Certificate no.:
TAE00004V4

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Li-Ion Battery System

with type designation(s)
LTO-XXX-XXX

issued to
Van Meer Production B.V.
THOLEN, **Netherlands**

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 **2024-03-21**
This Certificate is valid until **2029-03-20**.
DNV local unit: **Netherlands VMC**

for **DNV**

Approval Engineer: **Uwe Supke**

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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.

Product description

The LTO EES (Electrical Energy Storage) system is build up with Toshiba SCiB Type3 battery modules. These modules are equipped with 2 different Toshiba LTO cells. All cells have the same safety properties resulting in a system that is equipped with a safe LTO (Lithium Titanium Oxide) chemistry from Toshiba.
Each battery module is built up out of 24 cells in a 2P12S configuration and is equipped with a CMU (Cell Monitoring Unit) board.
The CMU board measures all cell voltages and temperatures and transfers this data by a CAN-bus communication to a BMU (Battery Monitoring Unit) module installed in the EES cabinet drawer. This BMU module powers and controls the contactors that are installed in both poles (DC+ and DC-). The EES cabinet drawer is installed in the bottom of each EES cabinet and is withdrawable if the EES cabinet is switched off.
The LTO EES system is built up out of one or multiple EES cabinets and one or more EES system controllers. The EES system controllers are standardized for the LTO EES system. The EES cabinets are scalable in dimensions and offer three different cell types. Each cell type is optimized for different EES system characteristics. The EES cabinet is equipped with a cooling fan at the bottom of the cabinet and an air outlet at the top of the cabinet. The EES cabinet holds between 8 and 36 battery modules.

Type designation:

The 21 possible different configurations of the EES cabinet are described with the following type code:
LTO-214-AE1, where

- LTO- is the EES cabinet chemistry,
- 2 is the number of columns: 2 or 3
- 14- is the number of rows: 2 column design:04-15 rows; 3 column design:04-12 rows
- A is the cooling method: A-air; L-liquid
- E1 is the cell type: E1 (23Ah); P1(20Ah)

Module including cells and CMU

Type	P1-Type 3-20	E1-Type 3-23
Capacity	39 Ah	45 Ah
Energy	1053 Wh	1242 Wh
Max charge/ discharge current	160 A (continuous)	
Voltage	27.6 VDC	
Number of cells	24	
Cell configuration	2P12S	
Cooling	Air cooled	

CMU

Type: CMU-Type 3 Rev.11

BMU

Type: BMU-2G-RJ45

Battery Management System

Functionality of BMS is distributed between PLCs, BMUs, CMUs. Independent overcharge protection, according to DNV Pt.6 Ch.2 Sec.1 [4.1.5.2](2021-07), is arranged as hardwired safety loop.

Software versions:

CMU: 00.01.03
BMU: 01.00.08
BMS software consists out of one software package based on Tia portal. Therefor we have only one software version for BMS, PLC and HMI: 1.7.X.X

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.

Name and place of manufacture

Van Meer Industrial Services B.V.
Tholen, Zeeland
Netherlands

Application/Limitation

1. When installed on a DNV classed ship or offshore unit, the valid DNV class rules for the 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 Safety description
- (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, including switch gear and control gear
- (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

Type tests according to applicable DNV rules and standards as listed below have been carried out.
DNV-CP-0418, DNV RU SHIP Pt.6 Ch.2 Sec.1 (2021-07) and DNV-CG-0339, IEC 62619 and IEC 62620
Propagation testing acc. DNVGL-RU-SHIP Pt.6 Ch.2 Sec.1 [4.2.2.1] (opt.1: no propagation between cells)

Marking of product

Manufacturer name, battery system type designation with serial number.

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