Fire safety - lithium cells and batteries

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Lithium batteries are used in many devices including e-cigarettes, mobile phones, portable appliances, handheld radios, tools and yacht toys. Batteries of this type are very sensitive to high temperatures and the effects of physical damage. They are inherently flammable and can rapidly degrade. If a lithium-ion battery pack fails, it can burst into flames and can cause significant damage and injury.

There are multiple reasons why failure can occur, including manufacturing defects or design flaws. However, these factors are out with the control of the user. Other reasons that batteries can catch fire are:

- IMPROPER USAGE: storing or placing batteries adjacent to heat sources or naked flames can cause the battery to fail, sometimes with explosive effects. Physical damage such as puncturing, pinching, compression of the casing can induce a sudden rise in temperature with eventual failure also resulting in fire.
- COUNTERFEIT PRODUCTS: The use of counterfeit batteries and chargers can increase the chances of failure as they often do not conform to the design and safety standards required to minimise the risk of fire.
- CHARGING ISSUES: Overcharging or charging at the incorrect rate – for example if the wrong charger is used.

Members can reduce the risk of fire by following these simple rules:

- Buy from a reputable manufacturer or reseller.
- Always follow the manufacturer's instructions.
- Requesting a copy of the shipper’s Statement of Compliance may be a useful due diligence measure.
- Register your device with the manufacturer to ensure notification of product recalls.
- Do not leave adjacent to, or on heat sources.
- Do not use, or ship, batteries that have been exposed to rough handling or those that have become damaged.
- Greater than usual heating when charging or during use is a sign that something is wrong.
- Make sure connections are properly fitted and undamaged, to prevent electric arcs.
- Don't permit disconnected batteries to come into contact with metal objects, such as coins, keys, or jewellery.
- Do not crush, puncture, or put a high degree of pressure on the battery, as this can

cause an internal short circuit and result in overheating.
- Don't use laptop computers on carpets, blankets or other soft surfaces that can interfere with heat dissipation from underside vents.
- Avoid dropping devices powered by lithium batteries, and do not allow the devices to get very hot or wet.
- Keep batteries at room temperature.
- Don't keep all lithium battery powered items together. That way, if one catches fire, the chances of the others catching fire are reduced.
- Use the charger supplied with the battery. It is designed to monitor the charge and avoid overcharging. If the original charger is not available, you may also use a CE certified charger approved for the device.
- Don’t leave devices on charge unattended.
- Charge devices only on non-flammable surfaces.
- Dispose of batteries in a safe way. Do NOT dispose in general waste and combustible material.
- Crew should be educated in these risks.

Cargo: General Considerations

The carriage of Lithium batteries by sea is governed by the provisions set out under the IMDG Code with exceptions for some lithium metal and lithium-ion cells and batteries under Special Provision 188 (SP 188). All relevant provisions under SP 188 must be complied with before shipping:

- Packaged batteries must be separated in a way to prevent short circuits and damage to terminals.
- They must be packed in a strong rigid outer packaging unless when contained in equipment, the battery is afforded equivalent protection by the equipment in which it is contained.
- The packaging should be sturdy and sufficient to prevent activation of the battery during transit.
- Appropriate labelling should be in place.

Once packed in a container, the contents are not visible from the outside. Lithium batteries that fall within the provisions of SP 188 are not subject to other requirements of the IMDG code. It is likely that the carrier will be unaware of the contents as there is no requirement to notify the carrier of the cargo, contained within.

Electric Vehicles

High profile incidents have raised industry concerns regarding the transport of Electric Vehicles

(EV) by sea. EV can be transported on Pure Car Carriers or on RO-RO/RO-Pax. The increasing popularity of EV brings a new dimension to the transport of these alternative fuelled vehicles with the potential for some operators to offer a ‘free charge’ during a voyage.

There are three types of EV:

- Battery Electric Vehicle (BEV) – only source of power is from a rechargeable battery.
- Plug-in Hybrid (PHEV) – contains a medium sized electric battery, which powers the engine with a petrol or diesel engine.
- Hybrid (HEV) – is not rechargeable via an external power source, the engine powers the generator whilst driving, producing electricity which is stored in the battery for later use.

Lithium batteries and cells are used in the manufacture of these vehicles and if ignited can result in very high temperatures with the associated production of highly toxic gases.

Research into the risk of fire from EV and associated preventative measures is continually evolving but some factors that may increase the risk of fire are:

- Poor manufacturing or design.
- Inadequate control systems.
- Mechanical impact and damage.

The prevention of fires involving EV is dependent on an understanding of the risks involved. Some considerations that may contribute to risk reduction include:

- Education of ship’s crew and those involved in the supply chain.
- Safe and effective cargo operations.
- The early identification of damaged vehicles, and the assessment of battery condition before loading.
- The clear marking of EV on stowage plans.
- The provision of realistic training and emergency drills.

The requirements and guidance for the charging of EV on board a vessel are currently limited. However, Draft guidance produced by the Maritime & Coastguard Agency (and other jurisdiction equivalents) provides useful information on the safe carriage and charging operation of EV; MGN 653 (M) Electric Vehicles Onboard Passenger RO-RO Ferries.

Fire Detection and Fighting

Lithium-ion battery fires can burn hotter, faster and require far more water to reach final extinguishment than typical fires on board ship, the batteries can also re-ignite hours or even days after the fire is initially controlled, creating new issues for our Members’ crews.

Designated charging areas for yacht toys may allow for the installation of specialist detection methods such as off-gas monitoring or thermal imaging cameras. However, these detectors would not be viable on car decks with diesel or petrol engines due to their exhaust systems. As with all fire types, early detection and prompt action of properly trained and equipped crew can reduce the impact.

Containment of the faulty cell or battery is a viable solution for hand held devices, however, it becomes more challenging when dealing with fires on open car decks with EVs. Portable water-based extinguishers may be used on individual small devices, and whilst complete extinguishment may not be possible, it should prevent the spread of fire. Placing of small devices in a container of water may help reduce the risk of re-ignition.

Existing firefighting techniques for vehicle fires can be utilised when tackling EV fires, and when looking at fixed systems, industry tests[1] have determined that there is no one ‘silver bullet’ solution to the suppression of Lithium-ion battery fires, with each suppression method providing unique strengths and drawbacks.

After the fire, those batteries involved in and affected by the fire still pose a potential to emit combustible and toxic gases, as well as having the potential to reignite; post fire management is therefore vital.

We welcome all feedback on this or any other Loss Prevention guidance. Please feel free to contact the team should you have any further queries on this matter.

[1] DNV - Technical Reference for Li-ion Battery Explosion Risk and Fire Suppression