



THE REPUBLIC OF LIBERIA
LIBERIA MARITIME AUTHORITY

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.174 (58) adopted on 10 October 2008. This certificate is valid only for the ballast water management system referred to below.

Ballast water management system supplied by..... Veolia Water Technologies Deutschland GmbH
Gerold-Janssen Str. 2, 28359 Bremen, Germany

under type and model designation..... CleanBallast®500-1
and incorporating:

Ballast water management system manufactured by..... Veolia Water Technologies Deutschland GmbH

to equipment/assembly drawing No.....560832 general-arrangement date..... 28 July 2010

Electrolysis Unit manufactured by..... Ectosys®500 RWO - Veolia

to components drawing No..... ENG-003298 date..... 12 August 2010

Filtration system manufactured by..... RWO - Veolia using Arkal
discs

To components drawing No..... 350-0900-006/007 date.....11/12 August 2010

TRO sensor unit manufactured by..... RWO – Veolia using Kuntze sensor

To components drawing No..... ENG-000389 (000667) date..... 27.01.2009

TRO neutralization unit manufactured by..... RWO Veolia using Prominent dosing pump

To components drawing No..... ENG-002951 date..... 29.12.2009

Gas Hydrogen (H₂) sensor unit manufactured by..... Dräger

Salinity sensor unit manufactured by..... Kuntze

Treatment rated capacity..... up to 500 m³/h

Active Substances Hydroxyl radicals, Sodium hypochlorite

Relevant Chemical Sodium Hypobromite, Dibromochloromethane, Tribromomethane, Dichloroacetic acid, Bromochloroacetic acid, 1.2.3.-Trichloropropane, Sodium bromate, Hydrogen

Final approval granted by IMO for systems using active substances..... MEPC 59/2/16 Annex 5, para 8.4

A copy of this Type Approval Certificate should be carried on board vessels 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. This Type Approval Certificate is issued based on approval by the Federal Maritime and Hydrographic Agency of the Federal Republic of Germany with Type Approval Certificate No. BSH/18228/RWO-1/S41 2010.

Limiting Conditions imposed and operating parameters are described in the Appendix to this document.



Margaret Ansumana

Deputy Commissioner of Maritime Affairs

Republic of Liberia

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Enc. This certificate consists of 8 pages, including the appendices and summary of the original test results.

APPENDIX

Limiting Conditions

Maximum treatment rated capacity (TRC).....	up to 500 m ³ /h
Maximum Allowable Dosage Concentration of TRO (as Cl ₂) at First Treatment.....	2.5 mg/L
Maximum Allowable Dosage Concentration of TRO (as Cl ₂) at Second Treatment ..	1.5 mg/L
Maximum Allowable Discharge Concentration of TRO after neutralizing.....	≤ 0.1 mg/L
Ballast water salinity range during shipboard tests.....	from 31 PSU (low salinity) to 34 PSU (high salinity)
Ballast water salinity range during land based tests.....	from 20,9 PSU (low salinity) to 33,8 PSU (high salinity)
During shipboard tests the water temperature ranged between	5.1°C – 19.8°C
Ballast water particulate organic compounds (POC) during SBT.....	0,1 mg/L to 2,7 mg/L
Ballast water total suspended solids (TSS) during SBT.....	5,0 mg/L to 175,0 mg/L
During land based testing the water temperature ranged between	6.7°C – 12.0°C
Ballast water dissolved organic compounds (DOC) during LBT	2.0 mg/L to 6.9 mg/L
Ballast water particulate organic compounds (POC) during LBT.....	2.1 mg/L to 9.0 mg/L
Ballast water total suspended solids (TSS) during LBT.....	13.1 mg/L to 64.4 mg/L
Minimum holding time.....	less than 1 day
Approved for use in explosive atmosphere	No
Installation on open deck	No
Maximum Hydrogen gas generation.....	To be not more than 80% LEL
Differential pressure across the filter.....	should not exceed 0.8 Bar
Flow rates during land-based testing	maximum 600 m ³ /hour
Flow rates during shipboard testing.....	maximum 542 m ³ /hour

Operating Parameters during land-based and ship-based testing

Operating TRO dosage.....	Max. 1.98 mg/L
Energy consumption at 500 m ³ /hour during ballasting	21 - 56 KW/hour
Energy consumption at 500 m ³ /hour during de-ballasting	8 - 48 KW/hour

The system is to be operated according to the manual provided by the manufacturer.

A plate or durable label containing the manufacturer's name, the type, the serial number, the date of manufacture and the treatment rated capacity must be attached to each system.

Summary of Land Based Test Results

For Ballast Water Management System, Type ...

CleanBallast®500-1

Manufactured by..... Veolia Water Technologies Deutschland GmbH Gerold-Janssen Str. 2,
28359, Bremen, Germany

Organization conducting the test Norwegian Institute for Water Research

The test results of the tested Ballast Water Management System are valid for the System that is given type approval with this document.

Notes:

At high (salt) salinity, eight and at low (brackish water) salinity, five independent experiments were carried out. A reference and a treated sample were taken with a minimum of 200 m³ at each sampling time. Samples were taken as triplicates.

High salinity test results (> 32PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 µm (/m ³)	Average 187,900.1 Min. 114,246.0	≥ 100 000	Average 28,319,4 Min. 20.767,0	> 90	Average 0.1 Max. 0.3	< 10
Phyla > 50 µm	≥3	≥ 3 different	N.A.	-	N.A.	-
Species > 50 µm	≥ 5	≥ 5 different	N.A.	-	N.A.	-
10-50 µm (/ml)	Average 2412.5 Min. 900	> 1000	Average 4.937,5 Min. 1,500	> 90	Average 5.4 Max. 13	< 10
Phyla 10-50 µm	≥3	≥ 3 different	N.A.	-	N.A.	-
Species 10-50 µm	≥ 5	≥ 5 different	N.A.	-	N.A.	-
Hetero. bact./ml	Average 27,750.0 Min. 13,000.0	≥10, 000	Average 53,000.0 Min. 13.000,0	-	Average 14.3 Max. 64	-
Escherichia Coli ¹ (cfu/100 ml)	Average 13.5 Min. 0.0	-	0	-	0	< 250
Vibrio cholerae (cfu /100 ml)	<1	-	<1	-	<1	< 1
Enterococcus group ² (cfu/100 ml)	Average 108.3 Min 0.3	-	Average 88,2 Min. 1,7	-	Average 0.4 Max. 2	< 100

Low salinity test results (3-32 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 μm (/m ³)	Average 192,515.2 Min. 130,038.0	$\geq 100\ 000$	Average 49,129.6 Min. 36,865	> 90	Average 3.9 Max. 10.3	< 10
Phyla > 50 μm	≥ 3	≥ 3 different	N.A.	-	N.A.	-
Species > 50 μm	≥ 5	≥ 5 different	N.A.	-	N.A.	-
10-50 μm (/ml)	Average 2,500 Min. 1,700	> 1000	Average 2,500 Min. 1,500	> 90	Average 4,32 Max. 8,8	< 10
Phyla 10-50 μm	≥ 3	≥ 3 different	N.A.	-	N.A.	-
Species 10-50 μm	≥ 5	≥ 5 different	N.A.	-	N.A.	-
Hetero. bact./ml	Average 73,400 Min. 22,000	$\geq 10\ 000$	Average 104,000 Min. 27,000	-	Average 722 Max. 2,200	-
Escherichia Coli ¹ (cfu/100 ml)	0	-	0	-	0	< 250
Vibrio cholerae (cfu /100 ml)	<1	-	<1	-	<1	< 1
Enterococcus group ² (cfu/100 ml)	Average 506 Min. 130	-	Average 472.8 Min. 4	-	Average 0.6 Max. 1	< 100

Reference Methods:

Parameters	Reference Method
Heterotrophic Bacteria (counts/mL)	Modified version of the Norwegian Standard NS-EN ISO 6222:1999
Escherichia coli (cfu/100mL)	Noregian Standard NS 4792:1990
Enterococci (cfu/100 mL)	Norwegian Standard NS-EN ISO 7899-2:2000
Vibrio cholerae (cfu /100 ml)	Modified version of the NMKL method No. 156, Pathogenic Vibrio species
Organisms $\geq 10 < 50\ \mu\text{m}$ (viable cells/mL)	Throndsen, J. (1978): The dilution-culture method; Ganassin et al. (2000)
Organisms $\geq 50\ \mu\text{m}$ (viable organisms/m ³)	OECD (1985): Test Guideline for Testing of Chemicals 202

Summary of Ship Based Test Results

For Ballast Water Management System, Type ... CleanBallast®500-1
 Manufactured by..... Veolia Water Technologies Deutschland GmbH Gerold-Jannsen Str. 2, 28359, Bremen, Germany
 Organization conducting the test..... Gollasch Consulting, Hamburg, Germany
 Tests were conducted on board the vessel..... “Maersk Penang”, IMO No.9168192
 Time of testing..... March 2009 – January 2010
 Maritime Area of testing..... North Sea, Atlantic Ocean, St. Lawrence River

Summary of ship-based test results

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	Average 1,021.8 Min. 692	> 90	Average 476 Min. 124	> 9	Average: 0,8 Max: 3,8	<10
10-50 µm (/ml)	Average 358 Min. 7	> 90	Average 334 Min. 4	> 9	0	<10
Escherichia coli (cfu /100 ml)	0	-	N.A.	-	0	<250
Vibrio cholerae (cfu /100 ml)	0	-	N.A.	-	0	<1
Enterococcus group (cfu /100 ml)	Average 15.3 Min. 0	-	Average: 11,9 Min: 0	-	Average 1.1 Max. 1.4	<100
TRO concentration with neutralization (mg/l)					Average: 0,028 Max: 0,07	0,1

Summary of Additional Land Based Test Results

For Ballast Water Management System, Type ...

CleanBallast®500-1

Manufactured by..... Veolia Water Technologies Deutschland GmbH Gerold-Jannsen Str. 2, 28359, Bremen, Germany

Organization conducting the testVeolia Water Technologies Deutschland GmbH Gerold-Jannsen Str. 2, 28359, Bremen, Germany

The test results of the tested Ballast Water Management System are valid for the System that is given type approval with this document.

Notes:

- Ballast water salinity range during additional land based tests..... from 0,4 PSU to 0,5 PSU
- During additional land based testing the water temperature ranged between 15.8°C – 19.7°C
- Ballast water dissolved organic compounds (DOC) during additional LBT 19,2 mg/L to 170,3 mg/L
- Ballast water particulate organic compounds (POC) during additional LBT..... 8,8 mg/L to 130,7 mg/L
- Ballast water total suspended solids (TSS) during additional LBT..... 65 mg/L to 81 mg/L
- Flow rates during additional land-based testing maximum 621 m³/hour

Fresh water test results (<1 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 µm (/m ³)	Average 266,316 Min. 169,801	≥ 100 000	Average 62,212 Min. 12,409	> 90	0	< 10
10-50 µm (/ml)	Average 4,859 Min. 2,970	> 1000	Average 290 Min. 19	> 90	0	< 10
Escherichia Coli ¹ (cfu/100 ml)	Average 133 <15	-	Average 1,095 Min. 30	-	Average 32 Max. 57	< 250
Vibrio cholerae (cfu /100 ml)	Neg.	-	Neg.	-	Neg.	< 1
Enterococcus group ² (cfu/100 ml)	Average 11 Min neg.	-	Neg.	-	Neg.	< 100

Reference Methods:

Parameters	Reference Method
Heterotrophic Bacteria (counts/mL)	EN ISO 6222:1999
Escherichia coli (cfu/100mL)	EN ISO 9303-3:1998
Enterococci (cfu/100 mL)	EN ISO 7899-2-K15:2000
Vibrio cholerae (cfu /100 ml)	Standard methods for examination of water and waste water American Public Health Association
Organisms $\geq 10 < 50$ μm (viable cells/mL)	Thronsdon, J. (1978): The dilution-culture method; Ganassin et al. (2000)
Organisms ≥ 50 μm (viable organisms/m ³)	OECD (1985): Test Guideline for Testing of Chemicals 202

Official Stamp



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