Maritime & Coastguard Agency

MARINE GUIDANCE NOTE

MGN 653 (M)

ELECTRIC VEHICLES ONBOARD PASSENGER RO-RO FERRIES

Notice to all Shipowners, Ship Operators, Masters and Officers of Ships, Ship Designers and Shipbuilders of vessels to charge Electric vehicles onboard

Summary

This Marine Guidance Note provides the UK shipping industry with best practice guidance to facilitate safe carriage and charging operations of electrified vehicles being transported onboard roll-on roll-off passenger (Ro-pax) ferries. The MCA has developed this guidance in conjunction with, and at the request of, industry.

1. Introduction

1.1 Currently there are limited requirements specific to the charging of electric vehicles onboard UK vessels. However, noting the increasing popularity of the electric vehicle it has become apparent that there is a potential for both the users of these vehicles and the operators of vessels to charge vehicles onboard.

1.2 The limited capacity for charging on board and the fuel source of the ro-ro ferry should be considered when making decisions on charging electric vehicles.

1.3 There are two main areas within SOLAS where there are requirements that are applicable to performing charging operations onboard; SOLAS regulation II-1/45 which is the generic regulation covering precautions against shock, fire and other hazards of electrical origin, and SOLAS regulation II-2/20.3 which covers fire safety of vehicle spaces.

1.4 The following guidance follows these regulations and should help provide a framework for charging operations onboard. Operators should perform a thorough risk assessment in conjunction with these guidelines, regulations and operational aspects.

1.5 This guidance also provides good advice for any electric vehicle fire and should be considered when any electric vehicles are transported on board.

2. Design, arrangement and location of charging equipment

2.1 The following paragraphs are a combination of the current legislative requirements and additional recommended guidelines.

2.2 The location for charging should be preferably on the weather deck or if charging is done in a closed ro-ro space SOLAS II-2/20.3.2.2 shall apply. The regulatory requirements for this space according to SOLAS II-2 are; IP 55* (or greater) ingress protection rating. Electrical equipment and wiring shall not be situated less than 450 mm above deck level (including ramps unless there is good air flow around the ramp), ventilated with no less than 10 air changes per hour during charging operations. The hazardous area space shall have safe type equipment suitable for the hazardous area classification determined from the risk assessment as per SOLAS II-2/20.3.2.1.

*For reference IP 55 means: Complete protection against contact with live or moving parts inside the enclosure. Protection against harmful deposits of dust. The ingress of dust is not totally prevented but cannot enter in an amount sufficient to interfere with satisfactory operation of the machine. Water projected by a nozzle against the enclosure from any direction shall have no harmful effect.

2.3 The equipment for charging should be designated for charging, have minimum IP55 protection, be protected against mechanical damage and be designed so that the circuit can be disconnected when any potential error is anticipated for example by way of an isolation switch between the charging station and the ships main electrical system.

2.4 Personnel managing the garaging and charging of electric vehicles should be competent to do so. The condition of equipment and cables should be regularly checked and documented as part of the ships Safety Management System.

2.5 No open flames to be permitted within hazardous areas and no combustibles should be stored nearby.

3. Wiring Arrangements

3.1 Where the prescriptive requirements within SOLAS and related Codes (IBC and IGC Codes) and the standards published by the International Electrotechnical Commission (IEC), such as, but not limited to, IEC 60092-502, are not aligned, the prescriptive requirements in SOLAS and other relevant IMO instruments should take precedence and be applied. MSC.1/Circ.1557 provides discrepancies between the codes for the extent of hazardous area classification.

3.2 The electric wiring systems used should have armoured cables for ducts subject to movement or without any mechanical protection.

3.3 The risk of impact between rusty iron and aluminium or other light metals causing thermite reaction should be considered in the area identified as a hazardous zone.

3.4 Vibration is undesirable which can cause premature deterioration of equipment if allowed to persist. Loosening of electrical connections should be considered for installation and maintenance management.

3.5 Safe type equipment should be used which have specific design and safety expedients concerning the electrical system such as connectors, sensors and control units. All those non-electric parts that could generate high temperatures or sparks such as, brakes and sources of static charge should be considered and mitigated for the identified hazardous zone.

4. Connections to the ship and charging operations

4.1 Vessel operators and electric vehicle experts have identified that there is a risk associated with the charging of electric vehicles if they are not in a suitable condition. Ship owners/operators should consider how decisions are made whether to charge or not charge an electric vehicle on their vessel, which may involve policies such as;

4.1.1 To only charge un-modified vehicles from reputable manufacturers.

4.1.2 To test any electric vehicle before charging commences.

4.2 The use of an operator developed checklist or flow chart is recommended for consistency of application in decision making with regards charging operations.

4.3 Areas designated for charging should be monitored by CCTV or regularly inspected by appropriately trained vessel crew.

4.4 Only ship owned cables and connectors shall be used in charging operations.

4.5 Ground fault detection systems or other technology which provides discrimination detection and protection for earth and short circuit faults should be provided on electric circuits along with an alarm to the engine control room or other monitoring station.

4.6 Socket outlets, regardless of the rating, should be provided with a switch, and be interlocked in such a way that the plug cannot be inserted or withdrawn when the switch is in the "on" position. (Plugs should be inserted into the vehicle charging point before being switched on – similar to that for a shore supply cable).

4.7 A separate final sub-circuit should be provided for each socket outlet. Each final sub-circuit should be automatically disconnected in case of overcurrent or overload or earth fault.

4.8 It may be accepted to group final sub-circuits in order they can be automatically disconnected in case of earth fault, e.g. with an earth fault breaker. In that case, relevant operational procedures should also be in place.

4.9 The temperature rise on the live parts of socket outlet and plugs should not exceed 30°C. Socket outlets and plugs should be so constructed that they cannot readily short-circuit whether the plug is in or out, and so that a pin of the plug cannot be made to earth at either pole of the socket outlet.

4.10 The equipment should be provided with means to maintain the same degree of protection after the plug is removed from the socket-outlet. Where a loose cover is used for this purpose, it should be anchored to its socket-outlet, for example by means of a chain.

4.11 In addition to SOLAS regulation II-1/45.5, electric cables that may be damaged by vehicles or cargo units during loading and unloading operations should be suitably protected by protective casings, even when armoured, unless the ships structure affords adequate protection. Metal protective casings if used should be efficiently protected against corrosion and effectively earthed.

4.12 Records of charging operations should be maintained.

5. Fire Fighting Measures

5.1 In case of fire affecting electric vehicles powered by lithium-ion batteries only water supplied in large quantities can cool the batteries and extinguish the fire. It is most likely that this will have to be manually applied as the pressurized fixed water drench in the vehicle spaces is unlikely to satisfy the fire-extinguishing needs for electric vehicles due to the limits of the scope of the spray, though it will help to slow the spread of fire. Other methods to restrict the flame and heat spread such as specialist Vehicle Fire Blankets may be used until sufficient water quantity is available.

5.2 It is critical that fire-fighting personnel are made aware of the risk posed by electric high voltage equipment in electric vehicles. Fire-fighters using fire hoses may receive electric shocks, which can put their lives in danger, it is essential as part of the fire-fighting measures to ensure that the ships electrical supply to the vehicle has been cut isolated before attempting to fight the fire.

5.3 Operators should consider their fire-fighting strategies with regards the potential risk of electric shock of the crew and the equipment provided for fire-fighting. In order to control and extinguish fires in electric vehicles it may be necessary to use specialized fire-fighting equipment, such as foam fire extinguishers, water lances, car fire blankets, or water monitors on weather decks.Suitable fire extinguishing equipment should be readily available at/by the location or located practicably close to any access points likely to be used for fire-fighting.

5.4 A burning or heated battery releases toxic vapours. These vapours may include volatile organic compounds, hydrogen gas, carbon dioxide, carbon monoxide, soot, particulates containing oxides of nickel, aluminium, lithium, copper, cobalt, and hydrogen fluoride.

5.5 Responders should always protect themselves with full PPE, including a SCBA, and take appropriate measures to protect crew and passengers downwind from the incident. The common high voltage battery consists of lithium-ion cells. These cells are considered dry cells. If damaged, only a small amount of fluid can leak. Lithium-ion battery fluid is clear in colour.

5.6 Operators should develop procedures for safely removing a person (who may be injured or immobile) from within a potentially damaged or live electrified vehicle, and for extinguishing a battery fire. Instructions should be prominently posted in the designated vehicle charging areas. Regular drills should be carried out and included within the ship's Safety Management System.

5.7 The high voltage battery and drive unit are liquid cooled with a typical glycol-based automotive coolant. If this blue coolant is found to leak the high voltage battery casing may be damaged. A clear fluid leak may indicate that the battery cell itself is damaged

5.8 A damaged high voltage battery can create rapid heating of the battery cells. If you notice smoke coming from the high voltage battery, assume that it is heating and take appropriate firefighting measures.

5.9 As a minimum the crew involved in car deck inspections should be supplied with and trained in the use of Thermal imaging cameras. These can be used to check floor plans of electric vehicles to detect any overheating, before embarking and during crossings. Increase in battery temperature will be anticipated during charging so care should be taken in determining what temperature rise should trigger alarms.

5.10 Furthermore, the operators should also consider the addition of CCTV which can incorporate a flame recognition system.

6. Carriage of Damaged Vehicles

6.1 Damaged electric vehicles are at a significantly higher risk of catching fire than undamaged vehicles.

6.2 Electric vehicles which are damaged should not be charged on board.

6.3 Electric Vehicles which have been damaged should be thoroughly inspected by a competent before being allowed to be transported on board to assess the risk to the vessel.

6.4 Consideration should be given to carriage of damaged electric vehicles on weather decks due to their increased fire risk. This shall be considered in conjunction with the full stowage plan including any dangerous goods that may be being transported.

6.5 Where vehicles are being towed or carried by a car transporter disconnection of the battery pack should be considered. This shall be undertaken by a suitably qualified person.

More Information

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Published: Month Year
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