



Best practice

The British Standards Institution has published two water-mist fire-fighting systems standards in response to widespread concerns amongst those involved in the specification, provision and insurance of fire safety in buildings, writes Bob Whiteley.



The lack of British or EN standards for water-mist fire protection was considered to be leading to instances of poor practice and fear of potential failure to protect life and property in the event of fire.

Consultations with interested parties concluded that EN water-mist standards were some years away and that, based upon the working drafts, could fail to address some of UK's concerns. The meetings of interested parties agreed to co-operate on the creation of two standards covering the two areas, where water-mist fire protection has application for land-based building fire protection and prepared justifications to British Standards for agreement to proceed.

The BS8489 series, published in May this year, is titled: *Fixed fire protection systems – industrial and commercial water mist systems*, where Part 1 covers the code of practice for design and installation; and subsequent parts provide fire test protocols for a selection of applications. This article will focus on BS8489

BS8458, published last year, is titled: *Fixed fire protection systems – residential and domestic water mist systems, code of practice for design and installation*, which includes fire test protocols. It has been created to mirror BS9251 requirements for domestic and residential sprinkler systems to ensure consistency of approach.

Both standards set out requirements for components without setting down their type approval test requirements. They also provide the basis for assessment under third party installer audit schemes.

The standards advise – but cannot require – the desirability of third-party testing and certification of conformity with the British Standards.

As with other standards, the new water-mist standards have been created by industry experts on the basis that their execution would be entrusted to appropriately qualified and experienced people.

Local application

Local application water-mist fire extinguishing systems consist of a calculated supply of water arranged to discharge directly onto discrete and identified hazards. These systems enable

protection to be provided for specific hazards within a larger, possibly unprotected, area. Typical risks include industrial oil cookers and diesel generators, for example.

Where a risk assessment shows that the spread of fire could involve two or more objects of local application, the water-mist system should be designed for the combined hazard.

System design parameters will need to be determined by representative and successful full-scale fire tests, which would be expected to have been verified by third parties, and with water supplies capable of discharge durations at least twice those required to achieve fire extinguishment and prevention of reignition; with a minimum discharge time of 10 minutes.

Volume protection

Volume protection water-mist fire systems, on the other hand may be either open nozzle systems, where all nozzles discharge simultaneously throughout the entire enclosure, or automatic nozzles where only the nozzles in the immediate vicinity of the fire are expected to operate. Depending on the fire hazards and the fire test protocols used, the systems may be engineered to provide fire suppression – typically for Class A ordinary combustibles – or to provide fire extinguishment of flammable liquid hazards.

Volume protection systems should be designed and installed for the hazards to be protected within the volume, in accordance with the design parameters established through representative fire tests. For water-mist systems designed to extinguish fires the water supply duration would be as for local application systems; however, for fire suppression systems the standard requires discharge for the duration of 60 minutes at a minimum. Where the spread of fire is deemed likely to involve two or more enclosed volumetric spaces, this must be taken into account and the water-mist system should be designed for the combined hazard.

An annex to the standard sets out the provisions needed for 'enhanced availability', where a water-mist system is being provided for compliance with a regulatory requirement; or where water mist is proposed as an alternative means of compliance in respect of life-safety measures.



The installation of an automatic door closing mechanism is expected to improve the effectiveness of water-mist systems by ensuring that any doors to the volume being protected are kept shut to retain the mist and block strong air currents.

Fire testing

All water-mist system designs are required to be based upon successful fire testing of the supplier's system against fires that simulate those in the hazard to be protected. The testing determines the nozzle types, flow rates and operating pressures, maximum and minimum nozzle heights and spacing. As there are no 'standard' water-mist nozzles, each supplier will arrive at their own unique solution for any given hazard.

From the experience gained from testing and application of water mist over the past 20 years, a growing database of fire test protocols now exists for a wide variety of applications. Whilst BS8489 sets out a number of fire test protocols for hazards, such as industrial oil cookers, turbines, local application involving flammable liquids, and low hazard occupancies; the standard does not preclude the use of other fire test protocols.

One of the greatest challenges to the engineering of water-mist fire-fighting systems lies in determining whether the conditions of a particular test protocol are representative of the actual conditions in a given application based on an understanding of the dynamics of the interaction of water mist with fire. The following application parameters need to be determined as a minimum.

- a) Is the fuel similar to the test protocol (liquid or solid fuel, flash point, combustibility, quantity, arrangement)?
- b) Is the compartment volume equal to or less than the volume of the test room?
- c) Is the compartment height equal to or less than the test protocol?
- d) Is the compartment ventilation conditions similar (presence of fans, forced ventilation, etc, area of openings, position of openings)?
- e) Are there more obstructions to the distribution of mist than the test protocol?
- f) Is the duration of protection provided by the listed system appropriate for the actual level of protection needed?

Water mist is a specific application solution which needs to be proven for each individual application and/or occupancy and to have demonstrated performance against standardised fire tests and component tests, as indicated by a report issued by the fire test laboratory.

Users of the British Standard are advised to consider the desirability of using a test facility that operates a quality system and has water-mist testing in the scope of its accreditation. Of particular importance with respect to testing of water-mist fire-fighting systems are comprehensive understanding of water-mist technology; ability to properly condition and characterise the fuels; and use of appropriate instrumentation and methodology to verify the compliance or non-compliance with the pass/fail criteria, and repeatability.

Where a water-mist system application is not covered by a recognised fire test protocol, additional testing is likely to be required.

Water supply

One of the attractions of water mist is that, in general, it uses less water than other water-based fire suppression and extinguishing systems. However the supply must be just as reliable and readily available.

For smaller systems the supply may be provided by water

stored in cylinders and purged by gas. This enables the supply to be 'stand alone' without the need for a permanent connection to a town's main supply. However, for most systems the supply is delivered by one or more automatically starting pump sets drawing from a storage tank in-filled from the towns' main.

BS8489 has gone into some detail on these provisions and the document sets out the determination of 'effective capacity' of storage tanks with and without vortex inhibitors, as well as the need for a flow-test facility to check the flow capacity of the town's main feed. This becomes necessary as the standard allows for reduced capacity tanks, holding not less than 30% of the total water required, where the town's main is sufficient to enable the system discharge duration to be met.

BS8489-1 also sets out the necessary electrical power supply provisions to ensure security of supply by requiring that the pump power connections are taken from the incoming supply side of the main switchboard.

Hydraulic design

All systems are to be fully hydraulically calculated. The standard calls for designs to determine the assumed maximum area of operation (AMAO) at both the hydraulically most remote area and the most favourable.

These two calculations are done to ensure that the water supply can deliver sufficient flow and pressure. In the case of the most remote AMAO, to ensure there is sufficient flow and pressure at the farthest part of the system after accounting for the pipe friction losses through the system. The calculation for the most favourable area is carried out to ensure that the water supply can still meet the increased flow to the areas close to the supply to where there are the minimum of pipe friction losses. The standard has a specific annex which explains how and where the AMAOs should be established.

Concluding, BS8458 and BS8489 replace the previously published DDs (Drafts for Development). They have been created through the collaborative efforts of industry experts to reflect experience gained over the past 20 years. They provide, for the first time in UK, standards to which specifiers can refer; engineers with knowledge and expertise in water-mist fire systems can provide consistent and uniform compliance; and auditors can review against. Their publication places in the public domain the current 'industry best practice' for the use of water mist when and where appropriate.

The design of all water-mist systems remains firmly based upon fire test verified solutions for each specific application supported by test reports made available to interested third parties so that it can be clearly understood exactly what has been tested and how.



Bob Whiteley is chair of the BS water mist committee and the joint FIA/BAFSA water-mist working group.

One of the attractions of water mist is that in general it uses less water than other fire suppression and extinguishing systems.