

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Ballast Water Management System**with type designation(s)
Ecochlor® Ballast Water Management SystemIssued to
Ecochlor, Inc.
Maynard, MA, USAis found to comply with
Resolution MEPC.174(58)
Resolution MEPC.169(57)
DNV GL class programme DNVGL-CP-0209 – Type approval – Ballast water management systems
DNV GL rules for classification – Ships**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 Guidelines contained in Resolution MEPC.174(58) and DNV GL Rules stated above. This Certificate is valid only for the Ballast Water Management System referred to above.****For compliance with Resolution MEPC.174(58), 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 the relevant Maritime Administration.****Operating media:**Issued at **Høvik** on **2018-09-04**for **DNV GL**This Certificate is valid until **2022-10-23**.DNV GL local station: **New York**Approval Engineer: **Michael Lehmann**

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.



Job Id: **262.1-019159-1**
 Certificate No: **TAP00000ZS**
 Revision No: **2**

Ballast water management system supplier

Ecochlor Inc.

Type and model designation

Ecochlor® BWMS Series 75, Ecochlor® BWMS Series 100, Ecochlor® BWMS Series 150, Ecochlor® BWMS Series 200, Ecochlor® BWMS Series 250, Ecochlor® BWMS Series 300.

Place of production: ProFlow Inc. 303 State St., North Haven, CT 06473, USA and FluidTech Environmental & Equipment Technology Co., Ltd., 1st Floor, Block 2, Henglu Modern Industrial Park, 166 Min Dong Road, Pudong New Area, 201209 Shanghai, P.R. China.

Equipment assembly drawings

The Ballast Water Management System (BWMS) shall be installed in accordance with the relevant piping and instrumentation diagrams listed below.

Description	Title	Drawing No.	Rev.
Piping and instrumentation diagram	Treatment System P&ID	ES04075H01	J
		ES04100H01	H
		ES04150H01	H
		ES04200H01	J
		ES04250H01	H
		ES04300H01	J
Piping and instrumentation diagram	Main Filtration System P&ID Two Filter (Shared)	ES04075H02 to ES04300H02	K
Piping and instrumentation diagram	Main Filtration System P&ID Two Filter (Each)	ES04075H12 to ES04300H12	B
Piping and instrumentation diagram	Main Filtration System P&ID Single Filter (Each)	ES04075H22 to ES04300H22	B
Piping and instrumentation diagram	Main Filtration System P&ID Single Filter	ES04075H32 to ES04300H32	B
Piping and instrumentation diagram	Zone 0 Main Filtration System P&ID Two Filter (Shared)	ET04075H42 to ET04300H42	B
Piping and instrumentation diagram	Motive Water Filter P&ID	ES04800H05	B
Wiring diagram	Main Filtration System – Electrical Details	Package Revision ES05400H02	C
Wiring diagram	Treatment System - Electrical Details	Package Revision ES05400H01	C
Wiring diagram	Aft Peak System Electrical Details	Package Revision ES05400H04	A
Wiring diagram	Zone 0 Main Filtration System - Electrical Details	Package Revision ET05400H02	A

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Product description

The Ecochlor Ballast Water Management System description is given in the "Operation, Maintenance & Safety Manual (OMSM), Ecochlor Standard (ES), 20Apr2018 / Rev. C" and the "Operation, Maintenance & Safety Manual (OMSM) Ecochlor Tanker (ET), 20Apr2018 / Rev. C" approved by DNV GL.

Treatment sequence

- Ballast water uptake: Filtration and chemical disinfection with chlorine dioxide (ClO₂).
- Ballast water discharge: Manual verification of the chlorine dioxide (ClO₂) levels in the ballast water to be discharged. Discharge is allowed when the maximum concentration is ≤0.20 mg/L.

Application/Limitation

Model	TRC (m ³ /h)	ClO ₂ concentration (mg/L) during uptake
Ecochlor® BWMS Series 75	<500	4.25
Ecochlor® BWMS Series 100	<1300	4.25
Ecochlor® BWMS Series 150	<3500	4.25
Ecochlor® BWMS Series 200	<6900	4.25
Ecochlor® BWMS Series 250	<12200	4.25
Ecochlor® BWMS Series 300	<16200	4.25

- Minimum capacity is 50 m³/h for all models.
- Temperature is not a limiting condition for this system.
- The minimum holding time is 24 hours. The holding time is dependent on the time to reach maximum allowable discharge concentration of the chlorine dioxide (ClO₂). The manual in-tank sampling regime defined is depending on the holding time times; 24-48 hr, 48-72 hr or >72 hr.

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Filter

The BS-series filters manufactured by Filtersafe are screen filters with a 40 µm wire mesh and are available in Standard, Turbo and Superturbo configurations. The filter(s) shall be installed with a TRC that corresponds to the ballast flow capacity. The filter requires a minimum inlet operational pressure of 1.6 bar prior to cleaning. The backwash shall initiate when a differential pressure across the filter is 0.4 bar.

Model	TRC (m ³ /h)
BS-025	50
BS-031	75
BS-050	125
BS-061	150
BS-061-T	180
BS-061-ST	200
BS-070	180
BS-100	250
BS-100-T	275
BS-101	250
BS-101-T	300
BS-101-ST	350
BS-150	375
BS-150-T	410
BS-151	375
BS-151-T	450
BS-151-ST	525
BS-200	500
BS-200-T	550
BS-201	500
BS-201-T	600
BS-201-ST	700
BS-300	750

Model	TRC (m ³ /h)
BS-300-T	900
BS-300-ST	1000
BS-400	1000
BS-400 -T	1200
BS-400-ST	1400
BS-603	1500
BS-603-T	1800
BS-603-ST	2100
BS-804	2000
BS-804-T	2400
BS-804-ST	2800
BS-1004	2500
BS-1004-T	3000
BS-1004-ST	3500
BS-1204	3000
BS-1204-T	3600
BS-1204-ST	4200
BS-1206	3000
BS-1206-T	3600
BS-1206-ST	4200
BS-1406	3500
BS-1406-T	4200
BS-1406-ST	4900

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Installation- and operational specifications for the different components

Flow meter

The type approved system must be installed with a flow meter on filter outlet. If the flow meter is installed on the filter inlet, an additional filter flush flow meter is to be installed.

Chemical storage and piping

The treatment system comprises two chemical storage tanks containing sulfuric acid (78 %) and Purate™ BWT (a mixture of NaClO₃ (40 %) and H₂O₂ (<8 %)). For the safety arrangement of chemical storage and piping, DNV GL rules Pt.6 Ch.7 applies.

Further details are given in DNV GL report no 262.1-019159-J-83, rev. 0.

Control and monitoring equipment

Monitoring equipment to be installed are gas detectors inside ClO₂ generator installation space, flow meters for precursor chemicals, motive water and ClO₂ piping, pressure transmitters monitoring vacuum conditions for mixing chamber and leakage detectors in secondary containments and ClO₂ generator. Any indication of leakage shall trigger an alarm and shutdown. The gas sensors are to be arranged with an independent shutdown functionality.

The control and monitoring devices are to be energized and to remain active while the system is switched OFF, in case of leakage during longer voyages.

The type approved system includes the following control units and sensors:

Name	Manufacturer	Model
Treatment system control panel	Ecochlor	CP-1 CP-1ExZ1
Main ballast filter control panel	Ecochlor	CP-2 CP-2EXZ1 CP-2ExZ0 CP-4
Remote HMI panel	Ecochlor	CP-3
Mixing chamber	Nalco	6052111, 6052121, 6052128
Metering pump	IWAKI	IX-C060TCF-TF01, IX-D150TCF-TF01, IX-D300TCF-TF01
ClO ₂ gas detector	Dräger	Polytron 7000
ClO ₂ sensor	Optek	AF26
Handheld ClO ₂ measuring instrument	Palintest	Photometer 7500
Handheld ClO ₂ measuring instrument	Palintest	ChlordioXense
PLC program	Ecochlor	ES0400 V14_SP1 180101

All changes in the software are to be recorded as long as the system is in use on board. The records of all changes are to be forwarded to DNV GL for evaluation and approval. Major changes to the software are to be approved before installed in the computer. Based on the modification, a Certification of Application Functions may be required for the particular vessel.

Information regarding the selected components shall be part of the documentation related to the specific installation, either by a reference to valid type approval certificate or technical documentation.

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Explosion proof version

Some parts of the Ecochlor system are not designed for the installation in a hazardous area. The Ecochlor filter Ex model meets the requirements for use in hazardous area Zone 1 and Zone 0 in accordance with DNV GL rules Pt.4 Ch.8 Sec.11.

Ex-certification is not covered by this certificate. Installation in a hazardous area are 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.

Documents approval for each installation

The following documentation is to be submitted for approval in each case.

Piping:

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

Control and instrumentation:

- Power supply arrangement.
- Interface description specifying external signals including alarms for failure.
- Description confirming the arrangement of alarms for bypass of the BWMS system (as part of the Ballast Water Management Plan).
- List of Ex equipment according to Pt.4 Ch.8 Sec.11 if the system is to be installed in a hazardous zone.

Type approval documentation

- GBF / Test Quality Assurance Plan, Ecochlor BWTS Series 75, Model ES-400S-1.0, 8 April 2015, Rev.0
- GBF / Final Land-based Ballast Water Management Report According to USCG Final Rule, Ecochlor BWTS Series 75, Model ES-400S-1.0, 17 March 2017, Rev.0.
- GBF / Final Shipboard Ballast Water Management Report According to USCG Final Rule, Ecochlor BWTS Series 75, Model ES-400S-1.0, 5 October 2016, Rev.0.
- Operation, Maintenance & Safety Manual (OMSM), Ecochlor Standard (ES), 20Apr 201C, Rev.C
- Operation, Maintenance & Safety Manual (OMSM) Ecochlor Tanker (ET), 20Apr2018, Rev.C
- OMSM ES Appendix Package
- OMSM ET Appendix Package
- ES Installation Specification, 26 March 2017, Rev.A
- ET Installation Specification, 26 March 2017, Rev.B
- Retlif / Test Report for Ballast Water Treatment Systems (BWTS), report no. R-15756-1, 17 October 2016
- Information for Approval of Scaled Treatment Systems, Series 100 to Series 300, 8 March 2017, Rev.4
- Ecochlor Commissioning, 22 June 2017, Rev.C
- Filtersafe / Testing and Comparison of the Filtersafe Standard, Turbo and Superturbo Configurations, June 2017
- DHI / Filter performance test (Doc. No. 11820938), dated 8 September 2017

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Tests carried out

- Land-based testing in accordance with Resolution MEPC.174 (58) witnessed by DNV GL
- Shipboard testing in accordance with Resolution MEPC.174 (58) witnessed by DNV GL
- Factory Acceptance Test of the control and automation system witnessed by DNV GL
- Environmental testing in accordance with Environmental test specification for instrumentation and automation equipment, DNV GL CG-0339 and Resolution MEPC.174(58)

Marking of the product

For the traceability of this Type Approval, each treatment system is to be marked with:

- Manufacturer's name or trade mark
- Type designation
- Serial number

Periodical assessment

DNV GL's surveyor is to be given permission to perform a Periodical Assessment at any time during the validity of this certificate and at least every second year. The arrangement is to be in accordance with procedure described in DNV GL-CP-0338 Section 4.

The scope of the periodical assessment includes:

- Ensuring that the documentation for the type approval is available.
- Inspection of factory samples, selected at random from the production line (where practicable).
- Review of production and inspection routines, including test records from product sample tests and control routines
- Ensuring that systems, software versions, components and/or materials used, comply with type approved documents and/or referenced system, software, component and material specifications.
- Review of possible changes in the design of systems, software versions, components, materials and/or performance, and make sure that such changes do not affect the type approval given.
- Ensuring traceability between manufacturer's product type marking and the type approval certificate.

Copy of the type approval certificate

A copy of this type approval certificate should be carried on board a vessel fitted with this ballast water management system at all times. 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.