WATER MIST IN OFFICES

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A report "Water mist fire protection in offices: experimental testing and development of a test protocol", published by IHS BRE Press, provides the detailed results from a research project funded by the BRE Trust which included large-scale fire tests conducted by BRE Global at its Burn Hall near Watford. This report describes an experimental study carried out to provide fire test evidence to assist in the understanding of water mist systems. A fire test protocol for office occupancies was developed and experimentally tested with a sprinkler system and low- and high-pressure water mist systems. The test protocol has now been adopted by the British Standards Institution and forms part of a recently published water mist standard, Draft for Development DD 8489 Fixed fire protection systems –Industrial and commercial watermist systems".

In the UK water mist systems are increasingly being considered and used for the fire protection of buildings, including offices, hotels and commercial premises, and as an alternative to sprinkler systems. Water mist is an environmentally attractive fire protection system capable of reducing fire damage and business interruption with a relatively unobtrusive system. However, the impact of design on the performance of such systems is not well understood and so for those responsible for specifying systems and approving building designs, the lack of relevant and independent advice and information presents a significant challenge.

Water mist systems spray smaller water droplets than traditional sprinkler systems, and suppress a fire by cooling, wetting and displacing oxygen. This has been shown to be very effective for small compartments such as prison cells, both in suppressing a fire and improving conditions for survival of occupants. However, for larger, open spaces containing typical office combustibles, the effectiveness of water mist systems has not previously been as well understood. In order to fill this knowledge gap the BRE Trust funded a three year research programme supported by industry partners.

EXPERIMENTAL PROGRAMME

BRE Global conducted 48 fire tests with low pressure and high pressure water mist systems.

To assess the performance of the water mist systems, an experimental programme of work consisting of 3 key tasks was undertaken:

- wood crib fire tests assessing the impact of water mist system design, obstructions, ventilation and compartmentation
- development of a full-scale fire test for open plan office spaces based on a 'typical' office
- testing a sprinkler system and water mist systems provided and installed by industry partners to establish their performance in the full-scale fire test.

KEY FINDINGS

From the initial wood crib testing, it was found that the correct distance between nozzles was critical for suppression, as was the water flow rate. The water mist systems were more effective when in a small room compared with in a large open space. When the wood crib was shielded from the water mist nozzle the effectiveness was reduced, and performance was significantly hindered by ventilation.

In the full-scale testing, all the water mist systems demonstrated lower temperatures at ceiling level and less fire damage, compared with the unsuppressed fire test. However, not all arrangements met success criteria as determined by BRE Global. Of the water mist systems tested:

- the low-pressure water mist system (at 2.5m by 2.5m spacing) was successful
- the low-pressure water mist system (at the same flow rate and 3m by 3m spacing) was not successful
- the high-pressure water mist system (installed at 3m by 3m and 4m by 4m) was not successful.

The scope of the testing was necessarily limited and other system arrangements may perform differently.

CONCLUSIONS

Overall, the full-scale test results were of concern. Most water mist system arrangements were not able to provide expected levels of fire protection for the tested scenario (open plan office area with obstructed fire loads and a high ceiling). Or, in terms of the design of the tested systems, the spacing between nozzles was too great and the quantity and momentum of water discharged too low to provide effective fire suppression. The test work demonstrated that water mist system effectiveness cannot be assumed and that it is essential to verify system performance against realistic, reliable and repeatable fire test protocols.

There is now a fire test protocol that can be employed for testing the effectiveness of water mist systems in open plan offices, developed by BRE Global. This test forms part of the British Standard DD 8489-7 (for low hazard occupancies). The fire test protocol is relevant to the design of other low hazard occupancies (rooms and spaces), as long as limiting conditions are met. For example, the contents of the room are limited to ordinary combustibles with an equivalent fire load and rate of fire growth, the ventilation conditions are equivalent and the ceiling height is limited to the tested height.

Critical to the successful operation of a water mist system are the system design details, in particular, nozzle type, nozzle spacing and water flow rate, and building/room design details – particularly fire loads, obstructions, ventilation, ceiling height, compartmentation and openings. These design details need to be fully addressed in both the fire performance tests and the installed systems, to ensure the effectiveness of the water mist system.

At present water mist systems do not offer a simple alternative to sprinkler systems. Fire performance tests are necessary to confirm the effectiveness of a particular water mist system for specific applications. Confirmation of the water mist components requires additional assessments, as the UK and European standards are still under development. Verification of the design, installation and maintenance of a system requires expert review as many of the requirements are system and application specific. However, this BRE Global report and the new British Standard DD 8489 represent a significant step forward for the application of water mist systems in the UK.

Looking forward, LPCB are developing an independent third party LPS scheme for the approval and listing of water mist systems for use in commercial low hazard occupancies. The scheme will support and augment the requirements of DD 8489.

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