

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Ballast Water Management System**with type designation(s)
MMC Ballast Water Management SystemIssued to
Norwegian Greentech AS
Fosnavåg, Norwayis found to comply with
Resolution MEPC.174(58)
DNV GL rules for classification – Ships
DNV GL class programme DNVGL-CP-0209 – Type approval – Ballast water management 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 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 the resolution MEPC.174(58), the Certificate is issued on behalf of Transport Canada, Marine Safety & Security.****Product(s) approved by this certificate is/are accepted for installation on vessels classed by DNV GL, unless otherwise instructed by relevant Maritime Administrations.**Issued at **Høvik** on **2020-02-24**for **DNV GL**This Certificate is valid until **2020-10-28**.DNV GL local station: **Høvik Environmental Protection**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.



Ballast Water Management System Supplier

Norwegian Greentech AS

Type and Model Designation

MMC BWMS Model 50, MMC BWMS Model 94, MMC BWMS Model 100, MMC BWMS Model 150, MMC BWMS Model 300, MMC BWMS Model 370, MMC BWMS Model 450, MMC BWMS Model 500, MMC BWMS model 600, MMC BWMS Model 750, MMC BWMS Model 1000, MMC BWMS Model 1200 and MMC BWMS Model 1400.

Place of production: Norwegian Greentech AS, Fosnavåg, Norway.

Equipment / Assembly drawings

Ballast Water Management System (BWMS) manufactured equipment / assembly drawings are referred to under Type Approval documentation below.

The MMC Ballast Water Management System description is given in "Installation and Operation Manual MMC BWMS" rev.01 approved on the 2013-09-23 by DNV GL.

Treatment sequence:

- Ballast water uptake: Filtration and UV Treatment
- Ballast water discharge: UV Treatment

Application/Limitation

Model	UV-Chamber	TRC, (m3/h)
MMC BWMS model 50	DL.2.1500	5-50
MMC BWMS model 94	DXL6.1500 or DL4.1500	10-94
MMC BWMS model 100	DXL6.1500 or DL4.1500	10-100
MMC BWMS model 150	DXL6.1500	10-150
MMC BWMS model 300	2 pcs DXL6.1500 in series or, DXL12.1500	10-300
MMC BWMS model 370	D4XL10.3000	20-370
MMC BWMS model 450	3 pcs DXL6.1500 in parallel	30-450
MMC BWMS model 500	D4XL10.3000	20-500
MMC BWMS model 600	2pcs model 300 in parallel or D4XL12.3000	20-600
MMC BWMS model 750	D4XL16.3000 or 2 pcs D4XL10.3000 in parallel	40-750
MMC BWMS model 1000	D5XL18.3050 or 2 pcs D4XL10.3000 in parallel	40-1000
MMC BWMS model 1200	D5XL24.3050	40-1200
MMC BWMS model 1400	3 pcs D4XL10.3000 in parallel	40-1400

Product description

Acceptable minimum intensity: 7500 W/m².

UV dose below 100 mJ/cm² implies that the ballast water is not treated in accordance with this Certificate.

UV intensity below lower limit, corresponding to an UV transmission of 55% for these systems, implies that the ballast water is not treated in accordance with this certificate.

Salinity or temperature of water are not limiting conditions for the ballast water treatment system. Although not tested in fresh water, the BWMS was tested in at least two salinity ranges separated by at least 10 PSU as required by Resolution MEPC.174(58).

The BWMS was initially type approved by DNV GL on 2017-03-31 on behalf of the Norwegian Maritime Authority.

Filter

The type approved system includes a Boll & Kirch Filterbau GmbH Filter type 6.18.2 and 6.18.3 with 40 µm mesh. The shipboard tests and landbased tests were performed with 6.18.2 filter installed.

6.18.2 Boll & Kirch Size	Max flow	Minimum back-pressure	Max. pressure drop
100	100 m ³ /h	1 bar	1 bar
200	220 m ³ /h	1 bar	1 bar
250	400 m ³ /h	1 bar	1 bar
300	600 m ³ /h	1 bar	1 bar
350	800 m ³ /h	1 bar	1 bar
400	1200 m ³ /h	1 bar	1 bar
500	1600 m ³ /h	1 bar	1 bar
600	2500 m ³ /h	1 bar	1 bar
700	3300 m ³ /h	1 bar	1 bar
800	4300 m ³ /h	1 bar	1 bar
900	5400 m ³ /h	1 bar	1 bar

6.18.3 Boll & Kirch Size	Max flow	Minimum back-pressure	Max. pressure drop
AquaBoll 6.18.3 273	62 m ³ /h	1 bar	1 bar
AquaBoll 6.18.3 324	94 m ³ /h	1 bar	1 bar
AquaBoll 6.18.3 356	173 m ³ /h	1 bar	1 bar
6.18.3. 419 or, AquaBoll 6.18.3 419	370 m ³ /h	1 bar	1 bar
6.18.3. 521 or, AquaBoll 6.18.3 521	500 m ³ /h	1 bar	1 bar
6.18.3. 600 or, AquaBoll 6.18.3 600	750 m ³ /h	1 bar	1 bar
6.18.3. 750 or, AquaBoll 6.18.3 750	1400 m ³ /h	1 bar	1 bar
6.18.3.900	2100 m ³ /h	1 bar	1 bar
6.18.3.1000	2500 m ³ /h	1 bar	1 bar
6.18.3.1100	3800 m ³ /h	1 bar	1 bar
6.18.3.1200	4600 m ³ /h	1 bar	1 bar
6.18.3.1350	5400 m ³ /h	1 bar	1 bar

Monitoring

The type approved system includes a temperature sensor, pressure sensor, a flow meter and a pressure control valve.

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.

Control equipment

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

Name	Applicable Models	Model	Software revision
Main control cabinet	MMC	BWMS	NA
Controller	MMC	MMC BWMS Control	3.0
UV power and control cabinet	Best UV	DL2.1500 (50 m ³ /h) DL4.1500 (100 m ³ /h) DXL6-1500 (150 m ³ /h) D4XL10.3000 (500 m ³ /h) D4XL12.3000 (600 m ³ /h) D4XL16.3000 (750 m ³ /h) D5XL18.3050 (1000 m ³ /h) D5XL24.3050 (1200 m ³ /h)	NA
UV controller	Best UV	Lambda 3 Lambda 5	SW: L5 22.03 SW: L3 20.10
UV sensor	Best UV	Us3	NA
Pressure sensor	Vegabar	14	NA
Flow meter	Euromag	MUT 2200E L	NA

All changes in software are to be recorded as long as the system is in use onboard. 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.

A Certification of Application Functions may be required for the particular vessel.

Documents approval

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

Control and instrumentation:

- Power supply arrangement
- Piping and Instrumentation Diagram (P&ID) of the ballast system including the treatment system installation
- Interface description specifying external signals 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

- QAPP for fullscale testing of the Ballast Water Management System of MMC Green Technology AS approved by DNV GL on 2011-08-24.
- Land-based testing of the Ballast Water Management System of MMC Green Technology AS – Final report, Report SNO 6297-2012 approved by DNV GL on 2012-06-10.
- QAPP for shipboard testing of the Ballast Water Management System of MMC Green Technology AS approved by DNV GL on 2012-06-10.

- Shipboard testing of the Ballast Water Management System of MMC Green Technology AS – Final report, Report SNO 6362-2012 v.2.0
- Treatment efficiency and toxicity effect of the fullscale MMC BWMS approved by DNV GL on 2011-08-24.
- Installation and Operation Manual MMC BWMS approved by DNV GL, rev. 01 approved by DNV GL on 2013-09-23
- Model for design of UV systems for MMC GT, April 2012
- Model for design of UV systems for MMC GT, model 50m³/h, Feb 2017
- Model for design of UV systems for MMC BWMS 600, 06.12.2017
- Model for design of UV systems for MMC BWMS 300, 20.04.2017
- Model for design of UV systems for MMC BWMS 100, 06.12.2017
- Technical Specification MMC BWMS 600 m³/h, separate components 17.11.17
- Technical Specification MMC BWMS 300 m³/h, skid mounted 05.12.2017
- Technical Specification MMC BWMS 100 m³/h, skid mounted 18.10.2017
- Design for operation of parallel UV systems for MMC GT, model 450 m³/h, Sept 2015
- Model for design of UV systems for MMC GT, model 500 m³/h, Sept 2017
- Design for operation of parallel UV systems for MMC GT, model 600 m³/h, 29.03.2017
- Design for operation of parallel UV systems for MMC GT, model 1000 m³/h, 29.03.2017
- Design for operation of parallel UV systems for MMC GT, model 1400 m³/h, 29.03.2017
- Environmental testing of ballast water treatment system, Report No. DANAK-19/12610, Rev.0, approved by DNV GL on 2012-11-21.
- Environmental testing of ballast water treatment system, Report No. 2012-3321
- Factory Acceptance test report endorsed by DNV GL on 2012-10-12.
- Harhour Acceptance Test (HAT) MMC, Modes 50-1400
- DNV Report Assessment of Bollfilter model 6.18.3 versus filter model 6.18.2, report no. 385FIST130315-2, rev. 0.
- Model for design of UV systems for NorwegianGT BWMS 750, 25.09.2019
- Model for design of UV systems for NorwegianGT BWMS 1000, 22.11.2019
- Model for design of UV systems for NorwegianGT BWMS 1200, 22.11.2019

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 Standard for Certification No. 2.4 (April 2006) and Resolution MEPC.174 (58)

Marking of product

For 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

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.



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Certificate No: **TAP000021T**

- 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 be carried onboard a vessel fitted with this Ballast Water Management Systems at all times.

A reference to the test protocol and a copy of the test results should be available for inspection onboard the vessel.

END OF CERTIFICATE