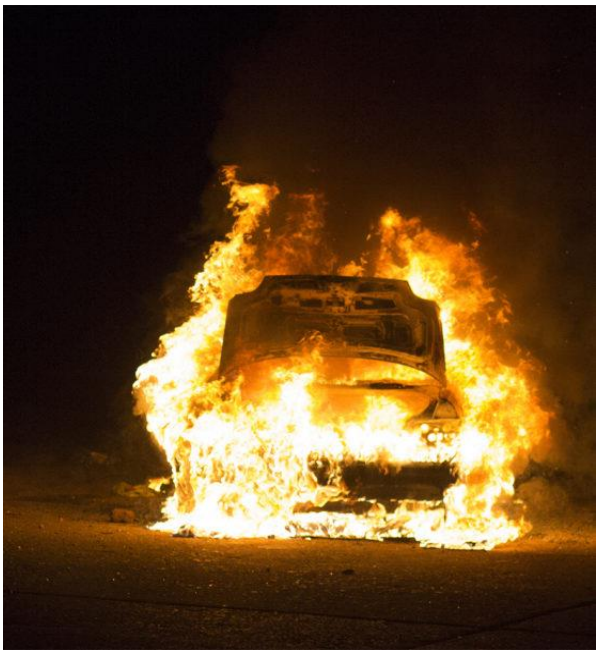
CV Safety Alert: 02/2023

GUIDANCE ON RISKS ASSOCIATED WITH THE CARRIAGE OF BATTERY ELECTRIC VEHICLES

Purpose

This safety alert provides guidance to operators of domestic commercial vessels (DCVs) on risks associated with the carriage of battery-powered electric vehicles (BEVs) on roll-on, roll-off (RORO) ferries, and how best to deal with these risks.



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Risk assessment

As per Marine Order 504 *(Certificates of operation and operation requirements)* you must conduct a risk assessment for your vessel to ensure that risks arising from the carriage of BEVs are addressed. Consideration must be given to the hazards arising from transporting BEVs and a vessel specific procedure developed for the prevention and mitigation of fire incidents involving BEVs.

New risks identified in relation to BEVs

Some risks associated with BEV fires onboard DCVs include:

- High voltage shocks
- Direct jet flames
- Fires develop in intensity quickly and rapidly reach their maximum intensity (typically within 2-3 minutes)
- Toxic gases
- Gas explosion (if the released gas accumulates for a while before being ignited)
- Long lasting re-ignition risk (can ignite or re-ignite weeks, or maybe months after the provoking incident)
- Once established fires are difficult to stop/extinguish
- Thermal runaway

Further considerations

BEVs are approximately 25% heavier than vehicles with internal combustion engines. This should be considered when stowing the vehicles to minimise the potential impact on vessel stability.

Lithium-ion batteries which are used in most battery powered vehicles have been known to suffer from spontaneous thermal runaway fires. The lower the charge retained by the vehicle's battery the lower the likelihood of a thermal runaway fire.

Some battery powered vehicles have a lower ground clearance than internal combustion engine vehicles. This means they are more susceptible to damage from ramps during boarding. Care should be taken in identifying these vehicles before boarding to ensure damage is not sustained to the battery. Physical damage of the battery can lead to thermal runaway. BEVs which have been damaged should not be loaded.

Charging the battery while onboard a vessel can increase the likelihood of a thermal runaway fire.

The use of close-circuit television (CCTV) with thermal imagining may allow for early detection of thermal runaway. Also, the crew can use a thermal imaging camera when conducting safety rounds of the vehicle deck to allow for early detection. Manufacturers estimate that the minimum temperature in the battery where potential exists for thermal runaway to begin is between 60 °C and 70 °C.

Fumes (hydrogen fluoride) given off by the lithium-ion batteries fires are toxic.

When fighting a lithium-ion battery vehicle fire with water, substantially higher quantities of water are required in comparison to an internal combustion vehicle fire. The water must also be applied for a longer period. There is also an elevated risk of re-ignition. Using other medium such as a car fire blanket designed to extinguish BEV fires may also assist to contain the fire.

A damaged high-voltage battery can create rapid heating of the battery cells. If you notice hissing, whistling, or popping, a possible sweet chemical smell, then black "smoke" (nanoparticles of heavy metals, not smoke) then white vapour coming from the high-voltage battery or the vehicle generally, assume that thermal runaway has occurred.

Directly attacking the fire with water hoses and breaking open the battery requires specialist training and equipment. It should not be attempted without extensive training and practice.

Recommendations

AMSA recommends operators of DCVs that carry or are likely to carry BEVs to review their safety management system, in line with the following operational guidance:

1) The presence of BEVs onboard the vessel should be known to the master and crew. Prior to loading, BEVs should be clearly identified with a marking system that the master and all the crew are familiar with.
2) Vessel operators should consider procedures to verify if the BEV has any alarms active in its battery management system prior to loading.
3) BEVs should not be charged while onboard. Appropriate control measures should be in place in the event BEVs require charging while onboard.
4) The BEVs should be stowed on the vessel to allow the crew direct access to the vehicles so they can respond quickly and effectively in an emergency.
5) BEVs should be stowed in designated areas that are away from machinery spaces, emergency equipment, dangerous goods, and passengers including egress routes and muster points for passengers.
6) The location for designated areas onboard for BEVs should also consider access for fire and emergency services from shore and the ability to evacuate the vessel when alongside.
7) Operators of vessels that have enclosed, or partially enclosed vehicle decks should consider stowage of BEVs taking into account the risks of toxic and potentially explosive gases released during fires. Operators should consider not stowing BEVs on enclosed or partially enclosed vehicle decks, unless the vessel is fitted with a water drenching system to help control fires in these areas.
8) The master should manoeuvre the vessel to control the flow of smoke and gases from the BEV fire away from passengers and crew. The smoke and gases are both toxic and potentially flammable.
9) If a BEV fire has broken out and has taken hold, the crew should undertake appropriate firefighting and emergency action from a safe distance. The crew should not approach the fire unless they have specialist protective clothing and firefighting training.
10) The increased amount of water required to be used in fighting BEV fires needs to be considered. Vessel stability needs to be assessed, and also, the deck drainage facilities to allow the free flow of water off the deck.

11) Using a low-lying fixed thermal imaging camera to give early warning to the crew of a potential fire.

12) Vessel operators should consult with local fire and rescue services to establish procedures for co-ordinating emergency operations. The estimated time taken for fire and rescue services to arrive should be factored when developing an onboard emergency response for BEV fires.

Further reading

https://lashfire.eu/ A project running in the EU aiming to significantly reduce the risk of fires on board RO-RO ships.