Water Mist Fire Protection Systems

Water mist systems provide fire protection for a range of industrial and process applications.

This Loss Prevention Standard provides guidance on the design, installation, and ongoing care of water mist systems to help ensure reliable performance and effective protection of property and critical assets.

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Introduction

Water mist fire protection systems are used as an alternative to other more traditional forms of fire protection, such as sprinkler systems. They typically protect relatively small compartments or rooms or are provided for specific hazards.

This document provides guidance to enable the selection and application of suitable water mist solutions to reduce the likelihood of fire development and mitigate the potential for spread.

Note: This Global Loss Prevention Standard relates to water mist fire protection systems and is focussed on Asset loss prevention and related risk management guidance. It is not intended to address Liability/General Liability exposures. The presumption is that all local regulatory territory requirements, and compliance with national/local building regulations, codes, or standards take precedence and have, or will be, met. In territories where local authorities have jurisdiction, compliance with applicable laws and regulations is assumed as a minimum requirement. The recommendations in this document are intended to supplement, not replace, local requirements.

How Water Mist Fire Protection Systems Operate

Water mist fire protection systems operate 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.

Whilst being able to offer limited protection across a wide range of risks, they are generally most suited to rooms or compartments requiring localised protection only, such as:

- Industrial frying lines/halls.
- Combustion turbines and machinery spaces.
- Standby generator rooms.

Advantages of Water Mist Systems

Water mist systems:

- Can be immediately activated.
- 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 improved accessibility for firefighter response.
- Can be cost effective, particularly when providing localised fire protection to smaller contained areas, such as fat frying lines/halls, rather than providing whole premises protection.
- Are relatively easy to retrofit, with less impact on business activities.
- Do not use chemicals and are less harmful to the environment.

Disadvantages of Water Mist Systems

Water mist systems:

- May not be accepted by asset insurers or local authorities having jurisdiction as a reliable and consistent means of structural fire protection.
- Do not have prescriptive design standards that specify:
  - ✓ The risks that can be protected (hazard or commodity classifications).
  - ✓ The correct discharge nozzle selection (type, size, discharge coefficient (k-factor).
  - ✓ Maximum and minimum nozzle spacing.
  - ✓ Pipe sizing requirements.
  - ✓ Pipe and fitting types.
  - ✓ Support and bracketing requirements.
  - ✓ Acceptable water supply arrangements (number, size, capacity, duration, pump type and power supply arrangements).
- Lack standardisation in nozzle design and manufacture.
- Rely on full-scale fire testing for system design and validation. This test data may not be available for wider ratification, review and/or acceptance.
- Require designs based on existing fire test data to be identical to the configuration, layout, and operating parameters used in the fire test.
- Do not operate effectively:
  - ✓ In areas with excessive ceiling heights.
  - ✓ Where obstructions are present below the discharge nozzles.
- Are unable to extinguish ventilated fires.
- Cannot control or extinguish fires involving high hazard or ordinary hazard classified commodities.
- Have very limited water supply durations, which can be as short as 10 minutes.
- Provide only a single opportunity to control or 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:

Deluge Total Flood Systems. These systems can be either manually or automatically actuated and have a series of open nozzles which are 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.

Sealed Head Systems. These are automatically operated and activated by heat sensitive detectors. These systems have closed nozzles, i.e., nozzles that remain sealed during normal conditions and only open when activated by the detectors.

Local Application Systems. These systems can be manual or automatic in operation and incorporate either closed or open nozzles, activated by heat sensitive elements. They are often used to protect frying and/or cooking equipment.

Water mist installations are generally either high-pressure 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.

Note: Water supply durations vary from 10 minutes for cylinder systems up to 20 minutes for pumped systems.

- **Low Pressure Systems** can be either:
  - ✓ Cylinder fed,
  - ✓ Supplied directly from the public water supply, or,
  - ✓ Fed from a pump and tank 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 completed by the companies providing the equipment and/or the installations.

Fire Test Data

It is critical that any water mist design is based on accurate or appropriate fire test data and that this is identical to that used in the fire test, i.e., they must have the same:

- Fire load/commodities.
- Compartment size.
- Ceiling clearance height.
- Obstructions.
- Ventilation arrangements.
- Power and ventilation interlocks.
- Discharge nozzle – including size, manufacturer, pattern and k-factor (discharge capacity of a nozzle, indicating how much water it delivers at a given pressure).
- Nozzle spacing.
- Pipe sizing.
- Pipe layouts.
- Type of water supply.
- Proximity of the water supply to the nozzle array.

Note: Unlike traditional sprinklers, each water mist nozzle has different design characteristics, spray patterns, K-Factors and pressure requirements. They are unable to be swapped or added to existing systems without significant redesign including completing full hydraulic calculations.

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

Equipment and Water Supplies

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 and location of the discharge nozzles.
  - ✓ Name of the manufacturer.
  - ✓ Size and 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 should the main supply fail?
- Electronic solenoid valves must be designed to fail safe, e.g., default to a safe condition in the event of a fault, failure, or loss of power, so as to minimise the risks to buildings and key assets.
- Isolation valves must be monitored and secured open with chains and padlocks.
- Alarm strategy for the actuating mechanism and water mist system including:
  - ✓ Fire alarm 1st stage.
  - ✓ Fire alarm 2nd stage.
  - ✓ Waterflow.
  - ✓ Manual actuation.
  - ✓ Common trouble.
  - ✓ Pump running.
  - ✓ Pump out of automatic.
  - ✓ Pump trouble.
  - ✓ Water low level, etc.

Interlock Systems

Water mist system should have the appropriate interlocks installed to enable the system to perform effectively. Upon activation:

- The equipment being protected should automatically shut down.
- Any fuel supply to the equipment being protected should automatically cut off.
- Relevant 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

- Regular weekly, monthly, quarterly and annual self-inspections should be conducted.
- The system and any associated interlocks should be tested at least weekly and the date, time and results formally records, along with the name of the test engineer(s).
- The system should be serviced and maintained in accordance with the manufacturers recommendations.
- Servicing and maintenance 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.

Refer to the Aviva Loss Prevention Standards **Self-Inspections** and **Maintenance Regimes** for further guidance.

Impairment Notification

Impairment notification should be in use and must be agreed with insurers or the authority having jurisdiction. If any fire detection and/or suppression 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.

Refer to the Aviva Loss Prevention Standard **Impairment Management** for further guidance.

Managing Change Notification

Agree with insurers or authority having jurisdiction a formal, documented procedure for managing changes involving the:

- Buildings
- Plant, machinery and 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.

Refer to the Aviva Loss Prevention Standard **Managing Change - Property** for further guidance.

Approving Authorities and Insurers

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

- Information relating to 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.
- Volumetric protection in buildings is largely unproven.
- 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 for insurances.
- Water mist systems may be considered as a favourable feature and not a reliable fire suppression/extinguishing system. As such they may not be considered when calculating some insurance loss estimates such as a Normal Loss Estimate (NLE).
- Local application water mist systems can only be considered as a “beneficial feature”.

Checklist

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

Contact Information

United Kingdom

Please visit Aviva Risk Management Solutions or email us at riskadvice@aviva.com. To speak to one of our advisors, call 0345 366 6666.*

*The cost of calls to 03 prefixed numbers are charged at national call rates (charges may vary dependent on your network provider) and are usually included in inclusive minute plans from landlines and mobiles. For our joint protection telephone calls may be recorded and/or monitored.

Canada

Please visit Aviva Risk Management Solutions | Aviva Canada or email us at arms.canada@aviva.com

Ireland

Please visit Insurance Risk Management | Business Risk Management Insurance - Aviva Ireland or Email us at armsireland@aviva.com

Specialist Partner Services

Aviva have created a network of Specialist Partners to complement our in-house capabilities and to enable our policyholders to benefit from a wide range of risk management solutions at preferential rates and terms. Together, we provide solutions to help with the significant challenges of modern-day risk management.

These partner relationships are wholly for the benefit of our policyholders with no income to Aviva.

For more information please visit:

United Kingdom

Aviva Risk Management Solutions – Specialist Partners

Ireland

Aviva Risk Management Solutions - Ireland

Canada

Aviva Risk Management Solutions (Canada) - Specialist Partners

Standards, Sources and Useful Links

United Kingdom

- BS8489-1 Fixed fire protection systems. Industrial and commercial watermist systems - Code of practice for design and installation
- BS8489-4 Fixed fire protection systems. Industrial and commercial watermist systems - Fire performance tests and requirements for watermist systems for local applications involving flammable liquid fires
- BS EN 14972-1 Fixed firefighting systems. Water mist systems - Design, installation, inspection and maintenance
- BS EN 14972-8 Fixed firefighting systems — Water mist systems — Part 8: Test protocol for machinery in enclosures exceeding 260 m^3 for open nozzle systems
- BS EN 14972-9 Fixed firefighting systems — Water mist systems — Part 9: Test protocol for machinery in enclosures not exceeding 260 m^3 for open nozzle systems
- BS EN 14972 16 Fixed firefighting systems — Water mist systems — Part 16: Test protocol for industrial oil cookers for open nozzle systems
- FPA Water Mist Questionnaires IQ1, IQ2 & IQ3

Note: British Standard **BS 8489 Fixed Fire Protection Systems - Industrial and Commercial Water Mist Systems** is currently 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.

Parts 5, 6 and 7 of this standard have been withdrawn and the guidance provided within the relevant parts of **BS EN 14972 Fixed firefighting systems — Water mist systems** should be followed.

The Fire Protection Association has published three mist questionnaires, IQ1, IQ2 & 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.

Canada

- NFPA 750 - Standard on Water Mist Fire Protection Systems
- CAN/ULC S548 — Devices and Accessories for Water Type Extinguishing Systems

Ireland

- I.S. EN 14972-1 Fixed firefighting systems. Water mist systems - Design, installation, inspection and maintenance
- I.S. EN 14972-8 Fixed firefighting systems — Water mist systems — Part 8: Test protocol for machinery in enclosures exceeding 260 m^3 for open nozzle systems
- I.S. EN 14972-9 Fixed firefighting systems — Water mist systems — Part 9: Test protocol for machinery in enclosures not exceeding 260 m^3 for open nozzle systems
- I.S. BS EN 14972 16 Fixed firefighting systems — Water mist systems — Part 16: Test protocol for industrial oil cookers for open nozzle systems

Other

- VdS 3188 — VdS Guidelines for Water Mist Systems – Water Mist Sprinkler Systems and Water Mist Extinguishing Systems (High Pressure Systems) – Planning and Installation

- EN 14972 – Fixed firefighting systems - Water mist systems - Part 1: Design, installation, inspection and maintenance
- VdS 3188 — VdS Guidelines for Water Mist Systems – Water Mist Sprinkler Systems and Water Mist Extinguishing Systems (High Pressure Systems) – Planning and Installation
- VdS 3883: Fire Test Protocols for Water Mist Systems – available at https://shop.vds.de/en/
- The French Standard Technical Document APSAD D2 - Water Mist (Guide for Installation of Water Mist Protection Systems)

Additional Information

Loss Prevention Standards

These documents set out best practice recommendations to help reduce the likelihood and impact of losses.

Relevant Aviva Loss Prevention Standards include:

- **Self-Inspections**
- **Maintenance Regimes**
- **Managing Change - Property**
- **Impairment Management**

Please visit Loss Prevention Standards to view the full library.

Aviva Risks Training Solutions

Aviva Risk Training Solutions, delivered through our Specialist Partner, SafetyCulture, provide free, bite-sized learning modules exclusively for Aviva policyholders.

Please visit Aviva Risk Training Solutions for further guidance.

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 for insulation, integrity and load bearing abilities)?		
4.	Have the necessary design specifications or questionnaires (e.g., UK's RISCAuthority IQ1, IQ2 & IQ3), been completed by the water mist company and approved by insurers?		
5.	• Is the water mist designed as a 'total flooding', '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)?		

	Title	Y/N	Comments
8.	Is the water mist system identical to that used in the fire test, with 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?		
9.	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?		
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? • 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.	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?		

	Title	Y/N	Comments
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: • 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 engineer?		
21.	Is there a regular weekly inspection of the system in accordance with manufacturer 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 manufacturer recommendations, with dates, times and results of the inspections, and 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?		

	Title	Y/N	Comments
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.	Additional Comments:		

Please Note

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