

Immersion Cooling - Technical Discussion

Immersion cooled battery module

As battery-powered applications demand higher energy densities and power outputs, thermal management has become a critical challenge. Traditional cooling methods, such as air and liquid cooling, often struggle with uneven heat dissipation, leading to hotspots, efficiency losses, and potential thermal runaway risks.

Immersion cooling offers a highly effective solution by submerging battery cells in a dielectric liquid, enabling direct heat dissipation, uniform temperature distribution, and enhanced safety. This approach eliminates the need for complex cooling loops and significantly improves battery performance, longevity, and reliability. The solution also has significant advantages in cold environments.

Chillwind has significant longtime experience in immersion cooling of battery modules. Order one of Chillwind's off the shelf products or let us adapt and design to your requirements.

KEY FEATURES

- Extremely compact
- Immersion cooled
- High fire safety
- Fast response (charge to discharge)
- High C-rate
- Efficient cell cooling
- Efficient cell heating
- Adaptable technology



Advantages of Immersion Cooling in Key Applications

In **Drone** applications, where lightweight and compact designs are crucial, immersion cooling provides an effective thermal management solution without adding bulky radiators or cooling systems. By submerging pouch cell batteries in a dielectric fluid, it ensures efficient heat dissipation and prevents thermal runaway, which is essential for safe operation in **UAVs**. This method also improves battery lifespan, allowing for longer flight durations and greater reliability in varying environmental conditions.

For high-performance electric motorcycles **“MoPe”**, immersion cooling enables sustained high-power output without the risk of overheating. It reduces thermal stress on high-discharge-rate cells, thereby enhancing battery longevity even under aggressive acceleration and heavy loads. Compared to traditional liquid-cooled systems, immersion cooling simplifies the overall design by eliminating complex cooling loops, reducing weight, and increasing efficiency. Additionally, it improves rider safety by minimizing the risk of overheating and potential fire hazards. The ability to maintain stable temperatures during rapid charging also allows for faster recharge cycles, while the compact nature of immersion-cooled battery modules contributes to more aerodynamic and space-efficient motorcycle designs.

In large-scale energy storage systems **“ESS”**, immersion cooling significantly enhances thermal efficiency by ensuring even heat dissipation across battery modules. This reduces degradation over time, extending system longevity and lowering maintenance costs. As energy storage systems require high power output for applications such as grid stabilization and industrial energy reserves, immersion cooling supports higher discharge rates without compromising efficiency. By preventing thermal runaway propagation in densely packed battery configurations, it also improves overall system safety, making it a viable solution for the growing demands of large-scale energy infrastructure.

Contact Chillwind to get help with your immersion cooled battery module.