



## GreenBattery, GreenBMS and GreenRack

## Features

Mega-Guard GreenBattery forms the heart of an electric energy storage (EES) system for marine environment. Sailing and silent running becomes a reality with GreenBatteries. The Mega-Guard electric energy storage system consists of the following main components:

- GreenBattery
- GreenBMS
- GreenRack

Energy storage systems in between 40kWh and 20MWh can be built with Mega-Guard EES.

Two versions are available:

- GreenBattery with 10kWh storage, 96VDC nominal voltage and a maximum charge and discharge rate of 1C
- GreenBattery-3C with 12kWh storage, 96VDC nominal voltage and a maximum charge and discharge rate of 3C

The Mega-Guard electric energy storage system is designed to be be compatible with all other Mega-Guard products so that complete electric propulsion and automation packages can be supplied within the Mega-Guard product range.

## GreenBattery

GreenBattery makes use of the extremely safe LiFePO4 (or LFP) chemistry. Safety can be compared with traditional lead acid batteries and are much safer than Li-ion NMC technology. GreenBattery is one of the lightest batteries available for marine energy storage and occupying minimum floor space.

GreenBatteries are wired in series to form a battery string with a maximum DC Bus voltage of 960VDC (10x GreenBattery). GreenBatteries are normally placed in GreenRacks and these are placed inside an air-conditioned battery room. In between GreenBatteries ventilation space is provided for natural ventilation and cooling against the environment in the battery room. GreenBattery-3C is supplied with water cooling connections. GreenBattery fulfils the latest class requirements and includes an exhaust valve with a safety release for venting to outside environment.



Specification	GreenBattery	GreenBattery-3C
Installation	GreenRack	GreenRack
Stored Energy	10kWh	12kWh
Usable energy 5% to 95%	9kWh	10.8kWh
Usable energy 10% to 90%	8kWh	9.6kWh
Technology	Lithium LFP	Lithium LFP
Nominal voltage	96VDC	96VDC
BMS (slave) with cell balancing	$\checkmark$	$\checkmark$
Electric connections	+/- surlok connector 50mm² cable	+/- surlok connector 120mm <sup>2</sup> cable
	BIVIS connector in/out	BIVIS connector in/out
Max. charging/discharging with automatic derating in case battery temperature > 45°C	105A/105A (1C/1C)	375A/375A (3C/3C)
Charge/discharge cycles: Depth of discharge 90% Depth of discharge 80% Depth of discharge 50%	Current 0.5C/0.5C >2000 @22°C ambient >5000 @22°C ambient >9000 @22°C ambient	Current 1C/1C >2000 @22°C ambient >5000 @22°C ambient >9000 @22°C ambient
Ambient temperature	10 ~ 25°C	10 ~ 25°C
	(air conditioned space)	(air conditioned space)
Storage temperature 1 year	0~35°C	0 ~ 35°C
Heat generation	< 0.18kW	< 0.5kW
Cooling	Natural ventilation	Water cooling Water glycol mixture Flow: 41/min. Inlet temperature 5°C higher than environment temp.
Exhaust	$\checkmark$	$\checkmark$
Dimensions (WxHxD)	298x231,5x700,4mm	437x221x668,5mm
Weight	81kg	94kg
Protection	IP67	IP67
Aluminum housing	Black Anodized	Black Anodized
Thermal runaway propagation test 1	passed	passed
According class	LRS, DNV-GL, ABS, CCS	LRS, DNV-GL, ABS, CCS





## GreenBMS

Each battery string is wired to a GreenBMS and includes DC Bus fuses, DC Bus contactors with pre-charge and a DC Bus common mode filter. The GreenBMS also accurately measures and calculates the state of charge (SOC) and state of health (SOH) of the battery string. The BMS monitors and protects each individual GreenBattery and communicates to an external GreenEMS energy management system through ethernet communication lines.

Specification	GreenBMS	GreenBMS-3C	
Installation	GreenRack	GreenRack	
DC Bus fuses	125A	400A	
DC Bus contactors	150A	400A	
DC Bus pre-charge	40A	100A	
DC Bus common mode filtering	$\checkmark$	$\checkmark$	
Earth fault	$\checkmark$	$\checkmark$	
State of charge (SOC)	$\checkmark$	$\checkmark$	
State of health (SOH)	$\checkmark$	$\checkmark$	
GreenBatteries communication	$\checkmark$	$\checkmark$	
GreenEMS communication	$\checkmark$	$\checkmark$	
DC Bus cabling	2x M40 EMC cable	4x M40 EMC cable	
	gland up to 95mm²	gland up to 95mm²	
EM stop	$\checkmark$	$\checkmark$	
Power supply	24VDC (-25%~+30%)	24VDC (-25%~+30%)	
Power supply consumption	25W	35W	
Ambient temperature	10 ~ 25°C	10 ~ 25°C	
	(air conditioned space)	(air conditioned space)	
Dimensions (WxHxD)	372x94x535mm	421x112x535mm	
Protection	IP67	IP67	
Aluminum housing	Black Anodized	Black Anodized	
According class	LRS, DNV-GL, ABS, CCS	LRS. DNV-GL. ABS. CCS	



GreenBatteries and GreenBMS are placed in a GreenRack. The rack makes it possible to exchange a GreenBattery or a GreenBMS by sliding out and in. Racks are supplied in 6 different heights; from 4 to 9 GreenBatteries and 2 different sizes: one for a standard GreenBattery and one for a GreenBattery-3C. At the bottom of a GreenRack either a GreenBMS or a blind plate is placed. GreenRacks need to be accessible from the front only and can be placed against a bulkhead or sidewall.

Number of GreenBattery	GreenRack Energy capacity	GreenRack size W x H x D	Rack Weight	Number of GreenBattery-30
4	40kWh	366x1231x720mm	440kg	4
5	50kWh	366x1485x720mm	535kg	5
6	60kWh	366x1738x720mm	630kg	6
7	70kWh	366x1992x720mm	725kg	7
8	80kWh	366x2245x720mm	820kg	8
				9



GreenRack exhaust and connections



GreenRack with 4 to 8 GreenBatteries and including a GreenBMS or blind plate at bottom side

Number of GreenBattery-3C	GreenRack-3C Energy capacity	GreenRack-3C size W x H x D	Rack Weight
4	48kWh	505x1157x690mm	490kg
5	60kWh	505x1382x690mm	600kg
6	72kWh	505x1606x690mm	710kg
7	84kWh	505x1831x690mm	820kg
8	96kWh	505x2055x690mm	930kg
9	108kWh	505x2280x690mm	1040kg



Vessel Management System



Ship Performance Monitor



Propulsion Control System



Wiper Control System



GreenInverter







Fleet Management System



Dynamic Positioning System



Energy Management System









GreenBattery

Fire Alarm System



Integrated Navigation System



BNWAS Watch Alarm System



GreenAzithruster



CCTV Video Distribution



Heading Control System



Navigation Light Control



GreenGenerator



GreenMotor



Ship automation, navigation and electric propulsion

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