

Proposal for Amendments to SOLAS for Controlling Fire Occurring from Electric Vehicles Shipped on RO-RO Ships

TEAM: Safety Carrier



INDEX **01 Background 02 Problem Analysis 03** Proposal **04 Conclusion**



Background

.1 The Rate of Increase in Electric Vehicle Fire

.2 The Case & Extent of the Demand



The Rate of Increase in Electric Vehicle(EV) Fire



EV Market Size from 2022 to 2023(USD Billion)

Comparison of Forecasted EV fire Accidents & Forecasted EVs Numbers in Australia

The volume of EV cargo through shipping is expected to increase



The Cases of EV Fire on Ro-Ro Ship



Felicity Ace('22.2.19.)

A fire broke out while passing through the sea near the Azores Island.

Loss: ship sank & \$155 million





Fremantle Highway('23.07.25.)

A fire broke out while passing through the sea near the island of Amelant in the northern Netherlands.

Loss: 1 crew dead & \$330 million



Problem Analysis



Proposal

Major Causes of EV Fire





Principle of Thermal Runaway(TR)



As a battery ignites, causing a propagation of <u>nearby batteries</u> to reach high temperatures and ignite quickly



Risk Of Thermal Runaway

The flames from an EV battery tend to spread horizontally and the rate of propagation is significantly faster than internal combustion engine vehicles





EV Fire Control Manual of Hyundai Glovis



Asphyxiation fire cover





Off-gas Emissions





Thermal Runaway



Fire Extinguishing Using Asphyxiation Fire Cover Off-gas emissions + continued thermal runaway

<Research Of National Fire Research Institute Of Korea>

In case of a large scale fire, it is impossible to enter water since crews can not carry it in person

https://www.e2news.com/news/articleView.html?idxno=244310 https://www.fnnews.com/news/202203300956281407 Research of Korea national fire research institute https://dhtotal.com/product/%EC%84%B8%EB%B8%90-%EC%8A%A4%ED%94%BC%EB%93%9C-%EB%85%B8%EC%A6%90-sb-600/11797/



Limitation of D-class fire extinguisher





D-Class Fire Extinguisher

- Class D fire is effective at extinguish fires occurring at Alkaline metals such as highly reactive lithium or Alkaline earth metals
- The EV battery consists of lithium ions including Oxygen in the Cathode material, not lithium metal

03 Proposal

.1 Installation of Partition & Designation of EV Zone

.2 Under Water-Cooling Fire Extinguishing System for EV



The best solution: Water-Cooling



Asphyxiation Fire Cover Method

Water-Cooling Method

The fundamental way to extinguish an EV battery fire is to cool the battery with water to prevent heat from transferring to nearby batteries



Installation of Partition & Designation of EV Zone





Partitions around individual EV

Designation of EV zone for loading



Under-Cooling Water Fire Extinguishing System for EVs



Spray water upward (from deck to EV's underbody) and make it submerge

Conclusion





SOLAS, Consolidated Edition, 2020 Edition

FSS code: international code for fire safety systems

IMDG Code 2022 Edition- Volume 1



SOLAS Chapter II-2: Construction – Fire Protection, Fire Detection and Fire Extinction

Part G – Special requirements (Helicopter facilities, carriage of dangerous goods, etc.)

Reg.19 Carriage Of Dangerous Goods

1 Purpose

. . .

Draft amendment

The purpose of this regulation is to provide additional safety measures in order to address the fire safety objectives of this chapter ...

2 General requirements

.6 Electric Vehicles

3 Special requirements

.9 Water spray system

.1 Devices to provide upwards water spray which shall be placed under a vehicle



SOLAS Chapter II-2, Part G – Special requirements

Reg.20 Protection of vehicle, special category and ro-ro spaces: Providing additional safety measures in order to address the fire safety objectives of this chapter for ships fitted with vehicle, special category and ro-ro spaces.

6.1.6 Fixed under-cooling water fire extinguishing system (Additional for Ships Loaded with Electric Vehicles)

Draft amendment

.2 Any other Fixed under-cooling water fire extinguishing system may be fitted provided the Administration is satisfied that an equivalent protection is achieved; and

.3 As an alternative, a system meeting the requirements of paragraph 6.1.2 may be fitted

.4 Means shall be provided for effectively cooling the designated underdeck cargo space by at least water per square meter of the horizontal area of cargo spaces,

.5 Bilge wells shall be of sufficient holding capacity and shall be arranged at the side shell of the ship at a distance from each other of enough in each watertight compartment.

.6 Water spray that can cover all of the lower area of an electric vehicle within the partitions that can cover all of the exterior of the vehicle.





IMDG PART 7 - PROVISIONS CONCERNING TRANSPORT OPERATION Chapter 7.2.4 -Segregation of cargo transport units on board roll-on/roll-off ships

7.2.4.1 - Applicability

Draft amendment

7.2.4.1.1 These provisions apply to the segregation of cargo transport units which are transported on board roll-on/rolloff ships or in roll-on/roll-off cargo spaces.

7.2.4.1.2 For roll-on/roll-off ships which carry cargo transport units on decks or in holds, and when these cargo spaces are properly arranged for the permanent stowage of such cargo transport units during transport, the provisions of 7.2.3 shall apply to such spaces.

. . . .

7.2.4.3 Special area for electric vehicle on board ro-ro ship.

7.2.4.3.1 These provisions apply to the segregation of electiric vehicles which are transported on board roll-on/roll-off ships or in roll-on/roll-off cargo spaces.



20



Background

SD 2 Integrate new and advancing technologies in the regulatory framework	PI 2.1	# of proposals submitted to IMO to incorporate new and advancing technologies into the regulatory framework
	PI 2.2	# of outputs to include new and advancing technologies (as specified in PI 2.1) on the agenda of IMO organs
	PI 2.3	# of amendments adopted to incorporate new and advancing technologies into the regulatory framework

SD 6: Address the human element

31 The human element is recognized as a key element of the safety of life at sea and the protection of the marine environment. Furthermore, the human element is an overarching principle for the Organization, particularly when developing and implementing new and existing requirements to ensure the safe, secure and environmentally sound operation of ships.



Thank you for your attention





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