

Loss Prevention Standards

Water Mist Fire Protection Systems

Introduction

Fixed fire protection systems such as water mist, are an engineered solution which can be designed for life safety or to protect business assets. Water mist fire protection systems have been in existence since the late 1800s, and started to be used in earnest during the later stages of the 1940s when a number of military and non-military capital ships began to protect their engine rooms using water mist systems. Since then many maritime ships now incorporate some form of automatic water mist fire suppression system.

In more recent times these systems are increasingly being considered and installed as a means of fire protection within various types of buildings. Water mist systems initially designed to protect relatively small compartments/rooms with limited heights can now be found protecting a wide range of risks including: hotels, schools, hospitals, commercial kitchens, industrial fryers, automated transportation systems, communication rooms, computer rooms, cable tunnels, standby generator rooms and engine compartments etc., often as an alternative to a conventional sprinkler installation.

A water mist fire protection system operates by forcing water through specially designed nozzles that create a fine mist of water droplets, with the intention of suppressing, controlling or extinguishing a fire by:

- Cooling the flame and surrounding gases.
- Displacing the oxygen by evaporation.
- Radiant heat attenuation.

Advantages of water mist systems include:

- Immediate activation which can provide suitable protection to some light hazard classified commodities.
- Requires relatively low quantities of water, reducing the water storage requirement as well as minimising the subsequent water damage to the area being protected, i.e. reduction in clean-up costs.
- Cools the atmosphere around the fire, allowing access for fire fighters to extinguish the fire.
- Cost effective solution (which are relatively easy to retro fit) for protecting a number of localised fire suppression applications such as fat fryers and engine fire rated compartments/rooms, etc.
- Does not harm the environment.
- No risk to personnel of asphyxiation (no delay required in activation to safely evacuate individuals).
- No use of chemicals.

However, care should be taken whenever considering the use of a water mist system to ensure that the exact scenario proposed has been fire tested, and that appropriate safety interlocks are provided.

Disadvantages of water mist systems include:

- No significant design standards available that provide information on the risks that can be protected (hazard/commodity classifications), the correct discharge nozzle (type, size, k-factor), maximum and minimum nozzle spacing, pipe sizing, type of pipe/fittings, support brackets or acceptable water supplies (number, size, capacity and duration).
- Design and installation relies on full fire testing.
- Designs based on existing fire test data must be identical to that used in the fire test, e.g. the same fire load/commodities, compartment size, discharge nozzle (size/manufacturer/discharge pattern/k-factor), nozzle spacing, pipe sizing, same water supply and proximity of the water supply. Current concerns for insurers include water mist systems being installed for applications that have not been adequately tested.
- Will not operate effectively:
 - in areas with excessive ceiling height clearances.
 - where obstructions exist below the discharge nozzles.
- Will not extinguish ventilated fires.
- Cannot control or extinguish fires involving high hazard or ordinary hazard classified commodities.
- Has very limited water supply duration (can be as little as 10 minutes).
- Only single 'one shot' attempt to extinguish a fire.
- Is not a replacement for automatic sprinkler protection.

Types of Water Mist Systems

Water mist systems can be automatic or manually operated, and can be designed as 'deluge', 'sealed head' or 'local application' systems.

Deluge total flood systems are typically used where a complete area requires protection, as the discharge of water in the event of fire is generally simultaneous through all nozzles. They have a series of open nozzles/heads with the system activated manually or automatically by separate fire detectors or heat sensitive elements.

Sealed head systems have closed nozzles, activated by their heat sensitive detectors.

Local application systems, for example, used over fryers or cooking ranges can have either sealed or open nozzles, activated by their heat sensitive elements.

Water mist installations are generally either high or low pressure systems. High pressure systems are usually supplied from either a pressurised water filled cylinder actuated by a small nitrogen gas cylinder similar to automated gaseous fire suppression systems, or pumped systems that draw water from a sealed tank. Water supply durations will vary from 10 minutes for cylinder systems, up to 15-20 minutes for pumped systems. Low pressure water mist systems can either be cylinder fed or supplied directly from the public water supply.

Design Standards

Any fire protection system requires to be appropriately designed and tested, to ensure that it able to suppress, control or extinguish a fire. There are varying national standards available for water mist but these all tend to provide very basic information and require the water mist design and installation to be based on actual full-scale fire testing.

It is important to ensure that any water mist designs based on existing fire test data, are identical to that used in the fire test, e.g. the same fire load/commodities, compartment size, ceiling clearance height, obstructions, discharge nozzle (size/manufacturer/pattern/k-factor), nozzle spacing, pipe sizing, pipe layouts, same type water supply and proximity of the water supply to the nozzle array.

Fire Testing

Only fire tests completed by a nationally recognised test and research facility are acceptable to insurers, such as the UK Fire Protection Association (FPA)/Building Research Establishment (BRE), or international organisations such as American Underwriters Laboratories (UL), American Factory Mutual (FM) or German Vds, etc.

Equipment

Only equipment listed, approved or certified by a nationally recognised test and research facility as mentioned above, should be used.

The following must be considered:

- Manufacturer, type of discharge nozzle, k-factor, angle of discharge and discharge rate needs to be known, and carefully considered.
- Full design drawings and hydraulic calculations to confirm the correct nozzle k-factors, and pipe sizes need to be issued by the water mist company.
- Design drawings must be fully dimensioned and show the positioning/location of the discharge nozzles, name of the manufacturer, size/k-factor of the nozzles used, type and size of pipework, support brackets (design and location/positioning), levels of pipework/nozzles/ceilings/depth of voids (floor and ceiling), location and size of any obstructions, type of water supply (size/capacity, design details and duration), compartment construction details (fire resistive/non-combustible or combustible) and include cross sectional views and location on a general site plan.
- Positioning of the discharge nozzles needs to be carefully considered to take account of any obstructions that may interfere with the nozzle discharge. Once installed, regular inspections of the system will be required to ensure that no changes to the building/operational layout results in nozzles becoming obstructed.
- Water supply (method and duration) is critical and must be suitable for the risk being protected.
- Is the water supply secure and will the supply remain constantly available (consider what happens to the supply when emergency repairs are being carried out, etc.)?
- Is there an impairment notification procedure?
- Consider the security of the electrical supply to the water mist system (valves/pumps). Is the electrical supply a dedicated supply that cannot be easily isolated?
- Is there an automatic standby water supply that will supply the system in case the main supply fails?
- Electronic solenoid valves must be designed to fail safe.
- Isolation valves must be monitored and secured open with chains and padlocks.

Interlock Systems

It is very important that any water mist system has the appropriate interlocks installed, to enable the system to perform effectively, which should operate upon activation of the system. For example:

- The equipment being protected should automatically shut down.
- The fuel supply to the equipment being protected should automatically cut off.
- Appropriate transfer systems (e.g. conveyors, etc.) should stop operating to restrict the spread of fire.
- Shutting down extract and/or ventilation systems.
- Closing fire doors/shutters.
- Interface with the main alarm system to sound audible and visual alarms.

Inspection, Testing, Servicing and Maintenance

It is important to regularly test the system and its interlocks at least weekly and record the date, time and results along with the name of the test engineer(s). Regular weekly, monthly, quarterly and annual inspections, correct servicing and maintenance of the water mist system in accordance with the system manufacturer's recommendations are also required. Maintenance and servicing should be undertaken by competent and qualified engineers, with dates, times and results of the inspections, servicing and maintenance including the name of the engineer(s) suitably recorded.

Impairment Notification

Impairment notification should be in use and must be agreed with insurers. If any fire-fighting equipment is undergoing maintenance or testing, adequate arrangements should be in place to ensure that a suitable level of safety and protection remains operative throughout this period.

Managing Change Notification

A formal documented procedure for managing changes involving significant works/expenditure to the building, plant machinery, equipment, services, fire detection, fire suppression and business operations etc. must be in use and agreed with insurers.

Any changes proposed to the water mist system protection or to the equipment or room being protected etc., need to be fully discussed with the water mist installation company, equipment supplier/manufacturer, insurers and other interested authorities.

Approving Authorities/Insurers

It is important to consult with insurers and other interested authorities prior to proceeding with ordering or installing water mist protection.

There are varying opinions in the fire protection and insurance industries on the effectiveness of these systems.

The Aviva official stance is as follows:

All water mist systems should be treated with caution particularly in building applications, for the following reasons:

- Current information about their overall effectiveness for commercial and industrial applications is not well established.
- Design, installation and components of water mist systems are not standardised.

- Protection strategy tends to be short duration protection rather than extended periods.
- Volume protection in buildings is largely unproven.
- Very few reported fire events in commercial buildings with water mist systems in the UK.
- Aspects such as reliability and long-term maintenance are largely unknown or unproven.
- Water mist can be effective in the protection of certain, but **NOT** all risks.
- Water mist is **NOT** equivalent to automatic sprinkler systems.
- Water mist must **NOT** be considered as an equivalent alternative to sprinkler systems protecting buildings and contents.
- Water mist does not attract sprinkler rating discounts.
- Water mist must not be taken into account when calculating an Estimated Maximum Loss (EML) for insurance purposes.
- Water mist local application protection can only be considered as a 'beneficial feature'.

In the UK, the RISCAuthority have published three documented water mist questionnaires (IQ1, IQ2 and IQ3) that should be used at the design stage to help ensure all design elements have been considered and checked, to ensure the expected risk control logic has been followed and recorded. These documents are available on the [RISCAuthority](#) website for free download, and should be completed by the water mist company and approved by Aviva prior to the installation of any water mist system.

Checklist

A generic Water Mist Fire Protection Systems Checklist is presented in Appendix 1 which can be tailored to your own organisation.

Additional Information

BSI "Fixed fire protection systems – Industrial and commercial water mist systems" design and installation series of standards; BS 8489: 2016 is published in the following parts:

- Part 1: Code of practice for design and installation;
- Part 4: Fire performance tests and requirements for water mist systems for local applications involving flammable liquid fires;
- Part 5: Fire performance tests and requirements for water mist systems for the protection of combustion turbines and machinery spaces with volumes up to and including 80m³;
- Part 6: Fire performance tests and requirements for water mist systems for the protection of industrial oil cookers;
- Part 7: Fire performance tests and requirements for water mist systems for the protection of low hazard occupancies.

[BSI Group](#)

[The Fire Protection Association \(FPA\)](#)

[Building Research Establishment \(BRE\)](#)

[Underwriters Laboratories \(UL\)](#)

[National Fire Protection Association \(NFPA\) - NFPA 750: Standard on Water Mist Fire Protection Systems](#)

[Factory Mutual - FM 5560: Approval Standard for Water Mist Systems](#)



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Further risk management information can be obtained from [Aviva Risk Management Solutions](#)

Please Note

This document contains general information and guidance and is not and should not be relied on as specific advice. The document may not cover every risk, exposure or hazard that may arise and Aviva recommend that you obtain specific advice relevant to the circumstances. AVIVA accepts no responsibility or liability towards any person who may rely upon this document.

Appendix 1 – Water Mist Fire Protection Systems Checklist

Location	
Date	
Completed by (name and signature)	

	Water Mist Fire Protection Systems Checklist	Y/N	Comments
1.	Have insurers and any other interested authorities been consulted and approvals obtained?		
2.	Has a risk assessment been completed of the equipment to be protected?		
3.	Is the equipment to be protected located in a dedicated fire resistant compartment including fire doors and fire shutters protecting window and conveyor openings (at least 1-hour fire rated)?		
4.	Has the necessary design questionnaires been completed by the water mist company, e.g. UK's RISCAuthority IQ1, IQ2 & IQ3, and approved by insurers?		
5.	Is the water mist designed as a 'deluge', 'sealed' or 'local application' system? Is the system automatic or manually activated?		
6.	Does the water mist design comply with a recognised national standard (if so state the name/details of the national standard used)?		
7.	Is the water mist design based on a full fire test completed by a nationally recognised test and research facility (state the name/details of the test and research facility)?		
8.	Is the water mist system identical to that used in the fire test, e.g. the same fire load/commodities, compartment size, ceiling clearance height, obstructions, discharge nozzle (size/manufacturer/pattern/k-factor), nozzle spacing, pipe sizing, pipe layouts, same type water supply and proximity of the water supply to the nozzle array?		

	Water Mist Fire Protection Systems Checklist Contd.	Y/N	Comments
9.	Is the water mist company a well established fire protection systems company and are they registered/certificated to design, and install water mist systems by a nationally recognised approval and certification authority, acceptable to insurers?		
10.	Is the water mist equipment listed, approved or certificated by a nationally recognised test and research facility (if so state the name of the certification company)?		
11.	Has the water mist company provided full design drawings and hydraulic calculations to confirm the pipe sizing, etc. (e.g. type of discharge nozzle, k-factor, angle of discharge, nozzle locations/spacing's, nozzle discharge rate, pipe sizing pipe layout and water supply details, size, capacity, and duration)?		
12.	Is the water supply duration known and assessed as acceptable for the type of protection provided (state the duration period)?		
13.	Does the water supply have a standby system that will automatically supply the water mist should the main supply fail or be isolated?		
14.	Is the water supply (delivery and supply) isolation valve secured in the open position with chains and padlocks, and is the supply reliable?		
15.	Is an alarm fitted to signal if any isolation valves (normally open) are closed?		
16.	Is this alarm tested weekly?		
17.	Are any electronic solenoid valves fitted to the water mist system designed to fail safe (open on loss of power)?		
18.	Does the water mist system have any safety interlocks that will automatically shut down the equipment and fuel supply, stop ventilation systems, extract fans or conveyor systems and close fire doors/shutters upon activation of the water mist?		

	Water Mist Fire Protection Systems Checklist Contd.	Y/N	Comments
19.	Is clear uninterrupted access maintained at all times to the control equipment?		
20.	Is there a regular weekly test of the water mist system, alarm signalling and its interlocks with records kept of the date, time, results, and the name of the test engineer?		
21.	Is there a regular weekly inspection of the system in accordance with the manufacturer's recommendations, with dates, times and results of the inspections, including the name of the test engineer recorded?		
22.	Are all the water mist nozzles kept clean, clear of debris and obstructions?		
23.	Is there regular servicing and maintenance of the system under contract with an accredited installer in accordance with the manufacturer's recommendations with dates, times and results of the inspections, including the name of the engineer recorded?		
24.	Is there an impairment notification procedure in use which is agreed with insurers?		
25.	Is there a managing change notification procedure in use which is agreed with insurers?		
26.	Have all necessary risk assessments been reviewed and updated following the installation of the water mist system, e.g. fire/security/housekeeping/health and safety, etc.?		
27.	Has the site's emergency plan been reviewed and updated following the installation of the water mist system?		
28.	Has the business continuity plan been reviewed and updated following the installation of the water mist system?		
29.	Additional comments:		

