

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Li-Ion Battery System**with type designation(s)
Siemens BlueVault

Issued to

Siemens AS
Oslo, Norway

is found to comply with

DNV GL 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 GL.**Issued at **Høvik** on **2018-08-16**This Certificate is valid until **2023-08-15**.DNV GL local station: **Trondheim**for **DNV GL**Approval Engineer: **Sverre Eriksen**

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.



Product description

Liquid cooled lithium-ion battery based energy storage system (ESS) for use in battery-powered or hybrid vessels and offshore units.

The system consists of battery modules connected in series to form a pack and achieve the required system voltage. Packs are installed in parallel in order to provide the required energy capacity.

Each battery module contains battery cells in series and a control circuit which includes functions as monitoring voltages and temperatures, balancing of cells and safety disconnection control.

The battery pack consists of battery modules connected in series, a battery isolation and protection unit and a battery pack controller.

The battery packs are installed in a dedicated cubicle which provides: all module and pack electrical interconnection, pack communication, module cooling, and an integrated thermal runaway exhaust duct.

Module including cells and control circuits

Type:	BlueVault Battery Module
Chemistry:	Lithium ion NMC
Number of cells:	28
Cell configuration:	1P28S
Max Voltage:	117 V
Min Voltage:	92 V
Capacity:	64 Ah
Energy:	6.6 kWh
Cooling:	Liquid

Pack

Type:	BlueVault Battery Pack
Max No. of modules:	9
Max operating voltage	1046 V
Max Voltage:	1058 V
Nominal Energy:	60 kWh @ 0.5C, 25°C

Battery Pack Controller (BPC)

Art. No: 953.6110.001

Battery Module Controller (BMC)

Art. No: 953.6120.001

Battery System Controller (BSC)

Art. No: 960.6150.001

Battery Management System (BMS)

Functionality of BMS is distributed between the battery modules, battery pack controllers and the battery system controller.

The software is identified by the following versions:

Battery module sw:	960.6101.001Bx
Battery pack controller sw:	960.6105.001Bx
Battery system controller sw:	960.6150.001.1.x

Application/Limitation

1. When installed on a ship or offshore unit, the DNV GL class rules for battery installation must be followed (DNV GL 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 GL rules Pt.6 Ch.2 Sec.1 shall be fulfilled.
3. The Type Approval covers hardware and software listed under Product description

4. The power rating of the busbar and breaker must be checked for each delivery.
5. If supply power and UPS power to the pack controller is lost, the restart procedure given in "CX-2083-61-00-Q005.1 Procedure for restart after shutdown.docx" must be followed before the SOH estimator can be utilized

Product certification:

A DNV GL product certificate according to DNV GL Pt.6 Ch.2 Sec.1 Table 2 is required for each delivery. The following documents shall be submitted for approval:

- Reference to this type approval certificate
- Copy of the approved Safety description
- (E120) Technical specification of the battery system that is subject for product certification
- (E170) Project specific electric schematic drawing showing ratings of busbars and breakers.
- (I030) Project-specific Battery System Block Diagram
- (I020) Project-specific functional description
- Information on software versions for BMC, BPC and BSC applicable for the particular delivery
- (Z252) Test procedure at manufacturer

Location classes (DNVGL-CG-0339)

Temperature	Class A
Humidity	Class A
Vibration	Class A
EMC	Class A
Enclosure	Improved IP21*

* In addition to IP 21, the cabinet has been tested for IPx4, with spray from the top and sides (aprox 45 degrees), but not vertically.

Software versions are declared in Siemens document "Software Quality Plan", doc. No.: CX-2083-61-00-M002, rev. B. Identifiers in the software version denoted as "x" may vary and are covered by the type approval.

When the type approved software is revised (affecting all future deliveries) DNV GL is to be informed by forwarding updated document CX-2083-61-00-Q009.1 Software Version History. 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 is to be forwarded to DNV GL for evaluation and approval before implemented on board.

Type Approval documentation

Tests carried out

Tests according to DNVGL-CP-0418, DNVGL-CG-0339 and pack level safety function tests, "Functional testing", doc. No.:CX-2083-61-00-P009.2, rev. B.

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)



Job Id: **262.1-027660-1**
Certificate No: **TAE00002SE**

- 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