



Certificate No. 03-002199/031908

TYPE APPROVAL CERTIFICATE

This is to certify that this product complies with the Rules for the classification of ships, Part 1 - General requirements, Chapter 3 - Type approval of products.

TYPE AND DESCRIPTION OF PRODUCT:

Lithium-ion battery system
AKASYSTEM 9 AKM 150 CYC

MANUFACTURER:

BorgWarner Akasol GmbH
Kleyerstraße 20
64295 Darmstadt
GERMANY

THE PRODUCT MEETS FOLLOWING RULES/REGULATIONS:

CRS RULES FOR THE CLASSIFICATION OF SHIPS

FURTHER DETAILS OF THE PRODUCT AND CONDITIONS FOR CERTIFICATION ARE GIVEN OVERLEAF.

APPROVAL IS VALID UNTIL: 2030-02-15

Place and date: Split, 2026-02-16 Seal _____

Marinko Popović, dipl.ing.

NOTE: This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify Croatian Register of Shipping of any modification or changes to the product in order to obtain a valid certificate.

DETAILED PRODUCT DESCRIPTION:

The AKASYSTEM 9 AKM 150 CYC battery contain lithium-ion cells, made typically of lithium-ion nickel-manganese-cobalt oxide cell chemistry (Li-Ion NMC). The cell temperatures and voltages are measured by a monitoring unit, called cell supervising circuit (CSC). The 9 AKM 150 CYC battery pack is a serial connection of nine modules. All modules are located inside the battery tray, as well as the removable contactor box containing electrical components such as controller, contactors, sensors and fuse. The tray has an inlet and an outlet connector for coolant fluid. The whole pack has one HV and one LV connector and is operated by a controlling device, called BMU.

Specifications of Cell (Li-Ion NMC)

Nominal Voltage		3,69 V
Max. Voltage		4,2 V
Min. Voltage		2,5 V
Rated Energy @ 0,2 C		18,2 Wh
Operating Temperature	Min.	-20 °C
	Max.	55 °C

AKASYSTEM 9 AKM 150 CYC Specifications

Number of serial modules per tray		9
Number of serial cells per module		20
Number of parallel cells per module		30
Nominal Voltage		665 V
Max. Voltage		759,6 V
Min. Voltage		468 V
Nominal Capacity		148 Ah
Peak Discharge Current (10s)		150 A
Peak Charge Current (10s)		150 A
Energy		98 kWh
Operating temperature range	Min.	-20 °C
	Max.	55 °C

AKASYSTEM 9 AKM 150 CYC Mechanical Data

Coolant	Liquid
Liquid coolant pressure (max.)	2 bar
Typical coolant pressure drop (Water/glycol = 50/50)	230 mbar @600l/h, nom. 25 °C
Approved Water/glycol range	70/30 to 50/50
Operating cell temperature range	-20° to 55 °C
Recommended operating cell temperature range	22°C to 28 °C
Protection class	IP67, IP6K9K
Weight (incl. RCB and brackets)	~ 598 kg
Outer dimensions (L x W x H in mm) incl. mounting brackets	1,890 x 726 x 310

The battery cell has a built-in feature (Current Interrupt Device - CID) that will, in case of overcurrent, overcharge or when the temperature exceeds the safety limits, electrically disconnect the cell. This provides a second shut down path independent from the electronic control system.

Software version

S YY WW 05.VV,XXX UU-00162

S --> Fix

YY --> Year

WW --> Week

05 --> Major version (fix)

VV --> Minor version

XXX --> Build no.

UU --> Build user

00162 --> Software variant (fix)

APPLICATION / LIMITATIONS:

CRS Rules for the classification of ships.

Product certification is required. Inspection and testing shall be witnessed by a CRS surveyor.

Documentation for each specific application shall be submitted to CRS for approval.

The water ingress detection system shall be present and installed for the product certification. The certificate holder is responsible for the correct installation and function of the water ingress detection system.

The automatic reconnection of the battery system performed by the failure reset has to be inhibited by system integrator and verified on system level.

TYPE APPROVAL DOCUMENTATION:

Documentation:

- 3030316TEN0032 V1.2 System Description
- 3030316TEN0036_Systemarchitecture_Electricalschematic
- 3030316TEN0002 Safety Instruction
- 3030316TEN0008 Safety Description
- 3030316TEN0001 User Manual
- 3030316TEN0026 Technical Data Sheet
- 3030316TEN0028 Leakage Detection
- 1M001930_02 AKASYSTEM 9 AKM 150 CYC
- 3M720061_01 HYDRAULICS 9MTRAY ARAYMOND
- 3-030316_TechnicalAppraisal_Pressure Test
- 1E050167 TC275 Schematic
- 1E020200 AkaSysMB V1.2 Schematic
- 1E010205 AkaSysCB NGalv V1.1 Schematic
- 1E030154 Base Schematic
- 3030316TEN0003 Overload and Short Circuit Protection Concept
- 3030316TEN0027 Public CAN Matrix
- 3030316TEN0004 Parametersheet
- SP-04_01 Software Change Management V2
- SP-04-FL01 Software Change Management Flow Chart
- 3030316TEN0020_Function_and_Safety_Test procedure
- 3030316TEN0034_Gas_Compositon

Test Reports:

- QDI-190729-C-INR21700M50L [UN] Test Report
- Propagation Test Report No.: R256007
- Test report No. 11-08163 Vibration test
- Test report No. 11-008164-1 Vibration test
- Test report No. 1-4150_22-02-02-A Dump Heat Cold
- Test report No. 2647_PBN_23032801E Salt Mist
- Test report No. T3KZ0002 EMC
- Test report No. 1-5384_22-01-02-A
- Test report No. 3030316TEN0019_System_IEC62620-Capacity-test
- Test report No. Report_SWE.6_AKA-SYSTEM_3-030316_2023_07_05-05_16_55_PM_DNV
- Test report: 3030316TEN0020_AKASYSTEM9AKM150CYC_Function_and_Safety_Test DNV sign

MARKING OF PRODUCT:

In accordance with IEC 62620 – Marking and identification (The Manufacturer and Type Designation of the product, serial number, date of manufacture, rated capacity, nominal voltage, ...).

CONDITIONS FOR CERTIFICATION:

All changes in software shall be recorded for the entire period the system is in use on board. Records of all changes shall be submitted to CRS for evaluation and approval. Major changes in components or software shall be approved by CRS prior to on-board implementation.