

Loss Prevention Standards – Asset Classes

Water Mist Fire Protection Systems

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Fixed fire protection systems such as water mist can be designed for life safety or to protect business assets.



Water Mist Fire Protection Systems



Introduction

Water mist fire protection systems have been in existence since the late 1800s. In the late 1940s, they began to be used more widely as a number of military and non-military capital ships began using water mist systems to protect their engine rooms – something that many maritime ships now incorporate.

In more recent times, these systems have been installed as a means of fire protection within various types of buildings. Water mist systems initially designed to protect relatively small compartments or rooms with limited heights are now often used as an alternative to other more traditional forms of fire protection.

How Water Mist Fire Protection Systems Operate

A water mist fire protection system operates by forcing water through specially designed nozzles that create a fine mist of water droplets. This can suppress, control or extinguish a fire by:

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

They can protect 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
- Engine compartments

Advantages of water mist systems

Water mist systems:

- Can be immediately activated – which can provide suitable protection to some light hazard classified commodities
- Require relatively low quantities of water – reducing the water storage requirement as well as minimising the subsequent water damage to the area being protected
- Cool the atmosphere around the fire – allowing access for fire fighters who can extinguish it
- Are cost effective – for protecting a number of localised fire suppression applications such as fat fryers, and are relatively easy to retro fit
- Do not harm the environment
- Pose no risk of asphyxiation to personnel – no delay is required in activation to safely evacuate individuals
- Do not use chemicals

Disadvantages of water mist systems

Water mist systems:

- Have no significant design standards available that provide information on the:
 - risks that can be protected (hazard or commodity classifications)
 - correct discharge nozzle (type, size, k-factor)
 - maximum and minimum nozzle spacing
 - pipe sizing
 - type of pipe or fittings
 - support brackets
 - acceptable water supplies (number, size, capacity and duration)
- Design and installation rely on full fire testing
- Designs based on existing fire test data must be identical to that used in the fire test
- 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
- Have very limited water supply duration – this can be as little as 10 minutes
- Provide only a single attempt to extinguish a fire
- Are 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 one of three systems:

1. Deluge total flood systems (these can be manual or automatic in operation)
This type of system has a series of open nozzles and is activated by separate fire detectors or by various heat sensitive elements. They are typically used where a complete area requires protection, as the discharge of water in the event of fire is simultaneous through all nozzles.
2. Sealed head systems (automatic in operation)
Activated by their heat sensitive detectors, these systems have closed nozzles.
3. Local application systems (these can be manual or automatic in operation)
With either sealed or open nozzles, local application systems are activated by heat sensitive elements. They are often used over fryers or cooking ranges.

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, or
 - pumped systems that draw water from a sealed tank
- Water supply durations vary:
 - from 10 minutes for cylinder systems
 - up to 20 minutes for pumped systems
- Low pressure systems can either be:
 - cylinder fed, or
 - supplied directly from the public water supply

Design Standards

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

BSI design and installation standards

The British Standards Institution (BSI) [BS 8489: 2016 Fixed fire protection systems – Industrial and commercial water mist systems](#) 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

Fire test data

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. they must have the same:

- Fire load/commodities
- Compartment size
- Ceiling clearance height
- Obstructions
- Discharge nozzle – including size, manufacturer, pattern, and k-factor
- Nozzle spacing
- Pipe sizing
- Pipe layouts
- Type of water supply
- Proximity of the water supply to the nozzle array

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

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. 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) should stop operating to restrict the spread of fire
- Shutting down extract and/or ventilation systems
- Closing fire doors and shutters
- Interface with the main alarm system triggering 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

Agree with insurers a formal documented procedure for managing changes involving significant works to the:

- Buildings
- Plant machinery
- Equipment
- Services
- Fire detection
- Fire suppression
- Business operations

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

Approving Authorities and 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. Aviva recommends that all water mist systems be treated with caution, particularly in building applications, as:

- Current information about their overall effectiveness for commercial and industrial applications is not well established
- The design, installation and components of water mist systems are not standardised
- Protection strategy tends to be for short duration rather than extended periods
- Volume protection in buildings is largely unproven
- There have been very few reported fire events in commercial buildings with water mist systems in the UK
- The reliability and long-term maintenance of water mist systems is 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, and does not attract sprinkler rating discounts
- Water mist systems must not be taken into account when calculating an Estimated Maximum Loss (EML) for insurance purposes
- Local application water mist systems can only be considered as a 'beneficial feature'

LOSS PREVENTION STANDARDS

In the UK, the [RISCAuthority](#) has published three documented water mist questionnaires (IQ1, IQ2 and IQ3) that should be used at the design stage to ensure all design elements have been considered and checked, and the expected risk control logic has been followed and recorded. These documents 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.

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Aviva Risk Management Solutions can offer access to a wide range of risk management products and services at preferential rates via our network of Specialist Partners.

For more information please visit:

[Aviva Risk Management Solutions – Specialist Partners](#)

Sources and Useful Links

- [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](#)

Additional Information

Relevant Loss Prevention Standards include:

- Sprinkler Systems – How they Operate

To find out more, please visit [Aviva Risk Management Solutions](#) or speak to one of our advisors.

Email us at riskadvice@aviva.com or call 0345 366 6666.*

*Calls may be recorded and/or monitored for our joint protection.

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.	Have you completed a risk assessment 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.	Have 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 and 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)?		

LOSS PREVENTION STANDARDS

	Water Mist Fire Protection Systems Checklist Contd.	Y/N	Comments
8.	<p>Is the water mist system identical to that used in the fire test, with the same:</p> <ul style="list-style-type: none"> • Fire load/commodities? • Compartment size? • Ceiling clearance height? • Obstructions? • Discharge nozzle – including size, manufacturer, pattern, and k-factor? • Nozzle spacing? • Pipe sizing? • Pipe layouts? • Type of water supply? • Proximity of the water supply to the nozzle array? 		
9.	<p>Are you using a well-established fire protection systems company that is registered or certificated to design and install water mist systems by a nationally recognised approval and certification authority acceptable to insurers?</p>		
10.	<p>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)?</p>		
11.	<p>Has the water mist company provided full design drawings and hydraulic calculations to confirm the:</p> <ul style="list-style-type: none"> • Pipe sizing? • Type of discharge nozzle? • K-factor? • Angle of discharge? • Nozzle locations and spacings? • Nozzle discharge rate? • Pipe sizing? • Pipe layout? • Water supply details, including size, capacity, and duration? 		
12.	<p>Is the water supply duration known and assessed as acceptable for the type of protection provided (state the duration period)?</p>		

	Water Mist Fire Protection Systems Checklist Contd.	Y/N	Comments
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 that are 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, upon activation of the water mist, will automatically: <ul style="list-style-type: none"> • Shut down the equipment and fuel supply? • Stop ventilation systems, extract fans or conveyor systems? • Close fire doors and shutters? 		
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, and the name of the test engineer recorded?		
22.	Are all the water mist nozzles kept clean and 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, and the name of the engineer recorded?		

LOSS PREVENTION STANDARDS

	Water Mist Fire Protection Systems Checklist Contd.	Y/N	Comments
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, including fire, security, housekeeping, and health and safety?		
27.	Has the site's Emergency Plan been reviewed and updated following the installation of the water mist system?		
28.	Has the site's Business Continuity Plan been reviewed and updated following the installation of the water mist system?		
29.	Additional comments:		

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LOSS PREVENTION STANDARDS