EC-TYPE EXAMINATION CERTIFICATE (MODULE B)

Certificate No:
MEDB0000833

Application of: Directive 2014/90/EU of 23 July 2014 on marine equipment (MED), issued as "Forskrift om Skipsutstyr" by the Norwegian Maritime Authority. This Certificate is issued by DNV AS under the authority of the Government of Norway.

This is to certify:

That the Sewage systems (for use by ships, other than passenger ships, in all areas and by passenger ships outside MARPOL Annex IV special areas)

with type designation(s)
MBR Series Marine Sewage Treatment Plant (Models MBR-15, MBR-30, MBR-50, MBR-80, MBR-100, MBR-120 and MBR-150)

Issued to
CSSC Nanjing Luzhou Machine Co.,Ltd
Nanjing, Jiangsu, China

is found to comply with the requirements in the following Regulations/Standards:
Regulation **(EU) 2022/1157,**
item No. MED/2.6b Marpol 73/78 as amended, Annex IV Regulation 9, IMO Res. MEPC.227(64) excluding section 4.2.

Manufacturers authorised representative
TeamTec AS
Tvedestrand, Norway

Further details of the equipment and conditions for certification are given overleaf.

This Certificate is valid until **2028-03-22**.

Issued at **Høvik** on **2023-03-23**

DNV local unit:
Nanjing NB & CMC

Approval Engineer:
Michael Lehmann

Notified Body
No.: **0575**

for **DNV AS**

Sverre Olav Bergli
Head of Notified Body

NORWEGIAN ACCREDITATION PROD 019

The mark of conformity may only be affixed to the above type approved equipment and a Manufacturer's Declaration of Conformity issued when the production-surveillance module (D, E or F) of Annex B of the MED is fully complied with and controlled by a written inspection agreement with a Notified Body. The product liability rests with the manufacturer or his representative in accordance with Directive 2014/90/EU.
This certificate is valid for equipment, which is conform to the approved type. The manufacturer shall inform DNV AS of any changes to the approved equipment. This certificate remains valid unless suspended, withdrawn, recalled or cancelled.
Should the specified regulations or standards be amended during the validity of this certificate, the product is to be re-approved before being placed on board a vessel to which the amended regulations or standards apply.

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 300,000 USD.

Product description

The MBR Series Marine Sewage Treatment Plant is intended for sewage treatment meeting the requirements specified in IMO Res. MEPC.227(64) and for use by ships (other than passenger ships) or offshore units in all areas and by passenger ships outside of a MARPOL Annex IV special area.

The MBR Series Marine Sewage Treatment Plant adopts combined biochemical and physicochemical treatment, and membrane separation to treat the sanitary sewage produced onboard ships or offshore units.

The plant consists of an equalization tank, an aerobic MBR tank, clean water tank, air supply system, electric control box, air pump, lifting pump, self-priming pump, discharge pump and turbidimeter (option).

The plant applies the biotreatment-flocculation-MBR treatment principle. Sewage firstly enters the equalization tank for pre-filtration and homogeneous water quality. After this pre-treatment, sewage flows into an aerobic MBR tank, which is an immersed flat membrane module and is the core of sewage treatment. The organic pollutants in the sewage are digested by aerobic bacteria and microorganisms into carbon dioxide and water. This digestion is promoted by active aeration. The treated discharge is temporarily stored in a clear water tank, before it is eventually automatically discharged overboard with the discharge pump.

Application/Limitations

The models covered in this certificate and the limitations applicable to each model are listed below:

Model	Hydraulic Loading [m^3/day]	Organic load [kg BOD_5/day]
MBR-15	2.7	1.35
MBR-30	5.4	2.7
MBR-50	9.0	4.5
MBR-80	14.4	7.2
MBR-100	18.0	9.0
MBR-120	21.6	10.8
MBR-150	27.0	13.5

The MBR Series Marine Sewage Treatment Plant also includes the larger models MBR-200, MBR-250 and MBR-300, which are not covered by this approval. The approval of these models shall be subject to satisfactory confirmatory performance testing in accordance with IMO Resolution MEPC.227(64) with the first produced MBR-200, MBR-250 or MBR-300 model. After satisfactory confirmatory performance testing of either the MBR-200, MBR-250 or MBR-300 model, a new revision of the certificate will be issued including approval of the models MBR-200, MBR-250 and MBR-300.

Operational conditions applicable to all models are listed below:

Ambient temperature (ºC)	0 – 55
Inlet water temperature (ºC)	2 – 32
Inlet water salinity (mg/L)	≤35 000
Operating humidity (%)	≤95

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

A copy of the Instruction Manual for the MBR Series Marine Sewage Treatment Plant shall be on board the vessel at all times.

Control and monitoring equipment

Software version

The MBR Series Marine Sewage Treatment Plant is type approved with the system control software SMART V2.X (where X shall be 3 or higher). Any changes to the software are to be recorded as long as a MBR Marine Sewage Treatment Plant system 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.

Electrical and electronic components

A MBR Marine Sewage Treatment Plant shall include the control and monitoring equipment indicated on the P&ID (Drawing No. W3147~W3153-00LC) and listed in the equipment list (W3131~W314100CL). 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. Changes made to these components shall be approved by DNV in advance:

Component	Manufacturer	Model
PLC	SIEMENS	PLC 6ES7 288-ESR60-0AA0
HMI	Artrich	HMI MT8102iE
Power supply	ABB	ABL2REM24045

Type examination documentation

Type	Title	Drawing no.	Revision
Operation & Maintenance Manual	Instruction Manual	W3147~W315600SM	2020-08-18
Piping and Instrumentation Diagrams (P&ID) / Flow Diagrams	System flow diagram	W3147~W3153-00LC	2020-08-18
Equipment List	MBR Series Main Components List	W3131~W314100CL	A (2023-02-09)
Arrangement Drawings	Assembly MBR-15	W3147-00	2020-08-18
	Assembly MBR-30	W3148-00	2020-08-18
	Assembly MBR-50	W3149-00	2020-08-18
	Assembly MBR-80	W3150-00	2020-08-18
	Assembly MBR-100	W3151-00	2020-08-18
	Assembly MBR-120	W3152-00	2020-08-18
	Assembly MBR-150	W3153-00	2020-08-18
	Assembly MBR-200	W3154-00	2020-08-18
	Assembly MBR-250	W3155-00	2020-08-18
	Assembly MBR-300	W3156-00	2020-08-18
Electrical Drawings	MBR type electrical control box	Q1127D	2020-08-18
Other Documents	Technical Conditions	W3147~W3156100JT	2020-08-18
	Plant Design Calculation	W3147~W315600JS	2020-08-18

Test plans and reports

- CSSC Nanjing Luzhou Machine Co.,Ltd: MBR Marine Sewage Treatment Plant Test Program, Report No. W3147~W315600SY, dated 2020-08-18

- Water Environment Testing Center of Lower Yangtze River: Influent and Effluent of MBR-30 Type Sewage Treatment Plan, Test Report No. CHXYSHJ2021-02, dated 2021-01-21
- China Shipbuilding Industry Environmental and Reliability Test Center for Electric and Electronic Equipment, Report no. Ship Test ER 2021-032, dated 2021-07-27
- China Shipbuilding Industry Environmental and Reliability Test Center for Electric and Electronic Equipment, Report no. Ship Test ER 2019-047, dated 2019-09-24
- China Shipbuilding Industry Environmental and Reliability Test Center for Electric and Electronic Equipment, Report no. F-SEC ER21094, dated 2021-06-23

Tests carried out

Performance tests:

- Testing of MBR-30 Type Sewage Treatment Plant in accordance with Resolution MEPC.227(64) at Water Environment Testing Center of Lower Yangtze River

  Testing witnessed by China Classification Society (Letter on Issuing Certificate of Approval for Marine Products, Job Control Number JS20PTB00318, dated 2021-03-15)

Environmental tests:

- Environmental testing of MBR electrical control box and MBR-NP electrical control box in accordance with CCS Guidelines GD22-2015 for Type Approval Tests of Electronic and Electrical Products at Sewage Treatment System at China Shipbuilding Industry Environmental and Reliability Test Center for Electric and Electronic Equipment

Marking of product

The marking shall give the following information:

- Manufacturers name or trademark
- Type and model designation
- Serial number and date of manufacture
- Hydraulic loading capacity

Revision history of this certificate

Revision No.	Date of Issuance	Description
0	2023-03-21	Initial certificate

A copy of this certificate should be carried on board any ship equipped with the MBR Series Marine Sewage Treatment Plant.

APPENDIX - SUMMARY OF TESTING

Test results and details of tests conducted on samples from the sewage treatment plant in accordance with resolution MEPC.227(64) excluding section 4.2:

Sewage treatment plant type:	MBR-30
Manufactured by:	CSSC Nanjing Luzhou Machine Co.,Ltd
Organization conducting the test:	Environment Testing Center of Lower Yangtze River (Test witnessed by China Classification Society)
Organization handling the samples:	Environment Testing Center of Lower Yangtze River
Test Location:	Waste water test room in Taixing Hesheng Transmission Machine Manufacturer Co.,Ltd
Designed hydraulic loading:	5.4 m^3/day
Designed organic loading:	2.7 kg BOD/day
No. of effluent samples tested:	40
No. of influent samples tested:	40
Total suspended solids influent quality:	635.5 mg/L
Total nitrogen influent quality:	
- Geometric mean:	N/A
- Maximum	N/A
- Minimum	N/A
Total phosphorus influent quality:	
- Geometric Mean:	N/A
- Maximum:	N/A
- Minimum:	N/A
BOD_5 without nitrification influent quality:	860.1 mg/L
Maximum hydraulic loading:	5.442 m^3/h
Minimum hydraulic loading:	5.890 m^3/h
Average hydraulic loading (Qi):	5.614 m^3/day
Effluent flow (Qe):	5.442 m^3/day
Dilution compensation factor (Qi/Qe):	1.0
Geometric mean of total suspended solids:	13 mg/L
Geometric mean of the thermotolerant coliform count:	<2 coliforms/100 ml
Geometric mean of BOD_5 without nitrification:	2.2 mg/L
Geometric mean of COD:	12.8 mg/L
Geometric mean of total nitrogen: Percentage reduction of total nitrogen:	N/A N/A
Geometric mean of total phosphorus: Percentage reduction of total phosphorus:	N/A N/A

Maximum pH:	7.71
Minimum pH:	7.44
Type of disinfectant used:	MBR cleaning water: Chlorine
If Chlorine - residual Chlorine:	
- Maximum:	<0.02 mg/L
- Minimum:	<0.02 mg/L
- Geometric mean:	<0.02 mg/L
Was the sewage treatment plant tested with:	
Fresh water flushing?	☒ Yes ☐ No
Salt water flushing?	☒ Yes ☐ No
Fresh and salt water flushing?	☒ Yes ☐ No
Grey water added?	☒ Yes ☐ No (Proportion 1:1.54)
Was the sewage treatment plant tested against the environmental conditions specified in section 5.9 of resolution MEPC.227(64):	
Temperature:	☒ Yes ☐ No
Humidity:	☒ Yes ☐ No
Inclination:	☒ Yes ☐ No
Vibration:	☒ Yes ☐ No
Reliability of Electrical and Electronic Equipment:	☒ Yes ☐ No
Limitations and the conditions of operation are imposed:	
Salinity:	≤35 000 mg/L
Temperature:	0 – 55ºC (Ambient) 2 – 32ºC (Inlet water)
Humidity:	≤95%
Inclination:	≤22.5º
Vibration:	2 – 13.2 Hz (Amplitude: ±1 mm) 13.2 – 80 Hz (Acceleration: ±6.9 m/s^2)
Results of other parameters tested:	N/A