

TITLE: Phase Change Materials in a Hot Tub

SPONSOR: Master Spas

Proposal/Scope

In a hot tub, heat loss from the water to the ambient air is one of the primary drivers of energy consumption. While current insulation methods provide some improvement, the latent heat characteristics of phase change materials could provide a unique opportunity to improve thermal performance. Some of the advantages of implementing phase change materials in a hot tub include:

- Provides high energy density in a small volume.
- Acts like a battery or “thermal flywheel” (i.e., delivers near-constant temperature buffering by absorbing heat at a targeted temperature, and then releasing it when needed).
- Smooths out energy consumption and allows for off-peak load shifting.

There are several challenges that must be overcome for phase change materials to be practically applied in a hot tub:

- The size and shape of the materials must fit within the tight space constraints and complex geometry on the underside of a hot tub.
- Allowances must be made for expansion and contraction of the material, as well as ensuring long-term cycling ability and stability.
- The material must have an appropriate melting point and thermal conductivity for the temperatures encountered in a hot tub environment.
- Any concerns with material safety, flammability, toxicity, and containment/leak prevention must be addressed.
- Installation of the materials must be easy and straightforward from a manufacturing perspective.
- The cost must be as low as possible to maintain affordability for the consumer (reasonable return on investment, where the higher initial cost is offset by ongoing energy cost savings).

The goal of this project is to investigate, specify, and test a suitable and practical phase change material in a hot tub.

Budget: \$10,000