



Certificate No:
TAE00004CF

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Li-Ion Battery System

with type designation(s)
EOH marine battery pack

Issued to

Hagal Ocean AS
Oslo, Norway

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 **2022-01-26**

This Certificate is valid until **2027-01-25**.

for **DNV**

DNV local station: **Norway CMC, East-South**

Approval Engineer: **Georgy Abramenko**

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Trond Sjøvåg
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.



Form code: TA 251

Revision: 2021-03

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Name and place of manufacture

Shenzhen Lithtech Energy Co., LTD
No.5, Shijing Industrial Park, Shijing Community, Shijing Street, Pingshan, Shenzhen, Guangdong, China

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 battery system is designed to be modular and could be scaled up to 1000VDC. The smallest entity of the battery is the battery module. 3 pcs battery modules can be connected in series to form a battery pack. Battery Pack consists of Module A+B+C and one PDU (power distribution unit). Packs are connected in parallel to form a battery bank which is controlled by BAMU (battery area management unit).

Up to 4 packs may be connected to form a battery system string.

The voltage of the string depends on the number of modules connected in series.

BAMU is interfaced with customer's energy management system (EMS).

Each battery module contains 10 cell blocks that equipped with BCU1/BCU2 (battery status information collection unit), collecting the voltage of cells and the temperature of the block. 8 cells connected in series form the battery module cell block.

Module including cell blocks

Pack characteristic (min/ max)	1 module system	3 modules system
Chemistry	Lithium Iron Phosphate (LFP)	
Number and configuration of cells	80S1P	240S1P
Nominal operating voltage	256V	768V
Max charge voltage	292V	876V
Max continuous charge/ discharge current	160A/ 0,7C	
Capacity	230Ah	230Ah
Energy	58,88kWh	176,64kWh
Cooling	Natural air	

Battery module control circuits

Type (BCU, battery status information collection unit): ARS-BCMS-LT122

Type (BCMU, battery control management unit): ARS-CBT12X(II)

BAMU (battery area management unit) controller

Type: ARS-BMMS-FS100

Battery Management system

Functionality of BMS is distributed between the battery cell blocks (BCU), battery modules (BCMU), battery back/ string (BAMU).

The software is identified by the following versions:

BAMU HMI : C015 16-20210805-V1.1.0

BAMU Controller: 18301

BCMU1: 10008

BCMU2: 10081

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. Battery system may be charged with 160A max in quick charging mode.

Product certification:

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

The following documents shall be submitted for approval:

- Reference to this type approval certificate

Job Id: 262.1-034090-1
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- 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 (DNV-CG-0339)

Temperature	Class A
Humidity	Class B
Vibration	Class A
EMC	Class A
Enclosure	IP67

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-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