

ACTIVE FIRE PROTECTION GUIDE WATERMIST

This document has been produced by RISCAuthority Active Suppression & Detection working group to provide information and outline guidance on the application of watermist.

Summary

Refer to AFPG-01 *Overarching Automatic Active Fire Protection Guide – All Technologies*.

Watermist:

- is a 'compartment' or 'Local Application' fire protection system
- can be used for 'building protection' if specifically design to do so (not native with installation standards)
- can be designed to be either an extinguishing or suppression system depending upon design and application
- generally requires relevant full-scale testing to assure performance because the mode of operation is the most complex of any active fire protection systems (AFPS)
- has good environmental credentials
- has few toxicity issues aside from deep-lung-penetration of fine droplets and Legionella potential from stored water
- is usually unsuitable for use with firefighting foams.

What is watermist?

Watermist is the provision of finely divided water droplets, typically 200um, that are created at high pressures through small orifices. The mist produced can be delivered by compressed gas or pumps (mains water supply pressures are too low).

How it works

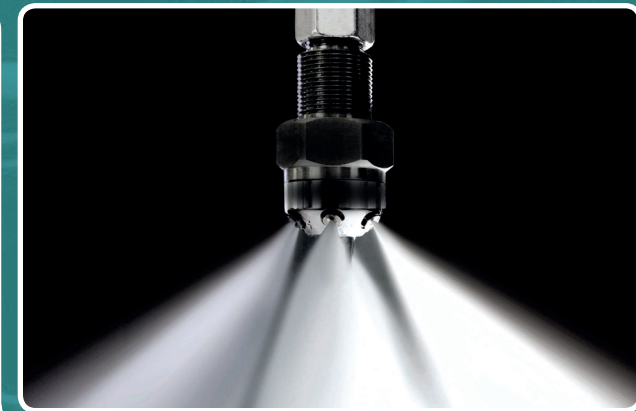
Watermist is generally described as providing a 2-part suppressing action. Part 1 provides thermodynamic cooling during evaporation, and part 2 provides reduced oxygen through steam displacement. When water changes into steam it expands by a factor of 1650, which creates the oxygen displacement at the base of the fire. Systems are activated either manually or by thermally sensitive bulbs and typically operate in one of three pressure ranges:

- low pressure ≤ 12 bar
- medium pressure 12 bar – 35 bar
- high pressure > 35 bar.

The system may be designed to shut down any air conditioning system, close openings and doors, and control all sources of oxygen and fuel (energy) prior to discharge.

Challenges and considerations

Watermist is unique amongst active fire protection system technologies in that it is the fire that drives the process, and as such, the mechanisms depend greatly on the relationship between the system, the size of the fire, the size of the compartment, and how well the compartment is sealed. During the process the fire size will change, and this can result in cyclical behaviour and varying effectiveness. As such guaranteed 'extinguishment' can be very difficult to assure and this is a crucial consideration in determining suitability to any given application because little residual benefit results from the small amounts of water dropped, once the supply runs out.



Watermist systems are typically most effective against large, well-developed fires and/or fires in confined, well-sealed enclosures. Larger fires are inevitably hotter and hence can generate more steam, which will both cool the fire and dilute the local oxygen concentration – making suppression or extinguishment more likely. In smaller enclosures with limited ventilation, the available oxygen supply is already limited so it will be much easier for the system to suffocate the fire. Thus 'large' fires in 'small' enclosures are likely to be more easily extinguished by a watermist system. Conversely, 'smaller' fires in 'larger' enclosures are unlikely to starve the fire of oxygen and so will need to rely on cooling the fire which is unlikely to result in extinguishment.

Watermist systems, due to complexity, micro-architecture, and underdeveloped certification systems, cannot boast the same reliability figures as sprinkler systems.

Applicable standards

BS 8458:2015 *Fixed fire protection systems – Residential and domestic watermist systems – Code of practice for design and installation*.

BS 8489-1:2016 *Fixed fire protection systems – Industrial and commercial watermist systems Part 1: Code of practice for design and installation*.

BS EN 14972-1:2020 *Fixed firefighting systems – Water mist systems Part 1: Design, installation, inspection, and maintenance*.

NFPA 750:2019 *Standard on Water Mist Fire Protection Systems*.

F.M Global Data Sheet 4.2 *Water Mist Systems* 2019.

May be effective for use with:

- high heat output fuels
- liquid fuels
- hot environments
- enclosed environments
- direct application
- environment cooling
- hidden fires (if large)
- gas cooling.

Has limitations in relation to:

- ventilated spaces
- high ceiling heights
- where sustained ignition sources exist
- hidden fires (if small)
- class A fuels
- small fires
- water supply duration (20 mins or less)
- limited historical proven reliability/records
- limited third-party approval of equipment/designers/installers
- manufacturer-based Design Installation Operating and Maintenance (DIOM) and not interchangeable.

Best practice

Watermist systems are bespoke to the manufacturer and their Design, Installation, Operating and Maintenance (DIOM) manuals and components. With a lack of third-party approval for system components, manufacturers, installers and designers, due diligence is required to ensure that the system chosen has successfully passed a recognised and relevant fire test standard.

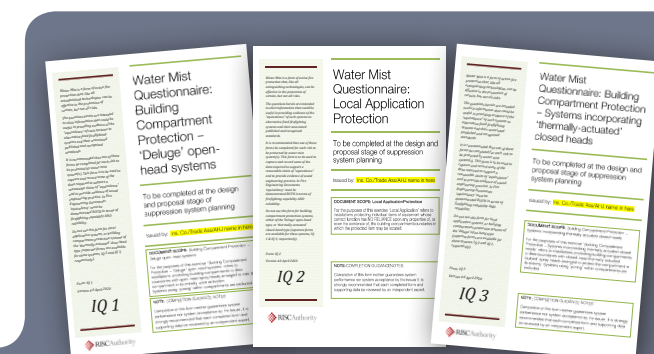
Most buildings contain a variety of different occupancy types and unlike sprinkler systems that cater for these differing occupancies, watermist cannot be assumed to be applicable to cover all areas. Each watermist system is required to be approved to a recognised test protocol for the specific application/occupancy that it is installed to protect. If the system has not been tested to a suitable certification scheme for the various occupancies, this should raise a red flag warning.

Watermist systems are complex and with fewer standards and certification schemes to rely on, there is a need to evaluate each system and ensure that it is suitable for the intended application.

Within RISCAuthority three questionnaires have been produced for three different system types:

- IQ1 – Deluge open head
- IQ2 – Local application
- IQ3 – Thermally actuated closed head.

The questionnaires have been developed to check that all relevant design elements have been considered and that the risk control logic has been followed and properly recorded.



Operation of the system should be interlocked with isolation of all sources of heat, energy, fuel, and conveyancing, and also invoke the main building's fire alarm system.

In general, mistakes associated with watermist can be attributed to:

- comparing watermist with sprinkler systems for Building Protection – they are not natively comparable (see AFPG-01)
- poor understanding of whether the overall fire management plan requires the active system to 'suppress' or 'extinguish' the fire
- understanding of follow-on actions if the system only 'suppresses' the fire for the water supply duration
- the risk not being properly understood or investigated
- the design not being validated for the risk or the test protocol being inadequate for the risk (e.g. marine test certification for a land based risk)
- reduced water supply durations
- insufficient control of ventilation
- lack of training
- DIOM guidance
- inappropriate detection
- water quality and blockage potential.

Watermist as a technology can be the best protection option for many applications, however, it is imperative to fully understand all the performance factors pertinent to meeting the expectations of the systems and by confirming if this system type is better than other suppression options.

It is suggested that when considering watermist as a fixed firefighting suppression system, the questionnaires are issued to the client/specifier/supplier/contractor for them to complete. Failure to complete the questionnaires should serve to confirm the likely unsuitability of watermist systems and alternative fire suppression solutions should be considered.

Best uses of watermist

'Life safety' – Watermist provides excellent atmospheric cooling to assist in preventing flashover conditions to assist evacuation but may struggle to robustly achieve extinguishment.

'Building regulations' – As a compensatory feature for travel distances, lack of passive protection and oversized compartments – BS9999 (only). Watermist is not recognised in AD 'B'.

'Property protection' – Within certain occupancies such as local application (kitchen risks), marine risks and other high-risk environments, and as an alternative to gaseous systems, but the system must be proven to achieve robust extinguishment.

Environmental credentials

Watermist has excellent environmental credentials as the suppression agent discharged is water with no additives. The suppression system as a whole is not considered to provide any harm to the environment and does not fall within the 'F-gas Regulations' as it does not contain any fluorinated greenhouse gases.