



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 Code for Approval of Ballast Water Management Systems (resolution MEPC.300(72)). This certificate is valid only for the ballast water management system referred to below.

Name of ballast water management system: SeaCURE^R Ballast Water Management System

Ballast water management system manufactured by..... Evoqua Water Technologies, Ltd or Affiliates
 210 Sixth Avenue, Pittsburgh, PA 15222, USA

under type and model designations:SC-F-500 ~ 6000

and incorporating: Equipment / Assembly Drawing No: / Datasheet No.

Process, Automation and Dosing Skid	6D-50644 Revision A	Dated:	24-03-2021
1.0 m Diameter Degassing System	6D-40293 Revision C	Dated:	24-11-2017
1.2 m Diameter Degassing System	6D-40116 Revision D	Dated:	11-08-2017
Air-cooled PSU	6S-50232 Revision A	Dated:	15-03-2021
Water-cooled PSU	6S-50051 Revision C	Dated:	02-11-2016
Process Control Panel [PCP]	6D-40135 Revision B	Dated:	23-01-2017
Hazardous Area Filter Control Panel [FCP]	6D-50610 Revision A	Dated:	29-03-2021
Safe Area Filter Control Panel [FCP]	6D-50611 Revision A	Dated:	29-03-2021
Ballast Control Panel [BCP – Remote HMI]	6D-40150 Revision B	Dated:	08-03-2017
Single-tank Neutralization System	6D-50645 Revision A	Dated:	13-04-2021
Dual-tank Neutralization System.	6D-50646 Revision A	Dated:	13-04-2021
MKIV Cell Electrolyser	6D-50671 Revision A	Dated:	04-03-2021

Filtration System Manufactured by

Filtersafe Automatic Screen Filtration

To Component Drawing No. 6D-40023 to 6D-40048

To Component Drawing No. 6D-50620 to 6D-50643

ORP Sensor Unit manufactured by:

Halogen Inc or Approved other

TRO Sensor Unit manufactured by:

Halogen Inc, HF Scientific or Approved other

TRO Neutralization Unit manufactured by:

Evoqua Water Technologies Ltd or Affiliates

Hydrogen [Gas] Detector manufactured by:

Not required unless specified by class

Conductivity sensor unit manufactured by:

Endress & Hauser, Hach or Approved other

Treatment Rated Capacity:

50 ~ 6,000 m³/h

Active Substances [as Total Residual Oxidants]:

Sodium Hypochlorite, Hypochlorous Acid

Relevant Chemicals:

Bromate, Chlorate, Trihalomethanes, Halogenated Aceto-Nitriles, Halogenated Acetic Acids.

Final approval granted by IMO for systems using active substances MEPC 75/4/12 Annex 4, para 11.4.

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.

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

Official Stamp



Margaret Ansumana

Deputy Commissioner of Maritime Affairs

Republic of Liberia

Date of issue: 20/April/2021 Place of issue: Dulles, USA

Date of Expiry: 20/April/2026

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

APPENDIX I

Conditions for operation of the BWMS

Treatment rated capacity (TRC).....	50 to 6000 m ³ /h
Maximum Allowable Dosage Concentration of TRO (as Cl ₂)	8.0 mg/L
Maximum Allowable Discharge Concentration of TRO after neutralizing.....	≤ 0.1 mg/L
Ballast water salinity range.....	Any
Ballast water temperature range	0 - 40 Deg.C
Operation with <25 PSU ballast water.....	Electrolyzer feed water from dedicated seawater tank
Minimum holding time with neutralization.....	24 Hours
Minimum holding time without neutralization	5 days
Approved for use in explosive atmosphere	Yes
Refer to drawing # 6D-40250 Rev C for installation in explosive atmosphere.	
Installation on open deck	No
Maximum Hydrogen gas generation.....	To be not more than 25% of LEL
Differential pressure across the filter.....	should not exceed 0.5 Bar

Summary of conditions during land and ship-based testing

Ballast water salinity range during shipboard tests (SBT)	33.0 to 38.1 PSU (Marine Water)
Ballast water salinity range during land based tests (LBT), from:	
	<ul style="list-style-type: none">• < 1 PSU (Fresh Water)• 10.1 – 10.9 PSU (Brackish Water)• 30-33.3 PSU (Marine Water)
During SBT the water temperature ranged between	16.3°C – 22.1°C
During LBT in marine water the water temperature ranged between.....	19.7°C – 21.1°C
During LBT in brackish water the water temperature ranged between	11 °C – 15.15°C
During LBT in fresh water the water temperature ranged between	16.1°C – 21.8°C
Ballast water particulate organic compounds (POC) during SBT.....	0.24 mg/L to 0.45 mg/L
Ballast water total suspended solids (TSS) during SBT.....	4.7 mg/L to 6.6 mg/L
Ballast water dissolved organic compounds (DOC) during LBT in marine water.....	7.6 mg/L to 9.0 mg/L
Ballast water dissolved organic compounds (DOC) during LBT in brackish water.....	6.3 mg/L to 7.1 mg/L
Ballast water dissolved organic compounds (DOC) during LBT in fresh water.....	7.4 mg/L to 8.8 mg/L
Ballast water particulate organic compounds (POC) during LBT in marine water	8.4 mg/L to 11.1 mg/L
Ballast water particulate organic compounds (POC) during LBT in brackish water	9.5 mg/L to 11.4 mg/L
Ballast water particulate organic compounds (POC) during LBT in fresh water.....	7.4 mg/L to 8.8 mg/L

Ballast water total suspended solids (TSS) during LBT in marine water.....	31.5 mg/L to 57 mg/L
Ballast water total suspended solids (TSS) during LBT in brackish water.....	90 mg/L to 111.2 mg/L
Ballast water total suspended solids (TSS) during LBT in fresh water.....	50.2 mg/L to 59.4mg/L
Maximum Allowable Dosage Concentration of TRO (as Cl ₂).....	8.0 mg/L
Maximum Allowable Discharge Concentration of TRO after neutralizing.....	≤ 0.1 mg/L
Flow rates during land-based testing	maximum 300 m ³ /hour
Flow rates during shipboard testing.....	maximum 1200m ³ /hour

The SeaCURE^R Ballast Water Management System has basic electrolyzers with nominal sodium hypochlorite production rates of 1.5 kg/h or 3 kg/h per cell. The total TRC of the SeaCURE^R Ballast Water Management System can be increased by modular installation of the basic electrolyzers according to BWM.2/Circ.33/Rev.1 and evidenced by using mathematical modelling and/or calculations.

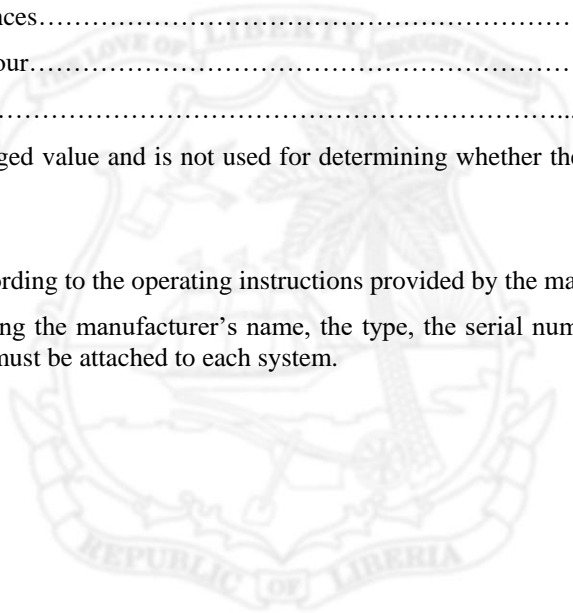
Operating Parameters during land-based and ship-based testing

Maximum dose for active substances.....	8.0 mg/L (as Cl ₂)
Energy consumption at 300 m ³ /hour.....	10.0 KW/hour*
Current	15 Amperes*

*Remark: The value is the averaged value and is not used for determining whether the system is operated properly or not.

The system is to be operated according to the operating instructions 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..... SeaCURE^R Ballast Water Management System,
 Model SeaCURE SC-300-800/1-D1/1-N-SA-300 for marine water
 Model: SeaCURE SC-F-250-500/1-D1/1-N-SA-250 for brackish and fresh water

Manufactured by.....Evoqua Water Technologies, Ltd or Affiliates, 210 Sixth Avenue, Pittsburgh, PA 15222, USA

Organization conducting the test..... MEA-nl B.V, Haventerrein 1-A, 1779 GS, Den Oever,
The Netherlands for marine water

Golden Bear Research Center, Vallejo, California,
USA for brackish and fresh water.

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 marine salinity - five, brackish salinity - five and in fresh water - 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.

Marine water test results (30-33 PSU):

Organism Type	Influent Water	IMO Req.	Discharge Control	IMO Req.	Discharge Treated	IMO Req.
>50 um (/m ³)	Min. 102,000 Av. 116,567	≥ 100 000	Min. 23,611 Av. 44756	100	Max. 0.8 Av. 0.4	< 10
Phyla > 50 um	>3	≥ 3 different	-	-	-	-
Species > 50 μm	>5	≥ 5 different	-	-	-	-
10-50 μm (/ml)	Min. 1297 Av. 1502	> 1000	Min. 1463 Av. 1758	100	Max. 0 Av. 0	< 10
Phyla 10-50 μm	>3	≥ 3 different	-	-	-	-
Species 10-50 μm	>5	≥ 5 different	-	-	-	-
Hetero. bact./ml	Min. 15080 Av. 28884	≥10 000	-	-	Min. <7 Av. 43	-
Escherichia Coli ¹ (cfu/100 ml) [/100 ml]	Min. <1 Max <1-56	-	Min. <1 Max. 7	-	<1	< 250
Vibrio cholerae (cfu /100 ml)	<1	-	<1	-	<1	< 1
Enterococcus group ² (cfu/100 ml)	Min. <1 Max. <1 - 2	-	Min. <1 Max. 27	-	<1	< 100

Brackish water test results (6-10 PSU):

Organism Type	Influent Water	IMO Req.	Discharge Control	IMO Req.	Discharge Treated	IMO Req.
>50 um (/m ³)	Min. 119,394 Av. 259,394	≥ 100 000	Min. 97,172 Av. 172,485	100	Max. 0.61 Av. 0.3	< 10
Phyla > 50 um	>3	≥ 3 different	-	-	-	-
Species > 50 μm	>5	≥ 5 different	-	-	-	-
10-50 μm (/ml)	Min. 1753 Av. 4044	> 1000	Min. 137 Av. 1243	100	Max. 1.83 Av. 1.1	< 10
Phyla 10-50 μm	>3	≥ 3 different	-	-	-	-
Species 10-50 μm	>5	≥ 5 different	-	-	-	-
Hetero. bact./ml	Min. 15,200 Av. 27,040	≥10 000	30,000	-	Max. 4333 Av. 4008	-
Escherichia Coli ¹ (cfu/100 ml) [/100 ml]	N.L.D.	-	N.L.D.	-	N.L.D.	< 250
Vibrio cholerae (cfu /100 ml)	-	-	-	-	-	< 1
Enterococcus group ² (cfu/100 ml)	N.L.D.	-	N.L.D.	-	N.L.D.	< 100

Fresh water test results (< 1 PSU):

Organism Type	Influent Water	IMO Req.	Discharge Control	IMO Req.	Discharge Treated	IMO Req.
>50 um (/m ³)	Min. 196,768 Av. 324,243	≥ 100 000	Min. 128,283 Av. 174.626	100	Max. 0.21 Av. 0.2	< 10
Phyla > 50 um	>3	≥ 3 different	-	-	-	-
Species > 50 μm	>5	≥ 5 different	-	-	-	-
10-50 μm (/ml)	Min. 1092 Av. 1742	> 1000	Min. 323 Av. 825	100	Max. 0.17 Av. 0.43	< 10
Phyla 10-50 μm	>3	≥ 3 different	-	-	-	-
Species 10-50 μm	>5	≥ 5 different	-	-	-	-
Hetero. bact./ml	Min. 29,833 Av. 29,966	≥10 000	30,000	-	Max. 8,900 Av. 3,140	-
Escherichia Coli ¹ (cfu/100 ml)[/100 ml]	Min. 7 Av. 15	-	Min. <1 Av. 2	-	< 1	< 250
Vibrio cholerae (cfu /100 ml)	-	-	-	-	-	< 1
Enterococcus group ² (cfu/100 ml)	Min. 9.1 Av. 20.0	-	Min. 7 Av. 251	-	N.L.D.	< 100

N.L.D.: No Live Organisms Detected

Reference Methods:

Parameters	Reference Method
>50 um	Microscopic Examination
10-50 µm	Vital Stain
Hetero. bact.	Procedure for Quantifying Heterotrophic Plate Counts (HPC) Using the Spread Plate Method
Escherichia Coli	Detection and Enumeration of Total Coliforms and <i>E. coli</i> Using IDEXX's Colilert®
Vibrio cholerae	Colony Blot Preparation for the Enumeration of Culturable <i>Vibrio cholerae</i> and Presence of <i>ctxA</i> Gene
Enterococcus group	Detection and Enumeration of <i>Enterococcus</i> using Enterolert™

Summary of Ship Based Test Results

Organization conducting the test Maritime Environmental Resource Center (MERC), Maryland, USA

Tests were conducted on board the vessel..... M.V. "COSCO Fortune", IMO Nr. 9472127

Time of testing..... January 2016 – June 2017

Maritime Area of testing..... Long Beach, California and La Spezia, Italy

Test 1

Organism Type	Influent Water	IMO Req.	Discharge Control	IMO Req.	Discharge Treated	IMO Req.
>50 µm (Individuals /m ³)	372991	100	609	10	9	<10
10-50 µm (Individuals /m ³)	129	100	83	10	0.03	<10
Escherichia coli (cfu / 100 ml)	26	-	5	-	B.D.L	<250
Vibrio cholerae (cfu / 100 ml)	0	-	0	-	B.D.L	<1
Enterococcus group (cfu / 100 ml)	120	-	80	-	B.D.L	<100
Temperature [°C]	16.3	-	-	-	18.5	-
Salinity [PSU]	33.3	-	-	-	33.5	-
POC [mg/l]	0.28	-	-	-	-	-
TSS [mg/l]	6.6	-	-	-	-	-
DOC [mg/l]	1.12	-	-	-	-	-

Test 2

Organism Type	Influent Water	IMO Req.	Discharge Control	IMO Req.	Discharge Treated	IMO Req.
>50 µm (Individuals /m3)	283,411	100	7574	10	0	<10
10-50 µm (Individuals /m3)	204	100	1346	10	0	<10
Escherichia coli (cfu / 100 ml)	110	-	30	-	B.D.L	<250
Vibrio cholerae (cfu / 100 ml)	0	-	0	-	B.D.L	<1
Enterococcus group (cfu / 100 ml)	-	-	60	-	B.D.L	<100
Temperature [oC]	18.1	-	-	-	18.5	-
Salinity [PSU]	33	-	-	-	33.5	-
POC [mg/l]	0.24	-	-	-	-	-
TSS [mg/l]	5.7	-	-	-	-	-
DOC [mg/l]	1.15	-	-	-	-	-

Test 3

Organism Type	Influent Water	IMO Req.	Discharge Control	IMO Req.	Discharge Treated	IMO Req.
>50 µm (Individuals /m3)	695,575	100	-	10	2.7	<10
10-50 µm (Individuals /m3)	1067	100	-	10	0	<10
Escherichia coli (cfu / 100 ml)	80	-	-	-	B.D.L	<250
Vibrio cholerae (cfu / 100 ml)	-	-	-	-	B.D.L	<1
Enterococcus group (cfu / 100 ml)	340	-	-	-	B.D.L	<100
Temperature [oC]	22.1	-	-	-	22.7	-
Salinity [PSU]	38.1	-	-	-	37.5	-
POC [mg/l]	9.6	-	-	-	-	-
TSS [mg/l]	4.7	-	-	-	-	-
DOC [mg/l]	2.07	-	-	-	-	-

B.D.L: Below Detection Limit

Official Stamp



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