

## Type Approval Certificate of Ballast Water Management System

This is to certify that the Ballast Water Management System listed below has been examined and tested in accordance with the requirements of the specifications contained in the Guidelines contained in IMO Resolution MEPC.169(57) and MEPC.174(58). This certificate is valid only for Ballast Water Management system referred to below.

**This certificate is issued to:**

**Producer** Desmi Ocean Guard A/S  
**Address** Lufthavnsvej 12  
 DK-9400 Nørresundby  
 Denmark

**Ballast Water Management System supplied by:** Desmi Ocean Guard A/S

**Under type and model designation and incorporating:** Mechanical filtration in combination with ozone and ultraviolet radiation with models - Oxyclean 75 to 3000.

**Ballast Water Management System manufactured by:** Desmi Ocean Guard A/S

<b>To equipment/assembly drawing No:</b>	40' Test container - DOGDWG_0113, Rev 2	<b>Date:</b> 16.08.2011
	40' Test container - DOGDWG_0111, Rev 7	<b>Date:</b> 17.08.2011
	Land based test - 2011-LT-PID-300-B, Rev 2	<b>Date:</b> 15.02.2011
	Land based test - 2011-LT-PID-300-D, Rev 2	<b>Date:</b> 15.02.2011

**Other equipment manufactured by:** See attached Design appraisal Document

**To equipment/assembly drawing No:** See attached Design appraisal Document

**Treatment Rated Capacity:** 75 to 3000 **m<sup>3</sup>/h**

A copy of this Type Approval Certificate should be carried on board a vessel fitted with this Ballast Water Management System at all times. A reference to the test protocol and a copy of the test results should be available for inspection on board the vessel. If the Type Approval Certificate is issued based on approval by another Administration, reference to that Type Approval Certificate shall be made.

Limiting Conditions imposed as described in the Design Appraisal Document forms part of this certificate.

Date of issue 07 November 2012 Expiry date 06 November 2017

**Certificate No.** MCA 1200027

Lloyd's Register EMEA  
A member of the Lloyd's Register group

Design Support, London Office

**EXAMINED**

For compliance with the requirements of IMO Res.MEPC.174(58)

Ref. Number: **MCA 1200027** Name: **U. Okon**

Date: 07/11/2012 Initials: UO

Lloyd's Register



**Sheet No** 1 of 11

U. Okon  
 Surveyor to Lloyd's Register EMEA  
 A Member of the Lloyd's Register Group

**Note:**  
 This certificate is issued on the behalf of the Danish Maritime Authority in accordance with the Danish Class Agreement 2012, Annex I, Chapter 1, Article 4.

This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify the nominated body named on this certificate of any modification or changes to the equipment in order to obtain a valid Certificate.

**DESIGN APPRAISAL DOCUMENT**

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/UE/W03146481/WP12254700
--------------------------	---

**ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. MCA 1200027**

The undernoted documents have been appraised for compliance with the relevant International Conventions for the Type Approval of Ballast Water Management Systems.

This Design Appraisal Document forms part of the Certificate that is issued under the authority given by the Danish Maritime Authority in the Danish Class Agreement 2012, Annex I, Chapter 1, Article 4.

**PLACE OF PRODUCTION**

Tagholm 1  
DK-9400 Nørresundby  
Denmark

**APPROVED RATINGS**

System	TRC m <sup>3</sup> /h	Filter	No. of UV units capability		No. of lamps		No. of UV intensity Sensor		No. of salinity sensor	Ozone injector	Static mixer (Desmi Ocean Guard Static Mixer)
			SW	FW	SW	FW	SW	FW			
Oxyclean 100	100	DN 200	1	2	9	18	1	2	1	Ejector	DN 150
Oxyclean 200	200	DN 250	2	3	18	27	2	3	1	Ejector	DN 200
Oxyclean 300	300	DN 300	3	4	27	36	3	4	1	Ejector	DN 200
Oxyclean 400	400	DN 350	4	6	36	54	4	6	1	Ejector	DN 250
Oxyclean 500	500	DN 350	5	7	45	63	5	7	1	Ejector	DN 250
Oxyclean 600	600	DN 400	6	8	54	72	6	8	1	Ejector	DN 300
Oxyclean 700	700	DN 400	7	10	63	90	7	10	1	Ejector	DN 300
Oxyclean 800	800	DN 500	8	11	72	99	8	11	1	Ejector	DN 350
Oxyclean 900	900	DN 500	9	12	81	108	9	12	1	Ejector	DN 350
Oxyclean 1000	1000	DN 500	10	14	90	126	10	14	1	Ejector	DN 350
Oxyclean 1100	1100	DN 600	11	15	99	135	11	15	1	Ejector	DN 400
Oxyclean 1200	1200	DN 600	12	16	108	144	12	16	1	Ejector	DN 400
Oxyclean 1300	1300	DN 600	13	18	117	162	13	18	1	Ejector	DN 400
Oxyclean 1400	1400	DN 600	14	19	126	171	14	19	1	Ejector	DN 500
Oxyclean 1500	1500	DN 600	15	20	135	180	15	20	1	Ejector	DN 500
Oxyclean 1600	1600	DN 700	16	22	144	198	16	22	1	Ejector	DN 500
Oxyclean 1700	1700	DN 700	17	23	153	207	17	23	1	Ejector	DN 500
Oxyclean 1800	1800	DN 700	18	24	162	216	18	24	1	Ejector	DN 500
Oxyclean 1900	1900	DN 700	19	26	171	234	19	26	1	Ejector	DN 500
Oxyclean 2000	2000	DN 700	20	27	180	243	20	27	1	Ejector	DN 500
Oxyclean 2100	2100	DN 800	21	28	189	252	21	28	1	Ejector	DN 500
Oxyclean 2200	2200	DN 800	22	30	198	270	22	30	1	Ejector	DN 600
Oxyclean 2300	2300	DN 800	23	31	207	279	23	31	1	Ejector	DN 600
Oxyclean 2400	2400	DN 800	24	32	216	288	24	32	1	Ejector	DN 600
Oxyclean 2500	2500	DN 800	25	34	225	306	25	34	1	Ejector	DN 600
Oxyclean 2600	2600	DN 900	26	35	234	315	26	35	1	Ejector	DN 600
Oxyclean 2700	2700	DN 900	27	36	243	324	27	36	1	Ejector	DN 600
Oxyclean 2800	2800	DN 900	28	38	252	342	28	38	1	Ejector	DN 600
Oxyclean 2900	2900	DN 900	29	39	261	351	29	39	1	Ejector	DN 600
Oxyclean 3000	3000	DN 900	30	40	270	360	30	40	1	Ejector	DN 600

**Please note:**

For PSU > 3 at sea water capability, a treated rated capacity of 100m<sup>3</sup>/hr is required per UV unit.  
For PSU < 3 at fresh water capability, a treated rated capacity of 75m<sup>3</sup>/hr is required per UV unit.

**DESIGN APPRAISAL DOCUMENT**

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/VO/W03146481/WP12254700
--------------------------	---

**TECHNICAL DESCRIPTION OF MAJOR COMPONENTS**

<b>Filters:</b>	
Manufacturer	BOLL & KIRCH Filterbau GmbH P.O. Box 1420, 50143 Kerpen Siemens str. 10-14, D-50170 Kerpen FON: +49 2273 591-9993 FAX: +49 2273 562-223
Filter models	6.18.2 BWT
Filter types	DN 200, 250, 300, 350, 400, 500, 600, 700, 800 and 900
Capacity range	64 - 3000 m3/h
Mesh size	30 µ
Maximum design pressure	10 bar
Max. working temperature	60°C
Filter body	Steel P265 GH

<b>UV Reactor:</b>	
Material	SS 316l or SMO 254
Mounting	Horizontal
Reactor connection	Flanges according to DIN-EN 1092
Seals	O-ring, EPDM and Viton Rubber
Components	UV Lamp, UV intensity sensor, draining valves, quartz sleeves, air inlet and ozone outlet.
Max operating pressure	10 bar
Volume approx	130 litres
Protection class	IP 68

<b>UV Lamp:</b>	
Manufacturer	HERAEUS Noblelight GmbH
UV Lamp model	Mercury low pressure lamp, Longlife Amalgam Lamp.
Type of Lamp	Strahler NIQ 800/150XL OOA
Quantity of lamps in 1 UV unit	9
Power input	800 W
Lamp input current	7,5 A
Lamp Voltage	100 V

<b>UV intensity sensor:</b>	
Manufacturer	ZED Ziegler Electronic Devices GmbH
Model	D-SiCONORM-LP
Protection class	10 bar / IP64
Supply voltage	12-24 V (stabilized)
Spectral range	220 - 290 nm; 99% at 254nm
Operation temperature (water)	0 - 40°C

**DESIGN APPRAISAL DOCUMENT**

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/UE/W03146481/WP12254700
--------------------------	---

<b>Salinity sensor:</b>	
Manufacturer	Georg Fischer Signet LLC
Model	2842
Max operating pressure	6.9 bar
Operating temperature range	-10°C - 100°C

<b>Ozone system:</b>	
Ozone injector	Korting hannover AG Korting Liquid Jet Vacuum Ejector
Dew point of dry air supply	< -10°C
Air flow approx.	8m <sup>3</sup> /hr per UV
Ozone generated approx.	15g/h per UV

<b>Cleaning in place system:</b>	
Dosage pump flow	10L/min
CIP interval (recommended)	500 running hours or Average UV intensity of less than 35W/m <sup>2</sup>
CIP fluid approx.	1.25 litres 20% citric acid per UV unit

<b>Power:</b>	
Supply voltage (V/Hz) 400/230 / 50-60	Power consumption: Approx 7.5kW per UV unit

Page 5 of 11
Document number MCA 1200027
Issue number 1

**DESIGN APPRAISAL DOCUMENT**

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/UO/W03146481/WP12254700
--------------------------	---

**SUMMARY OF LAND AND SHIPBOARD TEST RESULTS**

- a) Land based test and shipboard test was conducted by DHI, Horsholm and Hundested, Denmark.
- b) Desmi Ocean Guard prototype model- Oxyclean 300 (previously P40 - 300) was used in conducting both land and shipboard testing.
- c) All sampling was done in triplicate.
- d) Total bacteria was determined by the spread plate method according to ISO 8199, and according to NEN-EN-ISO 6222:1999.
- e) During landbased testing, E.coli were determined according to IDEXX Coli-ert kit while Enterococci were determined according to IDEXX Enterolert kit. A modified EN ISO 9308-3 and EN ISO 7899-1 were used for the shipboard testing.
- f) Vibrio cholerae were determined according to sections of ISO 21872:2007
- g) Organisms < 50µm were determined by vital staining and enumerated using a combination of fluorescence microscopy with measurements of primary production and using MPN analysis.
- h) Organisms > 50µm were determined by staining Neutral Red and enumerated using standard movement and response to stimuli technique.

**DESCRIPTION OF ACTIVE SUBSTANCE**

An Active Substance (ozone) and short-lived oxygen radicals produced from photons are generated *in situ* by the treatment process of the DESMI Ocean Guard system.

Desmi Ocean Guard Ballast Water Management System received Basic Approval at MEPC 60 based on the recommendation of the GESAMP-Ballast Water Working Group (MEPC 60/2/12) in accordance with the Procedure for approval of ballast water management systems that make use of active substance(G9) adopted by resolution MEPC.169(57).

Desmi Ocean Guard Ballast Water Management System received Final Approval in MEPC 64 with the current draft report reference MEPC64/WP.1/2.6 in accordance with the Procedure for approval of ballast water management systems that make use of active substance(G9) adopted by resolution MEPC.169(57).

**DESIGN APPRAISAL DOCUMENT**

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/UE/W03146481/WP12254700
--------------------------	---

Land based test summary		Brackish water test cycles (3-32 PSU)				
Size category	Sample	Test cycle A	Test cycle B	Test cycle C	Test cycle E	Test cycle F
≥ 50 µm (#/m3)	Inlet	283,133	195,847	241,167	152,344	106,605
	Control discharge	47,800	36,300	36,600	80,157	161,522
	Treated discharge	7	9	9	4	0
≥10 and <50 µm (#/mL)	Inlet	1,340	2,537	3,498	3,208	1,479
	Control discharge	1600*	477*	477*	540*	957*
	Treated discharge	0*	0.2*	0.2*	0*	0.2*
<i>E. coli</i> (CFU/100 mL)	Inlet	2	1	1	7	2,420
	Control discharge	1	1	1	1	2,058
	Treated discharge	1	1	1	1	1
Enterococci (CFU/100 mL)	Inlet	66	192	127	2420	569
	Control discharge	81	94	94	8	960
	Treated discharge	1	1	1	1	1
<i>Vibrio cholera</i> (CFU/mL)	Inlet / Control discharge	-	-	-	-	-
	Treated discharge	0	0	0	0	0

Land based test: Brackish water parameters						
Cycle	Salinity	Temp	PH	TSS	TRO	UV-T
	PSU	°C	PH	mg/L	mg Cl <sub>2</sub> /L	%
A	18,2	0,7	8,2	53,1	-	54
B	17,8	1,9	8,2	56,7	-	49
C	17,8	2,0	8,3	57,1	-	49
E	17,9	4,4	8,2	48,0	0,04	46
F	17,9	11,3	8,3	51,6	-	56

**DESIGN APPRAISAL DOCUMENT**

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/UE/W03146481/WP12254700
--------------------------	---

Land based test summary		Freshwater test cycles (<3 PSU)				
Size category	Sample	Test cycle G	Test cycle H	Test cycle I	Test cycle J	Test cycle K
≥ 50 µm (#/m3)	Inlet	1,308,200	2,084,117	107,811	112,364	116,667
	Control discharge	37,030	37,030	31,354	31,354	33,022
	Treated discharge	0	0	5	0	0
≥10 and <50 µm (#/mL)	Inlet	1,814	1,842	1,860	2,009	2,947
	Control discharge	793*	793*	1,600*	1,600*	957*
	Treated discharge	0.3*	0.2*	2.4*	3.4*	0.4*
<i>E. coli</i> (CFU/100 mL)	Inlet	19	12	17	14	100
	Control discharge	2	2	1	1	15.2
	Treated discharge	1	1	1	1	1
Enterococci (CFU/100 mL)	Inlet	214	101	6	147	76
	Control discharge	528	528	4	4	3.5
	Treated discharge	1	1	1	1	1
<i>Vibrio cholera</i> (CFU/mL)	Inlet / Control discharge	-	-	-	-	-
	Treated discharge	0	0	0	0	0

Land based test: Fresh water parameters						
Cycle	Salinity	Temp	PH	TSS	TRO	UV-T
	PSU	°C	PH	mg/L	mg Cl <sub>2</sub> /L	%
G	0,1	14,1	8,3	58,3	-	45
H	0,1	14,9	8,3	61,1	-	38
I	0,1	17,4	8,3	56,1	0,08	48
J	0,1	17,4	8,2	50,1	0,11	43
K	0,4	17,7	8,3	53,1	-	47

**DESIGN APPRAISAL DOCUMENT**

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/UE/W03146481/WP12254700
--------------------------	---

<b>1st shipboard test summary: Control Tank of Uptake Water</b>				
	Trial 1	Trial 2	Trial 3	Average
Organisms >50 µm [counts/m <sup>3</sup> ]	4892	8199	9983	7691
Organisms 10-50 µm [counts/mL]	>150	>160	54	-
<i>E. coli</i> [cfu/mL]	<10	130	<10	-
Enterococci [cfu/mL]	120	21	<10	-
<i>Vibrio cholera</i> [cfu/mL]	<1	<1	<1	-

<b>2nd shipboard test summary: Control Tank of Discharged Water</b>				
	Trial 1	Trial 2	Trial 3	Average
Organisms >50 µm [counts/m <sup>3</sup> ]	579	2010	1347	1312
Organisms 10-50 µm [counts/mL]	>160	>160	46	-
<i>E. coli</i> [cfu/mL]	800	14	<10	-
Enterococci [cfu/mL]	280	<10	<10	-
<i>Vibrio cholera</i> [cfu/mL]	<1	<1	<1	-

<b>3rd shipboard test summary: Treated Tank of Discharged water</b>				
	Trial 1	Trial 2	Trial 3	Average
Organisms >50 µm [counts/m <sup>3</sup> ]	0.17	0.26	0	0.14
Organisms 10-50 µm [counts/mL]	<0.18	<0.18	<0.18	-
<i>E. coli</i> [cfu/mL]	<10	<10	<10	-
Enterococci [cfu/mL]	<10	<10	<10	-
<i>Vibrio cholera</i> [cfu/mL]	<1	<1	<1	-

<b>Shipboard test parameters</b>						
Cycle	Salinity	Temp	PH	TSS	TRO	UV-T
	PSU	°C	PH	mg/L	mg Cl <sub>2</sub> /L	%
1	34,0	20,0	7,9	59,0	-	-
2	34,4	19,5	7,9	48,0	-	-
3	37,1	23,9	8,2	11,0	-	-



Page 9 of 11
Document number MCA 1200027
Issue number 1

**DESIGN APPRAISAL DOCUMENT**

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/UE/W03146481/WP12254700
--------------------------	---

**APPROVAL DOCUMENTATION**

Request for Services form	10th Nov 2009
40' Test container - DOGDWG_0113, Rev 2	16th Aug 2011
40' Test container - DOGDWG_0111, Rev 7	17th Aug 2011
Land based test - 2011-LT-PID-300-B, Rev 2	15th Feb 2011
Land based test - 2011-LT-PID-300-D, Rev 2	15th Feb 2011
Oxyclean - Operation and Technical manual, Rev 2	11th Oct 2012
DELTA test report - UV lamp and lamp driver	DANAK-19/12164; No.T200875; 18th Jun 2012
Oxyclean - 1 Ozone injection unit; Rev 2	22nd Oct 2012
BWTS Static Mixer	No.210-TA-2012 Rev 2; 07th Sept 2012
UV Unit, Rev 5	No.1769-101
LR BWTS Approval Checklist, Ver 1.10	01st Oct 2012

**TEST REPORTS**

Pilot test scale at DHI,	No. 11800984, Ver 0.2, Undated
Final Report - Immersion testing on coated and uncoated panels in ozone treated water	No. 4C 1303031-433373 DSP/BBJ, 31st Jan 2012
Summary - Immersion testing on coated and uncoated panels in ozone treated water	14th Feb 2012, DSP/NTA
Toxicity and risk evaluation for basic approval by DHI	No11805398; 12th Aug 2009
Land based test report by DHI	No. 11806056-1; 19th Aug 2009
Quality Assurance Project Plan	No.11806056; 22nd Mar 2011
Land based Quality Management Plan - DHI, Denmark	07th Sept 2011; Ver 2.3
LR Land based test review	LDSO/ENG/WP12254700; Rev 2.0; 22nd Oct 2012
LR Land based test visit reports	No. CPN0900944,
Shipboard test report by DHI	No. 11810704; 13th Jun 2012
Shipboard Quality Management Plan - DHI, Denmark	No.11810704; 09th Sept 2011
DHI, Denmark Certificate of Compliance by LR	DS/1093222-A; 09th May 2012
LR Shipboard test visit reports	12th Sept 2011 - 23rd Apr 2012
LR Shipboard test review	LDSO/ENG/WP12254700; Rev 2.0; 22nd Oct 2012
DELTA test report - UV lamp and lamp driver	DANAK-19/12164; No.T200875; 18th Jun 2012
LR environmental test report to Part 3, MEPC.174(58)	LDS/ETS/10579206-2, Issue 1
Application for final approval of D	Aug 2011 Agenda Item 2, MEPC 63

Page 10 of 11
Document number MCA 1200027
Issue number 1

**DESIGN APPRAISAL DOCUMENT**

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/UO/W03146481/WP12254700
--------------------------	---

**CONDITIONS OF CERTIFICATION**

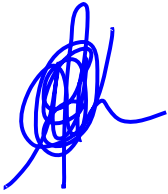
1. Notwithstanding the requirement to report before the fifth anniversary of the date of the type approval certificate, the licensee is required to comply with the following additional provisions:
  - 1.1 The licensee must report immediately all events to the Danish Maritime Authority leading to harm either to human health or the environment as a result of the operation of the ballast water management system.
  - 1.2 Any indications that the ballast water management system is not performing to the standards of the ballast water convention must be reported to the Danish Maritime Authority including any deficiencies identified by port State control.
  - 1.3 All accidents (e.g., accidental exposure to UV) in connection with the ballast water management system must be reported immediately to the Danish Maritime Authority.
  - 1.4 There shall be no deviation from the approved ratings listed. Significant changes in the construction or technical specification of the ballast water management system must be reported to both the Danish Maritime Authority and the recognised organisation that issued the type approval certificate on behalf of the Danish Maritime Authority; if they potentially affect the efficiency of the system, they must be approved by the Danish Maritime Authority.
  - 1.5 The licensee must take reasonable measures to ensure that the operator of the system is familiar with the operation of the system and is capable of operating and maintaining the system in accordance with the operating manual.
  - 1.6 If the licensee does not comply with these additional provisions, the type approval may be revoked by the Danish Maritime Authority.
2. Details of the location of the Desmi Ocean Guard OXYCLEAN ballast water treatment system, and its connection into the ship's ballast system are to be shown on the ship's plans, which are to be submitted for approval.
3. During installation survey and commissioning, verification is to be conducted as in IMO resolution MEPC.174(58) Section 8 to the satisfaction of the attending Surveyor.
4. All ballast water intake to ballast tanks and discharge from the ballast tanks are to be circulated through the filtration unit before discharge overboard. There shall be no back flushing from the filtration unit during de-ballasting overboard, except to the OXYCLEAN ballast water treatment system.
5. Electrical and electronic components of all approved ratings of Desmi Ocean Guard OXYCLEAN 100-3000 are to be of type complying with the requirements of IMO resolution MEPC.174(58) Part 3.

Page 11 of 11
Document number MCA 1200027
Issue number 1

### DESIGN APPRAISAL DOCUMENT

Date 07 November 2012	Quote this reference on all future communications LDSO/ENG/UO/W03146481/WP12254700
--------------------------	---

6. It is concluded that the Desmi Ocean Guard OXYCLEAN ballast water treatment system has no hazardous area certification and not suitable for installation in hazardous areas on ships.



U. Okon  
Surveyor to Lloyd's Register EMEA  
A Member of the Lloyd's Register Group.

