Certificate no.:
TAE000054U

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Li-Ion Battery System

with type designation(s)
Greenwill Marine Li-ion battery system

issued to
GNW Power Limited
Wong Chuk Hang Road, **Hong Kong**

is found to comply with
DNV rules for classification – Ships, offshore units, and high speed and light craft

Application:

Product approved by this certificate is accepted for installation on all vessels classed by DNV.

Issued at **Høvik** on **2025-09-29**
This Certificate is valid until **2030-09-28**.
DNV local unit: **China South NB**

for **DNV**

Approval Engineer: **Georgy Abramenko**

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 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 USD 300 000.

Product description

The Greenwill Marine battery system is designed to be modular and could be scaled up to 1000VDC. The smallest entity of the system is the battery module. 2 battery modules can be connected in series to form a string.
The minimum battery system string consists of 2 battery modules, one HVCB (high voltage control box) and one BAU (battery administrate unit), each battery string is isolated from a common DC bus by breaker/fuse.
Battery strings are connected in parallel to form a battery system which shall be controlled by BAU. Each BAU could manage 32 battery strings.

The battery module is assembled with 16S24P LFP cells and one BSU (Battery Slave Unit), each cell is fixed by the holder and connected through copper nickel sheet.
There are four interfaces on the front part of the battery module: battery positive pole, battery negative pole, two communication ports, CAN1 and CAN2, used to transfer the cell information to the BMU (battery management unit).
Besides that, a valve was equipped in the rear part of the battery module in case of thermal runaway or explosion event.

The Battery system uses a three-level BMS control structure: BSU, BMU and BAU, for monitoring, analyse and control the battery cell charging and discharging, communicate to external PCS (power converter system), EMS (energy management system).

The battery system meets the DNV Pt.6 Ch.2 Sec.1 Non-Propagation Design Option #1 requirement for no cell-to-cell propagation.

Battery system parameters

	1 string	32 strings
System capacity	110.4 Ah	3532.8 Ah
System voltage range	80 – 992.8 VDC	
System energy	11.3 – 96.1 kWh	2 MWh
Ingress protection	IP65	
Cooling	Natural air cooling	
EMC	Class A	
Vibration	Class A	
Temperature	Class B	
Humidity	Class B	

Modules	
Type of cells	Steel Cylindrical with CID
Chemistry	Lithium ion LiFePO4
Number and configuration of cells in module	16S24P
Max voltage	51.2 VDC
Min voltage	40 VDC
Energy	5652 Wh
Ingree protection	IP67
Cooling	Natural air cooling

Battery Management system (BMS)
Functionality of BMS is distributed between the battery modules BSU, BMU, and BAU.
BSU type: 012108SB04
BMU type: BMCE02-V06
BSU/ BMU firmware: 17/01
BAU type: BSC001-V04
BAU firmware: 14

Application/Limitation

1. Battery system complies to DNV Rules for Ships Pt.6 Ch.2 Sec.1 ed. December 2024 requirements.
2. When installed on a ship or offshore unit, the DNV class rules for battery installation must be followed (DNV Pt.6 Ch.2 Sec.1).
3. The Type Approval covers hardware and software listed under Product description.
4. The Type Approval is valid for systems made by production facilities listed under Place of Manufacture.
5. The system is designed for operating without an off-gas duct, but a reserved off-gas duct interface is provided as an option.

Product certification:
A DNV product certificate according to DNV Pt.6 Ch.2 Sec.1 is required for each delivery.
The following documents shall be submitted for approval:

- Reference to this type approval certificate
- Copy of the approved Safety description and Safety description supplement
- (E120) Technical specification of the battery system that is subject for product certification
- (I030) Project-specific Battery System Block Diagram
- (S010) Piping diagram of the drainage system
- (I020) Project-specific functional description
- Information on software versions applicable for the particular delivery
- (Z252) Test procedure at manufacturer.

Software update notification
When the type approved software is revised (affecting all future deliveries), DNV is to be informed by forwarding updated software version documentation. If the changes are judged to affect functionality for which rule requirements apply a new functional type test may be required and the certificate may have to be renewed to identify the new software version.

Type Approval documentation

Tests carried out
Tests according to DNV-CP-0418, Rules for Ships Pt.6 Ch.2 Sec.1 (ed. December 2024), DNV-CG-0339

Marking of product
Manufacturer name, and battery system type designation.

Manufactured by:
Name: GNW Power Limited.
Place of Manufacture: Dongguan, Guandong, China.
DNV station: China South NB

Periodical assessment
The scope of the periodical assessment is to verify that the conditions stipulated for the Type approval are complied with and that no alterations are made to the product design or choice of materials.
The main elements of the assessment are:

- Inspection on factory samples, selected at random from the production line (where practicable)
- Results from Routine Tests (RT) checked (if not available tests according to RT to be carried out)
- Review of type approval documentation
- Review of possible change in design, materials and performance
- Ensuring traceability between manufacturer's product type marking and Type Approval Certificate.

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

END OF CERTIFICATE