



Certificate No:
TAE00004MN

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Li-Ion Battery System

with type designation(s)
H173F220A ESS Battery system

Issued to

Avic-Intl Project Engineering Company
BEIJING, China

is found to comply with

DNV rules for classification – Ships, offshore units, and high speed and light craft

Application :

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Issued at **Høvik** on **2022-12-22**

This Certificate is valid until **2027-12-21**.

for **DNV**

DNV local unit: **Dalian NB & CMC**

Approval Engineer: **Uwe Supke**

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 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: 2022-12

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Name and place of manufacturer

China Lithium Battery Technology Co., Ltd., No. 66, Binhe North Road, High-New Technology Development Area, Luoyang, Henan, P.R.C. 471003

Product description

The H173F220A ESS Li-Ion Battery system is designed to be modular and can be scaled up to 1000VDC, with LFP cell and liquid-cooling module for continuously 1C charging/discharging operation, suitable for the battery-powered or hybrid applications in maritime field, with pre-charging and blackout prevention function etc.

The battery system is designed to be no thermal runaway propagation between cells. Off-gas is led outside of ESS space via integrated off-gas duct.

ESS including three essential parts: battery module, power distribution unit (PDU), and power connection cabinet (PCC). Battery modules connected in series up to seven (7) with PDU to form a string. Battery strings connected in parallel up to ten (10) with PCC to form an array. System Voltage-Energy matrix:

System Nominal Voltage & Energy (V, kWh)						
Modules in serial		3	4	5	6	7
Nominal Voltage		374.4	499.2	624	748.8	873.6
Strings in parallel	1	82	110	137	164	192
	2	164	220	274	328	384
	3	246	330	411	492	576
	4	328	440	548	656	768
	5	410	550	685	820	960
	6	492	660	822	984	1152
	7	574	770	959	1148	1344
	8	656	880	1096	1312	1536
	9	738	990	1233	1476	1728
	10	820	1100	1370	1640	1920

A three-level architecture BMS system (BMU/BCU/BAU) is included in the ESS system, to monitoring, control and protect the battery system. Independent over-charge protection function is included.

LFP prismatic cell

Rated capacity 220Ah
Limited charge voltage 3.65V
Nominal charge/discharge current 220A
Max. charge/discharge current 264A
Discharge cut-off voltage 2.5V

Module

The liquid-cooled module consists of 1P39S battery cells:

Rated capacity 220Ah
Limited charge voltage 142.35V
Nominal charge/discharge current 220A
Max. charge/discharge current 220A
Discharge cut-off voltage 97.5V
Module Type: H173F220A-1P39SA/B

PDU Type: PDU-GT-1C-SH

PCC Type: PCC-GT-SH-A0

Battery Management System (BMS)

Identification:

all BMS applicable hardware numbers: ESBMM4812 HV7.0.0

BMS software identification numbers:

BCU-A: SV_CF133_b3_4.0.2_GB2.8_20220369_01.22
 BCU-B: SV_CF133_b3_4.0.2_GB2.8_20220369_02.09
 BAU: SV_CF133_b3_5.0.1.1-GB2.9-20220369.10.5

Location Classes (DNV-CG-0339)

Temperature Class A (BMU Class B)
 Humidity Class B
 Vibration Class A
 EMC Class A
 Enclosure IP44 for PDU and PCC, IP67 for Module

Application/Limitation

Battery room ventilation

The battery room ventilation shall comply with the requirements as given for design option 1 with integrated ventilation duct.

Approval conditions

For each delivery to DNV class the following documentation of the battery system is to be submitted for approval:

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 certification test is to be performed at the manufacturer of the application system before the system is shipped to the yard. After certification, the clause for application software control will be put into force.

For product certification, at least the following documents should be submitted for approval, Ref. to DNV Pt.6 Ch.2 Sec.1 Table 8:

- Reference to this type approval certificate
- Copy of the safety description
- I030 Project-specific Battery System Block Diagram
- E120 Technical specification of the battery system that is subject for product certification
- E170 Electric schematic diagram of the battery system showing internal arrangement of battery modules, battery strings, switch unit, emergency stop and independent safety system
- Z060/ I020 Project specific functional description, including a project-specific overall description of the battery management system
 - software and hardware versions of components
 - other relevant information not covered by the safety description
- Z252 Test program for product certification, including routine tests specified in applicable rules
- Z265 Calculation report, documentation of the SOC and SOH calculation

The Type Approval covers hardware and software listed under product description.

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 software control

All changes in software are to be recorded as long as the system is in use on board. Documentation of major changes are to be forwarded to DNV for evaluation and approval before implemented on board.

Type Approval documentation

Tests carried out

Type tests for the battery system according to applicable DNV rules and standards have been carried out: DNV-CP-0418 (Edition: 2021-07) and DNV-RU-SHIP Pt.6 Ch.2 Sec.1 (Edition 2021-07), DNV-RU-SHIP Pt.4 Ch.8, DNV-RU-SHIP Pt.4 Ch.9, DNV-CG-0339 (Edition: 2021-08).

The propagation test has been passed in accordance to DNV-RU-SHIP Pt.6 Ch.2 Sec.1 [4.1.2.7] design option 1: no propagation between cells within a module.

Marking of product

The products to be marked with:

- manufacturer name
- model name

- serial number
- power supply ratings

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 of factory samples, selected at random from 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 of the 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