Certificate no.:
TAP00002TS

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Ballast Water Management System

with type designation(s)
BalClor® Smart BWMS BCS-150, BCS-300, BCS-500, BCS-800, BCS-1000, BCS-1500, BCS-2000, BCS-2500, BCS-3000, BCS-3500, BCS-4000, BCS-5000, BCS-6000, BCS-7000 and BCS-8000

issued to
SunRui Marine Environment Engineering Co.,Ltd.
Qingdao, **China**

is found to comply with
IMO Resolution MEPC.300(72) – Code for Approval of Ballast Water Management Systems (BWMS Code)
Resolution MEPC.169(57)
DNV rules for classification – Ships Pt.6 Ch.7 Sec.1 Ballast water management – BWM
DNV class programme DNV-CP-0209 – Type approval – Ballast water management systems
DNV class guideline DNV-CG-0339 – Environmental test specification for electrical, electronic and programmable equipment and systems

Application:

This is to certify that the Ballast Water Management System listed above has been examined and tested in accordance with the requirements of the specifications contained in the BWMS Code (MEPC.300(72)) and DNV rules stated above. This certificate is valid only for the Ballast Water Management System referred to above.

System Design Limitations / Limiting Operating Conditions imposed are described in this certificate.

For the compliance with the BWMS Code, the certificate is issued on behalf of the Danish Environmental Protection Agency (DEPA) and Danish Maritime Authority (DMA).

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV, unless otherwise instructed by relevant Maritime Administrations.

Issued at **Høvik** on **2023-12-01**
This Certificate is valid until **2028-11-30**.
DNV local unit: **Qingdao NB & CMC**

for **DNV**

Approval Engineer: **Qinglan Wu**

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

Name of ballast water management system (BWMS)

BalClor® Smart BWMS

Ballast water management system manufactured by

SunRui Marine Environment Engineering Co., Ltd.

Place of production

SunRui Marine Environment Engineering Co., Ltd., Qingdao, China

Type and model designations

BalClor® Smart BWMS BCS-150, BCS-300, BCS-500, BCS-800, BCS-1000, BCS-1500, BCS-2000, BCS-2500, BCS-3000, BCS-3500, BCS-4000, BCS-5000, BCS-6000, BCS-7000 and BCS-8000

Equipment / Assembly drawings

The BalClor® Smart BWMS shall be installed in accordance with the documents listed below.

Type	Title	Drawing no.	Revision
Operation, maintenance and safety manual (OMSM)	SUNRUI BalClor® Smart Ballast Water Management System User Manual	TSJK-OMSM-01-WJ	1.32
	SUNRUI BalClor® Smart Ballast Water Management System User Manual with Ex installation	TSJK-OMSM-E1-WJ	1.1
Installation manual	SUNRUI BalClor® Smart Ballast Water Management System Installation Manual (OMSM Annex L)	X1JK-BSIM-01-WJ	1.0
Piping and instrumentation diagram (P&ID)	Flow Diagram of BalClor® Smart BWMS (for BC150-BC8000) (OMSM Annex C)	X1JKPIDS01QD	1.3
	Flow Diagram of BalClor® Smart BWMS With Ex installation (for BC150-BC8000) (OMSM Annex C)	XSJKPIDE01QD	1.1
Bill of materials (BoM)	Bill of Materials For BalClor® Smart BWMS (BCS150-BCS8000) (OMSM Annex H)	XCJK-BOMS-01-WJ	1.2
	Bill of Materials For BalClor® Smart BWMS with Ex components (BCS150-BCS8000) (OMSM Annex H)	XCJK-BOMS-02-WJ	1.1
General Arrangement drawings	Assembly Drawings of BalClor® Smart BWMS (for BCS150-BCS8000) (OMSM Annex J)	XSJKADLX01QD	1.1
	Assembly Drawings of BalClor® Smart BWMS with Ex Components (for BCS150-BCS8000) (OMSM Annex J)	XSJKADEX01QD	1.0
Electrical wiring diagram	Electrical wiring diagram of BalClor® Smart BWMS (for BCS150-BCS8000) (OMSM Annex K)	ED1210TSJXTZ	1.2
	Electrical wiring diagram of BalClor® Smart BWMS with Ex installation (for BCS150-BCS8000) (OMSM Annex K)	ED1211TSJXTZ	1.1
Commissioning procedure	Commissioning Test Procedure for BalClor® Smart Ballast Water Management System	BTSCTTP008WJ	1.1

Other equipment manufactured by

Not applicable

Treatment Rated Capacity

130~150 – 6 500~7 200 m^3/h

Product description

Treatment sequence:

- Ballast water uptake: Injection of active substance generated by electrolysis
- Ballast water discharge: Neutralisation

System design limitations / Water quality parameters

Temperature & salinity

Temperature and salinity of the ballast water are not limiting conditions for the BalClor® Smart BWMS.

System design limitations / Operational parameters

Feed water to Electrolytic Disinfection Unit (EDU)

A strainer (filtration grade ≤0.8 mm) or pre-filter (filtration grade ≤0.8 mm, 725th institute filter models SR-30V, SR-40V, SR-60V or SR-100V or BOLLFILTER aquaBoll 6.18.3 DN50, DN80 or DN100), shall be installed in the EDU feed water line.

The temperature of the feed water to the EDU shall be 5-40°C. The feed water to the EDU shall as necessary be heated to ≥5°C by use of a heat exchanger.

The salinity of the feed water to the EDU shall be ≥15 PSU. For treatment of ballast water with a salinity of less than 15 PSU, the feed water to the EDU shall be sourced directly from a brine tank or a dedicated tank with treated seawater (or seawater filtered with strainer or pre-filter) to ensure that the feed water salinity is ≥15 PSU.

Holding time

The BalClor® Smart BWMS has demonstrated performance to the D-2 standard with a minimum holding time between uptake and discharge of 72 hours in land-based testing in each of the three salinity ranges. Therefore, a minimum holding time of 72 hours is required.

Treatment dose

The BalClor® Smart BWMS has demonstrated performance to the D-2 standard with a target TRO of 9.8 mg/L during ballast water uptake. The maximum allowable dosage approved in the Final Approval is 13.5 mg/L.

The TRO concentration at discharge shall be ≤0.1 mg/L. The system may empty tanks employing a stripping eductor without TRO monitoring if the ballast water is neutralized with excessive dosing of neutralizer in accordance with the OMSM.

Treatment Rated Capacity

The Treatment Rated Capacities (TRC) for ballast water uptake is stated below for each designated BalClor® Smart BWMS model. The TRC for ballast water uptake depends on whether the feed water to the EDU has a salinity ≥15 PSU and ≤20 PSU, a salinity in the range >20 PSU and ≤25 PSU or a salinity >25 PSU.

The TRC for ballast water discharge is limited by the capacity of the selected model of the Automatic Neutralization Unit as stated below.

The BalClor® Smart BWMS controls the flow rate in each ballast water line by using a flow control valve to ensure that flow rates are kept within the TRC of a specific model.

BalClor® Smart BWMS model	Electrolytic Disinfection Unit (EDU)	Maximum flow rate at ballast water uptake [m^3/h]		
		Salinity of the feed water to the EDU		
		≥15 PSU and ≤20 PSU	>20 PSU and ≤25 PSU	>25 PSU
BCS-150	EDU-150	130	130 ~150 (1)	150
BCS-300	EDU-300	260	260 ~ 290 (1)	290
BCS-500	EDU-500	450	450 ~ 500 (1)	500
BCS-800	EDU-1000	700	700 ~ 760 (1)	760
BCS-1000	EDU-1000	950	950 ~ 1 050 (1)	1 050
BCS-1500	EDU-1500	1 300	1 300 ~ 1 500 (1)	1 500
BCS-2000	EDU-2000	1 700	1 700 ~ 1 900 (1)	1 900
BCS-2500	EDU-2500	2 200	2 200 ~ 2 400 (1)	2 400
BCS-3000	EDU-3000	2 500	2 500 ~ 2 700 (1)	2 700
BCS-3500	EDU-3500	3 000	3 000 ~ 3 200 (1)	3 200
BCS-4000	EDU-4000	3 300	3 300 ~ 3 700 (1)	3 700
BCS-5000	EDU-5000	4 200	4 200 ~ 4 700 (1)	4 700
BCS-6000	EDU-6000	4 900	4 900 ~ 5 400 (1)	5 400
BCS-7000	EDU-7000	5 600	5 600 ~ 6 200 (1)	6 200
BCS-8000	EDU-8000	6 500	6 500 ~ 7 200 (1)	7 200

(1) The flow rate is adjusted according to a linear flow control curve depending on salinity.

Automatic Neutralization Unit (ANU)	Neutralization tank volume (1) [m^3]	Neutralization pump capacity [L/h]	Maximum flow rate for ballast water discharge [m^3/h]
ANU-A	0.5	50	4 800
ANU-B	1.0	90	8 600
ANU-C	1.5	90	8 600

(1) The concentration of the neutralizer shall be prepared as described in the OMSM for the relevant BCS BWMS model.

Pressure

The maximum operating pressure of the Electrolytic Disinfection Unit (EDU) is 5 bar.

Control and monitoring equipment

Software version

The BalClor® Smart BWMS is type approved with the system control software version BC.03.XX, where XX represents the minor revision number.

Any changes to the software are to be recorded as long as the system is in use on board. Records of any major software changes or any changes to the hardware are to be forwarded to DNV for evaluation. Major software changes include any change to the control and operating philosophy of the BWMS, which can alter the performance of the system. Testing of the application functions of the revised software may be required.

Safety measures

The BalClor® Smart BWMS is type approved with redundant Ex-certified blowers for venting of H_2 and with the following instruments for monitoring the safe operation of the BWMS and for activating, as necessary, an automatic shutdown of the BWMS:

- EDU feed water flow meter (FT21)
- Pressure transmitter at the EDU (PT21), arranged with safety function independent of BWMS control

- Temperature sensor at the EDU (TT21)
- Cl_2 gas sensor below the EDU (CS21)
- Ex certified H_2 gas sensor above the EDU (HS01), arranged with safety function independent of BWMS control
- Ex certified air pressure switch in the H_2 gas ventilation duct (WP21)
- Ex certified H_2 gas sensor in the gas ventilation duct (HS02), arranged safety function independent of BWMS control)
- Ex certified level meter for buffer tank (LS21)

Electrical and electronic components

The BalClor® Smart BWMS is type approved with the electrical and electronic components indicated on the P&ID and specified on the BoM.

Except for the components listed below, alternate components to the ones specified on the BoM may be used provided that information regarding the selected components is part of the documentation related to the specific installation, by providing either a reference to a valid type approval certificate or technical documentation demonstrating that the selected component was subject to environmental testing as per IACS UR E10 (rev. 7 or as amended).

For the following electrical and electronic components only the models specified in the BoM shall be used:

Tag No.	Component name	Manufacturer	Model(s)
TR	TRO analyzer	HF Scientific, USA	CLX-XT, CLX-Ex or CLX-Ex2
		SunRui Marine Environment Engineering Co., Ltd	SRK100-ST
EQ08	System control cabinet	SunRui Marine Environment Engineering Co., Ltd	SCC-1
EQ07	Rectifier	SunRui Marine Environment Engineering Co., Ltd	SCR-01X1, SCR-01A1, SCR-01B1, SCR-01Y1, SCR-01C1, SCR-01D1, SCR-01E1, SCR-01F1, SCR-01G1, SCR-01H1, SCR-01J1, SCR-01K1
EQ25	Motor control cabinet	SunRui Marine Environment Engineering Co., Ltd	MCC-1
EQ24	Remote control box (optional)	SunRui Marine Environment Engineering Co., Ltd	JCR-1

Hazardous area / Ex-proof

The BalClor® Smart BWMS has been evaluated and found to be in compliance with DNV Rules Pt.4 Ch.8 Sec.11 for hazardous area installations. The TRO analyser, flowmeter and valves are available with models certified for installation in hazardous areas and may be installed in hazardous area zone 1, gas group IIC and temperature class T4. The rectifiers, the EDU, the degas unit, the neutralization unit and the control cabinets are to be located in safe zone.

Ex-certification is not covered by this certificate. Installation in a hazardous area is to be approved in each case according to the Rules and Ex-certification / Special Condition for Safe Use, listed in a valid Ex-certificate issued by a notified/recognized Certification Body.

The model names of the BalClor® Smart BWMS suitable for installation in hazardous area have the suffix “-Ex” and comprise the same model range as stated under Treatment Rated Capacity (i.e., BCS-150-Ex to BCS-8000-Ex).

Documents approval

The following documentation is to be submitted for approval for each BWMS installation:

- Piping and Instrumentation Diagram (P&ID) of the ballast system including the treatment system installation

- Power supply arrangement (including power supply to dilution blowers)
- Commissioning procedure
- Interface description towards ship's existing systems including alarms for failure

Type approval documentation

Test plan and reports:

- DHI, Biological efficacy performance evaluation of Ballast Water Management System BalClor® Smart BWMS in land-based test - Land-based test report, Final report dated 2023-06-30
- DHI, Biological efficacy performance evaluation of Ballast Water Management System BalClor® Smart BWMS in shipboard test - Shipboard test report, Final report dated 2023-11-09
- IMO MEPC 80/17, Final approval to the BalClor® Smart BWMS submitted by Denmark in document MEPC 80/4/1
- Environmental and EMC test reports approved by DNV to be in accordance with DNV Standard for Certification No. 2.4 (April 2006) and Resolution MEPC.174(58)
- BalClor Ballast Water Management System for vibration test of System-A,
  Report no: 7191142928-EEC16/13-LYA
- TÜV SÜD, Environmental test for Sunrui BalClor Water Ballast Management System A,
  Report no: 7191142928-EEC16/14-PCA
- TÜV SÜD, Voltage Variations System A Control Cabinet, Report no: 7191142928-EEC16/16
- TÜV SÜD, Voltage Variations System A Motor Control Cabinet, Report no: 7191142928-EEC16/17
- TÜV SÜD, Voltage Variations System A Remote Control Box, Report no: 7191142928-EEC16/15
- TÜV SÜD, BalClor Ballast Water Management System for vibration test of System-B,
  Report no: 7191142928-EES16/09-LYA
- TÜV SÜD, Voltage Variations System B Rectifier Cabinet, Report no: 7191142928-EEC16/11
- TÜV SÜD, Environmental test for Sunrui BalClor Water Ballast Management System B,
  Report no: 7191142928-EEC16/10
- TÜV SÜD, BalClor Ballast Water Management System for vibration test of System-BC,
  Report no: 7191142928 EEC16/01-LYA
- TÜV SÜD, Environmental test for Sunrui BalClor Water Ballast Management System C,
  Report no: 7191142928-EEC16/02-TCY
- Marine Equipment Inspection & Testing Co., Ltd., Test Report – System Control Cabinet,
  Report no. CT202111064-EMC01
- Marine Equipment Inspection & Testing Co., Ltd., Test Report – Motor Control Cabinet,
  Report no. CT202111064-EMC02
- Marine Equipment Inspection & Testing Co., Ltd., Test Report – Remote Control Box.
  Report no. CT202111064-EMC03
- Marine Equipment Inspection & Testing Co., Ltd., Test Report – EDU Junction Box,
  Report no. CT202111064-EMC04
- Marine Equipment Inspection & Testing Co., Ltd., Test Report – Rectifier, Report no. CT202111064-EMC05
- Shanghai Marine Auxiliary Electromechanical Equipment Performance and Environmental Testing Center,
  Test outline for SRK100-ST Online total chlorine analyzer, Doc no. S554A-2022
- Shanghai Marine Auxiliary Electromechanical Equipment Performance and Environmental Testing Center,
  Report no. S594A-2023
- SunRui Marine Environment Engineering Co., Ltd: Summary on hydrogen separation efficacy performance test with optimized arrangement of Hydrogen Evacuation System of BalClor® BWMS. Document: X1JKSHEP0, ver. 1.1, dated 04-09-2018

System documentation:

- SunRui Marine Environment Engineering Co., Ltd., SUNRUI BalClor® Smart Ballast Water Management System User Manual, Doc. no. TS-JK-OMSM-01-WJ, Rev. 1.32
- SunRui Marine Environment Engineering Co., Ltd., SUNRUI BalClor® Smart Ballast Water Management System User Manual with Ex installation, Doc. no. TSJK-OMSM-E1-WJ, Rev. 1.1
- SunRui Marine Environment Engineering Co., Ltd., Functional description of BalClor® Smart BWMS, Doc. no. X1JK-SDFD-01-WJ, Rev. 1.22
- SunRui Marine Environment Engineering Co., Ltd., Commissioning Test Procedure For BalClor® Smart Ballast Water Management System, Doc. no. BTSC-TTP0-08-WJ, Rev. 1.1
- SunRui Marine Environment Engineering Co., Ltd., Scaling Principle for BalClor® Smart BWMS, Doc. no. X1JK-SPBS-01-WJ, Rev. 1.2
- SunRui Marine Environment Engineering Co., Ltd., Brief report of bench-scale testing for SunRui TRO analyzers, Doc. no. X1JK-TRFT-01-WJ, Rev. 1.1
- SunRui Marine Environment Engineering Co., Ltd., LB and workshop test report of SunRui TRO analyzer, Doc. no. X1JK-TRAT-01-WJ, Rev. 1.1
- SunRui Marine Environment Engineering Co., Ltd., SB test report of SunRui TRO analyzer, Doc. no. X1JK-TRSS-01-WJ, Rev. 1.2
- SunRui Marine Environment Engineering Co., Ltd., Optimization of electrolyzer end sealing for BalClor BWMS, Doc No X1RKOEESO1WJ, Rev. 1.2

Tests carried out

- Land-based testing using BalClor® Smart BWMS BCS-300 in accordance with Resolution MEPC.300(72)
- Shipboard testing using BalClor® Smart BWMS BCS-3000 in accordance with Resolution MEPC.300(72)
- Environmental testing in accordance with the environmental test specification for electrical, electronic and programmable equipment and systems contained in DNV-CG-0339 (August 2021) and Resolution MEPC.300(72)

Marking of product

For traceability of this type approval, each treatment system is to be marked with:

- Manufacturer’s name or trademark
- Type designation
- Serial number

Periodical assessment

For retention of the Type Approval, DNV Surveyor shall perform periodical assessments to verify that the conditions of the TA are not altered since the certificate was issued.

The scope of periodical assessment includes:

- Review of the TA documentation and verification that the documentation is still used as basis for the production
- Review of possible changes in design, material and performance of the product
- Verification of the company’s production and quality systems ensuring continued consistent production of the type approved products to the required quality
- Verification that the product marking for identification and traceability to the TA Certificate is not altered

Copy of type approval certificate

A copy of this type approval certificate should always be carried on board a vessel fitted with this ballast water management system. An annex containing the summary reports of the test results of land-based and shipboard tests should be available for inspection on board the vessel.

Revision history of this certificate

Revision No.	Date of Issuance	Description
-	2023-12-01	Initial certificate The BalClor Smart BWMS is a variant without filtration of the BalClor BWMS, which is type approved as per DNV type approval certificate no. TAP00001BB

Annex A: Summary of testing

Land-based testing

Table 1 Test water conditions and operational parameters in land-based testing with the BalClor® Smart BWMS BCS-300 at the DHI Maritime Technology Evaluation Facility in Hundested, Denmark, during the period from 16 September to 14 November 2022

Test cycle	Water temperature [°C]	Salinity [PSU]	DOC [mg/L]	POC [mg/L]	TSS [mg/L]	Holding time [hours]	Average flow rate at uptake / discharge [m^3/h]	TRO at uptake (1) [mg/L]	TRO at discharge (1) [mg/L]
Marine water									
M-1	13	29	7.9	6.0	42	72	291 / 344	10.0 (± 0.5) [8.66-10.7]	0.03 (± 0.03) [0.00-0.10]
M-2	11	29	7.2	6.1	46	120	292 / 345	9.85 (± 1.0) [6.81-11.6]	0.03 (± 0.03) [0.00-0.08]
M-3	11	29	7.2	6.1	46	120	292 / 346	10.2 (± 0.8) [8.48-12.3]	0.02 (± 0.03) [0.00-0.09]
M-4	11	29	7.3	5.4	47	72	293 / 345	10.0 (± 0.8) [8.50-12.0]	0.05 (± 0.03) [0.00-0.10]
M-5	12	29	7.3	5.4	47	72	292 / 345	10.3 (± 1.0) [8.96-12.9]	0.04 (± 0.03) [0.00-0.09]
Brackish water									
B-1	15	18	7.3	7.4	60	72	263 / 348	10.1 (± 0.9) [8.03-12.7]	0.01 (± 0.00) [0.00-0.02]
B-2	14	18	6.9	7.5	63	120	262 / 344	10.2 (± 0.8) [8.21-12.2]	0.01 (± 0.01) [0.00-0.06]
B-3	14	18	6.9	7.5	63	120	262 / 342	9.96 (± 1.6) [5.84-13.6]	0.00 (± 0.00) [0.00-0.01]
B-4	12	18	7.0	7.3	62	72	261 / 345	10.2 (± 0.5) [8.92-11.6]	0.00 (± 0.00) [0.00-0.01]
B-5	12	18	7.0	7.3	62	72	262 / 343	10.0 (± 0.9) [7.72-12.6]	0.00 (± 0.00) [0.00-0.01]
Fresh water									
F-1	15	0.42 (2)	5.9	6.9	75	72	263 / 345	10.1 (± 1.0) [8.00-13.3]	0.03 (± 0.01) [0.00-0.04]
F-2	15	0.42 (2)	6.9	6.6	63	120	264 / 343	10.1 (± 1.0) [4.88-11.9]	0.02 (± 0.01) [0.00-0.02]
F-3	16	0.42 (2)	6.9	6.6	63	120	262 / 344	10.1 (± 1.0) [6.75-13.0]	0.02 (± 0.00) [0.00-0.02]
F-4	14	0.42 (2)	6.8	6.0	62	72	262 / 348	10.1 (± 0.8) [7.67-12.0]	0.04 (± 0.01) [0.00-0.05]
F-5	14	0.42 (2)	6.8	6.0	62	72	262 / 344	10.1 (± 1.0) [7.37-12.3]	0.04 (± 0.01) [0.00-0.05]

(1) TRO average ± standard deviation and range (minimum and maximum) in parentheses. Data were extracted from the BWMS log.
(2) In the fresh water test cycles, stored seawater with a salinity of 18 PSU was used as EDU feed water.

Table 2 Average numbers of live organisms in influent water, treated discharge water and control water in land-based testing with the BalClor® Smart BWMS BCS-300. Live organisms ≥10 and <50 µm were quantified by microscopy counting after staining with FDA/CMFDA. Concentrations of the indicator microbes *Escherichia coli*, Enterococci and *Vibrio cholerae* in treated discharge water were below the D-2 standard in all test cycles.

Test cycle	Organisms ≥50 µm [organisms/m³]			Organisms ≥10-<50 µm [organisms/mL]		
	Influent water	Treated discharged water	Control water	Influent water	Treated discharged water	Control water
Marine water						
M-1	144 667	1.0	36 534	1 402	0	532
M-2	145 583	3.0	68 964 (1)	1 473	0	205 (1)
M-3	123 903	0.33		1 469	0	
M-4	132 167	5.0	56 583 (1)	3 110	0	1 820 (1)
M-5	128 444	0		2 988	0	
Brackish water						
B-1	117 444	2.0	45 785	2 307	0	758
B-2	100 778	0.33	44 085 (1)	2 892	0	270 (1)
B-3	101 639	1.0		2 829	0	
B-4	107 014	7.0	50 759 (1)	1 250	0	124 (1)
B-5	100 583	1.3		1 205	0	
Fresh water						
F-1	148 417	4.3	86 473	1 982	0	734
F-2	249 694	0	213 571 (1)	2 650	0	1 401 (1)
F-3	177 583	0.33		2 704	0	
F-4	228 375	0.33	133 380 (1)	1 464	0	887 (1)
F-5	239 597	0		1 520	0	

(1) Two test cycles were performed on the same day using the same control water tank.

Shipboard testing

Table 3 Test water conditions and operational parameters in shipboard testing with the BalClor® Smart BWMS BCS-3000 on board the tanker New Peace (IMO 9535797) during the period of 6 February to 16 August 2023

Test cycle	Water temperature [°C]	Salinity [PSU]	DOC [mg/L]	POC [mg/L]	TSS [mg/L]	Holding time [hours]	Average flow rate at uptake / discharge [m^3/h]	TRO at uptake (1) [mg/L]	TRO at discharge (1) [mg/L]
SB-1	27	30	2.4	0.29	23	66	2 583 / 1 802	10 [9.6 – 11]	0.00 [0.00 - 0.03]
SB-2	27	31	1.9	0.27	18	55	2 542 / 1 885	10 [9.7 – 11]	0.00 [0.00 - 0.12] 2)
SB-3	19	31	1.9	0.49	25	268	2 479 / 2 231	10 [9.2 – 11]	0.01 [0.00 - 0.05]
SB-4	18	31	1.8	0.20	31	251	2 537 / 2 190	10 [9.1 – 12]	0.01 [0.00 - 0.04]
SB-5	24	30	2.2	0.42	6.8	219	2 579 / 2 315	10 [8.2 – 11]	[0.01 [0.00 - 0.03]

(1) TRO average and range (minimum and maximum) in parentheses. Data were extracted from the BWMS log.
(2) High TRO value was observed towards the end of the uptake operation and is probably caused by air bubbles in the piping due to reduced flow

Table 4 Average numbers of live organisms in influent water and treated discharge water in shipboard testing with the BalClor® Smart BWMS BCS-3000. Live organisms ≥10 and <50 µm were quantified by microscopy counting after staining with FDA/CMFDA. Concentrations of the indicator microbes *Escherichia coli*, Enterococci and *Vibrio cholerae* in treated discharge water were below the D-2 standard in all test cycles.

	Organisms ≥50 µm [organisms/m^3]		Organisms ≥10-<50 µm [organisms/mL]	
Test cycle	Influent water	Treated discharged water	Influent water	Treated discharged water
SB-1	16 720	0	163	0.3
SB-2	19 222	0	157	0.3
SB-3	46 864	0	120	0.3
SB-4	70 751	0.18	133	0.2
SB-5	31 456	0	170	0