

# Safe operations below the surface.

Cutting-edge batteries powered by over  
100 years' knowledge and experience.



Creating the future – our way:



Innovation



Reliability



Sustainability



High Performance

# What is the key to a powerful fleet?

## Making the right decisions!

Hagen Batterie is a leading supplier to the defense industry and has protected navies around the world for decades. It provides the widest range of products, advanced technology, industry-leading expertise and support.

Submarine batteries are designed and produced according to a shipyard's and navy's specifications. Due to that fact, tools, moulds, fixtures and other auxiliary devices are provided especially for a specific battery type. Automation in submarine batteries production, therefore, is limited – 80% of the manufacturing process is done manually.

### Submarine Batteries Made in Germany



Today, Hagen's state of technology for submarine batteries offers an operational lifetime of 10 years, with all customers confirming a real-world lifespan of at least nine years. Hagen offers a warranty of a minimum 80% of the specified initial capacity, within seven years of peacetime operation, and/or 1,250 discharge cycle.

For more than a century, Hagen has focussed on optimizing cell components, aiming for maximum implementation of active materials and reduction of passive materials where possible.

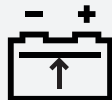
Hagen submarine batteries are made to strict specifications to ensure shock resistance, insulation requirements for on-board operation and minimum hydrogen generation.

Ultimately, what is the priority for any navy? Safety, performance and operational readiness (less downtime through fewer battery changes).

## Benefits of using a premium quality Hagen battery



Improved crew safety thanks to low gassing rate and less corrective maintenance work



Significant reduction in self-discharge



Reliability - Capacity performance close to 100% for the complete warranty period



Reduced  
Total Cost of  
Ownership (TCO)  
in the long term.



Highly-rated customer satisfaction, established relationships and 24/7 support



Safety - Low hydrogen evolution rate when the battery is in operation (agitation system can always be switched on)



Endurance - The **only** supplier in the world where its product is used for a longer time than its warranty period (operational life is 9-10 years)

### Environmentally-friendly battery.

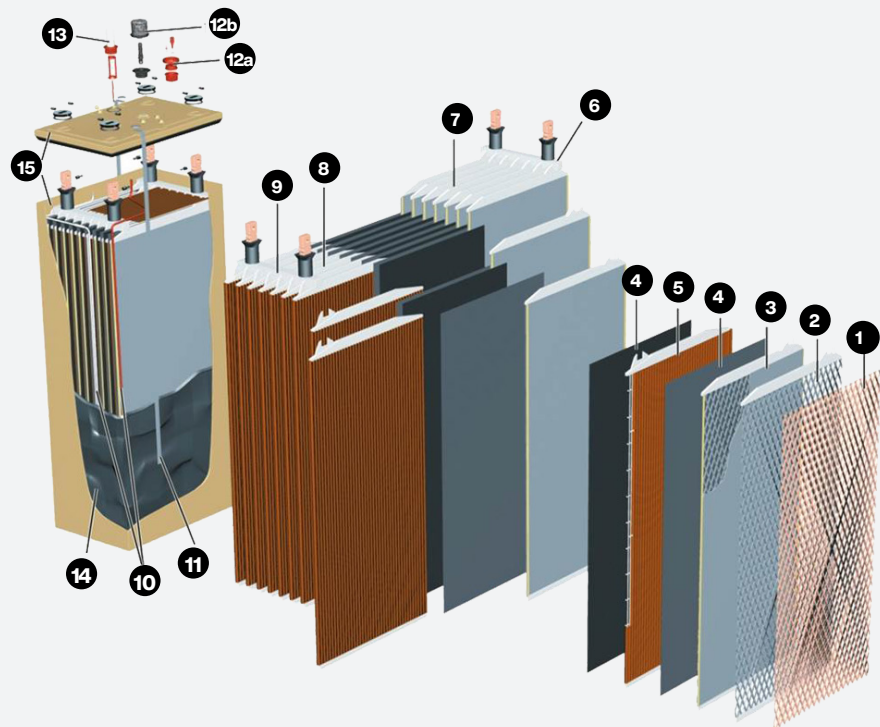
Hagen submarine batteries are based on lead-acid technology and, therefore, are fully-recyclable – another advantage over other battery solutions. Long-life, high energy efficiency and easy recycling make Hagen Batterie the green choice.

# Hagen Submarine Batteries.

## Proven track record.

Hagen's established CSM (copper stretched metal) technology has long set the standard for flooded batteries. Battery cells are assembled in slim-walled, high-performance glass-fibre containers, while the plate packages are sealed with rubber lining. Cell armatures offer easy access for control and maintenance.

- 1 Negative grid in CSM technology
- 2 Lead-coated negative CSM grid
- 3 Single negative plate
- 4 Separator
- 5 Single positive tubular plate
- 6 Negative pole bridge
- 7 Negative plate set
- 8 Positive plate set
- 9 Positive pole bridge
- 10 Acid agitation pipes (for flooded batteries)
- 11 Lead strip for insulation measurement
- 12a Service plug or valve (vent system)
- 12b Backflash arrestor (alternative vent system)
- 13 Acid level indicator (for flooded batteries)
- 14 Protection rubber bag
- 15 Glass fibre container and cover



## Training, service and support

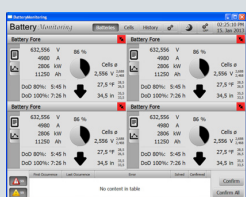
### Technical assistance

- Batteries, monitoring, and infrastructure all protected over their lifetime
- Charging and discharging devices for battery commissioning
- Complete battery-sets incl. connectors and acid-agitation system
- Measuring devices for battery surveillance, voltages recording
- Special tools for maintenance on-board
- Spare parts and tools for onshore maintenance
- All relevant technical documentation for operation and maintenance of propulsion batteries

### Capacity Tests

- Execution
- Supervision

### Battery Monitoring System and accessories

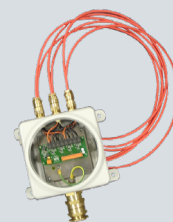


### PMU (Process Monitoring Unit)

- Central data management
- MMI management (Man-Machine Interface)
- Battery status calculation
- Archive management
- Optional interface to the submarine network

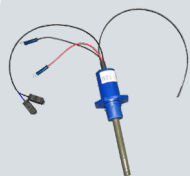
### Service

- On-board battery installation and dismantling support provided
- Activation of dry charged batteries onsite (Naval Base, Dockyard)
- Assistance for regular maintenance
- Execution of unplanned maintenance
- Training of navy and shipyard personnel



### DCO (Data Concentrator)

- Explosion-proof and ATEX certified



### RSU (Remote Sensor Unit)

- Explosion-proof and ATEX certified
- Local and remote operation mode with two three-color LED's
- Communication via fibre optic links
- Measures electrolyte level, temperature, voltage with local status indications

# Energy that goes beyond.

- Automotive battery plant
- Industrial battery plant
- Submarine battery plant
- R&D facility
- Recycling
- Global HQ
- Principle sales offices
- + Sales offices and distribution centers across the world



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|----------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------|
| All manufacturing plants<br><b>ISO 9001</b><br>certified | All automotive plants<br><b>IATF 16949</b><br>certified | All manufacturing plants<br><b>ISO 14001</b><br>certified | All manufacturing plants<br><b>ISO 50001</b><br>certified | Most manufacturing plants<br><b>ISO 45001</b><br>certified |
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