

# The Advantages of Aqueous Hybrid Ion Batteries Over Lithium Ion Batteries



		Aqueous Hybrid Ion (AHI™)	Lithium Ion
<b>Safety</b>	<b>Failure</b>	Aqueous electrolyte is non-toxic, non-caustic, and non-flammable. Battery remains safe if over-charged and has passed UL over-charge abuse testing.	Susceptible to thermal runaway, over-charge, short circuit, and gassing conditions. In the event of a fire, batteries can emit highly toxic gas.
	<b>Shipment and transportation</b>	Classified as standard goods. No special handling required.	Classified as Class 9 hazardous goods for shipment and handling. Special provisions required.
<b>Robustness</b>	<b>Calendar life</b>	Can be installed for up to several months from shipment, granting more application flexibility. No life-limiting side reactions while not in use.	Requires installation within 2-3 months from time of shipment due to irreversible side reactions while not in use.
	<b>Routine maintenance cycling</b>	Does not require maintenance cycling to maintain performance and life.	Many chemistries will experience degradation without regular maintenance cycles.
	<b>Recommended operating temperature range for optimal battery life</b>	-5°C to 40°C. AHI batteries are characterized at 30°C and are far less susceptible to operational temperature swings.	23°C to 28°C. Deviation from this temperature range impacts cycle life and overall performance significantly.
<b>Ease of Use</b>	<b>Auxiliary loads</b>	Operates without auxiliary loads. Doesn't need an external power supply for an HVAC system, safety circuits, etc.	Requires separate power supply for auxiliary loads from HVAC and lighting, increasing costs and losses and reducing overall efficiency.
	<b>Permitting</b>	Inherently safe chemistry may mitigate permitting concerns.	Safety concerns have led some municipalities to require permits for residential and commercial applications.
	<b>Fire suppression</b>	Chemistry not capable of thermal runaway. No fire suppression system required.	Can require costly fire suppression systems due to potential for thermal runaway and explosion.
	<b>Thermal management</b>	Generally none required, depending on the environment's ambient temperature.	Active thermal management required for safety, recommended for optimal battery life, and usually required to maintain warranty.
	<b>Recycling</b>	Mechanical materials can be recycled in normal recycling streams. Chemical materials can be disposed of safely without any special equipment or containers.	Must adhere to specific recycling requirements, which can add \$2.50–\$5.00/lb, adding hidden costs to ownership.

DISCLAIMER: This document reflects the general attributes of lithium ion batteries as compared to AHI batteries. Actual attributes of specific batteries and chemistries may vary.