



ESS Thermal Management

IFP 649 & WATER



ENERGY Series

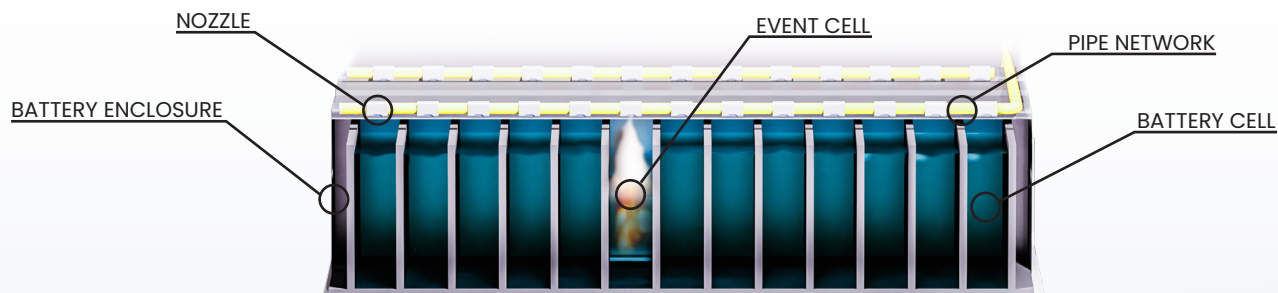


IFP Thermal Management

IFP 649

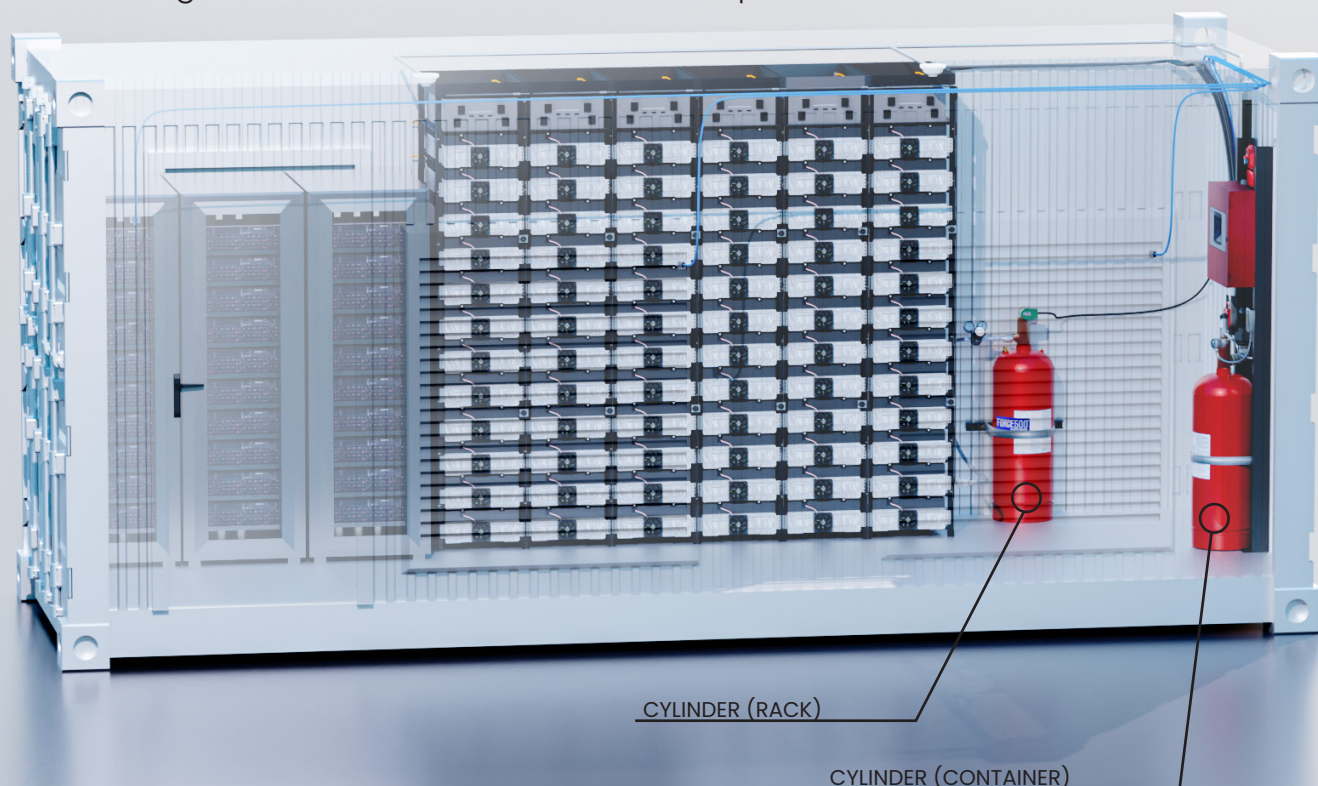
What does it do?

IFP's Thermal Management System detects, controls, and contains the chance for a lithium-ion battery cell to thermally transfer heat to adjacent cells, preventing uncontrollable thermal runaway.



How does it work?

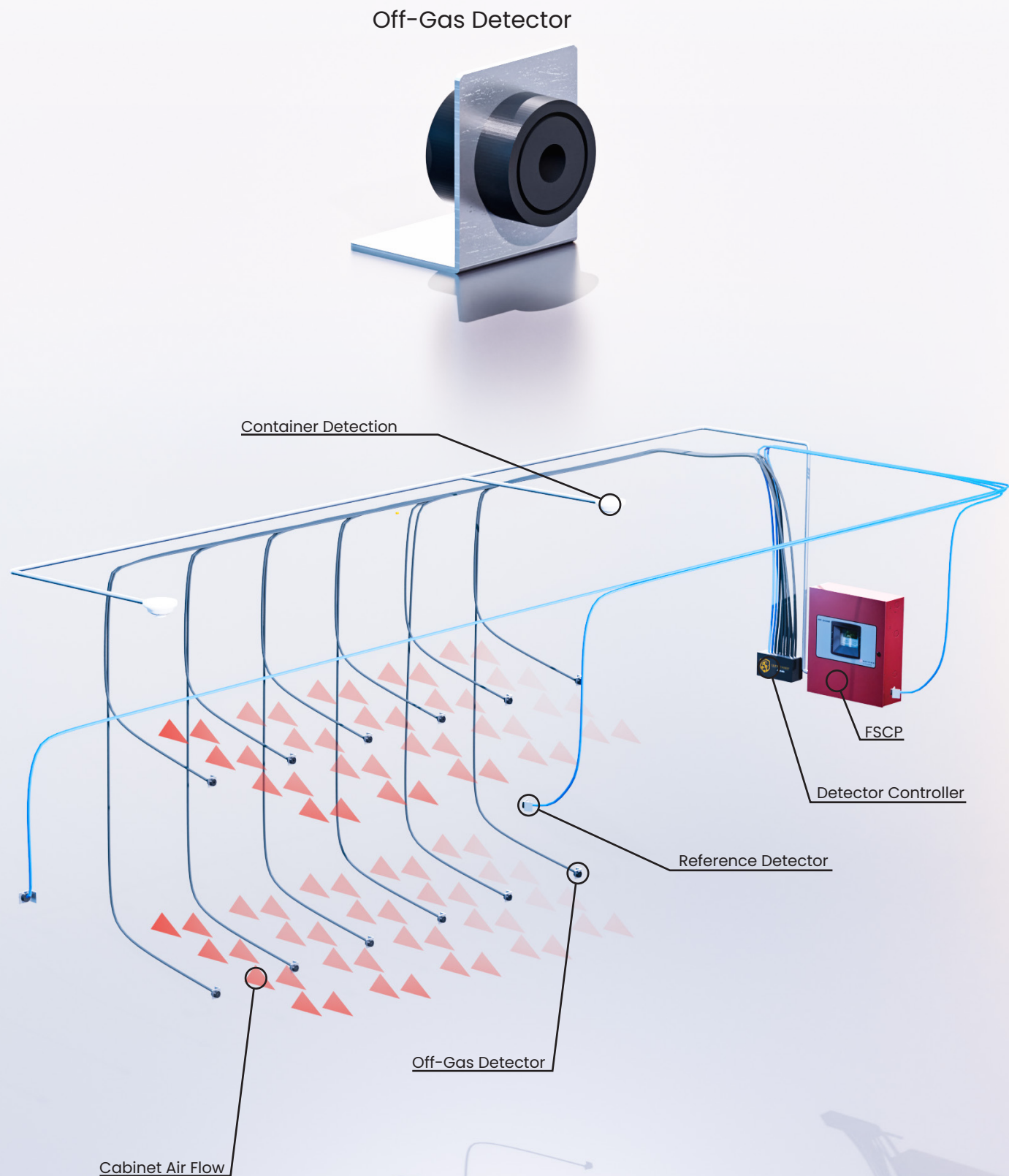
IFP's proprietary thermal management system utilizing IFP 649 fluid, bathes an overheated battery cell in our high heat capacity fluid by direct injection via a pipe network to the site of affected cell. By bathing the cell in IFP 649 fluid, the thermal event is controlled and heat transfer to the adjacent cells is contained, thus preventing uncontrollable thermal runaway. IFP 649 is electrically non-conductive, leaves no residue, is environmentally safe, and doesn't damage that which it is intended to protect. This means that while IFP 649 is controlling the affected cell, the remaining cells in the rack can continue to operate as intended.



IFP Thermal Management System

How does it detect the fire?

IFP's Thermal Management System detects fire utilizing off-gas detectors.

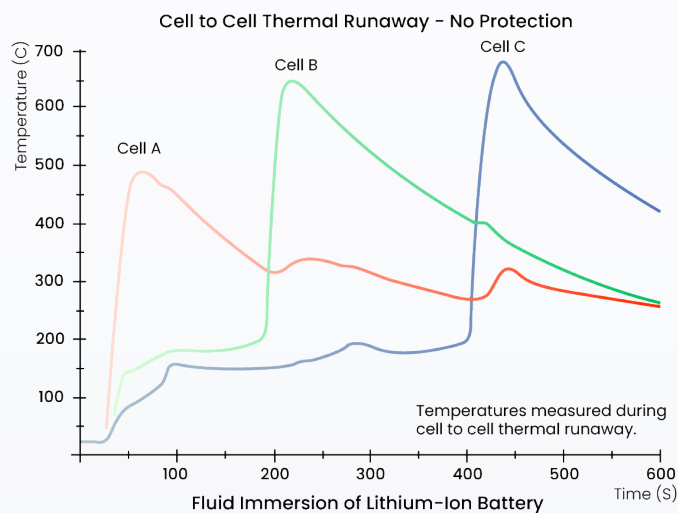


IFP Thermal Management System

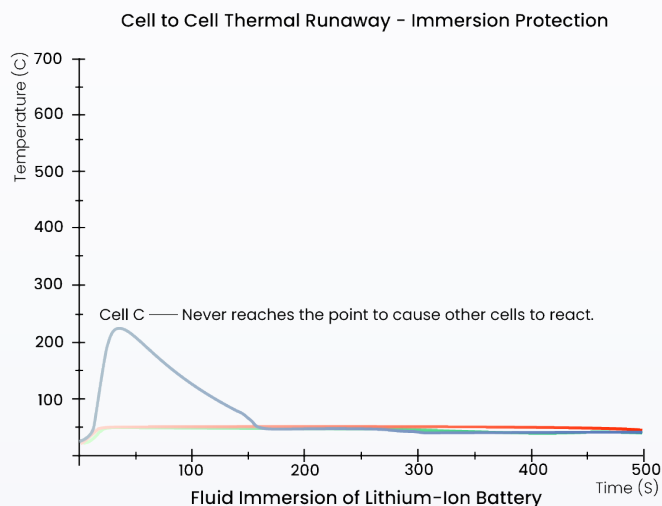
Testing

Below are graphs comparing thermal runaway with and without direct injection protection. We are protecting battery cells before they have a chance to develop a thermal event. If we contain one cell, we can prevent it from spreading to others.

NO PROTECTION



PROTECTION



Application of Fluid Immersion for Increased Safety of Lithium-Ion Battery and Electronic Devices. 3M Company, EMSD, Fire Protection Lab, St. Paul, Mn

See the system in action

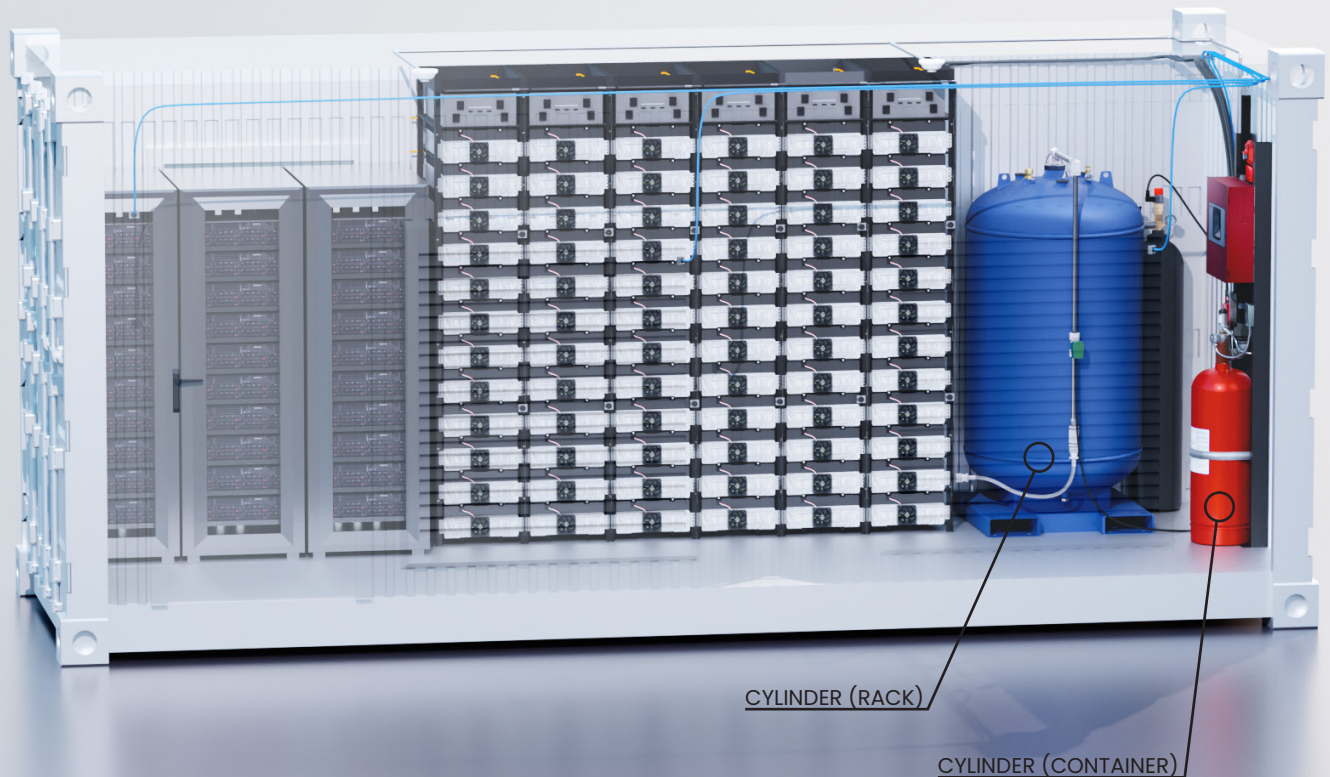
Click on the YouTube icon below to view our solution in action.



IFP Thermal Management Water

How does it work?

IFP's proprietary thermal management system utilizing water, bathes an overheated battery cell with water by direct injection via a pipe network to the site of cell damage. By bathing the damaged cell with water, the thermal event is isolated as heat transfer to adjacent cells is contained, preventing uncontrollable thermal runaway.





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