Thermal Batteries, ideal solutions for reserve energy
APS Advanced Power Sources is the Indian Company of ASB-Group. With more than 60 years of experience in Thermal Battery technologies, ASB-Group is also established in France (ASB), in UK (MSB) and in the USA (ATB).

**WORLD No.1**

The ASB Group are the currently world No.1 in this value add and technically challenging sector, The group specialise in R&D, process development, design and manufacture of Thermal Batteries. Our products are mainly developed in partnership with leading companies in the world of high technology, aeronautics, space, defence and energy.

**R&D**

Providing reliable effective power in extreme environments a challenge. We believe innovation & technology advancement is a key success factor. ASB Group aim to anticipate tomorrow’s expectations and make that technology available to you today.

**EXCLUSIVE TECHNOLOGIES**

APS has access to a number of technologies exclusive to the ASB Group e.g. lithium anode technology, unique chemistries and multilayer components i.e. combining the anode, electrolyte and the cathode for more demanding applications providing environmentally friendly optimal specific power performance levels (W/kg) and faster response times.

**CUSTOMER BASE**

ASB Group’s global customer base contains the majority of the leading names in the aeronautics, aerospace and defence industries in Europe, Americas, Asia and Australia.
COMMITMENT TO CUSTOMER SATISFACTION

APS product excellence is driven by the ASB Group’s core values; Customer Focus, Commitment to Quality and Continuous Improvement. It begins with our employees; training, experience and dedication are key to the quality of our processes and bring added value to our products and services.

APS can provide designs which meet your expectations by leveraging the experience of our development teams and extensive use of modelling tools developed in-house which results in robust products with excellent performance margins.

COMMITMENT TO QUALITY

APS capabilities include world class manufacturing processes which are standard across the group and include: full traceability, statistical process control, 100% non-destructive testing, 100% final inspection and AS9100 AQL sampled functional testing to your specification.

OFFSET PARTNER

APS has been registered as offset partner for the Indian Defence market.

As well as utilising the strengths of the ASB Group APS intend developing our own by investing in advanced manufacturing and inspection equipment to maintain and grow our capabilities.
Thermal batteries are primary reserve batteries consisting of a stack of electro-chemical cells; anode, electrolyte, cathode and heat mass, in a hermetically sealed container.

The Thermal Battery:

- Is activated by pyrotechnics e.g. a percussion cap, electric igniter etc.
- A fuse strip or central tube ignites a heating mass to produce temperatures high enough to melt the electrolyte.
- Molten, the electrolyte is highly conductive,
- Permitting an electro-chemical reaction between anode and cathode;
- The corresponding activation duration is almost instantaneous, as the battery immediately reaches its output voltage.
- Once fired and depleted the battery cannot be re-charged.
Specific advantages

SIMPLE

- “Plug and Play” solutions
- No auxiliary equipment required (heaters, control electronics etc.)
- Primary batteries: always available, no charging required
- Consistent electrical performance at extreme hot or cold temperatures
- Extremely robust, compatible with the harshest requirements

EASY

- Easy to assemble (fixings, connectors etc.)
- No logistic constraint for the transportation (non-hazardous Goods) and the storage (non pyrotechnic)
- ITAR-Free
- REACH compliant
- Mature technology (TRL9) with easy insertion

SAFE

- Remains safe when mistreated (subjected to fuel fire, reverse charging, high rate discharge, short circuit, open circuit etc.).
- Hermetically sealed (before, during & after operation).

AFFORDABLE

- Totally maintenance-free, hence with a low owning cost
- Can be combined in sets using parallel and series connection.
Questions & Answers

**What are the activation methods?**

There are 3 different ways to activate a thermal battery: either an electrical ignitor (usually a 1A-1W-5min No-Fire, requiring 3.5A-20ms All Fire), or a percussion cap (requiring a calibrated mechanical effort), or an inertial sensor (named “g-striker” and requiring a combination of acceleration level & duration, e.g. 5,000g-0,5ms).

Whatever the available energy, APS offers the optimised & reliable activation solution.

**What is the storage life?**

The storage life corresponds to the period of time during which the battery performance shall remain compliant with the specified load profile & operating conditions. APS commits into such a life on the basis of the following data: the return of experience (in order to commit in a reliability figure at the end of the storage life), the engineering calculation of the ageing effect (in order to size the design capacity in accordance), the acceptance conditions (in order to demonstrate this capacity margin), the in-process controls (in order to monitor the key parameters which will contribute to this storage life).

**What is the maximum skin temperature?**

After activation, the temperature in the cell stack will immediately rise to more than 550°C. Despite the insulation layers, the skin temperature will slowly increase and may reach +150°C wrt the initial operating temperature. Nevertheless, this parameter has never been a show stopper, for the following reasons: the maximal temperature is usually reached much later than the end of mission; APS has experienced specific modelling and solutions in order to cope with any requirement.

**What happen in case of system short circuit?**

... nothing! During the design phase, the battery parts will be sized, in order to ensure the cutting of the current collector in a defined safe zone, under the effect of an excessive current. The battery will then stop providing power and will progressively cool down. APS delivers safe solutions.

**What is the limiting factor to the operating duration?**

The thermal battery will stop delivering power either due to the exhaustion of the coulombic capacity of the cell stack, or due to the cooling of the electrolyte (the battery internal resistance will then rise again). It is therefore necessary to properly size the battery design on both the thermal balance and the energy capacity.
Battery range

Characteristics

- Battery weight from 0.014kg to 30kg
- Output voltage from 4V to 320V
- Discharge power from 2W to 70kW per battery (combination possible in set to even increase the power)
- Operating duration from 10s to 1hour
- Custom designed solutions, including specific interfaces (connecting, fixations)

Keys

- Specific Power up to 5kW/kg
- Specific Energy up to 80Wh/kg
- Reliability up to 99.995% (95% CL)
- Large range of electrochemistry combinations, including exclusive formulas (anodes, cathodes, electrolyte, heat pellets)
Application mapping

Everywhere
At any time
Reliably

- Space Launchers & satellite dispensers
- Aeronautics
  - Ejection seats
- Guided Artillery
- Guided bombs
- Tactical Missiles
- Emergency needs
- Sonobuoys & decoys
- Torpedoes
Artillery & Smart Ammunition

Applications
- Guided shells
- Mortar, naval
- Metric precision ammo
- Ammo Ø40mm to Ø155mm
- Dropped sensors

Characteristics
- Option for launch activation if fitted with g-striker (ASB-group exclusive)
- Single & multi output / multipolar voltages
- Qualified and in continuous production

Keys
- Can withstand huge acceleration levels (26,000g) and battlefield environments
- Provides enhanced system safety (no power until actual launch)
- The only power sources which can produce the required peak load profile
- Multiple operational benefits (long storage, maintenance-free, easy integration).

Customer References
BAE Systems, Raytheon, Saab, Nexter, Otomelara, Poongsan, Hanwha, T2M
# Bomb kits

## Applications
- Guidance kits
- With glider solutions
- For 125kg to 1,000kg bombs

## Characteristics
- Dedicated batteries for the Actuator power, the wing opening, the electronics power
- Single & multi output voltages
- Qualified and in continuous production

## Keys
- Safe, as the system remains inert during the connection
- Very robust, including in very low operating temperatures (high altitude)
- Cost optimised solutions
- The only power sources which can produce the required peak load profile
- Multiple operational benefits (long storage, maintenance-free, easy integration)

## Customer References
- Raytheon
- Lockheed Martin
- BAE Systems
- Thales
- Safran
- LIG Nex1
- Roketsan
Guided Rockets

Applications
- Guided rockets
- Guidance kits for ground-to-ground rockets
- Air-burst fuses
- Safety & arming units
- The battery is dedicated to the electronics and actuator power supply

Characteristics
- Very small & light solutions, thanks to exclusive electrochemistry combinations
- Innovative interfaces (connecting & fixings)

Keys
- Design to cost solutions, based on value analysis methodologies
- Produced at high rates (thousands/month)
- The only power sources which can produce the required peak load profile
- Multiple operational benefits (long storage, maintenance-free, easy integration)

Customer References
Raytheon, Lockheed Martin, BAE Systems, MBDA, Saab, Roketsan, LIG Nex1, Hanwha, TDA, FZ
Tactical Missiles

Applications
- Full range of tactical missiles (air, ground, naval dominance)
- Power supplies of electronics, seeker, telemetry bay, actuators, engine activations

Characteristics
- Very small & light solutions, thanks to exclusive electrochemistry combinations & titanium canisters
- Multi output voltages
- Innovative interfaces (connecting & fixings)

Keys
- More robust than alternatives in the specified operating environments
- Extremely reliable
- Design to cost solutions, based on value analysis methodologies
- The only power sources which can produce the required peak load profiles
- Multiple operational benefits (long storage, maintenance-free, easy integration)

Customer References
MBDA, Thales, Kongsberg, BAE Systems, Lockheed Martin, Boeing, Roketsan, LIG Nex1, Denel, ATK
### Sonobuoys & decoys

#### Applications
- Dropped sensors and sonars
- Sea & Air decoys
- Mobile target emulators

#### Characteristics
- Long operating duration (up to 1 hour)
- Multiple output voltages & polarities

#### Keys
- Extremely safe, fully compliant with air transportation regulations
- Longer storage life than the alternative solutions
- Maintenance free
- Compatible with severe environments (sea corrosion, low storage temperatures, sea drop shock)
- Immediately available, quick reaction time

#### Customer References
UTC Aerospace Systems (Goodrich), Chemring Energetics, BAE Systems, NEC, WASS
Applications

- Lightweight & heavyweight torpedoes
- Hard kill torpedoes
- Power supplies for the launch phase, but also new main power section
- Surface & air launch kit

Characteristics

- High power batteries (60 to 90kW)
- New solution as unique power source up to 65kg
- Compatible with low speed & high speed scenarios
- Fully autonomous solution (no auxiliary equipment, no electronics)

Keys

- Extremely safe solutions, compatible with the submarine requirements
- Compatible with the exercise configuration (training)
- Immediate availability
- Non-depending on the sea water quality (blue / brown)
- Cost competitive, as totally maintenance-free
- May supply the “boost phase” peak power for high speed manoeuvres

Customer References

DCNS, BAE Systems, WASS, US Navy
Space launchers

Applications
- Thrust Vector Control Actuators,
- Hydraulic pumps,
- Ejectors and pyro systems,
- Jettison of mini satellites
- Nozzle deployment

Characteristics
- Fitted with integrated connectors
- Voltage from 150V to 300V under load
- High power discharges for actuators (up to 100kW)
- Weight from 6 to 12kg
- Qualified and in series production

Keys
- Designed in compliance with the most severe environment & reliability requirements
- Simple: maintenance-free, easy insertion, no logistic constraint, available, etc.
- Modular: one battery combined in sets by series & parallel connection
- Provide the highest power density (up to 5kW/kg),
- 100% mission success in 20 years service
- Affordable

Customer References
Airbus Safran Launchers, Sabca, Arianespace
Aeronautics

Applications

- Emergency Power Source (EPS) for fighter aircrafts
- Substitution to the Ram Air Turbine (RAT) for civil aircrafts
- EPS for Helicopters
- Any emergency needs, e.g. door actuators

Characteristics

- Fitted with integrated connectors
- HVDC standard (270V)
- Qualified and in continuous production

Keys

- Ease of integration into the system, no logistics constraints, available, etc.
- Mature technologies (TRL9), in used over decades
- Ideal solution for innovative More Electric Aircraft (MEA) development
- Safe, robust, reliable
- Maintenance-free, low cost of ownership
- Compliant with the newest regulation, e.g. REACH
- ITAR-Free solutions

Customer References

Airbus, Korean Aerospace Industries (KAI), BAE Systems, MHI, Safran
Ejection seats

Main Battery Applications
- System initiation
- Canopy jettison
- Power source for the nozzle actuation of the seat

Characteristics
- Very short activation time (down to 20ms even at extreme low temperature)
- Miniaturised solutions
- Reliability, 100% Ejection Success

Keys
- “Green”, chromate free.
- Long field history >40 years
- Incorporated in all major fighter jet applications

Customer References
UTC Aerospace Systems (Goodrich), Chemring Energetics, Martin Baker
Emergency needs

Applications
- Offshore
- Nuclear plant
- Seismic surveillance
- Volcanic measurements
- Fire
- Railway, subway, transportation

Characteristics
- Batteries dedicated to the power supply to actuators, e.g. valve closure
- Full range of power demands
- Compatible with very high temperature (more than 200°C) and oceanic conditions

Keys
- Can be used in conjunction with rechargeable solutions ("peak & gap")
- Dedicated to emergency needs
- High reliability, long storage life
- All the intrinsic advantages of thermal batteries, including the compliance with extreme conditions (e.g. β radiation)
- Compatible with the post-Fukushima recommendations

Customer References
SINTEF, R&D advanced studies for several O&G leaders
Why choose a thermal battery?

IN SOME PLACES YOU NEED A POWER SOURCE THAT WON’T LET YOU DOWN

Thermal Batteries are an ideal solution when you need:

- A single-use power source,
- A safe solution,
- High POWER rather than an energy demand,
- To operate optimally in harsh conditions,
- Immediate availability after years of storage,
- Optimum reliability – e.g. when it is a matter of survival
- An affordable, but optimised & custom designed solution
Experience matters…

Battery reliability & performance are supported by experience gained through decades of research in:

- Thermal & Electrochemical Sciences,
- Industrial developments,
- Manufacturing & Process Control,
- Modeling.

Please challenge us

Thanks to our exclusive model ETHER, APS will conduct any dimensioning study based on your preliminary requirements:

- Voltage (min/max)
- Load (current vs time)
- Op. temperature range

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