Development of British Standards for WaterMist

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Introduction

The use of watermist fire protection has been evolving since the 1990s but the lack of robust land based standards has been seen as barrier to general acceptance of this technology.

The members of the main BSI fire protection systems committee -FSH/18 were concerned that the European watermist work would not meet UK needs in a timely fashion. Once completed in its limited form it was only published as advisory only. In anticipation of this a series of Joint Watermist Working Groups were formed to prepare separate standards covering commercial and industrial applications, and domestic and residential applications. In view of the rapid pace of developments in this technology, it was deemed appropriate for these standards to be DDs –Drafts for Development – in effect provisional standards. In this form they can be created and published quickly and would enable experience to be gained over their two year life span before they would be reviewed and considered for adopting as full British Standards.

Three Joint Working Groups were formed –
JWG1 – to input to work in Europe
JWG2 –DD8458 –Domestic and residential Watermist
JWG3 DD8489 Commercial and Industrial Watermist

Membership of the Joint Working Groups was provided by knowledgeable and interested parties from the Fire Industry Association, British Automatic Fire Sprinkler Association, the Fire Protection Association, Factory Mutual, Loss Prevention Certification Board and Insurers. The members assembled the best available information on watermist and existing mist system design and test standards as the basis for the UK standards.

What is Watermist?

Fire protection using watermist utilises the delivery of water as very small droplets at high momentum into a fire plume. The small droplets have a relatively high surface area and are thus more readily able to absorb heat and, being small, are light weight and thus able to remain airborne longer to absorb the heat and to readily vapourise into steam. Watermist thus attacks the fire triangle but cooling, steam smothering and blocking radiant heat transfer.

There are various mechanisms for generating small water droplets at high momentum which are well documented. Some nozzles use a separate gas supply to each nozzle to atomise the water. Some nozzles rely upon an external deflector plate to beak-up the water stream into fine droplets. Other nozzles incorporate a number of small sub-

nozzles with very small orifice plates in them. Lastly there are nozzle which contain an internal ‘swirl chamber’ which delivers a rotating sheet of water which fractures into very small droplets.

Watermist systems and equipment exist at operating pressures from 5to6 bars to over 200 bar to suit the component technologies being used. These considerations have no bearing on the watermist standards which are being developed as these standards focus on the performance requirements of any and all mist systems against defined fire scenarios.

A particular feature of all watermist systems is their highly efficient use of water which results in low water usage compared with other water based fire protection systems. In addition they provide excellent cooling of the fire and its surroundings which can provide increased safety for fire fighters and other personnel.

Where is watermist used?

Watermist can be used where its performance has been validated by representative fire testing. Many manufacturers have tested:

- Turbines and diesel generators
- Local applications
- Engine test cells
- Public spaces such as circulation area, shops and offices
- Food industry applications
- IT facilities
- Accommodation spaces

However the lack of common and consistent test protocols makes it difficult to establish the robustness of the test performance claims being made.

As with other water based fire systems, watermist nozzles may be ‘closed’ by thermally activated frangible elements, or they may be ‘open’ nozzles.

Depending on the application, watermist may provide fire suppression (complete fire knockdown but no extinguishment) for fires involving ordinary combustibles, but for flammable liquid fires, water mist may be engineered for extinguishment as well as for suppression. When considering watermist it is therefore important to understand what each particular system can provide.

DD8458 –Code of Practice for the Design & Installation of watermist fire suppression systems for residential & domestic occupancies

The work centres around a series of fire tests in an 8m x 4m room with both corner and centre room fires, with and without a through airflow. The watermist must suppress the fire for at least 10 minutes for domestic applications and 30 minutes for residential ones. It must also limit temperatures within the enclosure as well as preventing fire spread.

The tests will establish, for each manufacturer who tests, a set of design parameters giving:

- Maximum & minimum nozzle heights
- Maximum & minimum nozzle spacing
- Maximum & minimum distances from walls
- Distances from obstructions
- Distance from ceiling
- Maximum & minimum nozzle pressures and flows
- Identify where performance is dependent on water additives.

System design criteria for domestic and residential applications require protection of all parts of a dwelling excluding bathrooms (<5m^2), cupboards, non-communicating buildings such as garages, and crawl space. Pipework must be hydraulically calculated and may be copper, galvanised steel, stainless steel or fire rated PVC, with all systems hydrotested to 1.5 times their working pressure for one hour on completion.

The water supplies for watermist systems can be provided by either dedicated cylinders or from pump and tank. These must be able to supply the required flow and pressure for all nozzles to operate in any given room.

DD8489 Fire Protection Systems – Commercial & Industrial Watermist Systems

DD8489 covering commercial and industrial watermist systems will consist, initially, of seven parts:

1. Code of Practice for Design and Installation
2. Component specification and test protocols (pending)
3. Template for fire test procedures
4. Fire tests for local applications
5. Fire tests for combustion turbines ≤80 m^3
6. Fire tests for industrial oil cookers
7. Fire tests for hotel bedrooms and accommodation occupancies.

As with the DD8458 the testing will provide the design parameters for each manufacturer's system tested.

For extinguishing systems - the water supplies are required to operate for twice the time needed during testing to extinguish the fires and prevent re-ignition with the maximum number of nozzles operating. For suppression systems the water supplies must run for at least 30 minutes with twice the number of nozzles operating than these which operated during the tests. Thus a 100% safety factor has been incorporated into the water supply and hydraulic provisions of the standard. Where pump suction storage tanks are used their capacity should not be less than 30 % of the total water requirement along with sufficient infill capacity.

As with domestic and residential watermist systems –the water supplies may be from dedicated cylinders or pump and tank. Again -systems must be hydraulically calculated and corrosion resistant piping used.

DD8489 vs DD8458?

When is a protection required to DD8489 rather than DD8458? Basically the considerations are the same as those for sprinkler systems in that the systems for domestic and residential occupancies are primarily to prevent flashover to enable personnel to escape, whereas the commercial and industrial systems are primarily for property and asset protection.

Where do we go from here?

Both DD8458 and DD 8489 are in their final stages of drafting with the Joint Working Groups liaising with BSI editors to finalise the text. On completion the drafts then have to be approved by the main BSI Fire Systems Committee –FSH/18 so that, once approved, these will be published by BSI. It is envisaged that this will occur later this year.

The Joint Working Groups will then begin work on the component requirements (for which considerable data already exists), and on an office fire test protocol. It is envisaged that other test protocols will be added in response to commerce and industry requirements.