



LEGISLATIVE ASSESSMENT FOR SAFETY HAZARDS OF
FIRE AND INNOVATIONS IN RO-RO SHIP ENVIRONMENT

LASH FIRE
Information
sheet

Automatic first response water-based fire protection systems for vehicle carriers

Design and installation guidelines for water-based fire protection systems for closed ro ro spaces on vehicle carriers have been developed. The system should activate automatically and keep a fire under control to allow time for the activation of the fixed-installed Carbon Dioxide system.

Vehicle carriers are unique ships with a box-like superstructure running the entire length and breadth of the hull. They typically have a stern ramp and a side ramp for loading of thousands of vehicles such as passenger cars, freight trucks, buses, railcars and tramways, boats, mining equipment and heavy machinery. Lifiable decks allow for high-vehicle clearance and the decks can be raised or lowered to adjust deck heights for assorted cargo. The spaces are typically protected by a fixed-installed Carbon Dioxide system.

Supplementary water-based fire protection systems

Design and installation guidelines for supplementary, automatic water-based fire protection systems were developed. The work was partly based on a comprehensive literature review that identified relevant standards and information applicable to the design of automatic fire sprinkler and deluge water spray systems. The literature review was supported by intermediate- and large scale fire tests.

Part of the problem is the extreme compactness of vehicles in the spaces, that will promote rapid fire spread and the shielded nature of a fire. Additionally, the spaces are large, subject for

freezing, and deep beams make the optimal position of sprinklers or nozzles a challenge.

Large scale validation tests

Large scale fire tests were conducted using a dry pipe sprinkler and deluge water spray system design. A total of six tests were made, using either a passenger car, a van, and a freight truck as the primary fire source. The ceiling height was adjusted accordingly to simulate the clear height of a ro ro space.

The delay time is a problem

The ro-ro spaces are typically protected by a total-flooding Carbon Dioxide system. Due to its toxicity, there could be a considerable time delay from the start of a fire until the system is discharged, in order to close the ventilation system, dampers, hatches and to confirm that no crew members are present in the protected spaces. This time delay can result in extensive fire damage, as exemplified by the fires on board Courage (2015), Honor (2017) and Höegh Xiamen (2020).



Despite the activation of the Carbon Dioxide system, the extensive fire damage led to scrapping of the entire ship in two of the cases.

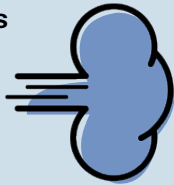


A series of photos shows the fire test with the freight truck. A dry pipe system utilizing upright high temperature, standard-response K115 sprinklers were installed at the ceiling, having a clear height of 4,6 m. The fire was started by the ignition of two heptane pool fire trays (photo 1) under the engine compartment. Steel sheet screens with spot welded thermocouples were positioned 300 mm to the sides of the freight truck, to mimic adjacent vehicles and to measure the degree of fire control. Photo 2 shows the fire size at the discharge of water from the sprinklers that had activated once water was allowed to fill the system piping. A total of seven sprinklers activated. Photo 3 shows the fire damage after the test.

The tests verified that the suggested system designs were able to provide fire control, by preventing or limiting fire spread to adjacent vehicles and by reducing ceiling gas temperatures.

Dry-pipe sprinkler systems

In a dry-pipe sprinkler system, the piping is filled with pressurized air, rather than water. This air pressure holds a dry-pipe valve in a closed position, to prevent water from entering the pipe until heat from the fire operates one or more sprinklers. The air escapes and the dry-pipe valve opens, allowing water to enter the pipe and be discharged through the sprinklers onto the fire. Dry pipe sprinkler systems are used in spaces where there is a risk for freezing.



Deluge sprinkler systems

A deluge fire sprinkler system has piping with open sprinklers or nozzles. The system is connected to a water supply through a deluge valve that is opened by a fire detection system installed in the protected area or by manual operation of the deluge valve. Water discharges through all of the sprinkler or sprinklers in the deluge section.



Photo 1



Photo 2



Photo 3



Reports box

[Deliverable D10.1: Description of the development of automatic first response fire protection systems for ro-ro spaces on vehicle carriers](#)

