



TYPE APPROVAL CERTIFICATE
No. ELE046121XP

This is to certify that the product below is found to be in compliance with the applicable requirement of the RINA type approval system.

<i>Description</i>	Battery Systems
<i>Type</i>	Battery System 60Ah BATTERY MODULE M2 BATTERY MONITORING UNIT (BMU) BATTERY CONTROL UNIT (BCU)
<i>Applicant</i>	Leclanché SA Av.des Sports 42 1400 Yverdon-les-Bains SWITZERLAND
<i>Manufacturer</i>	Leclanché SA
<i>Place of manufacture</i>	Av.des Sports 42 1400 Yverdon-les-Bains SWITZERLAND
<i>Reference standards</i>	Rules for the Classification of Ships - Part C - Machinery, Systems and Fire Protection - Ch 2, App 2: Battery Powered Ships

Issued in **Gdansk** on **April 27, 2021**. *This Certificate is valid until* **December 21, 2025**

RINA Services S.p.A.

This certificate consists of this page and 1 enclosure



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Battery System 60Ah

General Description:

Leclanche SA battery system consists of battery modules that contain up to 33 lithium ion cells, made of lithium ion nickel-manganese-cobalt oxide cell chemistry (Li-Ion NMC). The battery system is monitored and controlled by the Battery Management System (BMS). It consists of the BMUs for measuring local voltage and temperature on the modules level and BCU for monitoring and control of the batteries status, including system charging, discharging and host communication.

Cell:

Type: 936A04;
Material: lithium ion nickel-magnese-cobalt oxide (Li-Ion G/NMC);
Capacity [Ah]: 60 (measured at C/10 discharge rate, RT);
Voltage [V]: 3,0 to 4,2V;
Weight [kg]: ~1;
Volume [l]: 0,475;
Temperature [°C]: 0 to +45 for charge and -20 to + 55 for discharge;
Exp. Lifetime (cycles): 4500 (1C charge/discharge, at 100% DoD &RT)
8000 (1C charge/discharge, at 80% DoD &RT)
Exp. calendar life [years]: 10.

Module:

Type: M2 Marine Battery Module;
Quantity of cells: up to 33.

Each module includes BMU that monitors up to 24 individual cell voltages and up to 4 cell group temperatures. The measurements are transmitted to the BCU via internal RS485 bus. All modules are also equipped with an Excessive Temperature Detection System. The system is composed by a fixed temperature heat sensing cable detecting temperature above a defined temperature (68°C). The modules are inserted into the IP65 protected battery boxes which are equipped with the water cooling plates in their bottoms and the exhaust channels removing hot air as well as gas and smoke from the boxes in the fire conditions.

Excessive Temperature Detection System:

This system is independent from the other controlled functions. The system consists of the heat sensing cable type Thermocable 68°C manufactured by FyreLine (with fixed temperature 68°C) and the programmable logic controller type 750-8101 manufactured by WAGO.

Battery Management System BMS G2:

The BMS G2 can be used for voltages up to 1000VDC. The BMS G2 consists of BMUs for cell parameters monitoring and BCU for monitoring and control of the batteries status. The BCU can be configured and integrated into the battery system via CAN or Serial communication interface.



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Battery System module configuration:

Battery		Nominal			Discharge		Charge
Module	Cells	Capacity [Ah]	Energy [kWh]	Voltage [V]	Continuous [A]	Pulse [A]	Continuous [A]
M2.GMNC(60)4s8p	33	480	7.0	14.8	680	1200	480
M2.GMNC(60)8s4p	33	240	7.0	29.6	680	1200	240
M2.GMNC(60)16s2p	33	120	7.0	59.2	360	600	120

Special Conditions for Safe Use:

The special conditions for safe use of the Leclanche SA Battery Systems are to be considered based on the Risk Assessment that is required to be carried out in the design phase. In general, the arrangements mentioned on the following page are to be considered separately for each application:

- Ventilation/Exhaust, Structural Fire Protection, Fire and Gas Detection and Alarm System:

The battery room, where the Leclanche SA battery system is located, is to be provided with the above mentioned systems in the quantity or efficiency coming from the Risk Assessment created in the design phase and on the basis of the shipboard conditions and information from the system Manufacturer.

The ventilation system of battery compartment is to be independent and separate of the ventilation of other spaces and provided with local manual stop, still available in case of failure of the automatic and/or remote control system. The indication of ventilation running and of battery space ambient temperature is to be presented in a normally attended location.

- Emergency Shutdown:

Battery system is to be disconnected in an emergency situation by implementing an emergency shutdown. The emergency shutdown is to be provided locally, from outside of the battery space, and from a normally attended location. It is to be arranged as a separate hardwired circuit and it is to be independent from the control system. When battery system is used as storage of power dedicated to the propulsion system or as part of the main source of electrical power, the emergency shutdown is to be located on the bridge.

- Fire Suppression System:

The Leclanche SA battery system is to be operated with the fire suppression foam system or water mist system. The fire suppression system has to be accepted by the Manufacturer and RINA approved (TAC or case-by-case approved). Automatic release of the fire suppression system is acceptable only for small, not accessible, battery spaces. When an automatic release of fire extinguishing media is accepted, its activation is to be confirmed by more than one sensor. For this purpose the excessive temperature detection line on the battery modules and the smoke detection at the duct channel is to be used.



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Battery System**

Reference Documents:

- Documentation:

MRS Battery Safety Assessment DOT-X-C-MAT-GEN-008 version 5

Maintenance Manual DOT-X-C-MAT-GEN-007 version 7

Leclanché MRS – Battery Room and Battery System Ventilation Specification DOT-X-C-MAT-GEN-009 version 4

GNMC_DATASHEET_GL60 Energy Cell 60Ah 936A04;

SW Quality Plan DOT-X-C-MAT-GEN-040 version 7.0

ELET-24212 - DOT-X-C-MAT-GEN-054-2 MRS breaker cable replacement instruction

Leclanché MRS Technical Specifications E120 - DOT-X-C-MAT-GEN-027 version 2

List of Controlled and Monitored Points - DOT-X-C-MAT-GEN-026 version 1

UN38.3 regulation: extension of 946A03 test report results to cell 946A04

Technical Note MRS Gasket 18Dec2020

TAC BV and DNVGL

- Test Reports:

IEC 62620 Endurance testing Test Report - DOT-X-C-MAT-GEN-038 version 1

HMEL-4210 - Cell tests

HMEL-4211 - Environmental Tests

HMEL-4212 - Battery System Tests

Test Report – MRS2.0+ Propagation Internal Thermal Event 60 Ah G/NMC cell Fire suppression system: Marioff
Hi-FOG -version 1, dated 22.12.2020

Test Report – MRS2.0+ Propagation Internal Thermal Event 60 Ah G/NMC cell Fire suppression system:

Fifi4Marine Foam - version 1, dated 18.12.2020

Drop test report, dated 4.02.2021

VDE Renewables, report No: 2020-40430-BESS-1; dated 2020-10-1- 2020-12-18

Remarks:

The documentation mentioned in Pt C, Ch 2, App 2 of Rules for the Classification of Ships is to be submitted for each particular application. Special attention is to be paid to the requested Risk Assessment.

This certificate annuls and replaces the previous one n°ELE017420XP

Gdansk April 27, 2021

