Certificate no.:
TAP000031R

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Ballast Water Management System

with type designation(s)
OceanGuard Sim, OceanGuard Sim Ex

issued to
Headway Technology Group (Qingdao) Co., Ltd.
Qingdao, Shandong Province, 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 BWMS Code 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 Maritime Authority.

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 **2025-10-30**
This Certificate is valid until **2030-10-29**.
DNV local unit: **Qingdao NB & CMC**

for **DNV**

Approval Engineer: **Ingrid Sigvaldsen**

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 USD 300 000.

Name of ballast water management system (BWMS)

OceanGuard® Sim BWMS

Ballast water management system manufactured by

Headway Technology Group (Qingdao) Co., Ltd.

Place of production

Headway Technology Group (Qingdao) Co., Ltd., Qingdao, China

Type and model designations

OceanGuard® Sim BWMS OB-B-01, OG-B-02, OG-B-03, OG-B-04, OG-B-05, OG-B-06, OG-B-07, OG-B-08, OG-B-09, OG-B-10, OG-B-11, OG-B-12, OG-B-13, OG-B-14

Equipment / Assembly drawings

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

	Type	Description	Drawing No.	Rev.
OceanGuard Sim	Operation, maintenance and safety manual (OMSM)	OceanGuard® Sim Ballast Water Management System User Manual (OG-B-01~OG-B-14)	H-BWMS-B-T01UM	1.1.1
	Piping and instrumentation diagram (P&ID)	Flow diagram of OceanGuard Sim BWMS	H-BWMS-B-T04PI	A1.1
	Assembly drawing	Assembly Drawing of OceanGuard Sim BWMS	H-BWMS-OG-B	A1.0
	Electrical wiring diagram	Electrical Wiring Diagram	OG-B-E	A1.2
	Equipment list	Bill of Materials for OceanGuard® Sim BWMS	H-BWMS-B-T21BM	A1.1
	Commissioning procedure	Commissioning Procedure for OceanGuard® Sim BWMS	H-BWMS-B-T18CP	A1.0
OceanGuard Sim (Ex models)	Operation, maintenance and safety manual (OMSM)	OceanGuard® Sim Ballast Water Management System User Manual (OG-B-01~OG-B-14 Ex)	H-BWMS-B-T01UM-Ex	1.1.1
	Piping and instrumentation diagram (P&ID)	Flow diagram of OceanGuard Sim BWMS	H-BWMS-B-T04PI-Ex	A1.0
	Assembly drawing	Assembly Drawing of OceanGuard Sim BWMS	H-BWMS-OG-B	A1.0
	Electrical wiring diagram	Electrical Wiring Diagram	OG-B-E	A1.2
	Equipment list	Bill of Materials for OceanGuard® Sim BWMS	H-BWMS-B-T21BM	A1.1
	Commissioning procedure	Commissioning Procedure for OceanGuard® Sim BWMS	H-BWMS-B-T18CP	A1.0

Treatment Rated Capacity

65 – 5200 m^3/h

Product description

Treatment sequence:

- Ballast water uptake: Injection of active substance generated by electrocatalysis
- Ballast water discharge: Neutralization

System design limitations / Water quality parameters

Temperature & salinity

The temperature of the ballast water is not a limiting condition for the BWMS.

Salinity of the ballast water is not a limiting condition for the BWMS, if the DE Unit is fitted with a brine/sea water injection unit (optional) for ballast conditions with a salinity <8 PSU. Without a brine/sea water injection unit, the BWMS is limited to treatment of ballast water with a salinity of ≥8 PSU.

System design limitations / Operational parameters

Holding time

The BWMS has demonstrated performance to the discharge standard in land-based testing with a minimum holding time between intake and discharge of 48 hours across all salinities. A minimum holding time of 48 hours is required for the BWMS.

Dosing

The BWMS has demonstrated performance to the discharge standard with the target TRO of 9.5 mg/L during the ballast water uptake. The maximum allowable dosage approved in the Final Approval is 13.5 mg/L.

TRO concentration at discharge shall be ≤0.1 mg/L.

Treatment Rated Capacity (TRC) of the BWMS

The Treatment Rated Capacities (TRC) of the designated OceanGuard ® Sim BWMS models are listed below. The list also specifies the major components of the BWMS that shall be installed for a specific BWMS model.

The BWMS has no flow control function.

BWMS model	DE Unit	TRC m^3/h
OG-B-01	OG-B-DE01	65
OG-B-02	OG-B-DE02	130
OG-B-03	OG-B-DE03	260
OG-B-04	OG-B-DE04	390
OG-B-05	OG-B-DE05	585
OG-B-06	OG-B-DE06	780
OG-B-07	OG-B-DE07	1040
OG-B-08	OG-B-DE08	1300
OG-B-09	OG-B-DE09	1560
OG-B-10	OG-B-DE10	1950
OG-B-11	OG-B-DE11	2600
OG-B-12	OG-B-DE12	3250
OG-B-13	OG-B-DE13	3900
OG-B-14	OG-B-DE14	5200

Control and monitoring equipment

Software version

The OceanGuard ® Sim BWMS is type approved with the system control software PLC version 3.1.101.0xxx (where xxx shall be 002 or higher) and HMI version 3.1.001.00xx (where xx shall be 02 or higher). Any changes to the software are to be recorded as long as the BWMS is in use onboard. The records of all changes are to be forwarded to DNV for evaluation. Major changes in the software, which can alter the performance of the system, require approval. Testing of the application functions of the revised software may be required.

Safety measures

The BWMS is type approved with the following instruments related to safety:

- Flowmeter (installed in DE unit)
- Temperature sensor (TT) (mounted in DE unit)
- Pressure switch (PS) (mounted in DE unit and arranged with independent shutdown functionality)
- Redundant Ex-certified blowers for venting of H_2
- Ex-certified H_2 gas sensor (HS1) above DE unit arranged with safety function independent of BWMS control
- Ex-certified H_2 gas sensor (HS2) in the gas ventilation duct arranged with safety function independent of BWMS control
- Ex-certified air-pressure switch (PT) in the H_2 gas ventilation duct

Electrical and electronic components

The type approved BWMS shall include the following control and monitoring equipment (including the above listed instruments related to safety) indicated on the P&ID and specified on the component lists. Except for the components listed below, alternate models to the ones specified on the component lists 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 component lists shall be used:

Name	Manufacturer	Model
DE Power	Headway Technology Co., Ltd.	OG-B-EPxx
Control Unit	Headway Technology Co., Ltd.	OG-B-CL
Remote control Unit	Headway Technology Co., Ltd.	OG-B-CR
Safety Control Box	Headway Technology Co., Ltd.	OG-B-SC
Monitoring Unit	Baway Technology Co., Ltd.	BW-MU
TRO sensor*	Baway Technology Co., Ltd.	-

*This sensor is mounted in the BW-MU Monitoring Unit

Hazardous area / Ex-proof

The OceanGuard ® Sim BWMS has been evaluated and found to be in compliance with DNV Rules Pt.4 Ch.8 Sec.11 for hazardous area installations. The Monitoring Unit and flowmeter have Ex-certificates and can be installed in hazardous area zone 1, gas group IIC and temperature class T4, but the electrical supply and control systems 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 OceanGuard® Sim BWMS models suitable for installation in hazardous area are designated with the suffix “-Ex” to normal models, i.e. OG-B-01-Ex to OG-B-14-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
- Interface description towards ship’s existing systems including alarms for failure
- List of ex equipment according to Pt.4 Ch.8 Sec.11 B100 if the system is to be installed in hazardous zone
- Commissioning procedure

Type Approval documentation

Biological test reports:

- DHI Denmark: Final Approval testing of Headway Technology Group (Qingdao) Co., Ltd. BWMS OceanGuard Sim BWMS, dated March 2024
- DHI Denmark: Biological efficacy performance evaluation of Headway OceanGuard Sim Ballast Water Management System in land-based tests, dated March 2025
- DHI Denmark: Biological efficacy performance evaluation of Headway OceanGuard Sim Ballast Water Management System in shipboard test, dated August 2025
- Basic Approval, Report of the Marine Environmental Protection Committee, MEPC 60/22 dated 2010-03-26
- Final Approval, Report of the Marine Environmental Protection Committee, MEPC 82/4/2 dated 2024-07-15
- Final Approval, Report of the Marine Environmental Protection Committee, MEPC 83/4/3 dated 2025-01-07

Environmental test reports:

- DELTA: Test for Marine Type Approval of Headway OceanGuard BWMS, DANAK-19/17038, dated 2017-09-19
- TÜV SÜD: Environmental tests of OceanGuard BWMS for PDU, FCB unit and EUT Power unit, Test report no. 7191178338-EEC18/01-LYA, rev. 1, dated 2018-03-22
- TÜV SÜD: Environmental Test for Headway OceanGuard BWMS, Test report no. 7191178338-EEC18/02-PCA, rev. 1, dated 2018-03-08
- TÜV SÜD: Formal report on testing in accordance with USCG 46 CFR 152 060-30 Clause 8, DNV GL-CG-0339: 2015 Section 5 of A, Headway OceanGuard BWMS, HMT-200PDU, HMT-FC, HMT-200PE, Test report no. 7191178338-EEC18/03, dated 2018-03-08
- Shanghai Marine Auxiliary Electromechanical Equipment Performance and Environment Testing Center: Test report, Report no. S672A-2020G, dated 2021-03-25
- Shanghai Marine Auxiliary Electromechanical Equipment Performance and Environment Testing Center: Test report, Report no. S623A-2024, dated 2025-01-21

Corrosion test report:

- Test report of Influence of Treated Ballast Water on Material Properties of Ballast Tank, Doc. No. TW 239008-1, dated 2024-06-07

System documents:

- Headway ISO 9001:2008 Management System Certificate issued by DNV, dated 2025-03-03
- Design manual, doc no H-BWMS-B-T06DM, A.04
- Safety Assessment for OceanGuard Sim, Document No. H-ETC-OG-B02SA, dated September 2023

System manuals:

- OceanGuard® Sim Ballast Water Management System User Manual (OG-B-01~OG-B-14), file no. H-BWMS-B-T01UM, Headway, version 1.1.1, dated October 2025
- OceanGuard® Sim Ballast Water Management System User Manual (OG-B-01~OG-B-14 Ex), file no. H-BWMS-B-T01UM-Ex, Headway, version 1.1.1, dated October 2025

Commissioning procedures:

- Commissioning Procedure for OceanGuard® Sim BWMS, file no. H-BWMS-B-T18CP

Tests carried out

- Land-based testing using OG-B-03 model in accordance with Resolution MEPC.300(72) and USCG 46 CFR 162.060-26
- Shipboard testing using OG-B-10 model in accordance with Resolution MEPC.300(72) and USCG 46 CFR 162.060-26
- Function tests of the control and automation system witnessed by DNV
- Environmental testing in accordance with DNV-CG-0339 (July 2024), Resolution MEPC.300(72), USCG 46 CFR 162.060-30 and IACS UR E10 Rev.9
- Additional degas efficacy test

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 onboard 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 onboard the vessel.

Revision history of this certificate.

Rev.	Date of issuance	Description
-	2025-10-30	Initial type approval certificate in compliance with Resolution MEPC.300(72)

Annex: Summary of testing

Land-based testing

Table 1 Test water conditions and operational data, and organism density counts in land-based testing of the Headway OceanGuard® Sim BWMS model OG-B-03 with TRC 260 m^3/h at the DHI Maritime Technology Evaluation Facility in Hundested, Denmark, during the period from October 2023 to October 2024.

Test#	Salinity [PSU]	Temp. [°C]	TRO at ballasting [mg/L]	DOC [mg/L]	POC [mg/L]	TSS [mg/L]	UVT [%]	Avg. flowrate [m^3/h]	Holding time [days]
F-1	0.4	~5	9.3	8.7	6.3	60	NA	253	2
F-2	0.36	8.3	9.5	6.8	7.0	69	54	258	2
F-3	0.39	16	9.7	8.1	7.5	72	54	259	5
F-4	0.38	16	9.7	8.1	7.5	72	54	260	5
F-5	0.41	18	9.6	7.6	7.1	61	55	259	2
B-1	16	7.1	9.5	6.5	8.1	67	68	260	5
B-2	16	7.2	9.2	6.5	8.1	67	68	259	5
B-3	18	17	9.4	7.2	6.2	66	70	260	5
B-4	18	17	9.6	7.2	6.2	66	70	250	5
B-5	-	-	9.5	7.5	5.6	46	66	260	2
B-6	18	13	9.4	7.0	7.8	60	66	259	2
B-7	18	13	9.4	7.0	7.8	60	66	260	2
B-8	18	11	9.5	6.3	8.5	63	63	259	2
M-1	28	18	9.5	6.7	5.7	38	76	259	2
M-2	29	19	9.6	7.5	5.8	44	73	259	2
M-3	29	19	9.6	7.9	6.1	41	75	260	2
M-4	28	19	9.6	11	6.1	45	76	259	2
M-5	28	20	9.4	6.6	5.7	41	78	260	5
M-6	28	20	9.5	6.6	5.7	41	78	260	5

Table 2 Average numbers [three replicates] of live organism in inlet and treated discharge water during land-based testing of the Headway OceanGuard® Sim BWMS model OG-B-03 at DHI during the period from October 2023 to October 2024. Viable organisms ≥10 and <50 µm were quantified by microscopy counting after staining with CMFDA/FDA. All counts of pathogenic bacteria (*E. coli*, Enterococci and *Vibrio cholerae*) in treated water were below the ballast water discharge standard.

Test#	Density of organisms ≥50 µm [organisms/m^3]			Density of organisms ≥10-<50 µm [organisms/mL]		
	Influent water	Treated discharge water	Control water	Influent water	Treated discharge water	Control water
F-1	114,917	0.33	71,298	1,493	0.33	986
F-2	474,597	1	106,222	2,142	0.33	1,477
F-3	386,597	0.33	127,941	1,122	0	280
F-4	309,014	0	127,941	1,132	0.33	280
F-5	245,208	2.7	73,533	1,963	0	1,003
B-1	119,972	103	52,161	1,458	0	168
B-2	120,453	41	52,161	1,844	0	168
B-3	184,551	2.7	140,256	1,775	0	211
B-4	117,228	0.33	140,256	1,524	0	211
B-5	(1)	(1)		(1)	(1)	
B-6	310.861	2.7	204,655	3,383	0	1,612
B-7	276.986	0.33	204,655	3,378	0	1,612
B-8	309.292	0.33	225,070	1,753	0.33	1,165
M-1	104,034	23	18,429	1,584	0	720
M-2	156,292	3.7	62,757	2,307	0.33	1,229
M-3	198,292	2.7	40,964	4,061	0	982
M-4	637,500	0.67	57,140	3,764	0	2,289
M-5	385,000	9.7	88,277	3,188	0	224
M-6	387,153	0.33	88,277	3,369	0	224

(1) Test excluded due to deviation in challenge water

Shipboard testing

Table 3 Test water conditions, operational data, and organism density counts in shipboard testing of the Headway OceanGuard Sim® BWMS model OG-B-10 with TRC 1950 m^3/h on board the vessel SHEN HUA 533 during the period from 9 July 2024 to 24 June 2025. Live organisms ≥10 and <50 µm were quantified by microscopy counting after staining with CMFDA/FDA. All counts of pathogenic bacteria (*E. coli*, Enterococci and *Vibrio cholerae*) in treated water were below the D-2 standard.

Test#	Salinity [PSU]	Temp. [°C]	Flow rate [m^3/h]	Holding time [hours]	TRO at ballasting [mg/L]	Organism densities in influent water		Organism densities in treated discharge water	
						≥50 µm [org/m^3]	≥10-<50 µm [org/mL]	≥50 µm [org/m^3]	≥10-<50 µm [org/mL]
1	30.3	22.4	2,287	48	9.0	63,374	697	142	0.33
2	32.3	21.4	2,076	55	9.5	10,179	127	0	0
3	32.8	21.2	2,078	53	9.5	8,077	139	0	0.33
4	31.4	16.1	2,142	54	9.5	7,978	111	0.11	0.17
5	30.7	11.5	2,108	50	9.5	10,727	106	0	0.17
6	32.7	9.5	2,074	45	9.5	12,110	119	0.32	0.17
7	31.8	29	2,104	95	9.5	41,886	184	0	0.67