

F-500 Portable Fire Extinguishers



Ultimate protection against lithium-ion battery fires for the marine, commercial and private sectors

The power behind **your mission**

Johnson
Controls 

Superior fire protection for lithium-ion battery fires

From mobile phones to power batteries for ship propulsion systems, lithium-ion batteries power devices used every day in the marine, commercial, and private sectors.

As they have a high energy density, even lithium-ion batteries used in smaller devices – such as laptops, appliances, tools, and jet skis – present a variety of fire hazards that demand superior fire protection.

These batteries pose risks that include overheating—especially during charging—and internal pressure buildup that can lead to the explosion of the battery.

Multi-cell batteries can present an even higher risk, as neighbouring cells can ignite and transform the entire battery into a hazard with temperatures potentially exceeding 1000°C/1832°F.

Also, external forces, such as mechanical damage or external heat sources, can cause the battery to become a fire hazard.

Fire protection for these hazard areas must:



Suppress the lithium-ion battery cell fire



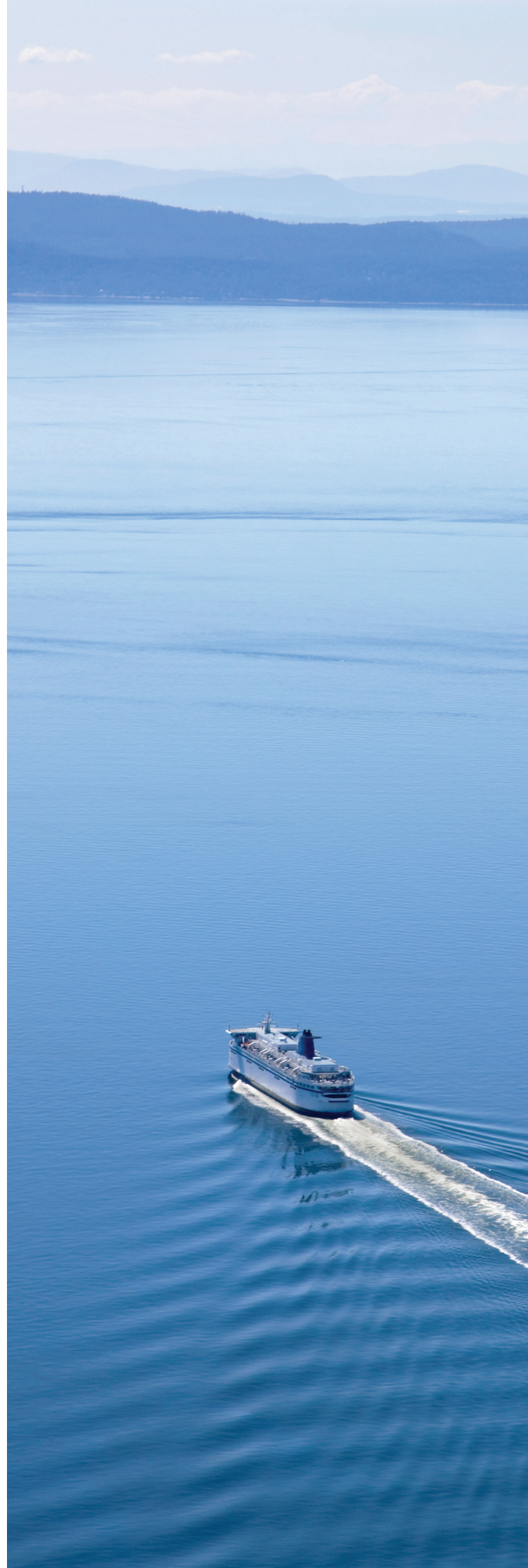
Cool the battery cells to help stop self-heating



Halt the ignition of neighbouring cells (thermal runaway)



Help ensure the safety of people in the hazard areas



New F-500 portable extinguishers really deliver

The new F-500 fire extinguishers provide superior protection through the cooling of superheated surfaces; high penetration of the extinguishing agent into the flammable material; and encapsulation of liquid fuel and potentially toxic exhaust gases. Fire extinguishers that blanket the burning battery with the goal of cutting off oxygen to help prevent reflash (e.g., D-powder) have not yielded positive results in practice. In some cases, a lithium-ion battery may release oxygen itself when burning, and the explosions of the cells can destroy the battery's casing because of the kinetic energy of the violently discharged gases.

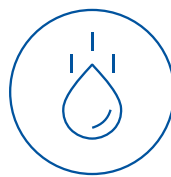
Why does the F-500 extinguisher agent succeed where other agents fail?

The F-500 extinguishing agent has proven more effective than other commonly used agents in the areas of cooling, agent penetration, and reduction of toxic gases.



Stronger cooling effect

Multiple tests have shown that the more powerful the cooling effect of the extinguisher/extinguishing agent, the more rapidly the fire is extinguished. Combining water with the F-500 additive creates a stronger cooling effect compared with pure water and other extinguishing agents (e.g., foam). The evaporation and extraction of heat begin at 70°C/158°F.



Greater penetrative effect

The surface tension of water is reduced considerably when the F-500 agent is added. This significantly increases the ability of the extinguishing agent to penetrate the battery and deliver the substantial cooling effect where it is most effective.



Reduction of toxic exhaust gases

The F-500 is an "encapsulation agent" that can envelop/contain combustibles and flammable gases, thus inhibiting their oxidizing effect (SAFE effect). This also helps reduce the impact of possible toxic exhaust gases (HF).



Two portable extinguisher models tackle a range of hazards



Cartridge-operated extinguisher
WA 9 F-500



Stored pressure extinguisher
WD 9 F-500 (MED approved)



Wheeled extinguisher
WA 50 F-500

Comprehensive testing was conducted on an E-scooter 182-cell battery (cell type 18650), a larger battery size than those generally used in devices such as mobile phones, laptops, power tools, gardening tools, model sports (e.g., remote-controlled cars, boats, drones), and E-bicycles (which can use 48-cell batteries). Neuruppin created two different portable 9L extinguisher models for lithium-ion batteries up to the tested battery type with 1890 Wh (51.1 V / 37 Ah).

These models deliver superior fire protection for a range of lithium-ion battery applications, from mobile phones to electric scooters. Additionally, a portable fire extinguisher with contents of 50 litres is available for enhanced user safety - greater extinguishing agent quantity, longer discharge time etc.

Larger risk areas, such as solar home storage (4-5 kWh), electric ferries batteries (over 15 kWh), and naval deck stations, demand the additional fire protection provided by installed F-500 extinguishing systems. These systems require sufficient supply units for the extinguishing agent in conjunction with pressure generators (pumps, propellant gas storage) or particular fire hose nozzles.

F-500 proves itself in rigorous testing

The fire hazard of lithium-ion batteries stems primarily from the flammable electrolytes – not the lithium – inside the battery. This may ignite if there is a temperature increase.

In cooperation with the Energy Research Centre of Lower Saxony (EFZN) Goslar, rigorous month-long fire behaviour tests were conducted on various types of lithium-ion batteries to address the spread of fire, temperature measurement, air emissions, and sewage water analysis with and without extinguishing the burning batteries. The extinguishing agent additive, F-500 (2 percent admixture to water), proved to be exceptionally effective.

The independent Dutch certification body KIWA, which oversees the testing and certification of extinguishing devices, tested and evaluated the F-500 extinguishing alongside common extinguishing agents such as powder and foam. Tests (KIWA no. 16120045) concluded that, of the tested agents, when used properly, only the F-500 was able to extinguish the burning lithium-ion batteries and reliably stop the spread of fire caused by thermal runaways before the cells exploded. The battery did not re-ignite in any test after suppression. This is because of the F-500's ability to penetrate and cool, a characteristic not found in dry chemical or powder agents.

Type	Result			Remark
	Nr. 1	Nr. 2	Nr. 3	
Powder Extinguisher	Poor	Poor	Poor	Do not apply on Li-ion battery fire
Foam Extinguisher	Moderate	Poor / Moderate	Moderate	Not recommended to apply on Li-ion battery fire
F-500 Extinguisher	Sufficient	Sufficient	Sufficient	Can be recommended to apply on Li-ion battery fire



Solar storage on yachts and ships



Propulsion batteries/
engine room



Large and/or unattended
battery storage areas

According to the KIWA report:

A hand fire extinguisher unit with the F-500 Encapsulador Agent as an additive is significantly better at achieving suppression mode directly after ignition of a single 1.9 kWh Cleantron battery than a hand fire extinguisher using standard powder or foam.

The F-500 hand fire extinguisher is recommended for application on a lithium-ion battery fire, taking into account the attempt to achieve suppression of a lithium-ion battery fire is not without any danger because of the possible explosive behaviour of the battery.

Advantages of the F-500 Extinguisher

	Safety	Environment
Strong cooling effect (evaporation starts at 70°C/158°F)	+	+
High penetrative effect of the extinguishing agent into the flammable material	+	+
Encapsulation of liquid fuel and exhaust gases	+	+
Significant reduction of toxic gases (HF)	+	+
Simple and safe operation	+	
Fluorine-free extinguishing agent		+
Quick and completely degradable		+
Extinguishing agent certification per UL, EN, maritime navigation regulations	+	
NATO stock number	+	
Low corrosive effect (pH value approx. 7)	+	
Fulfills EN3 specifications on the applicability with electrical systems (up to 1 kV, 1m minimum distance)	+	
Trajectory length 4–6 m	+	
Tried and trusted inner and outer plastic coating of the containers	+	
100% pressure testing of all containers	+	
Easy maintenance	+	
Made in Germany	+	

In addition to lithium-ion batteries, F-500 portable extinguishers help protect against a wide array of potential fire hazards



Solar panels



Manufacturing, processing, and storage of rubber, including tyres



Plastic and foil processing



Mixed waste (disposal and recycling)



Manufacturing, processing, storage, and warehousing of plastics. F-500 also protects small load carriers

Johnson Controls naval and marine solutions

Johnson Controls offers a complete range of turnkey solutions to the Naval and Commercial sectors within the marine industry. Our commitment is unparalleled and we remain at the forefront of our field. For more than 120 years, we have been working in partnership with the leading companies in these sectors to safeguard vessels and personnel from the threat of fire.

We operate in more than 150 countries through our unmatched network of branches and distribution channels, helping building owners, operators, engineers and contractors enhance the full lifecycle of any facility. Our arsenal of brands includes some of the most trusted names in the industry, such as Tyco®, YORK®, Metasys®, Ruskin®, Frick®, PENN®, Sabroe®, Simplex® and Grinnell®.

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