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Технические характеристики на литий-ионные аккумуляторные системы, модули для морского транспорта Seanergy

Seanergy® modules

High energy and high power Li-ion Super-Iron Phosphate

Seanergy® modules are the ideal choice for local energy management, particularly in conjunction with hybrid propulsion, photovoltaic and other renewable energy generators.

Built with proven Li-ion Super-Iron Phosphate® ($LiFePO_4$) technology, the Seanergy® module provides maintenance-free energy storage in a reduced volume, combining high operational reliability over thousands of cycles with outstanding energy efficiency. Its modular design allows adaptation of the battery configuration to various energy and voltage levels.

always supplies Li-ion 3U module with an associated Battery Management System (BMS).

Applications

- Hybrid-electric and/or full electric propulsion
- Auxiliary systems, hotel load
- Emergency back-up
- Actuators

Benefits of the Li-ion technology

- Reduced mass and volume
- Very long calendar, storage and cycling life
- Faster charging time
- Maintenance-free
- Operates in any orientation
- No memory effect
- High power (continuous and pulses)

Operational benefits

- Enable full electric propulsion with a compact volume (entering and exiting harbours and restricted areas)
- Load-levelling function to keep high level of fuel efficiency and reduced number of generating sets
- Standby power at shore
- Design flexibility (improved scalability and modularity)

Nominal characteristics	Seanergy® 48P (Power)	Seanergy® 48M (Energy)
Nominal voltage (V)	46.2	46.2
Minimum capacity (C/5) (Ah)	56	78
Nominal capacity (C/5) (Ah)	60	82
Minimum energy (C/5) (Wh)	2500	3600
Nominal energy (C/5) (Wh)	2600	3800
Nominal energy density (Wh/l)	76	106
Nominal specific energy (Wh/kg)	69	96
Mechanical characteristics		
Standard	19" - 3U - Double depth	
Width (mm)	448	
Height (mm)	133	
Depth (mm)	602.5	
Weight (kg)	39.5	
Electrical characteristics at + 25°C / + 77°F		
Voltage window (V)	37.8 to 53.2	
Maximum discharge current (A)	240	240
Peak discharge current (10 s) (A)	300	300
Maximum charge current (A)	240	80
Peak charge current (10 s) (A)	300	300
Recharge time (h) at nominal current (95% State of Charge)	0.5	2
Operating and storage conditions		
Lifetime at + 20°C perm (+ 68°F)	>20	
Lifetime at + 30°C (+ 86°F)	>10	
Cycle life (+ 20°C / + 68°F)	from 6000 cycles to 1 million	
Operating temperature - discharge - charge	 - 25°C / + 55°C (- 13°F / + 131°F) 0°C / + 55°C (+ 32°F / + 131°F)	
Storage temperature	- 40°C / + 55°C (- 40°F / + 131°F)	
Storage time	1 year	

Features

- Compact modules integrating VLM Fe Li-ion cells, module supervision and cell balancing
- Advanced industrial design offering highest reliability and robustness
- 20 years design life with high daily energy throughput
- Multiple cycling patterns from daily deep discharge to dynamic multiple charge/discharge profiles from any state of charge
- Best energy efficiency of all available energy storage systems
- State of charge and state of health indication (through BMM)
- 2-level redundant safety

System capability

- Series connection of up to 1000 V
- Battery string management and interfacing through separate BMM module
- Multi-string paralleling through MBMM to upscale battery energy

Functional characteristics

Seanergy® module technology contains VLM Fe cells with advanced nickel-based lithium-ion Super-Iron Phosphate® technology:

- Best safety among Li-ion chemistries
- Outstanding calendar and cycle life and reliability
- Stable internal resistance over entire life
- High capacity cell

Mechanical & electrical interface

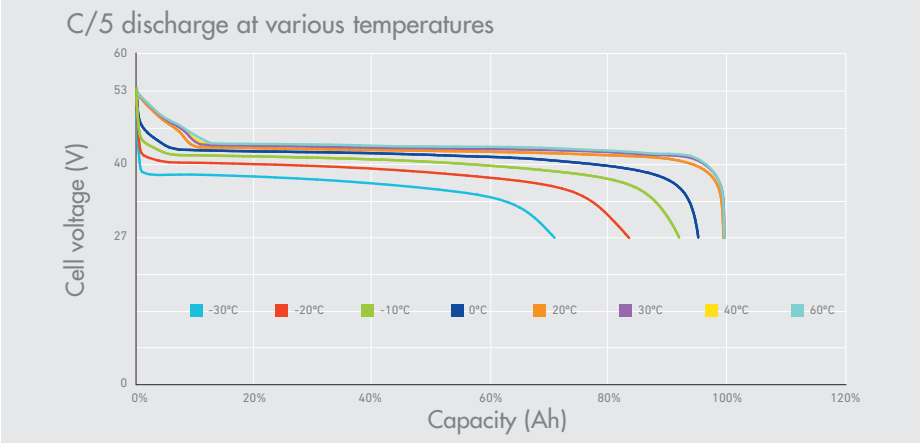
- Vertical or horizontal implementation
- Systems for 19" rack-mount in 3U height
- Stackable
- Optional 3U rack-mount brackets
- 2 screw terminals

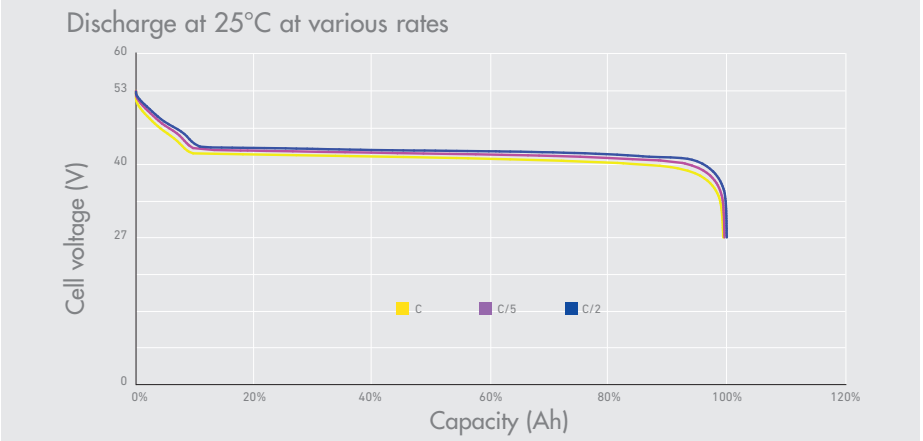
Safety

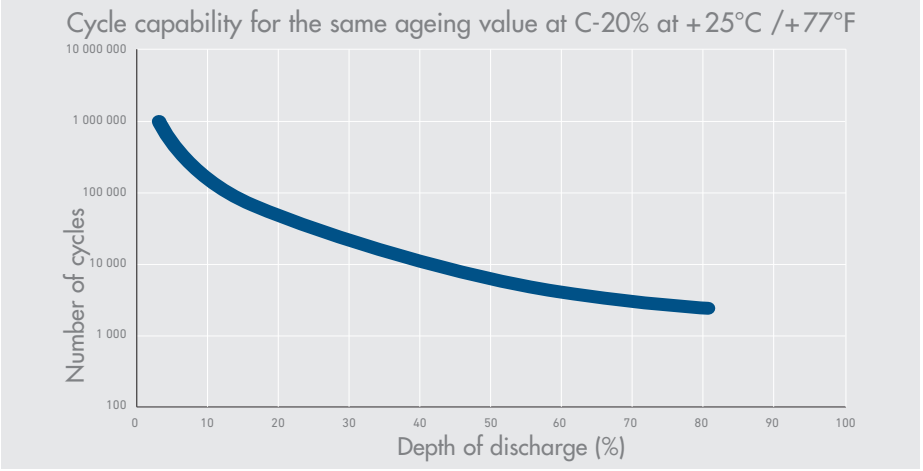
Redundant safety design to cope with component failure or abusive conditions:

- At cell level: no reaction in an abuse event with inert iron phosphate positive material, shutdown-effect separator, mechanical vent
- At module level: electronic board, individual cell voltage monitoring, module temperature monitoring, balancing, fuse
- At battery system level: electronic board, power switch, current sensor

Compliance to standards	
Module safety	EN 50178, cCSAus 60950, IEC 60950
United Nation Class	UN 3480
Hazard classification	Class 9
Transport regulation compliance	UN recommendations for dangerous goods transportation, model regulations and manual tests and criteria 38.3
EMC	EN 61000-4-2 Class B / EN 61000-4-3 Class A / EN 614000-4-4 Class B / EN 614000-4-6 Class A / EN 55022 Class B
Protection class	IP 20







Seanergy® battery system

High energy and high power Li-ion battery system

The Seanergy® battery system has been designed to suit the various power and energy requirements of a large variety of marine applications.

Its modular design allows to adapt the battery configuration:

- to any system voltage up to 1000 V,
- for floating or cycling applications,
- to any discharge pattern from high energy: energy requirements (hours or days of discharge) to very high power demands of seconds or minutes

Applications

- Passenger vessels (cruise liners, ferries, Ro-Pax, urban transports)
- Workboats (tugs, offshore vessels, administration ships, fishing vessels)
- Inland shippings (river-sea shuttles, pushers/tugs, freight)
- Leisure vessels (mega yachts, medium size yachts)

Seanergy® battery system

The Seanergy® battery system integrates power, safety, management and communication. It is a stand-alone rackable battery system, which offers the benefits of Li-ion Super Iron Phosphate® technology in a qualified industrial design.

The Seanergy® battery system provides maintenance-free energy storage in a reduced volume, combining safety and high operational reliability with outstanding lifetime under the most difficult environmental conditions.

Features

Unprecedented design flexibility through:

- Series connection of base modules to suit system voltages of up to 750 V maximum
- One unique control module per string, containing battery management and communication
- Parallel operation

Highest energy/power density

- Seanergy® modules use battery cells $LiFePO_4$ VL 41M Fe 265 Wh/liter, or VL 30P Fe 200 Wh/liter high power cell

Stand-alone system

- Integrating power, controls, communication and safety into a standard rack-assembly

Example of configuration:	1010 V Power	750 V Energy
Nominal characteristics		
Nominal voltage (V) (with 14 modules max)	880	647
Capacity (C/5) (Ah)	60	82
Minimum energy (C/5) (kWh)	49	50
Nominal energy (C/5) (kWh)	52	53
Mechanical characteristics (standard cabinet with 14 modules)		
Width max (mm)		600
Height max (mm)		From 24U to 47U
Depth (mm)		800
Weight (without cabinet) (kg)		560
Maximum weight (with cabinet) (kg)		750
Electrical characteristics		
Voltage window (V)	718 to 1010	529 to 745
Maximum charge voltage (V)	1010	750
Maximum discharge current (A)	240	180
Maximum charge current (A)		240 (Power) - 160 (Energy)
Std charging time (h) at nominal current (95% State of Charge)		0.5 (Power) - 2 (Energy)

Smart operation

- State of charge and state of health indication
- Built-in battery control for efficient operation
- Redundant safety
- Comprehensive communication
- Compatible with standard rectifiers

Benefits

- Optimized battery configuration whatever application requirements, due to modular architecture with standardized base elements
- No development cost and time due to configure customized battery solutions
- Reduced battery space and weight
- Easy installation and upscaling
- High operational reliability
- Optimized supervision strategy though remote control/diagnostic
- Very long lifetime
- Preventive but not premature replacement at end of life

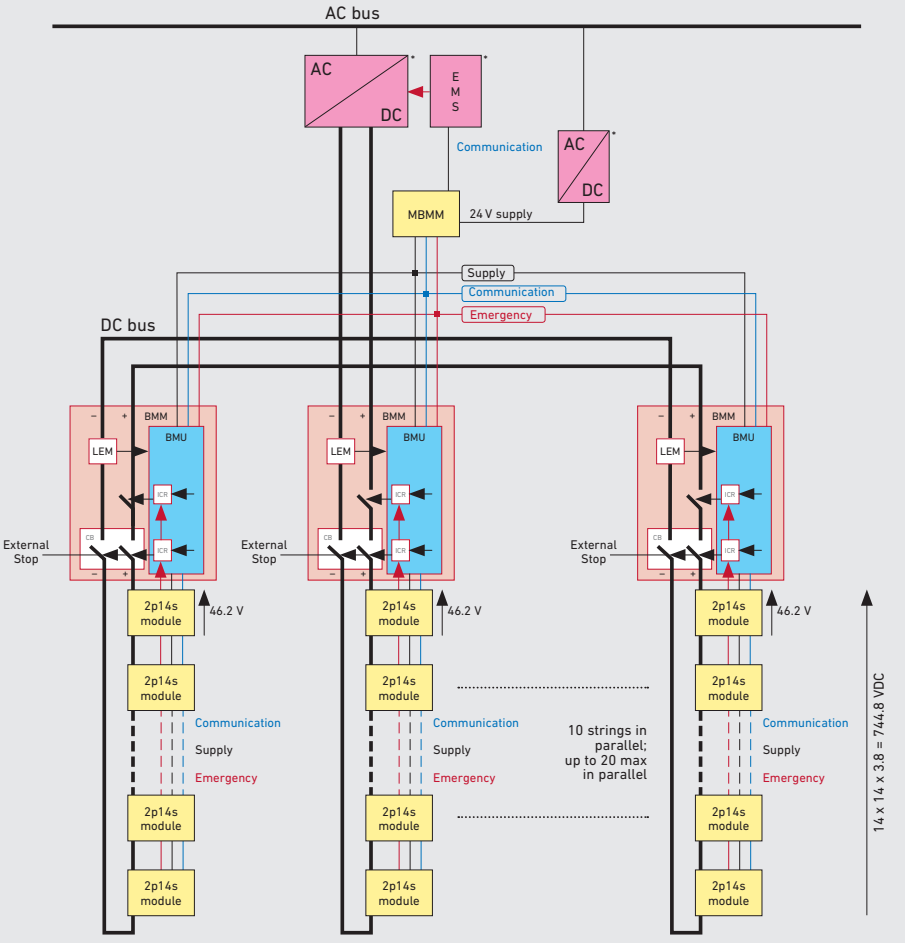
Safety

Redundant safety design to cope with component failure or abusive conditions:

- At cell level: no reaction in an abuse event with inert iron phosphate positive material, shutdown-effect separator, mechanical vent
- At module level: electronic board, individual cell voltage monitoring, module temperature monitoring, balancing, fuse
- At battery system level: electronic board, power switch, current sensor

Operating conditions	
Lifetime at +20°C perm (+68°F)	20 years
Lifetime at +40°C (+104°F)	>10 years
Cycle life (depending on delta DoD%; +20°C/+68°F)	from 3000 to 1 million cycles
Operating temperature	-25°C/+55°C (-13°F/+131°F)
Storage temperature	-40°C/+55°C (-40°F/+131°F)
Compliance to standards	
Module safety	EN 50178, cCSAus 60950, IEC 60950
United Nation Class	UN 3480
Hazard classification	Class 9
Transportation regulation compliance	UN recommendations for dangerous goods transportation, model regulations and manual tests and criteria 38.3
EMC	EN 61000-4-2 Class B / EN 61000-4-3 Class A / EN 614000-4-4 Class B / EN 614000-4-6 Class A / EN 55022 Class B
Protection class	IP 22

Example of a 500 kWh Battery System with a Master Battery Management Module (MBMM)



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