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…… ERMA FIRST ESK ENGINEERING SOLUTIONS S.A.
Schisto Industrial Park (VIPAS), Block 13, Keratsiniou
Skaramagas Ave., 18863, Perama, Greece

under type and model designation..... ERMA FIRST BWTS
FIT75/FIT100/200/FIT300/FIT400/FIT600/FIT800/
FIT1000/FIT1200/FIT1500/FIT 2000/FIT2500/FIT3000
(Filters)

ERMA FIRST BWTS 500/800/1000 (Cyclones) (Note: For additional models, a new Type Approval Certificate will be issued)

and incorporating:

Ballast water management system manufactured by… ERMA FIRST ESK ENGINEERING SOLUTIONS S.A.

to equipment/assembly drawing No…… Generic OMSM_Components_Drawings
See Appendix 1 date…….29 November 2011/ 17 November 2014

Electro-Chlorination Unit manufactured by……...ERMA FIRST ESK ENGINEERING SOLUTIONS S.A.

To components drawing…… No 1-801-G-00 and 2-802-G-00
See Appendix 1 date……..29 November 2011/17 November 2014

Filtration system manufactured by…… Filtrex, Italy /FilterSafe, Israel

To components drawing No. 2-802-G-00
See Appendix 1 date …….17 November 2014

TRO sensor unit manufactured by…… HF Scientific, USA

To components drawing No…….. 1-801-G-00 and 2-802-G-00
See Appendix 1 date……. 29 November 2011/17 November 2014

TRO neutralization unit manufactured by……. ERMA FIRST ESK ENGINEERING SOLUTIONS S.A.

To components drawing No…… 1-801-G-00 and 2-802-G-00
See Appendix 1 date……. 29 November 2011/17 November 2014

Treatment rated capacity...90 – 3740 m^3/h (ERMA FIRST BWTS FIT); 50-3000 m^3/h (ERMA FIRST BWTS)

Active Substances (as Total Residual Oxidants) …… Hypochlorite (HOCl, Ocl)
Hypobromite (HOBr, Obr-)

Relevant Chemical …… Chlorodibromomethane, Tribromomethane, Trichloromethane, Dichlorobromomethane, Sodium Bromate, Monobromoacetic acid, Dichloroacetic acid, Dibromoacetic acid, Bromochloroacetic acid, Trichloroacetic acid, Dibromochloroacetic acid, Tribromoacetic acid, Hydrogen

Final approval granted by IMO for systems using active substances….MEPC 63/23 para 2.7

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 Hellenic Republic, Ministry of Shipping with Type Approval Certificate No. 2323.6-5/01/18.

Limiting Conditions imposed and operating parameters are described in the Appendix 2 to this document.

Official Stamp

Margaret Ansumana
Deputy Commissioner of Maritime Affairs
Republic of Liberia
Date of Re-issue: 19/Oct/2018 Place of issue: Dulles, USA

Date of Expiry: 27/October/2020

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

APPENDIX I

ERMA FIRST BWTS Model (Cyclones)		
500	ERMA FIRST BWTS 500	1-800-G-01 ERMA FIRST 50-3000 OMSM
		DR-500-1-005
800	ERMA FIRST BWTS 800	1-800-G-01 ERMA FIRST 50-3000 OMSM
		DR-0800-2-004
1000	ERMA FIRST BWTS 1000	1-800-G-01 ERMA FIRST 50-3000 OMSM
		1-1200-G-1002 -01
ERMA FIRST BWTS Model (Filter)		
FIT75	ERMA FIRST BWTS FIT 75	2-1200-G-0751
FIT100	ERMA FIRST BWTS FIT 100	2-1200-G-1001
FIT200		2-800-G-07 ERMA FIRST FIT 100-3000 OMSM
		2-1200-G-0201
FIT300	ERMA FIRST BWTS FIT 300	2-800-G-07 ERMA FIRST FIT 100-3000 OMSM
		2-1200-G-0301
FIT400	ERMA FIRST BWTS FIT 400	2-800-G-07 ERMA FIRST FIT 100-3000 OMSM
		2-1200-G-401 – 01
FIT600	ERMA FIRST BWTS FIT 600	2-800-G-07 ERMA FIRST FIT 100-3000 OMSM
		2-1200-G-601-02
FIT800	ERMA FIRST BWTS FIT 800	2-1200-G-0801
FIT1000	ERMA FIRST BWTS FIT 1000	2-800-G-07 ERMA FIRST FIT 100-3000 OMSM
		2-1200-G-1001-02
FIT1200	ERMA FIRST BWTS FIT 1200	2-1200-G-1201
FIT1500	ERMA FIRST BWTS FIT 1500	2-800-G-07 ERMA FIRST FIT 100-3000 OMSM
		2-1200-G-1502-02
FIT2000	ERMA FIRST BWTS FIT 2000	2-800-G-07 ERMA FIRST FIT 100-3000 OMSM
		2-1200-G-2002
FIT2500	ERMA FIRST BWTS FIT 2500	2-1200-G-2502
FIT3000	ERMA FIRST BWTS FIT 3000	2-1200-G-3003

The installation, operation and maintenance manuals		
Generic OMSM/Components/Drawings	ERMA FIRST BWTS 50-3000 OMSM Generic Manual	1-800-G-01 ERMA FIRST 50-3000 OMSM
	ERMA FIRST BWTS FIT 100-3000 OMSM Generic Manual	2-800-G-07 ERMA FIRST FIT 100-3000 OMSM
	ERMA FIRST BWTS FIT 75-3000 OMSM Generic Manual	2-800-G-08 ERMA FIRST FIT 75-3000 OMSM
	Components ERMA FIRST BWTS (common)	12-802-G-00 Equipment Manual
	Components ERMA FIRST BWTS 50-3000	1-802-G-00 Equipment Manual
	Components ERMA FIRST BWTS FIT 100-3000	2-802-G-00 Equipment Manual
	Drawings ERMA FIRST BWTS 50-3000	1-801-G-00 Drawings

	Drawings ERMA FIRST BWTS FIT 100-300	2-801-G-00 Drawings
	Scope of Supply ERMA FIRST BWTS 50-3000	1-822-G-01 Scope of Supply
	Scope of Supply ERMA FIRST BWTS FIT 75-3000	2-822-G-07
	Installation in Hazardous Areas	2-823-G-07
	Environmental data as per IACS UR E10	12-840-G-07
	ERMA FIRST BWTS 75-3000 Model's Schedule	2-824-G-00

APPENDIX II

Limiting Conditions for operation of the BWMS

Maximum treatment rated capacity (TRC)……..... 3740 m^3/h (Filters)

…… 1000m^3/h (Cyclones)

Maximum Allowable Dosage Concentration of TRO (as Cl_2)……. 10 mg/L

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

(MSDS for neutralizing agent Sodium Thiosuplhate Pentahydrate to be made available for its use)

Ballast water salinity range……..... > 0.9 PSU

Operation with <0.9 PSU ballast water…….. Mixing 2.6% by volume salt water from holding tank

……..Mixing 1.6% with brine from holding tank

Ballast water temperature range ……..3 to 55ºC

Minimum holding time in tank prior to neutralization…… 1hr

Approved for use in explosive atmosphere ……Yes

Refer to Appendix 1 / Installation in Hazardous Areas/ 2-823-G-07 Ex

Installation on open deck ……. Ship specific

Maximum Hydrogen gas generation…… To be not more than 2% Vol. (50% LEL)

Automatic shut-down at 4% Vol.(LEL)

Maximum Chlorine gas generation……Not Applicable

Maximum differential pressure across the filter prior flushing ……. 0.5 Bar(Filtersafe)/0.3 Bar (Filtrex)

Summary of conditions during land and ship-based testing

Ballast water salinity range during land based tests…….Tested in water salinity ranging from 0.9 PSU (fresh water) to 34.7 PSU (marine water)

Ballast water salinity range during ship board tests……..28.0 -34.0 PSU (high salinity)

During the shipboard tests the water temperature ranged between……. 6.0ºC – 17.0ºC

During the land based tests the water temperature ranged between…… 9.2ºC – 17.1ºC

Ballast water dissolved organic compounds (DOC)..... 3.0 mg/L (high salinity) to 3.0 mg/L (low salinity)

Ballast water particulate organic compounds (POC)…….. 17.6 mg/L (high salinity) to 54 mg/L (low salinity)

Maximum Allowable Dosage Concentration of TRO (as Cl_2)…….....6-10 mg/L

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

Flow rates during land-based testing ……. maximum 300 m^3/hour

Flow rates during shipboard testing…….. maximum 500 m^3/hour

(Maximum treatment rated capacity based upon mathematical modeling of Electrolyzer Module dose (scale-up electrode from 150 m^3/hour to 3,750 m^3/hour, depending on model)

Multiple models can be used to provide higher flow rates. For example: 2 X ERMA FIRST BWTS FIT3000.

Corrosion Tests

Refer to Appendix1-Reports of Environmental Tests/ TNO 2012, Corrosion Report

Operating Parameters during land-based and ship-based testing

Operating TRO dosage…….Max. 6-10 mg/L

Average Energy consumption at 1000 m^3/hour……18KW/hour*

Installed Current …….. up to 2000 Amperes**

*Remark: The value is the seawater operation

**Remark: The value is the installed value.

1. The system is to be operated according to the manual provided by the manufacturer.
2. 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.
3. The Flow control valve could be installed in inlet or outlet of the system.

Summary of Land Based Test Results

For Ballast Water Management System, Type…… ERMA FIRST BWTS

Manufactured by…….. ERMA FIRST ESK ENGINEERING SOLUTIONS SA

Organization conducting the test……

National Oceanographic Institute of the Netherlands (NIOZ) (Cyclone Version)

Marine Eco Analytics (MEA) (Filter Version)

The test results of the tested Ballast Water Management System are valid for the System that is given type approval with this document.

Please refer to supportive material:

ERMA FIRST BWTS 50-3000: 02-LIBERIA-21102015\ Land Based Testing\ Final Report Land-Based Testing
ERMA FIRST BWTS FIT 100-3000: 02-LIBERIA-21102015\ Land Based Testing\ Report 141110 MEA 2014, ERMA FIRST Final Land Based

Notes:

At marine salinity, five; at brackish salinity, five; and at fresh salinity, two 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)	175000	≥ 100 000	59300	> 100	0.1	< 10
Phyla > 50 um	3	≥ 3 different	-	-	-	-
Species > 50 µm	5	≥ 5 different	-	-	-	-
10-50 µm (/ml)	1094	> 1000	101	> 100	0.1	< 10
Phyla 10-50 µm	3	≥ 3 different	-	-	-	-
Species 10-50 µm	5	≥ 5 different	-	-	-	-
Hetero. bact./ml	5360000	≥10 000	3700000	-	1470000	-
Escherichia Coli (cfu/100 ml)	<1	-	<1	-	ND	< 250
Vibrio cholerae (cfu /100 ml)	ND	-	<1	-	ND	< 1
Enterococcus group (cfu/100 ml)	<1	-	<1	-	ND	< 100
Temperature ^{0} C	15.1-17.1	-	-	-	-	-
Salinity (PSU)	34.7	>32		-	-	-
POC (mg/L)	6.4	> 1		-	-	-
DOC (mg/L)	3.0	> 1		-	-	-
TSS (mg/L)	17.6	> 1		-	-	-

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)	545000	≥ 100 000	59300	> 100	2.3	< 10
Phyla > 50 um	3	≥ 3 different	-	-	-	-
Species > 50 µm	5	≥ 5 different	-	-	-	-
10-50 µm (/ml)	1193	> 1000	112	> 100	0.3	< 10
Phyla 10-50 µm	3	≥ 3 different	-	-	-	-
Species 10-50 µm	5	≥ 5 different	-	-	-	-
Hetero. bact./ml	8250000	≥10 000	3640000	-	145000	-
Escherichia Coli (cfu/100 ml)	<0.1	-	<0.1	-	ND	< 250
Vibrio cholerae (cfu /100 ml)	ND	-	ND	-	ND	< 1
Enterococcus group (cfu/100 ml)	<1	-	<1	-	ND	< 100
Temperature ^{0} C	9.2-14.3	-	9.2-14.3	-	9.2-14.3	-
Salinity (PSU)	24.6	3-32	24.6	-	24.6	-
POC (mg/L)	13.1	> 5	-	-	16	-
DOC (mg/L)	3	> 5	-	-	6.1	-
TSS (mg/L)	54	> 50	-	-	3.2	-

Fresh water < 1PSU:

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
>50 um (/m^3)	232889	≥ 100 000	278055	> 100	1.85	< 10
Phyla > 50 um	3	≥ 3 different	-	-	-	-
Species > 50 µm	5	≥ 5 different	-	-	-	-
10-50 µm (/ml)	2089	> 1000	201	> 100	2.1	< 10
Phyla 10-50 µm	3	≥ 3 different	-	-	-	-
Species 10-50 µm	5	≥ 5 different	-	-	-	-
Hetero. bact./ml	3700000	≥10 000	2200000	-	2450000	-
Escherichia Coli (cfu/100 ml)	<0.1	-	<0.1	-	<1	< 250
Vibrio cholerae (cfu /100 ml)	ND	-	ND	-	ND	< 1
Enterococcus group (cfu/100 ml)	11	-	<1	-	<1	< 100
Temperature ^{0} C	18.7	-	18.9	-	18.95	-
Salinity (PSU)	0.9	3-32	0.9	-	0.95	-
POC (mg/L)	10.3	> 5	3.3	-	9.05	-
DOC (mg/L)	8.7	> 5	10	-	8.65	-
TSS (mg/L)	20.15	> 50	-	-	8.85	-

Reference Methods

Parameters	Reference Method
Heterotrophic Bacteria (counts/mL)	Refer to: ERMA FIRST BWTS 50-3000: 02-LIBERIA-21102015\ Land Based Testing\ **Final Report Land-Based Testing** ERMA FIRST BWTS FIT 100-3000: 02-LIBERIA-21102015\ Land Based Testing\ **Report 141110 MEA 2014, ERMA FIRST Final Land Based**
Escherichia coli (cfu/100mL)	
Enterococci (cfu/100 mL)	
Vibrio cholerae (cfu /100 ml)	
Organisms >=10 < 50 um (viable cells/mL)	
Organisms >= 50 um (viable organisms/m3)	

Summary of Ship Based Test Results

Organization conducting the test…… National Oceanographic Institute of the Netherlands (NIOZ)

Tests were conducted on board the vessel…… "M/V COSCO GUANGZHOU", IMO Nr.9305570

Time of testing……. ……. January 2011 – August 2011

Maritime Area of testing…… Rotterdam and off Vlieland, Netherlands; Felixstowe, UK

Test 1

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	3246	> 90	3218	> 9	1.9	<10
10-50 µm (/ml)	1647	> 90	4409	> 9	ND	<10
Escherichia coli (cfu /100 ml)	22	-	16	-	ND	<250
Vibrio cholerae (cfu /100 ml)	ND	-	ND	-	ND	<1
Enterococcus group (cfu /100 ml)	29	-	74	-	ND	<100
Temperature (°C)	5.2	-	6	-	5	-
Salinity (PSU)	28.2	-	28.1	-	28	-
POC (mg/l)	4.8	-	4.8	-	4.4	-
TSS [mg/l]	10.5	-	9.9	-	9.5	-

Test 2

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	3487	> 90	2777	> 9	1.2	<10
10-50 µm (/ml)	374	> 90	120	> 9	ND	<10
Escherichia coli (cfu /100 ml)	ND	-	ND	-	ND	<250
Vibrio cholerae (cfu /100 ml)	ND	-	ND	-	ND	<1
Enterococcus group (cfu /100 ml)	14	-	15	-	5.3	<100
Temperature (°C)	7.1	-	10.1	-	9	-
Salinity (PSU)	34	-	33.7	-	32.9	-
POC (mg/l)	4.7	-	4.1	-	4.6	-
TSS [mg/l]	11.1	-	10.6	-	11.2	-

Test 3

Organism Type	Influent Water	IMO req.	Discharge control	IMO req.	Discharge treated	IMO req.
> 50 µm (/m3)	12494	> 90	10052	> 9	4.4	<10
10-50 µm (/ml)	1398	> 90	473	> 9	ND	<10
Escherichia coli (cfu /100 ml)	37	-	9	-	ND	<250
Vibrio cholerae (cfu /100 ml)	ND	-	ND	-	ND	<1
Enterococcus group (cfu /100 ml)	14	-	6	-	3.7	<100
Temperature (°C)	17.6	-	17.9	-	18	-
Salinity (PSU)	33.8	-	33.8	-	33.5	-
POC (mg/l)	18	-	13.4	-	10.5	-
TSS [mg/l]	61	-	38	-	20.5	-

Official Stamp

Margaret Ansumana
Deputy Commissioner of Maritime Affairs
Republic of Liberia
Date of issue: 19/Oct/2018

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