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..... Kuraray Co., Ltd

under type and model designation ..... Microfade BWMS MF 250~2000

and incorporating:

Ballast water management system manufactured by..... Kuraray Co.,Ltd

to equipment/assembly drawing No..... See Appendix I

Chemical Infusion Unit manufactured by..... Kuraray Co.,Ltd

to components drawing No..... See Appendix I

Filtration Unit manufactured by..... Kuraray Co.,Ltd

To components drawing No..... See Appendix I

MCU I and II Panel Computer .....ITPC-A120-TD customized by Tohan-Denshi-Kiki
based on KHPPC-1201T .....Manufactured by EIP

Treatment rated capacity..... 250 – 2,000 m^3/hour

Active Substance..... Calcium Hypochlorite

Relevant Chemicals .....Trihalomethanes, Halogenated Acetic Acids, Halogenated Acetonitriles

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. This Type Approval Certificate is issued based on approval by the Ministry of Land, Infrastructure, Transport and Tourism of Japan with Type Approval Certificate No. 6 (Rewritten) dated June 29th, 2014.

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

Official Stamp

Margaret Ansumana
Deputy Commissioner of Maritime Affairs
Republic of Liberia
Date of issue: 13/July/2018 Place of issue: Dulles, USA
Date of Expiry: 27/October/2020

Enc. This certificate consists of 9 pages, including the appendix and summary of the original test results.

APPENDIX I

Series	BWMS Equip/Assembly drawing no.	Date
250	BDZ-09345	12/Dec/2013
500		
750	BDZ-09346	12/Dec/2013
1000		
1250	BDZ-09349	12/Dec/2013
1500	BDZ-09347	12/Dec/2013
2000	BDZ-09348	28/Mar/2012

Series	Chemical Infusion Unit drawing no.		Date	
250	BDZ-09023	BAC-09325	02/Nov/2011	12/Dec/2013
500		BAC-09294		07/Oct/2013
750		BAC-09293		09/Oct/2013
1000				
1250	BDZ-09190	BAC-09296	26/Nov/2012	13/Nov/2013
1500	BDZ-09189	BAC-09297		
2000				

APPENDIX II

Limiting Conditions for operation of the BWMS

Maximum treatment rated capacity (TRC)..... 250 – 2,000 m3/h
Ballast Water Temperature Range..... From 0^0C to 50^0C
Ballast water salinity range..... Brackish and Marine Water
Maximum Allowable Dosage Concentration of TRO (as Cl_2)..... 2 mg/L
Minimum holding time..... Not Applicable
Maximum Allowable Discharge Concentration (MADC) of TRO (as Cl_2)..... <= 0.2 mg/L
Prior to discharge, the MADC is to be determined [for details see manufacturer's manual]. Should the MADC exceed 0.2 mg/L, the treated ballast water must not be discharged.

Summary of conditions during land and ship-based testing

Ballast water salinity range during land based tests.....Tested in water salinity ranging from 18.1 PSU (low salinity) to 33.5 PSU (high salinity)
Ballast water salinity range during ship board tests.....Tested in water salinity ranging from 31.2 PSU (low salinity) to 33.4 PSU (high salinity)
During the shipboard tests the water temperature ranged between..... 9.6°C – 14.8°C
During the land based tests the water temperature ranged between..... 8.1°C – 14.1°C
Ballast water dissolved organic compounds (DOC).....1.0 mg/L (high salinity) to 18.7 mg/L (low salinity)
Ballast water particulate organic compounds (POC)..... 0.7 mg/L (high salinity) to 52.7 mg/L (low salinity)
Ballast water total suspended solids (TSS)..... 3.1 mg/L (high salinity) to 183.7 mg/L (low salinity)
Minimum holding time..... Not Applicable
Maximum Allowable Discharge Concentration (MADC) of relevant chemicals... Not limited
Means to account for changes in MADC ..... TRO sensor installed
Maximum treatment rated capacity (TRC)..... 250 – 2,000 m^3/h
Flow rates during land-based testing averaged..... 259 m^3/h
Flow rates during shipboard testing averaged..... 248 m^3/h

(Maximum treatment rated capacity based upon mathematical modeling of chemical infusion dose from 250 m^3/h to 4,000 m^3/h)

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.

Operating Parameters during land-based and ship-based testing

Operating TRO dosage..... 0.2 mg/L (as Cl_2)
Power consumption ..... 1.2 kWh/250 m^3

SUMMARY OF LAND BASED TEST RESULTS

For Ballast Water Management System, Type..... Microfade BWMS MF 250~2000

Manufactured by..... Kuraray Co.,Ltd

Organization conducting the test..... Laboratory of Aquatic Science Consultant Co., Ltd.
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 salinity (marine), fivend at low (brackish) salinity, five independent experiments were carried out. A reference and a treated sample were taken with a minimum of 250 m^3 at each sampling time. Samples were taken as triplicates.

High salinity test results (> 32 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 um (/m^3)	Min. 2.1 E+5 Max. 9.5 E+5	≥ 100 000	Min. 1.5 E+4 Max. 7.3 E+4	> 90	N.D	< 10
Phyla > 50 um	6-9 different	≥ 3 different		-		-
Species > 50 µm	15-18 different	≥ 5 different		-		-
10-50 µm (/ml)	Min. 2.1 E+3 Max. 3.3 E+3	> 1000	Min. 1.4 E+2 Max. 6.5 E+2	> 90	N.D	< 10
Phyla 10-50 µm	4 different	≥ 3 different		-		
Species 10-50 µm	12-29 different	≥ 5different		-		
Hetero. Bact./ml	Min. 2.6 E+5 Max. 5.5 E+5	≥10 000	Min. 7.4 E+4 Max. 7.5 E+5	-	Min. 2.0 E+2 Max. 8.4 E+5	-
Escherichia Coli (cfu/100 ml)	N.D.	-	N.D	-	N.D	<250
Vibrio cholerae (cfu /100 ml)	N.D	-	N.D	-	N.D	< 1
Enterococcus group (cfu/100 ml)	Min N.D Max. 4.9 E+3	-	Min N.D Max. 4.8 E+3	-	N.D	< 100

N.D: Not Detectable

Low salinity test results (3 – 32 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 um (/m^3)	Min. 1.1 E+5 Max. 6.5 E+5	≥ 100,000	Min. 3.4 E+2 Max. 4.5 E+4	> 90	Min N.D Max. 5.3	< 10
Phyla > 50 um	3-4 different	≥ 3 different		-		-
Species > 50 µm	9-13 different	≥ 5 different		-		-
10-50 µm (/ml)	Min. 1.2 E+3 Max. 3.7 E+3	> 1000	Min. 1.4 E+2 Max. 3.2 E+2	> 90	Min. <0.01 Max. 0.76	< 10
Phyla 10-50 µm	3-4 different	≥ 3 different		-		-
Species 10-50 µm	6-14 different	≥ 5 different		-		-
Hetero. Bact./ml	Min. 4.9 E+5 Max. 9.0 E+5	≥10,000	Min. 2.7 E+5 Max. 1.1 E+7	-	Min. 2.3 E+6 Max. 7.3 E+6	-
Escherichia Coli (cfu/100 ml)	N.D	-	N.D	-	N.D	< 250
Vibrio cholerae (cfu /100 ml)	N.D	-	N.D	-	N.D	< 1
Enterococcus group (cfu/100 ml)	Min. 21 Max. 2.4 E+2	-	<Min. N.D Max. 38	-	Min. N.D Max. 2.3	< 100

N.D: Not Detectable

Reference Methods:

Parameters	Reference Method
Heterotrophic Plate Counts(cfu/mL)	See Document "06A_QAPP", section 4.3.
Escherichia coli (cfu/100mL)	See Document "06A_QAPP", section 4.3.
Enterococci (cfu/100 mL)	See Document "06A_QAPP", section 4.3.
Organisms >=10 < 50 um (organisms/mL)	See Document "06A_QAPP", section 4.2.
Organisms >= 50 um (organisms/m3)	See Document "06A_QAPP", section 4.1.

SUMMARY OF SHIP BASED TEST RESULTS

Organization conducting the test ..... Laboratory of Aquatic Science Consultant Co., Ltd.

Tests were conducted on board the vessel.....MV KARTINI, IMO No.9272993

Time of testing..... From July 7, 2011 to March 9, 2012

Maritime Area of testing.....Asia, mostly Japan

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	Min. 5.0 E+4 Max. 1.2 E+5	> 90	Min. 4.3 E+2 Max. 4.2 E+4	> 9	Min. N.D Max. <1	<10
10-50 µm (/ml)	Min. 1.5 E+2 Max. 1.9 E+3	> 90	Min. 42 Max. 1.1 E+3	>9	Min. N.D Max. <0.01	<10
Escherichia coli (cfu /100 ml)	Min. 3.5 Max. 36.7	-	Min. 0.7 Max. 16	-	Min. N.D Max. 0.07	<250
Vibrio cholerae (cfu /100 ml)	N.D	-	N.D	-	N.D	<1
Enterococcus group (cfu /100 ml)	Min. 0.8 Max. 8.3	-	Min. N.D Max. 0.5	-	Min. N.D Max. 0.02	<100

N.D: Not Detectable

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