



Certificate No:
TAE00004R0

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Li-Ion Battery System

with type designation(s)
Octopus High Energy Module, Octopus High Power Module

Issued to
EST-Floattech B.V.
Badhoevedorp, Noord-Holland, Netherlands

is found to comply with
DNV rules for classification – Ships, offshore units, and high speed and light craft

Application :

Products approved by this certificate are accepted for installation on all vessels classed by DNV.

Issued at **Høvik** on **2023-03-30**

This Certificate is valid until **2028-03-29**.

DNV local unit: **Netherlands VMC**

for **DNV**

Approval Engineer: **Trond Kleivi Sjøvåg**

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 manufacture

EST-Floattech B.V
Badhoevedorp, Noord-Holland, Netherlands

Product description

The Octopus system is an air-cooled lithium-ion battery-based energy storage system (ESS) for use in battery powered or hybrid vessels and offshore units.

The system consists of two main components: the String Controller (SC) and the Battery Module (BM).

The String Controller unit (SC) is consisting of three printed circuit boards (PCBs): the High Power board, the Emergency Stop board and the String Controller board.

The battery modules can be delivered in two variants: Octopus High Energy (HE) module or Octopus High Power (HP) module.

Parameter	Octopus High Energy Module	Octopus High Power Module
Rated Capacity	192 Ah	112 Ah
Cell configuration	14S4P	14S4P
Operational voltage range	47.6 – 57.4 Vdc	47.6 – 57.4 Vdc
Energy	10 kWh	5.8 kWh
Maximum charge current	290 A	330 A
Maximum discharge current	330 A	330 A
Communication interface	CAN bus (Proprietary protocol)	CAN bus (Proprietary protocol)
Mass	≈85 kg	≈81 kg
Dimensions	253 x 582 x 726 mm (h x w x d)	253 x 582 x 726 mm (h x w x d)
Ingress Protection	IP65 (IP2X for connectors)	IP65 (IP2X for connectors)
Enclosure material	Die-casted aluminium	Die-casted aluminium
Cooling	Forced air	Forced air
Short circuit current range	2.8 - 15 kA	3.2 - 18 kA
Cell chemistry	Lithium NMC (Nickel Manganese Cobalt)	Lithium NMC (Nickel Manganese Cobalt)
Max no of modules per string	18	18
Max voltage (string)	1033V	1033 V
Max energy (string)	180 kWh	108 kWh

Up to 18 battery modules can be connected in series to form a battery string and achieve the required system voltage. A String Controller is required for each string to connect and disconnect from the application. Multiple battery strings can be connected in series to achieve the required energy capacity and form the complete ESS. An ethernet switch is required to connect multiple String Controllers to the same ethernet network.

Each Battery Module has a Module Controller (MC) which performs cell voltage monitoring, cell temperature monitoring, charge / discharge current monitoring, passive cell balancing and data logging.

The String Controller communicates with all Module Controllers in the string. The String Controller provides user interface via Modbus, contains contactors and fuses, performs string voltage and current measurement, and value and event logging.

The Battery Modules are installed in a racking system which includes an off-gas ducting system in case of thermal runaway event.

The battery module meets the DNV Pt.6 Ch.2 Sec.1 Non-Propagation Design Option #1, no cell-to-cell propagation.

Software releases

Software configuration	SC MPU	SC MCU	SC FPGA	MC MCU	MCU FPGA
Version	1.0.0	1.0.0	1.0.0	1.0.0	1.0.0

Location Classes

Temperature Class B
Humidity Class B
Vibration Class A
EMC Class A

Enclosure Battery Module IP65
Enclosure String Controller IP54

Application/Limitation

1. Ethernet switches and local control panel (HMI) are not part of this TA certificate. Such components must have a valid DNV TA.
2. The battery rack's off-gas exhaust system must be connected to a ship's off-gas exhaust system.
3. The fuses inside the String Controller will not give a complete protection for all fault currents. Overload currents between 900A and 2,5kA must be cleared by external protection devices (e.g Mersen D72SG120V250QF Protistor aR fuse). The external fuse selection and the coordination of selectivity to higher level systems is system integrator responsibility. Reference is made to the Safety Description.

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
- Reference to Type Approval Certificate for components not covered by this certificate (see Applications / limitations pt.1)
- 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
- (I110) Project specific list of controlled and monitored points, as submitted to other top systems, or displayed on delivered HMI (as applicable)
- Information on software versions applicable for the specific delivery
- (Z252) Test procedure at manufacturer

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