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…….... BIO-UV GROUP

850 Avenue Louis Medard, 34400 Lunel, France

under type and model designation…… BIO-SEA®BWTS-B06-900

and incorporating:

Ballast water management system manufactured by……. BIO-UV GROUP

to equipment/assembly drawing No……..… FIC-BET-10 version H date…… 10 March 2020

UV Reactor manufactured by…….. BIO-UV GROUP

to components drawing No…….. FIC-BET-10 version H date…… 10 March 2020

Filtration system manufactured by……. FILTREX (Italy)

To components drawing No……. FIC-BET-10 version H date……..... 10 March 2020

Treatment rated capacity…… 900 m^3/h

Active Substance…… Not Applicable

Relevant Chemical……. No relevant chemicals

Final approval granted by IMO for systems using active substances …… Not Applicable

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 French Administration with Type Approval Certificate No. 46835/A3 MMF dated 22 June 2018 and reissued as certificate No. 46835/A6 MMF dated 10 April 2020.

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

Official Stamp

Margaret Ansumana
Deputy Commissioner of Maritime Affairs
Republic of Liberia
Date of issue: 07/June/2020 Place of issue: Dulles, USA
Date of Expiry: 27/October/2020

Enc. This certificate consists of 6 pages, including the appendix and summary of the original test results

APPENDIX

Limiting Conditions for operation of the BWMS

Maximum treatment rated capacity (TRC) with 6 UV reactors of 150 m3/each …… 900 m^3/h

Measured Minimum UV Intensity at full flow……..…… 906 W/m^2

(Corresponding to a minimum UV transmittance of 70%)

Salinity range…… Fresh, Brackish and Marine Water

Water temperature range……. -2°C to +40 °C

Ambient temperature range …… 0°C to +55 °C

Max system operating pressure…… 6-10 Bar

Max differential pressure across filter ……. 0.5 Bar

Minimum holding time……... Not Applicable

Maximum holding time …… Not Applicable (UV treatment upon discharge)

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 <1 PSU (Fresh water) to 34 PSU (high salinity)

Ballast water salinity range during ship board tests…… Tested in water salinity ranging from 13 PSU to 36 PSU

During the shipboard tests the water temperature ranged between……. 16°C – 28°C

During the land based tests, the water temperature ranged between…… 6.5°C – 18°C

Ballast water dissolved organic compounds (DOC) ……...…… 6.6 mg/L to 14.0 mg/L

Ballast water particulate organic compounds (POC) …….. 7.2 mg/L to 10 mg/L

Ballast water total suspended solids (TSS)…… 40 mg/L to 62 mg/L

Minimum holding time…… Not Applicable

Maximum Allowable Discharge Concentration (MADC) of (OH) radical …… Not limited

Minimum UV transmittance at full flow (IMO mode)……. 61%

Minimum UV measured Intensity (IMO mode)…… 906-931 W/m^2

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 (at minimum flow in IMO/MPN mode, UVI value is 494 W/m2 corresponding to 53% UVT. For B06-0900, minimum flow is 300 m3/h)

Total Residual Oxidant Level …….. Not Applicable

Maximum treatment rated capacity (TRC)…… 900 m^3/h

Flow rates during land-based testing averaged (IMO mode)…… 150-300 m^3/h

Flow rates during shipboard testing averaged (USCG mode)…….....890-1520 m^3/h

Maximum treatment rated capacity, based upon mathematical modeling of UV Reactor dose: from 50 m^3/h to 150 m^3/h per reactor. Reactors installed in parallel to increase the capacity of the BWMS (6 x 150 = 900 m3/h). CFD Modelling is done for validating hydraulic balance between reactors.

Operating Parameters during ship-based testing (B14-2000 model)

USCG/CMFDA mode Operating UV Intensity at 71 % UVT…… 1372 W/m^2

IMO/MPN mode Operating UV Intensity at 61 % UVT…… 906 W/m^2

Energy consumption at 2000 m^3/hour…… 328KW

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……..... BIO-SEA®BWTS-B02-0300

Manufactured by…… BIO-UV GROUP

Organization conducting the test ……. DHI environmental Laboratory, Denmark

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, eight, at low salinity, five and at fresh water, 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 (> 32 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 um (/m^3)	Min. 167,194 Max. 283,118	≥ 100 000	Min. 3.91 E+3 Max. 4.08 E+5	> 90	Min. 1.3 Max. 76	< 10
Phyla > 50 um	3 different	≥ 3 different		-		-
Species > 50 μm	5 different	≥ 5 different		-		-
10-50 μm (/ml)	Min. 1,066 Max. 2,998	> 1000	Min. 1.39 E+2 Max. 479	> 90	Min. < 0.18 Max. 5.9	< 10
Phyla 10-50 μm	3 different	≥ 3 different		-		
Species 10-50 μm	5 different	≥ 5different		-		
Hetero. Bact./ml	Min. 26,733 Max. 242,667	≥10 000	> 200,000	-	Min. 17 Max. 1,501	-
Escherichia Coli (cfu/100 ml)	Min. < 10 Max. 186	-	Min. < 10 Max. 9,662	-	< 10	<250
Vibrio cholerae (cfu /100 ml)	-	-	-	-	-	< 1
Enterococcus group (cfu/100 ml)	Min. < 10 Max. 36	-	Min. < 10 Max. 10	-	< 10	< 100

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. 129,043 Max. 267,149	≥ 100,000	Min. 16,327 Max. 65,713	> 90	Min. 0 Max. 1.7	< 10
Phyla > 50 um	3 different	≥ 3 different		-		-
Species > 50 µm	5 different	≥ 5 different		-		-
10-50 µm (/ml)	Min. 1,594 Max. 2,397	> 1000	Min. 303 Max. > 1,600	> 90	Min. < 0.18 Max. 6	< 10
Phyla 10-50 µm	3 different	≥ 3 different		-		-
Species 10-50 µm	5 different	≥ 5 different		-		-
Hetero. Bact./ml	Min. 23,317 Max. 307,500	≥10,000	> 200,000	-	Min. 29 Max. 125	-
Escherichia Coli (cfu/100 ml)	Min. < 10 Max. 357	-	Min. < 10 Max. 120	-	< 10	< 250
Vibrio cholerae (cfu /100 ml)	-	-	-	-	-	< 1
Enterococcus group (cfu/100 ml)	Min. < 10 Max. 38	-	Min. < 10 Max. 99	-	< 10	< 100

Fresh water test results (<3 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 um (/m^3)	Min. 142,259 Max. 435,458	≥ 100,000	Min. 132,5641 Max. 209,768	> 90	Min. 0 Max. 5.5	< 10
Phyla > 50 um	3 different	≥ 3 different		-		-
Species > 50 µm	5 different	≥ 5 different		-		-
10-50 µm (/ml)	Min. 23,395 Max. 32,480	> 1000	Min. 1,247 Max. >1,600	> 90	<0.19	< 10
Phyla 10-50 µm	3 different	≥ 3 different		-		-
Species 10-50 µm	5 different	≥ 5 different		-		-
Hetero. Bact./ml	Min. 30,467 Max. 49,600	≥10,000	Min. 18,167 Max. 38,250	-	Min. 27 Max. 60	-
Escherichia Coli (cfu/100 ml)	Min. 48 Max. 72	-	Min. 6 Max. 40	-	< 1	< 250
Vibrio cholerae (cfu /100 ml)	-	-	-	-	-	< 1
Enterococcus group (cfu/100 ml)	Min. 35 Max. 56	-	Min. 3 Max. 42	-	< 1	< 100

Reference Methods:

Parameters	**Reference Method**
Organism size class ≥50 µm	DHI SOP 30/1700
Organism size class ≥10 µm and <50 µm	Microscopy : DHI SOP 30/1701
Organism size class ≥10 µm and <50 µm	Re-growth essay (MPN) : DHI SOP 30/1704
Organism size class ≥10 µm and <50 µm	Primary production (algae) : DHI SOP 30/1702
Heterotrophic aerobic bacteria	DHI SOP 30/1706.
E. coli and enterococci	DHI SOP 30/1708
Vibrio cholerae	DHI SOP 30/1707.
TSS, DOC and POC	DHI SOP 30/530 + DHI SOP 30/1769
Temperature, pH, O2, salinity and turbidity	DHI SOP 30/1764
UV transmittance at 254 nm, 1 cm	DHI SOP 30/1770

Summary of Ship Based Test Results (B14-2000)

Organization conducting the test…….. DHI Environmental Laboratory, Denmark

Tests were conducted on board the vessel…… "M/V "CMA CGM WASHINGTON",IMO No.9780847

Time of testing…….…….……. 07 June 2017 – 02 December 2017

Maritime Area of testing…… Hong Kong, Shenzhen/P.R. of China, Los Angeles, San Francisco

Organism Type	Influent Water	IMO req.	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	Min. 400 Max. 34,243	> 90	> 9	Min. 0 Max. 9.5	<10
10-50 µm (/ml)	Min. 124 Max. 483	> 90	>9	Min 0.18 Max 2.8	<10
Escherichia coli (cfu /100 ml)	Min. 72 Max. < 100	-	-	< 100	<250
Vibrio cholerae (cfu /100 ml)	-	-	-	-	<1
Enterococcus group (cfu /100 ml)	Min, 17 Max. < 100	-	-	< 100	<100

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