals X2-13 and X2-14 (NC) are bridged. The user can connect a dry run connection for the oil separator pump there. When the dry run protection triggers, the system switches into standby mode and activates the alarm output.

b) 7 Oil monitor
By factory default, the limit value signal 1 (set by default to 14ppm (4ppm)) is connected to terminals X2-15 and X2-16, and limit value signal 2 (set by default to 15ppm (5ppm)) to terminals X2-17 and X2-18.
Both signals serve for controlling the recirculation valves (item 23) and the valves (item 57 and item 58) for an adsorber bypass.

- If the value falls below limit value 1 and limit value 2
  The valve for sample water (item 57) is switched to guide the water upstream of the adsorber to the monitor.
  The bypass valve (item 58) is switched to guide the water downstream of the oil separator bypassing the adsorber.
  The recirculation valve (item 23) is switched to guide the cleaned water outboard.

- If the value exceeds limit value 1 and falls below limit value 2
  The valve for sample water (item 57) is switched to guide the water downstream of the adsorber to the monitor.
  The bypass valve (item 58) is switched to guide the water downstream of the oil separator through the adsorber.
  The recirculation valve (item 23) is switched to guide the cleaned water outboard.
• If the value exceeds limit value 1 and limit value 2.
  The valve for sample water (item 57) is switched to guide the water downstream of the adsorber to the monitor.
  The bypass valve (item 58) is switched to guide the water downstream of the oil separator through the adsorber.
  The recirculation valve (item 23) is switched to guide the cleaned water back to the bilge.

  c) Alarms
  All alarm states activate a collective alarm relay. The display shows the different alarms as text. Potential-free changeover contacts X1-14; X1-15 can be used for an alarm signal.

  d) System status message
  If these requirements are met: "Oily water separator switched on" and "Hand – 0 – Auto is not on Zero" and "Level in the bilge tank is high" and "Alarm states (except 15ppm (5ppm) – Alarm) are not present", two relays are activated.

  • The user can connect a remote indication light of the system status.
  • Terminal X1-20 and X1-21, connected by RWO, provide an operation signal to the oil monitor which logs the oil separator operating hours.

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