

Ceiling Height Limits for Effective Water Mist Protection of FM Global HC-2 and HC-3 Fire Hazards in Open Environment

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Abstract

In recent years the standard bodies in Europe and United States have begun to expand the water mist protection of solid combustible fires beyond those in the light hazard occupancies. An exploratory study was thus conducted in FM Global to evaluate the efficacy of using water mist to protect the more fire challenging HC-2 and HC-3 hazards as described in FM Global DS 3-26. The study was presented in the 2016 IWMA conference. Subsequently, a follow-up investigation was performed to determine the ceiling height limits for effective water mist protection of the above two fire hazards in open environment.

A series of fire tests was conducted for water mist protection of HC-2 and HC-3 fire hazards for both deluge and automatic nozzle applications. The HC-2 fire hazard was a 2-tier high rack storage, each pallet load consisting of three nested double-wall corrugated cardboard cartons with a metal liner insert sitting on a wood pallet, while the HC-3 fire hazard was represented by a palletized storage of cartoned expanded polystyrene of one pallet-load high. An optimized water mist spray was employed for this investigation, which discharged 76 lpm at 16.5 bar and had a volume median droplet diameter of around 220 μm . The nozzle spacing was 3.05 x 3.05 m, providing a nominal application density of 8.1 mm/min. The water mist discharge in both the deluge and automatic nozzle protections was activated by thermal sensors rated at 73.9°C and an RTI (i.e., Response Time Index) of 27.6 (m-s)^{1/2}, all located at 0.15 m below the ceiling.

The tests showed that, with the water mist sprays employed in this investigation, the HC-2 and HC-3 fires could be protected with deluge nozzle application for ceiling heights up to 9.1 m. However, with the automatic nozzle protection, the ceiling height limit had to be reduced to 6.1 m, with a water demand of 8.1 mm/min over an area of 186 m².

KEYWORDS: solid combustible fires, deluge nozzle protection, automatic nozzle protection