

Lithium Ion Battery Fires

Devices

E-Mobility Device



E-Mobility Device



E-Mobility Device



Burns Hotter and Faster

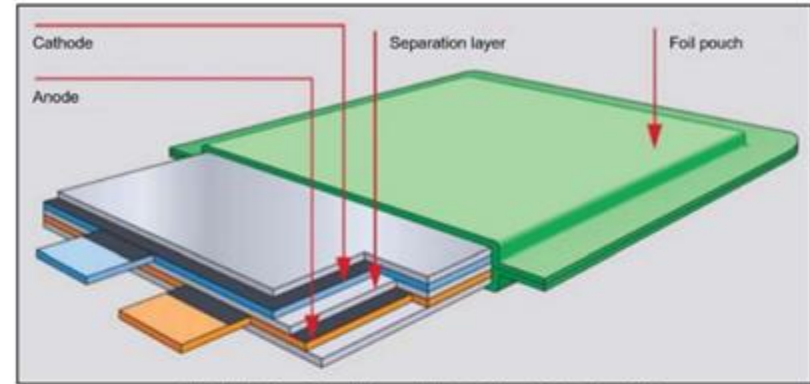


Li-ion cell construction

- **Physical format:** pouch, prismatic, cylindrical
- **Four major components:**
 1. **Cathode:** Al foil + metal oxide coating (NMC, NCA, LFP, LCO, LMO)
 2. **Anode:** Cu foil + carbon coating
 3. **Separator:** Plastics (PE, PP and 0.001" to 0.0003" thick!)
 4. **Electrolyte:** Hydrocarbons (EC, DEC, DMC, EMC, etc.), lithium salts, and "additives"
- **Safety features:** vents, switches, fuses, circuitry, "polyswitch", etc.

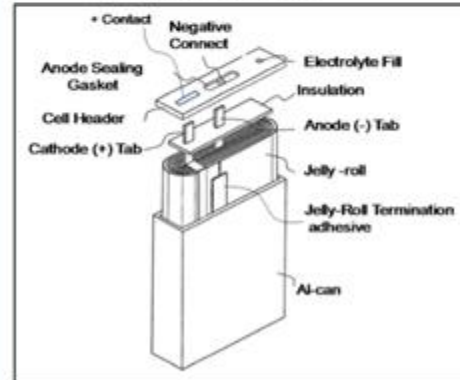
Combustible components: Cathode, separator, electrolyte, case (sometimes).

POUCH



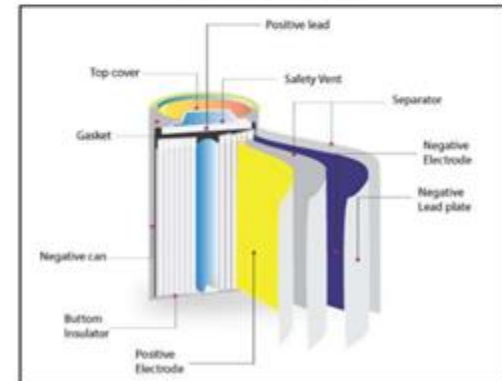
"Introduction to Lithium Polymer Battery Technology", Jauch, 2018

PRISMATIC



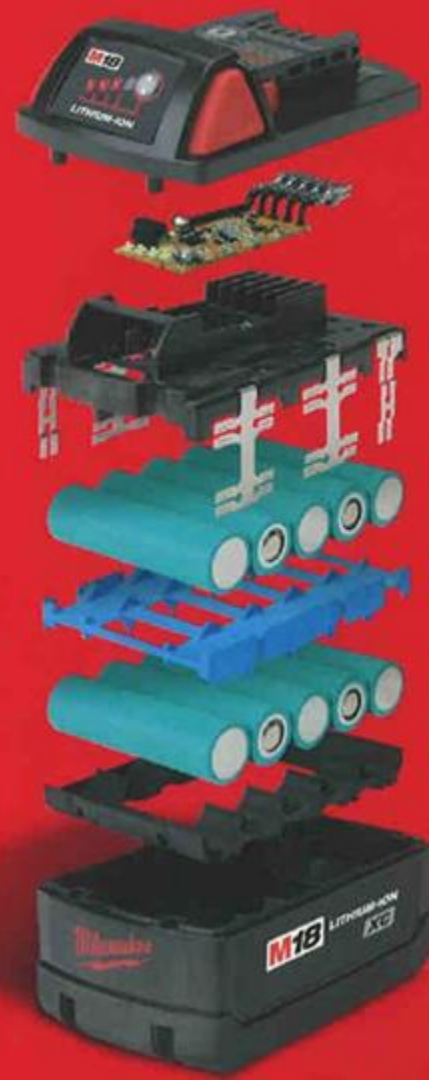
"Lithium Ion Cells/Batteries Electromagnetic Field Reduction in Phones for Hearing Aid Compliance", Maleki, H; Zurek, R.; et al.

CYLINDRICAL



<https://www.techsciresearch.com/blog/manufacturing-lithium-ion-batteries/29.html>

Lithium Ion Batteries



Thermal Runaway

“...when an electrochemical cell increases its temperature through self-heating in an uncontrollable fashion...

...when the cell's generation of heat is at a higher rate than the heat it can dissipate.”



Thermal Runaway

Points to Consider:

Time between release

Smoke / Vapor

Distance to damage

Not all cells release



Incidents

Laptop Pouch Style Battery

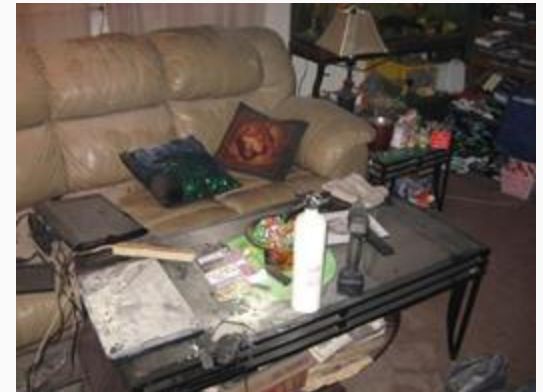
- Overheated
- Pouch expanded but did not breach



Incidents

Laptop cylindrical battery fire

- Lithium ion batteries expelled from the laptop and started multiple fires.



Incidents

Drone battery fire



Incidents

Tool battery fire



Incidents

E- Cigarette exploded and caught fire



Incidents

Milwaukee Batteries



Incidents

Medical Call



Incidents



Incidents

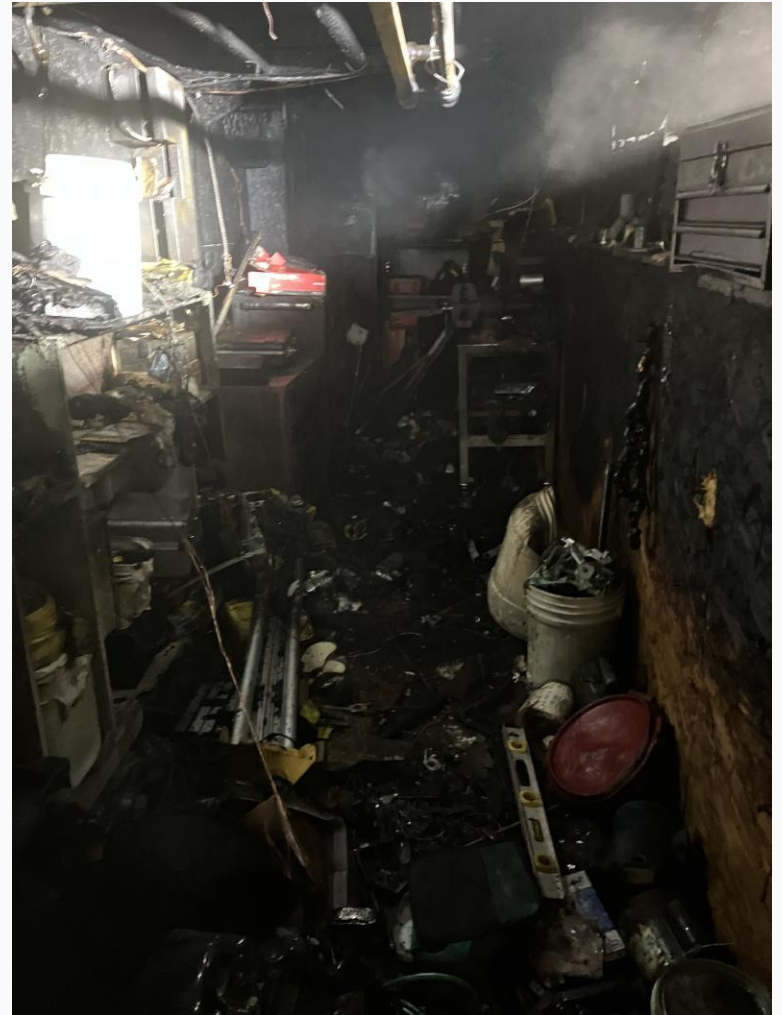
Multiple Bikes and Batteries



Incidents

**Multiple Bikes and
Batteries**

Burn hotter and faster.





Multiple Li-ion batteries off gassing toxic and flammable gasses.



General for all incidents:

- Any incident involving Lithium Ion Batteries notify the IC and shift commander if not the same.
- All interactions with a damaged and or exposed Lithium Ion Battery members shall be in full PPE with SCBA and charged hoseline in place.
- Resist the urge to just pick them up.
- Lithium Ion Batteries = Mini Pipe Bomb
- Lithium Ion Batteries = Rekindle

Lithium ion batteries and/or devices *exposed* to heat and NOT currently on fire:

- Incident Commander shall be notified immediately.
- All FF's in the vicinity of the batteries shall be in full PPE, including SCBA.
- Charge hose line shall be in place.
- Device shall be isolated away from the fire area by placing in a sink, tub or bucket with cells fully submerged in water.
- Device shall not be transported in an elevator and stairs should be avoided (think mattress) unless overpacked.
- Do not block egress when relocating devices.
- Remove from building when possible and safe to do so.
- Overpacking in a drum with Cell Block prior to moving is preferred if practical.

If a lithium ion battery is discovered during or after overhaul:

- Incident Commander shall be notified immediately.
- All FF's in the vicinity of the batteries shall be in full PPE, including SCBA.
- Charged hoseline shall be in place.
- If during overhaul stop.
- Start over.





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PETER J. OSTROSKY
STATE FIRE MARSHAL

MEMORANDUM

To: Heads of Fire Departments
From: Peter J. Ostroskey
Date: February 06, 2023
Re: Dangers of Lithium Batteries

“Owner of Lithium-ion battery device should hire a Hazardous Waste (HW) Contractor for transport/disposal of lithium-ion battery container under hazardous waste manifest. If owner does not have the means to hire HW Contractor, DEP may hire a HW Contractor for transport/disposal of lithium-ion battery container under hazardous waste manifest.
DEP Emergency Response-1-888-304-1133.”

Lithium Ion Battery Operations

Mitigation

- Batteries must be removed to the outside and isolated.
- Crew with full PPE and charge hoseline in place.
- Overpack in approved container with Cell Block
- 3" vertical separation
- 2" horizontal separation
- Overpack with Fire Prevention present.
- Photograph and log contents of each drum.



Lithium Ion Battery Operations:



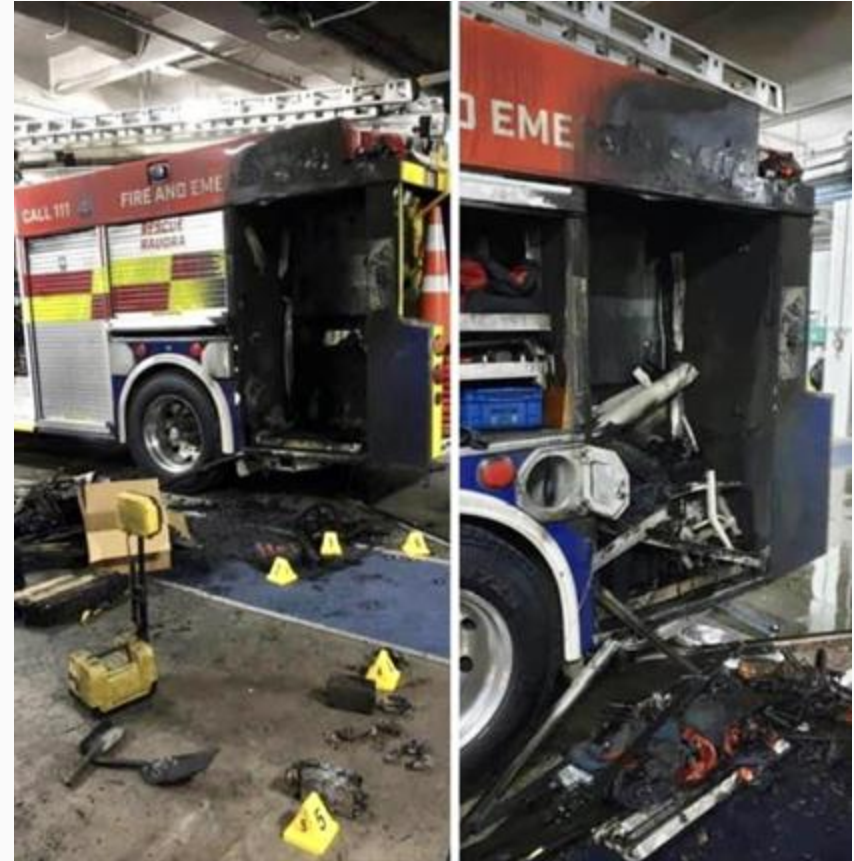
Lithium Ion Battery Operations:

- What is your removal and disposal plan?
- Who will transport the drum(s)?
- Who will store them and where?
- Who will ship them and to whom?
- Who is going to pay?

Lithium Ion Battery Operations

Fire Department Batteries:

- Battery management program for Fire Department batteries
 - All Lithium Ion Batteries shall be maintained
 - All Lithium Ion Batteries shall be regularly inspected for damage - Equipment Report
 - Any Lithium Ion Batteries that are dropped or damaged shall be evaluated
 - DDR batteries vs end of life batteries.
- Civilians bringing LIB's to the firehouse.



FIRE DANGER

150 FIRES

**RELATED TO E-BIKES
AND E-SCOOTERS**

EXAMINE THIS



www.fda.gov

100 100 100

Lithium Ion Battery Operations:

- Lithium Ion Batteries pose a serious hazard and should not be taken lightly.
- Take the necessary precautions.
- When they fail, they fail violently and with little to no warning.
- If LIB's are involved notify the IC and/or Shift Commander.
- Conduct a threat assessment in your community.
- Public Education
- Be Proactive, develop your plan now.