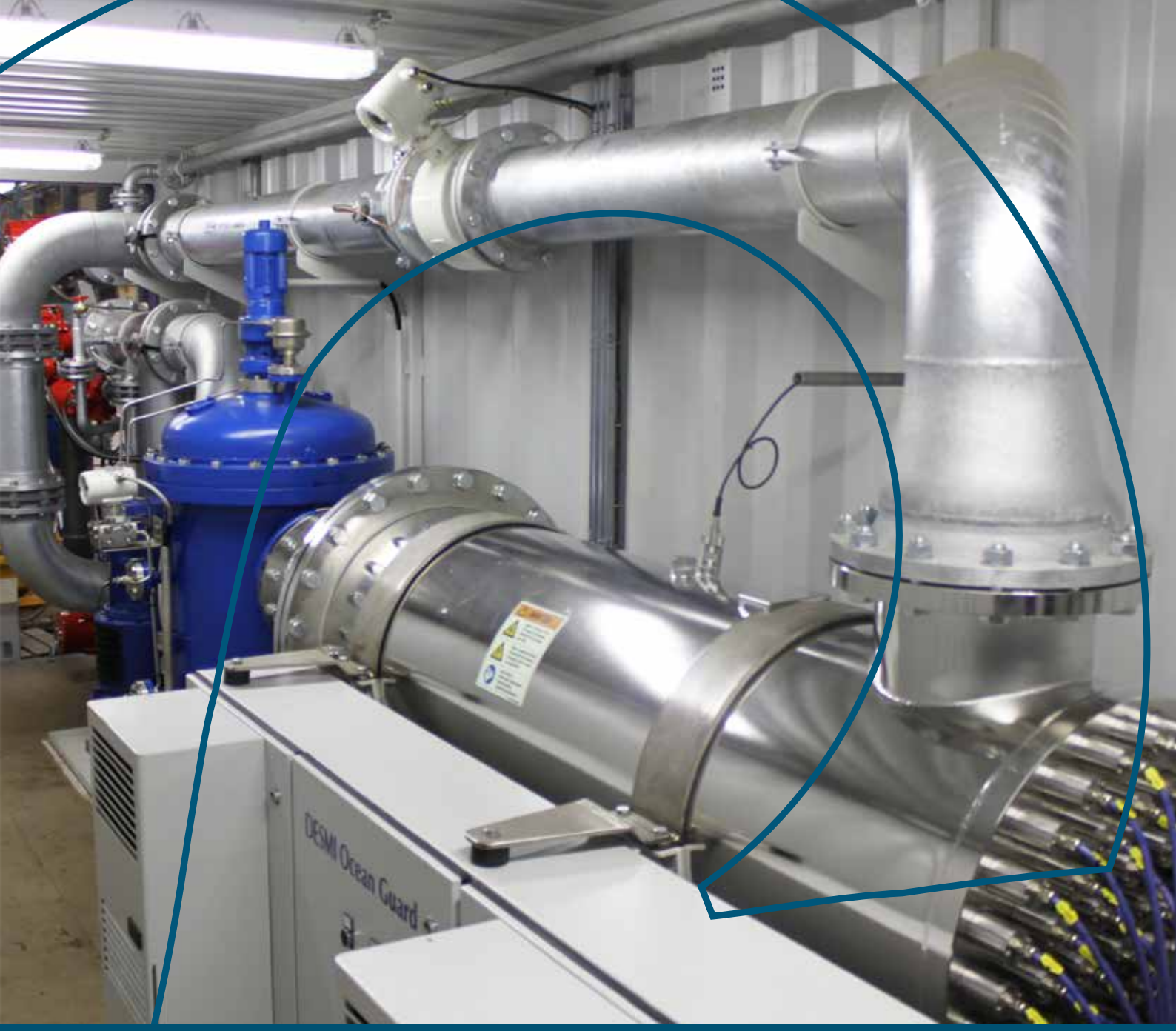


DESMI Ocean Guard RayClean

Ballast Water Treatment System

PROVEN TECHNOLOGY

DESMI

RayClean – lowest energy consumption in class

RayClean Ballast Water Treatment System is the leading system in the marine industry with unrivalled treatment performance and lowest energy consumption in class.

RayClean is tested to meet the latest requirements and guidelines adopted by the International Maritime Organisation (IMO) and the US Coast Guard.
Type approval testing is progressing according to plan and IMO and USCG type approvals are expected in early 2014.

RayClean can be used in all water salinities and temperatures, and automatically adjusts the treatment in order to ensure IMO and USCG compliance at all times with the minimum required power consumption.

Proven effective in all water salinities with UV-T (UV-Transmission) as low as 0.33 which sets the industry benchmark.

The RayClean system automatically adapts the treatment to the quality of the water.

In very clear water the UV lamps are dimmed in order to reduce the energy consumption and in very dirty and unclear water the flowrate is reduced. This results in a system that can cope with more challenging water conditions than any other system - and with the lowest energy consumption in class!

The types of waters that the vessel could encounter can be anything from high salinity to fresh water, high temperatures to low temperatures, and with UV-Transmittance ranging from very high to very low where high UV-T corresponds to very clear water and low UV-T corresponds to extremely coloured and dirty water.

Brackish and freshwater conditions are encountered in many of the world's major ports that are located in rivers or at river estuaries. Examples are Shanghai, Rotterdam and Bremerhaven, to mention just a few.

RayClean has been tested and proven effective in all salinities including fresh water - from very low to very high temperatures and down to a UV-T of 0.33 which sets the industry benchmark.

FILTRATION

RayClean has a self-cleaning filter in order to remove the vast majority of organisms larger than 50 micron.

During de-ballast the filter is used to ensure that organisms which are small or soft enough to pass the filter on uptake, and which have grown large enough to be stopped by the filter mesh at discharge, will be treated and rendered inactive.

The RayClean filter system has a unique and patent pending way of recirculating the filter backflush stream on ballast water discharge.

UV-IRRADIATION

The UV treatment takes place in units with a flow capacity of 300 m^3/h. Each UV unit is equipped with 60 highly efficient low-pressure UV lamps. These lamps are roughly twice as energy efficient as the widely used medium pressure UV lamps, and as they work at much lower temperature they have superior lifetime and no issues with regard to fouling.

Constant online monitoring of the UV intensity inside each unit is used to dim the UV lamps in very clear water (high UV-Transmission) in order to save energy, and to reduce the flow through the unit in extremely unclear water (low UV-Transmission). This ensures a carefully dosed UV treatment at all times resulting in IMO and USCG compliance even in extremely challenging water conditions. All lamp dimming and flow control are fully automatic.

OPERATION

RayClean is a fully automatic process based on a PLC platform, which controls the valves, pumps, UV sensor, flow meters, pressure- and temperature sensors.

The operation of the system is made as simple as possible. The operator only has to start and stop the ballast and de-ballast operation and the remaining part of the operation is then fully automatic.

RayClean can be started or stopped from the colour graphic Touch Screen on the Master Control Panel which can be intregrated in an exsting control system on board the vessel.

RayClean is automatically optimizing the power consumption via dimming of the lamps and regulation of the flow in accordance with the characteristics of the water.

During ballast and de-ballast operations the control system is logging the operation data and time-stamp the date before it is saved into a log file.

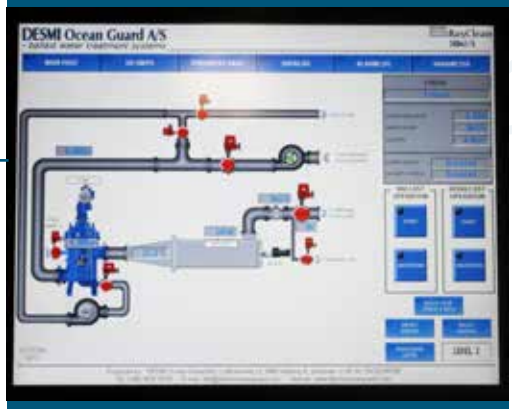
AUTOMATION

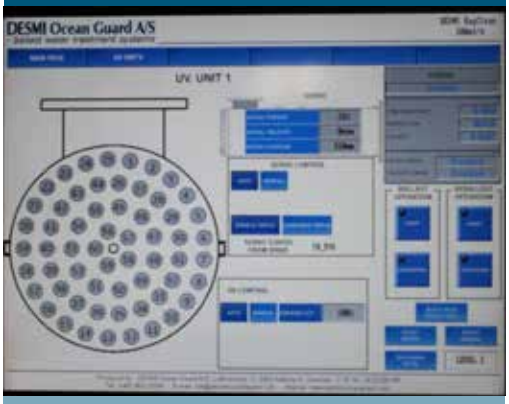
RayClean consists of two types of control panels, a Master Control Panel and a number of UV Control Panels, one for each UV unit.

RayClean is controlled by the PLC located in the Master Control Panel. The UV Control Panels are connected to the Master Control Panel via a Profinet Ring bus.

The Master Control Panel has a 15" colour graphic touch screen (also called HMI). This is used for local control of the system, but as an option one or more HMI's can be offered and integrated into the solution.

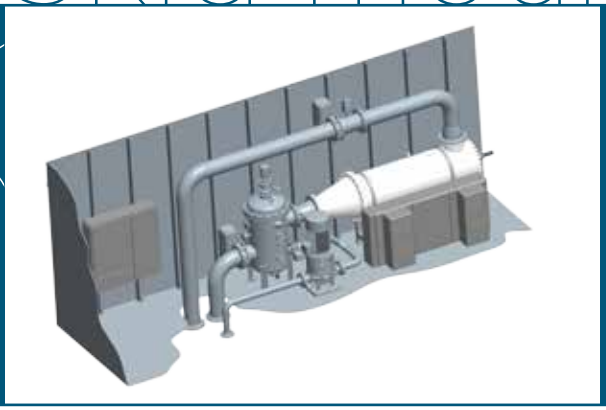
RayClean can interface with the vessel's Integrated Ship Automation System and/or Power Management System. This is can be made either as hardwired signals via a multicore cable and/or as MODBUS RTU communication.

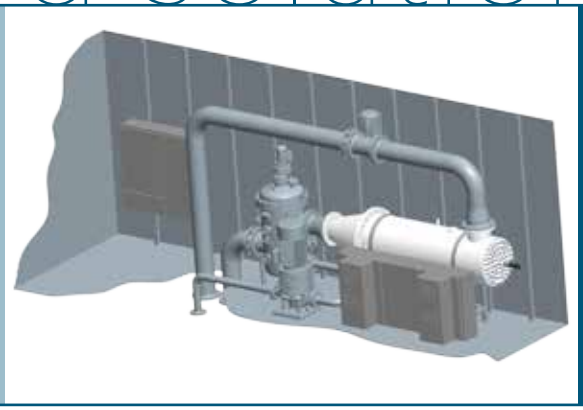




Component delivery

Skid mounted solution





Container solution

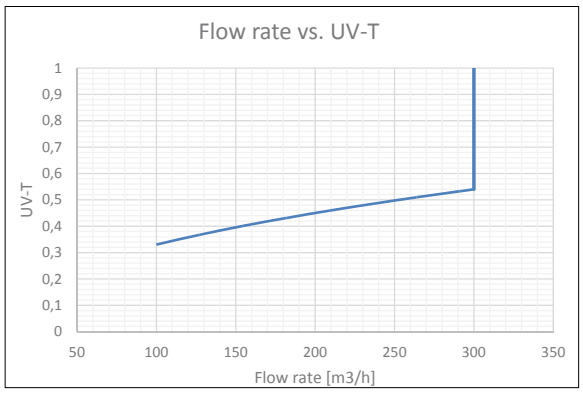
RayClean - lowest energy consumption in class

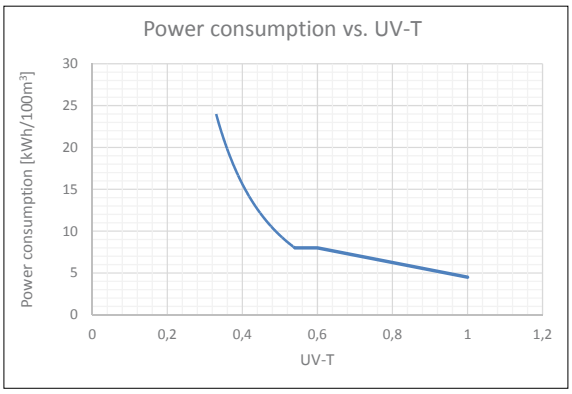
The low power consumption is achieved by use of highly energy efficient low-pressure UV lamps combined with lamp dimming in clear water (high UV-T) and flow reduction in very challenging and unclear water (low UV-T).

By monitoring the UV intensity inside each unit the lamps can be dimmed when the intensity is higher than the critical level, and the flow can be reduced when the intensity is lower than the critical level.

This results in a constant applied UV dose independently of the UV-T of the water to be treated.

Under normal conditions where the UV-T is higher than 0,55 the flowrate per unit is 300 m^3/h and the energy consumption of the entire system is around 8 kWh/100 m^3 when lamps are not dimmed, and as low as 5 kWh/100 m^3 when the lamps are dimmed as much as possible.

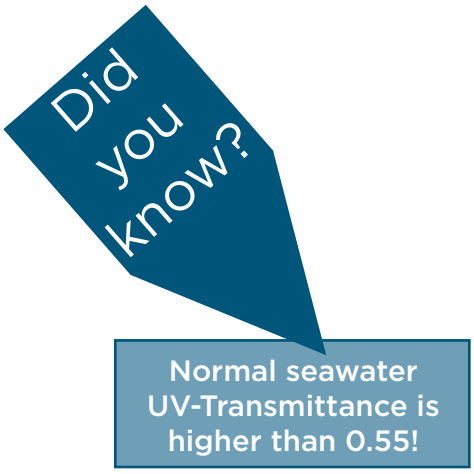




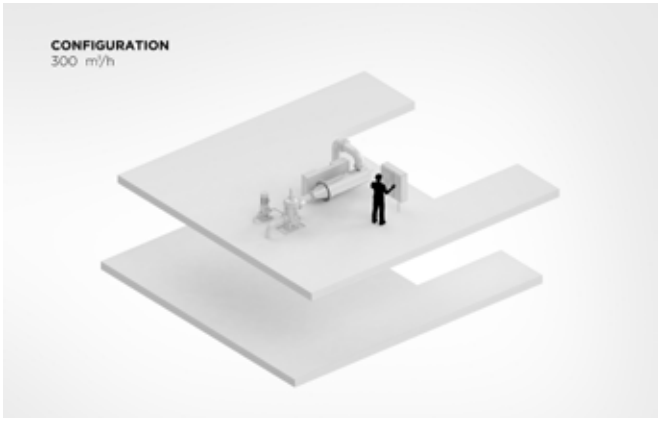
Under challenging conditions with UV-T less than 0.55 the flow rate is reduced gradually and hence the energy consumption per 100 m^3 treated water increases. At the most extreme point water with UV-T as low as 0.33 can be treated at a flowrate of 100 m^3/h, and the corresponding energy consumption is here 24 kWh/100 m^3.

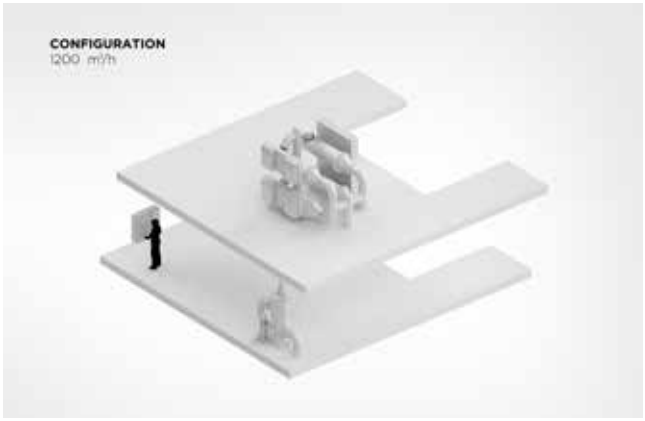
The result of this active monitoring and control is minimum power consumption under all conditions, and certainty that the system will be able to comply with IMO and USCG discharge standards even in extremely challenging water conditions.

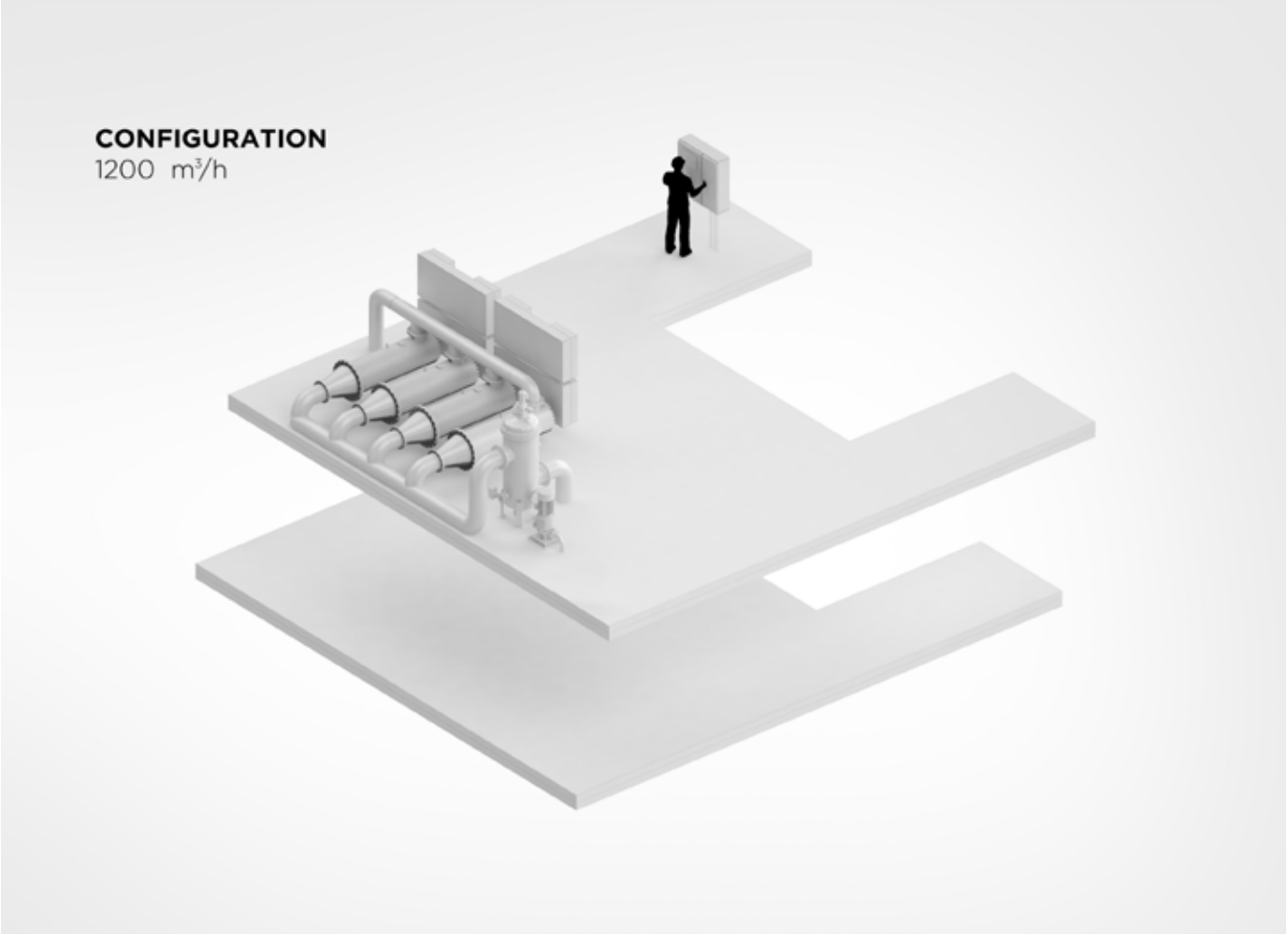
RayClean power consumption	
Size (m^3/h)	Nominal power (kW)
300	24
600	48
900	72
1200	96
1500	120
1800	144
3000	240

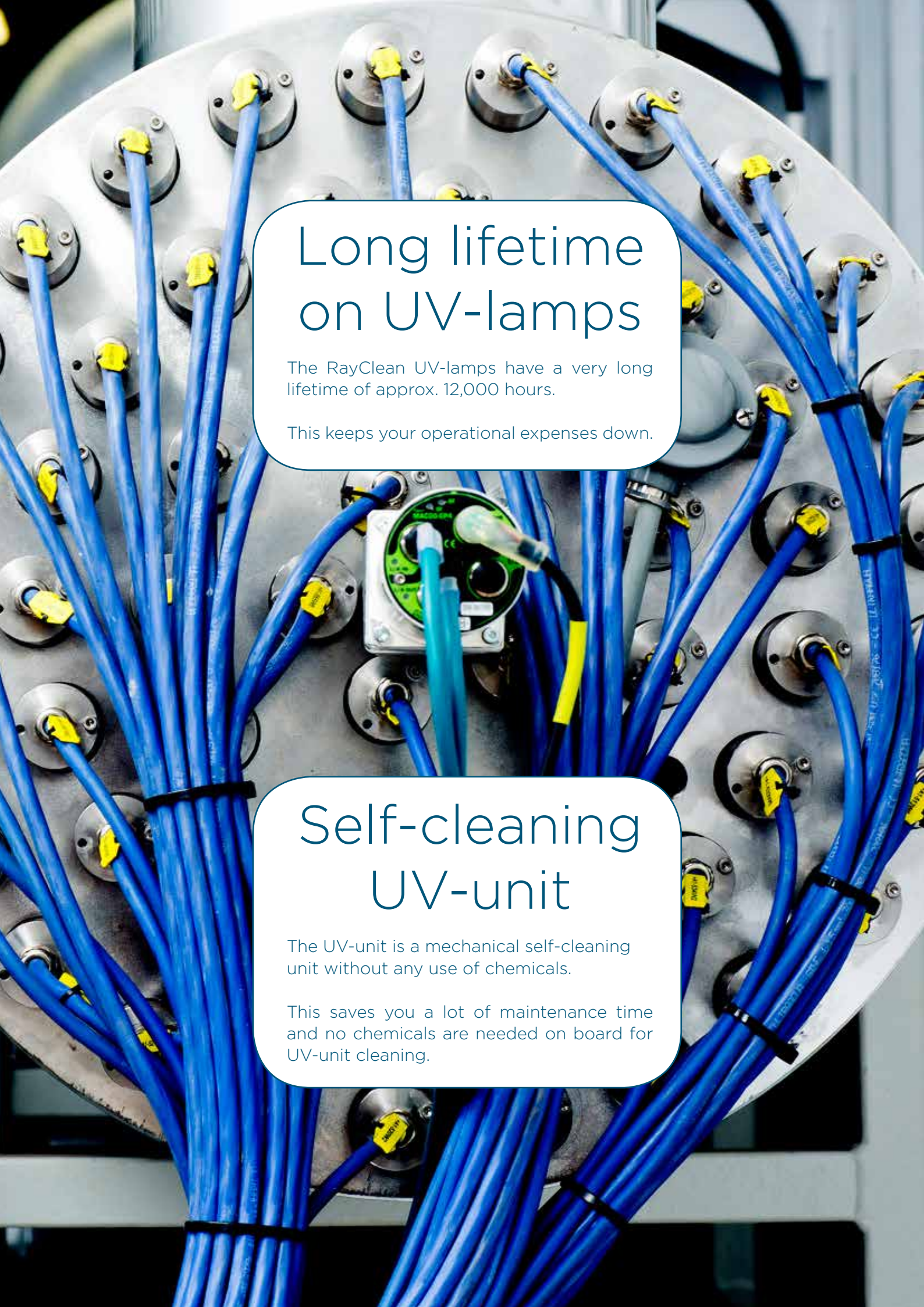


RayClean - Flexible Configuration - Easy Integration









Long lifetime on UV-lamps

The RayClean UV-lamps have a very long lifetime of approx. 12,000 hours.

This keeps your operational expenses down.

Self-cleaning UV-unit

The UV-unit is a mechanical self-cleaning unit without any use of chemicals.

This saves you a lot of maintenance time and no chemicals are needed on board for UV-unit cleaning.

Why say “Yes” to RayClean?

✓ All water salinities

RayClean is proven effective in all water salinities, including fresh water, muddy water & cold water. This gives your ship the flexibility of travelling around the world, making sure de-ballast is allowed in every harbour.
RayClean runs automatically, the operator only has to push “START”.

✓ Low energy consumption

With RayClean you will get very low operating expenses. The energy consumption is the lowest in class, the lifetime on the UV-lamps are up to 12,000 hours and all components are of such a high quality that they will last for a long time.

✓ Type approved

RayClean is expected to be type approved early 2014 according to IMO and USCG.
DNV is monitoring the type approval testing.

✓ Flexible and simple installation

RayClean is a modulized system that can be installed very quickly and according to your requirements, thus reducing down-time to a minimum.
RayClean can also be delivered as a containerized solution.

The DESMI Ocean Guard RayClean BWTS System is developed by DESMI Ocean Guard A/S. The company is owned by A. P. Moller - Maersk, Skjølstrup & Grønborg & DESMI.

Three times competences - Three times expertise
All in one company!

MAERSK

The A.P. Moller - Maersk Group is a worldwide conglomerate with operation in some 130 countries and a workforce of some 108,000 employees. In addition to owning one of the world's largest shipping companies, the Group is involved in a wide range of activities in the energy, logistics, retail and manufacturing industries.

The main shipping companies belonging to the A.P. Moller – Maersk Group are Maersk Line, Maersk Tankers, Maersk Supply Service and Svitzer. Together these companies operate more than 500 container vessels, more than 200 tankers, over 60 supply vessels and more than 500 tugs, salvage and emergency response vessels.

DESMI

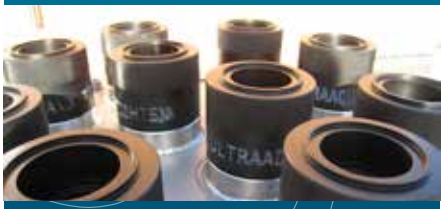
The DESMI group is one of the oldest companies in Denmark, located in Aalborg, Denmark. The mission of DESMI is to develop, manufacture, sell, and service pumps and pumping systems, environmental equipment, and special products related to these areas.

DESMI operates globally in sale and sourcing of components. Sales are effected both directly and through wholly or partly owned companies, agents, and distributors.

ULTRAQUA
WATER RESOURCES TECHNOLOGY

The company Skjølstrup & Grønborg was founded by the two engineers Jens Skjølstrup and Ole Grønborg, and today Skjølstrup & Grønborg is a leading company within sophisticated water treatment. The company is located in Aalborg, Denmark.

Under the brand name UltraAqua, Skjølstrup and Grønborg are today among the leading suppliers of water treatment systems for on- and offshore aquaculture (fishfarms). Zoo's with large basins constantly contaminated with organic material and public swimming pools treated effectively without the hazardous chlorine concentration just above the water line.



Read more about DESMI Ocean Guard and the RayClean BWTS by scanning here.

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