



**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..... Miura Co., Ltd  
under type and model designation..... Miura BWMS

and incorporating:

Ballast water management system manufactured by..... Miura Co. Ltd  
to equipment/assembly drawing No..... A602-026-5020 date..... February 20, 2014

UV Disinfection System manufactured by..... Miura Co., Ltd  
to components drawing No..... A604-282-6001/A604-283-5001  
A604-282-9001/A604-283-6001 date..... June 06, 2014

Filtration system manufactured by..... Miura Co., Ltd  
To components drawing No..... A604-283-0010 date..... February 13, 2014

UV Intensity sensor manufactured by..... Zed Ziegler Electronic Devices GmbH  
To components drawing No..... SiCONORM sensor outlet date..... November 29, 2013

Treatment rated capacity..... 200 to 1800 m<sup>3</sup>/h

Active Substance..... N/A Relevant Chemical..... N/A

Whole Effluent Toxicity (WET) tests carried out in accordance with Resolution MEPC. 169(57) with negligible effect

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 Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism with Type Approval Certificate No. 11

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



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Date of issue: 26 January 2015 Place of issue: Vienna, USA

Date of Expiry: 25 January 2020

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

## APPENDIX I

### **Limiting Conditions for operation of the BWMS**

Maximum treatment rated capacity (TRC).....	200 to 1800 m <sup>3</sup> /h
Measured Minimum UV Dose .....	105 mJ/cm <sup>2</sup>
Salinity range.....	Brackish and Marine Water
Temperature.....	0 to 50°C
Max system operating pressure.....	0.7 MPa
Maximum differential pressure across the filter .....	60 kPa
Minimum holding time.....	Not Applicable
Maximum Allowable Discharge Concentration (MADC) of (OH) radical.....	Not limited
Total Residual Oxidant Level .....	Not Applicable
Approved for use in explosive atmosphere .....	No
Installation on open deck .....	No

### **Summary of conditions during land and ship-based testing**

Ballast water salinity range during land based tests.....	Tested in water salinity ranging from 19.2 PSU (low salinity) to 34.4 PSU (high salinity)
Ballast water salinity range during ship board tests...	Tested in water salinity ranging from 27.1 PSU to 28.9 PSU
During the shipboard tests the water temperature ranged between.....	27.0°C – 27.7°C
During the land based tests the water temperature ranged between.....	8.1°C – 12.6°C
Ballast water dissolved organic compounds (DOC).....	1.9 mg/L (high salinity) to 8.6 mg/L (low salinity)
Ballast water particulate organic compounds (POC).....	1.6 mg/L (high salinity) to 6.7 mg/L (low salinity)
Ballast water total suspended solids (TSS).....	10.0 mg/L (high salinity) to 72.3 mg/L (high salinity)
Minimum holding time.....	Not Applicable
Maximum Allowable Discharge Concentration (MADC) of (OH) radical.....	Not limited (OH) radical dissipates immediately upon leaving the UV Reactor.)
Means to account for changes in UV-transmittance.....	UV intensity sensor mounted in UV reactor
Information on reduced flow rates .....	Flow rates are controlled by changes in intensity value
Total Residual Oxidant Level .....	Not Applicable
Maximum treatment rated capacity (TRC).....	200 to 1800 m <sup>3</sup> /h for all types
Flow rates during land-based testing .....	211 m <sup>3</sup> /h
Flow rates during shipboard testing .....	209 m <sup>3</sup> /h
(Maximum treatment rated capacity based upon mathematical modeling of Filter Unit (TRC x 0.006m <sup>2</sup> ) and UV Reactor dose (multiple units in parallel or series) from 200 m <sup>3</sup> /h to 1800 m <sup>3</sup> /h)	

### **Operating Parameters during ship-based testing**

Operating UV dose .....	129 to 130 mJ/cm <sup>2</sup>
Energy consumption at 200 m <sup>3</sup> /hour.....	33 KW

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..... Miura BWMS 200 ~ 1800 m<sup>3</sup>/h

Manufactured by..... Miura

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

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, five and at low salinity, five independent experiments were carried out. A reference and a treated sample were taken with a minimum of 200 m<sup>3</sup> 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 <sup>3</sup> )	Average 3.3 x 10 <sup>5</sup> Min. 2.7 x 10 <sup>5</sup>	≥ 100 000	Average 41.8 x 10 <sup>2</sup> Min.	> 100	Average <1 Max. 1	< 10
Phyla > 50 um	Average 5 Min. 4	≥ 3 different	Average Min.	-		-
Species > 50 μm	Average 15 Min. 11	≥ 5 different	Average Min.	-		-
10-50 μm (/ml)	Average 2 x 10 <sup>3</sup> Min. 1.71 x 10 <sup>3</sup>	> 1000	Average 10.6 x 10 <sup>3</sup> Min. 4.97 x 10 <sup>2</sup>	> 100	N.D	< 10
Phyla 10-50 μm	Average 4 Min. 3	≥ 3 different	Average Min.	-		
Species 10-50 μm	Average 18 Min. 12	≥ 5 different	Average Min.	-		
Toxicogenic vibrio Cholera (cfu/100ml)	N.D.	-	N.D.	-	N.D	< 1
Escherichia Coli (cfu/100ml)	Average 1.2 Min. N.D.	-	N.D.	-	N.D	< 250
Intestinal Enterococci group (cfu/100 ml)	Average < 1 Min. <1	-	<1	-	Average <1 Max. 11	< 100
Temperature °C	Average 9.7 Min. 8.1	-	Average 10.5 Min. 10	-	Average 10.4 Min. 9.9	-
Salinity (PSU)	Average 33.4 Min. 32.4	>32	Average 33.1 Min. 32.4	-	Average 33.0 Min. 32.4	-
POC (mg/L)	Average 1.8 Min. 1.6	> 1	Average 0.5 Min. 0.4	-	Average 0.45 Min. 0.4	-
DOC (mg/L)	Average 2.3 Min. 1.9	> 1	Average 1.2 Min. 1	-	Average 1.2 Min. 1	-
TSS (mg/L)	Average 11.3 Min. 10.0	> 1	Average 1.7 Min. 1	-	Average 2 Min. 1.7	-

**N.D Not Determined**

**Low salinity test results (3-32 PSU):**

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 um (/m <sup>3</sup> )	Average 4.3 x 10 <sup>5</sup> Min. 2.8 x 10 <sup>5</sup>	≥ 100,000	Average 17 x 10 <sup>2</sup> Min. 4.3 x 10 <sup>2</sup>	> 100	N.D	< 10
Phyla > 50 um	Average 3 Min. 3	≥ 3 different	Average Min.	-	-	-
Species > 50 μm	Average 8 Min. 6	≥ 5 different	Average Min.	-	-	-
10-50 μm (/ml)	Average 1.8 x 10 <sup>3</sup> Min. 1.5 x 10 <sup>3</sup>	> 1000	Average 13.6 x 10 <sup>2</sup> Min. 8.5 x 10 <sup>2</sup>	> 100	N.D	< 10
Phyla 10-50 μm	Average 4 Min. 3	≥ 3 different	Average Min.	-	-	-
Species 10-50 μm	Average 8 Min. 6	≥ 5 different	Average Min.	-	-	-
Toxicogenic vibrio Cholera (cfu/100mL)	N.D.	-	N.D.	-	N.D	<1
Escherichia Coli (cfu/100 ml)	Average 17 Min. N.D.	-	< 1	-	N.D	< 250
Intestinal Enterococci group (cfu/100 ml)	Average < 1 Min. N.D.	-	Average < 1 Min. N.D.	-	Average < 1 Max. 2	< 100
Temperature °C	Average 11.2 Min.10.5	-	Average 10.9 Min.9.9	-	Average 10.7 Min.9.8	-
Salinity (PSU)	Average 20.1 Min. 19.2	3-32	Average 19.8 Min.19	-	Average 20.2 Min.19.4	-
POC (mg/L)	Average 6.2 Min. 5.8	> 5	Average 1.6 Min. 0.7	-	Average 1.9 Min. 0.7	-
DOC (mg/L)	Average 8.2 Min. 7.6	> 5	Average 5.8 Min. 4.3	-	Average 5.3 Min. 3.0	-
TSS (mg/L)	Average 59.6 Min. 52.7	> 50	Average 6.1 Min. 2.3	-	Average 6.4 Min. 3.0	-

**Reference Methods:**

Parameters	Reference Method
Heterotrophic bacteria (cfu/mL)	According to D-01-200
Escherichia coli (cfu/100mL)	According to D-01-200
Intestinal enterococci group (cfu/100mL)	According to D-01-200
Toxicogenic vibrio cholerae (cfu/100mL)	According to D-01-200
Organisms 10-50 $\mu\text{m}$ (ind./mL)	According to D-01-200
Organisms > 50 $\mu\text{m}$ (ind./m <sup>3</sup> )	According to D-01-200

**Summary of Ship Based Test Results**

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

Tests were conducted on board the vessel..... “M/V HIMAWARI No.6”, IMO Nr. 9070450

Time of testing..... August 5, 2013– February 6, 2014

Maritime Area of testing..... Tokyo (Ariake)-Hakata-Uno-Tokyo(Ariake)

**Test 1**

<b>Organism Type</b>	<b>Influent Water</b>	<b>IMO req.</b>	<b>Discharge control</b>	<b>IMO req.</b>	<b>Discharge treated</b>	<b>IMO req.</b>
> 50 µm ( /m3 )	515,867	> 90	233,680	> 9	< 1	<10
10-50 µm ( /ml )	338	> 90	135	>9	< 1	<10
Toxicogenic Vibrio cholerae (cfu /100 ml)	N.D	-	N.D	-	N.D	< 1
Escherichia coli (cfu /100 ml)	133	-	67	-	3	< 250
Intestinal Enterococci group (cfu /100 ml)	N.D	-	N.D	-	N.D	< 100
Temperature ( °C )	27.0	-	26.9	-	26.0	-
Salinity ( PSU)	27.1	-	27.0	-	27.8	-
POC ( mg/l )	< 0.1	-	< 0.1	-	< 0.1	-
TSS [ mg/l ]	4.9	-	3.7	-	2.9	-

## Test 2

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	150,500	> 90	71,573	> 9	1	<10
10-50 µm (/ml)	111	> 90	68	>9	< 1	<10
Toxicogenic Vibrio cholerae (cfu /100 ml)	N.D	-	N.D	-	N.D	< 1
Escherichia coli (cfu /100 ml)	133	-	133	-	191	< 250
Intestinal Enterococci group (cfu /100 ml)	N.D	-	N.D	-	N.D	< 100
Temperature ( °C )	27.7	-	28.2	-	27.2	-
Salinity ( PSU)	27.5	-	28.7	-	30.0	-
POC ( mg/l )	< 0.5	-	< 0.5	-	< 0.5	-
TSS [ mg/l ]	5.5	-	5.5	-	4.1	-

## Test 3

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	61,900	> 90	10,299	> 9	4	<10
10-50 µm (/ml)	126	> 90	47	>9	< 1	<10
Toxicogenic Vibrio cholerae (cfu /100 ml)	N.D	-	N.D	-	N.D	< 1
Escherichia coli (cfu /100 ml)	333	-	2,000	-	56	< 250
Intestinal Enterococci group (cfu /100 ml)	< 1	-	< 1	-	N.D	< 100
Temperature ( °C )	27.4	-	27.2	-	26.6	-
Salinity ( PSU)	28.9	-	29.4	-	29.6	-
POC ( mg/l )	< 0.5	-	< 0.5	-	< 0.5	-
TSS [ mg/l ]	5.3	-	4.7	-	3.9	-

Official Stamp



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Date of issue: 26 January 2015 Place of issue: Vienna, USA