Certificate no.:
TAP00002VS

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Sewage Treatment Plants

with type designation(s)
MBR2, MBR4, MBR6, MBR8, MBR12, MBR16, MBR18, MBR24, MBR30, MBR32, MBR36, MBR40, MBR42, MBR48, MBR54, MBR56, MBR60, MBR64

issued to
Wartsila Water Systems Ltd.
Poole, Dorset, **United Kingdom**

is found to comply with
IMO Resolution MEPC.227(64) "2012 GUIDELINES ON IMPLEMENTATION OF EFFLUENT STANDARDS AND PERFORMANCE TESTS FOR SEWAGE TREATMENT PLANTS"

Application:

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

System design limitations / limiting operating conditions imposed are described in this document.

Issued at **Høvik** on **2024-06-06**
This Certificate is valid until **2029-06-05**.
DNV local unit: **UK & Ireland CMC & VMC**

for **DNV**

Approval Engineer: **Anna Piotrowska**

Product description

The MBR Series provide a biological process to treat the wastewater produced by the ship. The collected black water and grey water are led through a Pre-Screen and enters 1st stage of the Bioreactor, where the untreated influents are mixed with biomass returning from the 2nd stage of the Bioreactor.
Thereafter, the 2nd stage of the Bioreactor receives a process fluid from the Interstage Filter (ISF) and Membrane Module, for a further biological treatment using aeration blowers. The blowers provide air to the aerobic zone and anoxic zones of the 2nd stage of the Bioreactor.
Then the flow leads to the Membrane Module, where the permeate liquid is separated from the biomass by filtering the clear effluent through a very fine porous membrane surface and collected in a Permeate Tank. The effluent from the Permeate Tank is discharged using the discharge pumps.

Application/Limitation

Application:

MBR Model	Designed hydraulic loading (m^3/day)	Designed organic loading BOD_5 (kg/day)
MBR 2	144	160
MBR 4	288	319
MBR 6	432	478
MBR 8	576	637
MBR 12	864	956
MBR 16	1152	1274
MBR 18	1296	1434
MBR 24	1728	1911
MBR 30	2160	2389
MBR 32	2304	2548
MBR 36	2592	2867
MBR 40	2880	3185
MBR 42	3024	3345
MBR 48	3456	3822
MBR 54	3888	4300
MBR 56	4032	4459
MBR 60	4320	4778
MBR 64	4608	5096

There are two configurations for each model:
1. Treats combined black and grey water in accordance with MEPC.227(64) excluding paragraph 4.2 (Conventional mode)
2. Treats combined black and grey water in accordance with MEPC.227(64) including paragraph 4.2 (NDN mode)

Hydraulic and Organic Loadings may be less than the design capacity stated of the MBR model. Design capacity is the maximum capacity through the MBR. Additional membranes may be added to system for redundancy at the request.

Limitation:

Ambient temperature (°C)	0-55°C
Relative humidity	90%
Inclination range	0 - 22.5°
Power supply	440(380*)/690 V and 50/60 Hz

*Small Test Panel

The Membrane Bioreactor (MBR) Series of Sewage Treatment Plant is for use by all type of ships or offshore units for the treatment of sewage in accordance with resolution MEPC.227(64), including for the use by passenger ships when operating in MARPOL Annex IV special areas (for model configuration with a NDN mode).

Sewage Sludge shall be discharged according to the procedures described in the Process Description and Operation Instructions.
The design of sludge tanks (for sewage desludge operation) and associating constructed piping are not evaluated as part of this examination.

The equipment is not permitted to be installed in spaces subject to explosion hazards.

The ship should have on board at all times a copy of the Operation and Maintenance Manual listed in 'Type Approval documentation'.

Type Approval documentation

Mechanical and Assembly Drawings:

Drawing Title	Drawing Number	Revision (date)

Piping and Instrumentation Drawings:

Drawing Title	Drawing Number	Revision (date)

Electrical and Instrumentation Drawings:

Drawing Title	Drawing Number	Revision (date)

Operation and Maintenance Manuals:

Drawing Title	Drawing Number	Revision (date)

Note: *The public copy of this certificate, visible in DNV Approval Finder on the DNV website, does not include information considered as proprietary details. All information is contained in the signed original certificate, owned by the manufacturer.*

A copy of the Process Description and Operation Instructions shall be on board the vessel at all times.

Basis of acceptance

Performance testing was conducted on the MBR 50N model ashore in accordance with IMO Resolution MEPC.2(VI) and upgrading the sewage treatment plant in accordance with IMO Resolution MEPC.227(64) excluding section 4.2 by the Gap analysis ''GO 097440 - 032 - Gap analysis 159(55)'' and ''GO098873 - 033- Gap analysis 227(64) Ex 4.2'', summarized by''PDR0008 MBR Performance Testing Analysis''.

Performance testing upgrading sewage treatment plant in accordance with IMO Resolution MEPC.227(64) including section 4.2 for Passenger Ships in Special Areas was conducted on board the ship 'M/S The World'', IMO no. 9219331 for MBR 8 model.

The test reports with the results of all the testing on the MBR units are listed in the "Tests carried out" section of this certificate and the results are given in the appendices.

Environmental testing was carried out in accordance with IMO Resolution MEPC.107(49) Annex Part 3 as required by IMO Resolution MEPC.227(64) and the test reports are listed in the "Tests carried out" section of this certificate.

Tests carried out

Performance Tests:

- Location: Ship ''M/S The World'', IMO no. 9219331 (On board testing)
  Date of testing: 2017-04-30 – 2017-05-09
  Organisation that conducted the test: Admiralty Environmental and SGS

- Location: (ashore testing) Wessex Water PLC Cabot Lane Sewage Treatment Works,
  Poole, Dorset, United Kingdom
  Date of testing: 2003-04-28 – 2003-05-17
  Test report: R62014 Evaluation and performance testing of the wastewater treatment plants MBR50N
  Test Report Date: 2003-09-24
  Testing witnessed by Lloyd's Register

Environmental Tests:

- Location: Laboratory (CTL) at Millbrook Proving Ground Ltd
  Test Report: MBK 16/0548 (High Temperature and Humidity test), Date of testing: 2016-06-17
  Test Report: CT0087-006-01 (Low Temperature Test), Date of testing: 2016-04-27
  Test Report: CT0087-006-02 (High Temperature Test), Date of testing: 2016-04-27
  Test Report: TRA-031111-26-CR-01A (Vibration and Dwell Testing) Date of testing: 2016-04-06 - 2016-04-08

Marking of product

The marking shall give the following information:

- Manufacturer's name or trademark
- Type designation
- Serial number
- Designed hydraulic loading, and any other operational or installation limits considered necessary by the manufacturer or the Administration

A copy of this Certificate should always be carried on board a vessel, when fitted with this sewage treatment plant.

Periodical assessment

For retention of the Type Approval, a DNV surveyor shall perform periodical assessments (refer to Type Approval program DNV-CP-0338). The main scope of the periodic assessment will normally include:

- Verification of the Type Approval applicant's production and quality system with relation to ensuring continued consistent production of the type approved products at the applicant's own premises and at other companies that are given the responsibility for manufacturing of the products
- Review of the documentation and checking that this is still used as basis for the production
- Review of possible changes to the design, material and performance of the product
- Verification of the product marking

This certificate is valid for five years and periodical assessments will be required after 2 years (+/- 90 days) and 3.5 years (+/- 90 days).

Revision history

Revision	Date of issuance	Description
0	2024-06-06	Initial certificate

APPENDIX A - Summary of test results for MBR 8

Test results and details of tests conducted on samples from the sewage treatment plant in accordance with IMO Resolution MEPC.227(64) including section 4.2 for Passenger Ships in Special Areas:

Sewage treatment plant type: .....

Manufactured by: .....

Organization conducting the test: .....

Organization handling the samples: .....

Test Location: .....

Designed hydraulic loading: .....

Designed organic loading: .....

No. of effluent samples tested: .....

No. of influent samples tested: .....

Total suspended solids influent quality: .....

Total nitrogen influent quality:
- Geometric mean:
- Maximum
- Minimum .....

Total phosphorus influent quality:
- - Geometric Mean:
- - Maximum:
- - Minimum: .....

BOD_5 without nitrification influent quality: .....

Maximum hydraulic loading: .....

Minimum hydraulic loading: .....

Average hydraulic loading (Qi): .....

Effluent flow (Qe): .....

Dilution compensation factor (Qi/Qe): .....

Geometric mean of total suspended solids: .....

Geometric mean of the thermotolerant coliform count: .....

Geometric mean of BOD_5 without nitrification: .....

Geometric mean of COD: .....

Geometric mean of total nitrogen:
Percentage reduction of total nitrogen: .....

Geometric mean of total phosphorus:
Percentage reduction of total phosphorus: .....

Maximum pH: .....

Minimum pH: .....

Type of disinfectant used: .....

If Chlorine - residual Chlorine:

Maximum: .....

Minimum: .....

Geometric mean: .....

Was the sewage treatment plant tested with:

Fresh water flushing? .....

Salt water flushing? .....

Fresh and salt water flushing? .....

Grey water added? .....

Was the sewage treatment plant tested against the environmental conditions specified in section 5.9 of resolution MEPC.227(64):

Temperature: .....

Humidity: .....

Inclination: .....

Vibration: .....

Reliability of Electrical and Electronic Equipment: .....

Limitations and the conditions of operation are imposed:

Salinity: .....

Temperature: .....

Humidity: .....

Inclination: .....

Vibration: .....

Results of other parameters tested: .....

APPENDIX B - Summary of test results for MBR 50N

Test results and details of tests conducted on samples from the sewage treatment plant in accordance with IMO Resolution IMO Resolution MEPC.227(64) excluding section 4.2 with reference to ''PDR0008 MBR Performance Testing Analysis'' document upgrading the sewage treatment plant:

Sewage treatment plant type: .....

Manufactured by: .....

Organization conducting the test: .....

Organization handling the samples: .....

Test Location: .....

Designed hydraulic loading: .....

Designed organic loading: .....

No. of effluent samples tested: .....

No. of influent samples tested: .....

Total suspended solids influent quality: .....

Total nitrogen influent quality:
- Geometric mean:
- Maximum
- Minimum .....

Total phosphorus influent quality:
- - Geometric Mean:
- - Maximum:
- - Minimum: .....

BOD_5 without nitrification influent quality: .....

Maximum hydraulic loading: .....

Minimum hydraulic loading: .....

Average hydraulic loading (Qi): .....

Effluent flow (Qe): .....

Dilution compensation factor (Qi/Qe): .....

Geometric mean of total suspended solids: .....

Geometric mean of the thermotolerant coliform count: .....

Geometric mean of BOD_5 without nitrification: .....

Geometric mean of COD: .....

Geometric mean of total nitrogen:
Percentage reduction of total nitrogen: .....

Geometric mean of total phosphorus:
Percentage reduction of total phosphorus: .....

Maximum pH: .....

Minimum pH: .....

Type of disinfectant used: .....

If Chlorine - residual Chlorine:

Maximum: .....

Minimum: .....

Geometric mean: .....

Was the sewage treatment plant tested with:

Fresh water flushing? .....

Salt water flushing? .....

Fresh and salt water flushing? .....

Grey water added? .....

Was the sewage treatment plant tested against the environmental conditions specified in section 5.9 of resolution MEPC.227(64):

Temperature: .....

Humidity: .....

Inclination: .....

Vibration: .....

Reliability of Electrical and Electronic Equipment: .....

Limitations and the conditions of operation are imposed:

Salinity: .....

Temperature: .....

Humidity: .....

Inclination: .....

Vibration: .....

Results of other parameters tested: .....