

Controlling EV car fires with the Fire Isolator concept

On March 17th, 2022, a live demonstration of the Fire Isolator took place in Frederikshavn, at the Nordjyllands Beredskabs Uddannelsescenter in Hvims Denmark (Fire Training center). In front of an audience of Ferry owners, safety directors of both maritime and onshore sectors, port authorities, government, professional fire fighting teams, and dealers/distributors, all steps of the concept were successfully completed.

Where an EV car fire causes hectic and fear, the Fire ⚡ Isolator concept ensures control and overview. With this, we offer a proven and tested process that fits seamlessly into your EV car fire strategy.

Target audiences:

- Ferry operators
- Shipping companies
- Car park management
- Facilities & real estate safety managers
- Professional intervention services

Summary

This report provides a summary of the demonstration of the Fire Isolator concept that was performed on March 17th, the history of the concept, key insights into the operation of the concept, a conclusion and recommendations.



Contents

Foreword	Page 1
Introduction	Page 3
History of FIRE/ISOLATOR	Page 3
Working Principle of FIRE/ISOLATOR	Page 4
Demo results	Page 5
Conclusion & Recommendations	Page 7
Annex	Page 9
Attendance list 17 March 2022	Page 10

1. Introduction

- 1.1 Currently there are limited requirements specific to the firefighting of electric vehicles onboard vessels or in carparks. Due to the increasing numbers of the electric vehicles it has become very clear that there is a big need to implement methods/strategies to control unforeseen EV car fires. The main risk is the extreme temperatures of the fire as a result of the lithium-ion batteries heating up and catching fire.
- 1.2 In the unlikely event of an incident, accident, or emergency on board ferries or in a building or carpark, which may be directly or indirectly related to any type of EV, fire and heat are major concerns. Preventive actions to mitigate the chance of fire elements, heat, fuel, and energy release are an important issue for the safety of people, ships, cargo, surrounding vehicles and building constructions.
- 1.3 In recent years 2020 to 2022, a group of specialists created an easy to use concept, called **FIRE/ISOLATOR**. The concept's aim is to isolate the fire (not so much kill the fire altogether, as that can only be done by submerging the EV completely in water) by use of available products and provide any crew/team enough time to (for maritime) either safely reach the nearest port to unload passengers, cargo and the vehicle, or (for carparks/facilities) to win time by controlling the EV fire until the burning EV is safely removed by intervention services.
- 1.4 Extensive real life testing has been performed in the last 2 years to make sure that the **FIRE/ISOLATOR** concept works in practice.

A demonstration day was held on 17 March 2022 at Nordjyllands Beredskabs Uddannelsescenter in Hvims Denmark. Attended by Ferry owners out of Sweden, Norway & Denmark, Port Authority Fredrikshavn, Danish Maritime Authority and Fire specialists from Denmark, Netherlands, Israel and het Baltics.

- 1.5 With regards to the maritime sectors, the **FIRE/ISOLATOR** concept is based upon guidelines as described by MCA / MGN 653 and upcoming EMSA guidelines which require shipowners to implement strategies to control fires in Electrical Vehicles.

2. History of **FIRE/ISOLATOR**

- 2.1 The concept for the **FIRE/ISOLATOR** concept to limit the damage done by EV fires, arose when partners with a long track record in the European ferry industry got together after questions were raised by their crews on how to best deal with EV fires while sailing. As these experts were aware that lithium fires are extremely difficult to extinguish, another and completely new concept was invented: **FIRE/ISOLATOR**.

Instead of extinguishing the lithium fire by any means necessary, it was proposed to isolate the fire to win valuable time to reach a safe port without additional damage to other cars, where the burning EV can be unloaded by professionals. The same idea is to gain additional time when an EV fire occurs in an (underground) parking garage.

Based on this, the concept of **FIRE/ISOLATOR** can be summarized by 'winning as much time as possible to limit the collateral damage'.

2.2 The method developed by the **FIRE/ISOLATOR** creators (T-ISS BV, Studsgaard A/S and Garant Protech) consist of the use of both new* and already available firefighting products.

*The main idea was to use equipment available on the market and modify it in such a way that it could be used to control EV fires.

2.3 The most important goal onboard ferries was to achieve a method which gives the crew a minimum of 6 hours* to reach the nearest port.

*After reviewing all north European ferry lines 6 hours is in general the maximum time frame in which a vessel with an EV fire should be able to reach the nearest port.

For carpark facilities and real estate sectors, the main goal is win time, minimize the collateral damage and provide professional firefighters the time come up with a strategy or to remove the EV safely.

Working principle of **FIRE/ISOLATOR**

3.1 In case of a fire in an electric vehicle powered by lithium-ion batteries, extinguishing the fire with water will have no lasting effect. Submerging the vehicle completely under water is the only 100% effective method. The Fire Isolator provides a strategy to minimize the collateral damage and provide control of the situation.

It is most likely that in case a fire is discovered, a drenching or sprinkler system will try to suppress the fire and keep the surrounding vehicles from catching fire, be aware that this will just assist but never extinguish the actual lithium-ion fire. By using the drenching system onboard a ferry for a longer period, the surrounding cars can be severely damaged by the salt water.

3.2 The **FIRE/ISOLATOR** concept will not try to extinguish the fire but to isolate the fire and lowering the temperature in order to gain time and avoid any collateral damage.

3.3 The concept is based upon the combined use of its 3 main components

A: a special high temperature resistant light coloured fire blanket (+1100°C continuous, peak +1600°C)

B: low pressure aerosol units designed for lithium fires.

C: a water mist lance with extended length up to minimum 1,3 meters.



Fire Blanket



Aerosol units



Water Mist Lance

3.4 The concept in brief:

When an electric vehicle fire is discovered, the goal is to cover the car as soon as possible with the high temperature resistant blanket. The fire blanket can withstand very high temperatures but does not stand up well to sharp objects or overly rough handling of the blanket. The installation of the blanket must therefore be done carefully, without hard, jerky movements, so as not to damage the fabric or the loops.

Surrounding vehicles and cargo should be covered by similar blankets to avoid collateral damage. Next, the low pressure aerosol unit should be placed under the EV and blanket.

As the fire blanket creates an enclosed space, the effect of the aerosol unit is maximised because the gases from the aerosol unit remain enclosed and cannot escape.

The discharge gas of the aerosol will smother the fire for a certain period of time. During the time it takes the ships to arrive at the (nearest or destination) port, the fire should be monitored by the firefighters or crew with a thermal camera, this will indicate when the aerosol unit has emptied itself. Once the temperature is rising again, a new aerosol unit should be placed under the blanket.

During the whole period the blanket can be kept wet with a local water mist spray. This will avoid rising temperature and kill the smoke, preventing damage and nuisance from smoke.



4 Demo Results

Fighting EV car fires with the Fire Isolator concept is a tested and proven method for minimizing the collateral damage of EV car fires.

4.1 After the lithium battery pack of the car caught fire, the vehicle was covered with the blanket, causing the temperature to drop down from 800°C towards 300°C.



4.2 After the Aerosol unit was placed under the fire blanket, the fire temperature was reduced (within a minute) to under 100°C.



4.3 After the Aerosol unit was placed under the blanket, smoke was reduced by an estimated 90%. Below shows before and after placing the blanket.



4.4 Responders felt stress relief and no time pressure once the aerosol unit & blanket were in position.



4.5 Before the team that performed the demonstration started, they were made familiar with the products and procedures. Anyone deploying the **FIRE/ISOLATOR** concept should develop procedures for safely and fast positioning of the blanket on the EV. Training is necessary due to the size and weight of the blanket: 9x6 meters & weight of 40kg . The fire blanket can withstand very high temperatures but does not stand up well to sharp objects or overly rough handling of the blanket. The installation of the blanket must therefore be done carefully, without hard, jerky movements, so as not to damage the fabric or the loops.



4.6 The low pressure aerosol units had immediate effect within seconds on temperature of fire once they were in position.

5 Conclusion

5.1 The **FIRE/ISOLATOR** concept is an easy to use method to isolate E-vehicles in order to minimize the collateral damage, (for ferries/ships) to win time to contain the situation and safely reach a port and (for car parks/facilities teams) to minimize the collateral damage until the EV can safely be removed by intervention services.

5.2 The **FIRE/ISOLATOR** concept provides control of the situation once the fire blanket is placed, this reduces stress situations by crew in these hectic situations as well as heat reducing to prevent damage to steel and/or concrete structures.

5.3 The effectiveness has clearly been demonstrated.

5.4 Attendees are convinced a staff / crew training is necessary in order to achieve the objective to isolate the car fire and avoid further collateral damage.

6 Recommendations based on test results

6.1 The **FIRE/ISOLATOR** developers recommend to install on every car deck of a RoRo ferry at least on average 2 sets of Fire blanket/aerosol suitcase (each containing 2 units) & 1 water mist lance per deck. Advised, based on best practice, is to have 4 blankets available per deck to also cover cars parked next to the burning EV.

6.2 The **FIRE/ISOLATOR** developers recommend to install on every car deck of a (Fjord) ferry with a max normal crossing-time of 1 hour at least 2 blankets and 1 set of aerosol units.

- 6.3 The number of **FIRE/ISOLATOR** sets (blanket/aerosol unit/water mist lance) to be present in car parks is to be decided in collaboration with building owners/facilities teams etc, depending on the surface and number of floors of the parking garage.
- 6.3 The **FIRE/ISOLATOR** developers recommend to have enough crew members onboard or present in a building who had a training by specialists in this matter.
- 6.4 The **FIRE/ISOLATOR** developers recommend that the crew should have a training course for fighting EV fires and to have regular training in EV fighting.



ANNEX 1 – Preliminary conclusions

- A. The method described under 3.4 can only be achieved by a trained crew. Therefore it is recommended to train your team(s) in the concept during a simple 1 day course.

When the EV is already heavily burning, it is advisable that responders protect themselves with full PPE, including a Self Contained Breathing Apparatus.

It is critical that fire-fighting personnel are made aware of the risk posed by electric high-voltage equipment in electric vehicles.

- B. Possible application scenarios for the Fire Isolator concept along with already active firefighting systems onboard ferries

Scenario 1

Perform regular temperature checks (preventive) using a thermal camera to early detect potential lithium batteries heating up. When a fire blanket is then installed on the car, any potential fire outbreak is managed early in the process.

Scenario 2

When a EV fire occurs, the drenching system is activated. After the blanket is placed gently on the car on fire, the drenching system could be switched off to prevent any water damage/nuisance to occur.

Scenario 3

When an EV car fire occurs, the drenching system is activated. The drenching system stays active until the port is reached. The drenching system is then switched off and the fire blanket is put over the car so that the ferry guests can

- C. Accessories which can be deployed in the **FIRE/ISOLATOR** concept.
- : Thermal camera with temperature till +1200° (e.g. Bullard)
 - : Fire axe, Fire suit (3/4 layer)
 - : GRP storage boxes, reclosable.

6 Attendance list

Brian Studsgaard MD of Studsgaard Safety A/S Fredrikshavn Denmark
Mick Jensen Manager Studsgaard Safety A/S Fredrikshavn Denmark
Michael Petersen Manager Studsgaard Safety A/S Fredrikshavn Denmark
Willem Heijboer CEO T-ISS BV Dinxperlo Netherlands
Jan Peter Verheuvell Manager T-ISS BV Netherlands
Ron Verstegen MD T-ISS BV Dinxperlo Netherlands
Konstantin Toregozin MD Garant Protech, Klaipeda Lithuania
Ib S Nielsen, Beredskabsinspektør Nordjyllands Beredskap, Hvims, Denmark
Uri Bitton, MD of UB Safe, Tel Aviv, Israel
Kasper R Nielsen, Manager Lotek A/S, Sonderborg, Denmark
John H Jorgensen, Port of Fredrikshavn, Fredrikshavn, Denmark
Allan Christensen, Danish Maritime Authority, Denmark

and safety specialist teams of major Scandinavian Ferry operators