



Installation, operating and maintenance manual OWS-COM

acc. to IMO Resolution MEPC.107(49)



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1 General

1.1 Design of the documentation

This document includes all important information for the user of the described plant / unit:

- Safety instructions
- Instructions for commissioning, handling and maintenance
- Technical data

If you need further information or if problems occur that are not covered by these operation instructions, please contact RWO GmbH directly. (→ 1.5 Contact information)

Images, schematic diagrams and tables are only intended for better understanding, in general they reflect RWO standard but can differ in case of special systems, additional options and technical modifications. For detailed information to the RWO system you purchased, refer to the provided drawings.

1.2 Location of the manual

A copy of the manual must be kept easily accessible for the operating and supervising staff.

1.3 Use of these documents

- Descriptions are given in the running text.
- Enumerations are marked with (•).
- Steps are marked with (1), 2), 3)...
- Notes and links are marked with (→).
- **Highlights** in the running text indicate security advices.

1.4 Guarantee

Any warranty in terms of our sales and delivery conditions as well as RWO's confirmation of order are only granted if:

- The plant / unit is used corresponding to these operation instructions.
- The operating log is updated daily in full.
- The plant / unit is not used improperly.
- Repairs are carried out by authorised specialised personnel only (such training can be booked through the service department (→ 1.5 Contact information)).
- Only original parts or spare parts and chemicals approved by RWO GmbH are used for repair.
- No unauthorised alterations are carried out on the whole plant.

Excluded from the guarantee are typical wear and tear parts, like e. g.

- all rotating parts
- gaskets
- filters
- desiccant cartridge
- etc.

1.5 Contact information			
Department	Telephone	Fax	E-mail
Repair and service	+49 421 53705 0	+49 421 53705 440	service.rwo@veolia.com
Spare parts service	+49 421 53705 228	+49 421 53705 442	spares.rwo@veoliawater.com
Sales	+49 421 53705 213	+49 421 53705 445	sales.rwo@veoliawater.com
Internet	www.rwo.de		
Postal address	RWO GmbH Marine Water Technology Gerold-Janssen-Strasse 2 28359 Bremen Germany		
 Note	When ordering spare parts, please provide us with the serial number of the plant / unit (see cover page of these operation instructions or name plate of the plant / unit) and the IMO number of the vessel.		

Tab. 1 Contact information

2 General safety notes

2.1 Responsibilities of the operator

The plant / unit has been constructed and manufactured considering the applicable resolutions, standards and technical specifications. It corresponds to state-of-the-art technology and guarantees highest possible safety in all operation states.

The safety of the plant / unit can only be guaranteed if all the required measures are fulfilled. The operator of the plant has to plan these measures according to the instructions.

Especially, the operator must make sure that:

- The plant / unit is operated in perfect, functional condition only. The safety devices should be checked regularly to ensure correct function.
- Required personal protection equipment (PPE) is available and used when required.
- The operation instructions are always complete, readable and available on site for use on the plant / unit.
- The operating log is updated daily in full.
- Only qualified and authorized personnel are permitted to operate, maintain and repair the plant / unit (such training can be booked through the service department (→1.5 Contact information)).
- The personnel are instructed regarding all questions of working safety and environmental protection, and know the contents of the operation instructions and the safety notes contained therein.
- All safety and warning notes attached to the plant / unit are visible and readable and have been neither removed nor covered.
- Modifications are to be carried out by authorised specialised personnel only and in coordination with the supplier.

2.2 Specific safety notes and symbols

The operation instructions contain specific safety notes.

These are to avoid dangers to:

- Persons
- Product and plant / unit
- Environment

The symbols used in the operation instructions shall draw the attention to the following issues!



DANGER

DANGER denotes an immediate danger. Non-observance of the instruction can result in most severe or fatal injuries.



WARNING

WARNING denotes a potentially dangerous situation. Non-observance of the instruction could result in most severe or fatal injuries.



CAUTION

CAUTION denotes a potentially dangerous situation. Non-observance of the instruction can cause injuries.



Denotes important information and steps, non-observance of which can cause damage and/or functional faults of the plant / unit.



Denotes application help, tips and other useful information about the respective topic.

2.3 Safety measures at the location of installation

The plant / unit must be placed onto an even and solid base and be fixed or welded onto the ship fundament at the designated points.



To overthrow the plant / unit means mortal danger!

2.4 Basic safety measures during normal operation

The plant / unit must be operated by specially trained and authorized persons only, who know the operation instructions (such training can be booked through the service department (→ 1.5 Contact information)).

Check and make sure before starting the plant / unit that:

- Only authorized persons are allowed to stay in the working area of the plant / unit.
- Nobody can be injured when plant / unit is started!

Check plant / unit for visible damage before starting and make sure that it is operated in perfect condition only! Any damage to the plant / unit must be reported immediately!

2.5 Basic safety measures during maintenance

- Perform maintenance and upkeep work only with moderate sea or in the harbour.
- Ensure the intervals and activities for inspection and maintenance are observed as stated in the operating instructions!
- Observe maintenance and repair instructions regarding the single components in the appendix!
- Before starting maintenance or repair works, close the access to the plant / unit by unauthorized persons! Provide signs mentioning that maintenance or repair works are carried out!
- Switch-off main switch of power supply before starting maintenance and repair works!
- Depressurize the system, interrupt the feed to the plant / unit and protect against restart!
- When exchanging heavy plant / unit parts, use suitable and functionable lifting devices only!
- Make sure before starting maintenance and repair works that all parts are at room temperature.

2.6 Basic information on personal protection equipment (PPE)



Change your clothes before performing any kind of maintenance or other work at the unit.

Wear:

Disposable single-use boiler suits

Rubber boots

Rubber coated textile gloves

Goggles or face protection

Safety harness



After work, dispose of the single-use clothes properly and clean the other parts with fresh water before storing them.

2.7 Observe the environmental regulations

Legal regulations for e. g. avoiding and separating waste have to be taken into consideration during all works carried out at the plant / unit.

Electric waste and electronic components must only be disposed of by approved specialised companies.

Recycle plastic components

Scrap metal components

Dispose of other components sorted by material, especially water-polluting substances such as:

- lubricants and oils
- hydraulic oil
- coolants
- acids and lyes
- Cleaning agents

are not to be discharged into the soil or the drain!

These substances must be collected in suitable tanks, transported and disposed of according to regional regulations!

2.8 Risk potential of the bilge water oil separator







The bilge water oil separator has been subject to a safety inspection and acceptance test. Faulty operation or misuse may result in severe health risks for the user and damage to the environment. Additionally, the bilge water oil separator and other assets of the ship can suffer permanent damage.

All persons involved in the installation, the electric and hydraulic connection and the operation of the bilge water oil separator must be qualified accordingly (the relevant training sessions can be booked in our service department (→1.5 Contact information)) and must pay close attention to these installation and operating instructions.

Protect yourself from skin contact and inhaling of liquids and aerosols when opening the bilge water oil separator in order to prevent sensitisation.

Your safety is concerned!

2.9 Sources of danger

 DANGER	Voltage > 42 V. Direct contact with live parts may cause serious injury or death. Before working on electric equipment, interrupt the voltage supply externally and turn the main switch (1Q1, →7.9 Automatic control panel) to "0". Any wiring at the unit only by trained staff!
 DANGER	Risk of explosion! Standard plants must not be operated in explosive areas.
 WARNING	The bilge water oil separator operates with an eccentric spiral pump. Do not put your hands into the area of the transmission bell housing - stuffing box packing at the rotating shaft! Danger of most severe finger and hand injuries.
 CAUTION	Risk of injuries when working at lines under pressure. Before taking up the work, check water and compressed air lines and make sure that they are not under pressure.
 WARNING	All pneumatic valves are closed by a pre-tensioned spring. On dismantling the valve drive, the spring can eject forcefully and cause injuries.
 CAUTION	If the bilge water oil separator is heated to the upper range with an electric heater or a steam heater, temperatures up to approx. 60 degrees celsius can occur. Risk of burns.

3 Design and function

3.1 Component overview

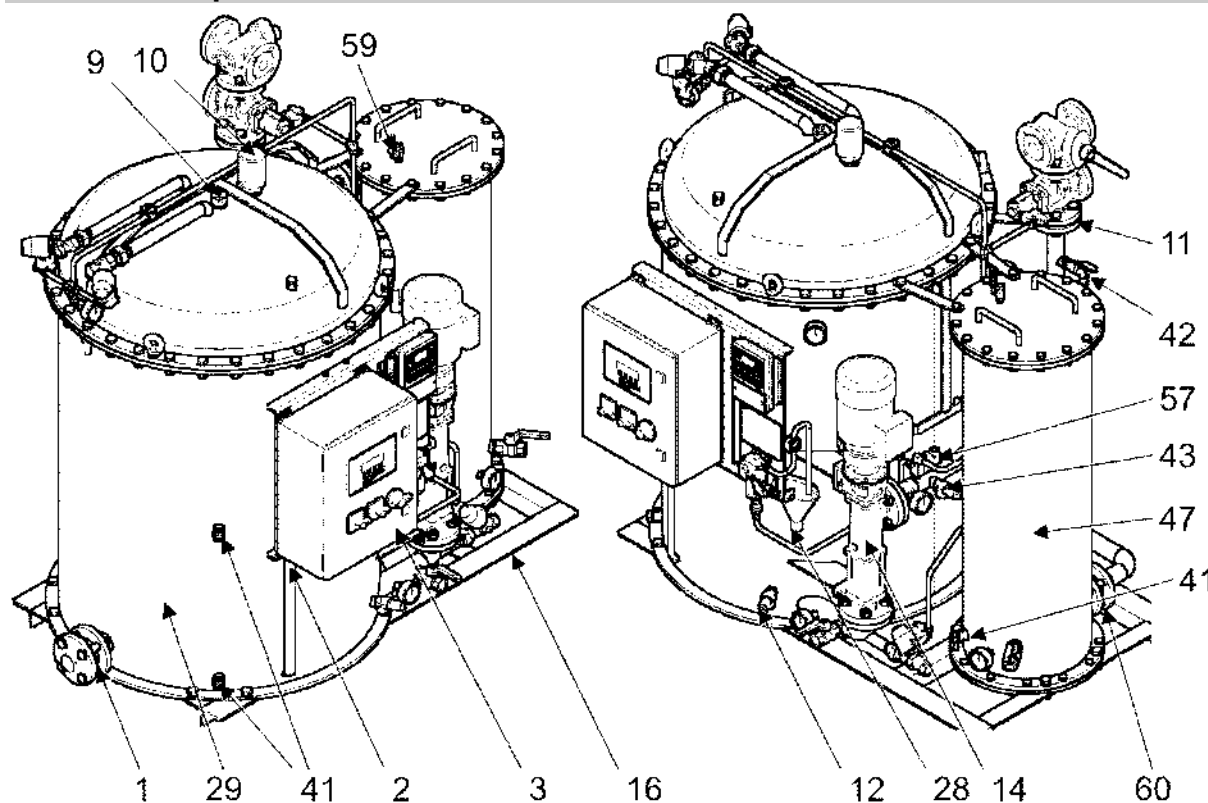


Fig. 1 Component overview

Pos.	Description
1	Non-return valve
2	Inlet
3	Control box
9	Sensor electrode
10	Electric heating
11	Jam panel
12	Safety valve (1 bar)
14	Single outlet pump
16	Foundation
28	Funnel
29	Coalescer container (1. stage)
41	Zinc anode
42	Sampling valve
43	Safety valve (3 bar)
47	Adsorber (2. stage)
57	Sample water valve
59	Venting
60	Non-return flap

Tab. 2 Component overview

3.1.1 Component overview control system

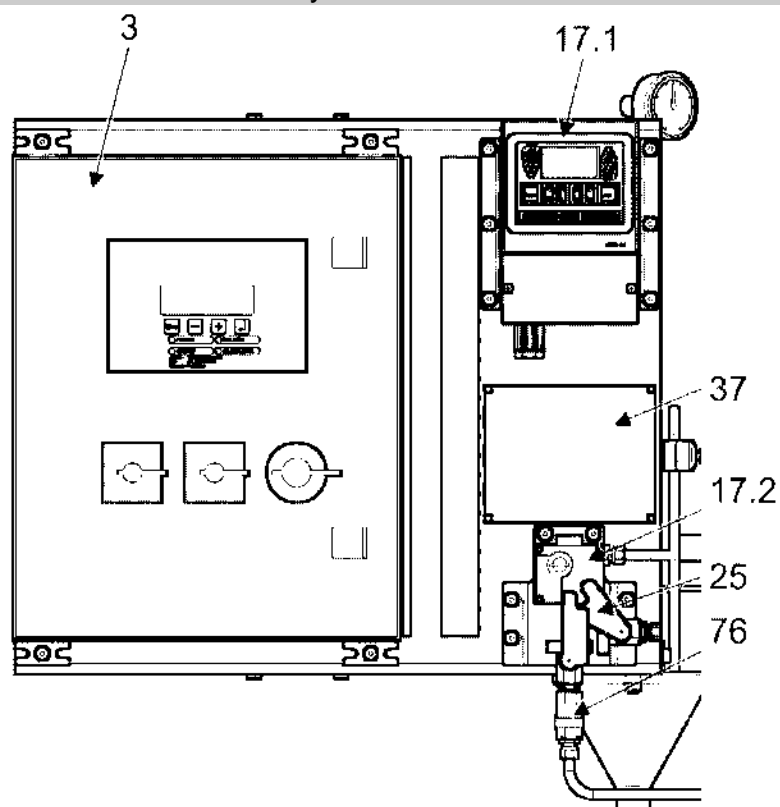


Fig. 2 OMD and measuring cell

Pos.	Description
3	Control box
17.1	Oil monitor OMD
17.2	Measuring cell
25	3-way ball cock
37	Identification plate
76	Non-return valve

Tab. 3 OMD and measuring cell

3.1.2 Component overview pressure gauge,

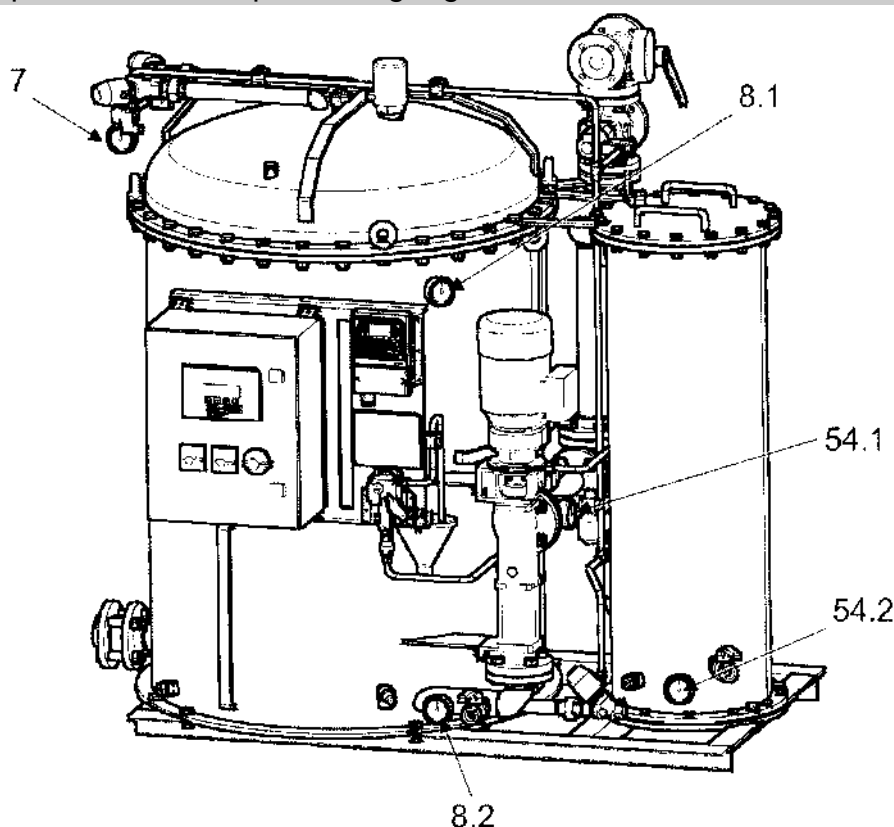


Fig. 3 Pressure gauge

Pos.	Description
7	Pressure gauge 0-10 bar compressed air
8.1	Vacuum pressure gauge -1/+5 bar coalescer input
8.2	Vacuum pressure gauge -1/+5 bar coalescer output
54.1	Pressure gauge 0-10 bar adsorber input
54.2	Pressure gauge 0-10 bar flushing water input

Tab. 4 Pressure gauge

3.2 Standard scope of supply

The standard version of the oily water separator type series OWS-COM is marked by the following characteristics:

The entire oil separator system (as of type OWS-COM 0,25) is screwed to a base (→Fig. 1/16) which has to be welded in the engine room of the ship.

The second stage is equipped with adsorber cartridges. The pump (→Fig. 1/14) (as of type OWS-COM 0,25) is attached to the container, connected by tubes and cables.

All piston valves (→Fig. 5/4, 5, 15, 23, 58) are initiated by the solenoid valves and are completely installed in tubes.

The automatic control box (fig. 1 pos. 3→3.1) is connected to the system/unit and wired to the sensor electrode, the electric heater, the pump and the oil monitor OMD.

The oil monitor OMD (→Fig. 2/17) is attached to the oily water separator. The sample water lines and the electric system are ready installed.

The plant (as of type OWS-COM 0,25) is equipped with an electric heater (→Fig. 1/10) in the upper part of the oil separator which keeps the separated oil in a liquid state. A thermo element limits the temperature; by defaults it is set to 45°C. It is controlled by a contactor in the automatic system control box (→Fig. 1/3). The heater can also be switched off manually using a switch (→Fig. 12/2S1).

Optionally, the oil separator system can be equipped with a steam or thermal heater instead of the electric heater and with a temperature control valve.

The oil separator systems are coated with a two-components epoxy resin on the inside. The outer coating consists of a universal primer and a machine varnish.

(Any differing scope of delivery can be found in writing in our order confirmation.)

3.3 Proper use

The oil separator type OWS-COM is, according to IMO Resolution MEPC.107(49), a highly specialised device with the sole purpose of separating oil from the bilge water. Any other use beyond this field is not permitted. In case of non-obedience, all warranties and claims will be void.

The IMO Resolution MEPC.107(49) has been put into effect on July 18, 2004 and applies to all bilge water oil separators and 15ppm alarm units installed on ships after January 1, 2005.

IMO Resolution MEPC.107(49) describes the details of the type test for oil separators and 15ppm oil content alarm systems. The main different to the old Resolution MEPC.60(33) consists in that the new MEPC.107(49) includes an oil in water emulsion. This emulsion is generated by mixing the different test oils with a specified emulsifying chemical and an iron oxide powder for an hour under controlled conditions using a centrifugal pump with high speed. The bilge water oil separator must be able to split the emulsion and to separate oil residues.

3.4 Excerpt from the IMO Resolution MEPC.107(49)

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

3.5 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

3.6 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.

3.8.1 15 ppm Bilge Separator;

3.8.2 15 ppm Bilge Alarm

3.8.3 Automatic stopping device

3.7 MEPC.107(49)

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

3.8 Equipment requirements

3.8.1 Bilge Separator

15 ppm Bilge Separators are considered to be applicable for use in conjunction with oily bilgewater 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.

3.8.2 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. very 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.

3.8.3 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.

3.9 Installation requirements

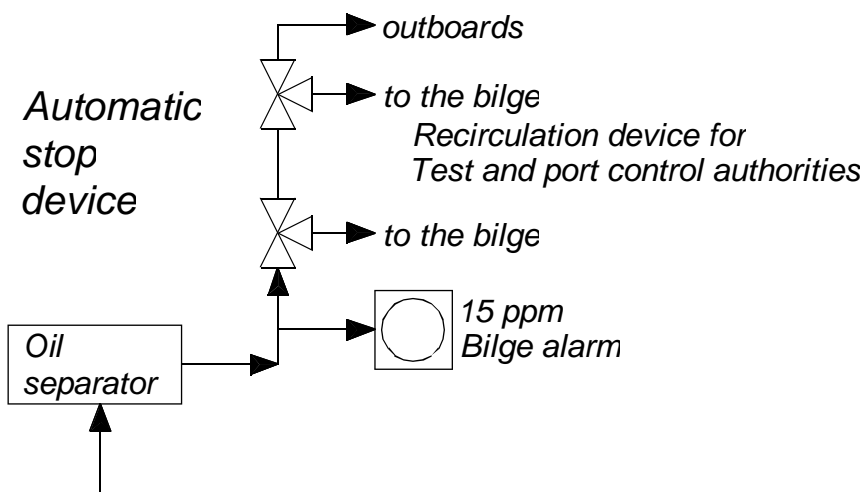


Fig. 4 Automatic stop device

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 (→ Fig. 4 Automatic stop device).

The re-circulating facility should be so configured as to prevent under all operating conditions any by-pass of the oily-water-separator. 15 ppm Bilge Separator should be based in a non-hazardous area.

3.10 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 to be recorded, see "Routine and repair maintenance record" Tabelle in "Operation and maintenance instruction".

3.11 Training

Ship staff training should include familiarization in the operation and maintenance of the equipment.

3.12 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

3.13 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 agent have proven to be relatively suitable for use in our system:

- RWO Multiclean Quick Sep - 25 ltr / container RWO part number: 6061313352

3.14 Technical data

3.14.1 Capacity, dimensions and weight

Type	Capacity (m ³ /h)	Dimensions W x D x H (mm)	Weight (kg)	
			Net	Wet
OWS-COM 0.1	0.10		125	142
OWS-COM 0.25	0.25	953 x 744 x 1023	180	240
OWS-COM 0.5	0.50	1003 x 747 x 1050	193	510
OWS-COM 1.0	1.00	1210 x 798 x 1320	270	460
OWS-COM 2.5	2.50	1506 x 1056 x 1484	455	929
OWS-COM 5.0	5.00	1824 x 1382 x 1714	758	1988
OWS-COM 10.0	10.00	2154 x 1574 x 2001	1195	3370

Tab. 5 Capacity, dimensions and weight, electric data

3.14.2 Electric data

Type	Power consumption (440V/50Hz)		Max. cross-section Connection terminal (mm ²)	Cable gland (pos. 2) clamping range (mm)
	P (kW)	I (A)		
OWS-COM 0.1	0.80	1.19	2.5	9 – 17
OWS-COM 0.25	2.60	1.19	2.5	9 – 17
OWS-COM 0.5	3.20	1.55	2.5	9 – 17
OWS-COM 1.0	3.20	1.55	2.5	9 – 17
OWS-COM 2.5	3.70	2.00	2.5	9 – 17
OWS-COM 5.0	4.60	3.50	2.5	9 – 17
OWS-COM 10.0	7.70	4.50	2.5	9 – 17

Tab. 6 Electric data

Other voltage values are possible. Comply with the connection voltage as stated on the label at the control cabinet. The internal wiring of the device is fixed, all external connections have to be made by the customer acc. to the wiring diagram.

3.14.3 Valves and pipe connections

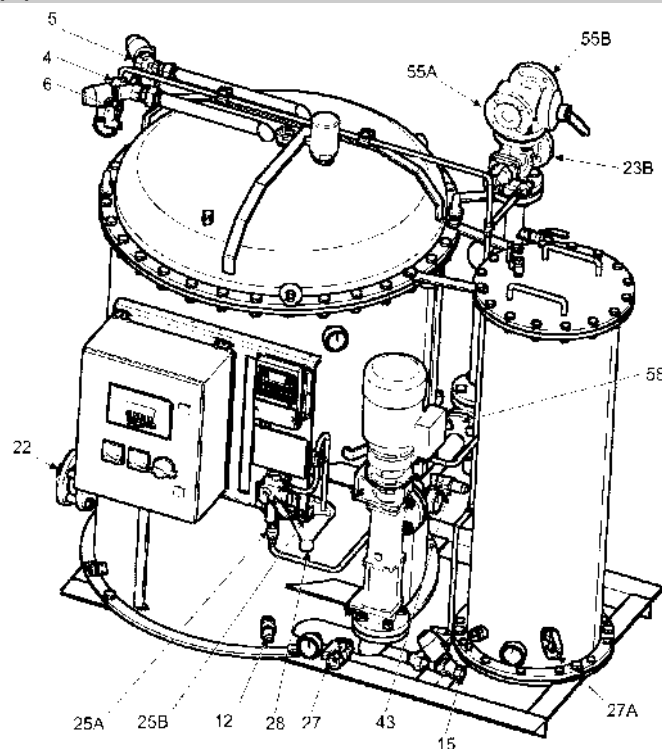


Fig. 5 Valves and pipe connections

Pos.	Description
4	Oil drain
5	Flushing water outlet
6	Compressed air inlet
12	Safety valve (1. stage)
15	Flushing water inlet
22	Bilge water inlet
23B	To the bilge water tank
25A	Test water inlet (OMD)
25B	Flushing water inlet (OMD)
27	Drain valve (1nd stage)
27A	Drain valve (2nd stage)
28	Funnel
43	Safety valve (2. stage)
55A	Outboards
55B	To the bilge water tank
58	Bypass valve

Tab. 7 Valves and pipe connections

Type	OWS-COM 0.1	OWS-COM 0.25	OWS-COM 0.50	OWS-COM 1.00	OWS-COM 2.5	OWS-COM 5.0	OWS-COM 10.0
Pos.							
4	1/2"	1/2"	3/4"	3/4"	1"	1"	DN40
5	1/2"	1/2"	1/2"	1/2"	3/4"	3/4"	DN32
6	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
15	1/2"	1/2"	1/2"	1/2"	1/2"	3/4"	1"
22	DN15	DN15	DN25	DN25	DN32	DN50	DN65
23B	3/4"	3/4"	3/4"	1"	DN32	DN40	DN50
25A	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
25B	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
27	1"	1"	1"	1"	1"	1"	1 1/2"
27A	1/4"	1/2"	1/2"	1/2"	1/2"	1"	1"
55A	3/4"	3/4"	3/4"	1"	DN32	DN40	DN50
55B	3/4"	3/4"	3/4"	1"	DN32	DN40	DN50

Tab. 8 Pipe connections

Connect all pipe connections in the specified dimensions. Make sure to adjust the pipes without tension and leaks to the unit.

3.15 Oil separator control system

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.

3.15.1 Elements of the control and display field

The control system is equipped with 3 switches to set the system to different operating states (→Fig. 12).

On / Off – main switch 1S1

Switch for the supply voltage of the oily water separator (on or off)

Switch hand – 0 – Auto 2S3:

Switch for the operation mode of the oily water separator control (manual, zero or automatic operation).

- Position "Hand":
The oily water separator operates independently from the level in the bilge or bilge water tank.
- Position "Zero":
The oil separator does not operate.
- Position Automatic:
The oil 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.

On/Off switch el. heater 2S1:

If the oily water separator is equipped with an electric heater, this button switches it on or off.

3.15.2 LED displays

The display contains 4 LEDs which permanently indicate special operating states. Some of the 4 LEDs are multi-coloured.

White LED (power)

This LED 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.

Red LED (failure)

This LED indicates a failure state. The cause of the failure can be found on the display.

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.

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.

3.15.3 Keys

The control panel has 4 buttons. With these buttons you can enter all input and query the operating states.

ESC button

This button is enabled in all operating states. It serves to undo the previous operating stage. 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.

+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.

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.

3.15.4 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 (→Fig. 6/1) to adjust the contrast of the LCD to the lighting conditions.

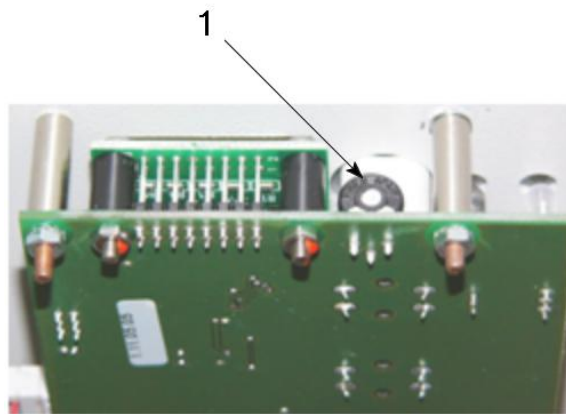


Fig. 6 Potentiometer

3.16 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 (→Fig. 1/9). 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 opens the oil drain valve (→Fig. 5/4) and the flushing water inlet valve (→Fig. 5/15) 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 and the flushing water outlet valve (→Fig. 5/5). 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 OWS-COM can operate largely without requiring attendance and maintenance.

During oil discharge and flushing, the pump (→Fig. 1/14) and the electric heater (→Fig. 1/10) switch off automatically!

3.17 Oil monitor

By factory default, limit signal value 1 is set to 14ppm (4ppm) and connected to the terminals X4-7 and X4-8. The limit signal value 2 is set to 15ppm (5ppm) and connected to terminals X4-9 and X4-10.

The signals serve to control the recirculation valve (→Fig. 5/23), the sample water valve (→Fig. 1/57) and the bypass valve (→Fig. 5/58).

If the value falls below limit value 1 and limit value 2:

The valve for sample water is switched to guide the water upstream of the adsorber to the monitor.

The bypass valve is switched to guide the water downstream of the oil separator bypassing the adsorber.

The recirculation valve 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 is switched to guide the water downstream of the adsorber to the monitor.

The bypass valve is switched to guide the water downstream of the oil separator passing through the adsorber.

The recirculation valve is switched to guide the cleaned water outboard.

If the value exceeds limit value 1 and limit value 2:

The valve for sample water is switched to guide the water downstream of the adsorber to the monitor.

The bypass valve is switched to guide the water downstream of the oil separator passing through the adsorber.

The recirculation valve is switched to guide the cleaned water back to the bilge.

3.17.1 Alarms

All alarm states activate a collective alarm relay. The display shows the different alarms as text. Potential-free changeover contacts X1-1, X1-3 and X1-5 can be used for an alarm signal.

3.17.2 System status message

If the following conditions are met:

- Switch 1Q1 = On (→Fig. 12).
- Switch 2S3 ≠ 0 (→Fig. 12).
- "Level in bilge tank is high" (→3.18)
- Alarm status except 15ppm (5ppm) – Alarms not given,

two relays are activated.

The user can connect a remote indication light of the system status.

Terminals X4-5 and X4-6 (ready connected by RWO) provide an operation signal to the oil monitor which logs the oil separator operating hours.

3.18 Optional control functions

By factory default, 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 detect 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.



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.

3.18.1 Oil separator remote control

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.

3.18.2 Oil tank overflow

If software variant OP000 / OP001 / OP002 or OP003 is 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.

3.18.3 Monitor flow controller

If software variant OP004 / OP005 / OP006 or OP007 is 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.

3.18.4 Oil alarm by means of capacitive probe in the oil separator

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.

3.18.5 Pressure difference switch

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).

3.18.6 Dry run protection

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.

3.19 Identification of type

Every device has an engraved type plate with the following data:

- IMO Res. MEPC.107(49)
- Type
- Service
- RWO serial number
- RWO order number

- BGV approval number
- BGV approval date
- USCC approval number
- Year of construction
- operating pressure
- Test pressure
- Class (optional)
- Steering wheel symbol
- Number of notified body
- Conformity mark
(Russian Federation
Government Order No.
696 dated 19.11.2003)



3.20 Type tests

The system was type-approved by the test and certification body BG Verkehr, Department for Ship Safety, on 2014-10-01.

The type-test certificates according to IMO - Resolution MEPC.107(49) have been issued by the BG Verkehr, EC conformity according to the Marine Equipment Directive MED (module B + module D) has been confirmed.

- Part 1 Test and performance specifications for type approval of 15ppm bilge separators
- Part 2 Test and performance specifications for type approval of 15ppm 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 15ppm bilge separator
- Appendix 2 Certificate of type approval for 15ppm bilge alarm

The bilge water separator complies with the technical regulation about safety of sea transport items „RF Government Order No. 620 dated 12.08.2010“ and is covered by the „All-Russian products classification code 641600“. The system is labeled with a conformity mark corresponding to the „RF Government Order No.696 dated 19.11.2003“

The following type test certificates are present:

	Oil separator OWS-COM 0.1.....10 m3/h	Bilge Alarm OMD-24
EC-conformity acc. to MED 96/ 98/ EC as amended by Directive 2012/32/EC	 Module B Module D	 Module B Module F
National Certificate Germany	BGV	BGV
National Certificate USA	USCG	USCG
National Certificate China	CCS	CCS
National Certificate Russia	RMRS TR-620	RMRS

Tab. 9 Type test certificates

3.21 Environmental requirements

3.21.1 Voltage

Comply with the connection voltage as stated on the label at the control cabinet. The internal wiring of the unit is complete. All external connections have to be arranged by the customer acc. to the wiring diagram.

The power consumption depends on size and equipment of the unit and is specified on the wiring diagram.

3.21.2 Feed water

Feed water has to show the characteristics as defined by the IMO. Do not use any biocides or chemicals for cleaning on board which aren't biodegradable if these products finally get into the plant.

3.21.3 Connections

Connect all pipe connections in the specified dimensions (→ Tab. 7). Make sure to adjust the pipes without tension and leaks to the unit.

3.21.4 Cleaning facilities

Provide a fresh water connection at the unit and some space for doing simple investigations of the technical status of the unit.

3.21.5 Oil detection and oil discharge

Oil detection and oil discharge are mainly automatised. The oil separation interval and the flush cycle are aligned in such a way that the bilge water oil separator can operate largely without requiring attendance and maintenance.

3.21.6 Protection

The electric protection is implemented in IP 56.

3.21.7 Humidity

As by IMP requirements, the unit can tolerate the conditions in the engine room onboard (tropical).

3.21.8 Temperature

The oil separator system is designed for a water mix temperature between min. + 2°C and max. 45°C.



NOTE

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.

3.22 Noise

The noise pressure level is below 80 dB(A).

3.23 Vibrations

The unit is made and tested for the acceleration/vibration load which can be expected on board acc. to the IMO requirements.

4 Important terms and definitions for bilge water oil separator

4.1 Test and certificates of the unit

Test and certification acc. to regulation by German See-Berufsgenossenschaft - Schiffssicherheitsabteilung, basing on IMO MEPC.107(49)

4.2 Constructional measure to prevent sea pollution by oil

Defined in MARPOL 73/78, Annex I and in the Helsinki – Convention HELCOM, Annex IV, Rule 4, Annex 1.

4.3 Adsorption

Adsorption (from Latin adsorptio, adsorbere „suck (in)“) refers to the enrichment of substances from gases or liquids on the surface of a solid body, or more general at the border between two phases.

4.4 Emulsion

Emulsion designates a finely dispersed mixture of two liquids which normally cannot be mixed without visible de-mixing

4.5 Coalescence

Coalescence in general designates the flowing together of colloidal particles, e. g. emulsion drops. These must meet and merge. The surface of the newly formed "drop" is now smaller than the sum of the individual drops, i.e. the surface is decreased. This surface decrease causes a reduction of the drop's friction resistance so that the drop rises or sinks faster than without coalescence.

5 Bearing

5.1 Transport

For lifting use a crane crossbeam and sling only to the available lifting eyes. Lifting eyes (X) for the oily water separator and lifting eyes (Z) for the lid only.

The lifting eyes pointing down (Y) only serve as safeguard against tilting during transport.

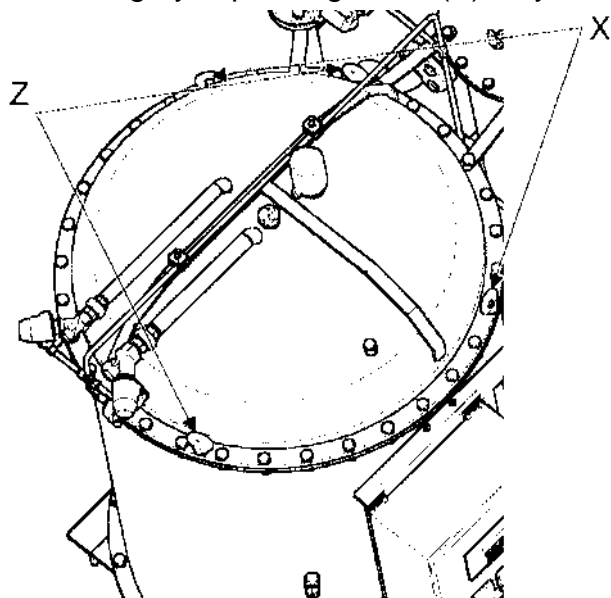


Fig. 7 Lifting eyes X and Z

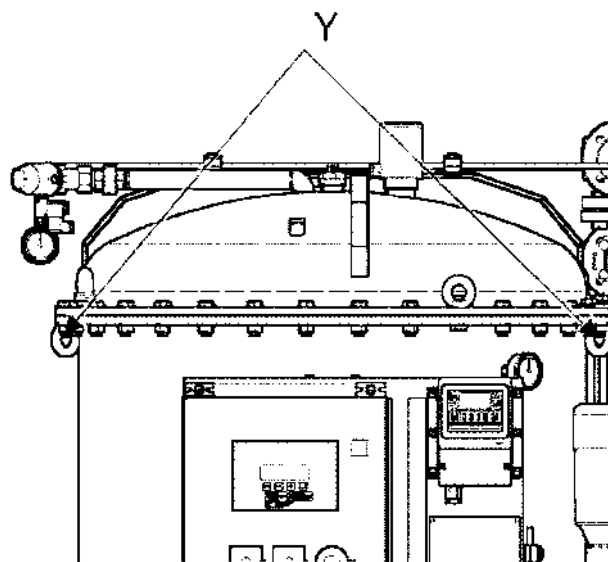


Fig. 8 Support eyes (only to be used for transport)

5.2 Unpacking

Open the transport case by removing the top side first. Then remove the side walls. Pay attention to additional parts inside the case and keep them next to the unit. For lifting use a crane crossbeam and sling to the available lifting eyes (X) only (→Fig. 7).

5.3 Bearing

Depending on unit's size it comes in adequate packaging. Protect the units by keeping them in the original packaging as long as possible. Store the unit dry and frost-free on a flat surface.

5.4 Packaging disposal

The material is treated with heat (56°C) for 30 min acc. to ISPM 15 rules so it can be disposed regularly acc. to the procedures at site.

5.5 Requirements for taking the unit out of service for longer periods of time

If the unit is to be taken out of operation for a longer time, switch off the system and open the covers of the coalescer container and the adsorber(s). Open the drain valves and clean the containers with freshwater. The coalescer of the first stage can only be cleaned roughly from the outside. At least drain the remaining water. Try to dry the system by keeping it open for a while before closing the covers again. Close all external valves (to prevent any feed into the unit) and disconnect the power line.

6 Preparation for commissioning

The customer must provide the RWO Oil Separator System OWS-COM with the following media.

6.1 Compressed air



WARNING

Lines under pressure bear a risk of injury.

Before taking up the work, check compressed air lines and make sure that they are not under pressure.

The oil 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 installed by factory default. They are fed via a cutting-ring screw connection (→Fig. 5/6). This must be established with a pipe Ø8x1 mm and an air pressure of approx. 6-8 bar. We recommend to equip the compressed air line with a filter and maintenance unit.

6.2 Flushing water



WARNING

Lines under pressure bear a risk of injury.

Before taking up the work, check water lines and make sure that they are not under pressure.

The standard system requires clean water with a pressure of 1 to max. 1.5 bar at the flushing water inlet valve (→Fig. 5/15) for the oil discharge and the backflush of the coalescer. For the 15ppm (5ppm) alarm device (→Fig. 2/17.2), another flush connection (pipe Ø8x1 mm) is provided. Both sea water and desalted water are suitable for this purpose. The consumption is low, it depends mainly on the amount of oil to be separated and on the flushing water pressure. As a rough estimate, for systems up to 0.25 m³ one can expect approx. 10% and for systems of more than 0.5 m³ approx. 5% of the oil separator hourly performance per cycle.

6.3 Supply unit consumption list

Components	Consumption per oil discharge and flushing process						
OWS-COM	0.1	0.25	0.5	1.0	2.5	5	10
*1 Fresh water	3.5	6	18	23	35	76	119
*2 Compressed air	0.3	0.4	0.4	0.5	0.6	0.7	0.8

Tab. 10 Supply unit consumption list

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

*2 Average air amount in litres for a complete discharge process at a pressure of 6 bar

6.4 Electricity



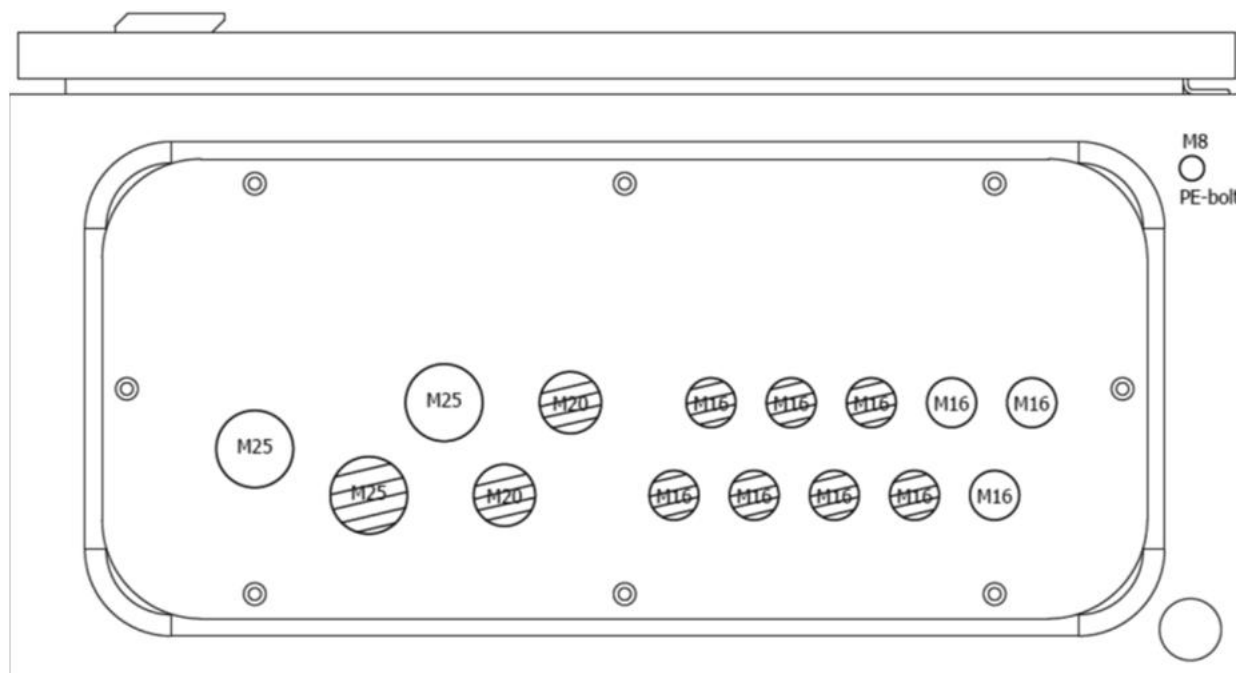
Note

The voltage on board must be specified during the order and check for compliance with the label on the automatic control box before connecting to the oil separator system.

Incorrect electric connection voltage can destroy electric components! The voltage on board must be specified during the order and check for compliance with the label on the automatic control box before connecting to the oil separator system. Incorrect electric 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 operate on 3-phase alternating current.

The automatic system is installed in a robust steel housing IP 56, the supply (→ Fig. 1/2) is done via Cable inlet.



 Cable Glands used by RWO

Fig. 9 Cable glands at OWS-COM

Kabelverschraubungen für Werftkabel

Size	Number	Range cable outer-diameter
M16	3	4.5 ... 10 mm
M20	--	7 ... 13 mm
M25	2	9 ... 17 mm

Tab. 11 Cable glands for use

6.5 Safety aspects before use

The unit has to be fastened securely to the ship-side foundation. All piping must be arranged properly in the given dimensions and material and be installed without pre-tension. The electric connections have to be carried out acc. to the given wiring diagram.

6.6 Installation

The unit needs a flat surface which is big enough and stable. The foundation must be welded to the ship's structure. The piping should be arranged in steel (galvanized or well coated) PN 10 (16). A freshwater tap near the unit is necessary (for connection of hose in case of cleaning). Space for maintenance must be provided (→ Fig. 10 / Fig. 11). Make sure that the area is well lit and ventilated.

Electric installation acc. to the wiring diagram has to be carried out in proper workmanship by trained staff only adhering to valid regulations.

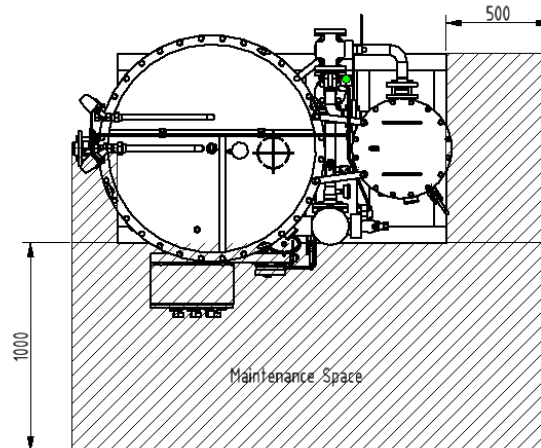


Fig. 10 Oil separator, maintenance space

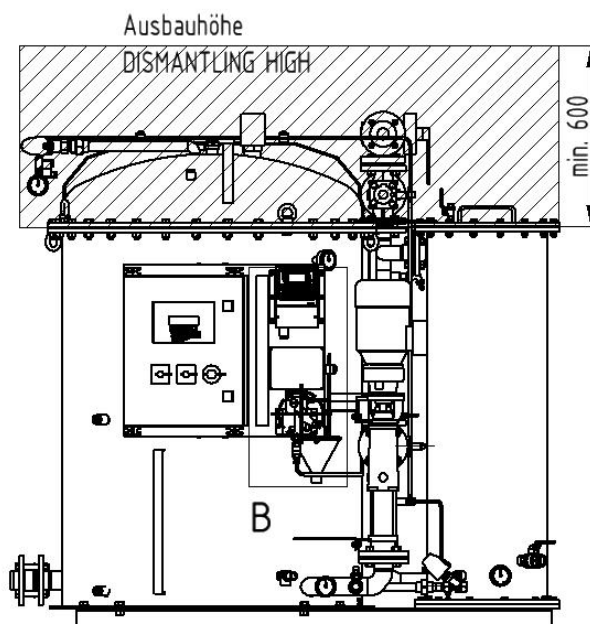


Fig. 11 Oil separator, maintenance height

7 Commissioning

Observe the following notes for installing the RWO oil separator system OWS-COM.

7.1 Pump



Note

In order not to overcharge the attached single outlet pump (→ Fig. 1/14), install the oil separator at a low point of the engine room. The pump is designed for a suction height of 4 - 5m at medium temperatures up to approx. 30°C and a pumping head to 30 mWs (3 bar).



NOTE

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



NOTE

The rotational direction of the pump is "CLOCKWISE" when viewed from the motor. If the rotational direction is incorrect, there is an 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.



NOTE

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.

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. Ø2 mm at sufficient free sieve area. Upon request, we provide the appropriately dimensioned sieve basket filter for every oil separator. Please contact our sales department (→ 1.5 Contact information).

Mounted to the oil separator is a non-return flap (→ Fig. 1/1) which prevents self-draining 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.



Note

The suction line must be air-tight because the oil separator operates with a vacuum. In case of leaks in the suction line, the oil separator sucks air. The oil separator then enters a permanent cycle (air suction, air discharge, etc.).

7.3 Flushing water inlet



WARNING

Lines under pressure bear a risk of injury.

Before taking up the work, check water lines and make sure that they are not under pressure.

The oil separator system requires clean water for oil discharge, coalescer flashback and for the monitor zero compensation and cleaning (→6.2 Flushing water).

7.4 Oil outlet

The pipeline from the oil outlet (→Fig. 5/4) to the oil collector tank must be laid without pressure. The oil collector tank must be vented sufficiently.

7.5 Flushing water outlet

The pipeline from the flushing water outlet (→Fig. 5/5) must be laid without pressure back to the bilge or into the bilge water tank.

7.6 Clean water outlet

The clean water outlet is the connection at the 3-way valve (→Fig. 5/55A) outboards.

7.7 Recirculation outlets



Note

According to IMO MEPC 107(49), the outboards pipeline must be equipped with a 3-way valve (→Fig. 5/55) and a non-return valve (→Fig. 13/24). Please observe also the corresponding material specifications of the respective classification board for fittings on the ship's side. For operation of the OWS-COM, no special fittings in the outboards line are required, but the outboards outlet should be above the upper edge of the oil separator.

The pipeline from the recirculation outlet at the 3-way valve (→Fig. 5/23B) and at the manual 3-way valve (→Fig. 5/55B) back to the bilge or the bilge water tank must be laid without pressure and be equipped with a venting pipe.

7.8 Pipelines

For connecting the OWS-COM oil separator system we recommend the following pipeline cross-sections, chapter →3.14.3 Valves and pipe connections.

7.9 Automatic - control box



DANGER

Voltage > 42 V

Direct contact with live parts may cause serious injury or death.

The connection to the operating mains must only be done by trained specialists (electrician).

All system components are connected to the automatic control system (→Fig. 1/3) by factory default (as of type OWS-COM 0.25). The housing consists of steel plates with protection rating IP 56. The supply (→Fig. 1/2) is done through cable glands. The line cross-section must be measured and fused depending on the oil separator power →3.14.2 Electric data.

The 4 LEDs in the control box door indicate the basic functions. The oil separator system can be started and the operating modes selected via a main switch and a switch "Hand"- "Zero"- "Auto". There are terminals for two level switches in the bilge in order to switch automatic mode of the system on or off depending on the level. By factory default the terminals of the floating switches are bridged.

For a detailed description of the oil separator control system with micro processor see →3.15 Oil separator control system and following.

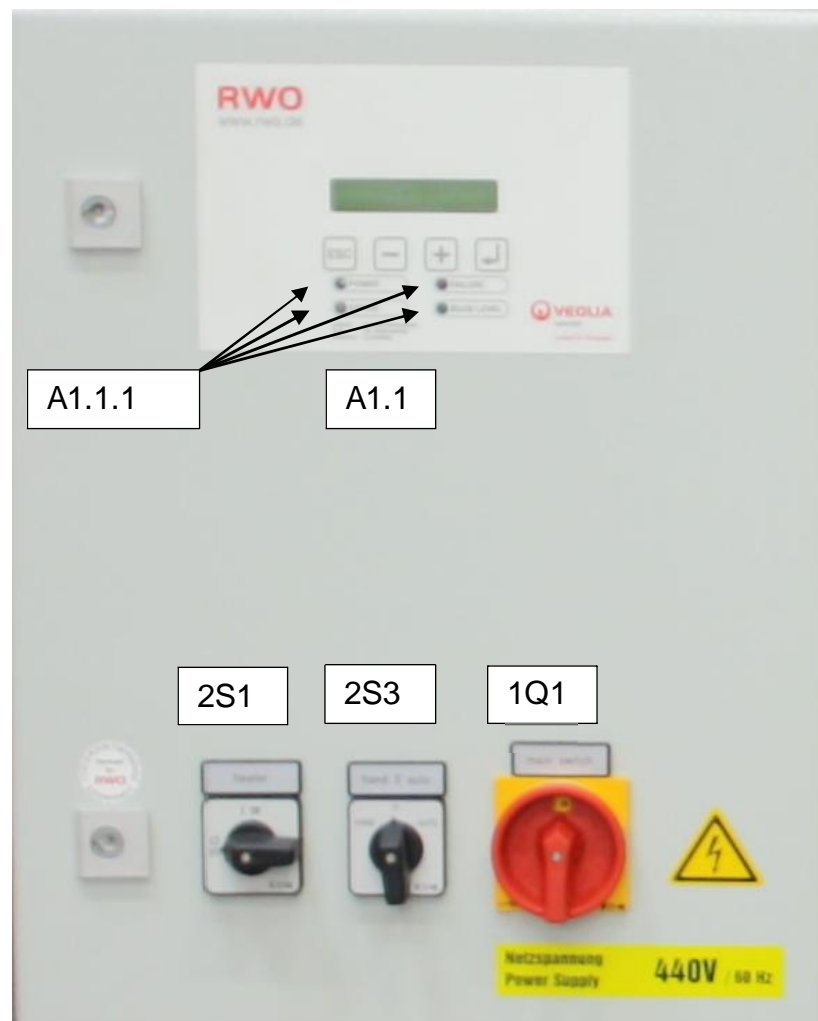


Fig. 12 Control box

Pos.	Description
2S1	Heating
2S3	Hand 0 Automatic
1Q1	Main switch
A1.1	Control panel
A1.1.1	LED displays 1-4

Tab. 12 Component overview of control box

7.10 Electrical connections of oil separator control system

See electric diagram

8 Installation plan

8.1 P&ID (pipeline and instrument diagram)

See documentation

8.2 Installation scheme – suggestion

Pos.	Designation	Flange connections
4	Oil discharge valve (outlet)	All flange connections acc. to DIN EN 1092-1, PN16. All thread connections acc. to DIN 259-1 (R) / ISO 228-1 (G)
5	Flush valve (outlet)	R-thread or DIN EN 1092-1, PN16
21	Sieve basket (optional)	R-thread or DIN EN 1092-1, PN16
22	Suction line from bilge (bilge water tank)	
23B/55B	Back to bilge, bilge water tank	
24	Outboard valve (optional)	
55A	Overboard line	R-thread or DIN EN 1092-1, PN16

Tab. 13 Installation scheme

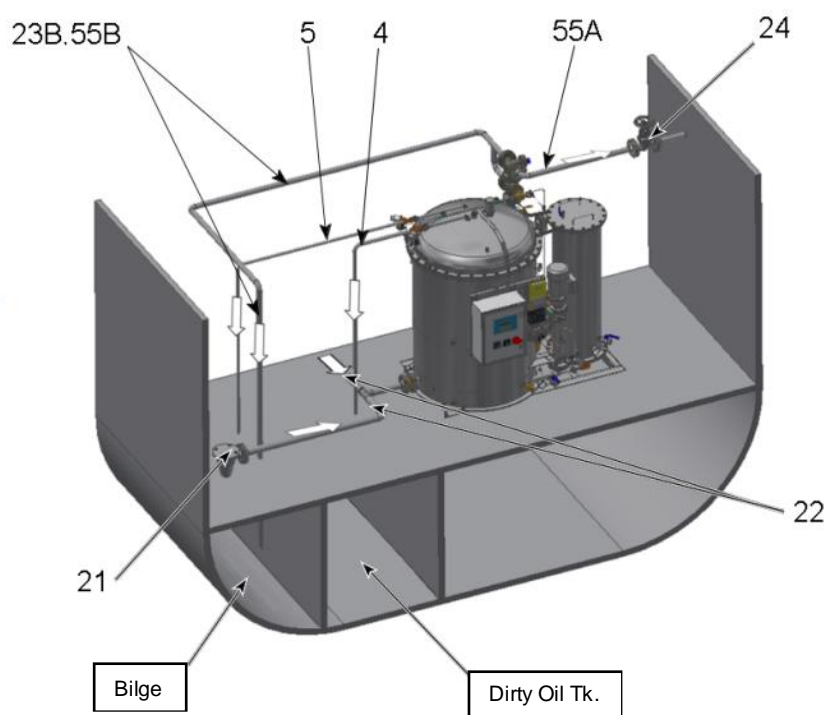


Fig. 13 Installation scheme

9 Process description

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

9.1 Oil water separation

An eccentric spiral pump (→Fig. 1/14) sucks through the OWS-COM from the bilge. This flow conduction avoids unnecessary additional mixing of oil and water due to pump turbulences upstream of the gravity oil separator. In the 1st stage of the OWS-COM the rough separation is improved by using the different density 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 ensures the excellent efficiency of the OWS-COM oil separator.

9.2 Adsorber bypass

The adsorber bypass is controlled by the bilge alarm monitor OMD. The adsorber elements remove all types of carbon hydrides from the water. The adsorption capacity is mainly limited by the amount of dissolved or emulsified carbon hydrides in the water, but dirt particles in larger amounts can block the adsorber. In order to extend the adsorber lifespan, heavy emulsions with a high oil concentration should be avoided by using rapidly separating cleaning agents in the machine room. Emulsions by air conditioning system or cleaning sludge should not be discharged into the bilge water.

To increase the lifespan of the adsorber cartridges, an automatic adsorber bypass is installed. The 15ppm (5ppm) oil alarm monitor checks the water quality periodically (every 5 minutes for 4 seconds) at the outlet of the first oil separator stage. If the value at this measuring point is below 14ppm (4ppm), the bypass valve (→Fig. 5/58) guides the cleaned water directly outboard, passing the adsorber stage. If the value is over 14ppm (4ppm), the adsorber stage is activated. This process control ensures a significantly increased useful life of the adsorber cartridges.

During the short measurement time (4 seconds), the 3-way valve (→Fig. 5/23) guides the cleaned water back to the bilge / bilge tank for safety reasons. This type of control ensures that only cleaned water with less than 15ppm (5ppm) residual oil content can get outboards. By factory default, the alarm threshold 2 is set to 15ppm (5ppm) and the alarm threshold 1 to 14ppm (4ppm). Only if a residual oil content of 15ppm (5ppm) is exceeded for at least 2 seconds, an alarm message to the engine control room is activated. Alarm 1 must be set lower than alarm 2.

In principle, three control states are possible:

a) Sample point falls below the limit value of 15ppm (5ppm) set for alarm 2 and sample point falls below the limit value of 14ppm (4ppm) set for alarm 1.

Operation without adsorber, cleaned water is guided outboards.

Voltage is applied to the solenoid valve of the 3-way valve (→Fig. 5/58), the 3-way valve guides the water bypassing the adsorber. Voltage is applied to the 3-way valve (→Fig. 1/57) and guides sample water from the sample point upstream of the adsorber to the oil alarm monitor OMD. Voltage is applied to the solenoid valve of the 3-way valve (→Fig. 5/23), the 3-way valve guides the water outboards.

The display of the control system indicates:

OPERATION	AUTO
WATER DISCHARGE	

b) Sample point exceeds the limit value of 15ppm (5ppm) set for alarm 2 and sample point falls below the limit value of 14ppm (4ppm) set for alarm 1.

Operator with adsorber, cleaned water is guided outboards.

No voltage is applied to the solenoid valve of the 3-way valve (→Fig. 5/58), the 3-way valve guides the water through the adsorber. No voltage is applied to the 3-way valve (→Fig. 1/57), it guides sample water from the sample point downstream of the adsorber to the oil monitor OMD. Voltage is applied to the solenoid valve of the 3-way valve (→Fig. 5/23), the 3-way valve guides the water outboards.

The display of the oil separator control indicates:

OPERATION	AUTO
WATER PASS ADSORBER	

c) Sample point exceeds the limit value of 15ppm (5ppm) set for alarm 2 and sample point exceeds the limit value of 14ppm (4ppm) set for alarm 1.

Operator with adsorber, cleaned water is guided back to the bilge or the bilge water tank.

No voltage is applied to the solenoid valve of the 3-way valve (→Fig. 5/58), the 3-way valve guides the water through the adsorber. No voltage is applied to the 3-way valve (→Fig. 1/57), it guides sample water from the sample point downstream of the adsorber to the oil monitor OMD. No voltage is applied to the solenoid valve of the 3-way valve (→Fig. 5/23), the 3-way valve guides the water back to the bilge or the bilge water tank.

The display of the oil separator control still indicates and the oil separator keeps operating.

OPERATION	AUTO
WATER PASS ADSORBER	

Additionally an alarm message to the engine control room is activated. On the monitor, two red LEDs signal that both limit values are exceeded and thus an alarm.

Process overview of the situational and valve states

Monitor OMD	Pos.	Designation	Valve state	Solenoid valve
Oil content less than 14ppm (4ppm) (limit value 1) at the sample point downstream of the OWS, upstream of adsorber	57	Sample water valve	Measuring upstream of adsorber	Voltage
	23	Recirculation valve	Outboards	Voltage
	58	Bypass valve	Bypassing adsorber	Voltage
Oil content is 14ppm (4ppm) but less than 15ppm (5ppm) (limit value 1 / 2 at the sample point downstream of the adsorber	57	Sample water valve	Measuring downstream of adsorber	No voltage
	23	Recirculation valve	Outboards	Voltage
	58	Bypass valve	Passing adsorber	No voltage
During mode b), the system periodically checks the oil content at the sample point upstream of the adsorber every 5 minutes.	57	Sample water valve	Measuring upstream of adsorber	Voltage
	23	Recirculation valve	Back to bilge / bilge water tank	No voltage
	58	Bypass valve	Passing adsorber	No voltage
Oil content higher than 15 ppm (5ppm).	57	Sample water valve	Measuring downstream of adsorber	No voltage
	23	Recirculation valve	Back to bilge / bilge water tank	No voltage
	58	Bypass valve	Passing adsorber	No voltage

Tab. 14 Process overview

9.3 Discharge control

In the upper calming zone of the oil separator the separated oil is collected. The RWO sensor electrode (→Fig. 1/9) measures the accumulated oil level. As soon as a specified amount of oil has been collected, the RWO automatic level system (→Fig. 1/3) opens the oil drain valve (→Fig. 5/4) and the flushing water inlet valve (→Fig. 5/15) 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 and the flushing water outlet valve (→Fig. 5/4). The oil separation interval and the flush cycle are aligned in such a way that the OWS-COM can operate largely without requiring attendance and maintenance.

9.4 Bilge alarm monitor OMD

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

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 tampering 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 an overboard discharge of polluted water is not possible.

10 Operation

10.1 Before commissioning

1) Check electrical connections



Voltage > 42 V

Direct contact with live parts may cause serious injury or death.

The fixed connection to the operating mains must only be done by trained specialists (electrician).



Danger of explosion

Standard plants must not be operated in explosive areas!

2) Check pipe and flange connections



Lines under pressure bear a risk of injury.

Before taking up the work, check water and compressed air lines and make sure that they are not under pressure.



The OWS-COM operates in suction mode. Make sure that the oil separator does not suck in any air through leaks in the suction line and/or flange connections at the oil separator tank. Sucked-in air will cause repetitive flushing processes. This way, the oil separator cannot draw any wastewater and thus cannot perform the water oil separation properly.

3) Check if bilge water is present



The control light "Bilge Level" is intended as optical indication for the presence of wastewater.

By factory default, the oil separator is delivered with two bridges between the terminals X2-1 and X2-2 and the terminals X2-3 and X2-4. The oil separator system can only start if it is bridged.

We recommend to replace these bridges by two floating switches (level switch bottom and level switch top) in the bilge or the bilge water tank and thus switch the oil separator system depending on the level. For this purpose, both floating switches must operate as normally open. If the level rises, they must close one after the other, only then the oil separator system starts. If the level falls, they open one after the other, only then the oil separator system stops.

4) Ensure compressed air supply of approx. 6-8 bar and flushing water supply 1bar (max. 1.5 bar).

5) Open the valves in the suction line

6) Open the valves in the clean water line outboards.



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

7) Check the rotational direction of the pump.

**Note**

With a new start and/or after longer periods of standstill, make sure that the drive motor can rotate the pump without problems. Should this prove to be impossible, e.g. because of the high adhesion between rotor and stator in new condition, you can support this movement using a suitable tool at the shaft behind the shaft seal.

**WARNING**

Do not put your hands to the rotating shaft in the area of the transmission bell housing - stuffing box packing! Danger of severe finger injury.

8) Check pressure gauge

The pressure gauges are equipped with a glycerine leak protection. To achieve a pressure compensation in the pressure gauge housing, you must cut off the nipple at the rubber cap with scissors before commissioning.

10.2 Before each startup

9) Check if wastewater is present.

**Note**

The control light "Level" is intended as optical indication for the presence of wastewater. See the detailed description under section →3) Check if bilge water is present.

10) Ensure compressed air supply and flushing water supply.

11) Open the valves in the suction line

12) Open the valves in the clean water line outboards.

**Note**

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

13) Remove the sealing cord at the venting screw on the gear of the pump drive motor.
(See separate operating instructions for the gear motor.)**10.3 Commissioning the OWS-COM****DANGER**

Voltage > 42 V

Direct contact with live parts may cause serious injury or death.

The fixed connection to the operating mains must only be done by trained specialists (electrician).

The 4 LEDs in the control box door indicate the basic functions. The oil separator system can be started and the operating modes selected via a main switch and a switch "Hand"- "0"- "Auto". There are terminals for two level switches in the bilge in order to switch automatic mode of the system on or off depending on the level. By factory default the terminals of the floating switches are bridged.

See chapter →3.18 Optional control functions

Decide whether to operate in "Manual mode" or "Automatic mode".

**Note**

In "manual mode", the oil separator operates independent of the level switch signals in the bilge. The oily water separator does not switch off automatically according to the level. Therefore you should only select this mode if permanent monitoring is ensured.

- 1) Switch on the main switch "POWER". The control light "RED-OILDISCHARGE" lights up in red (oil to the collector tank), because the sensor electrode indicates air and oil (both non-conductive media). The pneumatic piston valves at the flushing water inlet (→Fig. 5/15) and oil outlet (→Fig. 5/4) are open (voltage is applied to both solenoid valves) and the system is automatically filled with flushing water and at the same time vented through the oil outlet. In this process, the pump remains switched off. As soon as the water level reaches the sensor electrode (→Fig. 1/9) (conductive medium detected), the control light switches to "ORANGE-FLUSHING" (backflush). The pneumatic piston valve (→Fig. 5/5) opens (voltage applied at solenoid valve) and with a time delay the oil outlet valve (→Fig. 5/4) closes (no voltage applied to solenoid valve).
- 2) As soon as the system is filled, the piston valves (→Fig. 5/5+15) close (no voltage applied to either solenoid valve). The control light "GREEN WATERDISCHARGE" lights up in green at the automatic control box (water outboards). Now the pump starts up and draws from the bilge. The system is now ready for operation.
- 3) The heater can now be switched on with the switch "Heater".

10.4 Meaning of the message lights

Designation	Colour	Condition	Meaning / cause
<u>POWER</u>	White	Main Switch "On"	Power supply provided / voltage applied
<u>FAILURE</u>	Red	One or more alarm states pending	The alarm trigger is shown as a text message on the display
<u>BILGE LEVEL</u>	Green	Floating switches in the bilge or the bilge water tank indicate "Wastewater present"	Display of wastewater level. If no floating switches are connected, you must bridge the corresponding terminals, else in automatic operation the oil separator cannot start.
<u>STATUS</u> Green Water-Discharge	Green	System in operation The display shows "WATER DISCHARGE"	Cleaned water is delivered
Red Oil-Discharge	Red	System in operation The display shows "DISCHARGE"	Oil or air is discharged to the oil collector tank Pump and electric heater are switched off Valve 4 and 15 are open
Orange-Flushing	Orange	System in operation The display shows "FLUSHING"	The backflush process is running. Pump and heating are switched off Valves 5 and 15 are open

Tab. 15 Meaning of the message lights

In chapter →3.15 Oil separator control system (and following) you find a detailed description of the oil separator control with micro processor

The annex contains a checklist for commissioning

(→ 16.1 Checklist for commissioning). Follow this list item for item.

10.5 Menu structure

10.5.1 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?	RWO Water Technology Version Nr 1.8 OP00?
--	--

10.5.2 Operation display

After 3 seconds splash screen, the operation mode display appears automatically. The operation mode display indicates the status of the control system.

Under normal conditions, the operation mode display only contains the status text of the oil separator. However, if special messages are present, they are displayed cyclically (e.g. MOTOR FAILURE OVERCURRENT). 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 position "0", the following display appears:

BETRIEB STOP STAND BY	OPERATION STOP STAND BY
--------------------------	----------------------------

In position "STOP", the oil separator keeps the function STAND BY

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

BETRIEB HAND STAND BY	OPERATION HAND STAND BY
--------------------------	----------------------------

If the oil separator is in standby in manual mode, a special condition must be present. This display now appears alternating with the corresponding message (→ **alternating messages**).

Other displays in manual mode are:

BETRIEB HAND ENTOELN	OPERATION HAND WATER DISCHARGE
-------------------------	-----------------------------------

BETRIEB HAND ABSTEUERN	OPERATION HAND OIL DISCHARGE
---------------------------	---------------------------------

BETRIEB HAND SPUELEN	OPERATION HAND FLUSHING
-------------------------	----------------------------

Display only for oil separator with adsorber

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

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

BETRIEB AUTO STAND BY	OPERATION AUTO STAND BY
--------------------------	----------------------------

If the oil separator is in standby in automatic mode, a special condition is present. This display appears alternating with the corresponding message (→ **alternating messages**).

Other displays in automatic mode are:

BETRIEB AUTO ENTOELEN		OPERATION AUTO WATER DISCHARGE
--------------------------	--	-----------------------------------

BETRIEB AUTO ABSTEUERN		OPERATION AUTO OIL DISCHARGE
---------------------------	--	---------------------------------

BETRIEB AUTO SPUELEN		OPERATION AUTO FLUSHING
-------------------------	--	----------------------------

Display only for oil separator with adsorber

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

Display of alternating messages:

! LANGZEIT- !		! LONG TIME !
! BETRIEBSALARM !		! RUNNING ALARM !

! BILGENLEVEL !		! BILGELEVEL !
! NIEDRIG !		! LOW !

! FERNAUSSCHALTUNG !		! REMOTE STOP !
! !		! !

! OELTANK !		! OILTANK !
! UEBERLAUF !		! OVERFLOW !

! MOTORSTOERUNG !		! MOTOR FAILURE !
! UEBERSTROM !		! OVER CURRENT !

! ENTOELER !		! SEPARATOR !
! OEL-ALARM !		! OIL-ALARM !

! DIFFERENZDRUCK !		! DIFFERENCIAL !
! UEBERSCHREITUNG !		! HIGH PRESSURE !

! ENTOELER !		! SEPARATOR !
! TROCKENLAUF !		! RUN DRY !

! OEL-SENSOR !		! OIL-SENSOR !
! FEHLER !		! FAILURE !

! BILGEN-SENSOR !		! BILGE-SENSOR !
! FEHLER !		! FAILURE !

10.5.3 Displays initiated 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):

BETRIEB	AUTO	OPERTION
ENTOELEN		SEPARATE

After pressing the Enter button
Language selection (→ 10.5.4)

SPRACHE:		LANGUAGE:
DEUTSCH	ENGLISCH	GERMAN ENGLISH

After pressing the Enter button
Input mapping (→ 10.5.5)

EING: 0. 0. 0. 0	IN: 0. 0. 0. 0
0110.1011.0001.1000	0110.1011.0001.1000

After pressing the Enter button
Output mapping (→ 10.5.6)

AUSGANG:	OUT:
1000.0111.00	1000.0111.00

After pressing the Enter button
Query branching to the user settings (→ 10.5.7)

KUNDENPARAMETER	USER SETTINGS
AENDERN? NEIN JA	MODIFY? NO YES

After pressing the Enter button
Query branching to the factory parameters (RWO service only)

WERKSPARAMETER	FACTORY SETTINGS
AENDERN? NEIN JA	MODIFY? NO YES

After pressing the Enter button
Back to operation display

10.5.4 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.

10.5.5 Notes on input mapping

EING: 48. 0. 0. 65	IN: 48. 0. 0. 65
0110.1011.0001.1001	0110.1011.0001.1001

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. With a 0-10V input, the value 48 indicates approx. 4.8V. The 3rd and 4th digit reflect the resistances measured at the sensor electrode inputs. 0 indicates no or low resistance (water). High numbers (e.g. 65) indicate a high resistance (oil).

In the second line, the On/Off status of the inputs is displayed by 0 or 1. In total, 16 input information are displayed. For better overview, the 16 states are divided by points into blocks of 4. 14 of the 16 information units are received by inputs 1 to 14. The last two input information are derived from the sensor electrodes. If the measured resistance exceeds the threshold for oil detection, the input is displayed as "1". If the resistance falls below the threshold for water detection, the input is displayed as "0".



Note

The threshold value of the sensor electrodes is set by factory default to usual bilge waters and oils and generally does not need to be adjusted. If in special cases an adjustment to special conditions on board is necessary, contact RWO service (→1.5 Contact information).

10.5.6 Notes on output mapping

AUSGANG:	OUT:
1000.0111.00	1000.0111.00

The output image displays the state of the 10 output relays. "0" indicates that the relay is switched off. "1" means that the relay is switched on. For better overview, the 10 states are divided by points into blocks of 4.

10.5.7 Branching to the user settings

In the submenu user settings you can view and modify these settings. For this purpose you must set a branch to this level. To do so, activate the field "Yes" at the main item using the + button.

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

KUNDENPARAMETER	USER SETTINGS
AENDERN? NEIN JA	MODIFY? NO YES



After pressing the Enter button:

Query of the customer password (PIN = 7963)

KUNDENPASSWORT:	USER PASSWORD
0000	0000

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 fourth digit will check the password. If the password is incorrect, the following message appears:

PASSWORT FALSCH!	WRONG PASSWORD!
BITTE NEU EINGEBEN!	PLEASE RETYPE PASSWD

If the password is correct, the display jumps to the user settings level, and there to the query to change the first parameter. The reply "NO" is selected by default. Pressing the Enter button therefore automatically jumps to the next parameter. Here, the change query

is also initially set to "NO". 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 select "Yes" here, you jump back to the beginning of the user settings)



WARNING

**The values for oil and water detection must not be changed without consulting RWO service!
Incorrect settings can cause severe functional failures!**



Note

See →10.5.5 Notes on input mapping

OEL-ERKENNUNG	> %		OIL IDENT	> %
AENDERN?	NEIN JA		MODIFY?	NO YES

WASSER-ERKENNUNG	< %		WATER IDENT	< %
AENDERN?	NEIN JA		MODIFY?	NO YES

SPUELZEIT			FLUSHING TIME	
SEK.			SEC.	
AENDERN?	NEIN JA		MODIFY?	NO YES

LANGZEIT ALARM			LONG TIME ALARM	
MIN.			MIN.	
AENDERN?	NEIN JA		MODIFY?	NO YES

WERKSEINSTELL. HOLEN			RESTORE DEFAULTS	
	NEIN JA			NO YES

After the last user setting, you leave the level of user settings and return to the ring structure of the main level. The next stage in the main level is the question about changing factory settings.

10.5.8 Changing user settings

If you branched to the user settings as described above, you must select "YES" to change the individual parameters (+ button). 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!**



Note

See →10.5.5 Notes on input mapping

OEL-ERKENNUNG	> %		OIL IDENT	> %
AENDERN?	NEIN JA		MODIFY?	NO YES

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.

OEL-ERKENNUNG > %	OIL IDENT > %
WERT : 055	VALUE: 055
(000..100)	(000..100)

WASSER-ERKENNUNG > %	WATER IDENT > %
WERT : 048	VALUE: 048
(000..100)	(000..100)

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

OEL-ERKENNUNG > %	OIL IDENT > %
SPEICHERN? NEIN JA	STORE? NO YES

With the +/- button you can now select "Yes". Pressing the Enter button confirms 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.

SPUELZEIT SEK.	FLUSHING TIME SEC.
AENDERN? NEIN JA	MODIFY? NO YES

The flushing times depend on the oil separator performance, the factory settings are as follows:

OWS	0.1	0.25	0.5	1.0	2.5	5.0	10.0
Sec.	8	12	15	20	30	40	50

Tab. 16 Factory settings

LANGZEIT ALARM MIN.	LONG TIME ALARM MIN.
AENDERN? NEIN JA	MODIFY? NO YES

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 section "Restore defaults".

WERKSEINSTELL. HOLEN.	RESTORE DEFAULTS.
AENDERN? NEIN JA	MODIFY? NO YES

If you reply the item "Get factory settings" with "YES", there is not sub-menu to adjust the values, but all parameters (except flushing time) are set to the general initialisation settings.



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 user settings have been changed or factory settings have been retrieved, you must restart the control software to accept the changes by switching the system off and on again.

11 Maintenance

Always observe the →General safety notes

11.1 Monthly inspections

- Check the pressure difference between pressure gauge (→Fig. 3/8.1) and pressure gauge (→Fig. 3/8.2). The pressure difference shall not exceed 0.3 bar.



Note

Pressing the buttons (+) and (-) simultaneously for at least 2 seconds starts an oil simulation. After releasing the buttons, the flushing process starts.

If this does not bring the desired effect, change the coalescer.

- Check the pressure difference between pressure gauge (→Fig. 3/54.1) and the downstream pressure gauge (→Fig. 3/54.2). The pressure difference shall not exceed 3.0 bar. If exceeded, exchange the adsorber elements.
- Check the stuffing box packing of the pump. Slight leakage (one to two drops per minute) is desired. Intensive leakage, re-tighten the nuts of the stuffing box packing slightly (see operating and maintenance instructions for the eccentric spiral pump, item 2.3). If this does not yield the desired effect, exchange the stuffing box packing (see operating and maintenance instructions for the eccentric spiral pump, item 3).
- On the suction side of the pump, check the negative pressure indicated on the pressure gauge (→Fig. 3/8.2). As a minimum value, the real suction height between bilge level and oil separator must be reached as negative pressure in meter water column. If this value is not achieved, check stator and rotor. If necessary, replace worn components. (see operating and maintenance instructions for the eccentric spiral pump, item 3).

11.2 Semi-annual inspections

- Check the zinc anode. Replace if necessary.
- Check of oil level in pump gear motor. If necessary, fill up oil (see operating and maintenance instructions for the gear motor).

11.3 Annual inspections

- Check of inner lining. Repair damaged spots.
- Check seals and piston valves, replace damaged seals and components.
- Check and clean the sensor electrode (→Fig. 1/9), replace if necessary.
- Check the function of the heating (→Fig. 1/10), replace if necessary.

11.4 Changing the coalescer

11.4.1 Disassembly

- 1) Switch off the voltage of the oil separator.
- 2) Shut all pipelines to and from the oil separator.
- 3) Drain the oil separator. Remove drain cap or open drain valve.
- 4) Undo cable connection of sensor electrode (→Fig. 1/9).
- 5) Undo cable connection of heating (→Fig. 1/10).
- 6) Disconnect flange or sleeve connection between lid and valves (→Fig. 5/4 + 5). The valves should remain screwed to the ship's pipeline.
- 7) Unscrew the sensor electrode.
- 8) Unscrew the electric heater, if present.
- 9) Remove screws from oil separator lid.
- 10) Remove oil separator lid and lid seal. For oil separators with a power of 2.5 m³/h or more, use lifting equipment.

- 11) Remove circlip from the pipe in the centre of the oil separator.
- 12) Pull off the upper coalescer cross from the pipe.
- 13) Pull out the winding end of the coalescer mesh with pliers. Pull out the coalescer package layer by layer out of the oil separator.
- 14) Remove the lower coalescer cross from the oil separator.
- 15) Clean the inside of the oil separator container.

11.4.2 Assembly

- 1) Insert lower coalescer cross.
- 2) Thread the coalescer package with even pressure into the oil separator; in this process the coalescer package presses to the inner sides of the oil separator.



NOTE

**Caution: Make sure there are no overlaps in the coalescer package in this step.
Make sure that the coalescer package does not form angles during assembly.**

- 3) By alternating pressure from above (stepping on it) the lower edge of the coalescer package on the level of the inlet pipe will lower.
- 4) Put your hand into the open centre hole of the coalescer package and pull the lower inner package edge over the edge of the centre pipe.
- 5) By alternating pressure from above (stepping on it) the coalescer package will lower onto the lower coalescer cross.
- 6) Insert upper coalescer cross.
- 7) Push the circlip into the groove of the diffusion pipe.
- 8) Put on new lid seal.
- 9) Put on oil separator lid, insert screws and tighten by hand
- 10) Connect valves with pipelines and tighten screws or screw connections.
- 11) In the first two turns, tighten the screws of the oil separator lid by half a turn each. In all other turns, re-tighten by two and later by one hexagon only, until the distance between lid and oil separator flange is reduced by about half.
- 12) Screw in the sensor electrode
- 13) Screw in the heater.
- 14) Plug on sensor electrode connection socket and screw tight.
- 15) Insert cable in heater and connect.
- 16) Attach loose cables at lid of oil separator by cable straps.

11.4.3 Commissioning the oil separator

→7 Commissioning

11.5 Replacing the adsorber cartridges

11.5.1 Open adsorber housing.

- 1) Switch off oil separator
- 2) Open venting valve (→Fig. 1/59) on the adsorber lid and dismount venting line.
- 3) Open drain valve (→Fig. 5/27A) and drain container.
- 4) Remove all lid screws and take off lid.

11.5.2 Take out the adsorber cartridges

- 1) Dismount the wing nuts (→15.1/106) of the cover plate (→15.1/105).
- 2) Lift out cover plate.
- 3) Turn each adsorber cartridge (→15.1/101+103) separately on their caps and pull up until they lift from the lower tappet (→15.1/108). Lift out adsorber cartridge. Then unscrew the cartridge stuff (→15.1/104) out of the adsorber cartridge for reuse.
- 4) For a the second adsorber cartridge level, repeat step 3.

- 5) Screw the cartridge connection nipples (→15.1/102) out of the cartridges for reuse.



Wet cartridges are very fragile!
Handle with care when re-using.

11.5.3 Inserting new adsorber cartridges

- 1) If there are any deposits on the base, clean and flush.
- 2) Screw new cartridges separately at the their caps onto the tappets of the base nipples.



The cartridges are very fragile!
Very careful handling is recommended.
Wetting the seal tappet facilitates inserting the cartridges.

- 3) Then screw the plug connection nipple into the cartridges.
- 4) If present, screw the cartridges of the second level also separately onto the tappets of the connection nipples.
- 5) Then screw all head plugs again into the cartridge openings.
- 6) Set the cover plate onto the cartridges.
- 7) Make sure that the threads of 2 threaded rods slide into the provided drilled holes in the cover plate.
- 8) Screw wing nuts onto both rods.
- 9) Then thread the remaining cartridges stuffs and the remaining threaded rod
- 10) Screw wing nut onto third threaded rod.
- 11) Tighten all three fastening nuts hand-tight.






11.5.4 Close adsorber housing.

- 1) Place new lid seal (→15.1/109) onto the flange and align in the groove.
- 2) Set the lid onto the container, insert all lid screws and tighten hand-tight.
- 3) Tighten all screws with a spanner by one turn.
- 4) Repeat this process with a half to a full turn.
- 5) Check all screws for even, tight connection.
- 6) Close drain valve (→Fig. 5/27A).
- 7) Mount venting line.
- 8) Start the system and wait until water flows out of the venting line.
- 9) Close venting valve (→Fig. 1/59) of the adsorber lid.
- 10) Check the lid for tightness.
- 11) If there are leaks, check the seat of the lid seal on the groove. If that is not enough - tighten screws again until the lid is tight.

12 Troubleshooting

Always observe the → General safety notes

12.1 Warning notes

 DANGER	Voltage > 42 V Direct contact with live parts may cause serious injury or death. Before working at electric equipment, interrupt the power supply (turn off main switch, remove fuses or switch them off).
 WARNING	Lines under pressure bear a risk of injury. Before taking up the work, check compressed air lines and make sure that they are not under pressure.
 WARNING	The oil separator operates with an eccentric spiral pump. Do not put your hands to the rotating shaft in the area of the transmission bell housing / stuffing box packing! Danger of severe finger injury.
 WARNING	The valves (→ Fig. 5/4, 5, 15) up to rated width R 1“ are closed by means of a pre-tensioned spring. On dismantling the valve drive, the spring can eject forcefully and cause injuries.
 CAUTION	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.

12.2 Table of faults

Fault	Reason	Measure
Permanent repetition of the flushing process in short intervals	The system draws air from the empty bilge No switchoff by level switch in bilge	Switch off the system! Check the level switch
Permanent repetition of the flushing process and pressure vacuum gauge shows insufficient suction height as compared to installation level.	The system draws air due to leaks in the course of the suction line or possibly at the oil separator (cover, flanges, valves)	Lift off system and suction line, remove leakage.
Low delivery power at high vacuum display	The suction line or the rough filter at the inlet are jammed	Clean suction line and/or rough filter
	Valve closed in suction direction	Open valves

Fault	Reason	Measure
Insufficient pump capacity, several metres pressure difference between the vacuum meters at the pump and on the oil separator cover	Coalescer packing is jammed	Flush manually extensively by pressing the button "Test". If that does not prove to be successful, remove and replace coalescer
Motor protection switch triggers	Motor burnt	Replace motor
	Short circuit in supply line or motor	Check motor and supply line
	Protection switch set too low	Adjust motor protection relay according to the motor value
	Rotor of the pump blocked	Determine cause, remove stator, replace stator and rotor if necessary
	Pump shaft blocked	Loosen stuffing box
Piston valves do not operate	Control air failure	Check compressed air supply
	No control voltage present	Check automatic system
	Piston ring defective	Replace upper part
	Contamination in the solenoid valve	Remove contamination
	Solenoid valve defective	Check solenoid valve by switching the main switch on and off (you can feel and hear the function)
	Piston is jammed	Make piston movable
System flushes permanently or uncommonly long	Non-return valve at bilge water inlet does not close	Check, remove and clean if necessary
	Oil outlet blocked	Check, clean if necessary
	Flushing water pressure insufficient	Check flushing water pressure. Flushing water flow pressure min 1 to max 1.5 bar
System detects oil but discharges water	Cable connection control box / electrode interrupted	Check cable connection, replace if necessary
	Electrode clotted	Clean contact surfaces of the electrode rods

Fault	Reason	Measure
	PCB defective	Bridge terminals X2-1 and X2-3 unless water is detected (LED gn-water illuminates green when PCB ok) Replace PCB
System detects oil but does not discharge	Outlet "oil to collector tank" blocked	Check pipeline to collector tank, clean if necessary
	Flushing water supply interrupted	Ensure water supply
		Check piston valve (→Fig. 5/15)
	Piston valve (→Fig. 5/4 or 15) does not operate	Check connection voltage in automatic control box, between terminal X1-9/10 and X1-11/12, 24 V DC must be applied. If not, replace PCB
System does not flush	Flushing water outlet (→Fig. 5/5) to the bilge blocked	Clear pipeline
	Piston valves (→Fig. 5/5 or 15) do not operate	Check connection voltage in automatic control box, between terminal X1-11/12 and X1-13/14, 24 V DC must be applied. If not, replace PCB
System detects no oil	Electric connection between sensor electrode and PCB defective	Check the electric connection
	PCB defective	Check PCB by pulling the plug from the electrode (→Fig. 1/9); if no oil detection occurs, replace PCB
	Electric conductivity in the oil phase too high, possible emulsion formation	Avoid emulsion formation. Contact RWO service (→1.5 Contact information)
	Oil binds water	Contact RWO service (→1.5 Contact information)

Fault	Reason	Measure
No heater power	Heater body defective	Replace heater body
	Cable connection interrupted	Check cable connection, replace if necessary
	Thermo sensor out of tune or defective	Set thermo sensor to 45°C or replace it
	Heater contactor defective	Replace contactor
No control voltage present	Transformer fuse defective, unless 24 V AC are applied between terminals X1-7/8	Replace fuse; if defect reoccurs, determine cause
	Cable connection interrupted	Replace cable connection
	PCB defective	Check PCB; with "RED-OIL-DISCHARGE", 24 V DC must be applied between terminals X2-9/10 and X2-13/14

Tab. 17 Table of faults

13 Removal, disassembly and disposal of the system



DANGER

Voltage > 42 Volts.

Direct contact with live parts may cause serious injury or death.

Before working on the electric system, interrupt the voltage supply, set the main switch to „0“ and remove or switch off fuses.

Work at live lines must only be done by personnel specifically qualified for electric works!



CAUTION

Risk of injuries when working at lines under pressure.

Before taking up the work, check water and compressed air lines and make sure that they are not under pressure.



NOTE

Damage to the environment in case of incorrect disposal

The system / unit contains no toxic or potentially harmful substances acc. to the IMO Resolution MEPC.269(68) dated 15.05.2015 tables A and B.

13.1 Before disassembly

- Switch off energy supply and secure against restart, separate cables physically and discharge residual energy.
- Shut off compressed air supply, separate lines physically.
- Fence off all pipings from and to the system / unit, separate pipings physically, collect escaping liquids in suitable containers and dispose of them properly.
- Remove operating and auxiliary materials.
- Clean interior of container thoroughly, collect escaping liquids in suitable containers and dispose of them properly.

13.2 For disposal

Legal regulations for e. g. avoiding and separating waste have to be taken into consideration during all works carried out at the plant / unit.

Electric waste and electronic components must only be disposed of by approved specialised companies.

Recycle plastic components

Scrap metal components

Dispose of other components sorted by material, especially water-polluting substances such as:

- lubricants and oils
- hydraulic oil
- coolants
- acids and lyes
- cleaning agents

are not to be discharged into the soil or the drain! These substances must be collected in suitable tanks, transported and disposed of according to valid regional regulations!

**Note**

The liquidation process for the system / unit mentioned above must be carried out according to the rules and regulations of the technical regulation TR 620 about safety of sea transport items and the federal law No. 89 of the Russian Federation. Regional rules and regulations must be observed.

14 Spare parts

The individual spare parts are listed in groups in the following tables. All spare parts lists below match the standard scope of delivery of the bilge water oil separator by RWO GmbH.



Note

Upon ordering, please provide us with the device number (see cover sheet), the IMO number of the vessel as well as data regarding any special version of the system.

The provided drawings contain the position numbers.



Note

All spare parts listed here are optional / not part of the standard scope of delivery.

Contact the spare parts department: (→1.5 Contact information)

14.1 Spare parts for OWS-COM 0.1

Pos.	Designation	Item number
Consumables		
34	coalescer complete 0.1	3600010122
30	cover gasket 1. stage	8320010002
101, 103	set polisher 0.1	2840001001
109	cover gasket polisher housing	8322001002
Valves and accessories		
4, 5, 15	2/2 way piston valve 1/2"	5936001501
4.5, 5.5, 15.5	gasket set for 2/2 way valves OWS-COM 0.1	2823001001
23, 58	3/2 way piston valve 3/4"	5938002001
23.5, 58.5	gasket set 3/2 way valve 3/4"	5938302001
57	solenoid valve 24V AC	5940033056
4.3, 5.3, 15.3, 58.3	solenoid valve 24V AC	5940311015
23.3	solenoid valve 24V AC	5940311016
8	pressure gauge -1/+5 bar	5920008095
54	pressure gauge 0/6 bar	5920008092
7	pressure gauge 0/10 bar	5920008094
12	safety valve 1 bar, 1/2"	5903015012
43	safety valve 3 bar, 1/2"	5903015013
41	anode 3/4"	6453020001
1	non return flap DN 15	5909015001
60, 76	non return valve 1/4"	5922010001
27	2/2 way ball valve 1"	5906030251
27A, 59	2/2 way ball valve 1/4"	5906030081
42	2/2 way ball valve 1/2"	5906040111
55	3/2 way ball valve 3/4"	5906040201
Pump and accessories		
14	pump AEP 1	Specify voltage and frequency
207 (AEP)	gland packing AEP 1	5460207EP1
402 (AEP)	stator AEP 1	5460402EP1
125 (AEP)	package-no.1 - shaft - AEP 1	5500125EP1
307 (AEP)	package-no.2 - coupling rod - AEP 1	5500307EP1
401 (AEP)	package-no.3 - rotor - AEP 1	5500401EP1
203 (AEP)	package-no.4 - gland packing - AEP 1	5500203EP1
Monitor OMD 24		
9 (OMD)	desiccator cartridge OMD 24	51110EM027
--	cell brush OMD 24	51110EM006
--	service kit OMD 24	51110EM028
17.1	computer unit OMD 24	51110EM014
17.2	measuring cell OMD 24	51110EM003
Control systems		
9	sensor electrode	5120302001
A1	CPU main board	5120101050
A1.1	display pcb	5120101055
K1, K2	contactor	5131005013
F1	Motor controller	Specify voltage and frequency
F2, F5	set fuses	2810101003
T1	transformer	5130602001

Tab. 18 Spare parts OWS COM 0,1

14.2 Spare parts for OWS-COM 0.25

Pos.	Designation	Item number
Consumables		
34	coalescer complete 0.25	3600025122
30	cover gasket 1. stage	8320025002
101, 103	set polishers 0,25	2840002501
109	gasket 2. stage	8322005002
106	wing nut	8118008002
104	cover fitting	5911600002
108	bottom fitting	5911600003
Valves and accessories		
4, 5, 15	2/2 way piston valve 1/2"	5936001501
4.5, 5.5, 15.5	gasket set for 2/2 way valves OWS-COM 0.25	2823002501
23, 58	3/2 way piston valve 3/4"	5938002001
23.5, 58.5	gasket set 3/2 way valve 3/4"	5938302001
57	solenoid valve 24V AC	5940033056
4.3, 5.3, 15.3, 58.3	solenoid valve 24V AC	5940311015
23.3	solenoid valve 24V AC	5940311016
8	pressure gauge -1/+5 bar	5920008095
54	pressure gauge 0/6 bar	5920008092
7	pressure gauge 0/10 bar	5920008094
12	safety valve 1 bar, 1/2"	5903015012
43	safety valve 3 bar, 1/2"	5903015013
41	anode 3/4"	6453020001
1	non return flap DN 15	5909015001
60	non return flap DN 20	5909020002
76	non return valve 1/4"	5922010001
27	2/2 way ball valve 1"	5906030251
59	2/2 way ball valve 1/4"	5906030081
27A	2/2 way ball valve 1/2"	5906030151
42	2/2 way ball valve 1/2"	5906040111
55	3/2 way ball valve 3/4"	5906040201
Pump and accessories		
14	pump AEP 1	Specify voltage and frequency
207 (AEP)	gland packing AEP 1	5460207EP1
402 (AEP)	stator AEP 1	5460402EP1
125 (AEP)	package-no.1 - shaft - AEP 1	5500125EP1
307 (AEP)	package-no.2 - coupling rod - AEP 1	5500307EP1
401 (AEP)	package-no.3 - rotor - AEP 1	5500401EP1
203 (AEP)	package-no.4 - gland packing - AEP 1	5500203EP1
Monitor OMD 24		
9 (OMD)	desiccator cartridge OMD24	51110EM027
--	cell brush OMD24	51110EM006
--	service kit OMD24	51110EM028
17.1	computer unit OMD-24	51110EM014
17.2	measuring cell OMD-24	51110EM003
Control systems		
9	sensor electrode	5120302001
10	heating element	Specify voltage and frequency
A1	CPU main board	5120101050
A1.1	display pcb	5120101055
K1, K2	contactor	5131005013
F1	Motor controller	Specify voltage and frequency
F2, F5	set fuses	2810101003
T1	transformer	5130602001

Tab. 19 Spare parts OWS COM 0.25

14.3 Spare parts for OWS-COM 0.5

Pos.	Designation	Item number
Consumables		
34	coalescer complete 0.5	3600050122
30	cover gasket 1. stage	8320050002
101, 103	set polisher 0.5	2840005001
109	gasket polisher housing	8322005002
106	wing nut	8118008002
104	cover fitting	5911600002
108	bottom fitting	5911600003
Valves and accessories		
5, 15	2/2 way piston valve 1/2"	5936001501
4	2/2 way piston valve 3/4"	5936002001
4.5, 5.5, 15.5	gasket set for 2/2 way valve OWS-COM 0.5	2823005001
23, 58	3/2 way piston valve 3/4"	5938002001
23.5, 58.5	gasket set for 3/2 way valve 3/4"	5938302001
57	solenoid valve 24V AC	5940033056
4.3, 5.3, 15.3, 58.3	solenoid valve 24V AC	5940311015
23.3	solenoid valve 24V AC	5940311016
8	pressure gauge -1/+5 bar	5920008095
54	pressure gauge 0/6 bar	5920008092
7	pressure gauge 0/10 bar	5920008094
12	safety valve 1 bar, 1/2"	5903015012
43	safety valve 3 bar, 1/2"	5903015013
41	anode 3/4"	6453020001
1	non return flap DN25	5909025002
60	non return flap DN20	5909020002
76	non return valve 1/4"	5922010001
27	2/2 way ball valve 1"	5906030251
59	2/2 way ball valve 1/4"	5906030081
27A	2/2 way ball valve 1/2"	5906030151
42	2/2 way ball valve 1/2"	5906040111
55	3/2 way ball valve 3/4"	5906040201
Pump and accessories		
14	pump AEP 2	Specify voltage and frequency
207 (AEP)	gland packing AEP 2	5460207EP1
402 (AEP)	stator AEP 2	5460402EP2
125 (AEP)	package-no.1 - shaft - AEP 2	5500125EP1
307 (AEP)	package-no.2 - coupling rod - AEP 2	5500307EP1
401 (AEP)	package-no.3 - rotor - AEP 2	5500401EP2
203 (AEP)	package-no.4 - gland packing - AEP 2	5500203EP1
Monitor OMD 24		
9 (OMD)	desiccator cartridge OMD24	51110EM027
--	cell brush OMD24	51110EM006
--	service kit OMD24	51110EM028
17.1	computer unit OMD-24	51110EM014
17.2	measuring cell OMD-24	51110EM003
Control systems		
9	sensor electrode	5120302002
10	heating element	Specify voltage and frequency
A1	CPU main board	5120101050
A1.1	display pcb	5120101055
K1, K2	contactor	5131005013
F1	Motor controller	Specify voltage and frequency
F2, F5	set fuses	2810101003
T1	transformer	5130602001

Tab. 20 Spare parts OWS COM 0.5

14.4 Spare parts for OWS-COM 1.0

Pos.	Designation	Item number
Consumables		
34	coalescer complete 1.0	3600100122
30	cover gasket 1. stage	8320100002
101, 103	set polisher 1.0	2840010001
109	gasket 2. stage	8322010002
106	wing nut	8118008002
104	cover fitting	5911600002
108	bottom fitting	5911600003
Valves and accessories		
5, 15	2/2 way piston valve 1/2"	5936001501
4	2/2 way piston valve 3/4"	5936002001
4.5, 5.5, 15.5	gasket set for 2/2 way valve OWS-COM 1.0	2823010001
23, 58	3/2 way piston valve 3/4"	5938002501
23.5, 58.5	gasket set for 3/2 way valve 3/4"	5938302501
57	solenoid valve 24V AC	5940033056
4.3, 5.3, 15.3, 58.3	solenoid valve 24V AC	5940311015
23.3	solenoid valve 24V AC	5940311016
8	pressure gauge -1/+5 bar	5920008095
54	pressure gauge 0/6 bar	5920008092
7	pressure gauge 0/10 bar	5920008094
12	safety valve 1 bar, 1/2"	5903015012
43	safety valve 3 bar, 1/2"	5903015013
41	anode 3/4"	6453020001
1, 60	non return valve DN25	5909025002
76	non return valve 1/4"	5922010001
27	2/2 way ball valve 1"	5906030251
27A	2/2 way ball valve 1/2"	5906030151
59	2/2 way ball valve 1/4"	5906030081
42	2/2 way ball valve 1/2"	5906040111
55	3/2 way ball valve 1"	5906040251
Pump and accessories		
14	pump AEP 2	Specify voltage and frequency
207 (AEP)	gland packing AEP 2	5460207EP1
402 (AEP)	stator AEP 2	5460402EP2
125 (AEP)	package-no.1 - shaft - AEP 2	5500125EP1
307 (AEP)	package-no.2 - coupling rod - AEP 2	5500307EP1
401 (AEP)	package-no.3 - rotor - AEP 2	5500401EP2
203 (AEP)	package-no.4 - gland packing - AEP 2	5500203EP1
Monitor OMD 24		
9 (OMD)	desiccator cartridge OMD24	51110EM027
--	cell brush OMD24	51110EM006
--	service kit OMD24	51110EM028
17.1	computer unit OMD-24	51110EM014
17.2	measuring cell OMD-24	51110EM003
Control systems		
9	sensor electrode	5120302002
10	heating element	Specify voltage and frequency
A1	CPU main board	5120101050
A1.1	display pcb	5120101055
K1, K2	contactor	5131005013
F1	Motor controller	Specify voltage and frequency
F2, F5	set fuses	2810101003
T1	transformer	5130602001

Tab. 21 Spare parts OWS COM 1.0

14.5 Spare parts for OWS-COM 2.5

Pos.	Designation	Item number
Consumables		
34	coalescer complete 2.5	3600250122
30	cover gasket 1. stage	8320250002
101, 103	set polisher 2.5	2840025001
109	cover gasket 2. stage	8322025002
106	wing nut	8118008002
104	cover fitting	5911600002
108	bottom fitting	5911600003
Valves and accessories		
4	2/2 way piston valve 1"	5936002501
5	2/2 way piston valve 3/4"	5936002001
15	2/2 way piston valve 1/2"	5936001501
4.5, 5.5, 15.5	gasket set for 2/2 way valves OWS-COM 2.5	2823025001
23, 58	3/2 way piston valve DN32	5925113202
23.5, 58.5	gasket set for 3/2 way valves DN32	5925S13202
57	solenoid valve 24V AC	5940033056
4.3, 5.3, 15.3, 58.3	solenoid valve 24V AC	5940311015
23.3	solenoid valve 24V AC	5940311016
8	pressure gauge -1/+5 bar	5920008095
54	pressure gauge 0/6 bar	5920008092
7	pressure gauge 0/10 bar	5920008094
12	safety valve 1 bar, 1/2"	5903015012
43	safety valve 3 bar, 1/2"	5903015013
41	anode 3/4"	6453020001
1, 60	non return flap DN32	5909032002
76	non return valve 1/4"	5922010001
27	2/2 way ball valve 1"	5906030251
27A	2/2 way ball valve 1/2"	5906030151
59	2/2 way ball valve 1/4"	5906030081
42	2/2 way ball valve 1/2"	5906040111
55	3-way manual valve DN32	5905132001
Pump and accessories		
14	pump AEP 4-2	Specify voltage and frequency
207 (AEP)	gland packing AEP 4-2	5460207EP1
402 (AEP)	stator AEP 4-2	5460402EP4
125 (AEP)	package-no.1 - shaft - 4-2	5501125EP4
307 (AEP)	package-no.2 - coupling rod - AEP 4-2	5500307EP4
401 (AEP)	package-no.3 - rotor - AEP4-2	5500401EP4
203 (AEP)	package-no.4 - gland packing - AEP 4-2	5501203EP4
Monitor OMD 24		
9 (OMD)	desiccator cartridge OMD24	51110EM027
--	cell brush OMD24	51110EM006
--	service kit OMD24	51110EM028
17.1	computer unit OMD-24	51110EM014
17.2	measuring cell OMD-24	51110EM003
Control systems		
9	sensor electrode	5120302002
10	heating element	Specify voltage and frequency
A1	CPU main board	5120101050
A1.1	display pcb	5120101055
K1, K2	contactor	5131005013
F1	Motor controller	Specify voltage and frequency
F2, F5	set fuses	2810101003
T1	transformer	5130602001

Tab. 22 Spare parts OWS COM 2.5

14.6 Spare parts for OWS-COM 5.0

Pos.	Designation	Item number
Consumables		
34	coalescer complete 5.0	3600500122
30	cover gasket 1.stage	8320500002
101, 103	set polisher 5.0	2840050001
109	gasket 2 stage	8322025002
106	wing nut	8118008002
104	cover fitting	5911600002
108	bottom fitting	5911600003
Valves and accessories		
5, 15	2/2 way piston valve 3/4"	5936002001
4	2/2 way piston valve 1"	5936002501
4.5, 5.5, 15.5	gasket set for 2/2 way valves OWS-COM 5.0	2823050001
23, 58	3/2 way piston valve DN40	5925114002
23.5, 58.5	gasket set for 3/2 way valve DN40	5925S14002
57	solenoid valve 24V AC	5940033056
4.3, 5.3, 15.3, 55.3	solenoid valve 24V AC	5940311015
23.3	solenoid valve 24V AC	5940311016
8	pressure gauge -1/+5 bar	5920008095
54	pressure gauge 0/6 bar	5920008092
7	pressure gauge 0/10 bar	5920008094
12	safety valve 1 bar, 3/4"	5903020012
43	safety valve 3 bar, 3/4"	5903020014
41	anode 3/4"	6453020001
76	non return valve 1/4"	5922010001
60	non return flap DN40	5909040002
1	non return flap DN50	5909050001
27, 27A	2/2 way ball valve 1"	5906030251
59	2/2 way ball valve 1/4"	5906030081
42	2/2 way ball valve 1/2"	5906040111
55	3/2-way ball valve DN40	5905140001
Pump and accessories		
14	pump AEP 5-2	Specify voltage and frequency
207 (AEP)	gland packing AEP 5-2	5460207EP1
402 (AEP)	stator AEP 5-2	5460402EP5
125 (AEP)	package-no.1 - shaft - 5-2	5501125EP4
307 (AEP)	package-no.2 - coupling rod - AEP 5-2	5500307EP4
401 (AEP)	package-no.3 - rotor - AEP 5-2	5500401EP5
203 (AEP)	package-no.4 - gland packing - AEP 5-2	5501203EP4
Monitor OMD 24		
9 (OMD)	desiccator cartridge OMD24	51110EM027
--	cell brush OMD24	51110EM006
--	service kit OMD24	51110EM028
24	computer unit OMD-24	51110EM014
25	measuring cell OMD-24	51110EM003
Control systems		
9	sensor electrode	5120302002
10	heating element	Specify voltage and frequency
A1	CPU main board	5120101050
A1.1	display pcb	5120101055
K1, K2	contactor	5131005013
F1	Motor controller	Specify voltage and frequency
F2, F5	set fuses	2810101003
T1	transformer	5130602001

Tab. 23 Spare parts OWS COM 5.0

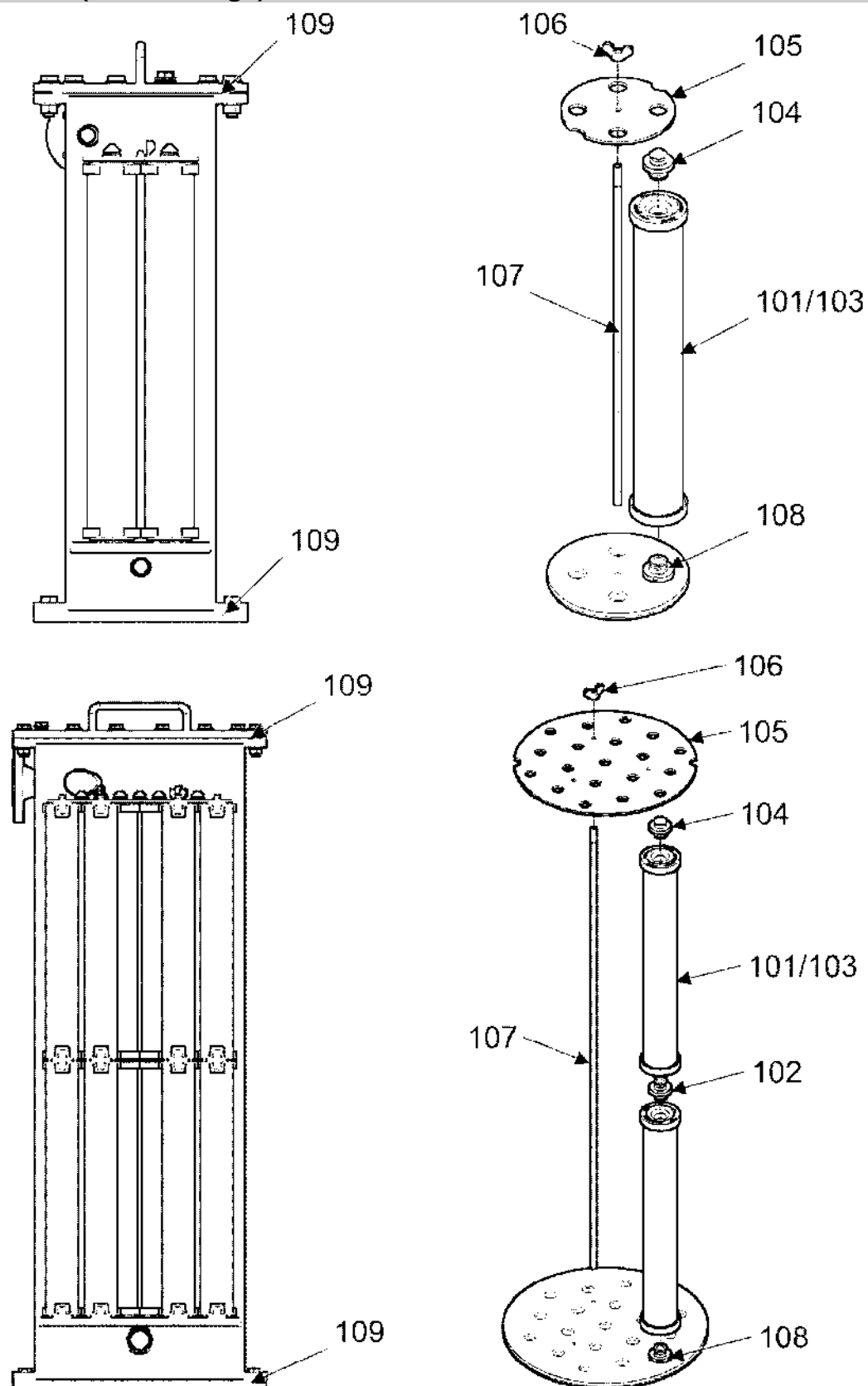
14.7 Spare parts for OWS-COM 10.0

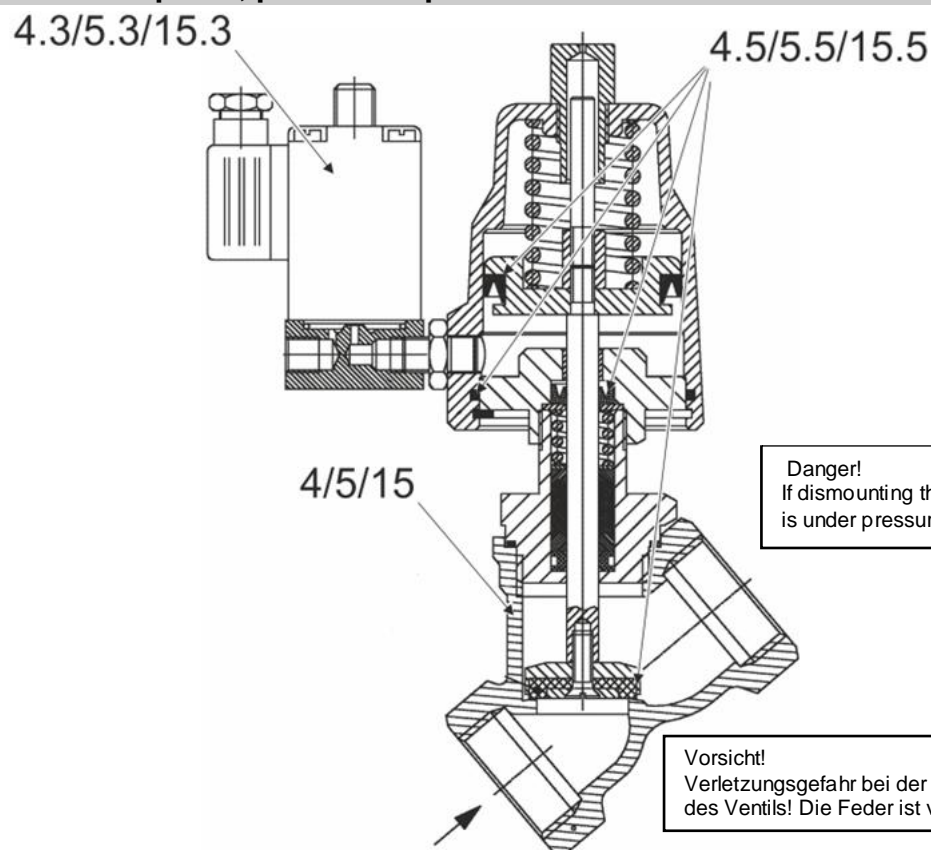
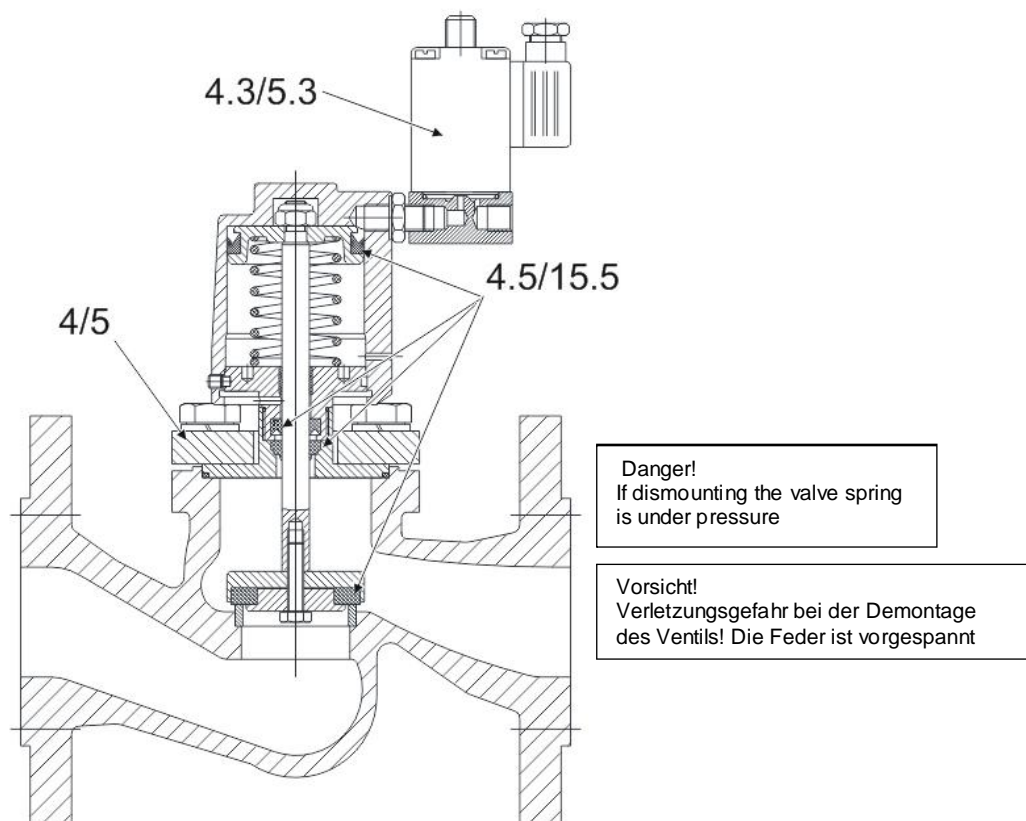
Pos.	Designation	Item number
Consumables		
34	coalescer complete 10.0	3601000122
30	cover gasket 1. stage	8321000002
101, 103	set polisher 10,0	2840100001
109	gasket 2. stage	8322025002
106	wing nut	8118008002
104	cover fitting	5911600002
108	bottom fitting	5911600003
Valves and accessories		
5	2/2 way piston valve DN32	5925203210
4	2/2 way piston valve DN40	5925204010
15	2/2-way piston valve 1"	5936002501
4.5, 5.5, 15.5	gasket set for 2/2 way valves OWS-COM 10.0	2823100002
23, 58	3/2 way piston valve DN50	5925115002
23.5, 58.5	gasket set 3/2 way valve DN50	5925S15002
57	solenoid valve 24VAC	5940033056
4.3, 5.3, 15.3, 58.3	solenoid valve 24V AC	5940311015
23.3	solenoid valve 24V AC	5940311016
8	pressure gauge -1/+5 bar	5920008095
54	pressure gauge 0/6 bar	5920008092
7	pressure gauge 0/10 bar	5920008094
12	safety valve 1 bar, 1"	5903025013
43	safety valve 3 bar, 1 1/4"	5903032004
41	anode 3/4"	6453020001
60	non return flap DN40	5909040002
1	non return flap DN65	5909065001
76	non return valve 1/4"	5922010001
27	2/2 way ball valve 1 1/2"	5906030401
27A	2/2 way ball valve 1"	5906030251
59	2/2 way ball valve 1/4"	5906030081
42	2/2 way ball valve 1/2"	5906040111
55	3/2 way ball valve DN 50	5905150001
Pump and accessories		
14	pump AEP 6-2	Specify voltage and frequency
207 (AEP)	gland packing AEP 6-2	5461207EP6
402 (AEP)	stator AEP 6-2	5460402EP6
125 (AEP)	package-no.1 - shaft - AEP 6-2	5501125EP6
307 (AEP)	package-no.2 - coupling rod - AEP 6-2	5501307EP6
401 (AEP)	package-no.3 - rotor - AEP 6-2	5500401EP6
203 (AEP)	package-no.4 - gland packing - AEP 6-2	5501203EP6
Monitor OMD 24		
9 (OMD)	desiccator cartridge OMD24	51110EM027
--	cell brush OMD24	51110EM006
--	service kit OMD24	51110EM028
17.1	computer unit OMD-24	51110EM014
17.2	measuring cell OMD-24	51110EM003
Control systems		
9	sensor electrode	5120302002
10	heating element	Specify voltage and frequency
A1	CPU main board	5120101050
A1.1	display pcb	5120101055
K1, K2	contactor	5131005013
F1	Motor controller	Specify voltage and frequency
F2, F5	set fuses	2810101003
T1	transformer	5130602001

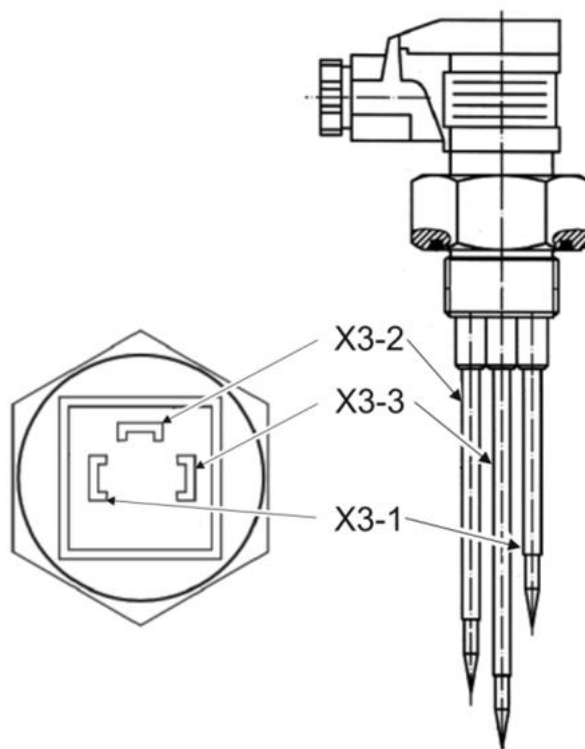
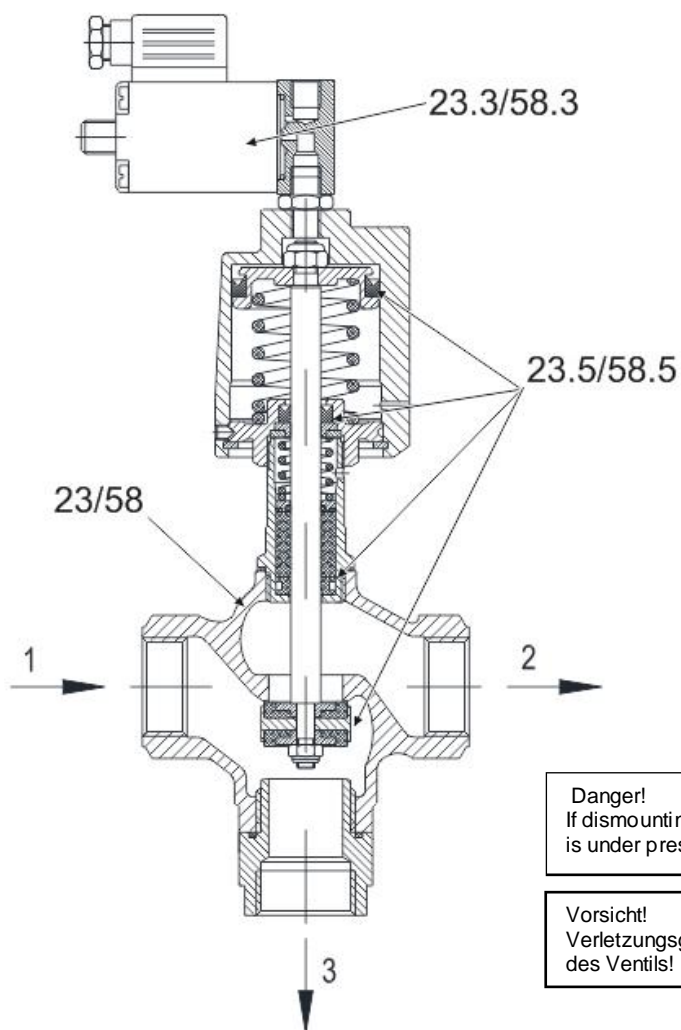
Tab. 24 Spare parts OWS COM 10.0

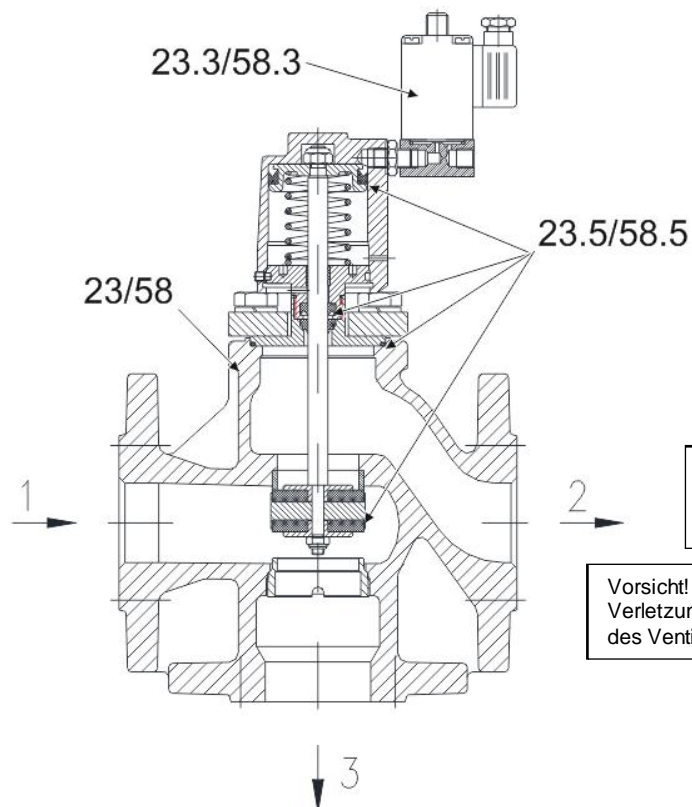
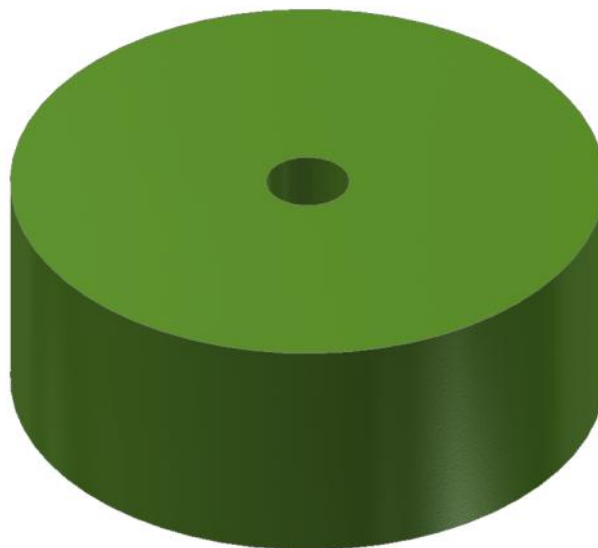
15 Drawings

15.1 Adsorber (second stage)



15.2 Piston valve pos.4, pos. 5 and pos. 15 OWS-COM 0.1 - 5.0m³/h**15.3 Piston valve pos.4 / pos. 5 OWS-COM 10.0 m³/h**

15.4 Sensor electrode pos. 9**15.5 3/2-way piston valve pos. 23 and pos.58 at the OWS-COM 0.1 - 1.0 m³/h**

15.6 3/2-way piston valve pos. 23 and pos.58 at the OWS-COM 2.5 - 10.0 m³/h**15.7 Coalescer pos. 34 OWS-COM 0.1 m³/h – 10.0 m³/h**

16 Annex**16.1 Checklist for commissioning**

The middle column is provided for a checkmark "OK".

Start procedure	OK	Remarks
Open valve(s) in the compressed air supply.		Pressure 6-8 bar.
Open valve(s) in the flushing water supply.		Pressure max. 1.5 bar.
Open valve(s) in the suction line		The suction line must be air-tight because the oil separator operates with a vacuum.
Open valve(s) in the outboard line.		The pump must not be operated upstream of closed fittings.
Check rotational direction of the pump		The rotational direction of the pump is "CLOCKWISE" when viewed from the motor. Incorrect rotational direction bears danger of the pump running dry!
Open the tap of the adsorber housing cover		until the adsorber is filled with water
Cut off the rubber nipples of the caps on all pressure gauge housings.		For pressure compensation
Check if cooling air can escape through the venting grid of the fan cap of the motor without hindrance		This ensures proper motor cooling
Select either "manual mode" or "automatic mode"		In "manual mode" no automatic switch-off occurs when the bilge is empty
Switch the system's main switch to "On"		
a) The bilge level LED only illuminates in green when the level in the bilge is high enough		Prerequisite for system start in "automatic mode",
b) The control light "RED-OILDISCHARGE" lights up in red (oil to the collector tank), because the sensor electrode indicates air and oil (both non-conductive media). The pneumatic piston valves at the flushing water inlet (→Fig. 5/15) and oil outlet (→Fig. 5/4) are open (voltage is applied to both solenoid valves) and the system is automatically filled with flushing water and at the same time vented through the oil outlet. The pump remains switched off in this process		The system is filled with water Pump and heater are switched off during that time. Display in automatic mode: BETRIEB AUTO DISCHARGE Display in manual mode: BETRIEB HAND DISCHARGE
c) As soon as the water level reaches the sensor electrode (→Fig. 1/9) (conductive medium detected), the control light switches over to "ORANGE-FLUSHING" (backflash). The pneumatic piston valve (→Fig. 5/15) opens (voltage applied at solenoid valve) and with a time delay the oil outlet valve (→Fig. 5/4) closes (no voltage applied to solenoid valve).		The backflush starts (8 to 50 seconds) Pump and electric heater are now switched off. Display in automatic mode: BETRIEB AUTO FLUSHING Display in manual mode: BETRIEB HAND FLUSHING
d) As soon as the system is filled, the piston		The 1st stage is now operational.

Start procedure	OK	Remarks
valves (→Fig. 5/5+15) close (no voltage applied to either solenoid valve). The control light "GREEN WATERDISCHARGE" lights up in green at the automatic control box (water outboards). Now the pump starts up and draws from the bilge.		The pump starts and the heater is switched on. Prerequisite: The heater switch is set to "On". Display in automatic mode: BETRIEB AUTO ENTOELN Display in manual mode: BETRIEB HAND ENTOELN
The bypass valve (→Fig. 5/58) guides the water to the second stage (adsorber)		The solenoid valve is currentless
The measurement valve (→Fig. 1/57) guides the water from the sample point downstream of the second stage to the monitor		The solenoid valve is currentless
Alarm monitor OMD alarm 1 is red "On"		The measuring cell contains air
Alarm monitor OMD alarm 2 is red "On"		The measuring cell contains air
Alarm monitor OMD system is red		The monitor reacts to air with an alarm
The recirculation valve (→Fig. 5/23) guides the water back to the bilge		The solenoid valve is currentless
The second stage (adsorber) is filled		
Close the ventilation tap of the adsorber housing cover		
During the first 5 minutes: The bypass valve (→Fig. 5/58) guides the water through the second stage (adsorber)		The solenoid valve is currentless
The measurement valve (→Fig. 1/57) guides the water from the sample point downstream of the second stage to the monitor		The solenoid valve is currentless
Alarm monitor OMD alarm 1 is green "Off"		The measuring cell contains clean water
Alarm monitor OMD alarm 2 is green "Off"		The measuring cell contains clean water
Alarm monitor OMD system is green		The monitor signals "no alarm"
The recirculation valve (→Fig. 5/23) guides the cleaned water outboards.		The solenoid valve is under voltage
After the first 5 minutes:		
a) if the measurement result at sample point "upstream of adsorber" does not exceed 14ppm (4ppm)		
The bypass valve (→Fig. 5/58) guides the water bypassing the second stage (adsorber)		The solenoid valve is under voltage
The measurement valve (→Fig. 1/57) guides the water from the sample point upstream of the second stage to the monitor		The solenoid valve is under voltage
Alarm monitor OMD alarm 1 is green "Off"		The measuring cell contains clear water
Alarm monitor OMD alarm 2 is green "Off"		The measuring cell contains clear water
Alarm monitor OMD system is green		The monitor signals "no alarm"
The recirculation valve (→Fig. 5/23) guides		The solenoid valve is under voltage

Start procedure	OK	Remarks
the cleaned water outboards.		
b) if the measurement result at sample point "upstream of adsorber" exceeds 14ppm (4ppm)		
Alarm monitor OMD alarm 1 is red "On"		The measuring cell contains water with more than 14ppm (4ppm)
The measuring valve (→Fig. 1/57) is switched. It now guides the water from the sample point downstream of the second stage to the monitor		The solenoid valve is currentless
The bypass valve (→Fig. 5/58) is switched. Now it guides the water through the second stage (adsorber).		The solenoid valve is currentless
Alarm monitor OMD alarm 1 is green "Off"		The measuring cell contains clean water
Alarm monitor OMD alarm 2 is green "Off"		The measuring cell contains clear water
Alarm monitor OMD system is green		The monitor signals "no alarm"
The recirculation valve (→Fig. 5/23) guides the cleaned water outboards.		The solenoid valve is under voltage
b) if the measurement result at sample point "downstream of adsorber" does not exceed 15ppm (5ppm)		Alarm The adsorber elements are used up
Alarm monitor OMD alarm 1 is red "On"		The measuring cell contains water with more than 15ppm (5ppm)
Alarm monitor OMD alarm 2 is red "On"		The measuring cell contains water with more than 15ppm (5ppm)
Alarm monitor OMD system is red "Alarm"		
The measurement valve (→Fig. 1/57) still guides the water from the sample point downstream of the second stage to the monitor		No voltage applied to the solenoid valve
The bypass valve (→Fig. 5/58) still guides the water through the second stage (adsorber).		No voltage applied to the solenoid valve
The recirculation valve (→Fig. 5/23) guides the insufficiently cleaned water back to the bilge		No voltage applied to the solenoid valve

Tab. 25 Checklist

16.2 Record of the maintenance and repair works

Signature																
Name																
Maintenance work performed																
Time																
Date																