



Powering Possibilities
Energizing Tomorrow

Calor XHT

High-Temperature Lead-Acid Battery Technology for Critical Power Systems

The Calor XHT high-temperature lead-acid battery is an innovative solution engineered for extreme heat and power conditions. Through in-depth performance data, Calor XHT demonstrates its ability to overcome the limitations of conventional lead-acid batteries in key areas such as high-temperature tolerance, high-rate power output, and extended service life, delivering enhanced power delivery + reliability.

Market Trends & Growth Drivers

Rising global temperatures and the push for greater energy efficiency are reshaping operating conditions across industries. In data centers, telecom, and energy storage, systems are increasingly exposed to high-temperature environments.

According to the U.S. Department of Energy, cooling systems consume 30~ 40% of total energy in data centers¹. To reduce these costs, many operators are increasing ambient temperatures, raising the thermal load on batteries.

At the same time, data center capacity is projected to grow from 19 GW in 2023 to 35 GW by 2030, an 80% increase². This combination of higher heat and rapid infrastructure growth is driving strong demand for batteries that deliver long-term stability, performance, and safety under elevated temperatures.

Challenges in High-Temperature

As operating temperatures rise in data centers, telecom base stations, and energy storage systems, traditional lead-acid batteries are encountering significant challenges. High temperatures accelerate the degradation of internal components, leading to reduced capacity, shortened lifespan, and heightened safety risks.

- **Shortened Lifespan:** Elevated temperatures accelerate internal electrochemical reactions. Studies indicate that for every 10°C increase in ambient temperature, battery lifespan is reduced by approximately 50%.
- **Grid Corrosion:** High temperatures speed up the corrosion of the positive grid in lead-acid batteries. This oxidation weakens the grid structure, compromising battery integrity and lifespan.



- **Water Loss:** Heat accelerates water evaporation, increases electrolyte density, and deteriorates battery performance over time. Batteries operating continuously in hot environments are particularly susceptible to rapid water loss.
- **Increased Internal Pressure and Structural Deformation:** Under high temperatures or overcharging conditions, significant amounts of hydrogen and oxygen gases can accumulate. If not properly vented, this raises internal pressure, potentially causing casing swelling or deformation.

In an era where elevated temperatures, space constraints, and uptime expectations are redefining infrastructure demands, how can backup systems evolve to deliver **greater resilience, higher output, and longer service life**, without compromising reliability or driving up operating costs?

Calor XHT: Built for the Heat, Designed for Reliability

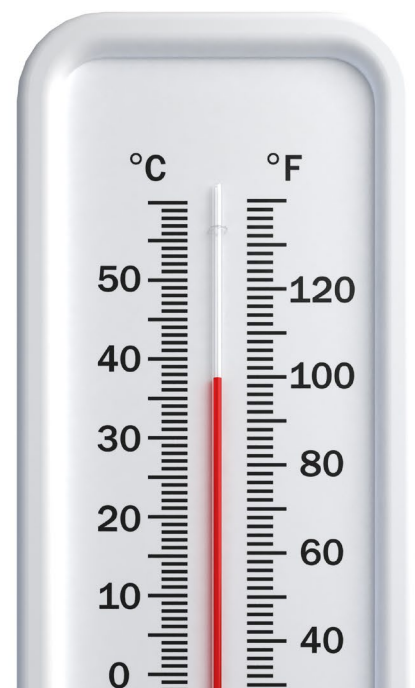
Introducing the Calor XHT; a purpose-built series to address the most critical challenges faced in high-temperature environments. Calor XHT maintains high performance under thermal stress, delivers rapid and reliable power output, and extends operational lifespan far beyond that of conventional lead-acid batteries.

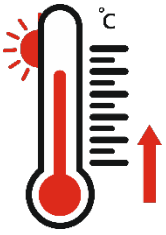
- The new lineup includes three high-power SKUs delivering 7000W, 8000W, and 9000W per battery at 5-minute rates.
- Pure Lead VRLA Technology with Catalyst 2X for enhanced conductivity and thermal stability.
- Front and top access options enable quick and convenient installation and servicing.
- Reinforced with PC-ABS plastic casing for high-temperature resistance and impact protection.
- Delivers up to 500kW (480Vdc @ 30-sec) perfect for critical backup
- 40% higher power density compared to standard high-temperature batteries.
- Wide temp range: -40°C to 65°C for demanding environments
- UL 1973 certified, and UL 1989 recognized for safety and reliability.



XHT7000FT/8000FT/9000FT 12V VRLA-AGM

Calor XHT was developed to meet the demands of high-temperature applications, introducing four key innovations that set a new benchmark for lead-acid battery performance.





High-Temperature Resilience

Equipped with our proprietary Catalist 2X, the Calor XHT battery significantly enhances internal chemical reactions, allowing it to maintain stable and efficient operation even under harsh high-temperature conditions. The battery casing is reinforced with high heat-resistant and impact-resistant PC-ABS plastic, ensuring thermal endurance to meet the most demanding applications.

Superior High-Rate Discharge Capability

The Calor XHT series offers over 40% higher power density compared to typical high-temperature batteries. Rigorously tested and certified, it delivers up to 500kW of instantaneous power within just 30 seconds under 480VDC conditions. This ensures dependable high-power output for mission-critical infrastructure such as data centers, telecom base stations, and industrial systems, providing immediate and stable power during emergencies.



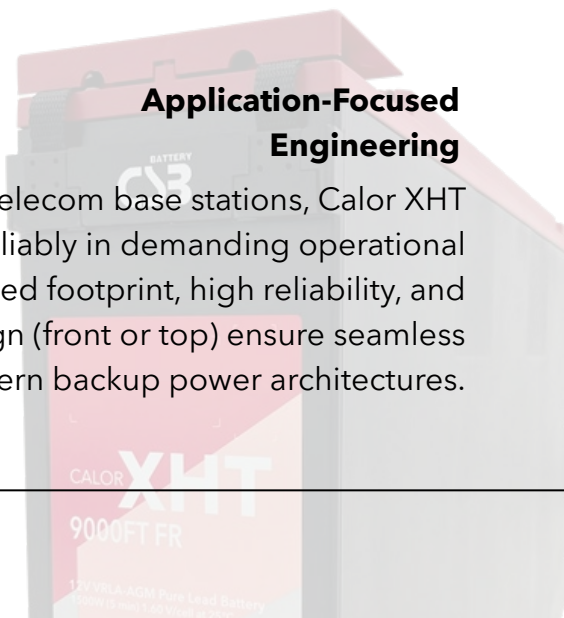
Long Service Life by Advanced Design



In an industry where lead-acid battery lifespan is often compromised by heat and grid corrosion, Calor XHT stands out with a suite of enhancements: catalyst technology, pure lead plates, a proprietary separator design, reinforced housing, and thermally stable internal structures. These innovations collectively extend operational lifespan significantly.

Application-Focused Engineering

Whether installed in data centers or telecom base stations, Calor XHT is engineered to perform reliably in demanding operational environments. Its optimized footprint, high reliability, and maintenance-friendly access design (front or top) ensure seamless integration into modern backup power architectures.



Calor XHT

powered by **CSB Catalyst 2X**

The Calor XHT series incorporates CSB's proprietary **Catalist 2X**, by using VRLA catalysts inside the battery specifically developed to mitigate these degradation pathways and significantly extend battery life.

Catalist 2X is a high efficiency catalyst module developed by CSB specifically for the Calor XHT series of VRLA batteries. Its primary function is to promote the recombination of hydrogen and oxygen gases inside the battery ($H_2 + \frac{1}{2}O_2 \rightarrow H_2O$), effectively reducing gas emissions, internal pressure, and water loss. This enhances battery stability and extends service life, particularly under high-temperature or long-duration float charge conditions.

Beyond gas management, the catalyst also influences the electrochemical polarization behavior of the battery plates. By stabilizing the negative plate potential and relieving polarization stress, **Catalist 2X** helps reduce float current, mitigate positive grid corrosion, and improve overall electrochemical performance, making it a key technology for improving battery reliability and longevity.



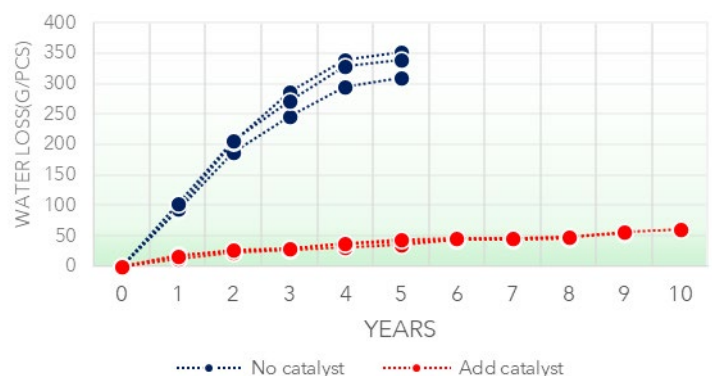
Catalist 2X also significantly reduces water loss from the electrolyte, a common failure mode in lead-acid batteries operating under high temperatures. Water loss not only increases electrolyte specific gravity but also leads to cell dry-out, a critical condition that compromises battery performance and safety.

Test data demonstrates that batteries equipped with the catalyst show substantially lower water loss over identical testing cycles compared to conventional designs. This enables the battery to maintain optimal electrolyte balance over time, greatly reducing the need for maintenance and minimizing operational risks.



Catalist 2X Cutaway Diagram

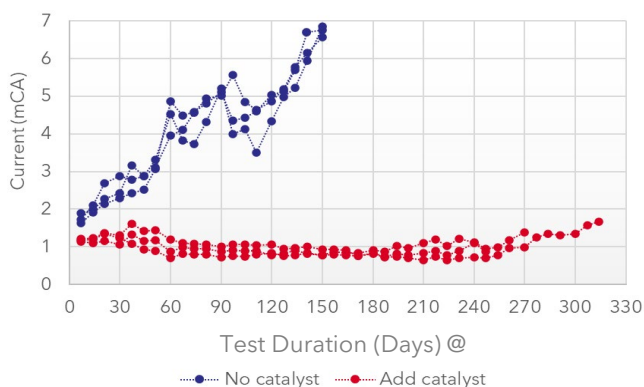
Trickle Life Water Loss



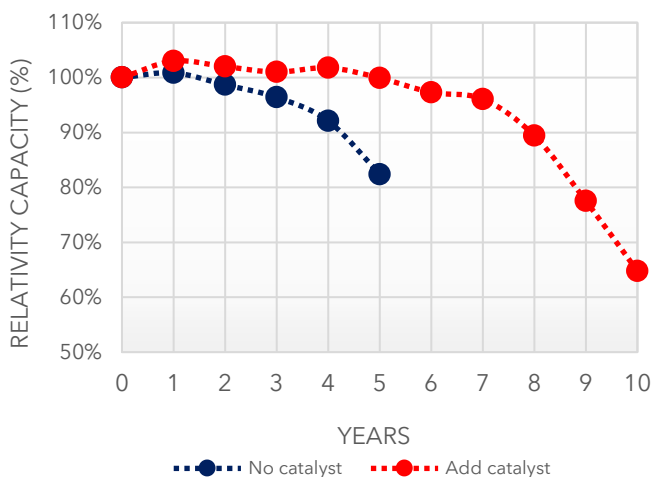
Catalist 2X also promotes the ability to operate the battery at a significantly lower float current to keep the batteries fully charged longer over time. The ultimate impact is reflected in the battery's overall lifespan.

According to performance testing, batteries equipped with the catalyst retained over 90% of their capacity even after multiple high-stress test cycles. This clearly demonstrates that Calor XHT is more than just a high-temperature-resistant battery, it is a system-level solution designed to extend operational life and enhance energy reliability.

Trickle Life - Float Current



Trickle Life @ 60°C

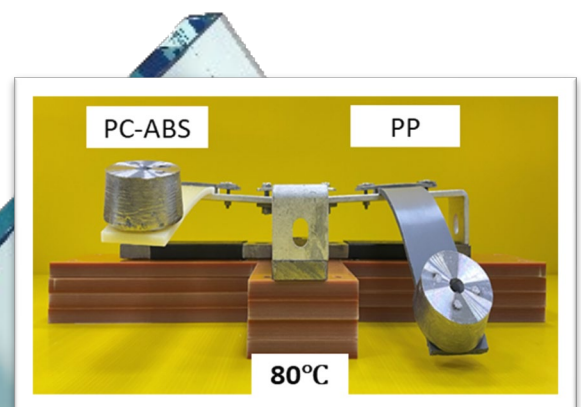


High-Rigidity Flame-Retardant Casing Design

Calor XHT addresses this challenge with a UL94 V-0 flame-retardant PC-ABS casing, offering superior heat resistance and structural integrity compared to traditional ABS or PP enclosures.

With a higher Heat Deflection Temperature (HDT), the casing maintains its shape during prolonged float charging and high-rate discharges—effectively reducing deformation risks.

As shown below, Calor XHT exhibits significantly lower deformation rates at elevated ambient temperatures (40°C to 80°C) compared to standard battery casings. This highlights its ability to perform reliably in mission-critical, heat-intensive environments.



PC-ABS Rigidity Example

High-Efficiency Conductive Structure

Calor XHT is specifically engineered for high-rate discharge applications, where rapid and efficient conduction of large currents is essential.

If electrical conductivity is insufficient, a significant portion of energy is lost as heat. Prolonged operation under such thermal stress can adversely affect connection points and significantly increase the risk of battery failure over time.

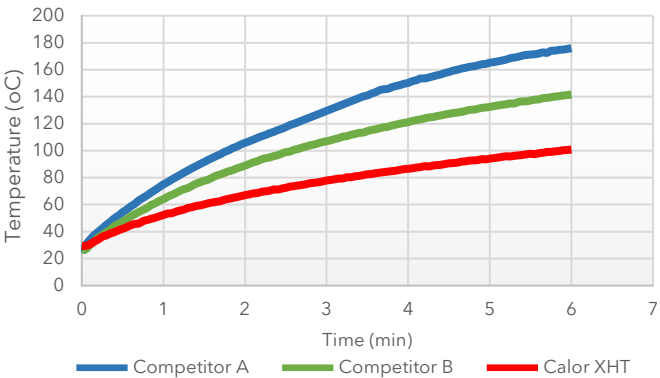
To address this, the Calor XHT series features a newly integrated intercell connection design that minimizes the conductive path between the internal straps and terminals. This improvement reduces resistance and heat generation during high-current discharge.

As shown in graph above, during a 700A discharge test, the XHT9000FT exhibited the lowest temperature rise at the inter-cell connection area compared to other front-terminal high-rate batteries. This performance advantage is directly attributed to its proprietary one-piece conductive structure. The result is reduced thermal stress, improved reliability, and enhanced conductivity enabling the battery to deliver higher power output more frequently and with greater stability.

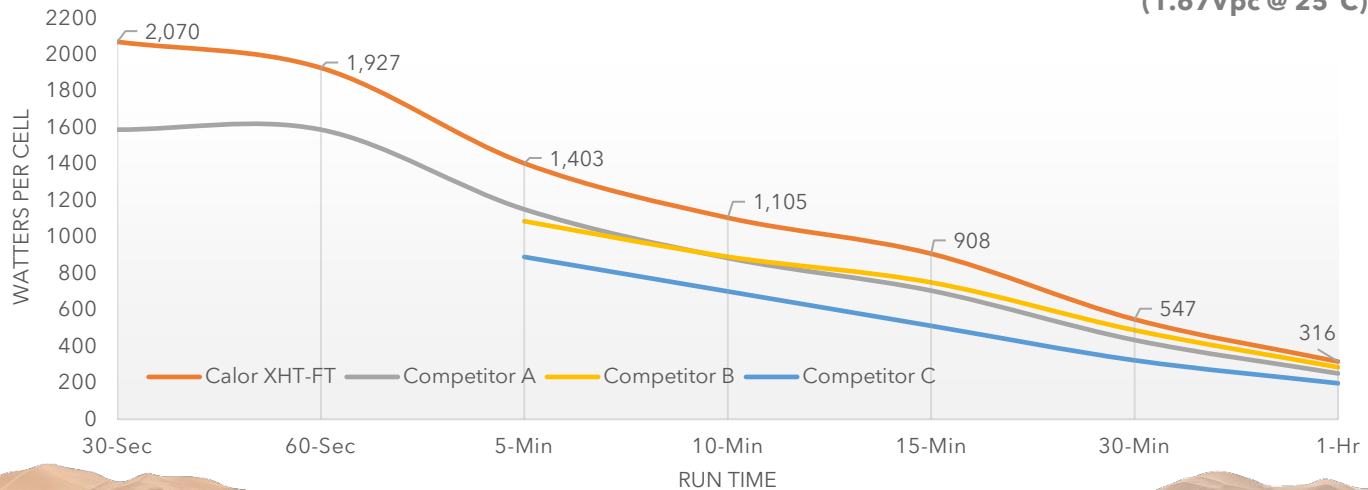
The advanced conductive structure is what empowers the Calor XHT series to achieve true ultra-high-rate discharge capability. As shown by the red line, Calor XHT outperforms comparable products in average power output, particularly under short-duration, high-rate conditions.

Its proprietary one-piece connection design minimizes internal resistance and heat buildup, enabling higher power delivery with lower temperature rise, delivering superior efficiency and thermal stability in demanding applications.

Runtime v.s Intercell Connections Temperature



Average Watts Per Cell - High Temperature, High Rate Series
(1.67Vpc @ 25°C)



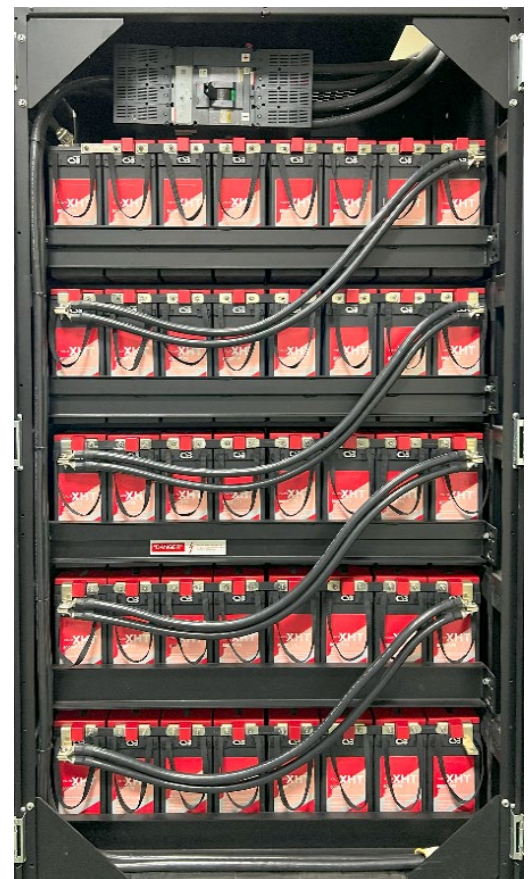
Flexible Installation & Servicing

Front terminal batteries – Calor XHT-FT series are commonly referred to as “narrow” batteries. These are typically 12V units with terminals positioned on the upper section of the short front face, allowing seamless integration into standard 19-inch or 23-inch racks and cabinets.

Thanks to an increased surface area along the depth of the battery, front terminal configurations offer enhanced heat dissipation. This design significantly reduces the likelihood of thermal runaway under high-rate or elevated-temperature conditions.

When installed vertically in an upright position, front terminal batteries not only save valuable floor space in equipment rooms, but also simplify installation and maintenance, ensuring faster, safer handling. As illustrated in picture, a string of 40 Calor XHT-FT fits cleanly into a standard front-access cabinet, demonstrating excellent space efficiency.

For installations that require top-side cable routing or specific DC busbar arrangements, users can easily switch to a top-access configuration. With a simple terminal adapter kit, the Calor XHT-FT enables fast reconfiguration between front and top access, offering exceptional flexibility for diverse layout and wiring needs.



XHT9000FT Battery Cabinet 480Vdc

Space Efficiency

Calor XHT delivers superior volumetric power discharge density compared to competitor front-terminal batteries, enabling more efficient energy output within the same physical footprint. This makes it a more effective and reliable choice for space-constrained environments such as data centers and telecom installations.

In addition to minimizing physical footprint, deploying fewer strings also lowers the total system complexity and improves ongoing maintenance efficiency—delivering both CAPEX and OPEX benefits across the battery lifecycle.





In-Case Formation for Sustainable Production

The Calor XHT battery line adopts the In-Case Formation (ICF) process, where cured plate groups are assembled directly into the battery case. Sulfuric acid is added, and formation occurs in a sealed container through a temperature-controlled water bath. This method prevents acid mist and lead emissions while improving process consistency and product quality, ICF advantages include:

- **Reduced water usage**
- **Lower carbon emissions**
- **Greater charging efficiency and uniformity**

With automated ICF, CSB saves 75,587 tons of water and cuts CO₂ emissions by 60% annually. Additionally, the Calor XHT production incorporates low- and zero-carbon technologies such as high-efficiency equipment, process optimization, and solar energy—supporting CSB's long-term path toward net-zero emissions.

Conclusion

Calor XHT is a next-generation high-temperature lead-acid battery designed for demanding environments. With **Catalist 2X**, enhanced thermal tolerance, and high-rate performance, this technology overcomes the limitations of traditional batteries. Its compact, service-friendly design and clean ICF production make it ideal for data centers, telecom, and backup power.

More than a battery, Calor XHT is a resilient and future-ready power storage solution.

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1. Doe announces \$40 million for more efficient cooling for data centers. Energy.gov. (2023, May 9). <https://www.energy.gov/articles/doe-announces-40-million-more-efficient-cooling-data-centers>
2. Walton, R. (2024, May 30). US data center electricity demand could double by 2030, driven by Artificial Intelligence: EPRI. Utility Dive. <https://www.utilitydive.com/news/artificial-intelligence-doubles-data-center-demand-2030-EPRI/717467/>

About CSB

CSB is a leading and globally recognized manufacturer of VRLA batteries. The company was established in 1987 through a technological joint venture with Shin-Kobe Electric Machinery of Japan. Through its commitment to cutting-edge technology and service, CSB has earned the trust of customers worldwide and forged long-lasting relationships.

- CSB has over 100+ batteries and 13+ different series designed for multiple applications including UPS, Telecommunications, Renewable and Electric Vehicle, among others.
- CSB is focused on Quality management. All CSB's factories are ISO 9001 certified.
- CSB is dedicated to fostering a Sustainable environment, as evidenced by its ISO certifications ISO 14001 (Environmental Management) and ISO 50001 (Energy Management), as well as through its Eco-Friendly production processes.
- CSB possesses global service support capabilities, with factories, sales offices and warehouses located strategically throughout Asia, Europe, and the Americas. We also have an extended network of 150+ key distribution partners across all major regions and countries.

