

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Li-Ion Battery System**with type designation(s)
Dolphin Energy and Power

Issued to

Corvus Energy AS
Nesttun, Norwayis found to comply with
DNV GL 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 GL.**Issued at **Høvik** on **2021-01-27**This Certificate is valid until **2026-01-26**.for **DNV GL**DNV GL local station: **Norway CMC, East-South**Approval Engineer: **Georgy Abramenko**

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 GL AS, its parent companies and subsidiaries as well as their officers, directors and employees ("DNV GL") 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 manufacture

Corvus Energy Nesttun and Porsgrunn, Norway

Product description

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

The system consists of one or several battery packs connected in parallel, depending on required power and energy. Each battery pack contains a pack controller, and one or several strings of series-connected modules. A battery pack can be operated as an independent unit or in a system comprising several packs, controlled by the Battery System Controller (BSC) which interfaces with the customers Energy Management System (EMS). The BSC communicates with the battery pack controllers which monitor and controls the modules in the packs.

The battery modules contain cells and control circuits which monitor and control the cell blocks and communicate with the pack controller. Each battery module is cooled and ventilated by an individual fan, circulating air from battery space through the battery module.

Module including cells, cell and group modules

	Dolphin Energy	Dolphin Power
Type of cells	Cylindrical 18650 Li-ion cells	
Chemistry	Lithium ion NMC	
Number and configuration of cells	27p32s (4 cell modules, 27p8s)	
Max voltage	134 V	
Min voltage	80 V	
Capacity	95 Ah	68 Ah
Energy	11 kWh	7.8 kWh
Cooling	Forced air	

Battery module control circuits

Type: OCM CM10xA (4 per module)

Type: CGM CGM03xA (1 per module)

Pack/ string controller

Type: String Controller SC 3.xA

Max No. of modules per string: 7

Max Voltage: 940VDC

Battery system controller

Type: Battery System Controller BSC3.xA (PLC, HMI, can be placed in customized cabinet)

Battery Management system

Functionality of BMS is distributed between the battery modules, battery pack controller and battery system controller.

The software is identified by the following versions:

BMS controlled release version:

Battery System Controller: 3.xx

Pack Controller: CU v2.1.xx.x / CS v1.9.x

Battery Module: CGM v1.9.x

Application/Limitation

1. When installed on a ship or offshore unit, the DNV GL 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. Energy storage system is equipped with interface to gas detection system. Gas detection system shall be provided to meet DNV GL class requirements (DNV GL Pt.6 Ch.2 Sec.1 2.3.2)
5. Due to ingress protection of IP2X the battery system is only to be installed in dry room that is protected against water (or other liquids) intrusion. Fire extinguishing system must be gas based.

Product certification:

A DNV GL product certificate according to DNV GL Pt.6 Ch.2 Sec.1 Table 2 is required for each delivery to DNV-GL classed vessel.

The following documents shall be submitted for approval:

- 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 B
Humidity	Class B
Vibration	Class A
EMC	Class A
Enclosure	Class A

Software update notification

When the type approved software is revised (affecting all future deliveries) DNV GL 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 DNVGL-CP-0418, 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