

Intensium[®] Max

Containerized Energy Storage System



SAFT

Intensium[®] Max



Saft Li-ion container solutions for the most challenging energy storage applications

The increasing penetration of decentralised and variable renewable generation presents important stability and reliability challenges for power grids. Effective energy storage can ensure that generation meets demand in stable grids even with high amounts of variable renewables going online.

Saft is building on over 15 years of proven expertise in large format Li-ion battery systems in most challenging applications for the space, automotive, telecom and many other demanding industries.

The third generation of our successful Intensium[®] Max container range includes a wealth of experience based on more than 100 MW of grid scale storage systems deployed by Saft since the first container left the factory back in 2012.

Making renewable generation predictable and grid-compatible

Developers of solar and wind power schemes and utilities in remote or isolated areas know that the significant output peaks and troughs inherent in renewable energy sources are a factor that can make their successful integration into power grids more difficult.

Saft energy storage systems can smooth this intermittent generation and reduce ramp rates for medium- and large-scale renewable energy plants. In addition, storage can provide power reserve which is key in both microgrids and main grids.

To stabilise wind farms and solar arrays, batteries must handle high power levels in charge and discharge, significant daily energy throughput under very dynamic cycling conditions at variable depth-of-discharge. Saft Li-ion systems achieve an outstanding power density offering 3 MW power output in a single 20 foot container, with the proven capability to deliver high performance over a lifespan exceeding 10 years.

Saft provides complete solutions from Li-ion modules to our ready-to-install Intensium Max containers integrating a proprietary Battery Management System (BMS), thermal management and safety management. Safety is a priority at Saft with a consistent approach embracing cell, module, string and container designs. Our BMS and thermal management are conceived to ensure highest energy efficiency, availability, maintainability and life time, thus enabling lowest TCO to our customers.



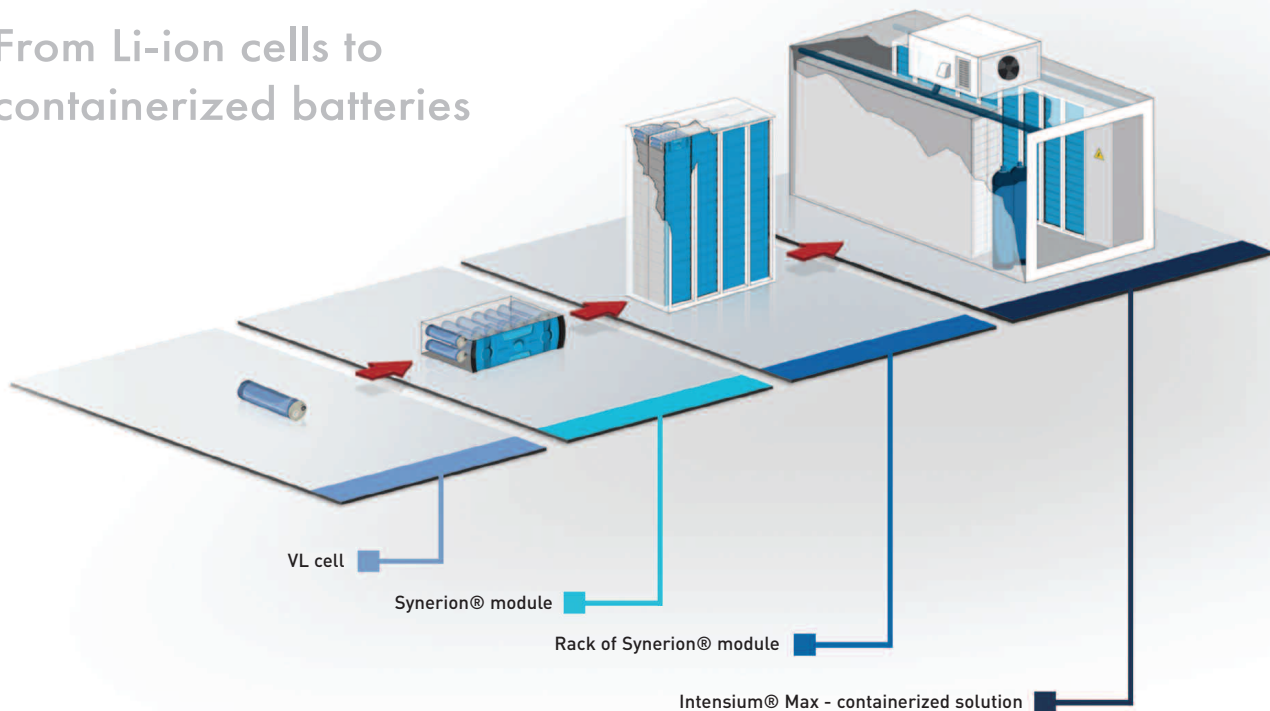
A containerized Li-ion battery system

Intensium® Max is Saft's ready-to-install containerized energy storage system designed for on-grid applications. It provides a megawatt-level energy storage solution in 20 foot containers with a very flexible design based in 1 or 2 power outputs per

container, daisy-chain architectures and 3 Li-ion cell types. With Intensium® Max containers, Saft offers optimized solutions matching the client requirements of power, energy, space and interface. The IM+ 20 is based on 18 parallel strings, each comprising

30 battery modules (24 V), delivering a nominal 770 V and a rated energy of 44, 60 and 66 kWh depending on the cell type. Each string also incorporates an electronic Battery Management Module (BMM) that controls the temperature, voltage and current of each module and indicates their state of charge and health.

From Li-ion cells to containerized batteries



Delivering megawatts of energy storage



Excellent energy and power characteristics in an efficient format

Intensium Max is delivered in a standardised 20-foot container that can be easily and efficiently transported to wherever you need it – including hard to reach spots.

The fully-integrated solution provides excellent power and energy characteristics with the flexibility and scalability to suit many different applications. Multiple containers can be integrated within a single Energy Storage System to deliver the desired high levels of energy (MWh) and power (MW).

Power and energy ratings

	IM+ 20E High Energy	IM+ 20M Medium Power	IM+ 20P1 High power 1 Power output	IM+ 20P2 High power 2 Power output
Energy (kWh)	1180	1090	780	700
Nominal discharge power (kW) [1]	2300	2400	2500	2800
Nominal charge power (kW) [1]	900	2300	2600	2900
Current max (A)	3240	3240	3380	3760
Voltage range (V)	630 - 867			
Dimensions L x W x H (m) [2]	6,1 x 2,4 x 2,9			
Weight (t)	19,5			19,0

[1] continuous power (over 30sec) at nominal voltage, BoL

[2] not including HVAC

Each container comprises:

- Battery management system
- Thermal management system
- Local monitoring panel / remote supervision capability
- Power and communication interfaces
- Fire suppression system





The technology inside

The Intensium Max is built around Saft's range of Synerion E, M or P Li-ion modules, which provides maintenance-free energy storage in a compact, adaptable format that combines high operational reliability, long cycle life and outstanding efficiency with the capability to provide hundreds of kWh of energy from a single unit. Thanks to this technology, the Intensium Max has the best energy efficiency of all available energy storage systems on the market today.

Energy efficiency, high reliability and robustness thanks to:

- Compact module that integrates VLE, VLM or VLP Li-ion cells, module supervision and cell balancing
- Advanced industrial design offering high levels of reliability and robustness
- 20 year long design life with high daily energy throughput
- Up to 5C power capability enabling highly dynamic charge/ discharge profiles from any state of charge



Saft's Synerion@ 24 M
Medium Power Li-ion module

Battery management system

To ensure optimum performance, reliability and safety, Saft Li-ion battery modules come complete with fully integrated electronic battery management systems.

BMM
(Battery Management Module)

Each battery string is supervised by an electronic BMM (Battery Management Module). This controls the temperature, current and voltage of the 30 individual battery modules and estimates their state of charge (SOC) and health (SOH). The BMM can also electrically isolate individual strings if necessary.

MBMM
(Master Battery Management Module)

A Master Battery Management Module (MBMM) provides overall control of the 18 parallel battery strings. Its vital function is to monitor and equalize the state of charge in all the parallel strings. A PLC also provides the control interface with the power conversion systems.



Intensium[®] Max



One solution, multiple capabilities

Saft's containerized approach to energy storage systems offers multiple capabilities. This means that not only can a single technical solution address multiple applications, but also a single battery system can enable grid operators to realise multiple value streams.

Support for large renewable generation plants

- Avoid curtailments of large solar or wind power plants
- Smooth intermittent generation
- Reduce ramp rates
- Shaping power output

Provide ancillary services in the medium voltage grid

- Provide frequency regulation in the primary or secondary reserve markets
- Reduce feeder congestion during demand and generation peaks
- Provide local dynamic voltage support
- Enable black start and islanding

Fully-integrated, easy and efficient

Saft has designed the Intensium Max container to provide an effective 'plug and play' approach to energy storage, with the emphasis on ease of specification, ease of installation, flexibility of application and user-friendly operation.

- Ready-to-install container, fully populated and tested in Saft's factories
- Easy to relocate
- Suitable for multiple charge and discharge patterns, from high power short duration cycles to deep discharge duration
- Able to perform different services in sequence or in parallel with high energy turnover per day, leading to optimized ROI
- Outstanding, field proven availability ensuring high reliability and secured revenue of your asset
- Fully-integrated solution with sophisticated Battery Management System (BMS) and power and communication interfaces
- Incorporates Temperature and Safety Management Systems
- User-friendly monitoring interface



Built upon our tested and proven Li-ion technology

Field-proven, with over 15 years experience in demanding applications, Saft Li-ion battery technology offers several critical advantages for energy storage systems.

- Fast response time, limited only by power electronics
- High power capability both in charge and discharge
- Excellent cycling capability
- High round-trip efficiency (better than 95%)
- Outstanding calendar life even at high temperatures
- Subsequently, reduced HVAC size and energy consumption
- High, field proven availability



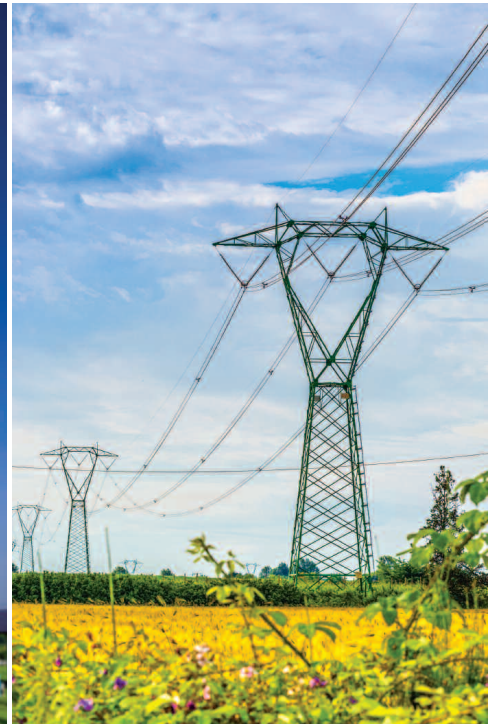
www.saftbatteries.com

Saft is committed to the highest standards of environmental stewardship

As part of its environmental commitment, Saft gives priority to recycled raw materials over virgin raw materials, reduces its plants' air and water releases year after year, minimizes water usage, reduces fossil energy consumption and associated CO₂ emissions, and ensures that its customers have recycling solutions for their spent batteries.

Regarding industrial batteries, Saft has had partnerships for many years with collection companies in most EU countries, in North America and in other countries. 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 lithium-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.



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