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…… HANLA IMS Co., Ltd.

115, Hwajeonsandan 1-ro, Gangseo-Gu Korea

under type and model designation…… . EcoGuardian™ Ballast Water Management System

Models:

Non-EX Proof:

EG-0500/0800/1000/1500/2000

EX-Proof:

EG-0500-Ex/0800-Ex/1000-Ex/1500-Ex/2000-Ex/2600-Ex/3000-Ex

and incorporating:

Ballast water management system manufactured by…….. HANLA IMS Co., Ltd.

to equipment/assembly drawing No…… Appendix I date…… 12 July 2018

Electrolysis Unit manufactured by…… HANLA IMS Co., Ltd.

to components drawing No…… Appendix I date…… 12 July 2018

Filtration system manufactured by…… HANLA IMS Co., Ltd.

To components drawing No……. Appendix I date……..... 12 July 2018

TRO sensor unit manufactured by…… HANLA IMS Co., Ltd.

To components drawing No…… Appendix I date……..... 12 July 2018

TRO neutralization unit manufactured by…….. HANLA IMS Co., Ltd.

To components drawing No…… Appendix I date……..... 12 July 2018

Gas Hydrogen (H_2) sensor unit manufactured by…… HONEY WELL/GASTRON

Salinity sensor unit manufactured by…….. JUMO/HERIANA

Treatment rated capacity…….. 500, 800, 1000, 1500, 2000 m^3/h

Active Substances (as Total Residual Oxidants) …… Chlorine, Bromine, Sodium Hypochlorite, Sodium Hypobromite, Hypochlorous Acid, Hypobromous Acid, Chloramines, Bromanine

Relevant Chemical ……Halogenated Aliphatic and Aromatic Compounds including THMs, halogenated Aceto-Nitriles, Halogenated Acetic Acids

Final approval granted by IMO for systems using active substances…..... MEPC 65/2/19 Annex 5, para 7.4

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 Ministry of Oceans and Fisheries of the Republic of Korea with Type Approval Certificate No. 2018-80, 2018-81, 2018-82, 2018-83, 2018-84 for Non-EX Proof and 2018-85, 2018-86, 2018-87, 2018-88, 2018-89 for EX Proof.

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

Official Stamp

Margaret Ansumana
Deputy Commissioner of Maritime Affairs
Republic of Liberia
Date of issue: 08/October/2018 Place of issue: Dulles, USA

Date of Expiry: 27/October/2020

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

APPENDIX I

Equipment/Assembly drawing number:

Model / Equip.	EG0500	EG0500-Ex	EG0800	EG0800-Ex	EG1000	EG1000-Ex	EG1500	EG1500-Ex	EG2000	EG2000-Ex
AFU	A1-10000	A1-10000	A1-10000	A1-10000	A1-10000	A1-10000	A1-10000	A1-10000	A1-10000	A1-10000
ECU	E1-10000 E2-10000	E1-10000 E2-10000	E1-10000 E2-10000	E1-10000 E2-10000	E1-10000 E2-10000	E1-10000 E2-10000	E1-10000 E2-10000	E1-10000 E2-10000	E1-10000 E2-10000 E2-10001	E1-10000 E2-10000 E2-10001
SIU	S1-10000	S1-10000	S1-10000	S1-10000	S1-10000	S1-10000	S1-10000	S1-10000	S1-10000	S1-10000
NEU	N1-10000	N1-10000	N1-10000	N1-10000	N1-10000	N1-10000	N1-10000	N1-10000	N1-10000	N1-10000
TSU	0500N-T1-10001	0500E-T1-10001	0800N-T1-10001	0800E-T1-10001	1000N-T1-10001	1000E-T1-10001	1500N-T1-10001	1500E-T1-10001	2000N-T1-10001	2000E-T1-10001
PDU	M1-E0300	M1-E0300	M1-E0300	M1-E0300	M1-E0300	M1-E0300	M1-E0300	M1-E0300	M1-E0300	M1-E0300
MCP	M1-E0301	M1-E0301	M1-E0301	M1-E0301	M1-E0301	M1-E0301	M1-E0301	M1-E0301	M1-E0301	M1-E0301
RCP	0500N-R1-E0300	0500E-R1-E0300	0800N-R1-E0300	0800E-R1-E0300	1000N-R1-E0300	1000E-R1-E0300	1500N-R1-E0300	1500E-R1-E0300	2000N-R1-E0300	2000E-R1-E0300
MCP1	0500N-A1-E0300	0500E-A1-E0300	0800N-A1-E0300	0800E-A1-E0300	1000N-A1-E0300	1000E-A1-E0300	1500N-A1-E0300	1500E-A1-E0300	2000N-A1-E0300	2000E-A1-E0300
MPP1	0500N-U1-E0300	0500E-U1-E0300	0800N-U1-E0300	0800E-U1-E0300	1000N-U1-E0300	1000E-U1-E0300	1500N-U1-E0300	1500E-U1-E0300	2000N-U1-E0300	2000E-U1-E0300

APPENDIX II

Limiting Conditions for operation of the BWMS

Maximum treatment rated capacity (TRC)……up to 2,000 m^3/h

Maximum Allowable Dosage Concentration of TRO (as Cl_2)…….... 9 mg/L

Minimum Allowable Dosage Concentration of TRO (as Cl_2)…….... 7.2 mg/L

Maximum Allowable Discharge Concentration of TRO after neutralizing…… < 0.2 mg/L

Ballast water salinity range……..... 0 to 42 PSU

Ballast water temperature range …… 0 to 40°C

For operation with ballast water under 10^0 C: Heat Exchanger shall be used

Operation with >1<10 PSU ballast water…….. Using the holding tank as electrolyte storage, minimum 10 psu for the generation of oxidants.

Minimum holding time…… < 1 day

Approved for use in explosive atmosphere ……. Yes

Conditions for use in explosive atmosphere:

1. Water temperature sensor installed and operated to shut down at 45°C;
2. Intrinsically safe wiring provided;
3. Electrical bonding must be provided;
4. Auto Filter Unit, TRO Sensor Unit, Flow Meter are designed for installation in hazardous location.

Installation on open deck …… Yes

Maximum Hydrogen gas generation…….. To be not more than 2% (LEL)

Maximum Chlorine gas generation……..…… N/A

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 land-based testing …… 20.7 PSU (low salinity) to 34.4 PSU (high salinity)

Ballast water salinity range during ship-based testing …… 29.7 PSU to 33.41 PSU

Ballast Water temperature range during land-based testing ……. 14.1°C – 22.4°C

Ballast Water temperature range during ship-based testing ……. 18.76°C – 29.62°C

Ballast water dissolved organic compounds (DOC)..... 1.99 mg/L to 6.05 mg/L

Ballast water particulate organic compounds (POC)…….. 1.74 mg/L to 7.48 mg/L

Ballast water total suspended solids (TSS)……. Land-based testing 21.1 mg/L to 89.3 mg/L

Flow rates during land-based testing ……. maximum 250 m^3/hour

Flow rates during shipboard testing…….. maximum 350 m^3/hour

(The EcoGuardian system has basic electrolyzers with the Treatment Rated Capacity (TRC) of 250m^3/hr, 400m^3/hr 500m^3/hr, 750m^3/hr, 1000m^3/hr. The total TRC of the EcoGuardian system can be increased to 2,000 m^3/hr by parallel installation of the basic electrolyzers according to BWM.2/Circ.8.)

Corrosion Tests

1. Monitoring programme to be installed to provide for long term inspection of ballast systems using EG treatment to ensure that no common obvious or extensive corrosion failures occur as a result of using EG ballast water treatment system.
2. Longer term studies on both uniform and localized corrosion rate determination of corrosion of carbon steel to be performed at the TRO level in ballast water applied by the treatment system.

Operating Parameters during land-based and ship-based testing

Operating TRO dosage……. Max. 9 mg/L

Energy consumption at 250 m^3/hour…… 12 KW/hour*

*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 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… EcoGuardian™ Ballast Water Management, EG0500 ~ EG2000
Manufactured by…… HANLA IMS Co., Ltd.,115, Hwajeonsandan 1-ro, Gangseo-Gu Korea

Organization conducting the test……. Korea Institute of Ocean Science and Technology, Busan Techno Park, Korea

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 (seawater) salinity, five and at low (brackish) salinity, five independent experiments were carried out. A reference and a treated sample were taken with a minimum of 200 m^3 at each sampling time. Samples were taken as triplicates.

High salinity test results (33.7 – 34.4 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 um (/m^3)	Min. 160,417 Max. 299,567	≥ 100 000	Min. 2,060	> 90	Max. 1	< 10
Phyla > 50 um	≥3	≥ 3 different	N.A.	-	N.A.	-
Species > 50 µm	≥ 5	≥ 5 different	N.A.	-	N.A.	-
10-50 µm (/ml)	Min. 730 Max. 2,252	> 1000	Min. 93	> 90	Max. 1	< 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	Min. 2.2E+05	≥10, 000	-	-	-	-
Escherichia Coli [1] (cfu/100 ml)	Min. 0 Max. 17	-	Min. 0 Max. 27	-	Max. 0	< 250
Vibrio cholerae (cfu /100 ml)	0	-	0	-	0	< 1
Enterococcus group[2] (cfu/100 ml)	Min.0 Max. 773	-	Min. 15 Max. TNTC	-	Max.0	< 100

TNTC: Too numerous to count

Low salinity test results (20.7-21.8 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 um (/m^3)	Min. 91,000	≥ 100 000	1,182	> 90	0	< 10
Phyla > 50 um	≥ 3	≥ 3 different	N.A.	-	N.A.	-
Species > 50 µm	≥ 5	≥ 5 different	N.A.	-	N.A.	-
10-50 µm (/ml)	Min.1,150 Max. 2,805	> 1000	Min. 83 Max. 238	> 90	Max. 0	< 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	Min. 1.9E + 05	≥10 000	-	-	-	-
Escherichia Coli [1] (cfu/100 ml)	Min. 3 Max. 210	-	Min. 10 Max. 223	-	Max. 28	< 250
Vibrio cholerae (cfu /100 ml)	0	-	0	-	0	< 1
Enterococcus group[2] (cfu/100 ml)	Min. 17 Max. 2,460	-	Min. 30	-	1	< 100

Reference Methods:

Parameters	Reference Method
Heterotrophic Bacteria (counts/mL)	JGOFS (UNESCO, 1994)
Escherichia coli (cfu/100mL)	Gangar & Curiale (1999), 3M™ Petrifilm™ Plate manual
Enterococci (cfu/100 mL)	APHA, 9230C
Vibrio cholerae (cfu /100 ml)	APHA, 9260H
Organisms >=10 < 50 um (viable cells/mL)	Pouneva I (1997), Susana & Carmen (2002)
Organisms >= 50 um (viable organisms/m3)	ASTM E1440 (2004) ASTM E729 (2007)

Summary of Ship Based Test Results

Organization conducting the test……. Korea Institute of Ocean Science and Technology, Busan techno Park, Korea

Tests were conducted on board the vessel……. "CHANG YAHNG", IMO No.9121027

Time of testing…….. ……8 December 2013 – 16 September 2014

Maritime Area of testing……. Gamcheon, Donghae, Gunsan, (South Korea), Hong Kong

Summary of ship-based test results

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	Min. 2,050	> 90	Min. 1,175	> 9	Max. 3	<10
10-50 µm (/ml)	Min. 106	> 90	Min. 14	> 9	Max. 1	<10
Escherichia coli (cfu /100 ml)	Min. 18	-	Min. 1	-	Max. 2	<250
Vibrio cholerae (cfu /100 ml)	0	-	N.A.	-	0	<1
Enterococcus group (cfu /100 ml)	Min. 0 Max. 39	-	N.A.	-	0	<100

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Official Stamp

Margaret Ansumana
Deputy Commissioner of Maritime Affairs
Republic of Liberia
Date of issue: 08/October/2018 Place of issue: Dulles, USA