Certificate no.:
TAE00004VB

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Li-Ion Battery System

with type designation(s)
ERS3

issued to
Echandia Marine AB
Solna, **Sweden**

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, following DNV Rules of July 2022 edition.

Issued at **Høvik** on **2024-05-08**

This Certificate is valid until **2029-05-07**.

for **DNV**

DNV local unit: **Sweden CMC**

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.

Name and place of manufacturer
Echandia Marine, Solna Sweden

Product description
Air cooled lithium-ion battery-based energy storage system for use in vessels and offshore units. The system consists of multiple strings connected in parallel, where each string comprises of up to 37 modules connected in series to achieve the required system voltage. It is considered a passive system and relies on a parent system (automation system, EMS etc.) for full functionality.

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

Each string consists of multiple battery module provided with cell monitoring units (CMU) monitoring the voltage and temperature down on cell level. String controller (SC) provided in strings are monitoring the voltage, current and temperature, protecting and tracking the status of the battery unit. The SC communicates with upstream battery management system (BMS). The SC makes sure that the string is only connected to the DC bus if the modules are in a safe state.

An Industrial PC (IPC) hosts the software that manages the system and communicates with HMI, logs operational data, and sorts the string into different groups. The IPC is connected to the battery strings via switches. For communication to a parent system, a PLC is utilized. ERS-3 supports MODBUS TCP for parent system communication. The battery modules, CMU, SC, all other string components, IPC and PLC are housed within a dedicated racking system which provides: all module and strings electrical interconnection, communication, module cooling, and exhaust ventilation system.

Modules including cells and CMU

Type	**Type 3-20**	**Type 3-23**	**Type 3-26**
Capacity	39 Ah	46Ah	51.1 Ah
Energy	1053 Wh	1242 Wh	1379 Wh
Max charge / discharge current	160 A (continuous), 500 A (in-rush)	160 A (continuous), 350 A (in-rush)	
Voltage	27.6 VDC		
Number of cells	24		
Cell configuration	2P12S		
Chemistry	Lithium titanate (LTO)		
Cooling	Air cooled		

String

Max voltage	33 – 1200 VDC	
Min voltage	18 – 600 VDC	
Nominal voltage	27 - 904 VDC	
Max charge / discharge current	160 A (continuous), 500 A (in-rush)	160 A (continuous), 350 A (in-rush)

CMU
Type: CMU Type 3 Rev. 11

SC
Type: ESCU-S01-RXX

Monitoring units
Type: E-FOC-S01-RXX
Type: E-ROP-S03-RXX

Battery Management System
Functionality of BMS is distributed between IPCs, SCUs and CMUs. Independent overcharge protection, according to DNV Pt.6 Ch.2 Sec.1 [4.1.5.2], is arranged as hardwired signal tripping hardware safety loop (E-ROP)..

The software is identified by the following versions:
BMS: 3.xx.xx
PLC: 3.xx.xx
HMI: 3.xx.xx
BMU: 3.xx.xx

Location classes (DNV CG-0339)

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

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 piping system, venting the exhaust gases from the rack to open air/safe location, shall be verified onboard in each case. Requirements in DNV rules Pt.6 Ch.2 Sec.1 shall be fulfilled.
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 'Name and place of manufacture'.
5. Total flooding fire extinguishing system shall be provided according to DNV Rules for Ships Pt.6 Ch.2 Sec.1.
6. Ambient temperature in battery system space should be maintained in the range 0…+25°C for conformance to continuous load performance.

Product certification:
Each delivery of the application system to be certified according to DNV Pt.6 Ch.2 Sec.1. This includes factory acceptance test to be performed at the manufacturer before the system is delivered to the yard.
For each delivery to DNV class the following documentation of the battery system is to 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

Type Approval documentation

Tests carried out

Tests according to DNV-CP-0418 and DNV-CG-0339, IEC 62619 and IEC 62620.

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