Certificate no.:
TAE00004VA

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Li-Ion Battery System

with type designation(s)
CAEV-BAT-L317

issued to
Contemporary Amperex Electric Vessel Technology Limited
Ningde, Fujian, 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 **2024-10-17**
This Certificate is valid until **2029-10-14**.
DNV local unit: **China South NB**

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.

Product description

The CAEV-BAT-L317 marine battery system is designed for pure electric propulsion vessels, hybrid propulsion vessels and all other types of vessels. The system consists of modules connected in series to form a string and achieve the required system voltage. Strings, at least 1 string and at most 8 strings, are installed in parallel in order to provide the required energy up to 2482.4kWh. The basic entity of the system is the battery module, and the maximum number of modules in a string connected in series is 19, which can be scaled up to nominal voltage 978.88V DC, maximum voltage 1109.6V DC. The minimum unit of the battery module is LFP prismatic cell. There are 16 cells series connection in each module.

To ensure cell consistency and enable high-performance operation of the system, the system supports liquid cooling or air cooling.

Battery Cell:	
Battery type	LFP
Cell model	CBC10
Rated capacity	317 Ah
Nominal voltage	3.22 V
Operating voltage range	2.5V~3.65V
Rated storage energy	1020.74 Wh
Max continuous charge and discharge current	1C / 317 A
Battery Module:	
Rated capacity	317 Ah
Nominal voltage	51.52 V
Operating voltage range	40 ~ 58.4 V
Cell configuration	1P16S
Rated storage energy	16331 Wh
Maximum continuous charge and discharge rate	1C / 317 A
Cooling	Liquid cooling or air-cooling
IP rating	IP67
Battery String:	
Max number of modules	19
Max voltage	1109.6V DC
Nominal voltage	978.88V DC
Max energy	310.30kWh
Battery System:	
Max number of strings	8
Nominal voltage	978.88V DC
Max voltage	1109.6V DC
Max energy	2482.4kWh

System designation

The CAEV-BAT-L317 battery system is composed of one Control Cabinet and several parallel Battery Strings. One Battery String includes a SBox and several serial Battery Modules.

The battery system also has BMS arranged in various parts, detailed as CSC and OTD in Battery Module, SBMU and OTPU in SBox, MBMU and HMI in Control Cabinet. The versions of parts are shown as below.

System Part			BMS Unit		
Name	Type Designation	Hardware Version	Name	Hardware Version	Software Version
Battery Module	L317G01	V01	CSC	CSC-C1-1.xx	CSC-V01.xx
			OTD	OTD-C1-1.xx	OTD-V01.xx
SBox	SBox/1200V/350A	V01	SBMU	SBMU-C1-1.xx	SBMU-V01.xx
			OTPU	OTPU-C1-1.xx	OTPU-V01.xx
Control Cabinet	CCabinet/1200V/2500A	V01	MBMU	MBMU-C1-1.xx	MBMU-V01.xx
			HMI	HMI-C1-1.xx	HMI-V01.xx

Location Classes

Temperature Class	A
Humidity Class	B
Vibration Class	A
EMC Class	A
Enclosure	
Battery module	IP 67
SBox	IP 67
Control Cabinet	IP 44

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
- Z072 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
- I020 Functional description, including a project-specific overall description of the battery management system
  - I320 software and hardware versions of components
- Z252 Test program for product certification, including routine tests specified in applicable rules

The Type Approval covers hardware and software listed under system designation.

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
When installed on a DNV classed ship or offshore unit 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 overcharge protection is CID based on cell level and is not required to be tested during product certification. For non DNV classed installations the product certification will be not mandatory.

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 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: 2019-12), DNV-CP-0418 (Edition: 2020-07).

The Propagation test has been passed in accordance with DNV-RU-SHIP Pt.6 Ch.2 Sec.1 design option 1 no propagation between cells.

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 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