



SEAPOWERTM

LONG ENDURANCE SUBSEA BATTERIES



How to Extend Mission Time
Through the Use of Next Generation
Pressure-Neutral Batteries



// When it comes to subsea missions, offshore personnel around the world must answer **three important questions:**

1 How can I extend mission time?

2 How can I minimize turnaround time?

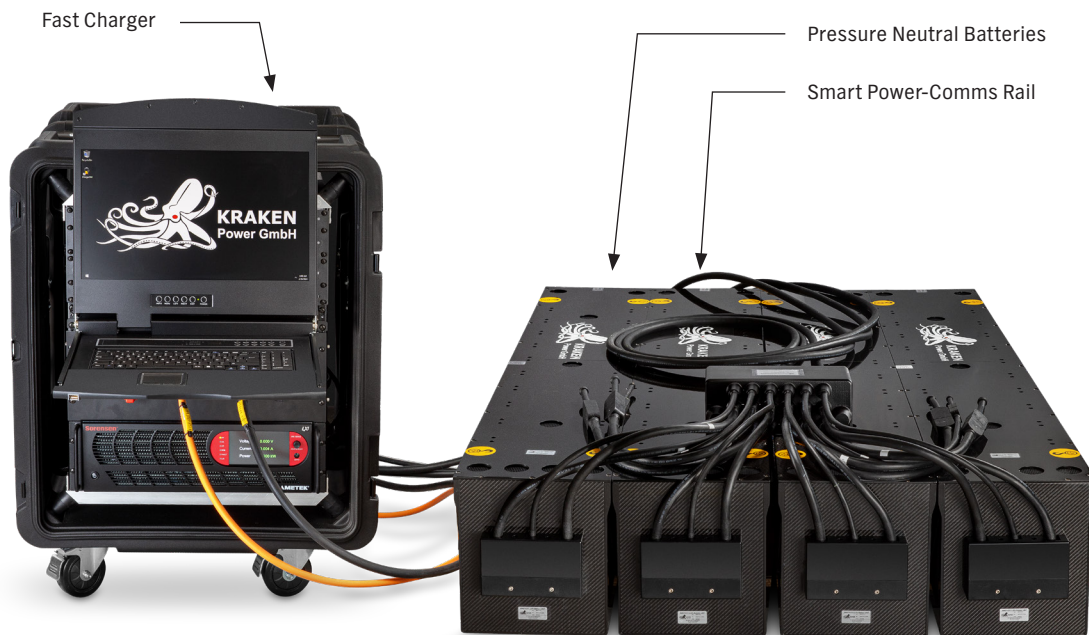
3 How can I reduce the risk of environmental impact?



Maritime and Naval operations seeking to deploy subsea vehicles require efficient mission execution.

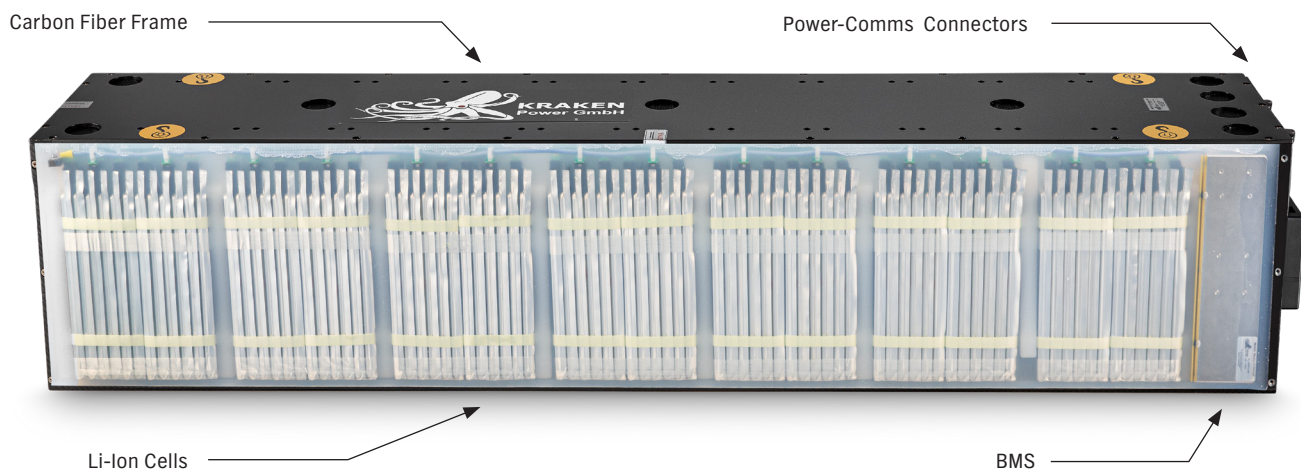
Subsea operations can be costly and high-risk. Frequent launch and recovery operations, along with extended recharge times, can extend Unmanned Underwater Vehicle (UUV) operations by several weeks. With this in mind, Kraken Robotics has developed the Seapower system, integrating advanced pressure-neutral batteries, fast chargers, and intelligent cabling, significantly improving mission efficiency and reliability.

This technology replaces traditional pressure-housed batteries, increasing energy density and reducing both the weight per kilowatt-hour and charging time, while also eliminating the need for oil or oil compensators.



// PRESSURE NEUTRAL BATTERIES

Energy and Reliability that Increases Mission Efficiency



6.000 meters rated, UN38.3 compliant



Kraken's SeaPower batteries are rated for 6000 meters and utilize a pressure-neutral design, encasing the battery cells and electronics in silicone polymer. This protects them from water and allows for pressure equalization without the need for housings, oils, or compensators. The design, featuring high-capacity lithium-ion pouch cells, delivers an impressive energy density of up to 260 Wh/l and 145 Wh/kg, with a consistent density of 2 kg/l.

Each battery module consists of cells connected in series and parallel, allowing for the customization of voltage, capacity, and dimensions. Kraken offers three standard battery sizes: small, medium, and large. These batteries are available in a range of voltages from 45V to 355V and offer capacities of up to 23 kWh per module.

Additionally, Kraken can design and manufacture battery modules to specific requirements, and these modules can be linked in series or parallel to create larger banks.

Kraken's SeaPower innovative pressure-neutral battery design delivers up to 2x the energy density at 46% less weight in water per kWh when compared to traditional oil compensated, pressure-housed batteries.

Each battery is equipped with two power connectors and one RS485 connector for communications. The batteries feature an integrated Battery Management System (BMS) with solid-state relays, utilizing copper bars to distribute power, thus reducing the need for cables and connectors. The batteries have a robust, redundant CAN Bus communication system to each cell's, offering:

- Cell balancing and monitoring of temperature and voltage.
- Tracking of health status for energy optimization.
- Management of charging and discharging processes.
- Battery under- and over-voltage protection.



Seapower Batteries

Depth Rating	6000 m
Encapsulation	Pressure Neutral Silicone-Polymer
Certification	UN 38.3 compliant
Chemistry	Li-ion NMC
Operating Temp. (Charging)	10° to 45°
Operating Temp. (Discharging)	-10° to 55°
Discharge Cycles @ 0 Bar	>2.000 cycles @ 80% retention
Shelf Life	>5 years @ 80% retention
Connectors	SubConn Low Profile series
BMS	Integrated
Communication	RS485
Dimension Small (LxWxH)	428 x 249 x 266 mm
Dimension Medium (LxWxH)	954 x 249 x 266 mm
Dimensions Large (LxWxH)	1425 x 249 x 266 mm

*Custom battery options are available. All parameters are subject to manufacturing tolerances, and performance depends on adherence to product guidelines.

Capacity

Voltage	Current	Small	Medium	Large
45 V	28 A	5.0 kWh	12.6 kWh	22.8 kWh
48 V	28 A	5.5 kWh	13.7 kWh	21.9 kWh
118 V	15 A	NA	13.5 kWh	20.2 kWh
311 V	15 A	NA	NA	17.7 kWh
355 V	15 A	NA	NA	20.3 kWh

Weight (Air / Water)

Voltage	Current	Small	Medium	Large
45 V	28 A	42 / 23 kg	95 / 52 kg	158 / 72 kg
48 V	28 A	45 / 25 kg	103 / 56 kg	160 / 87 kg
118 V	15 A	NA	105 / 57 kg	148 / 81 kg
311 V	15 A	NA	NA	153 / 63 kg
355 V	15 A	NA	NA	153 / 63 kg



Although the secret behind SeaPower's high-energy density and reliability lies in exclusive, tightly integrated pressure-neutral and electronic design technology, the exceptional production quality of these batteries is just as crucial. Crafted with German precision, Kraken batteries undergo ISO 9001 certified quality control processes, ensuring that each unit meets the highest standards of production excellence.

To guarantee enhanced operational range and dependability, each battery unit undergoes rigorous pressure testing. This includes subjecting the unit to over 600 bar. Such extensive testing ensures that the batteries are not only reliable but also durable under the extreme pressures of deep-sea environments.

Furthermore, SeaPower battery modules are compliant with UN38.3 standards, which certifies the safety of batteries for transportation by air, sea, and land. Each battery is carefully packed in certified containers prior to shipment.

Kraken also offers additional certifications tailored to client-specific needs, ensuring that the battery solutions meet various operational and safety requirements across different industries.





// Fast Charger

Speed and Control to Minimize Downtime

SeaPower offers a custom Fast Charger solution to enhance safety and minimize downtime. SeaPower batteries have integrated cell heaters that condition the cells and speed up the charging process. When used with the 15 kW fast charger, it can fully recharge a 23 kWh battery in 4 hours. Additionally, the charger can manage the charging process and balance the load for up to 9 batteries simultaneously, addressing each battery's power needs and health. Designed for offshore operations, the charger is housed in a durable, portable enclosure with a retractable keyboard and monitor. The SeaPower charger control software enables charge profile customization and intelligent battery monitoring via a user-friendly interface. The SeaPower Fast Charger is specially designed to meet the rigorous demands of offshore operational needs.

- Over-current protection to safeguards against excessive current that could damage the battery.
- Built in power resistors enables controlled discharge of the battery.
- Intuitive graphical user interface to adjust charging parameters.
- Data logging and data visualization for historical analysis and comparison.



Charger

Charging Power	15 kW
Output Voltage	0 to 400 VDC
Max Output Current	38 A
Max Humidity	95% @ 25°C
Simultaneous Charging	Up to 9 Batteries
Weight	125 Kg
Dimensions (D x H x W)	920 x 889 x 687 mm
Mounting	Mobile rack-based housing
Operation Temp.	0 to 40°C
Storage	-25° to 65°C
Input Frequency	47 - 63 Hz
Input Voltage (3 phase)	187 to 253 VAC
	342 to 440 VAC
	396 to 528 VAC



To ensure safe and controlled charging, the Seapower Fast Charger continuously monitors the health status of all connected batteries. With its built-in control function, it helps mitigate risks and human errors during the charging process.

The Intelligent Solution for Power Banks

Each customer's needs are unique when integrating multiple batteries within their Unmanned Underwater Vehicles (UUVs). Whether for small-scale vehicles equipped with a couple of batteries or expansive XL-AUV systems that use up to 64 batteries, the crucial point remains: how these multiple batteries are interconnected. Kraken's Power-Comm Rails come into play here, providing a streamlined solution for combining up to 64 batteries into a single power bank with a capacity of up to 1 MWh.

The primary function of the Power-Comm Rail is to consolidate the energy from all the batteries into one unified output while managing the communication routes for each battery. These rails are designed to be modular, allowing them to be chained together for scalability. This modularity also facilitates the ability to easily turn on or off the entire bank or select subsystems, providing exceptional control over power management.

Kraken also offers an Intelligent PCR variant, in which each power rail includes the capability to intelligently switch individual batteries on or off. The Intelligent Power-Comm Rail enhances power conservation by allowing either a Standby Mode (<6W power consumption), or an Off Mode (zero power consumption). This feature is particularly advantageous for long-term deployment management, ensuring energy is not wasted and operational longevity is maximized."

The image depicts a 6:1 power-comms rail for the connection of six batteries.



Increase Mission Efficiency with Next-
Generation Battery and Chargers

SEAPOW[™]