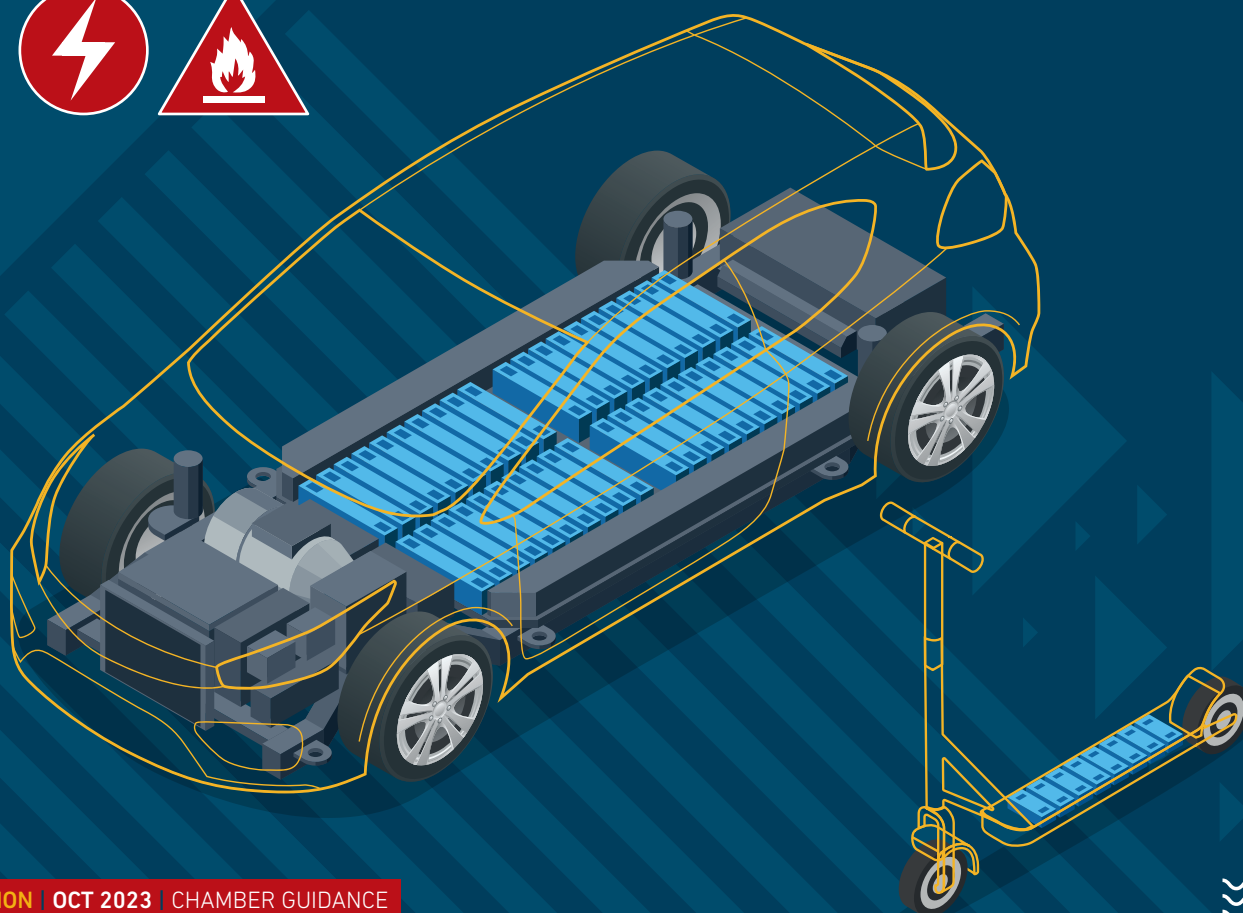


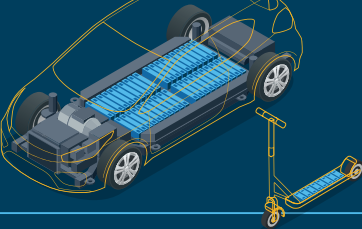
Carriage of Electric Vehicles with **Lithium-Ion Batteries**

Information for Masters and crew

The following guidance should be considered in conjunction with any applicable company standard operating procedures and risk assessments



CARRIAGE OF ELECTRIC VEHICLES WITH LITHIUM-ION BATTERIES



How Lithium-Ion Battery (LIB) fires differ from other types of fire

Lithium-ion batteries (LIBs) are able to store very high quantities of energy. If one becomes too hot, it can start a chain reaction in which yet more heat is created – a state known as thermal runaway. Thermal runaway generates large volumes of flammable gases that can catch fire very quickly. It can also cause a vapour cloud explosion.

Thermal runaway in LIBs may result from:

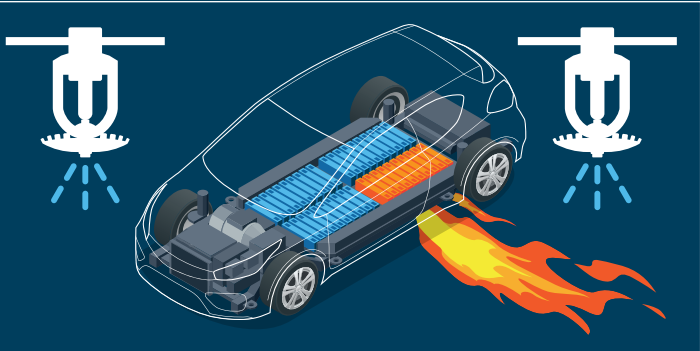
1. Mechanical abuse
External local damage to the LIB such as impact, indentation, puncture etc.

2. Electrical abuse
Overcharging or over-discharging of the battery.

3. Thermal abuse
Battery subjected to extreme temperatures.

Drenching a LIB that is on fire will reduce the risk of the fire spreading. However, this cannot stop the thermal runaway and a risk of re-ignition will remain. LIB fires can produce jet flames, which can be highly directional and may extend a significant distance from the source.

Alternative methods to control/extinguish a LIB fire are being trialled and may be recommended for shipboard use in the future.



Status and control of EVs

Devices containing LIBs have Battery Management Systems (BMSs) that are designed to keep them safe and prevent them from overcharging and overheating. LIBs that have been damaged, or modified by users, pose an increased risk of fires and explosions and require special precautions to be taken by the ship operator.

EVs may be monitored with equipment that will indicate signs of overheating and possible thermal runaway: CCTV, gas detection monitors or thermal imaging cameras. If there is any indication of an overheating LIB, the ship's emergency procedures should be activated to prepare for the possibility of thermal runaway.

Other LIB risks (especially carry on items) onboard ships

Where possible, Light Electric Vehicles (LEVs), which include e-bikes, e-scooters, jet skis and other large items containing LIBs, should be stowed in a well-ventilated area on board and monitored for any overheating. They should not be stored in passenger accommodation spaces or in vehicles.



How the fire and explosion risks can be reduced

If EVs are stowed on enclosed decks, the crew should operate the ship's ventilation system continuously where possible and, in all cases, no less frequently than hourly. The ship should be equipped with a means of forced ventilation that can be activated remotely.

Aims for the first response

Should you become aware of a fire, or a vapour cloud, originating from a vehicle with LIBs;

1. Alert the bridge.

2. Clear the area.

3. Activate the drenchers (should the vessel not have drenchers, commence dousing from a safe distance).

4. Increase ventilation to the maximum possible effect seeking to keep vapour and combustible gases away from passenger areas and command control centres.

5. Monitor the situation from a safe distance.

6. Only approach the vehicle wearing **protective clothing** and **breathing apparatus**.

The fire might not have been caused by, or involve, an LIB and it may be possible to put it out using a **hand-held extinguisher** or **firehose**. However, if the interior of the vehicle is filled with smoke, it could contain flammable gases and pose an explosion risk.

In this case:

- ▶ **Drench the vehicle** or **douse from a safe distance**.
- ▶ **Ventilate the vehicle deck**.
- ▶ **Keep well clear** of the vehicle.

How to protect yourself, crew, passengers, vessel, and cargo: when a LIB goes into thermal runaway

- ▶ **During loading** | Inform the bridge, call for external fire brigade assistance, stop all loading operations, activate drencher system, increase all ventilation to maximum safe supply on all fans, clear all passengers and other crewmembers from the area. Await professional assistance.
- ▶ **Underway** | Inform the bridge, clear the area, activate drencher system, increase all ventilation to maximum supply on all fans. Do not put yourself into danger. Stay clear and focus on boundary cooling and minimising heat spread.
- ▶ **Approaching port or on short routes** | The same as for underway however in addition, immediately request fire brigade assistance via VTS/CG. Always aim to get the vessel alongside as a priority rather than remain at sea for ease of evacuation and additional assistance.
- ▶ **Discharging** | As per loading operation. Because of the speed at which RoRo vessels are unloaded of running traffic, the safest option would be to continue discharging rather than removing passengers from vehicles at this late a stage.
- ▶ **Post-incident** | Be aware that contamination is likely. PPE should be removed with the assistance of a fellow crew member (who is wearing PPE). Follow company de-contamination procedures.

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