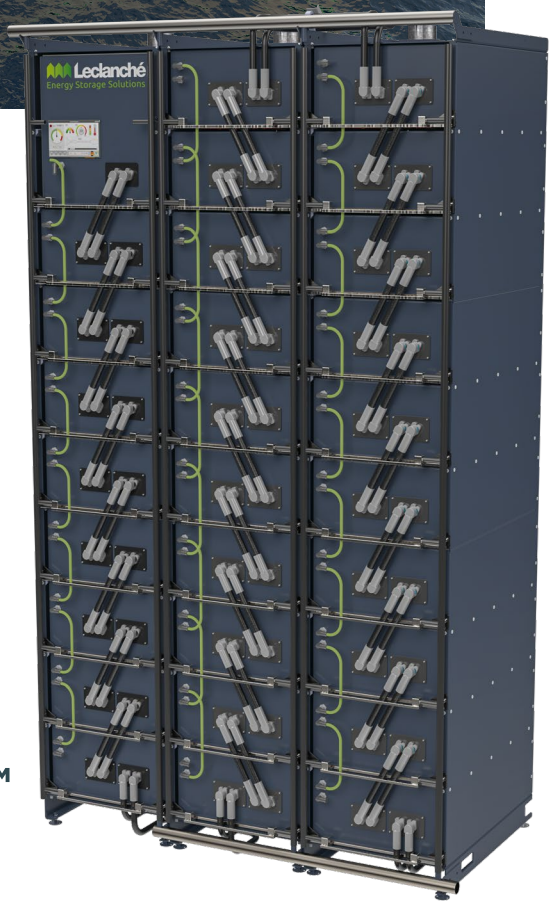
Leclanché
Energy Storage Solutions

E-MARINE SOLUTIONS

Navius MRS-3

Marine Battery System



High performance, European-made lithium-ion battery system for marine applications.

MRS-3™

E-MOBILITY

European Made

Cells, Modules, BMS and Racks made in EU

Class Leading Cycle Life

7,000 cycles* at 80% DoD

Superior Safety

Active Safety System

Multiple Configurations

Fully scalable and available in 7 heights

*With 65Ah G/NMC cell. 8,000 cycles with 60Ah cell

LECLANCHÉ MADE IN EUROPE

Available 2023

The **Overview**

The Navius MRS-3, from Leclanché, is a new generation of marine battery system specifically designed for the supply of on-board energy storage in marine applications.

It comprises the latest generation Leclanché M3 Energy battery modules fitted with our proprietary high energy G/NMC cells, a Functionally Safe Battery Management system and is assembled into a scalable and modular rack system. This new design enables the Navius MRS-3 to be configured to fit efficiently into the available space on nearly any vessel.

It is an evolution of the successful and well proven Leclanché MRS-2 system which is powering vessels around the world.

The Navius MRS-3 battery system utilises liquid-cooling for more efficient thermal management, a longer system lifetime and high performance in a compact footprint.

At the heart of the new Navius MRS-3 battery system are unique Leclanché high cycle-life G/NMC cells which are designed and developed by our world class electrochemistry experts and produced at our automated facility in Germany.

Photo: Wasaline Aurora Botnia fitted with a Leclanché MRS-2 battery system.

PRELIMARY DATA:
Leclanché reserves the right to modify these specifications

Features and Specifications

- Battery string voltage up to 1200 VDC
- Up to 720 A string continuous discharge current
- Integrated Leclanché Functionally Safe BMS battery management system
- High energy Leclanché 65 Ah G/NMC cells
- Scalable string configuration for multi-MWh system sizes
- Optional multi-string controller (MSC) to support parallel battery strings
- Liquid-cooled for optimum system temperature control, cell cycle life & energy density
- Thermal propagation protection using an integrated active safety system
- European manufactured cells, modules and racks for enhanced supply chain reliability, reduced environmental footprint and best in class quality.

Operation Modes

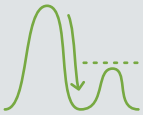
Integrating a Leclanché Marine Rack System offers an array of benefits for different vessel types such as hybrid or fully electric vessels.

Spinning Reserve

Switching off redundant generators allows the MRS to handle the emergency power load. It also enhances operational safety by preventing power outages.

Enhanced Dynamic Performance

The MRS smoothens the sudden changes in load demand on the generators.



Peak Shaving

Removing load peaks helps generators to operate at a steady and optimal power level.

Strategic Loading

Allows switching, as appropriate, from diesel to electrical power for propulsion, manoeuvring, cargo handling, hotel load provision at port, etc.

Zero Emission Operation

The Leclanché MRS powers fully-electric vessels with no emissions, no fuel consumption and quiet operation.

Cells

Leclanché holds over 100 patents in lithium-ion cell development and manufacture. At the core of the MRS-3 are G/NMC cells with an unmatched combination of energy density and cycle life. Our focus on high cycle life improves overall environmental footprint while providing significant cost of ownership benefits. The cells are manufactured by Leclanché at our advanced production facility in Germany.

PRELIMARY DATA:
Leclanché reserves the right to modify these specifications

Modules

The Leclanché M3 Energy modules have 13% more energy than those fitted to our previous generation, MRS-2, battery system. Each cell in the module is temperature monitored. The modules are assembled on a new state-of-the-art automated assembly line in Switzerland.

Battery Management System (BMS)

The Navius MRS-3 is equipped with a state-of-the-art Functionally Safe BMS that offers the ultimate in safety and reliability. Both the BMS master and module slave units are designed in line with Functional Safety standards.

These standards are mandatory in both the automotive and rail industries and set safety integrity level requirements for all major components and the complete system.

A secure, remote battery-data monitoring system is available, which enables continuous monitoring of the battery condition through a user-friendly, cloud based, IoT platform.

Certification

The Navius MRS-3 is being developed to meet or exceed the require-ments of all major marine classification societies.

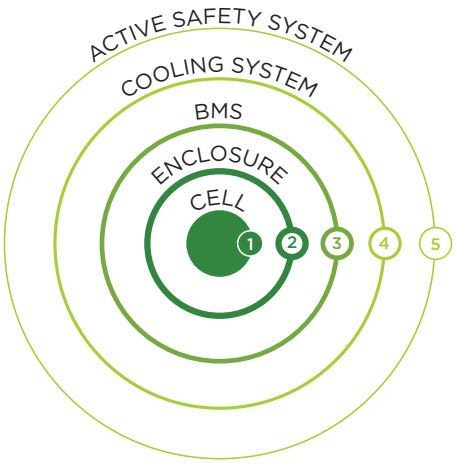
Warranty and Service

A comprehensive service offering is available to support our customers over the battery system's life. This includes reactive, preventive and predictive services as well as the option of spare parts packages.

Navius MRS-3 battery systems are provided with a 2-year warranty period. Performance warranty periods of up to 10 years are available, subject to the inclusion of a Leclanché support and maintenance contract.

Safety

The safety of marine battery systems is of paramount importance. At Leclanché, safety is engineered into our solutions at all levels from individual cells to the complete battery system.



1 Cells

Laminated ceramic separators provide protection against internal short circuits and the reduced electrolyte design minimises the potential volume of flammable materials.

2 Modules and Enclosure

The module is fitted with a functionally safe slave unit which measures cell voltages, cell temperatures and runs diagnostics such as open wire detection and self-checks. The IP-rated module enclosure provides protection against mechanical and electrical incidents. Water and contaminants are kept out while in the event of a thermal runaway; noxious gases or flames are kept in and routed out via a sealed exhaust system.

3 Battery Management System (BMS) & Control Unit

A Functionally Safe BMS comprising of master and slave units integrated inside every module ensures the highest levels of safety. Cell surface temperature detection on each cell enables superior reactiveness. Reliable operation is guaranteed in hostile EMC environments. A high voltage breakdown solution provides additional safety.

4 Liquid Cooling

The modules are liquid-cooled with dedicated cooling plates. All cooling plate, pipe connections are external to the module enclosure, preventing the risk of leaks within the module that could compromise isolation integrity.

5 Active Safety System

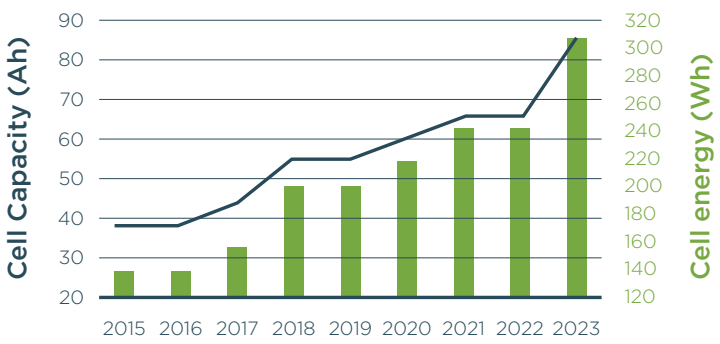
Each module enclosure contains an automated system that prevents thermal propagation.

Technology

At Leclanché, we pride ourselves on being in control of the entire marine battery system development process, from cell design and manufacturing to complete solutions which incorporate our own dedicated battery management systems.

Our experienced electrochemistry team strives to continually develop cutting-edge, high-performance G/NMC & high power LTO lithium-ion cells, which deliver class-leading cycle life. Our product roadmap delivers relentless cell performance improvements to provide the best cost of ownership options for our customers.

CELL CAPACITY ROADMAP



PRELIMARY DATA:
Leclanché reserves the right to modify these specifications

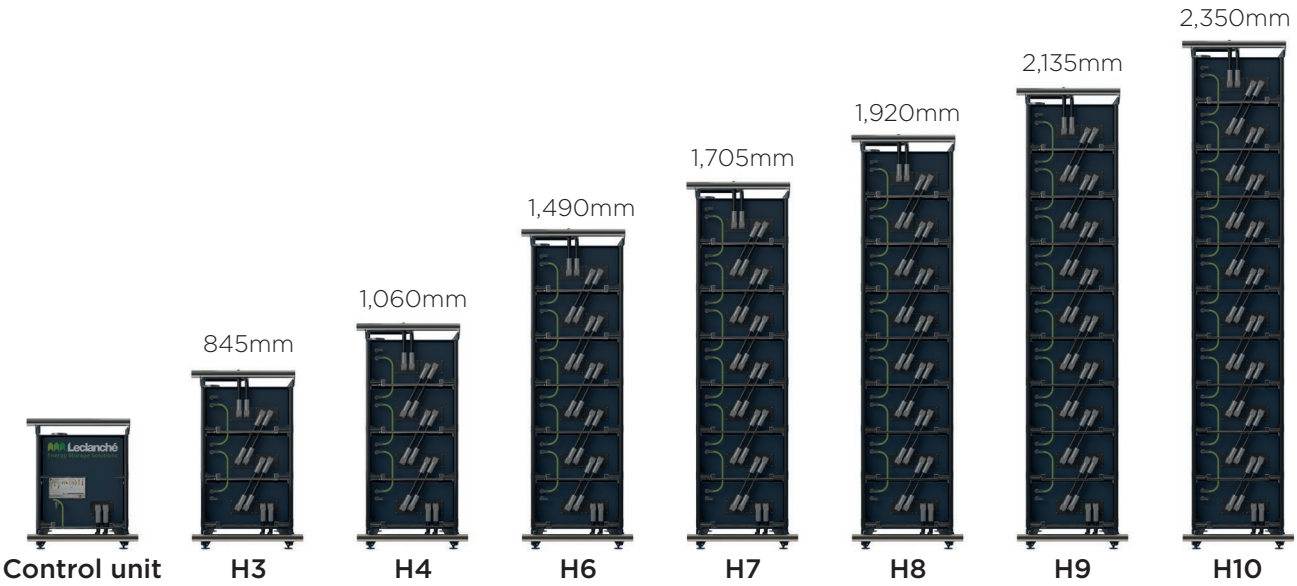
System Configurations

The Navius MRS-3 battery racks are available in 7 different heights, ranging from 845mm to 2,350mm (including the exhaust duct), which enables them to fit perfectly into nearly all battery room sizes, whatever the vessel type.

The lowest “H3” variant contains up to 3 modules and the tallest “H10” variant up to 10 modules.

A number of racks are combined into a string – each containing a dedicated Battery Management System. Strings are then combined to create a complete system providing the required energy of the vessel application. Strings with differing heights can be combined into a system if required.

The Navius MRS-3 employs a new architecture which enables it to offer a 50% improvement in battery room installed energy capacity compared to our previous generation MRS-2 system.



System Specifications

Rack Heights (Note: 125mm installation clearance is required)	H3: 845mm, H4: 1,060mm, H6: 1,490mm, H7: 1,705mm, H8: 1,920mm, H9: 2,135mm, H10: 2,350mm
Rack Width & Depth	W 435mm, D 710mm
Rack Weights including Energy Modules	H3: 251kg, H4: 327kg, H6: 478kg, H7: 554kg, H8: 630kg, H9: 707kg, H10: 738kg
Rack Weight including Energy Modules & Control Unit[2]	H3: 153kg, H4: 229kg, H6: 380kg, H7: 456kg, H8: 532kg, H9: 609kg, H10: 685kg
Single Module Energy / Nominal Voltage	8.7 kWh / 33.6V to 67.1V
Single String[3] Max. Voltage)	1200V
Max. Gravimetric Density – Rack / String[3]	111 / 108 Wh/kg
Max. Volumetric Density – Rack / String[3]	120 / 112 Wh/litre
Max. Energy Density footprint – Rack / String[3]	282 / 263 kWh/m²

PRELIMARY DATA:
Leclanché reserves the right to modify these specifications

Performance Specifications

C-Rate - Peak – (Discharge / Charge)	4.6C / 3.0C[1]
C-Rate - Continuous – (Discharge / Charge)	2.8C / 1.0C[1]
Cycle Life (80% DoD)	7,000 cycles (65Ah G/NMC cell)

Example System 1

System Configuration	4 strings[3] each comprising of 5 x H7 Racks (with 65Ah cell)
Energy	1,079 kWh
Voltage (Min / Nom / Max)	837 V / 1038 V / 1172 V
Dimensions & Weight (Depth x Width x Height / Mass)	708 x 8,600 x 1,762mm / 9,362 kg
Energy Density	115 Wh/kg / 105 Wh/litre

Example System 2

Rack Types	20 strings[3] each comprising of 3 x H10 Racks (with 65Ah cell)
Energy	4,875 kWh
Voltage	756 V / 937 V / 1058 V
Dimensions & Weight (Depth x Width x Height / Mass)	708 x 25,800 x 2,407mm / 41,946 kg
Energy Density	116 Wh/kg / 115 Wh/litre

Safety Specifications

Thermal Runaway Anti-Propagation	Active Safety System
Disconnect Circuit	String level with HV breakdown
Short Circuit Protection	Fuses at battery string level.
Emergency Stop Circuit	In line with class requirements
Ground Fault Detection	Integrated in each battery string
Disconnect Switchgear Rating	400A / 800A (continuous)

General Specifications

Communication Protocol	CAN or Modbus
Class Compliance (Planned)	DNV, BV, RINA, LR, ABS
Ingress Protection	IP44
Cooling	Liquid-Cooled

[1] Dependent on module configuration used.
[2] When a Control Unit (consisting of BMS and Switching) is fitted to a rack, it takes the space of 2 modules.
[3] A string comprises of a number of sets of battery racks. Strings are combined in parallel to create the complete battery system.

Leclanché Manufacturing Sites

An environmentally conscious manufacturing company:

- Cell manufacturing facility fully powered by renewable energy
- The only company that utilizes a patented, fully water-based, cell manufacturing process
- Automated cell production at our state-of-the-art facility in Germany

Production and engineering facilities fully accredited by the leading international quality standards organizations including ISO 9001, 14001 and 45001

Leclanché Cell & Module Assembly Lines

The **Marine Partners**

Scandlines

AWILCO DRILLING

KONGSBERG

YARA

WÄRTSILÄ

CGN

HySeasIII

DAMEN

Eferry
connecting blue and green

GRIMALDI LINES

wasaline

Leclanché E-Mobility SA
(Headquarters)
Avenue des Découvertes 14 C
1400 Yverdon-les-Bains
Switzerland

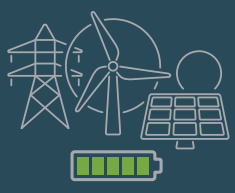
Leclanché GmbH
Industriestrasse 1
77731 Willstätt
Germany

Leclanché
North America, Inc.
2685 Enterprise Dr
Anderson, IN 46013
USA

Leclanché
Norway
Karenslyst alle 53
0279 Oslo
Norway

www.leclanche.com
info@leclanche.com

WE ARE ENABLING THE ENERGY TRANSITION


STATIONARY SOLUTIONS


E-MOBILITY


SPECIALTY BATTERY SYSTEMS

MRS EN-EUR B20228 0