



Certificate No:
TAE00004BT

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Li-Ion Battery System

with type designation(s)
Green Battery

Issued to

Praxis Automation Technology B.V.
Leiderdorp, Zuid-Holland, Netherlands

is found to comply with

DNV GL rules for classification – Ships, offshore units, and high speed and light craft

Application :

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Issued at **Høvik** on **2021-08-18**

for **DNV**

This Certificate is valid until **2026-08-17**.

DNV local station: **Benelux VMC**

Approval Engineer: **Sverre Eriksen**

Marta Alonso Pontes
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.

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.



Name and place of manufacturer

Praxis Automation Technology B.V.
Leiderdorp, Zuid-Holland
Netherlands

Product description

Liquid cooled lithium-ion battery-based energy storage system (ESS) for use in battery-powered or hybrid vessels and off-shore units.

The ESS system consists of battery modules connected in series to form a pack (battery string) and achieve the required system voltage. Each battery pack consists of battery modules connected in series of maximum 10 modules and a battery management system (BMS) module controlling the battery modules. Packs are installed in parallel in order to provide the required energy capacity.

Battery modules and BMS units, safety relays with fuse and all other pack components are housed within a dedicated racking system which provides all module and pack electrical interconnection, pack communication, module cooling, and an integrated thermal runaway exhaust duct.

The ESS system is designed to have no thermal runaway propagation between the prismatic cells.

The ESS system is designed to ventilate possible off-gas through a dedicated overpressure output in the battery modules.

Module including cells and control circuits

Type: GreenBattery Battery Module
Chemistry: Lithium Iron Phosphate (LFP)
Number of cells: 30
Cell configuration: 1P30S
Max Voltage (nominal): 110 V
Min Voltage (nominal): 75 V
Capacity: 105 Ah
Energy: 10 kWh
Max charge/discharge rate: 1C
Cooling: Liquid cooling
HW Part number: 93.4.200 Revision: GABBC

Battery Management System (BMS)

Type: GreenBattery Battery Management System
Max No. of modules: 10 battery modules.
HW Part number: 93.4.210 Revision: BAAAE
SW version number: 6.0.1.13

Application/Limitation

1. When installed on a DNV classed ship or offshore unit, the DNV class rules for battery installation must be followed (DNV GL Pt.6 Ch.2 Sec.1)
2. The Type Approval covers hardware and software listed under Product description
3. The Type Approval is valid for systems made by production facilities listed under Place of Manufacture
4. The ventilation duct from the battery packs/racks to open air is not a part of this type approval. The piping system venting the exhaust gases from the rack to open air/safe location and gas detection shall be verified onboard in each case. Requirements in DNV GL rules Pt.6 Ch.2 Sec.1 shall be fulfilled.
5. The DC power supply for the system shall be derived from a power supply unit which is DNV type approved, alternatively secured through a DNV type approved DC/DC converter.

Product certification:

Battery systems rated equal or larger than 50kWh shall have a product certificate according to DNV GL Pt.6 Ch.2 Sec.1 Table 4 for each delivery to DNV classed vessels.

For product certification, at least the following documents should be submitted for approval, Ref. to DNV GL Pt.6 Ch.2 Sec.1 Table 8:

- Reference to this type approval certificate
- Copy of the approved Safety description
- (E120) Technical specification of the battery system that is subject for product certification
- (I030) Project-specific Battery System Block Diagram
- (I020) Project-specific functional description
- Information on software versions applicable for the particular delivery

- (Z252) Test procedure at manufacturer

Location classes (DNVGL-CG-0339)

Temperature	Class A
Humidity	Class B
Vibration	Class A
EMC	Class A
Enclosure	IP66

Type Approval documentation

Document as listed in approval letters 1 - 6, ref 262.1-031386-J4/J7/J11/J12/J15/J17.

Tests carried out

Tests according to DNVGL-CP-0418 including DNVGL-CG-0339.

Marking of product

Manufacturer name, and battery system type designation.

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