



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..... COSCO Shipbuilding Industry Co., Ltd.

9/F Tower 1, No. 15 Guanghua Road, Chaoyang District, Beijing, People's Republic of China

under type and model designation..... COSCO Blue Ocean Shield BWMS-BOS05-100~1600

and incorporating:

Ballast water management system manufactured by... COSCO (Weihai) Shipbuilding Marine Technology Co., Ltd

to equipment/assembly drawing No..... BOS02-01, BOS05-01-GLYL date..... 2009-06-04

MPUV Reactor manufactured by.....COSCO (Weihai) Shipbuilding Marine Technology Co., Ltd.

to components drawing No..... BOS05-02 date..... 2015-07-31

Filtration system manufactured by..... COSCO (Weihai) Shipbuilding Marine Technology Co., Ltd.

To components drawing No..... BOS05-01 date..... 2015-07-31

Treatment rated capacity..... 100 ~ 1600 m³/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 China Maritime Safety Administration with Type Approval Certificate No. QD10T00012_02.

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: 08/July/2018 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).....	100 ~ 1600 m ³ /h
Measured Minimum UV Dose	200 mJ/cm ²
(Corresponding to a minimum UV transmittance of 70%)	
Salinity range.....	Brackish and Marine Water
Temperature.....	minimum 0°C
Max system operating pressure.....	7 Bar
Max differential pressure across filter	0.8 Bar
Minimum holding time.....	Not Applicable
Maximum Allowable Discharge Concentration (MADC) of relevant chemicals.....	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 20.0 PSU (low salinity) to 32.3 PSU (high salinity)
Ballast water salinity range during ship board tests.....	Tested in water salinity ranging from 31.7 PSU (low salinity) to 34.3 PSU (high salinity)
During the shipboard tests the water temperature ranged between.....	19.4°C – 21.2°C
During the land based tests the water temperature ranged between.....	22.5°C – 22.7°C
Ballast water dissolved organic compounds (DOC).....	11.3 mg/L (low salinity) to 3.58 mg/L (high salinity)
Ballast water particulate organic compounds (POC).....	10.3 mg/L (low salinity) to 1.0 mg/L (high salinity)
Ballast water total suspended solids (TSS).....	107.2 mg/L (low salinity) to 10 mg/L (high salinity)
Minimum holding time.....	Not Applicable
Maximum Allowable Discharge Concentration (MADC) of relevant chemicals.....	Not limited
Minimum UV transmittance	70%
Minimum UV measured Dose	200 mJ/cm ²
Means to account for changes in UV-transmittance.....	UV intensity sensor mounted in MPUV 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).....	100-1600 m ³ /h
Flow rates during land-based testing averaged.....	300 m ³ /h
Flow rates during shipboard testing averaged.....	600 m ³ /h
(Maximum treatment rated capacity based upon mathematical modeling of MPUV Reactor dose from 250 m ³ /h to 550 m ³ /h)	

Operating Parameters during ship-based testing

Operating UV Dose at 70 % UVT.....	200 mJ/cm ²
Energy consumption at 300 m ³ /hour.....	27KW
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..... COSCO Blue Ocean Shield BWMS-BOS05-100~1600

Manufactured by.....COSCO (Weihai) Shipbuilding Marine Technology Co., Ltd

Organization conducting the test Pony Test Science and Technology Co., Ltd, Beijing, P.R. China

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, six and at low salinity, six 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.

High salinity test results (> 32 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 µm (/m ³)	Min. 2.52 E+5 Max. 4.88 E+6	≥ 100 000	Min. 3.91 E+3 Max. 4.08 E+5	> 90	< 10	< 10
Phyla > 50 µm	3 different	≥ 3 different		-		-
Species > 50 µm	5 different	≥ 5 different		-		-
10-50 µm (/ml)	Min. 1.09 E+3 Max. 8.06 E+3	> 1000	Min. 1.39 E+2 Max. 479	> 90	< 10	< 10
Phyla 10-50 µm	3 different	≥ 3 different		-		
Species 10-50 µm	5 different	≥ 5different		-		
Hetero. Bact./ml	Min. 2.41 E+4 Max. 5.3 E+4	≥10 000	Min. 2.18 E+4 Max. 2.91 E+5	-	Min. 0 Max. 7.62 E+2	-
Escherichia Coli (cfu/100 ml)	Max. 0.36	-	<0.3	-	<0.3	<250
Vibrio cholerae (cfu /100 ml)	<1	-	<1	-	<1	< 1
Enterococcus group (cfu/100 ml)	Max. <0.3	-	<0.3	-	Max. <0.3	< 100

Low salinity test results (3-32 PSU):

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 μm (/m ³)	Min. 1.46 E+5 Max. 4.45 E+5	$\geq 100,000$	Min. 5.19 E+3 Max. 2.67 E+5	> 90	<10	< 10
Phyla > 50 μm	3 different	≥ 3 different		-		-
Species > 50 μm	5 different	≥ 5 different		-		-
10-50 μm (/ml)	Min. 1.42 E+3 Max. 1.32 E+4	> 1000	Min. 1.01 E+2 Max. 3.56 E+2	> 90	<10	< 10
Phyla 10-50 μm	3 different	≥ 3 different		-		-
Species 10-50 μm	5 different	≥ 5 different		-		-
Hetero. Bact./ml	Min. 2.05 E+4 Max. 9.4 E+4	$\geq 10,000$	Min. 2.18 E+4 Max. 2.91 E+5	-	Min. 0.20 E+2 Max. 1.68 E+2	-
Escherichia Coli (cfu/100 ml)	Max. 0.36	-	<0.3	-	<0.3	< 250
Vibrio cholerae (cfu /100 ml)	<1	-	<1	-	<1	< 1
Enterococcus group (cfu/100 ml)	<0.3	-	<0.3	-	<0.3	< 100

Reference Methods:

Parameters	Reference Method
Acute toxicity test of fish	OECD 203 , IMO G9
Acute toxicity test of fleas	OECD 202 , IMO G9
Growth inhibition test of algae	OECD 201 , IMO G9
Chronic toxicity test of fish	EPA-821-R-02-012 , IMO G9
Chronic toxicity test of fleas	EPA-821-R-02-014 , IMO G9
Determination of chemical substance	Water and Wastewater Monitoring and Analysis Method (4th edition), IMO G8
Determination of heterotrophic bacteria	Microbiological Examination Rules for Ballast Water of Entry-exit ships SN/T 1875-2007 The Specification for Marine Monitoring-Part 7: Ecological Survey of Offshore Pollution and Biological Monitoring GB 17378.7-2007
Determination of E. coli	Microbiological Examination Rules for Ballast Water of Entry-exit ships SN/T 1875-2007 Microbiological Examination of Food Hygiene-- Enumeration of Escherichia Coli GB/T 4789.38-2008
Determination of Vibrio cholerae	Microbiological Examination Rules for Ballast Water of Entry-exit ships SN/T 1875-2007 Inspection Codes for Cholera at Frontier Port SN/T 1239-2003
Determination of enterococcus	Microbiological Examination Rules for Ballast Water of Entry-exit ships SN/T 1875-2007 Examination Methods of the Fecal Streptococcus Group in Commodities for Export SN/T 0475-95
Determination of plankton larger than 50µm	Specifications for Oceanographic Survey-Part 9: Guidelines for Marine Ecological Survey GB/T 12763.9—2007 Technical Specification for Marine Ecological Survey: Ocean Press
Determination of plankton between 10-50µm	Specifications for Oceanographic Survey-Part 9: Guidelines for Marine Ecological Survey GB/T 12763.9—2007 Technical Specification for Marine Ecological Survey: Ocean Press

Summary of Ship Based Test Results

Organization conducting the test..... Pony Test Science and Technology Co., Ltd, Beijing, P.R. China
 Weihai Marine Environment Monitoring Stations of the State Ocean Administration

Tests were conducted on board the vessel..... "M/V "COSCO ROTTERDAM",IMO No. 9221073

Time of testing..... 27 November 2009 – 7 June 2010

Maritime Area of testing..... Zhoushan, Shanghai, Shenzhen, Hong Kong

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	Min. 1.1 E+3 Max. 3.6 E+4	> 90	Min. 1.2 E+3 Max. 2.3 E+4	> 9	<10	<10
10-50 µm (/ml)	Min. 1.2 E+2 Max. 2.8 E+2	> 90	Min.0.35 E+2 Max. 1.9 E+2	>9	<10	<10
Escherichia coli (cfu /100 ml)	Min <0.3 Max. 0.74	-	-	-	<0.3	<250
Vibrio cholerae (cfu /100 ml)	<1	-	-	-	<1	<1
Enterococcus group (cfu /100 ml)	Max. 0.06	-	-	-	<0.3	<100

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Deputy Commissioner of Maritime Affairs

Republic of Liberia

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