



Certificate no.:
TAE00004VC

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Li-Ion Battery System

with type designation(s)
Blue Whale

issued to

Corvus Energy
Richmond, BC, Canada

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 **2024-04-25**

This Certificate is valid until **2029-04-24**.

for **DNV**

DNV local unit: **Vancouver**

Approval Engineer: **Sverre Eriksen**

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.



Form code: TA 251

Revision: 2023-09

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Name and place of manufacture

Corvus Energy Richmond, Canada

Product description

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

The system consists of battery modules connected in series to form a string and achieve the required system voltage. Strings are connected in parallel to form a pack in order to provide the required energy capacity.

Each battery module contains a module control board (MCB) which monitors and communicates voltage, temperature, and diagnostic information to the pack controller. The pack controller (PC) consists of pack controller cabinet (PCC) and string disconnection module (SDM). SDM is the electrical interface between the load and the battery pack. The MCB communicates with the pack controller and external systems.

The battery modules, SDM, PC and all other pack components are housed within a dedicated stacking systems which provides: all module and strings electrical interconnection, pack communication, module cooling, and an integrated thermal runaway exhaust duct.

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

Battery module with control circuits

Type:	Battery module BW10-80-AR-25-[BB] Where [BB]= busbar configuration: standard (blank), splitter (SP) or unfused (UF) *See application/limitation note 4.
Type of cells:	Prismatic 280Ah
Chemistry:	Lithium ion LFP
Cells manufacturer:	EVE
Number and configuration of cells:	(2P12S)2S - 2 sub modules of 2P12S in series
Max voltage:	87.6 V
Min voltage:	60.0 V
Energy:	44 kWh
Cooling:	Forced air

Module stack cap: BWSC-750A-25

Pack controller with control cabinet and string disconnection unit:

Pack controller:	PC100-S[S]P[P]-VAC-L Where [S]=number of string disconnect modules in the PC, range 1-8 and [P]=number of string disconnect modules in the PC with precharge, range 0-8
Pack controller cabinet:	PCC0-[KK]-VAC-L Where [KK]= number of stacks that the cabinet can accommodate, range 01-16
String disconnection module:	SDM100-750A-[RR]R Where [RR]= pre-charge resistance, 0=NA, 17=17 ohms
Max No. of modules per string:	14
Max Voltage:	1226 VDC
Max No. strings:	8

Pack Controller Interface Base: PIB100-S[S]
Where [S]= number of string disconnect modules, range 1-8

Stack Interface Base: SIB100

Battery Management system

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

The software is identified by the following versions:

Pack Controller Cabinet: 4.0.9-20231114.2

Battery Module: 4.0.6 #884.0.6 #88

String Disconnect Module: V4.0.7 #110

Application/Limitation

1. 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)
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 battery modules can be delivered with or without internal fuse. When using unfused modules the string must terminate at the stack cap such that the stack cap will act as the positive fuse. Therefore unfused modules (UF) cannot be used in the same string as splitter modules (SP).

Product certification:

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

For product certification, at least the following documents should 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;
- (E170) Electrical schematic diagram showing the battery packs, strings, modules with switchgears and control gears, dimensions of bus bars as relevant;
- (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 (DNV-CG-0339)

Temperature Class B
Humidity Class B
Vibration Class A
EMC Class A
Enclosure Class B (IP44)

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 Pt.6 Ch.2 Sec.1 DNV-CP-0418, DNV-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