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A whole range of solutions... …to meet any requirement
Saft’s extended range of technologies and track-record of reliability enable rapid and targeted response to customers’ requirements. Saft will continue to provide exceptionally reliable solutions and is committed to maintaining the highest international standards.

Continuous improvement
Saft has invested extensively for over 30 years in advanced production methods, research and product development. Maximised safety in storage and extended shelf life to over 8 years is now achieved – even in diverse environmental conditions.

Example
Saft’s Type RB47 battery for SAFT/GDT4 easily surpasses the specified 8 years shelf life with a typical 10 + 6 years period. A lifetime extension up to sixteen years is possible with this new generation of battery, markedly reducing the life cycle cost.

Saft’s torpedo battery technologies

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<tr>
<td>SST4 &amp; S JT</td>
<td>HWT</td>
<td>Combat and Exercise, Silver-Zinc</td>
</tr>
<tr>
<td>BRM3</td>
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</tr>
<tr>
<td>BlackShark</td>
<td>HWT</td>
<td>Combat, Silver-oxide aluminium</td>
</tr>
<tr>
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The company operates at the forefront of innovation, developing and delivering advanced solutions for critical applications that are highly dependent upon integrated technology. As the next generation of intelligent defence systems takes shape, Saft is actively engaged in supporting major international companies leading this change.

**Silver-oxide**

Seawater-activated

Operating principle: The battery is stored without electrolyte, and activated by seawater after the torpedoes have been launched. Through a scoop located in the hull of the torpedoes, a continuous flow of electrolyte removes the heat, gas and mineral mud produced by the discharge and corrosion reactions.

Seawater-activated Type V116 and M120 batteries are used respectively for A244 and MK44 torpedoes. Saft is a sole qualified supplier of the V116 battery for Allied torpedoes.

Storage conditions:
- Specified storage life: 5 years
- Actual storage life exceeds 10 years when the batteries are stored in their storage containers and protected against humidity

Silver-Zinc

Operating principle: The battery is activated by a pyrotechnic device, ignited by an external electrical signal. Pulled by compressing-nitrogen, the electrolyte fills the cells through a distribution system.

The battery is then primed. Heating of the electrolyte is possible. Autonomy: from 1.3 min (high speed) up to 5 r/min (low speed).


Concept based on the assembly of multiple prismatic cells connected in series with the electrolyte stored in a separate reservoir.

The energy to charge the electrolyte from seawater is transferred as the cells are primed by a pressurized gas tank.

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Silver-oxide

Operating principle: The electrolyte forms when sodium hydroxide powder is dissolved in seawater. Electrolyte circulates through the deck in a closed loop.

Silver-oxide positive electrode, aluminium alloy negative electrode and cells pile stack technology was developed in the 1970s in the USA and then in France by DCN and Saft. High temperature operation (≤130°C) and high electrolyte conductivity provide for very good power capability.

Flagship products: AgZnM70 stacks for HWT and Blackshark.

Lithium-ion

Example:

The full discharge of a VL27MT lithium-ion battery does not require any thermal management, even for extremely high discharge rates. The VL27MT cell is a modular version of the commercial cell already proposed by Saft for underground applications. Modifications include a tough mechanical form factor designed to meet military shock and vibration requirements. It also includes a Li-ion technology specially designed for high rate discharge (up to 1 C-rate).
Saft’s extended range of technologies and track-record of reliability enable rapid and targeted response to customers’ requirements. Saft will continue to provide exceptionally reliable solutions and is committed to maintaining the highest international standards.

Example

Saft’s Type RB47 battery for SUT/SST4 easily surpasses the specified 8 years shelf life with a typical 10+ 6 years period. A lifetime extension up to sixteen years is possible with this new generation of battery, markedly reducing the life cycle cost.

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Saft batteries for torpedoes
Meeting the challenge in defence

Saft is a global, multi-technology battery specialist and is the world’s leading manufacturer of high-end batteries for industrial, transportation, space and defence applications. The company operates at the forefront of innovation, developing and delivering advanced solutions for critical applications that are highly dependent upon integrated technology. As the next generation of intelligent defence systems takes shape, Saft is actively engaged in supporting major international companies leading this change.

Absolute capability
Multiple technologies

Seawater-activated
Operating principle: The battery is stored without electrolyte, and activated by seawater after the torpedo has been launched. Through a scoop located in the hull of the torpedo, a continuous flow of electrolyte removes the heat, gas and mineral mud produced by the discharge and corrosion reactions.
Seawater-activated Type V616 and M606 batteries are used respectively for A244 and Mk44 torpedoes. Saft is a sole qualified supplier of the V616 battery for Allied torpedoes.
Storage conditions:
• specified storage life 5 years
• actual storage life exceeds 10 years when the batteries are stored in their storage containers and protected against humidity

Silver-Zinc
Operating principle: The battery is activated by a pyrotechnic device ignited by an external electrical signal. Pulled by compressing-nitrogen, the electrolyte fills the cells through a distribution system. The battery is then primed. Heating of the electrolyte is possible.
Seawater-activated Type A244 and A1044 batteries are used respectively for A244 and Mk44 torpedoes. Saft is a sole qualified supplier of the A244 battery for Allied torpedoes.
Storage conditions:
• specified storage life 5 years
• actual storage life exceeds 10 years when the batteries are stored in their storage containers and protected against humidity

Silver-oxide phosphate
Operating principle: The battery is activated by a pyrotechnic device ignited by an external electrical signal. The electrolyte circulates through the device in a closed loop.
Silver-oxide phosphate batteries are used respectively for A244 and Mk44 torpedoes. Saft is a sole qualified supplier of the A244 battery for Allied torpedoes.
Storage conditions:
• specified storage life 10 years when the batteries are stored in their storage containers and protected against humidity

Example
Lithium-ion

Lithium represents the most promising technology for exercise torpedoes. Specific batteries will be developed by Saft according to customer’s specific requirements. Li-ion batteries can be connected in parallel without any specific devices. The torpedoes battery is an association of cells connected in parallel (groups) in order to comply with the capacity request, and groups connected in series in order to comply with the battery voltage specification.
Li-ion batteries are managed by a specific electronic control system, supplied by Saft, adapted to the application requirements.

Seawater-activated

Silver-oxide phosphate

Worldwide, world-class capability
Saft’s global reach and vast capability enable it to provide the highest efficient and professional response necessary for large-scale production. Around 300-300 clients use Saft batteries to power lightweight and heavy-duty torpedoes in training programs and combat roles.
Saft: total reliability
Saft’s modern production facility at Poitiers manufactures standard and advanced solutions on sophisticated production lines employing a large variety of electro chemistries. Saft is specified as a reliable supplier for all western electricity powered torpedoes.

Absolute capability
Multiple technologies

Flagship products: batteries for torpedoes. Saft is a sole qualified supplier of the V616 battery for SST4, SUT and A184 torpedoes.
Flagship products: AgZn-Al stacks for SST4, SUT and A184 torpedoes. Only aluminium/silver-oxide truly can provide twice the power and energy capability.

Li-ion

Lithium-ion

Example

The full discharge of a VL27MT lithium battery does not require a battery management, even for extremely high discharge rate. The VL27MT cell is a tubular version of the commercial cell proposed by Saft for lithium-ion aerospace. Modifications include:
• a tough mechanical format
• designed to meet military shock and strain requirements

The diameter of a special electrode providing extended high rate discharge performances (4 to 13Cs)

Example

Electrolyte circulates through the device in a closed loop.

Electrolyte is provided by a pressurized gas tank.

The energy to transfer the electric charge from one cell to another is provided by a pressurized gas tank.
Saft batteries for torpedoes
Meeting the challenge in defence

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Worldwide, world-class capability
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Saft: total reliability
Saft’s modern production facility at Poitiers manufactures standard and customised batteries. The company’s modernisation projects include employing a large variety of electrochemistries. Saft is specified as a reliable supplier for all western electricity powered torpedoes.

Seawater-activated
Operating principle: The battery is stored without electrolyte, and activated by immersion after the torpedoes have been launched. Through a scoop located in the hull of the torpedoes, a continuous flow of electrolyte removes the heat, gas and mineral mud produced by the discharge and corrosion reactions.
Seawater-activated Type V616 and MK61 batteries are used respectively for AD44 and MK44 torpedoes. Saft is a sole qualified supplier of the V616 battery for Allied torpedoes.
Storage conditions:
• specified storage life 5 years
• actual storage life exceeds 10 years when the batteries are stored in their storage containers and protected against humidity

Silver-Zinc
Operating principle: The battery is activated by a pyrotechnic device, ignited by an electrical signal, pushed by compressing-nitrogen, the electrolyte fills the cells through a distribution system. The energy to transfer the electrolyte is possible thanks to a no load voltage specification. The battery is then primed. Heating of the electrolyte is possible.

Silver-oxide aluminium
Operating principle: The electrolyte forms when sodium hydroxide powder is dissolved in seawater. The battery is a thin prismatic. Electrolyte circulates through the device in a closed loop.

Silver-oxide
Operating principle: The electrolyte is provided twice the power and energy density. Only aluminium/silver-oxide truly can provide for very good power capability.

Silver-oxide/polymer
Operating principle: The battery is activated by a pyrotechnic device, ignited by an electrical signal, pushed by compressing-nitrogen, the electrolyte fills the cells through a distribution system. The energy to transfer the electrolyte is possible thanks to a no load voltage specification.

Flagship products: Ag0-Al stacks for SST4, SUT and A184 torpedoes. Specific batteries will be developed by Saft adapted to the application requirements.

Flagship products: batteries for A184 and PB47 for SST4, SUT and A184 torpedoes.

Lithium-ion
Lithium-ion represents the most promising technology for use in future torpedoes. Specific batteries will be developed by Saft according to customer’s specific requirements. Li-ion cells can be connected in parallel without any specific device. The torpedoes battery is an association of cells connected in parallel (groups) in order to comply with the capacity request, and groups connected in series in order to comply with the battery voltage specification.

Meeting the challenge in defence
Saft batteries for torpedoes
Absolute capability
Multiple technologies
– specialised solutions deployed worldwide

Lithium-ion

Lithium-ion battery does not require maintenance, even for extremely high discharge rate. The Li-ion technology will provide for HWT a much cheaper way to perform sea trial.

Conservative values for battery life are:
• > 5 years

Lithium batteries do not need maintenance (Sealed cell)

Thanks to a no load voltage reading, an accurate energy gauge can be established

Electrolyte circulates through the device in a closed loop.

The energy to transfer the electrolyte is possible thanks to a no load voltage specification.

The full discharge of a VL27MT lithium-ion battery does not require specific maintenance, even for extremely high discharge rate.

The VL27MT cell is particularly well adapted to high rate discharge such as torpedoes propulsion.

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Multi-technology battery systems
Integrated solutions for torpedo propulsion

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