Evaluation of a Hybrid System of High Pressure Water Mist and Aerosol Fire Suppression Systems

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Abstract

A new hybrid system combining High Pressure Water Mist (HPWM) and aerosol fire suppression systems was tested to investigate the effectiveness of the hybrid system in providing fire protection for hazardous spaces, e.g. machinery rooms.

This main objective of the study is to investigate how both the HPWM and aerosol systems interact with each other; and whether the hybrid system enhances or diminishes the fire suppression performance of each system. Various activation sequences of the HPWM and aerosol systems were explored to compare the fire suppression performance of the new hybrid system in realistic settings to determine the best fire protection measures.

Six full-scale fire tests were conducted in a 500 m^3 compartment with dimensions of 10 m (W) by 10 m (L), with a ceiling height of 5 m. Figure 1 shows the test set-up. The compartment was equipped with both HPWM and aerosol fire suppression systems. Water mist nozzles and aerosol generators were installed on the celling. Temperatures, pressures and gas concentrations were monitored to observe fire behaviour. The fire scenarios tested in this project included various sizes of heptane and diesel pan fires; wood and plastic crib fires; and heptane spray fires. The fires were located either in the open area in the test compartment or shielded by obstructions.

Overall, the fire suppression performance of the hybrid system was relatively better than that of the aerosol system, in particular for the wood crib fire and the diesel pan fire. The water mists provided quick control of the fire and rapid cooling of the test room, while the aerosol provided quick fire extinguishment. Both the aerosol system and the hybrid system extinguished the plastic crib fires and the heptane spray fires fairly rapidly within 1 – 2 minutes from activation.

The effect of activation sequence of the two systems was also investigated. The suppression times of the wood crib fire varied with different activation sequences of the HPWM and aerosol systems. The earliest fire extinguishment resulted when the HPWM system was activated first, followed by the aerosol system with a delay of 30 seconds. For the other fire scenarios, the hybrid system appeared to be slightly less effective when the aerosol system was activated earlier than or concurrently with the

HPWM. Figure 2 shows room temperatures measured for the hybrid system when the aerosol system was first activated.

This study showed that the hybrid system is feasible and effective. Furthermore, test results indicated that the fine water mists did not interfere with the fine aerosol particles scavenging free radical around the flame. Nonetheless, both systems complemented the effectiveness of each system.

The use of the two systems with different design requirements demands detailed system designs, some of which are air tightness of the enclosure and peak pressure relief of the enclosure. Therefore, further study is necessary with the focus on realistic settings of an actual machinery room.

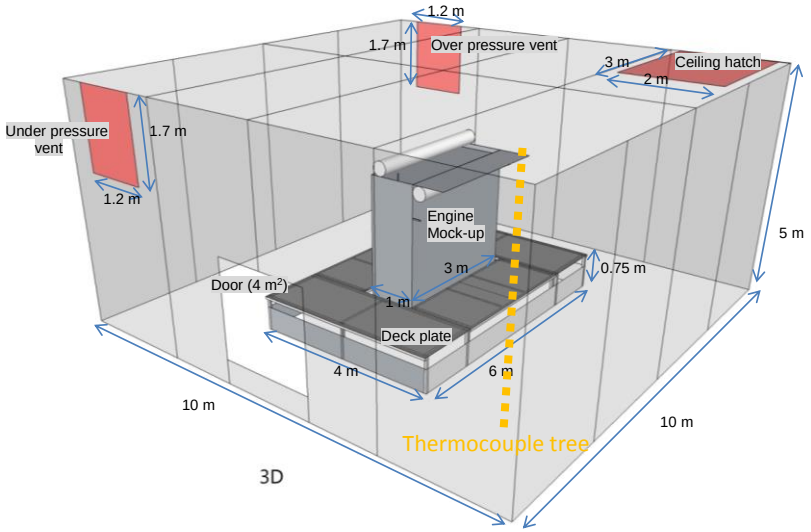

Figure 1 3-dimensional perspective view of the test room

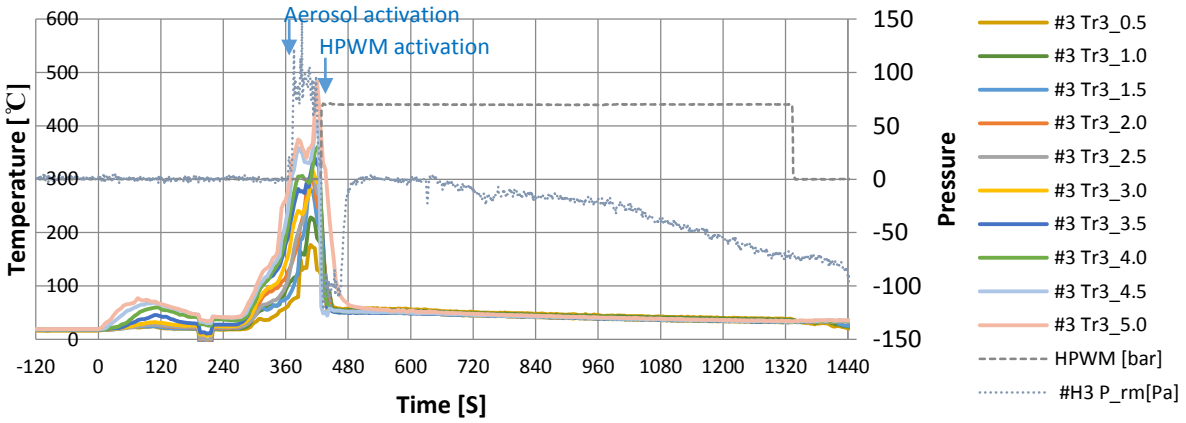

Figure 2 Room Temperature measured in the room during a hybrid system test

KEYWORDS: High pressure water mist system, aerosol system, hybrid system, machinery space protection