

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Ballast Water Management System**with type designation(s)
Seascope BWMS (model range 80 - 5000)

Issued to

Elite Marine Corp.
Nantong, China

is found to comply with

DNV GL rules for classification – Ships**DNV GL class programme DNVGL-CP-0209 – Type approval – Ballast water management systems****IMO Resolution MEPC.300(72) - Code for Approval of Ballast Water Management Systems (BWMS Code)****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 GL 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 document.****For the compliance with the BWMS Code, the Certificate is issued on behalf of the Norwegian Maritime Authority.****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL, unless otherwise instructed by relevant Maritime Administrations.****Operating media:**Issued at **Høvik** on **2020-05-15**This Certificate is valid until **2025-05-14**.for **DNV GL**DNV GL local station: **Nantong**Approval Engineer: **Wenjun Wu****Dag Sæle-Nilsen**
Head of Section

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 GL AS, its parent companies and subsidiaries as well as their officers, directors and employees ("DNV GL") 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)

Seascope BWMS

Ballast water management system manufactured by

Elite Marine Corporation

Place of production

Elite Marine Corporation, Nantong, China

Type and model designations

Seascope Ballast Water Management System (BWMS) Seascope-80, Seascope-150, Seascope-200, Seascope-300, Seascope-400, Seascope-500, Seascope-600, Seascope-800, Seascope-1000, Seascope-1200, Seascope-1600, Seascope-2000, Seascope-2400, Seascope-3000, Seascope-4000, Seascope-5000

Equipment / Assembly drawings

Type	Description	Drawing no.	Rev.
P&ID	Generic P&ID of Seascope BWMS (OMSM Annex A)	21-3-54	Rev.4
General Arrangement Drawings	General Arrangement Drawing (OMSM Annex B)	21-3-58	Rev.3
Electrical schematic diagram	Electrical Schematic Diagram of Seascope BWMS (OMSM Annex C)	21-3-56	Rev.3
Equipment list	Bill of Materials of Seascope BWMS (OMSM Annex D)	21-3-57	Rev.2

Treatment Rated Capacity

80 – 5000 m³/h

Product description

Treatment sequence:

- Ballast water uptake: Filtration & UV disinfection
- Ballast water discharge: Filtration & UV disinfection

After ballasting or de-ballasting operation, the system shall be cleaned using the systems Cleaning in Place (CIP) function. Cleaning Liquid: UNITOR ULTRACIP

System design limitations / Water quality parameters

Temperature and Salinity

Temperature and salinity of the ballast water are not limiting conditions for the Seascope BWMS.

System design limitations / Operational parameters

Holding time

Seascope BWMS has demonstrated performance to the discharge standard in land-based testing with a minimum holding time between intake and discharge of 48 hours in brackish/fresh water and 24 hours in marine water.

A minimum holding time of 48 hours is required for brackish and fresh water (<21 PSU), and a minimum holding time of 24 hours is required for marine water (≥21 PSU).

UV Intensity

The minimum UV intensity of the designated Seascope BWMS models are listed in below.

The Seascope BWMS operates at full TRC when the measured UVI is above 1200/1180/1000 W/m² in marine/brackish/fresh water. When the Seascope BWMS is operating below with UVI below 680 W/m² when the water transparency is low, it will be outside of Elite Marine's minimum claims, an UV intensity low alarm will be triggered and logged by the BWMS.

Salinity	TRC (m ³ /h)	Lower limit UVI for full flow (W/m ²)	Lower limit UVI for reduced flow (50% TRC) (W/m ²)
Marine water (≥21 PSU)	300	>1200	680
Brackish water (<21 and >5 PSU)	200	>1180	
Fresh water (≤5 PSU)	200	>1000	

Treatment Rated Capacity (TRC) of the BWMS

The Treatment Rated Capacities (TRC) of the designated Seascope BWMS models are listed below. The list also specifies the major components of the Seascope BWMS that shall be installed for a specific Seascope BWMS model. In water with <21 PSU, Seascope BWMS is approved with a TRC that is 2/3 of the TRC in marine water.

The BWMS controls the flow rate in the ballast line by using a flow control valve to ensure that flow rates are kept within the TRC of a specific model and according to salinity.

EPT units and filter units can be installed in parallel configuration to achieve higher flow capacities according to the design and installation guide and the table below. One flow meter and one flow control valve are installed in the ballast pipe after the EPT units.

Model	TRC ⁽¹⁾ (m ³ /h)	Filtration unit	EPT unit
Seascope-80	80	EMSLQ-200 I	EME-80
Seascope-150	150	EMSLQ-200 I	EME-150
Seascope-200	250	EMSLQ-200 I	EME-300
Seascope-300	300	EMSLQ-250 I	EME-300
Seascope-400	400	EMSLQ-250 I	EME-400
Seascope-500	500	EMSLQ-300 I	EME-600
Seascope-600	600	EMSLQ-300 I	EME-600
Seascope-800	800	EMSLQ-400 I	EME-800
Seascope-1000	1000	EMSLQ-400 I	EME-1000
Seascope-1200	1200	EMSLQ-450 I	2x EME-600
Seascope-1600	1600	2x EMSLQ-400 I	2x EME-800
Seascope-2000	2000	2x EMSLQ-400 I	2x EME-1000
Seascope-2400	2400	2x EMSLQ-450 I	3x EME-800
Seascope-3000	3000	2x EMSLQ-450 I	3x EME-1000
Seascope-4000	4000	3x EMSLQ-450 I	4x EME-1000
Seascope-5000	5000	4x EMSLQ-450 I	5x EME-1000

(1) 2/3 of given value if PSU is <21

Pressure

The minimum/maximum pressure and the differential pressure triggering backflushing are listed below.

Model	Minimum filter inlet pressure (bar)	Maximum working pressure (bar)	Differential pressure triggering backflushing (bar)
Seascope-80 – Seascope-5000	1	10	0.1

Control and monitoring equipment

Software version

The Seascope BWMS is type approved with the system control software version V2.4. Any changes to the software are to be recorded as long as the BWMS is in use onboard. 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:

- Liquid level sensor (mounted in EPT unit)
- Temperature sensor (mounted in EPT unit)
- Two pressure sensors (mounted in BWMS inlet/outlet)
- Filter differential pressure sensor (mounted in Filtration unit)
- A safety relief valve mounted in EPT unit outlet, with opening at 10 bar

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 (21-3-54) and specified on the equipment lists (21-3-57). 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.

For the following electrical and electronic components, only the models specified in the component lists shall be used:

Name	Manufacturer	Model
Control unit	Elite Marine	EMC-80-1000 EMC-1200 EMC-1600-2000 EMC-2400-3000 EMC-4000 EMC-5000
Remote control unit	Elite Marine	EMR-1
Power cabinet unit	Elite Marine	EMP-80 – EMP-5000
UV lamp	Alpha-Cure	ACP-11520
UV intensity sensor	UV Technik	SUV 32.2 A1 Y2 B6 CD1

Hazardous area / Ex-proof

The Seascope BWMS has no Ex models and is not suitable for installation in hazardous area.

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
- Description confirming the arrangement of alarms for bypass of the BWMS system (as part of Ballast Water Management Plan)

Type Approval documentation

Test plans and reports:

- Biological Efficacy Performance Evaluation of Ballast Water Management Systems – Land-based Test plan, DHI Singapore, Rev. 1.2, 2016.12.30
- Biological efficacy performance evaluation of Seascope 300 Ballast Water Management System in land-based test in DHI Denmark – Test Plan, DHI Denmark, Rev. 1.1, 2019.06.12
- Biological efficacy performance evaluation of Elite Marine Corporation's SEASCAPE 1000 BWMS – Shipboard Test plan, DHI Singapore, Rev. 1.5, 2017.08.11
- Test Outline for Type Approval of Seascope BWMS, Shanghai Marine Auxiliary Mechanical & Electric Equipment Performance Environmental Test Centre, Rev. 1.1, 2018.11.23
- Elite Marine Seascope Ballast Water Management System – Full-Scale Testing in Support of Elite CFD Scaling Validation Study – Test Plan, DHI Singapore, Rev. 1, 2018.02.26
- Biological Efficacy Performance Evaluation of Seascope-300 Ballast Water Management System in Land-based Test, Elite Marine, DHI Singapore, Rev. Revised Final, 2020.03.09
- Biological efficacy performance evaluation of Seascope 300 Ballast Water Management in land-based test, Elite Marine Corporation, DHI Denmark, Rev. Final, 2020.02.14
- Biological efficacy performance evaluation of Seascope 1000 Ballast Water Management System in shipboard test, Elite Marine Corporation, DHI Singapore, Rev. Final, 2020.02.18
- Test report for Type Approval of Seascope-BWMS-300 S413-2018G1, Shanghai Marine Auxiliary Mechanical & Electric Equipment Performance Environmental Test Centre, Rev. Signed, 2020.02.10
- Elite Marine Seascope Ballast Water Management System – Full-Scale Testing in Support of Elite Marine CFD Scaling Validation Study – Test Report, DHI Singapore, Rev. Final, 2018.11.09
- Initial Type Approval Assessment Report, DNV GL, 2020-05-13

System documents:

- 21-3-2 Operation, Maintenance, and Safety Manual of the Seascope BWMS with Appendixes, Elite Marine, Rev. 10, 2020.05.13
- ISO 9001:2008 Management System Certificate by Shanghai Sira Quality Certification Co., LTD

Tests carried out

- Land-based testing using Seascope-300 model with EMSLQ-250 I filter at DHI Singapore in accordance with Resolution MEPC.300(72) and USCG 46 CFR 162.060-26
- Land-based testing using Seascope-300 model with EMSLQ-250 I filter at DHI Denmark in accordance with Resolution MEPC.300(72) and USCG 46 CFR 162.060-26
- Shipboard testing using Seascope-1000 model with EMSLQ-400 I filter 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 GL
- Environmental testing in accordance with DNVGL-CG-0339 Standard for Certification Nov. 2015 "Environmental test specification for electrical, electronic and programmable equipment and systems", Resolution MEPC.300(72), USCG 46 CFR 162.060-30 and IACS E10
- Additional tests for validation of CFD model
- Additional tests for verification of regrowth effect

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 GL 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 shall be carried on board a ship fitted with this ballast water management system, for inspection on board the ship. A reference to the test protocol and a copy of the test results should be available for inspection onboard the vessel.

ANNEX 1 SUMMARY OF TESTING

Summary of land-based testing for Elite Seascope BWMS

Table 1 Test water conditions and operational data in land-based testing of the Elite Seascope BWMS with Seascope-300 model with TRC 300/200 m³/h in 2017-2019 at the DHI test facility in Singapore and Denmark. All data are inlet samples.

Test cycle	Salinity (PSU)	Temp. (°C)	DOC (mg/L)	POC (mg/L)	TSS (mg/L)	UVT (%)	Average UVI (mW/cm ²)	Average flowrate (m ³ /h)		Holding time (hours)
								Before filter	After filter	
F-1 ⁽¹⁾	0.43	16	10	6.4	67	50	771	178	154	48
F-2	0.43	16	10	6.4	67	50	781	179	155	48
ELMFW04	0.2	30.7	8.8	5.5	55.0	79.3	1,195	231.3	207.9	48
ELMFW08	0.2	30.8	8.8	7.3	66.6	78.1	777	232.4	199.3	48
ELMFW09	0.2	32.0	9.3	7.2	61.7	78.8	836	223.0	200.8	48
ELMFW10	0.2	28.8	8.9	7.7	57.2	79.5	901	226.9	198.2	48
ELMFW11	0.2	29.4	9.1	7.7	56.1	78.5	897	222.7	198.6	48
B-1	18	17	7.3	9.3	68	65	1,298	228	200	48
B-2 ⁽¹⁾	18	19	13	8.6	67	49	620	128	101	48
B-3	18	19	13	8.6	67	49	623	129	103	48
ELMBW06	18.2	30.4	8.1	8.0	57.3	79.5	1,337	230.0	206.8	24
ELMBW07	18.4	30.0	6.9	5.8	62.5	79.0	1,316	220.1	204.9	24
M-1	30	21	7.9	7.5	65	61	1,099	310	273	24
M-2	28	19	7.4	7.0	47	71	1,283	341	294	24
M-3	28	20	7.4	7.8	68	63	1,316	341	283	24
M-4	28	20	12	9.5	87	50	659	159	116 ⁽³⁾	24
M-5	28	20	14	6.9	68	50	582 ⁽²⁾	168	143	24

(1) This test cycle and the following test cycle were run consecutively by use of the same test water and the same control

(2) Due to a higher UV-T of the source water for test cycle M-5 compared to M-4, the test water had to be adjusted with higher amounts of lignin sulphonate (LS) to reach the UV-T target of 50%. This affected the UV-I to a higher degree. The final concentration of LS in the test water was 25 and 31 mg/L for BE test cycle M-4 and M-5, respectively

(3) Low flow rate due to high TSS conditions which forced DHI staff to override the BWMS flow control, resulted in an increased test duration and thereby higher power consumption

Table 2 Average densities of live organisms in inlet and treated discharge water during land-based testing of the Elite Seascope BWMS Seascope-300 model. 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 ballast water discharge standard.

Test #	Organism densities in inlet water		≥ 50 μm organisms densities in discharge water (organisms/ m^3)		≥ 10 and < 50 μm organisms densities in discharge water (organisms/mL)	
	≥ 50 μm (org/ m^3)	≥ 10 - < 50 μm (org/mL)	Treated	Control	Treated	Control
F-1 ⁽¹⁾	177,250	2,200	0	242,211	1.5	836
F-2	259,195	2,073	0	242,211	1.0	836
ELMFW04	230,828	1,740	0	353,766	5	537
ELMFW08	143,842	2,590	2	124,353	6	414
ELMFW09	680,983	2,044	1	703,044	8	152
ELMFW10	161,881	1,816	1	168,832	4	931
ELMFW11	613,641	1,296	4	476,817	4	482
B-1	386,044	2,220	0	39,294	0.17	565
B-2 ⁽¹⁾	374,517	1,438	2.3	128,668	3.0	831
B-3	381,439	1,596	0.67	128,668	2.3	831
ELMBW06	300,953	6,550	1	37,519	1	4,856
ELMBW07	382,672	4,667	3	100,826	0	1,088
M-1	275,319	2,138	0	113,803	0.33	2,503
M-2	222,411	1,233	0	76,467	0	1,030
M-3	184,261	1,028	0.67	142,088	0.33	656
M-4	157,639	2,169	0	226,091	1.7	1,227
M-5	233,542	1,807	1.0	89,461	6.5	1,199

(1) This test cycle and the following test cycle were run consecutively by use of the same test water and the same control

Summary of shipboard testing for Elite Seascope BWMS

Table 5 Test water conditions, operational data, and organism density counts in shipboard testing of the Elite Seascope BWMS Seascope-1000 model with TRC 1000 m³/h, May-December 2017 on board vessel Hua Sheng 162. 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 ballast water discharge standard.

Test #	Salinity (PSU)	Temp (°C)	Average flowrate after filtration during ballast (m ³ /h)	Holding time (hour:min)	UVT (%)	UV-I (mW/cm ²)	Organisms ≥50 µm (org/m ³)		Organisms ≥10- <50 µm (org/mL)	
							Inlet	Discharge	Inlet	Discharge
1	29	19	975	25:45	91	1,320	1,285	2.0	1,072	4.0
2	31	28	921	117:48	92	1,271	23,833	0	978	0.33
3	32	25	960	116:49	88	1,303	6,876	0	94	0
4	27	21	992	56:09	93	925	52,011	0	98	0.17
5	32	23	961	49:31	95	1,058	19,243	0	100	0