

# Hydrogel Extinguishing Instructions for Lithium-Ion Battery Fires

## Introduction

Lithium-ion (Li-ion) battery technology is integral to modern applications, ranging from portable electronics to electric vehicles and industrial equipment. Despite their efficiency and widespread use, Li-ion batteries present a significant fire hazard when damaged, improperly charged, or exposed to mechanical or thermal stress.

Understanding the nature of these risks and applying appropriate extinguishing methods is essential for ensuring safety and minimizing damage.

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## Mechanism of Li-Ion Battery Fires

Li-ion battery packs consist of multiple individual cells enclosed within plastic and/or metal housings. Fire incidents typically originate from a single defective or compromised cell.

As the internal temperature of the affected cell rises rapidly, it initiates the generation of flammable gases—a process referred to as **thermal runaway**. The resulting pressure build-up leads to rupture of the cell casing, releasing combustible gases. Upon ignition, these gases produce an intense fire.

The heat generated can propagate to adjacent cells, triggering a cascading failure and resulting in large-scale fires that are complex and hazardous to control.

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## Hydrogel Fire Suppression Technology

Anogas Hydrogel is an advanced extinguishing agent specifically engineered for lithium-ion battery fires. Its formulation has been validated through extensive testing under controlled and real-world conditions.

The Hydrogel delivers multi-functional fire suppression through:

- **Rapid and sustained cooling** to reduce cell temperature
- **Oxygen displacement**, limiting combustion
- **Chemical stabilization** of reactive lithium components

Additionally, the Hydrogel exhibits thermally activated thickening properties, enabling strong adhesion to hot surfaces and ensuring prolonged localized cooling.

Portable Hydrogel extinguishers allow application from distances exceeding 3 meters and are certified for use on electrical systems up to 1000 volts.

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## Recommended Application Volumes

Battery Type	Recommended Hydrogel Volume
Small devices (smartphones, laptops, cameras)	Minimum 2 liters
Medium battery packs (e-bikes, power tools)	Minimum 6 liters

## Industrial Applications

For large-scale or industrial Li-ion battery systems (e.g., forklift batteries), access to the ignition source may be restricted by robust enclosures.

In such cases:

- **Immediately notify emergency services**
- Deploy higher-capacity systems:
  - 25–50 liters (mobile trolley units)
  - 300–10.000+ liters (compressed air delivery systems)

Hydrogel can be used to suppress and contain the fire from a safe distance until professional responders take control.

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## Safety Considerations

- Always wear appropriate **respiratory protection** due to the release of toxic and potentially hazardous gases
- Maintain a **safe operational distance** throughout the intervention
- Be advised that while Hydrogel reduces the emission of toxic gases, it does **not fully eliminate them**

## Application Procedure

Effective application is essential. Hydrogel should be applied in controlled intervals to maintain a consistent cooling layer, with the extinguishing stream directed toward visible flames and areas where gas is being released.

Focus first on extinguishing all visible flames to prevent the fire from spreading. Once the flames are under control, apply Hydrogel to the surface of the battery pack, aiming to penetrate into the internal structure for localized cooling.

If the internal components of the battery pack cannot be reached, stop applying additional Hydrogel and reassess. Continuously monitor the situation for signs of further de-gassing or new flames, especially from adjacent batteries that may already be in an advanced stage of thermal runaway.

Repeat this process—extinguishing flames and applying Hydrogel where effective—until:

- No visible flames remain
- No new flame eruptions occur
- Audible gas emissions (such as hissing or sizzling) have stopped

At this point, the thermal runaway of the affected battery pack is considered stabilized. The Hydrogel will continue cooling the battery to a safe state, typically producing white water vapor (steam) as part of the cooling process.

Operators should maintain a safe distance and use appropriate respiratory protection. Although Hydrogel reduces the release of toxic gases, it does not eliminate them entirely, and exposure risks remain during intervention.

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## Post-Incident Management

- Monitor the affected battery for a **minimum of 20 minutes** following extinguishment
- Remain vigilant for signs of re-ignition or thermal instability

Once stabilized:

- Transfer the battery to a **water-filled containment vessel**
- Store in an outdoor or well-ventilated area, isolated from combustible materials
- Allow a cooling period of **at least 48 hours** prior to disposal

Final disposal must be conducted in accordance with applicable **hazardous waste regulations**.

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## Cleanup Procedure

Residual Hydrogel can be removed efficiently:

- Absorb excess material using appropriate cloths or absorbents
  - Rinse affected surfaces thoroughly with water
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## Conclusion

Effective response to lithium-ion battery fires requires both appropriate extinguishing agents and a clear understanding of associated hazards. Hydrogel technology provides a reliable, environmentally responsible, and highly effective solution for managing such incidents.

For additional technical information, training, or implementation support, please contact Anogas. Proactive preparation and proper response protocols are critical to safeguarding personnel, property, and the environment.