

Water Mist Extinguishment of Exhaust Duct Fires

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Biography

Bert is a Principal Scientist at the FM Global Research. His key area of interest is water-based fire protection. He has eight patents as a lead- or co-inventor. He received the best paper award in the 10th IAFSS Symposium and jointly received the 2010 SFPE Jack Bono award. He is the current chair of the Scientific Council of the International Water Mist Association, and serves in NFPA 13D&R and 750 committees.

Abstract

The efficacy and requirements for water mist to extinguish ventilated duct fires was investigated. The investigation was carried out by first establishing the protection for a 0.30-m duct, then projecting and verifying with fire tests the requirements for the protection of a 0.61-m duct. Water mist was applied at two locations about 3.0 m apart, with a propane fire placed at the upstream end, midpoint and downstream end between these two locations.

The 0.30-m duct tests were mainly conducted with a water mist discharge rate of 44 lpm at each duct location, with a volume-median droplet diameter of about 77 μm . Limited testing was also performed with a higher discharge rate of 64 lpm at each location, with a median droplet size of about 88 μm . The nozzles were all discharging in the exhaust direction. In each test, propane was released to give a free-burn heat release rate ranging from 105 to 475 kW. The tests showed that the fire could be extinguished in the horizontally- and vertically-oriented ducts. The protection is deemed applicable to steel, fiber-reinforced-plastic and fiberglass ducts. However, polypropylene and polyvinyl-chloride ducts should be avoided due to the low softening temperatures.

Modeling suggested that the required water mist discharge rate in the 0.61-m duct should be four times that for the 0.30-m duct protection at the same exhaust velocity. The 0.61-m tests indicated that, with the nozzles discharging in the exhaust direction as in the 0.30-m duct tests, fire could be extinguished similarly as in the 0.30-m duct, provided that the discharge rate could meet the above requirement and the median droplet size was less than 90 μm . The tests also showed that the fire could be more readily extinguished by discharging water mist against the exhaust flow.

KEYWORDS: water mist protection, exhaust duct fire, global fire extinguishment