

Soft Lithium Batteries

Cutting-edge technology for extreme environments



Oil & Gas industry



Oil & Gas industry

The vital business of exploring and drilling for oil and gas is one of the most challenging industries in today's economy and the whole world depends on their safe and reliable production and transport. The increasingly complex and sensitive technology utilised by businesses involved in the industry is specifically designed to meet the extremely challenging environments where they operate while helping them to drive efficiency and ensure safety. In some operations utilising highly delicate instrumentation, batteries are the only option. So, the batteries must be absolutely reliable.

Saft offers the advanced battery solutions required for the cutting-edge technology employed in these tough environments. For example, we are the only battery manufacturer in the world today that offers lithium-ion batteries that can be utilised under temperatures conditions up to 125°C and that present no danger up to 150°C. These sophisticated tools almost always require a custom-designed battery. Of course, Saft also manufactures a comprehensive range of Primary batteries solutions for all operators requiring this technology, relying on its unparalleled experience in developing this technology.

All Saft's battery solutions for the Oil & Gas industry benefit from the company's unique combination of R&D and production capabilities, which enable it to industrialise its production process to meet any customer specification with optimum efficiency.



Saft's unique industrial capabilities



Saft is a specialist in the design and manufacture of high-technology batteries for advanced industrial and defence applications. Saft has decades of experience in the field of lithium batteries and pioneered technological breakthroughs in space, aviation, military, hybrid and electrical vehicles, medical, large energy storage and many other applications.



Long experience

Saft pioneered breakthrough battery performance by investing in R&D in rechargeable lithium technologies, with over 33 years of experience in the field of primary lithium and more than 10 years of designing and manufacturing of lithium-ion batteries.

Research and Development

Saft places R&D at the core of its business and the quality of its R&D teams is a major competitive strength of the group. They enable Saft to maintain its technology edge, the key to its commercial success. Saft invests over 5% of annual sales in R&D, including customer-funded development and grants. Some 250 people work in product development at manufacturing sites.

Local partner, with a global footprint

Thanks to its factories in Europe, Asia and the USA, Saft's manufacturing capacities are broad, deep and highly flexible. You benefit from global service provided by a truly global network ensuring local support to Oil & Gas equipment manufacturers and end-users everywhere.

Saft implements world-class industrial processes:

- Fully automated lines ensuring reproducibility, quality control traceability and high output.
- Dedicated Oil & Gas battery workshop: customised design, rugged construction.

Saft designs for safety:

- Saft's Lithium systems comply fully with all safety regulations, including regulations relating to use of battery equipment in explosive atmospheres.
- Battery systems are designed to offer multiple layers of safety protections: at electrochemistry, cell and battery pack level.
- FMEA methodology implemented throughout the development and manufacturing phases.
- Extensive qualification programs and in-house equipments including SW modelling, vibrations and shock, thermal, electrical and abusive tests.

Customer-driven design

Each Oil & Gas program is unique with its own set of requirements. A combination of extensive program experience, electrochemical expertise, world class manufacturing, and close working relationships with our customers, enables Saft to design each energy storage system to handle the most stringent requirements.

► For our sales contacts, visit our web site: www.saftbatteries.com

Saft

The best battery solutions for the Oil & Gas industry



► Exploration

Sophisticated instrumentation onshore and offshore

The essential task of determining the precise location of oil and gas deposits requires perfect measurement. Major geophysical survey companies and equipment makers rely on Saft batteries to ensure the accuracy of their seismic surveys in marine and desert

environments around the globe. Reflected seismology, for example, requires compact size and dependable performance over extended time frames because batteries are the only available power source. Saft's batteries enable devices like geophones

and towed hydrophones to collect data over a wide area and they fit perfectly into the limited space available. Saft high energy battery pack enables weight saving for operators deploying sensors for land operations.

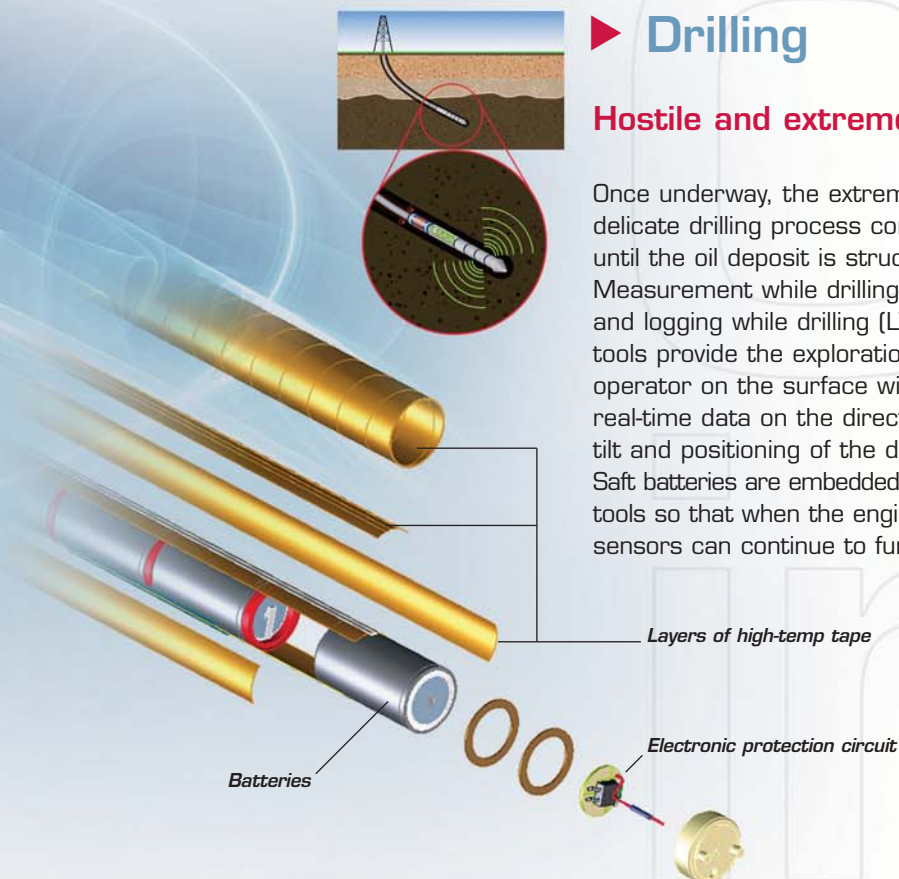
► Drilling

Hostile and extreme conditions, tight drilling schedules

Once underway, the extremely delicate drilling process continues until the oil deposit is struck. Measurement while drilling (MWD) and logging while drilling (LWD) tools provide the exploration operator on the surface with vital real-time data on the direction, tilt and positioning of the drill bit. Saft batteries are embedded in these tools so that when the engine is off sensors can continue to function.

Batteries must operate for sustained periods of 20 hours or more under extreme conditions – from well below 0°C on Arctic oil rigs to very high temperatures of +150°C or higher during deep drilling – subject to very high vibrations and shock levels. MWD is a particularly demanding area where Saft has valuable experience and obtained exceptional battery performance. The diameters of Saft batteries are specifically adjusted to fit with the main drill tools.

The lithium-ion batteries are ideal when combined with down-hole turbines or generators to deliver compact solutions, eliminating the need to pull down-hole tools and instruments back to the surface for replacement.



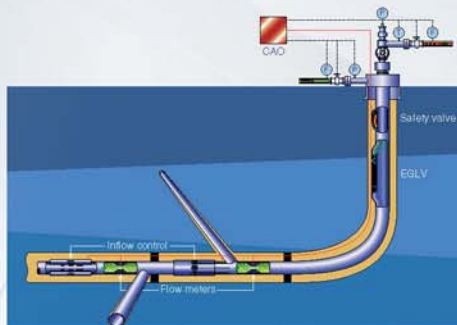


► Completion

Prepare the well for production, maximise oil production, reduce operating expenditures and provide intelligent monitoring from the surface

After drilling the well, it must be 'completed' so it can start producing. A complex installation is set up over the wellhead. The equipment used in the completion process requires delicate instrumentation to operate control valves, downhole gages, orientation and wellbore

surveying, and other downhole measurements. Saft's disruptive high temperature Li-ion technology enables the introduction of more intelligent completion solutions, removing the need of physical intervention for production data acquisition or for well control.



► Pipelines

Ensuring pipeline integrity for safety and uninterrupted flows

Delivery is money! Once completed, the well is ready to start producing. The process has finally arrived at the revenue generating stage and operators can begin to see a return on investment. The ongoing task of maintaining the system of oil and gas pipelines becomes essential, ensuring safety and a constant flow to market.

Pipeline inspection gauges

Pipeline inspection gauges (PIGs) rely intensively on battery power. Saft's batteries for pipeline inspection robotics are based on Magnetic Flux Leakage (MFL), Ultrasonic (UT) and Electro-Magnetic Acoustic technologies.

Rugged batteries for PIGs

Inspection projects can involve over 70 km of continuous pipeline to be checked. Batteries powering data collection devices must function fully and reliably from start to finish. A PIG battery has to resist high temperatures as well as intense shock and vibration.

Saft's full range of Primary lithium (Li-P) and Lithium-ion (Li-ion) batteries supply the entire pipeline inspection process for the following equipment:

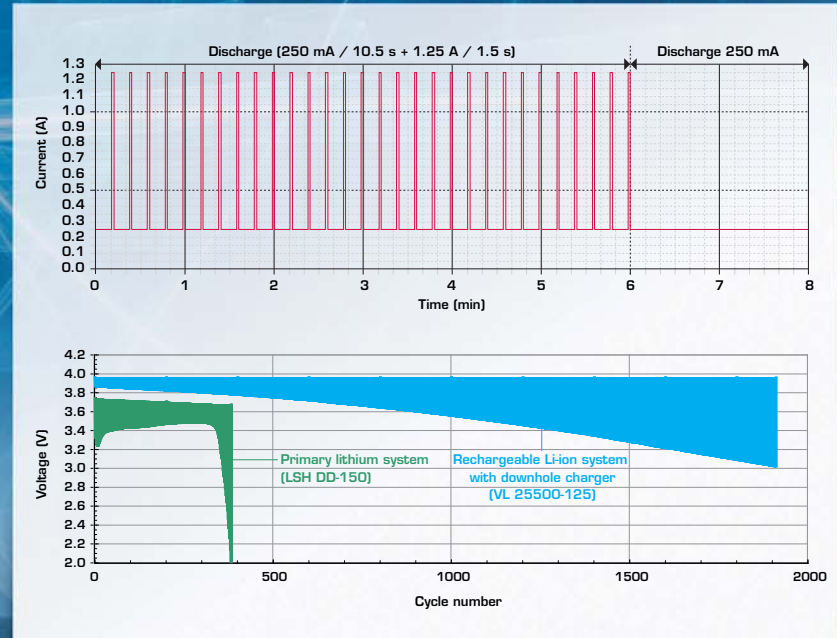
- PIGs
- Topside Transceivers
- Diver-held Receivers
- Remote Transceivers
- Subsea Antenna Transceivers
- PIG Global Positioning Satellite systems



PIG Batteries



Down-hole mission profile: end discharge versus cycle number at 125°C
VL 25500-125 : [Charge 3.95 V / 400 mA + 3.95 V floating] 20 min



Key Benefits

Benefits across all Saft product lines:

- Extended operating temperature range compared with conventional batteries.
- High energy with the longest, possible running times, meaning more data acquisition downtime.
- Rugged cell and battery pack design, for field operations in harsh environments.
- Safe and reliable under severe vibration/shock constraints.
- Hermetic and corrosion-proof glass-to-metal sealing.
- Low magnetic design, eliminating the risk of interference with data collection.
- Full battery systems available with interface charge controller; down-hole HT protection electronics, customized interfaces.

Specific benefits of Saft's primary batteries:

- Highest capacity delivered for MWD/LWD instruments.
- High and stable operating voltage.
- No noticeable self-discharge between partial jobs meaning longer battery autonomy in the field.
- No need for de-passivation before operation.

Specific benefits of Saft's Li-ion batteries:

- First cells in the world able to operate efficiently up to +125°C and safely up to +150°C.
- High savings on operation costs, thanks to long cycle life.
- Over 1,500 oil drilling surveys demonstrate efficiency at 125°C and more than 15,000 surveys at 85°C, compared with 300 surveys for primary systems.
- High voltage, high power electrochemical system.
- No passivation phenomenon.

Saft

The leading edge in battery technology

Saft is a major player in battery technologies for the Oil & Gas industry, supplying turnkey battery solutions at each step in a well's life cycle.

Primary lithium (Li-P) and rechargeable (Li-ion) batteries

		Nominal Voltage	Nominal Capacity	Size	Temperature range	Shock and vibration withstanding	Geophysical survey	Oil drilling	Well completion tools	Pipeline inspection
Li-P	LSH 20-150 *	3.60 V	14.0 Ah (300 mA)	D	-40/+150°C	Excellent		■	■	■
	LSH DD-150 *	3.60 V	28.0 Ah (600 mA)	DD	-40/+150°C	Excellent		■	■	■
	LSH 20	3.60 V	13.0 Ah (15 mA)	D	-60/+85°C	Moderate	■			■
	LSH 14	3.60 V	5.8 Ah (15 mA)	C	-60/+85°C	Moderate	■			■
Li-ion	VL 25500-125	3.60 V	2.0 Ah (400 mA)	C	0/+125°C	Excellent		■	■	■
	VL 32600-125	3.60 V	4.5 Ah (900 mA)	D	0/+125°C	Excellent		■	■	■
	MP 176065 HD Integration	3.75 V	3.6 Ah (720 mA)	Prismatic	-10/+60°C	Moderate				■
	MP 176065 Integration	3.75 V	6.8 Ah (1400 mA)	Prismatic	-50/+60°C	Moderate	■			■
	MP 174565 Integration *	3.75 V	4.8 Ah (1000 mA)	Prismatic	-50/+60°C	Moderate	■			■
	VL 34480	3.70 V	4.4 Ah (900 mA)	4/5 D	-20/+60°C	Moderate	■			■
	VL 34570	3.70 V	5.4 Ah (1100 mA)	D	-20/+60°C	Moderate	■			■
	VL 37570	3.70 V	7.0 Ah (1400 mA)	Fat D	-20/+60°C	Moderate	■			■

* Compliant with IEC 60079-11 intrinsic safety standard.

Chargers

	Geophysical survey	Oil drilling	Well completion tools	Pipeline inspection
Surface charger	■	■		■
Down-hole integrated charger		■	■	



About Saft

Saft (Euronext: Saft) is a world specialist in the design and manufacture of high-tech batteries for industry. Saft batteries are used in high performance applications, such as industrial infrastructure and processes, transportation, space and defence. Saft is the world's leading manufacturer of nickel batteries for industrial applications and of primary lithium batteries for a wide range of end markets.

The group is also the European leader for specialised advanced technologies for the defence and space industries and world leader in lithium-ion satellite batteries. Saft is also delivering its lithium-ion technology to new applications in clean vehicles and renewable energy storage. With approximately 4,000 employees worldwide, Saft is present in 18 countries. Its 15 manufacturing sites and extensive sales network enable the group to serve its customers worldwide. Saft is listed in the SBF 120 index on the Paris Stock Market.

For more information, visit Saft at
www.saftbatteries.com



**Saft is committed
to the highest standards
of environmental stewardship**



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