



LIQUID THERMAL MANAGEMENT FOR BATTERY ENERGY STORAGE SYSTEMS

Optimize battery temperature and maximize performance with circulating liquid conditioning.

Improved Performance Starts Here[®]

Liquid Cooling / Heating and Integrated Controls



PROVEN THERMAL MANAGEMENT

The industrial temperature control unit provides cooling and heating of water/glycol mixtures for liquid-based thermal management. Consisting of a hermetic vapor compression system, pump, and full controls, the system has cooling and heating capacity up to 4 kW*. The unit is rated to UL1995 standards.

CONTROLLED PRECISION

The unit's controls integrate with the battery energy storage system (BESS), optimizing battery temperature based on operating conditions to maximize battery performance. The battery module, coolant, and enclosure temperatures are continuously monitored. When needed, temperature control is initiated before the coolant temperature changes, compensating for the inherent time lag in liquid thermal capacity. Overall, the system optimizes battery temperature while using a lower parasitic load than standard HVAC systems.

MAXIMIZED BATTERY AVAILABILITY

The high heat capacity of coolant paired with proper thermal coupling at the modules minimizes temperature variation during charge and discharge. Batteries benefit from the thermal management unit running during balancing, ensuring battery cell temperatures are consistent system wide. Charge/discharge capacity is maximized when kept at consistent temperatures, extending battery life.

Length	Width	Height	Weight
38"	24"	38"	300 lbs
965 mm	610 mm	965 mm	136 kg

* Cooling/heating capacity dependent on ambient temperatures

Battery Rack and Fluid Manifold



MODULE DRIVEN DESIGN

Paired with the liquid thermal management unit, the purpose built battery rack features an integrated fluid management system with cold plates for direct delivery of coolant to the exterior of the battery modules. Built to accommodate customer specific battery form factors, the rugged, seismic-rated rack** features easy access trays for modules service.

EFFICIENT AND BALANCED

The integrated fluid management system consists of a supply and return manifold that connects to the cold plates with quick disconnect couplings, allowing battery operation without interference as well as easy battery removal without draining the system. The supply side includes flow balancing valves on each circuit to ensure uniform flow and heat transfer between the battery modules.

TARGETED BATTERY CONDITIONING

Efficient temperature conduction is achieved through integrated cold plates under each battery module. Connected to the fluid manifold, the plates are the end point for the circulating coolant, facilitating the module conditioning needed for optimized performance. An additional outlet on the cold plate allows for condensation to be captured under the battery modules and routed to the bottom of the rack for drainage. An integrated fluid sensor on the bottom of rack can alert operators of any leaks.

** 19" Standard EIA-301-D rack
ANSI MH16.1 site class D

SETTING THE STANDARD

For over 75 years, Hotstart has been designing and manufacturing thermal management solutions for OEMs and end users. Circulating liquid conditioning is a more effective heat transfer method than traditional air conditioning, providing reliable temperature management across the system.

Hotstart's thermal management system (TMS) interfaces with the battery energy storage system (BESS) to respond when needed, managing battery modules at optimized temperatures. Hotstart systems are suitable for behind-the-meter and front-of-the meter BESS applications including utility, power producer, commercial & industrial firms, and microgrids. Liquid TMS supports both high power and energy applications.

RACK: designed to battery module specs to optimize heat transfer

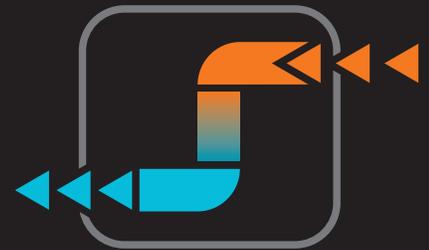
FLUID DISTRIBUTION: system manifold distributes conditioned glycol to cold plates on rack trays

CONDITIONER: cools or heats glycol as needed to maintain specified temperature range

CONTROLS: integration with BMS allows for real-time response to system requirements

TARGETED COOLING

Using a liquid-based thermal transfer medium allows for targeted cooling of battery cells. Heat is removed from the system maintaining the narrow temperature band for optimal operation.



ACTIVE HEATING

Energy storage applications in cold ambient environments can use the same liquid-based thermal transfer medium to introduce heat to the battery modules during charging to achieve optimal cell temperature.

