



RWO

Intelligent Water Management On-board Ships

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Total Water Management On-board Ships and Offshore Platforms

Who We Are

For more than 45 years the RWO experts develop, design, manufacture and service high-quality technologies for water treatment onboard ships and offshore installations, both for new installations or retrofitting. The product portfolio includes the treatment of drinking and process water as well as pollution prevention equipment such as oily waters, ballast, wastewater as well as a comprehensive range of after sales services. RWO is the worldwide market leader in the treatment of marine oily water separation. The main offices are located in Bremen, Germany.

Worldwide Sales & Service Network

RWO's international network of more than 40 qualified sales/service stations ensures short communication links between customer and manufacturer, making us the ideal partner for companies in the maritime sector. Contact us today to find out more about the way we work.



Key Competences

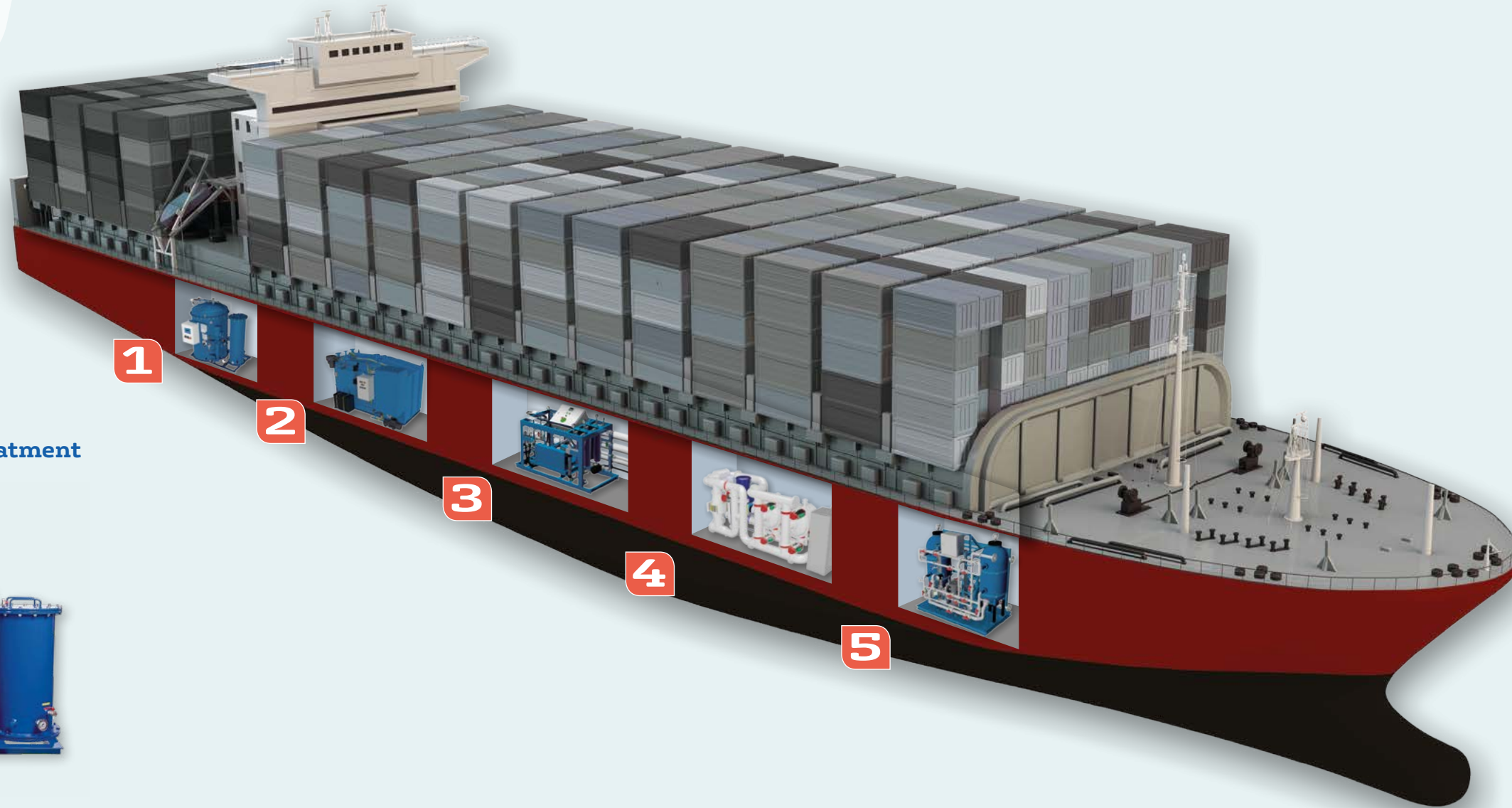
The RWO brand stands for decades of experience in the construction and service, in all field of maritime water treatment, inclusive of:

- > Oil Water Separation
- > Wastewater Treatment
- > Process & Drinking Water Treatment
- > Ballast Water Treatment

Key Benefits

- > High quality in every aspect
- > Worldwide network and support
- > Comprehensive experience in water treatment engineering
- > Get your water management solution from the market leader in OWS

Product Portfolio



1 Bilge Water Treatment



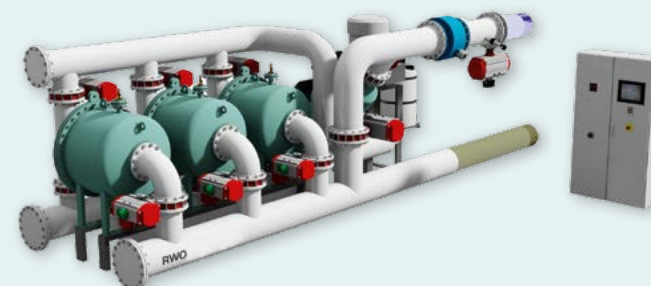
2 Sewage Treatment



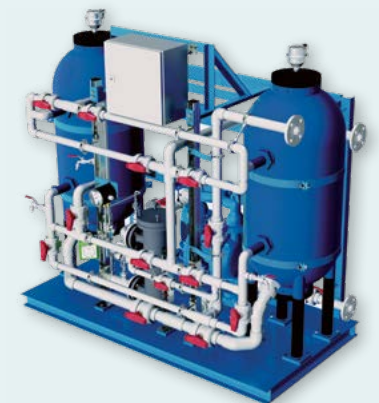
3 Desalination



4 Ballast Water Treatment



5 Process Water Treatment





RWO

Bilge Water Treatment

MARINE WATER TECHNOLOGIES

RWO's Classic: OWS-COM Oily Water Separator

RWO

Complying With Your Challenges Fulfilling the 5 ppm Standard

More than 16000 ships have already been equipped with RWO's oily water separators since RWO started its business in 1975. The OWS-COM system uses a combination of **highly effective open porous coalescer with automatic backflushing, together with a second stage emulsion breaking oil and hydrocarbon polisher.**

The periodical backflushing keeps the coalescer surface clean and offers long lasting operation according to IMO MEPC.107(49). The OWS-COM is part of RWO's leading **Total Water Management** offer.

Reliably reaches
**5 ppm
limit**
confirmed by
DNV GL and LR

- > IMO type approved
- > MED certified by German Administration
- > Approved by USCG, ABS, DNV-GL, RMRS, RRR, CCS



Oil Content Monitor

The RWO oily water separating system is equipped with a 15 ppm oil content alarm device, type tested and approved in accordance with IMO Resolution MEPC.107(49). During flushing of the sensor the overboard discharge valve is in recirculation mode.

According to IMO MEPC.107(49) an additional hand-operated 3-way valve is installed downstream of the oily water separator in the overboard line to recirculate the water to the bilge whenever required during Port State Control.



Automatic Bypass

To extend the operating life of the demulsifier, an automatic bypass is fitted to the separating system. The oil content monitor periodically checks the water quality of the first stage separator. If below the set max. value, the demulsifier is bypassed. This results in lower operational cost and long product life.

Key Features & Benefits

- > Most economical: second stage is bypassed whenever possible
- > Easy to install and maintain
- > Oil monitoring device continuously checks effluent
- > Suction type: preserves pump from attrition
- > Most compact: suitable for newbuildings and retrofits
- > Improved hydrodynamics for longer polisher lifetime

Type	Capacity m ³ /h	Length mm	Width mm	Height mm	Power kW	Empty weight kg
0.1	0.1	715	650	1100	0.8	125
0.25	0.25	960	750	1005	2.6	180
0.5	0.5	970	750	1050	3.2	195
1.0	1.0	1170	800	1220	3.2	270
2.5	2.5	1510	1060	1485	3.7	457
5.0	5.0	1825	1385	1715	4.6	757
10.0	10.0	2155	1575	2000	5.7	1195

CBM+ Bilge Water Compliance Monitoring System

RWO

Enabling Safe Discharge of Uncontaminated Water Overboard

The clean bilge monitoring system CBM+ is the monitoring system for tankers, cruise vessels and other ships with additional focus on environmental compliance. It is designed to monitor and control liquid discharges overboard your vessel in respect of its oil content. The system prevents the discharge of non-compliant oily water mixtures by automatically recirculating the liquid to the bilge water tank if the oil content is above a predetermined limit.

This compact system can be installed as a last monitoring and control device in the outlet pipe prior to the overboard discharge valve for safety purposes. Although designed with bilge water in mind other discharges like clean drains e.g. condensate from air conditioners can be monitored as well. The system independently monitors whether the maximum oil content is reached depending on the selected set-point of 5 or 15 ppm. Lower set-points can also be chosen on site.



CBM+ is a reliable system prior to discharging bilge water

The unit enables the safe discharge of uncontaminated water overboard. However, if there is oil present and it reaches a specific limit, a 3-way valve automatically returns the liquid to the bilge tank for further treatment. This way compliance with IMO MEPC.107(49), particular sensitive sea areas (PSSA) or other class or vetting regulations can be ensured.

Proof of Location by GPS Data

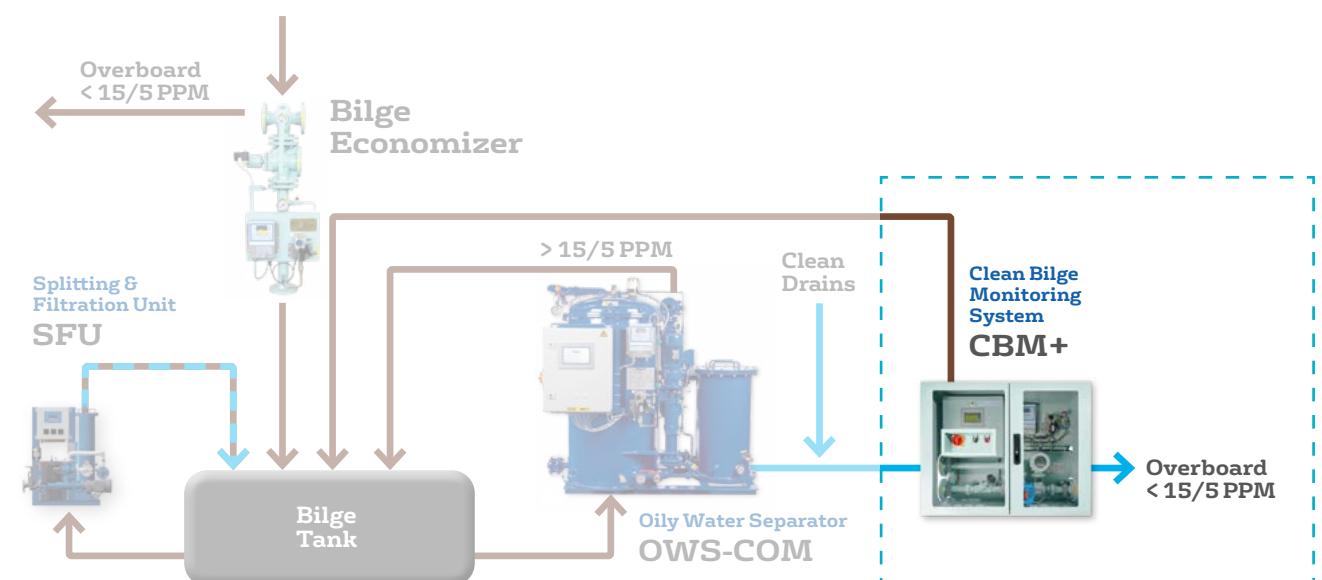
CBM+ includes an input of GPS data from the ship and multiple electrical potential free contacts that enable the connectivity to the ships' AMS system.

The system records and stores data on date, time, location, flow rate and oil content of every operation for 18 months. All relevant data is available via the system's touch screen and can be downloaded. This enables the crew to present the discharge data to port state control or other involved authorities.

Tamper Proof

The unit is designed as a standalone device, ready for plug and play and does not require any connection to an existing oily water separator. The housing of this tamper-proof designed unit is locked and any opening of the doors is recorded.

While the ship is in port or restricted areas, a so called 'Port Switch' can be enabled. In this mode the 3-way valve is locked in recirculation mode to prevent any overboard discharge.



Compliance

CBM+ is the perfect tool to prove that your vessel and crew comply with the respective laws and regulations.

Key Features & Benefits

- > Final compliance monitoring system directly prior to overboard discharge
- > Easy to read display of ppm curves
- > Tamper proof record of all relevant data
- > Connectivity to ships AMS
- > Compact plug & play design
- > Tamper proof housing
- > High quality components made in Germany

LINK Data Recording & Visualisation Unit

RWO

Linking Smart Technologies With RWO

The data recording and visualization unit LINK is designed to store relevant data of connected systems to make them available for further evaluation and downloading. The unit visualizes and stores operation data in reference to time and position.

How it Works

This compact system can be installed as add on to other systems for data storage, evaluation, visualisation and data logging. By using the data of any satellite navigation system, information is provided with a position and time stamp. LINK displays a wide range of information on a clear 15.6" touch screen, i.e. detailed alarm lists, separated operation data for each connected system

and graph visualisation with adjustable ranges and time selection. Using the ships' GPS data LINK visualizes the ship's position on a detailed map. Zoom functionality, recording and displaying of tracks are available as well as selected operation data for each way point.

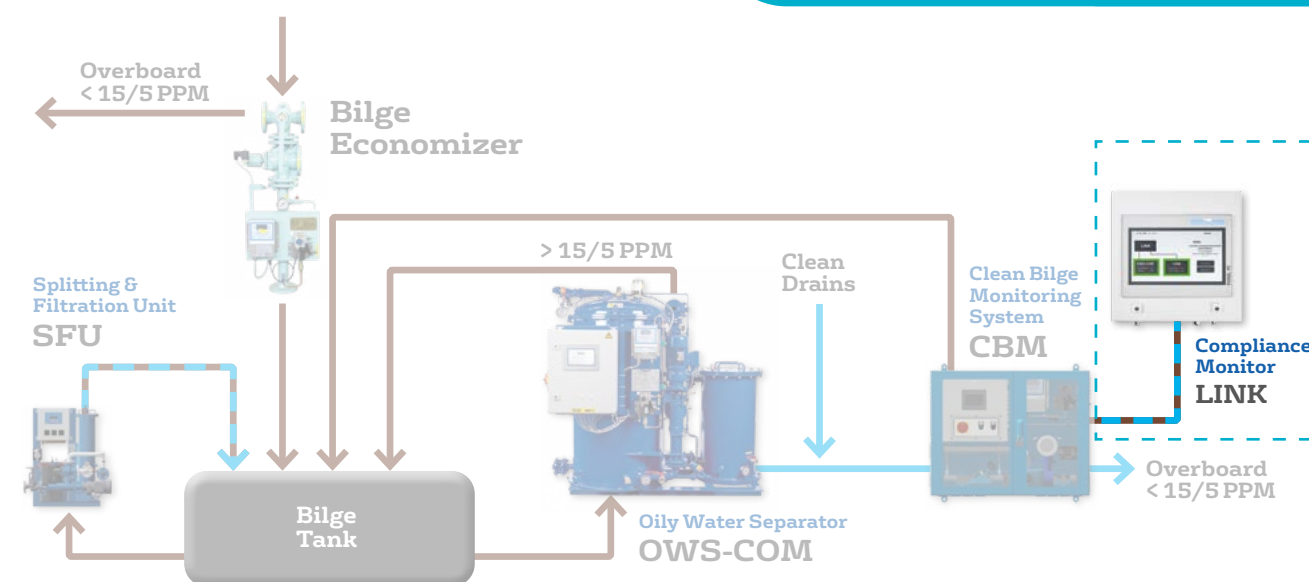
On top, defined special areas as mentioned in the IMO-MARPOL Annex 1 are implemented and can be selectively displayed. In case the boundary to a special area is crossed, information is stored and a visual alarm is activated. The graphical display of data via curves in real time, allows to interpret operations and gives indication about future needs. Each analog and digital information can be separately selected and shown, zoomed or in detail, over the recorded time. To make the data and information externally available LINK is provided with a data logging function and USB 3.0 interface. Protocols and graphical visualization can be repeated as often as needed as all data is safely stored for 24 month. LINK is provided with an uninterrupted power supply.



Easy to read overview of system status:
RWO'S LINK

LINK Key Features & Benefits

- > Easy to read display of system status
- > Generates and saves relevant data for a minimum of 24 months
- > Creation of predefined reports (on-screen & pdf) for crew and authorities
- > Tamper proof
- > Storage of reports on USB possible
- > Can be connected to other RWO systems on board
- > Location via any satellite navigation system
- > High quality components made in Germany



SFU Emulsion Splitting and Filtration Unit

RWO

Pre-treatment of Bilge Water to Relieve Your Oily Water Separation

Oily water separators are able to treat bilge water and ensure that it can be discharged overboard in an environmentally friendly way. Changing compositions and concentrations, the potential to emulsify as well as the increasing presence of particles and other contaminants in the bilge water often complicates the entire process.

For this reason RWO has developed the Splitting and Filtration Unit (SFU). The system is part of RWO's leading **Total Water Management** offer. This special pre-treatment system eases the treating of bilge water and offers key benefits to ship operators and owners.



SFU helps treating bilge water by splitting emulsions

SFU – Splitting and Filtration Unit

Emulsions and particles complicate the treatment of bilge water and cause a high amount of consumables for oily water separators. To relieve OWS-units from particles and save consumables, a pre-treatment can be installed.

RWO's SFU type is able to pre-treat difficult bilge waters and therefore to reduce the costs of operation significantly. Therefore, a fully automatic three-stage process is used, consisting of the addition of a special splitting agent, slow oil separation from the water and a filtration unit to remove all particles. Operators can also switch off the oily water separator and use the SFU system as a stand-alone filtration unit.

Advantages

- > The SFU splitting and filtration unit has been developed to support oily water separators if difficult compositions of bilge water exists.
- > The pre-treatment of the bilge water works with emulsion splitting combined with downstream filtration, so even **stable emulsions can be handled**.
- > The advanced removal of particles and splitting the emulsion in the bilge water storage tank saves consumables in the downstream oily water separator.

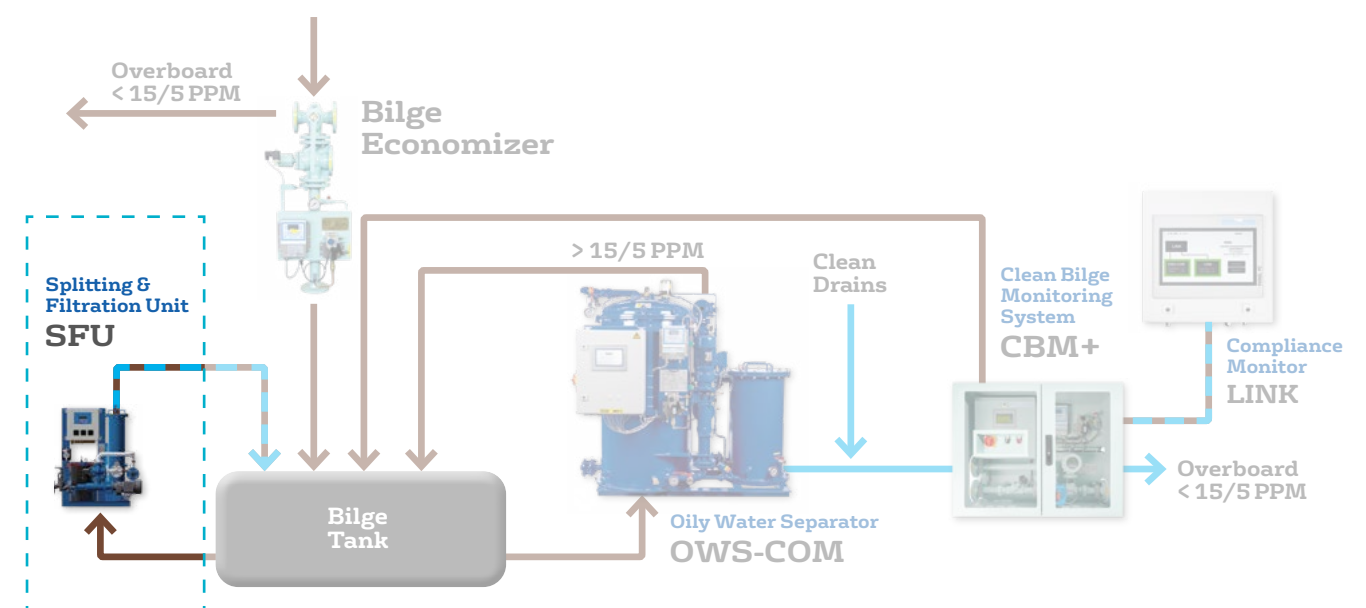
How it Works

The process of emulsion splitting and particle removal takes place automatically in three consecutive steps:

1. Addition and mix-in of a defined quantity of splitting agent to the bilge water
2. Settling phase with coalescence processes
3. Reduction of particle concentration by means of filtration

Key Features & Benefits

- > Saves consumables for downstream oily water separator
- > Extends operational life span of OWS
- > Easy to install and easy to handle
- > Worldwide service & support



Bilge Economizer Oil-water Separation System

RWO

A Small Issue With Big Result

On board every ship, so called 'clean drains' are treated in oil-water separation systems and strain machines and resources. These 'clean drains' usually consist of leakage and condensate from equipment used for seawater, fresh water, steam, air conditioning and other systems, which are usually not contaminated by oil.

Based on the IMO guidelines for 'Integrated bilge water treatment systems' (IMO MEPC.1/ Circ.642), RWO has developed the Bilge Economizer.

The Bilge Economizer allows ship operators to discharge the 'clean drains' overboard without any further treatment.

As a result, the bilge water volume handled by the oily water separator is much smaller, which reduces operating cost significantly.



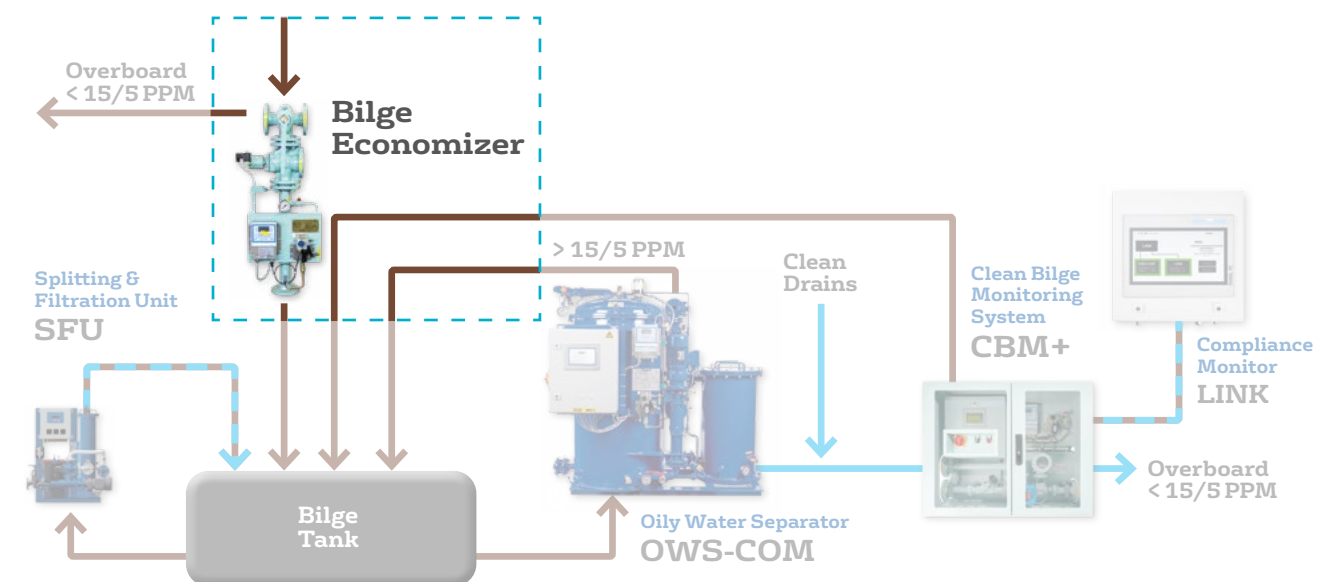
Bilge Economizer to discharge clean drains safe and efficient

How it Works

The Bilge Economizer is an easy to operate stand-alone oil monitor with automatic and manual 3-way valves. It is installed behind the discharge pump of the 'clean drains' holding tank. As long as the oil content of the 'clean drains' is below the set discharge limit value, it is discharged directly overboard. Whenever the oil content exceeds the set limit value, it will be diverted to the bilge holding tank for further treatment by the oily water separator.

Key Features & Benefits

- > Less operation cycles of OWS system required (reduced OPEX)
- > Smaller oily water separator (reduced CAPEX)
- > Less maintenance and reduced labour costs
- > Can alternatively be supplied as loose components





RWO

Sewage Treatment

MARINE WATER TECHNOLOGIES

CleanSewage-BIO Biological Sewage Treatment

RWO

Sewage Treatment With Minimal Efforts

CleanSewage-BIO is a compact, type approved marine Sewage Treatment Plant (STP) for cargo vessels. With an incorporated Moving Bed Bio-reactor (MBBR), the CS-BIO requires minimal process volume, still meeting the IMO MEPC.227(64) discharge criteria.

CS-BIO is designed for easy maintenance and operation. With the intuitive status control, operators can check at a glance, whether the system is running smoothly or intervention is necessary. The hygienic no-touch-cleaning system for sludge discharge makes maintenance nearly effortless.

The accessibility from one side allows ship designers to plan space in the engine room on a whole new level.

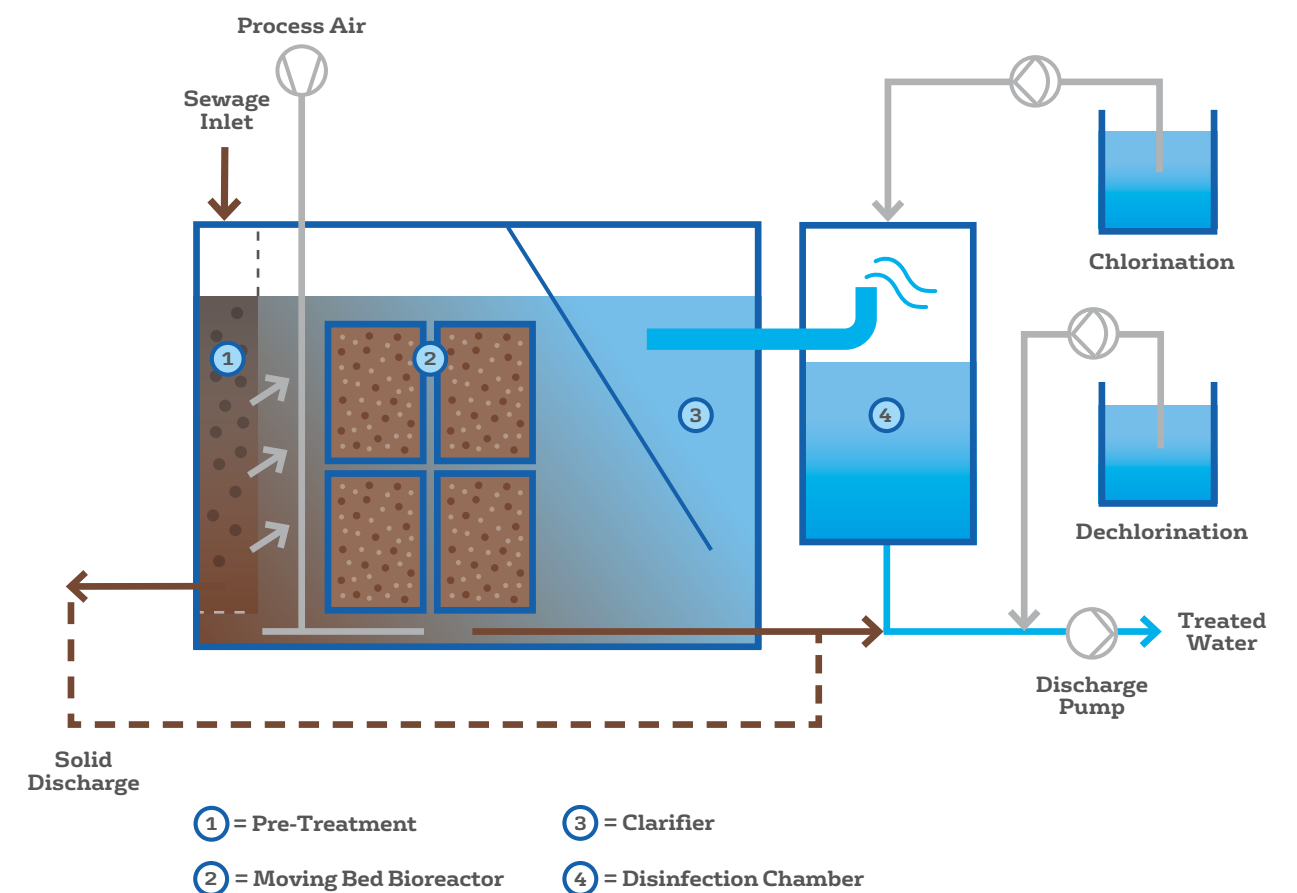


CS-BIO compact biological sewage treatment

How it Works

CleanSewage-BIO combines mechanical pre-treatment (screening), biological treatment by activated sludge (AS) with moving bed biofilm technology (MBBR) and solid separation via clarifier in the same tank. Compared to an activated sludge system, CS-BIO is a high efficiency solution for the removal of organic matter with very low sludge production due to the biofilm technology.

1. As a first step the sewage is separated from heavier solids and particles by a screen, thus preventing clogging or damages in further process steps.
2. In the biological stage, bacteria degrade organic matter into carbon dioxide and water. These bacteria grow as a biofilm on the carriers in the so-called moving bed. Aeration is applied both for the suspension of the biofilm carriers and the oxygen supply of the bacteria. As a natural process, bacteria accumulate in the system and form sludge flocs (also called excess sludge) which can be collected and disposed according to national and international laws.
3. In the clarifier residual solids and suspended activated sludge are separated by sedimentation and turned back into the biological chamber. The clean sewage flows into the disinfection chamber.
4. In the disinfection chamber a chlorine-based chemical is added to reduce bacteria to a minimum level. The clean water is then pumped overboard. To meet the limit values set for the chlorine content, a neutralising agent is dosed prior to the discharge pump.



Key Features & Benefits

Safe

- > Integrated mechanical pre-treatment
- > No harmful or flammable chemicals
- > Certificate of Type Approval for Sewage Treatment Plants according IMO MEPC.227(64) issued under the authority of the Federal Republic of Germany by BG Verkehr

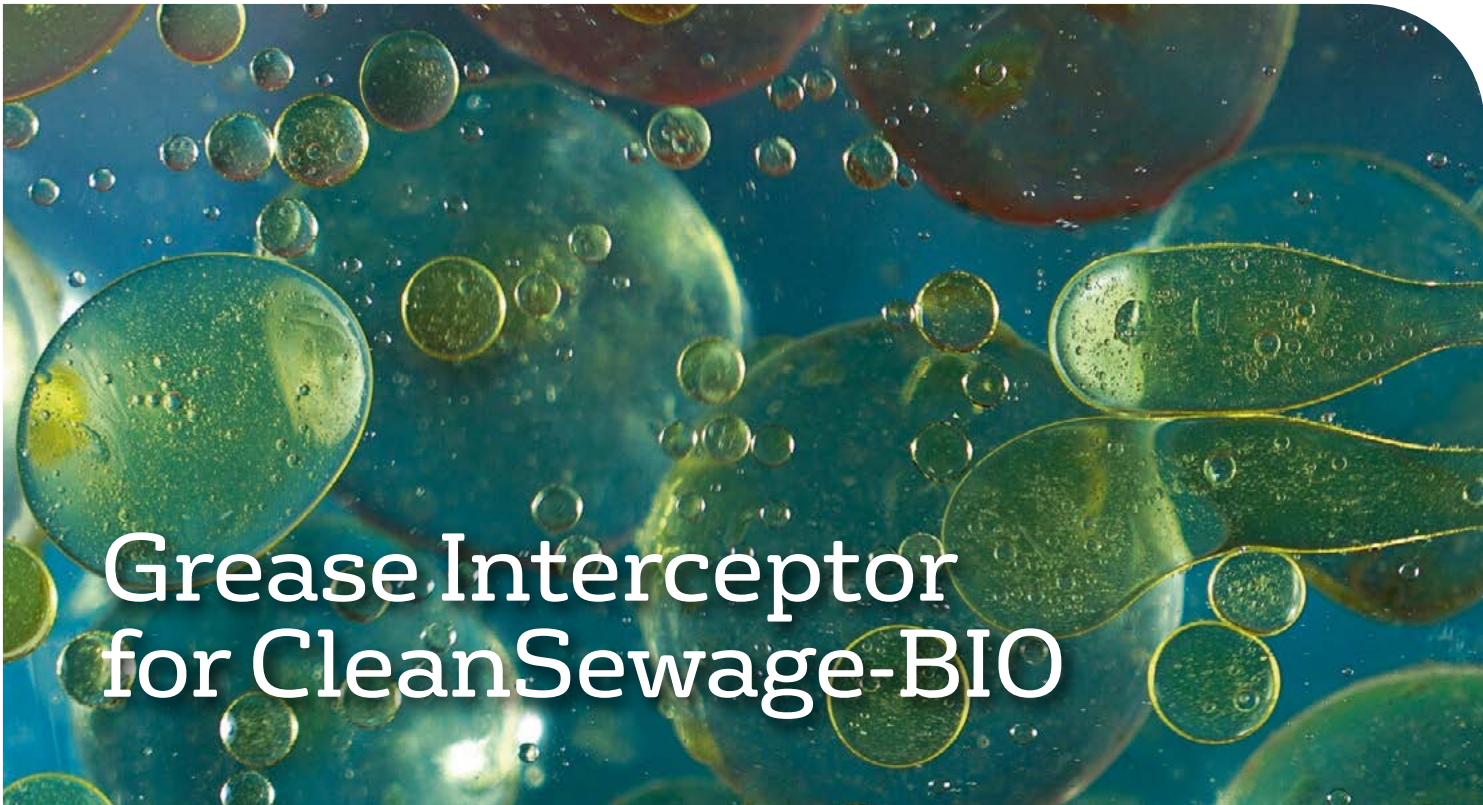
Small

- > No holding tank necessary
- > Up to 25% less space demand through unique one-side access

Easy to operate

- > No-touch-system for hygienic sludge discharge
- > 100 % control through individual switches for every component
- > Fast restart after maintenance due to biomass carrier in cages
- > Suitable for black & grey water
- > Compatible with all vacuum systems

CS-BIO	Organic Load	Hydraulic Load	Dimensions L x W x H	Weight	
Size	kg/d BOD ₅	m ³ /d	mm	Net kg	Wet kg
02	1.38	2.16	2095 x 1250 x 1480	859	2923
03	2.07	3.24	2608 x 1346 x 1612	1149	4134
04	2.76	4.32	2559 x 1646 x 1618	1335	5293
05	4.15	6.48	2781 x 1656 x 2058	1627	7407
06	5.53	8.64	3365 x 1656 x 2058	1885	9278
07	6.91	10.80	3365 x 1986 x 2058	2121	11719



Grease Interceptor for CleanSewage-BIO

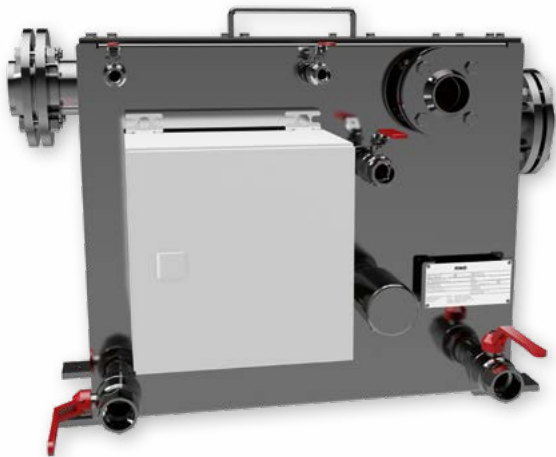
RWO

State-of-the-Art Galley Water Pre-Treatment

Waters originating from ship galleys contain grease, fats, oils and food waste. The Grease Interceptor works using the principle of gravity; Substances heavier than water settle down while lighter substances, such as grease and oil, rise. Galley water pre-treated in the Grease Interceptor can then be fed to RWO's wastewater treatment systems for further treatment. The system is part of RWO's **Total Water Management** offer.

Design

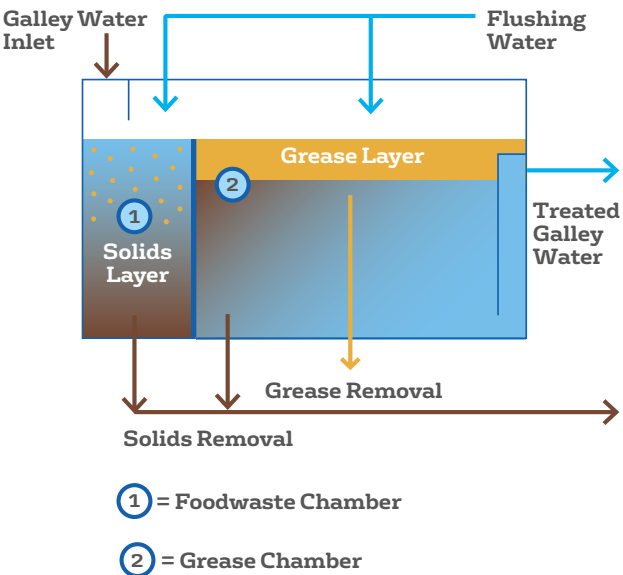
- > Compact and robust design in stainless steel 316Ti
- > Two-chamber process, designed in accordance with DIN EN 1825-1:2004
- > Cleaning-in-place (CIP) philosophy
- > Optional: An electrical heating system for grease removal and a 360° spraying system for flushing for minimal maintenance effort



Grease Interceptor for galley waste water pre-treatment

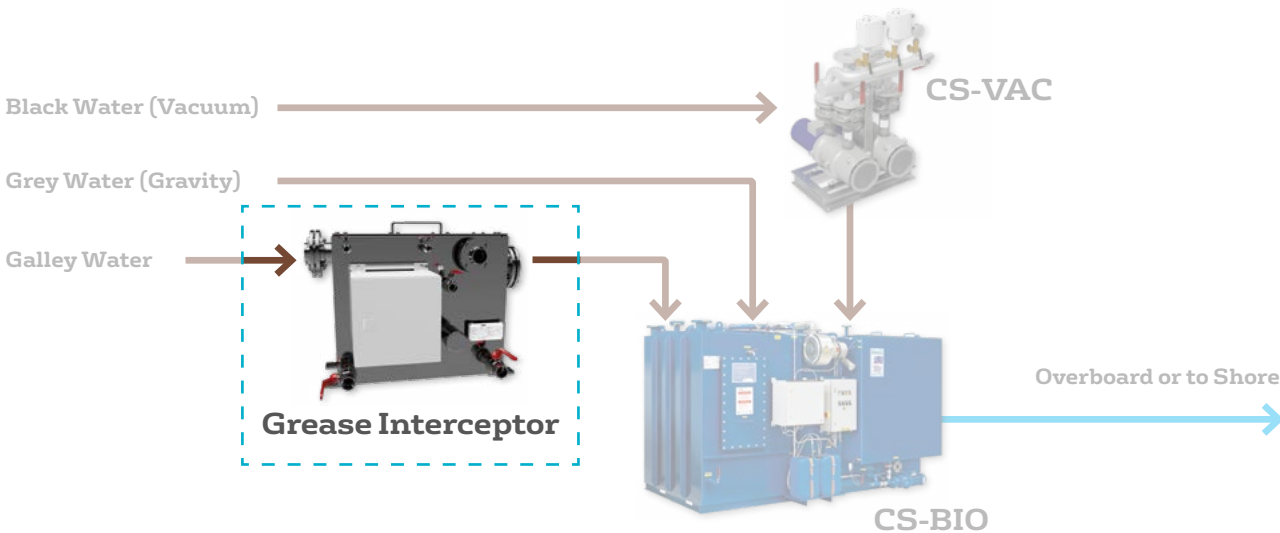
How it Works

The Grease Interceptor separates particles, fat, oil and grease (FOG) acc. to their density. It consists of a foodwaste and a grease retaining section. While heavier particles settle down and are collected in the lower section of the foodwaste chamber, grease and oils float on the upper part of the grease chamber.



Key Features & Benefits

- > Easy removal of solids and grease (dispose onboard or ashore)
- > Legal and safe operation while discharging
- > Expected lifetime exceeds industrial average even with difficult, acidic or super-alkaline waters
- > No consumables required for operation
- > No bad odour during normal maintenance
- > Accessibility from one side only



Type	# People	Collection Capacity		Dimensions L x W x H mm	Weight	
		Grease l	Sludge l		Net kg	Wet kg
GI 20	up to 20	6.2	15.5	832 x 360 x 661	55	142
GI 50	up to 50	13.4	33.5	902 x 460 x 661	73	213
GI 100	up to 100	20.8	52	1132 x 580 x 661	91	296

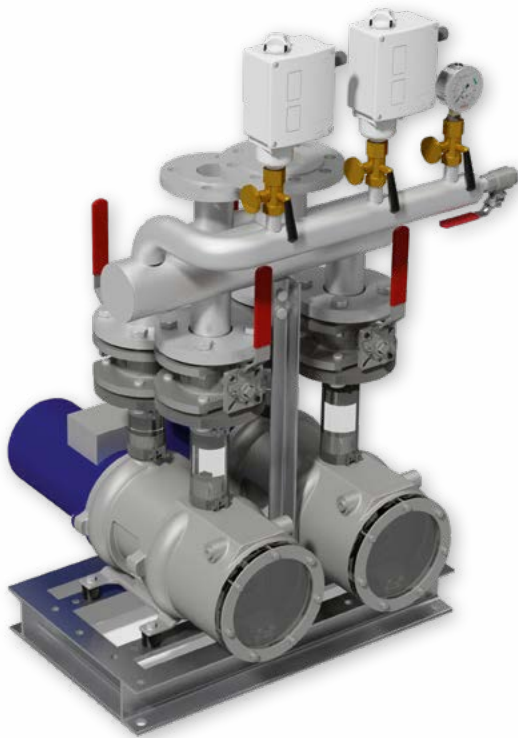
According to: MARPOL 73/78 Annex V

CS-VAC Vacuum Pump Station for CleanSewage-BIO

RWO

Efficient Solution for Sewage Pumping

The CleanSewage Vacuum Pump Station combines energy efficient vacuum creation, sewage maceration and pumping in one compact, skid-mounted device ready for installation on your vessel. The CS-VAC is the perfect match for RWO's CleanSewage treatment systems or any other STP, for new buildings as well as for retro-fittings. It has been developed for customers with a special demand on novel and sustainable sanitary systems.



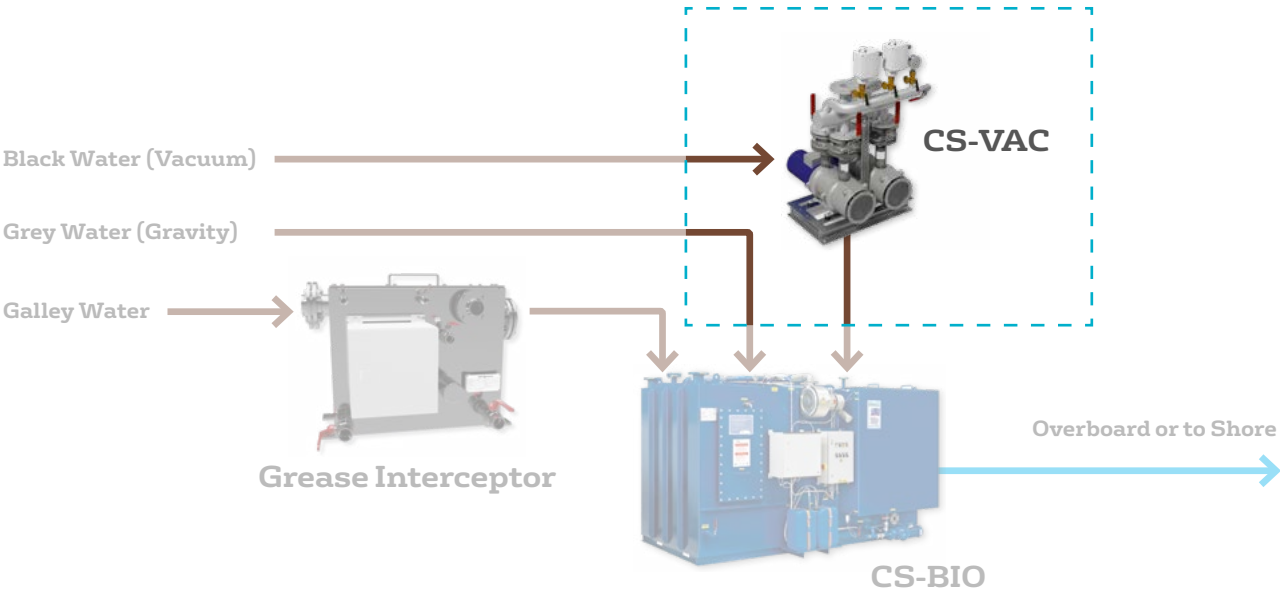
Vacuum maceration pump station for marine sewage treatment plants

How it Works

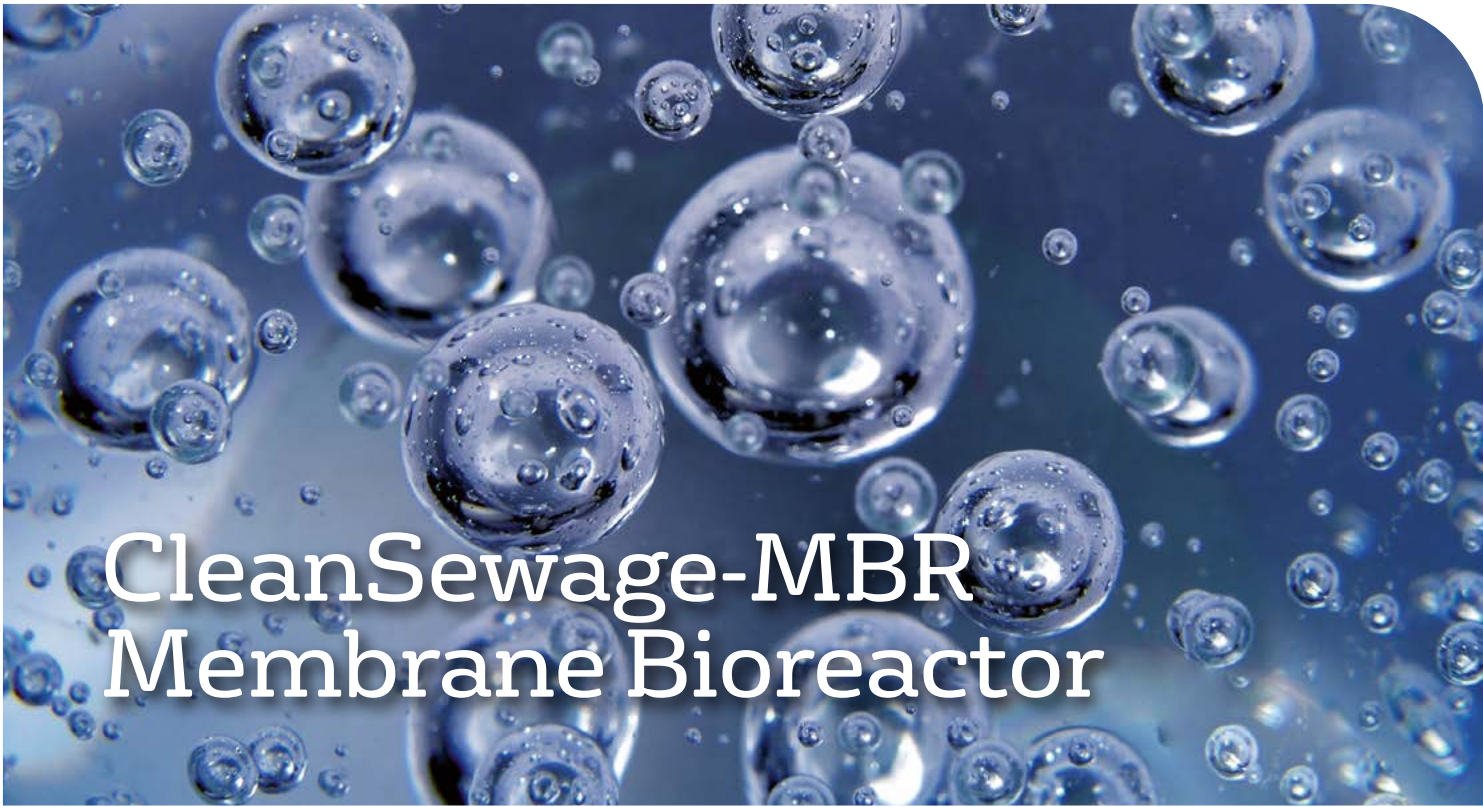
With its integrated and proven cutting technology CS-VAC is able to pump every combination of grey and black water. Insensitive to plait formation, the system only requires a minimum effort for operation and maintenance. Designed on the general principle of redundancy, the unit ensures a stable vacuum even if the installation on board is not directly close to the sewage treatment plant. An inspection glass at the pump's cutting system allows easy troubleshooting of the vacuum system. The pump station comes already mounted on a foundation with all internal piping, valves and wiring. Process control allows flexible adjustment of the system parameters based on the geometry of sewage collection piping system and user pattern.

Key Features & Benefits

- > Compact, efficient solution for sewage pumping
- > Proven cutting technology
- > Swirler prevents plait formation
- > Easy maintenance
- > Easy troubleshooting due to inspection glass
- > Easy replacement of wear parts
- > Premium energy efficiency IE3



Frequency	Air flow rate	Max. flow rate water	Flushing rate
Hz	m³/h @ 0.5 bar	m³/h @ 2 m	1/h
50	6	5	120
60	7.1	6.5	150



CleanSewage-MBR Membrane Bioreactor

RWO

Advanced Wastewater Treatment for Passenger Ships

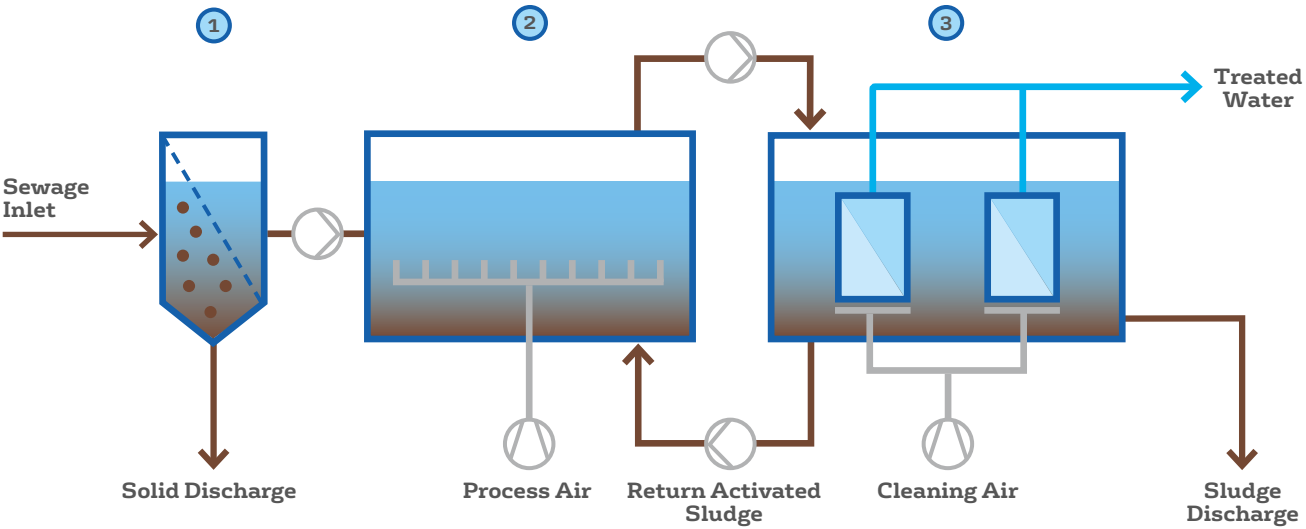
With the CleanSewage Membrane Bioreactor (CS-MBR) RWO has developed an advanced waste-water treatment (AWT) system fit for the requirements of sustainable passenger shipping as well as other high-standard applications. The CS-MBR is type approved according to the regulation IMO MEPC.227(64) including chapter 4.2 for nitrogen and phosphorus removal within special areas.



CleanSewage Membrane Bioreactor: Advanced Water Treatment from RWO

Sustainable Biological Treatment

CS-MBR is the successor of the MEMROD-Series, RWO's renown advanced water purification plant, with higher effluent quality and several operational advantages. The treatment process is divided into three steps: Solids are removed in the mechanical pre-treatment, pollutants are degraded in the biological stage and in a last step, a membrane barrier ensures absolutely reliable separation of solids, including microplastics. The submerged membrane system with extremely high mechanical strength and automated cleaning mechanism control make CS-MBR easy to operate and ensure long lifetime. The biological treatment process offers low OPEX due to low energy demand, low use of chemicals and thus a low production of solid byproducts/wastes.



- ① = Mechanical Pre-Treatment
- ② = Bioreactor
- ③ = Membrane Reactor

How it Works

The CS-MBR is based on a sustainable biological treatment technology that can be divided into three major process stages:

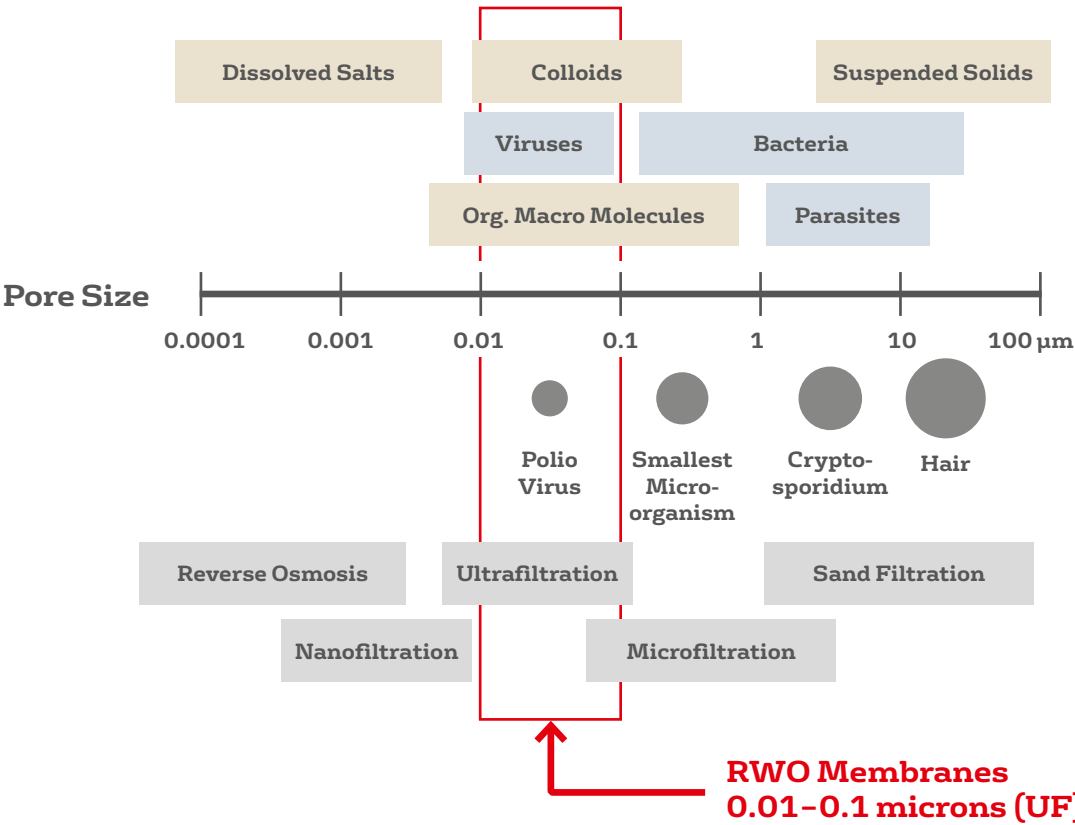
- > Mechanical pre-treatment
- > High Performance Activated Sludge Biological Treatment
- > Submersed Ultrafiltration (UF)

These modular technologies can be combined and scaled to meet individual customer requirements.

1. In the first stage, solids are removed from all incoming waste waters (blackwater, greywater from galley, accomodation, laundry, etc.). Grease separation for the galley water treatment can be added on demand.

2. The second stage consists of a high performance activated sludge process: Controlled by intelligent aeration design, bacteria remove organic pollutants, nitrogen and phosphorus from the wastewater. To achieve minimum phosphorus concentrations in the effluent, excess phosphorus is precipitated by adding coagulant.

3. In the third stage of the process, the clean water is separated from the activated sludge via a submerged membrane. While the water can pass through the membrane, sludge, bacteria, viruses and microplastics are held back as shown below. The result in downstream water is clear, free of solids and already disinfected.



Key Features & Benefits

MEPC 227 (64) compliant including special areas

- > Certificate of Type Approval for Sewage Treatment Plants according IMO MEPC.227(64) issued under the authoity of the Federal Republic of Germany by BG Verkehr

Low Footprint

- > Due to high performance activated sludge process and integrated solid separation

Minimum Maintenance Work

- > Automated membrane cleaning
- > extremely high mechanical strength of the membranes
- > Safe process design
- > User-friendly and intuitive operation

Sustainability and low OPEX

- > Membrane barrier removes more than 99 % of solids including microplastic
- > Removal of bacteria and viruses - no chlorination needed
- > No use of flocculants or chemicals for disinfection necessary
- > Low energy consumption and decreased use of chemicals
- > Low excess sludge production

CS-MBR is designed to minimize your vessel's impact on the marine environment. The advanced water treatment plant provides highest effluent qualities as described in table (see table) and thus exceeds the requirements of the International Marine Organization (IMO MEPC.227(64) incl. 4.2).

With our disinfection - add-on, even higher effluent standards as for example required for discharge in marine waters of the state ALASKA. Additional class notations like BV Clean, BV CleanSuper, DNV-GL CleanDesign and AWT-A/B can be issued on request.

Parameter	COD	BOD	TSS	TC	pH	TN	TP
Description	chemical oxygen demand	biological oxygen demand	total suspended solids	thermo-tolerant coliforms	-	total nitrogen	total phosphorous
Unit	mg/l	mg/l	mg/l	cfu/100ml	-	mg/l	mg/l
Value	50	≤ 5	≤ 5	100	6.5-8.5	≤ 20	≤ 1

CS-MBR effluent quality exceeding IMO MEPC 227(64) requirements for special areas.



RWO

Desalination and Other Water Treatment

MARINE WATER TECHNOLOGIES

SRO-COM Seawater Reverse Osmosis Desalination

RWO

SRO Fresh Water Maker

The SRO-COM is a standardized seawater desalination plant for service onboard ships. Seawater reverse osmosis plants are an advantageous solution whenever desalinated water for drinking, utility and process applications is needed. The technology is simple, the operation easy and only limited maintenance is required.

RWO offers standardized RO units for the common capacity requirements of commercial vessels. Permeate rates reach from 10 m³ per day up to 60 m³ per day.

This desalination plant has a stable permeate flow over the complete temperature range from 1°C to 35°C. The SRO units come with a built-in concentrate displacement device that will extend the membrane operation cycle.

The system is part of RWO's leading **Total Water Management** offer.

Available Options

- > Media Filter as pre-filtration
- > RO-Cleaning Station (CIP)
- > Buffering tank
- > Antiscalant Dosing
- > Post Treatment (Mineralization, Chlorination, UV-Sterilizer)



High-quality fresh water with maximum salinity of 500 ppm

Advanced Membrane Technology

The newly developed SRO-COM seawater reverse osmosis plants from RWO offers state-of-the art technology by using low energy membranes. Compared to conventional systems, they produce the same permeate rate at a considerably lower operating pressure, resulting in lower investment and lower energy costs.

High Reliability Plant Control

The heart of the plant is the integrated electronic control device, with a user friendly digital display. The graphic on the display shows the temperature, conductivity, operating pressure and operating hours. All failure recordings including the alarm and warnings can be checked through the menu feature.

How it Works

A two-stage filter system protects the membranes of the SRO-COM from suspended particles in the feed water. If the seawater has a high content of impurities, it is recommended to install an additional filter (such as sand filter). Generally a high pressure pump is used to provide working pressure up to a maximum of 68 bar.

Permeate, i.e. desalinated water, passes through the membranes, while the remaining seawater takes up the rejected salts and leaves the modules as concentrate back to the sea.

Type	Permeate m ³ /day	Recovery %	Desalination Rate %	Motor capacity kW	Length mm	Width mm	Height mm
SRO-COM 10	10	21	ca. 96-99%	5,5	1654	940	1080
SRO-COM 25	25	35	ca. 96-99%	10	2667	940	1088
SRO-COM 40	40	28	ca. 96-99%	20	2060	1208	1185
SRO-COM 60	60	32	ca. 96-99%	25	2936	1208	1150

Key Features & Benefits

- > Simple technology and modular design
- > Automated operation and low maintenance requirements
- > Designed for operation in unmanned engine rooms
- > Continuous operation: no downtime
- > Simple, compact installation
- > Proven technology
- > High-quality fresh water with a maximum salinity of 500 ppm
- > No chemicals needed



SAF-COM Sand Filter

RWO

Simple and Efficient Pre-treatment for Reverse Osmosis

The RWO sand filter SAF-COM is generally used as a pre-filtration step for fresh and process water treatment. The SAF-COM removes suspended particles. The system ensures high process efficiency of further filtration steps for fresh and process water treatment e.g. the RWO seawater reverse osmosis plant SRO-COM.



SAF-COM for pre-filtration for fresh and process water treatment

How it Works

It is a closed filter system and the filter media are chosen according to the raw water quality. These materials retain the turbidity in the filter. When the capacity of the filter is exhausted, it will be backwashed.

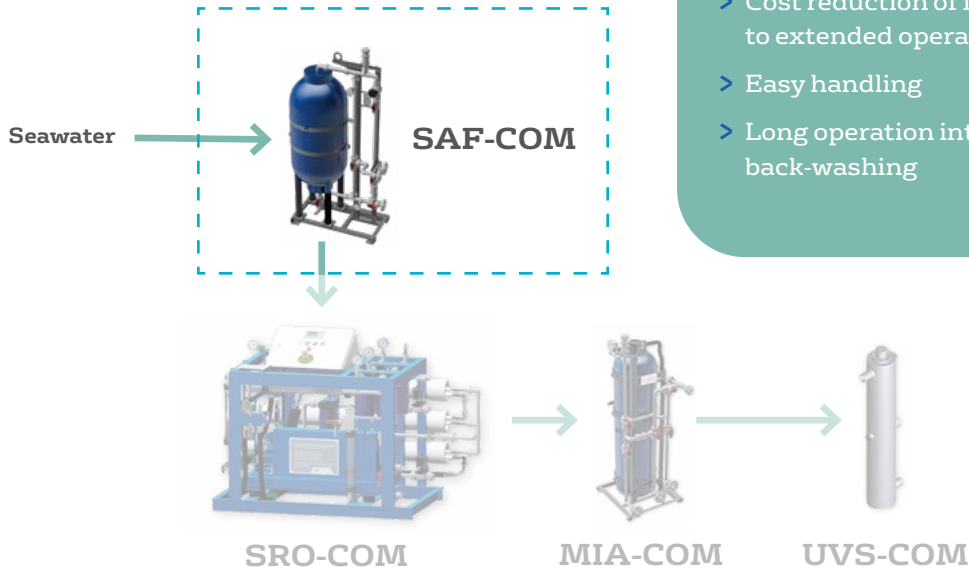
The dirt particles are rinsed out of the sand in the sand scrubber using filtered water. The rinsed sand trickles onto the sand filter bed and is available for further filtration. The dirt particles are removed from the system using the backwash water.

Easy Handling

The sand filter has a long life-cycle and is easy to operate. This plug-and-play unit does not need any electrical and pneumatic connections. The filter housings are made of polycarbonate. They are available with manual backwashing. The range of flow rates in the standard program is from 0.42 m³/h to 7.86 m³/h.

Key Features & Benefits

- > Skid-mounted units in a compact, marine-suitable design
- > Reliable equipment, safe to operate
- > Cost reduction of fine filtration due to extended operation times
- > Easy handling
- > Long operation interval before back-washing



Type	Capacity* m ³ /h	Length mm	Width mm	Height mm	DN/PN	Wet weight kg
SAF0420	0.42	725	470	1150	10/16	60
SAF01050	1.00	790	560	1360	15/16	100
SAF02040	2.00	920	555	1550	20/16	170
SAF03000	4.20	965	615	1875	25/16	310
SAF06000	8.50	1340	835	2125	40/16	680
SAF07860	7.86	1580	990	2120	50/16	1135

*Volumetric flow depends on the water composition and the type of filter media.

MIA-COM Mineralization and De-acidification

RWO

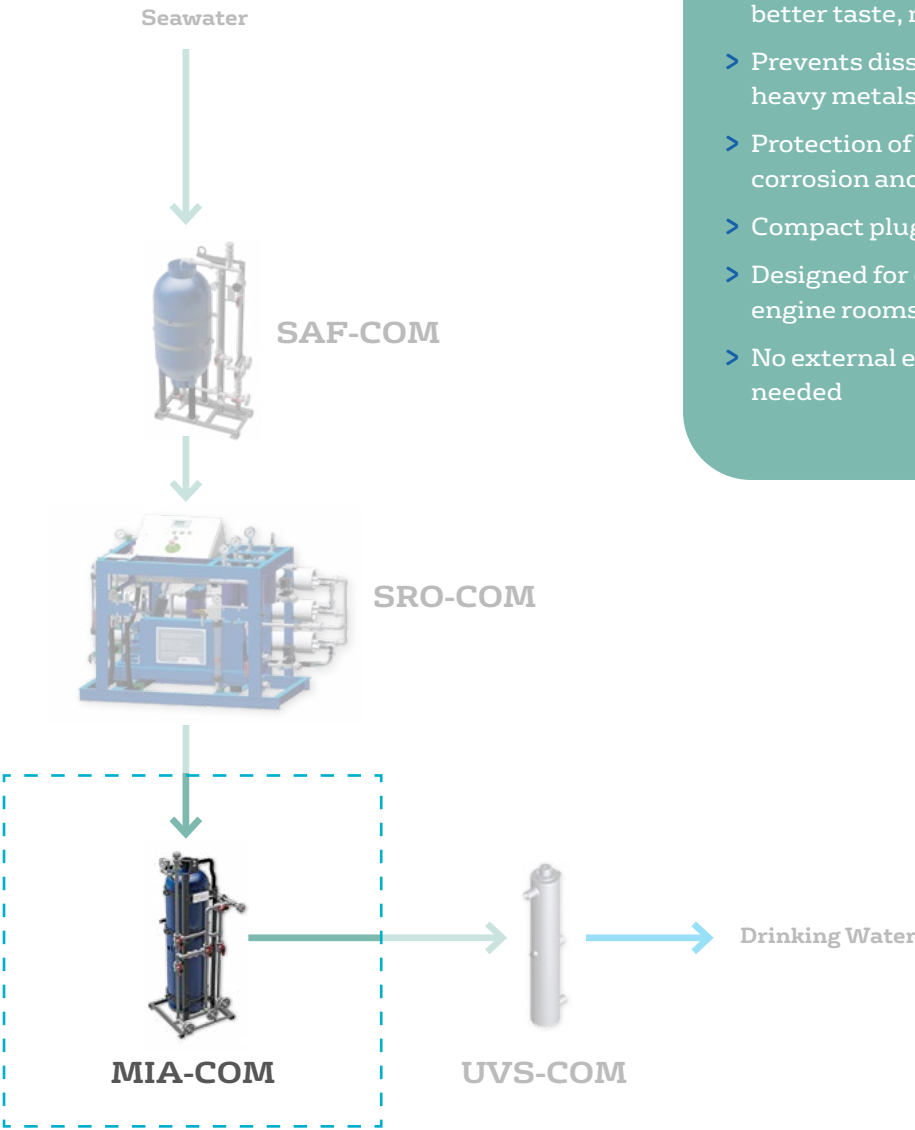
Simple and Reliable Post-treatment

Post-treatment of desalinated water from evaporators or reverse osmosis units is necessary to get safe, potable water. The mineralization and deacidification processes inside the MIA-COM unit help to prevent corrosion and improves quality of drinking water. The application of the mineralising unit brings advantages for both crew and passengers. It protects the material of downstream equipment, such as air-conditioners, ice makers and heating systems.



MIA-COM helps to prevent corrosion and improves health protection

The standard capacities of the RWO mineralizing single filter units range from 0.65 m³/h to 8.50 m³/h. Mineralizing units in duplex configuration, with two single filters operating in parallel mode, are also available.



Key Features & Benefits

- > Higher quality of potable water, better taste, no odour
- > Prevents dissolving hazardous heavy metals from the pipe surface
- > Protection of ship equipment against corrosion and subsequent damages
- > Compact plug-and-play design
- > Designed for operation in unmanned engine rooms
- > No external electrical power supply needed

Type	Capacity m³/h	Length mm	Width mm	Height mm	DN/PN	Wet weight kg
MIA-COM 650	0.65	725	470	1150	10/16	60
MIA-COM 1000	1.00	790	560	1360	15/16	100
MIA-COM 2000	2.00	920	555	1550	20/16	170
MIA-COM 4200	4.20	965	615	1875	25/16	310
MIA-COM 8500	8.50	1340	835	2125	40/16	680

max. allowed working overpressure: 6 bar; max. allowed operating temperature: 40 °C

UVS-COM Ultraviolet Disinfection

RWO

Reliable Disinfection of Potable Water

RWO's UV units consist of a reaction chamber with the UV lamp and a separate control cabinet. The UV lamps, which emit over 90% of the total UV emission at the optimum wave length of 254 nm, are fitted into the reaction chamber and protected by a UV transparent quartz glass.

Disinfection of potable water by UV radiation is a safe and reliable alternative to other methods such as chlorination and is also used as final polishing before distribution/prior to consumption.

How it Works

The radiation causes photochemical reactions in the cells of micro-organisms, thus inhibiting essential cell functions. UV radiation is most suitable for sterilisation as an exposure to UV-C radiation kills more than 99,9 % of the bacteria and viruses.

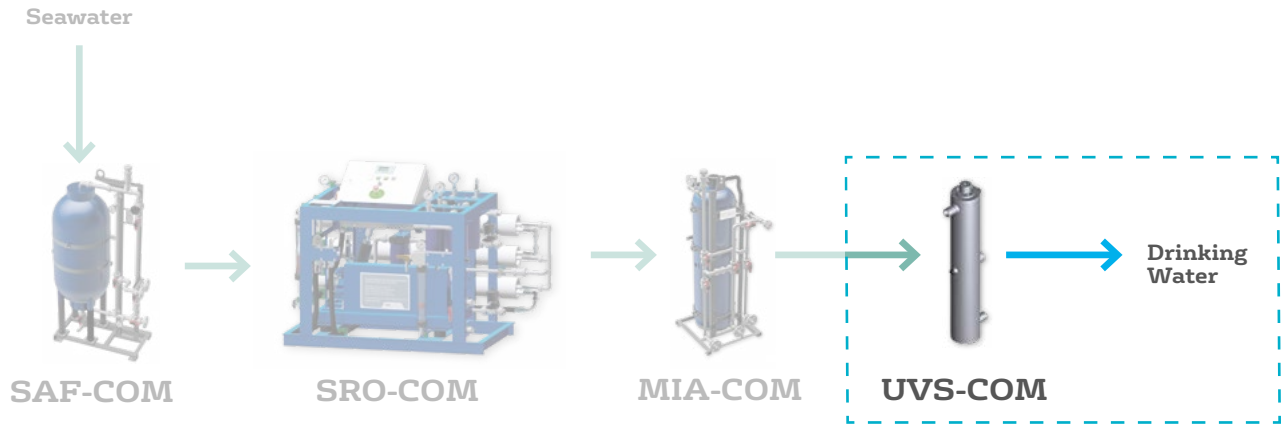
Key Features & Benefits

- > No chemicals required
- > No effects on taste and odour
- > No disinfection by-products
- > No corrosion problems
- > Safe disinfection of drinking water
- > Easy to operate an maintain



Dimensions

Type	UVS-COM 3	UVS-COM 5	UVS-COM 15
A	1000	1000	1350
B	165	210	210
C	89	114	114
D	900	900	1200
E	870	860	1105
F	1"	1 ½"	2"



Design-Parameters

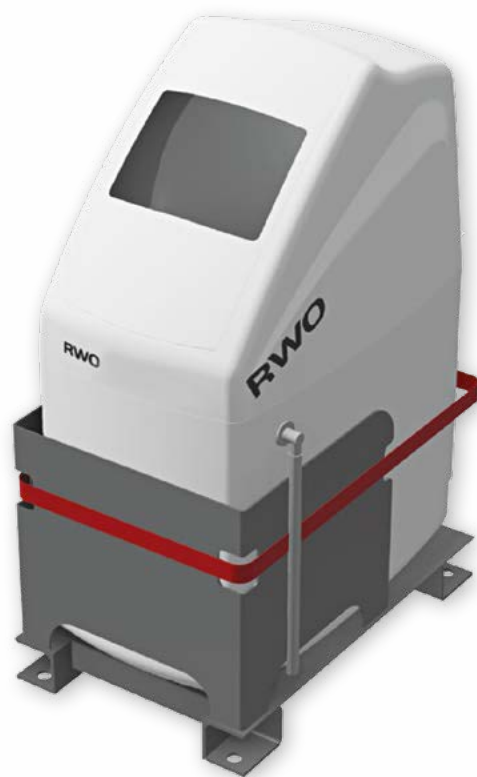
Type	UVS-COM 3	UVS-COM 5	UVS-COM 15
Flow-Rate (m³/h)	3	5	10-15
UV-C-Transmission -SSK m (T _{1cm})	96%	96%	96%
Dose (J/m²)	400	400	400
Water temperature (°C)	max. 35	max. 35	max. 55
Ambient temperature (°C)	max. 40	max. 40	max. 40
Working pressure (bar)	max. 10	max. 10	max. 10
Power supply (V/Hz)	230/50-60	230/50-60	230/50-60
Reactor (kg)	6	8.5	12
Control unit (kg)	11.5	11.5	11.5

SOE-COM Drinking Water Softening

RWO

Protecting Equipment from Scaling and Water Hardness

Hardness in water is caused by the ions of calcium and magnesium. The hardness of the water is of prime concern for many technical applications because of its scale-forming tendencies. Therefore, some water users on-board ships need softened water, e. g. hot water circuits, laundry water, galley pantry, boiler feed water, cooling water. We recommend the RWO drinking water softener SOE-COM.



Water softening for drinking water and technical systems

How it Works

RWO water softeners operate using the ion-exchange process. The hardness minerals, calcium and magnesium, contained in the water are exchanged with sodium when flowing through the softener. To set an optimal water hardness between 6 and 8° dH the blending can be optionally integrated into the system. After exhaustion of the ion-exchange capacity the softener will be regenerated with brine.

Minimal Resource Consumption

The special control of the plant calculates the required salt and water flow before each regeneration. The resource consumption is significantly reduced because only the actual required quantity of salt and water is used. This protects the environment and reduces operating costs.

Easy Handling

Operating status and service requirements are indicated on a multicolor display. The control concept supports an optimal plant operation over the entire life cycle.

	SOE-COM 1200
Typical capacity Δp 1 bar and blending 20°dH on 8°dH*	1.2 m³/h
Capacity min. /max.	0.3/1.2 m³/h
Adsorbtion capacity	13 ° dH x m³
Operating pressure	2.5 - 6 bar
Dimension A/B/C	345/620/790 mm
Connection	1 1/4"
Electrical connection	230 V, 50 Hz
Wet weight (kg)	80

*Other capacities available on request.

Key Features & Benefits

- > No scale inhibitors required
- > Compact plug-and-play design
- > Chemical saving system
- > Increased lifetime of water-contacting equipment
- > Low maintenance requirements
- > Designed for operation in unmanned engine rooms

Dosing Unit

RWO

Chemical Dosing on Board

Fresh water and service water onboard of ships is necessarily taken from various sources. To compensate the varying water quality the water has to be treated with chemicals. RWO dosing units assist you to condition the water easily and reliably in order to serve the intended use and to meet the technical requirements.



High dosing accuracy and easy installation

The field of applications includes the dosing of:

- > Acids for alkalinity reduction and scale prevention.
- > Polyelctrolytes for coagulation of suspended solids and an improved subsequent filtration.
- > Scale inhibitors to avoid scale deposits on reverse osmosis membranes.
- > Disinfectants for shock treatment in order to avoid bacterial growth.
- > Chlorine to avoid biological growth in pipes and storage tanks.
- > Hydrated lime or caustic soda for pH adjustment to neutralize dissolved free carbon dioxide.

RWO dosing units feature solenoid driven diaphragm metering pumps. The combination of solenoid drive and diaphragm guarantees durability and dosing accuracy. All parts in contact with media are chosen for their resistance against the standard chemicals used for water treatment.

The control of the pump allows a continuous adjustment of injection volume and frequency. This guarantees an adaptation to the dosing characteristics of the dosing agents.

Key Features & Benefits

- > High dosing accuracy local control for adjustment of dosing rate
- > Integral dosing head deaeration for degasing of chemicals
- > Easy installation and maintance high operational reliability
- > High quality materials
- > Accessories in great variety

Dosing Units AM

The AM line of products is designed for dosing proportionally to the flow. Contact signals from a water meter guarantee the appropriate dosing rate. This is important where regulations must be observed or the chemicals are expensive.

Dosing Units HM

Dosing units of the HM type are designed for applications where proportional dosing rates are not necessary or not applicable.

Accessories

- > Water meters for in-line installation, generating the timing pulse which is necessary for flow controlled dosing rates
- > Automatic control units for dosing units
- > A range of containers of different sizes for dosing chemicals
- > Handoperated mixers or motor driven mixers with timer and protection against dry running
- > Level switches for low level alarms and dry-running alarm
- > External failure signal

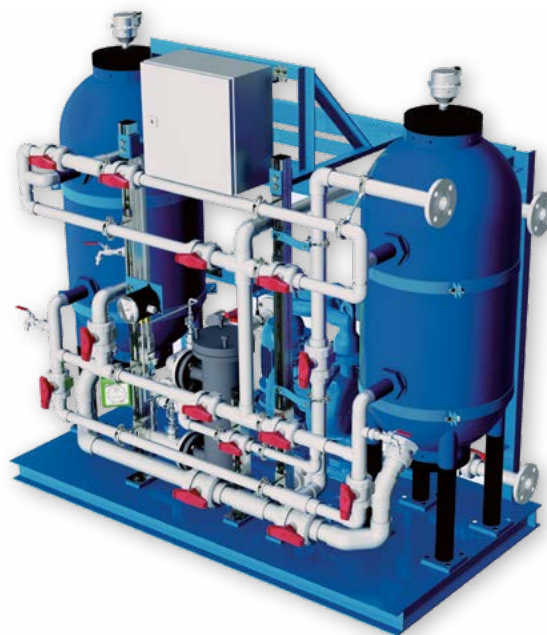
ACCuRem Copper Removal & Condensate Reuse

RWO



Economical Reuse of AC Condensate on Cruise Ships

Cruise ships that sail the warmer regions of the earth continuously produce a lot of condensate water. The air is cooled down inside the heat exchangers of the air-conditioning units to a temperature below the dew point of the outside atmosphere. This causes a large fraction of the air humidity to fall out as condensate, which accumulates at the bottom of the air conditioning (AC) units. Commonly, the AC condensate of heat exchangers is collected inside a central condensate tank from where it is used for secondary purposes or pumped overboard.



ACCuRem for water recycling offers a smart way to reduce expenses for fresh water generation

Economical Focus

What makes the AC condensate interesting is the fact that it is water almost free from salts and minerals. Desalination of water on board a passenger vessel is a costly process and the by-product AC condensate is available practically for free. The flow of condensate may vary between none at all to up to 20 m³/hr on board very large cruise ships. The condensate can be used for ship's laundry and other applications.

The Challenge

When the condensate is formed on the surfaces of the air coolers it takes up impurities from the air such as dust and bacteria, but also carbon dioxide, NO₂ and SO₂, and copper ions from the AC heat exchangers. The suspended solids and the copper, may cause problems when reusing the AC condensate, as the copper tends to precipitate, e. g. in the washing machines where it may cause greenish colour on the laundry. Therefore, even on ships, where reclaim systems are installed, there is no reuse of AC-condensate in most cases and the ships are using expensive potable water instead.

Your Solution: ACCuRem

The ACCuRem copper removal system is based on a combination of filtration and ion exchange. Numerous ACCuRem systems are in successful operation on cruise ships since its development and exceeding the expectations of both shipowners and operators. The system is part of RWO's Total Water Management offer.

Key Features & Benefits

- > Treats several thousands of cubic metres of condensate via a special process
- > Very small footprint for easy integration also into existing piping onboard ships
- > No requirement to operate or maintain regeneration equipment
- > Easy removal and refill of filter material
- > No other chemicals involved
- > Quick return of investment costs

How it Works

The handling of the ACCuRem system is simple and requires only a little monitoring for on-time detection of the exhaustion of the filter material. Checking the water quality after the treatment can be done by simple copper test kits or using the spectrophotometer. Reuse of AC drain condensate on board cruise ships for technical purposes, e. g. as laundry supply water, is an environmentally friendly and economic way of saving potable water, which otherwise needs to be produced conventionally from seawater by evaporation or reverse osmosis.

Further RWO Technologies for Cruise and Yacht Applications

- > Oil-water separators
- > Advanced wastewater treatment plants
- > Ballast water treatment
- > Reverse osmosis desalination
- > UV disinfection
- > Pre and fine filtration
- > Softeners and demineralisers
- > Mineralisation and deacidification
- > Chemical dosing systems



RWO

Ballast Water Treatment

MARINE WATER TECHNOLOGIES

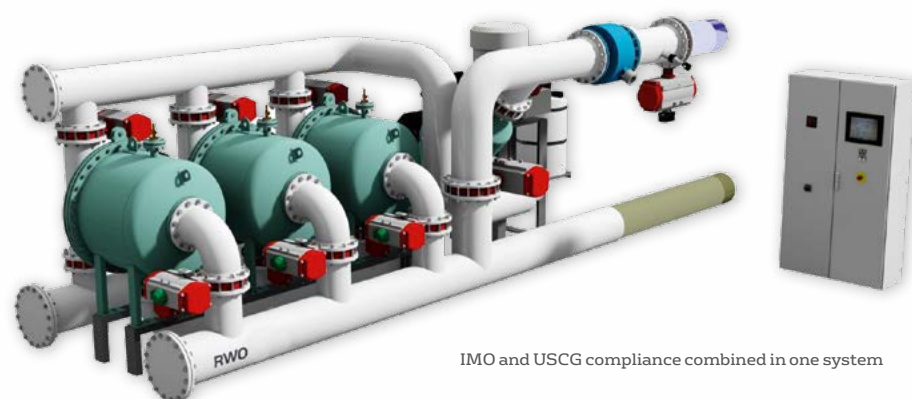
CleanBallast® Ocean Barrier System

RWO

The New CleanBallast® System: Less Complexity – Reduced Costs for Owner

The CleanBallast Ocean Barrier System (CleanBallast OBS) is the next generation of the first CleanBallast ballast water treatment system from RWO which was IMO type approved already in 2010 by the German Flag administration. The system has been designed to treat river, brackish and sea water by means of filtration and disinfection for use as ballast water.

Thousands of hours of operational experience from over 100 installed CleanBallast systems led to the significant improvements done with the new CleanBallast OBS. This way the system was simplified and made even more robust. For full adherence with the most recent legislations, CleanBallast OBS was developed in accordance with IMO Code for Ballast Water Management Systems MEPC.300(72) and USCG 46 CFR 160.60 requirements. Type approval testing was performed under the auspices of DNV, a leading class society and independent laboratory appointed by US Coast Guard.



IMO and USCG compliance combined in one system

How it Works

- > Filtration using superior, advanced disk filtration technology
- > Full-flow electrochlorination

- 1. Disk filtration:** The high quality disk filters have been proven to perform even in water with highest sediment loads while being extremely durable and resistant against corrosion. Reliable filtration without danger of clogging ensures uninterrupted ballast operation and therefore short off-loading operations for the ship's crew.
- 2. Full-flow electrochlorination:** Smaller organisms and algae that are not filtered out are eliminated with a disinfectant produced by electrochlorination of the full ballast flow. A simple process applying electric current converts salt in the intake water into sodium hypochlorite, which is an efficient active substance. The in-situ production is very robust and offers a small footprint while working in difficult environments like turbid waters.

No second treatment during discharge: Discharge of the ballast water requires no filtration or treatment with disinfectant. Only elimination of residual hypochlorite is done by adding the commonly used neutralizing agent sodium thiosulfate.

Models sizes (Treatment rated capacity)	500 ... 3000 m³/h
Treatment capacity	10 - 100% of TRC
Ambient temperature range	min. 0°C - max. 55°C
Electrolyte feed temperature	min. -2°C (ice free) - max. 35°C
Sediment load during ballasting	No limitations (within intended field of use)
Electrolyte feed salinity	0.9 - abt. 65 PSU
Operating pressure range	(recommended min.) 0.8 - max. 6.0 bar
pH-value	no limitations (within intended field of use)
TRO dosage	6 mg/L
Power consumption - Marine & brackish water - Fresh water	< 30 kWh/1000 m³ < 60 kWh/1000 m³
Differential pressure filter backflushing	0.5 bar

Key Features & Benefits

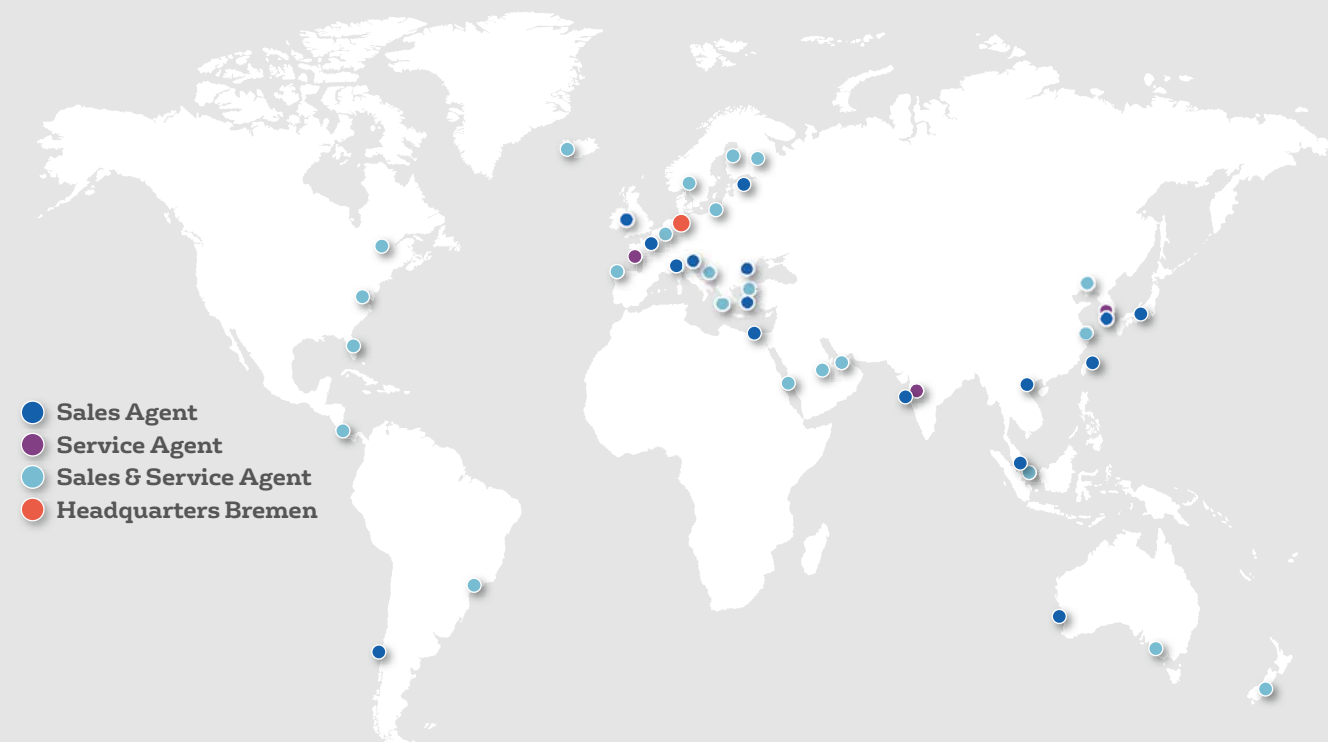
- > Optimized and reliable filtration technology ensures steady and safe ballasting operations, which could shorten port stays
- > Most competitive in view of Total Cost of Ownership (TCO), due to very low OPEX
- > Reduced maintenance due to robust design and simplicity of process for easy operation
- > Amperometric TRO sensor needs no consumables and requires little maintenance

Standard System

- 1. Control cabinet**
- 2. Filter unit for the removal of particles, sediments and larger organisms**
- 3. Electrochlorination (EC) unit for efficient disinfection of the remaining smaller organisms and bacteria**
- 4. Rectifier unit for the power supply of EC unit**
- 5. Dechlorination unit for dosing of neutralization agent at discharge**
- 6. Multiparameter sensor for feed-back control of process parameters**
- 7. Backflushing pump for automatic cleaning of filter units**

The system is fully automatic and controlled by Programmable Logic Controller (PLC). It may be supervised locally using the touch panel on the control cabinet or remotely (as optional) e.g. from the cargo control room. This allows monitoring operation, status messages and alarms from multiple locations. Additionally, the panel PC records data per the applicable IMO/USCG requirements and allows for easy and flexible downloading of operational data (PDF) for reports, Port State Controls etc.

Worldwide Sales & Service Network



Always Near – Always Available

RWO's network of more than 40 qualified sales and service center throughout the world ensure customer benefits due the short communication links to short response times. Thereby, our wide ranging expertise and our products, as well as services has made us a reliable partner in the maritime industry.

Spare Parts

RWO offers original spare parts for all types of water treatment applications. Please contact us for further information: spares@rwo-gmbh.de

Service

Depending on our customers' demands, we offer an individually designed range of services. With our large service network, and our competence in process engineering, we have optimized our service offer: service@rwo-gmbh.de

The Service Range Includes

- > Full service including preventive maintenance, repairs, supply of spare parts and consumables as well as troubleshooting
- > Optimization and updating of the control and measuring technology
- > Support helpline: standby with agreed response times
- > Training of the operating staff

Your Full Customer Care Experience

With the combination of RWO Spare Part Kit and RWO Service Inspection you will benefit from a full Customer Care Package all around the world.

A Spare Parts Kits

- > Emergency Kit
- > Regular Kit
- > Intermediate Kit
- > Docking Kit

B Service Inspection

- > Basic Inspection
- > Extended Inspection

C Customer Care Packages

- > Gold member
- > Silver member
- > Bronze member
- > Basic member

Keep the Heart of Your OWS Protected

It is crucial to have the right spare parts when you operate your oily water separator. Our spare part kits are available from an Emergency Kit upto a Docking Kit.

- > **Emergency Kit**
Reliable protection right from the start. A reliable kit covering basic parts you need in case of 'emergency'.
- > **Regular Kit**
The best choice to keep your machinery running. This kit contains control cabinet, mechanical and consumables components.
- > **Intermediate Kit**
According to maintenance schedule this kit ensures operational reliability after 2,5 years operation. Recommended to this kit is the **OWS - Basic Service Inspection** to extend the guarantee.
- > **Docking Kit**
An all-round kit, containing additional extended components at recommended interval of 5 years of operation. Recommended to this kit is the **OWS - Extended Service Inspection** which facilitates the renewal of the IOPP-Certification incl. the OMD-Recalibration.

Key Features & Benefits

- > Minimized lifecycle costs
- > Improved OWS performance with OEM-parts
- > Minimized unexpected failures
- > Keeping downtime at a minimum
- > Ensuring operational efficiency
- > Correct and timely maintenance

