



Certificate No:
TAE00004R8

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Li-Ion Battery System

with type designation(s)
KREISEL BATTERY PACK KBP63-A

Issued to
Kreisel Electric GmbH & Co KG
Rainbach im Mühlkreis, Oberösterreich, Austria

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 **2023-06-29**

This Certificate is valid until **2028-06-28**.

DNV local unit: **Augsburg**

for **DNV**

Approval Engineer: **Andreas Andrecht**

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

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Product description

The KREISEL Battery Pack KBP63-A is a liquid-tempered energy storage system for variable use. The KBP63-A can be used individually or in a network of several packs connected in parallel or in series as multipack. In a multipack, up to 8 KBP63 are connected in parallel.

Each battery pack has a controller unit where the BMS control layer resides. The BMS control layer performs the safety and control functions for the battery pack within multipack operation a leader has to be defined. The overcharge protection independent from BMS is performed on cell level with the CID (Current interruption device) as a passive safety feature.

Technical data Battery Pack KBP63-A

Cell technology	Li-Ion
Number of cells in series	99
Number of cells in parallel	36
Nominal voltage	364.3 V
Upper shut-off limit U _{Upper_limit}	411.8 V
Lower shut-off limit U _{Lower_limit}	277.2 V
End-of-charge voltage CCCV 8.3 A	409.0 V
Max. operating voltage U _{max} (90% DOD)	407.0 V
Min. operating voltage U _{min}	297.0 V
Nominal capacity	173.2 Ah
Energy content nominal	63.1 kWh
Max. continuous discharge current	330.0 A
Max. discharge current 10 seconds peak	690.0 A
Max. continuous charge current	121.0 A
Max. charge current 10 seconds peak	335.0 A
External dimensions of housing (l x w x h)	1111 x 795 x 351 mm
Net weight (without dielectric fluid)	~393 kg
HV battery fuse	PEC EVFP-d38sq- 600A
Degree of protection	IP67, IP6K9K

Technical data Cell

Cell type	21700 NCMA
Modell	INR21700-M50L
Nominal voltage	3.68 V
Upper shut-off limit	4.2 V
Lower shut-off limit	2.5 V
Max. operating voltage	4.13 V
Min. operating voltage	3.0 V
Capacity (nominal)	4.81 Ah
Weight	67.1 g

Thermal management

Each Li-ion cell is immersed by dielectric fluid to achieve optimal tempering and performance of the whole lifetime.

Dielectric fluid: Shell Thermal Fluid, E5 TM 410

Max. fluid pressure at the inlet of the HV battery: 1.0 bar above ambient pressure

Recommended max. temperature spread between modules of the HV battery ~ 5.0 K

Fluid volume within the HV battery ~ 18.5 l

Technical data of all multipack variants

Data	1s1p	1s2p	1s3p	1s4p	1s5p	1s6p	1s7p	1s8p
Nominal capacity [Ah]	173.2	346.4	519.6	692.8	866	1039.2	1212.4	1385.6
Nominal energy content[kWh]	63.1	126.2	189.3	252.4	315.5	378.6	441.7	504.8
Energy content @90% DOD*[kWh]	58.8	117.6	176.4	235.2	294	352.8	411.6	470.4
End-of-charge voltage [V]	409	409	409	409	409	409	409	409
Max. operating voltage @90% DOD [V]	407	407	407	407	407	407	407	407
Nominal voltage [V]	364.3	364.3	364.3	364.3	364.3	364.3	364.3	364.3
Min. operating voltage [V]	297	297	297	297	297	297	297	297
Upper shut-off voltage [V]	411.8	411.8	411.8	411.8	411.8	411.8	411.8	411.8
Lower shut-off voltage [V]	277.2	277.2	277.2	277.2	277.2	277.2	277.2	277.2
Max. continuous discharge current [A]	330	660	990	1320	1650	1980	2310	2640
Max. peak discharge current (10 s) [A]	690	1380	2070	2760	3450	4140	4830	5520
Max. continuous charge current [A]	121	242	363	484	605	726	847	968
Max. peak charge current (10 s) [A]	335	670	1005	1340	1675	2010	2345	2680
Max. precharge capacity [μF]	3000	3000	3000	3000	3000	3000	3000	3000

Identification Hardware version

00259028D00 Battery 99S36P - M50L - 24V

00259747D00 Battery 99S36P - M50L - 12V

Identification Software version

Current version: 90214202

Identification dbc file version

Current version: KE20-038_PTCAN_211403.dbc

Location Classes

Temperature Class	A
Humidity Class	B
Vibration Class	A
EMC Class	A
Enclosure Class	IP67

Application/Limitation

Battery room ventilation

The battery room ventilation shall comply with the requirements as given for design option 1 without integrated ventilation duct.

Additional Fuse

The minus pole must be external protected against short-circuits by fuse type PEC EVFP-d38sq-600A.

Series Operation

The series operation as multipack variant is not covered by the certificate and not permitted on DNV vessels.

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

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 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 2022-07), 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 to 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