

# Soft batteries for marine

For clean, cost-effective and safe civil operations



[norwatt@norwatt.es](mailto:norwatt@norwatt.es)

[www.norwatt.es](http://www.norwatt.es)



**SAFT**

# Saft batteries, for clean propulsion



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www.norwatt.es

The civil marine industry needs to adapt fast to meet ever tighter environmental regulations. Designers are playing a vital part in this evolution by integrating new concepts in ship architecture with cutting-edge battery technologies to reduce emissions and increase efficiency and profitability.

Saft is working proactively with navies, shipyards and OEMs in industrial programs worldwide to implement advanced technology for the design and manufacture of battery systems. By supplying fully integrated, turnkey systems backed with extensive technical support to OEMs and end-users, Saft is transcending the limitations of conventional technologies to create powerful new possibilities. Saft is already working with key partners in this growing and demanding market to provide lithium-ion (Li-ion) battery solutions for a variety of clean transportation modes.

Saft's range of rugged battery solutions are deployed in full-electric and hybrid electric transportation applications worldwide, as well as in other Industrial applications. Building on over 10 years of proven expertise in the delivery of large industrial Li-ion battery systems, Saft is your ideal partner today to help meet the civil marine goals of tomorrow.

**Saft's heritage: Saft is a recognised battery partner in many demanding applications such as Energy Storage Systems (ESS) for smart grids, space, rail, aviation and manned and unmanned submersible vehicles.**

## Surpassing expectations to meet stringent operational targets

| ▶ Social  | ▶ Economic   | ▶ Environment  |
|---|--|--|
| <ul style="list-style-type: none"> <li>• Safety</li> <li>• Increased comfort (reduced noise and vibration)</li> </ul> | <ul style="list-style-type: none"> <li>• Fuel efficiency</li> <li>• Reduced operating costs</li> <li>• Vessel productivity</li> <li>• Optimized Total Cost of Ownership (TCO)</li> </ul> | <ul style="list-style-type: none"> <li>➤ CO<sub>2</sub></li> <li>➤ NO<sub>x</sub></li> <li>➤ SO<sub>x</sub></li> </ul> |



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Powering all your marine applications, whatever your need

Saft has a wide range of battery systems to meet the needs of many different players in the marine industry from large ocean cruise-liners to private yachts.

ACTUATORS      POWER SUPPLY FOR THRUSTERS  
 LIGHTING      DYNAMIC POSITIONING  
 AUXILIARY SYSTEMS      EMERGENCY BACK-UP PROPULSION  
 LOAD LEVELING

| Work boat   | Ferry   | Offshore  | Cruise-liner  | Cargo vessel  |
|---|---|---|---|---|
| <br><b>Tug</b>     | <br><b>RoPax</b>       | <br><b>OPV</b> | <br><b>River cruiser</b> | <br><b>Arctic cargo</b>  |
| <br><b>Dredger</b> | <br><b>Urban ferry</b> | <br><b>OSV</b> | <br><b>Mega yacht</b>    | <br><b>Wind assisted</b> |

# Li-ion Super-Iron Phosphate<sup>®</sup> technology: a safe choice



Advanced lithium-ion (Li-ion) battery technology offers interesting new possibilities for the creation of highly efficient and cost-effective marine propulsion and auxiliary systems.

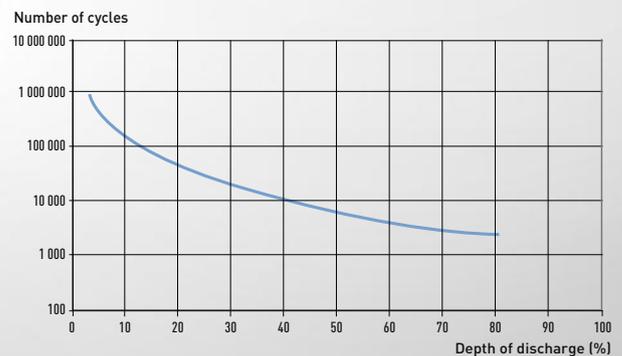
Li-ion technology is of particular interest for hybrid propulsion systems, where the batteries work in conjunction with diesel, or possibly gas turbine, generators and electric motors. Its specific advantages will vary according to the type of application. For workboats such as harbor tugs, which spend most of their time at sea

moving into position and only operate at full power for very short periods, hybrid power will significantly improve fuel efficiency and reduce CO<sub>2</sub> emissions. Rather than sizing a diesel engine for peak power, it can be specified at a more economical size for average power, with the extra power drawn from the batteries when required.

## What are the key advantages of Saft Li-ion Super-Iron Phosphate<sup>®</sup> (SLFP) technology?

- Increased safety
- Compact & weight saving package
- High efficiency
- Long calendar and cycling life
- Fast charging
- Maintenance-free
- High power (continuous and pulses) and high voltages (up to 1000 V)
- Full electric propulsion within a compact footprint

Cycle life at +25 °C / +77 °F



For the same ageing effect, Saft Li-ion Super-Iron Phosphate<sup>®</sup> (SLFP) offers more than 2000 cycles at 80% DOD (depth of discharge) or more than 10 000 cycles at 40% DOD.

# Seanergy<sup>®</sup>: a fully integrated marine solution



Saft Seanergy<sup>®</sup> modules & battery systems, based on proven Saft Li-ion Super-Iron Phosphate<sup>®</sup> (SLFP) technology, provide maintenance-free energy storage in a reduced volume, combining high operational reliability

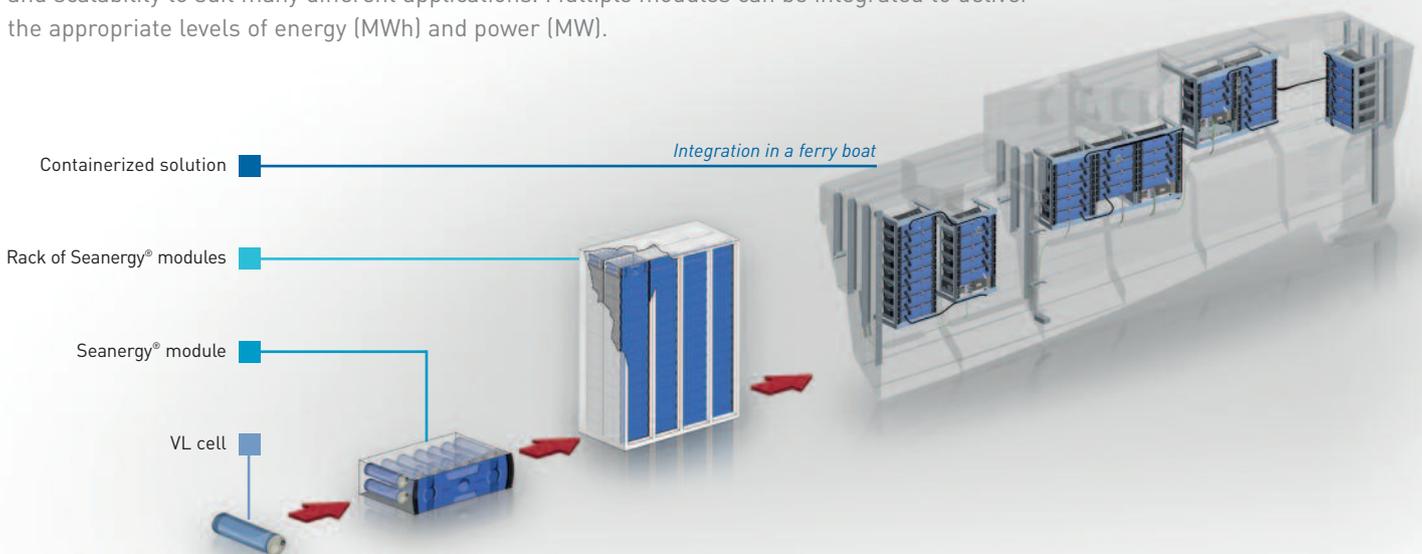
over thousands of cycles with outstanding energy efficiency. This modular design enables the battery configuration to be adapted readily to match various energy and voltage requirements.

Saft' range includes different types of Energy & Power Li-ion modules. The modules are always supplied with an associated Battery Management System (BMS).

## Excellent energy and power characteristics in a modular format, from kW to MW

### Providing a flexible approach from single cells to complete containerized system solutions

Saft's fully integrated solution provides excellent power and energy characteristics with the flexibility and scalability to suit many different applications. Multiple modules can be integrated to deliver the appropriate levels of energy (MWh) and power (MW).



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# Extensive experience in battery sizing

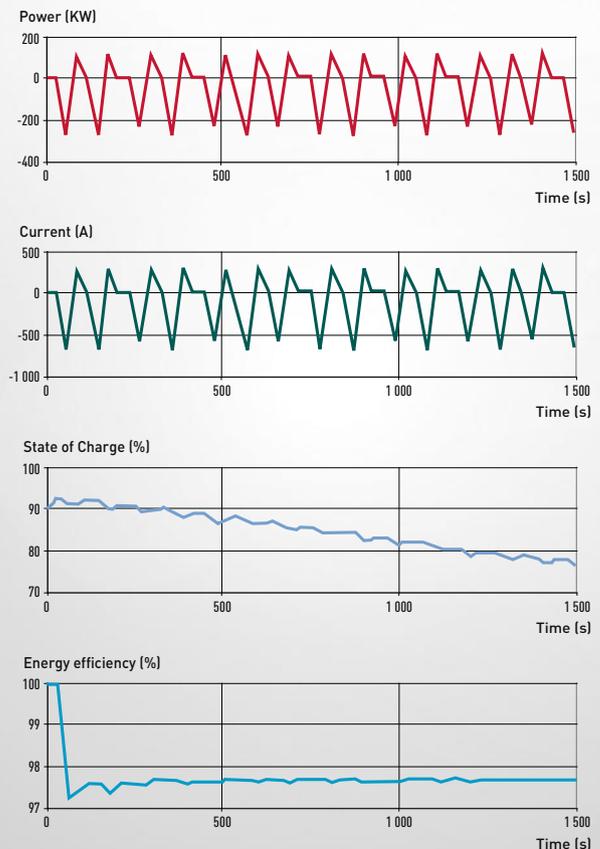


Saft has the know-how to support our customers in the critical task of sizing their battery systems to meet the needs of each specific application. Utilizing our extensive experience and customized modelling tools enables Saft to deliver the optimum solution.

To ensure the safety and long service life of a marine battery system it is vital to follow some basic rules:

- Understand fully the application and the operating profiles to choose the right type: power or energy range
- Identify aging parameters: temperature and cycling, charge and discharge rate
- Adapt the cooling system
- Run a Matlab simulation to verify parameters and profiles at end of life.

Simulation results for a repetitive 30 minutes profile



# Beyond batteries: our commitment to end-to-end support



Saft provides a wide array of support and services, both before you buy and after, so you can be sure of having a robust, reliable and well-maintained solution over an extended period of time.

## Design

Saft offers design consulting and advice to help you select the most optimised battery system. If one of our standard solutions isn't right for you, our R&D teams can tailor a made-to-measure battery design that perfectly meets your unique needs.

## Qualification

With our extensive test data and product knowledge, our teams can offer lifetime modelling and customised testing.

## Field deployment

Saft can help with installation and commissioning of your batteries, as well as assist you in determining the necessary lead-time for your project, answer your questions about proximity and reproducibility, and train your teams.

## Operations management

Saft's service doesn't stop when we deliver the batteries. We can also provide full after-sales support for maintenance, software interfacing and monitoring, asset management, on-going staff training and more.

## Retrofit

Saft teams can help plan for and then manage your product's obsolescence as well as advise on collection and recycling according to local regulations. We provide lifetime support to your batteries.

## e-Supervision tool to provide remote battery diagnostics

With increasingly complex battery systems it is essential to monitor the status and behavior of your battery at any point in its operational life. Saft offers an e-Supervision tool that enables customers to access key data in real time from a remote location, receive alerts and diagnose situations without having to physically interact with the system. The tool is already being used by customers in France and the Nordic countries.

## Saft marine batteries conform to all major quality, safety and environmental standards

- Quality: ISO 9001
- Environment: ISO 14001
- Hazard qualification: UN 3480



# Saft is committed to the highest standards of environmental stewardship

As part of this environmental commitment, Saft gives priority to recycled raw materials over virgin raw materials, reduces its plants' air and water releases year after year, reduces fossil energy consumption and associated CO<sub>2</sub> emissions, and ensures that its customers have recycling solutions for their spent batteries.

Regarding industrial batteries, Saft has had partnerships with collection

companies in most EU countries, in North America and in other countries. This collection network receives spent batteries from our customers and dispatches them to fully approved recycling facilities, in compliance with the laws governing trans-boundary waste shipments. This collection network receives and dispatches our customers' batteries at the end of their lives to fully approved recycling facilities, in

compliance with the laws governing trans-boundary waste shipments. Saft has selected a recycling process for industrial li-ion cells with very high recycling efficiency. A list of our current collection points is available on our web site. In other countries, Saft assists users of its batteries in finding environmentally sound recycling solutions. Please contact your sales representative for further information.

