

Forward

This document has been produced by BAFSA with the intention of providing a view of the present status of water mist industry fire suppression technology in the UK. BAFSA recognises that there are wide variations in the experience, capabilities and competence of the companies active in this field and in particular, acknowledges freely that there are reputable and capable designers, manufacturers and installers of certain types of mist systems.

BAFSA also recognises that there are fast-moving developments in the field and looks forward during 2006 to the production of draft British Standards for water mist systems in both commercial and industrial buildings and residential occupancies. BAFSA also recognises that there are a number of non UKAS accredited bodies (most notably FM Global and VdS) which have certificated certain company's systems and equipment.

It is earnestly hoped that a future edition of this BIF will be able to list a wide range of approved products and installations.

1. Introduction

Recent research and proprietary development in the application of water at higher pressures than is used by conventional sprinklers have resulted in a number of companies offering water mist systems as an alternative to conventional sprinkler equipment. Water mist systems employ small sprinkler-like heads discharging water in a mist and superficially appear very similar to conventional sprinkler systems. Indeed, these systems offer many of the benefits of conventional sprinkler protection.

Several proprietary systems are available ranging from low pressure (8 - 12 bars) systems providing a fine water spray extinguishing medium to very high pressure (up to 110 bars) systems producing a very fine water particle mist. The water is propelled either by pumps or by an inert gas and dispersed from nozzles that are designed to deliver water in a range of fine droplet sizes to the area of fire. The suppression mechanism relies on a combination of cooling by the water and the production of steam that displaces oxygen from the area of the fire to a level that cannot sustain combustion. High pressure water mist systems resemble gaseous extinguishing systems while low pressure systems are more akin to sprinklers or water spray/deluge systems.



Mist nozzles and stainless steel pipework for a system in a power station

2. Sprinklers and Mist Compared

In comparison with sprinklers, water mist systems use comparatively small amounts of water to fight fires which may offer benefits in respect of installation costs and reduction in water damage post-fire. Mist systems also offer the potential for installation in locations which are too small to accommodate the tanks and pumps of a conventional sprinkler system.

At present, there are no British or European standards for water mist systems although a European working group is currently developing a Draft standard - prEN 14972 – *Fixed firefighting systems – Watermist systems – Design and installation*. The US National Fire Protection Association has published NFPA 750 *Standard on Water Mist Fire Protection Systems* which gives useful general guidance on the application of water mist systems but does not provide a design guide for individual risk applications.

British Standards are also working in this area and a water mist supplier/installer has drafted a possible standard for water mist in domestic and residential premises. The Office of the Deputy Prime Minister recently (July 2005) commissioned work from the BRE published as a report *Fire suppression in buildings using water mist, fog or similar systems*. A number of the reservations BAFSA have in respect of the wider use of water mist systems appear to be supported by some of the conclusions in this paper.

3. Limitations on Mist System Effectiveness

The absence of a design and installation standard akin to BS 5306 *Fire extinguishing installations and equipment on premises Part 2 Specification for sprinkler systems* or BS EN 12845: 2004 *Fixed firefighting systems - Automatic sprinkler systems - Design, installation and maintenance* should be recognised as each type of mist system will have its own strengths and weaknesses and as most of the design concepts are proprietary, inherent weaknesses may not become evident until after installation. Some research has been undertaken into the appropriate use of these systems in confined spaces and large volume areas. High ceilinged spaces with large floor areas may present problems in designing nozzle layout to ensure all potential fire locations fall within the effective range of the nozzle distribution and such locations may be unsuitable for the installation of quartzoid bulb mist heads. Where it is not possible to use quartzoid bulbs then careful consideration of the selection and zoning of fire detection devices must be undertaken if spurious alarms and actuations are to be avoided. At the same time, the method of detection must also ensure that enough water is discharged to achieve the necessary mist configuration and pattern. Studies have also indicated that the design of some water mist systems needs careful consideration where the protected location is prone to significant air movement as this may impact on the effectiveness of the mist.



Replacement gas cylinders for a mist system

Tests have also shown that some types of mist systems are also less effective at extinguishing slow, deep-seated fires in 'normal combustibles' than traditional sprinkler systems. In one recent case, a water mist system was tested in a simulation of a cellular archive storage area and the results were disappointing when compared to the use of an inert gas system. The failure of the mist system to perform as anticipated was almost certainly due to the fact that the paper fire was deep-seated and did not generate enough heat to create steam. This and other limiting factors, such as personnel presence and detection parameters, require a careful risk assessment to be made before any conclusion is reached as to the type of protection needed for any particular location or occupancy. The risk assessment needs to take into account the fact that (unlike sprinkler systems) each mist system has to be specifically designed for the space it is to protect. In the absence of any recognised international standards for the design of water mist systems, care needs to be taken when deciding on the validity of **manufacturers' claims** – some of which are based on system technology and components developed for use in marine applications and so may not be directly relevant for building protection.

It has been suggested by a range of authorities including the FPA, that proposals for water mist systems should be subject to detailed scrutiny where such applications are novel or not covered by standards. In particular, the supplier or installer of a proposed system should be able to demonstrate that test fires have been satisfactorily extinguished or suppressed (whichever is the desired result from the system) in rooms of the same size and same occupancy and fire load as the intended application.

Other issues to be considered include the chosen method of system actuation. Mist nozzles can be open or fitted with quartzoid bulbs. Open nozzle systems will therefore require a separate detection system (analogous to that which is required for a pre-action sprinkler system), which as already stated could be subject to the sorts of stimuli which result in spurious or unwanted false alarms. Closed heads with bulbs are subject to the same constraints as sprinkler systems with possibly the disadvantage that many mist systems are designed to incorporate storage of very limited amounts of water. If a very rapid fire occurs which causes all the heads in a room to operate it is possible that the supply/duration of stored water may be inadequate. It should be noted that some medium and high-pressure mist systems depend on stored water of at least the purity of potable water or need the installation of special filtration equipment where the

available mains water does not meet such standards. Larger quantities of water need to be stored if the mains supply or filtration systems cannot be utilised.

Applications where adequate independent test-derived data exists to prove that mist systems are adequate (apart from marine applications) include: engine test cells, diesel generator rooms, battery and UPS accommodation, telecommunications cubicles and cable tunnels. At least three manufacturers claim satisfactory installations in hotels, historic buildings and also museums and galleries and while there is little empirical, independent test data to support some of the claims it would appear that mist systems are capable of fulfilling their intended design purpose in such locations. It should also be noted that there is little real fire experience of land based mist systems - possibly due to the relatively few installations in existence at the time of writing.

Although many of the issues identified will be resolved in time it is suggested that caution should be exercised in specifying water mist systems for the protection of very large open spaces or complete buildings until design and standards issues are resolved and British or European standards are published.

4. Application of Water Mist to Protect Domestic and Residential Accommodation

A number of UK companies are actively promoting water mist systems as an alternative to sprinkler protection for domestic and residential properties. While some of the systems proposed follow the well-established design model for marine water mist systems, others are hybrid systems which do not follow any established standard or code of practice. Concerns regarding the 'ad hoc' nature of some



Water mist gas cylinders and manifold for a Hotel installation

systems have been expressed by a number of authorities including the Fire Protection Association and insurers as well as some consulting fire engineers. A number of fire brigades have supported the use of such systems (reportedly on the basis that 'any protection is better than none') having been attracted by apparent lower costs when compared with full sprinkler protection. However significant concerns have been expressed at whether some of the domestic mist systems being installed will perform correctly in a real fire situation. While a few successful actuations of mist systems have been reported by installers there have been a number of demonstrations undertaken where systems have failed to extinguish test fires.

BAFSA have been asked on many occasions if water mist systems can be used to comply with the requirements of BS 9251:2005. We do not believe that they can for a number of reasons including the following: -

1. BS 9251:2005 requires a delivery of 60 l/min over an area of 15 sq. meters. This equates to a density of 4 mm/min. Most of the water mist

Summary of advantages and disadvantages of water mist and sprinkler systems

Water mist systems

Advantages:

- Less water
- Lighter systems
- Smaller water tank
- Smaller pipes

Disadvantages

- High maintenance costs
- Very high quality water required
- Expensive stainless steel pipework
- Short run time (typically 10 min)
- Not as effective on small or slow burning fires

Sprinkler Systems

Advantages:

- Recognised UK and European standards
- Third party approval of equipment and installers
- Long systems life (30 years plus)
- Components are manufacturer independent (no lock-in)
- Tried and tested for over 100 years
- Low maintenance cost

Disadvantages:

- Larger pipe sizes
- High water discharge
- Larger storage tanks if mains supply is not feasible

systems being marketed for domestic use deliver considerably less water than this.

2. BS 9251:2005 BS 9251 requires a minimum discharge density of 3.5 mm / minute per square metre at the most hydraulically remote area when all the sprinklers in the area of operation are activated. Most of the water mist systems being marketed for domestic use deliver considerably less water than this. It is also reported that many of the systems currently being promoted only provide enough water for a maximum of 4 minutes firefighting. Therefore any proposed use of water mist in a residential building must also consider the likely response time for fire service intervention. It is BAFSA's view that mist systems with limited water storage of less than the amount specified in the British Standard are not suitable for use as a compensatory feature in obtaining Building Regulations approval for properties where adequate fire brigade access is not possible (B5) or where means of escape from upper floors is impaired (B1).

3. BS 9251:2005 requires a delivery of a significant amount of water onto the walls of the compartment at high level to aid cooling of the compartment. Some water mist systems provide little or no wall wetting and so may be unsuitable for such 'single head applications' as bedrooms. However manufacturers and installers of mist systems have argued that there is now substantial experience of installing mist systems in cabins on board ships and that the systems work as designed in such applications.

4. BS 9251:2005 requires the system to deal with a wide variety of fires in many locations within the property. The water mist systems currently being marketed for domestic use tend to be risk-specific and may not provide this versatility.

5. BS 9251:2005 requires the systems to be installed to a known specification using products independently tested to acknowledged international standards. Many water mist systems (as are currently being marketed for domestic use) have no published specifications or independent test data



High pressure water mist pump set and control unit.

available and where compliance with standards is being claimed, this tends to be to an International Maritime Organisation code which is intended for use in accommodation spaces on board large ships.

6. BS 9251:2000 requires that only components that have been tested and approved to internationally recognised international standards be used. This is not the case for many of the mist systems being promoted

It is likely that with the appearance of authoritative standards, approved equipment and components together with further development and independent testing, water mist systems will have a part to play in domestic/residential fire safety. At the time of writing (May 2006) the British Standards committee FSH 18/2 responsible for fixed fire suppression systems is working on a draft standard for residential and domestic mist systems. Any Draft for Development (DD) and eventual British Standard will, however, have to prove that such water mist systems will provide an equivalent level of protection to a BS 9251 sprinkler system.

However, until the new BS (or DD) is issued, it is BAFSA's view that great care should be taken in the specification of water mist systems for domestic and residential properties. Where such systems are used as a form of alternative compliance in respect of the requirements of Approved Document B (or the Scottish Building Standards), great care should be taken to ensure that the levels of protection and the protected area is no less than that provided by a BS 9251 sprinkler system. It is possible that civil or even criminal liabilities could attach to those specifying or installing such a mist system should it fail to operate as specified.

Presented by:

