Certificate no.:
TAE000054J

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Li-Ion Battery System

with type designation(s)
EPT Battery Svenner

issued to
EPTechnologies GmbH
Reinbek, **Germany**

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 **2025-10-22**
This Certificate is valid until **2030-10-21**.
DNV local unit: **Hamburg – CMC North/East**

for **DNV**

Approval Engineer: **Andreas Andrecht**

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 USD 300 000.

Product description

The EPT Svenner Battery consists of air and optional liquid-cooled battery modules utilizing SS- LFP battery cells, meaning semi solid-state cells based on LFP chemistry. The solid-state technology combines a high level of safety with a high cycle life for the battery system.

Up to 15 battery modules are connected in series to a string control unit (SCU). The SCU including the Master Control Unit (MCU) as part of the battery management system, the main fuses and among other the main contractor's. The parallel operation of SCU strings is possible but not part of the current certificate. The battery modules can be optionally supplied with a fire prevention system, that is notable not required for design option 1 "No propagation between cells and without integrated off-gas duc".

Battery Module including:

- 16 single LFP battery cells per Module, connected in series
- 2 BMS Cell monitoring units including:
  - Cell temperature sensors
  - Cell voltage measurement
  - Passive cell balancing
- 2x Thermal switches used for the independent overcharge protection in the battery modules
- 1x Water Sensor
- 1x Emergency Power Line fuse

String Control Unit (SCU) including:

- Two fuses for all pole protection
- Two main contactors for connection to DC-bus
- Master control unit as BMS master
- Current and voltage measurement
- Insulation Monitoring
- 2x disconnection switch
- Manual operation key
- Pre-charge circuit
- Interfaces for communication to the external power management system

Battery Cell

Data	
Chemistry Type	Lithium-Iron-Phosphate Semi-Solid- State (LFP-SS)
Nominal Capacity	280Ah / 896Wh
Nominal Voltage	3.2V
Voltage Range	2.5 – 3-.65V
Charge / Discharge Rate	1.0C / 1.0C

Battery Mattery Module

EPT Svenner Solid State Battery	Air cooled module	Water cooled module
Dimensions (L x W x H)	810 x 425 x 250mm	810 x 425 x 250mm
Weight	110 kg	112 kg
Cooling	Air	Liquid (50% Water / 50%Glycole) or (40% Water / 60%Glycole)
Protection Class	IP 55	IP 55
Cell Configuration	16s/1p	16s/1p
Nominal Voltage	51.2V	51.2V
Nominal Capacity	280Ah	280Ah
Nominal Energy	14336Wh	14336Wh
Voltage Min	44.8V (2.8V cell)	44.8V (2.8V cell)
Voltage Min recommended	49.6V (3.1V cell)	49.6V (3.1V cell)
Recommended discharge current	170A (0.6C)	220A (0.8C)
Max continuous discharge current	220A (0.8C)	280A (1.0C)
Max pulse discharge current 15 min	330A (1.8C)	330A (1.8C)
Max pulse discharge current 30s	450A	450A
Max pulse discharge current 0.001s	750A	750A
Voltage Max	56.0V (3.50V cell)	56.0V (3.50V cell)
Voltage recommended	54.8V (3.45V cell)	54.8V (3.45V cell)
Voltage cell Max disconnection	3.65V cell	3.65V cell
Float voltage	53.45V (3.34V cell)	53.45V (3.34V cell)
Recommended charge current	90A (0.32C)	140A (0.5C)
Max continuous charge current	110A (0.4C)	190A (0.7C)
Max pulse charge current 15min	220A (0.8C)	220A (0.8C)
Max pulse charge current 30s	280A	280A
Type Nr. (with fire prevention)	999-090031 (999-090032)	999-090020 (999-090033)
CMU Board	100809	100809
CMU Hardware Version	LB-00953C01	LB-00953C01
CMU Software Version	N/A	N/A

String Control Unit (SCU)

EPT Svenner String Controller	
Dimensions (L x W x H)	475 x 430 x 194mm
Protection Class	IP 44
DC voltage range	100V to 850V
Nominal supply voltage LV	24.0V
Continuous DC current	350A
Max DC current (for 30s)	450A
Continuous LV supply current	2A
Peak LV supply current	8A
Battery modules connected min	1 in series
Battery modules connected max	15 in series
Type Nr.	999-16004
Hardware version SC	001803 Rev C
Software version SC	
Base-layer Software BSW	500.1.0.5.51.0.202506110949.e6bcff33
Application-layer Software ASW	103.1.0.18.2.0.202506111115.8d3c5bdf
Electric configuration Software ESW	10002.1.0.3.8.0..

Location classes

Temperature Class	B
Humidity Class	B
Vibration Class	A
EMC Class	A
Enclosure	IP44/IP55

Application/Limitation

Approval conditions

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

Battery system

- Reference to this type approval certificate
- Copy of the safety description
- I130 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 Functional description, including a project-specific overall description of the battery management system
    - software and hardware versions of components
    - capacity calculations for the gas extract ventilation fan
    - 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.

Product certificate
Each delivery of the application system is to be certified according to Pt.6, Ch.2, Sec. 1. 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. The independent cell voltage disconnection is integrated in the system and is not required to be tested during certification. See DNV-RU-SHIP Pt.6 Ch.2 Sec.1, Table 7 Tests of battery systems, item 10.

Application software control
All changes in software are to be recorded if 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 as listed below have been carried out. DNV-RU-SHIP Pt.6 Ch.2 Sec.1 (Edition 2023-07), DNV-RU-SHIP Pt.4 Ch.8, DNV-RU-SHIP Pt.4 Ch.9, DNV-CG-0339 (Edition: 2021-08), DNV-CP-0418 (Edition: 2021-09).

Propagation test passed in accordance with DNV-RU-SHIP Pt.6 Ch.2 Sec.1 [4.2.2] Edition July 2023 (with design option 1: No propagation between cells and without integrated off-gas duct).

Marking of product

Manufacturer name and battery system type designation.

Place of production

EPTechnologies ApS
Jyllandsgade 17
6400 Sønderborg
Danmark

EPTechnologies GmbH
Senefelder-Ring 51
21465 Reinbek
Germany

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