

## TYPE APPROVAL CERTIFICATE

### This is to certify:

**That the Ballast Water Management System**

with type designation(s)  
**RayClean™ BWTS**

Issued to

**DESMI Ocean Guard A/S**  
**NØRRESUNDBY, Denmark**

is found to comply with  
**Resolution MEPC.174(58)**  
**Det Norske Veritas' Rules for Classification of Ships**  
**DNV Type Approval Program No.771.91**

### Application :

**This is to certify that the Ballast Water Management System listed above has been examined and tested in accordance with the requirements of the specifications contained in Guidelines contained in Resolution MEPC.174(58) and DNV Rules stated above. This Certificate is valid only for the Ballast Water Management System referred to above.**

**This Certificate is issued on behalf of the Danish Maritime Authority and Danish Nature Agency.**

This Certificate is valid until **2018-12-31**.

Issued at **Høvik** on **2014-09-05**

DNV GL local station: **Aalborg**

Approval Engineer: **Ingrid Sigvaldsen**

for **DNV GL**

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**Dag Sæle-Nilsen**  
**Head of Section**

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed. If any person suffers loss or damage which is proven to have been caused by any negligent act or omission of the Society, then the Society shall pay compensation to such person for his proven direct loss or damage. However, the compensation shall not exceed an amount equal to ten times the fee charged for the service in question. The maximum compensation shall never exceed USD 2 million. In this provision the "Society" shall mean DNV GL AS as well as all its direct and indirect owners, affiliates, subsidiaries, directors, officers, employees, agents and any other person or entity acting on behalf of DNV GL AS.

Certificate No: **P-14955**  
 File No: **771.91**  
 Job Id: **262.1-014477-1**

## Type and model designation

RayClean™ BWTS, RayClean-300  
 Place of production: Nørresundby, Denmark

## Equipment /assembly drawings

TYPE	Description	Drawing no.	Rev.
Pipe and instrumentation diagram	BWTS 300 m3/h Non-EX RayClean BWTS	470460	A
Wiring diagram	Master Control Panel MCP	Project no. 2000002	17-7-2014
Wiring diagram	UV Control Panel UVCP	Project no. 200002	17-7-2014

## Product description

The RayClean Ballast Water Management System description is given in "Operation Maintenance and Safety Manual for RayClean by DESMI OceanGuard" approved by DNV.

Treatment sequence:

- Ballast water uptake: Filtration and UV Disinfection
- Ballast water discharge: Filtration and UV Disinfection

## Application/Limitation<sup>i</sup>

Treatment rated capacity (TRC) (m <sup>3</sup> /h) <sup>ii</sup>	Min UV- Intensity (W/cm <sup>2</sup> )	Min. UV – Transmittance (%)
300	55-165 <sup>iii</sup>	33-55

- Verified through 15 tests meeting D-2 discharge standard on G8 land-based challenge water in fresh, brackish and marine water and 5 tests meeting D-2 discharge standard on G8 shipboard challenge water.
- TRC is defined as net flow out of the treatment system, a net flow exceeding the given value implies that the ballast water is not treated in accordance with this certificate.
- When the UVI is between 55-165 W/m<sup>2</sup>, the flow will be regulated between 100-300m<sup>3</sup>/h to achieve the required dose. UV intensity below the lower limit implies that the ballast water is not treated in accordance with this certificate.

Minimum capacity is 30 m<sup>3</sup>/h.

Salinity and temperature are no limiting conditions for this system.

## UV unit

The system is equipped with an UV-lamp power optimization control. UV-lamp power usage is reduced in favourable water conditions based on measured UV-intensity. Lamp power usage can be reduced by up to 50%.

UV units can be installed in parallel configuration to achieve treatment rated capacities up to 3000m<sup>3</sup>/h according to the RayClean document 1011 "Overview Main Components and Sizes – RayClean BWTS" dated 06-06-2014 and the RayClean installation guide.

## Filter

Filter(s) shall be installed that corresponds to the ballast flow capacity.

## Boll & Kirch Filter, - 30µm wire mesh

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The type approved system includes a Bollfilter Automatic Filter Selfclean type 6.18.3 BWT with 30µm wire mesh. The filter is designed for 6 or 10 Bar. The maximum allowed filter differential pressure to initiate backflush is 0.5 bar.

<b>Boll &amp; Kirch type</b>	<b>Filter max flow (m3/h)</b>
717687 (6.18.3.419)	220
717688 (6.18.3.521)	300
717689 (6.18.3.600)	450
717690 (6.18.3.750)	850
717691 (6.18.3.900)	1250
717692 (6.18.3.1000)	1500
717693 (6.18.3.1100)	2250
717694 (6.18.3.1200)	2500
717695 (6.18.3.1330)	3000

## Operational specifications for the different components

### Flow Meter and Control Valve

The type approved system must be installed with a flow meter and a means for regulating the flow through each UV unit according to the approved control curve.

Information regarding the selected components shall be part of the documentation related to the specific installation, either by a reference to valid type approval certificate or technical documentation.

### Control Equipment

The type approved system includes the following control units and sensors:

<b>Name</b>	<b>Model</b>	<b>Software Revision</b>
UV Control Panel	UV CONTROL PANEL RayClean Non-EX UV CABLE OUT RIGHT UV CONTROL PANEL RayClean Non-EX UV CABLE OUT LEFT	
Master Control Panel	MASTER CONTROL PANEL RayClean 300 Non-EX MASTER CONTROL PANEL RayClean 600 Non-EX MASTER CONTROL PANEL RayClean 900 Non-EX MASTER CONTROL PANEL RayClean 1200 - 3000 Non-EX	V01.08 05.09.2013
Power Distribution Cabinet <sup>iv</sup>	POWER DISTRIBUTION PANEL RayClean 1200 Non-EX POWER DISTRIBUTION PANEL RayClean 1500 Non-EX POWER DISTRIBUTION PANEL RayClean 1800 Non-EX POWER DISTRIBUTION PANEL RayClean 2100 Non-EX POWER DISTRIBUTION PANEL RayClean 2400 Non-EX POWER DISTRIBUTION PANEL RayClean 2700 Non-EX POWER DISTRIBUTION PANEL RayClean 3000 Non-EX	-----
UV Sensor	ZED D-SiCONORM-LP	-----

iv. Only for systems with TRC greater than 900 m3/h.

All changes in software are to be recorded as long as the system is in use onboard. The records of all changes are to be forwarded to DNV for evaluation and approval.

Major changes to the software are to be approved before installed in the computer.

A Certification of Application Functions may be required for the particular vessel.

## Documents approval

The following documentation is to be submitted for approval in each case.

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- Piping and Instrumentation Diagram (P&ID) of the ballast system including the treatment system installation
- Power supply arrangement
- An overview of all controlled and monitored points, (I/O list)
- Description confirming the arrangement of alarms for bypass of the BWMS

### **Type Approval documentation**

- Biological efficacy performance evaluation of Ballast Water Management System, QAPP/V2.1/2012.11
- Preliminary Land Based Test Plan for RayClean (BWTS), 2012-11-13, rev. 2.
- RayClean Land-based testing -Final report, dated April 2014.
- RayClean - Shipboard test -Final report, dated May 2014.
- Operation Maintenance and Safety manual for RayClean, doc no. 10089, rev. 17, dated 2014-07-04.
- Piping and instrumentation diagram with drawing number 470442 and 470458.
- Drawing Package Ballast Water Treatment (BWT)
- DELTA Test report, DANAK-19/14301, dated 2014-07-02
- Factory Acceptance Test

### **Tests carried out**

- Land-based testing in accordance with Resolution MEPC.174 (58) witnessed by DNV
- Shipboard testing in accordance with Resolution MEPC.174 (58) witnessed by DNV
- Factory Acceptance Test of the control and automation system witnessed by DNV
- Environmental testing in accordance with Environmental test specification for instrumentation and automation equipment, DNV Standard for Certification No. 2.4 (April 2006) and Resolution MEPC.174 (58)

### **Marking of product**

For traceability of this Type Approval, each treatment system is to be marked with:

- Manufacturer's name or trade mark
- Type designation
- Serial number

### **Periodical assessment**

For retention of the Type Approval, DNV Surveyor shall perform periodical assessments to verify that the conditions of the TA are not altered since the certificate was issued.

The scope of periodical assessment includes:

Review of the TA documentation and verification that the documentation is still used as basis for the production.

Review of possible changes in design, material and performance of the product.

Verification of the company's production and quality systems ensuring continued consistent production of the type approved products to the required quality.

Verification that the product marking for identification and traceability to the TA Certificate is not altered.

### **Copy of type approval certificate**

A copy of this type approval certificate should be carried onboard a vessel fitted with this ballast water management system at all times. An annex containing the summary reports of the test results of landbased

and shipboard tests should be available for inspection onboard the vessel.