DNV·GL

Certificate No:
TAE00003WH

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Li-Ion Battery System

with type designation(s)
Echandia LTO

Issued to
Echandia Marine AB
Solna, Sweden

is 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 **2020-02-25**
This Certificate is valid until **2025-02-24**.
DNV GL local station: **Sweden CMC**

Approval Engineer: **Georgy Abramenko**

for **DNV GL**

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.

Name and place of manufacture

Echandia LTO
Solna
Sweden

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 multiple strings connected in parallel, where each string comprises of up to 32 modules connected in series to achieve the required system voltage.
It is considered to be a passive system and relies on a parent system (automation system, EMS etc.).

Each string consists of multiple battery module provided with cell monitoring unit (CMU) controlling the voltage and temperature down to cell level. Battery monitoring units (BMU) provided in strings are controlling the voltage, current and temperature, protecting and tracking the status of battery unit. The BMU communicates with upstream battery management system (BMS).
The programmable Logic Controller (PLC) hosts the software for the BMS. It communicates with the HMI, parent system and battery strings via switches. For communication to parent system, Echandia LTO ESS recommends PROFINET, CAN protocols but also supports MODBUS TCP.
The battery modules, CMU, BMU, all other string components and PLC are housed within a dedicated racking system which provides: all module and strings electrical interconnection, communication, module cooling, and an exhaust ventilation system.

Module including cells and CMU

Type:	Type 3-23
Chemistry:	Lithium titanate (LTO)
Number of cells:	24
Cell configuration:	2P12S
Max voltage:	32.4V
Min voltage:	18V
Capacity:	46 Ah
Energy:	1242 Wh
Cooling:	Air cooled

CMU
Type: CMU Type 3 R04

BMU
Type: BMU-2G-RJ45 5P4E0124P001

Battery Management Sysytem
Functionality of BMS is distributed between PLCs, BMUs, CMUs. Independent overtemperature protection according to DNV GL Pt.6 Ch.2 Sec.1 [4.1.5.2] is arranged as hardwired signal tripping hardware safety loop.

The software is identified by the following versions:

BMS controlled release version:	PLC: 1
	HMI: 1
	BMU: B2R10106

Location classes (DNV-GL 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 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.

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 piping system venting the exhaust gases from the rack to open air/safe location shall be verified onboard in each case. Requirements in DNV GL 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 Place of Manufacture.
5. Total flooding fire extinguishing system shall be provided according to DNV-GL Rules for Ships Pt.6 Ch.2 Sec.1 in addition to FiFi4Marine system optionally recommended by ESS manufacturer.
6. Ex certified non sparking exhaust fans are required to be provided for each application.

Product certification:
Each delivery of the application system to be certified according to DNV GL 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-GL 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

Tests carried out

Tests according to DNVGL-CP-0418 and DNVGL-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