

WATER MIST FIRE PROTECTION SYSTEMS

ALLIANZ RISK CONSULTING



Nozzle – ©Hi-Fog - Marioff

This Tech Talk discusses the applications and features of water mist systems and Allianz Risk Consulting (ARC) recommendations.

AT-A-GLANCE

- Water mist systems are special fire protection systems capable of delivering very fine water spray intended to control, suppress, or extinguish fires.
- A technical review by ARC is recommended to ensure the water mist system is the most appropriate fire protection system for the hazard.
- Water mist systems should be proven by fire testing on a hazard of the same configuration and general hazard type.

INTRODUCTION

Water mist systems are similar in operation to sprinkler systems; however, compressed gas or a high pressure pump is typically used to deliver water through spray nozzles, which creates a mist to control, suppress or extinguish fires. Water mist has long been used as a means of fire protection, in particular to fight fires on board ships, where the amount of available potable water is very limited. These systems also use less water than traditional sprinkler systems, which can be desirable for areas highly susceptible to water damage.

However, there are no detailed standards for **designing** water mist systems, unlike for sprinkler or gas extinguishing systems. The design of a water mist system is different from one system to another depending on the manufacturer and the hazards being protected. Each manufacturer has its own list of materials, equipment, requirements and full scale test results.

This is why clients often ask ARC about water mist systems when assisting them with the design and installation of fire protection systems.



High Pressure Nozzle – © Aquamist Fog - Tyco

WATER MIST SYSTEM APPLICATIONS

Water mist systems are recognized as being effective for the following specific applications:

- Machinery spaces
- Combustion turbines
- Industrial oil cookers
- Continuous wood board presses
- Indoor transformers
- Wet benches in cleanrooms
- Computer room subfloors
- Light and ordinary hazard occupancies

All water mist systems should be proven by fire testing on a hazard of the same configuration and general hazard type.

HOW DO WATER MIST SYSTEMS EXTINGUISH FIRES?

There are several mechanisms involved with extinguishing fire with water mist. In enclosed spaces, the atomized water droplets are quickly drawn into the base of the fire along with room air. The water instantly vaporizes into steam, which displaces the oxygen needed for combustion. This action, along with an overall cooling and air scrubbing effects, make water mist highly effective when properly designed and tested. While water mist is less sensitive to enclosure openings, it still must be considered in the design.

The water droplets also block radiant heat, which prevents adjacent combustible materials from igniting. The finer the water droplet, the more effective it is at blocking radiant heat.

WATER MIST SYSTEM CHARACTERISTICS

Water mist systems are defined by several characteristics.

1. OPERATING PRESSURE

NFPA 750 defines three types of systems based on the pressure (P) the distribution system piping is exposed to:

Low Pressure	Intermediate Pressure	High Pressure
$P \leq 12.1 \text{ bar}$ (175 psi)	$P > 12.1 \text{ bar}$ (175 psi) and $< 34.5 \text{ bar}$ (500 psi)	$P \geq 34.5 \text{ bar}$ (500 psi)



Test performed in a recognized laboratory – © Siemens

2. PERFORMANCE OBJECTIVE

Water mist systems may be designed based on one of the following three performance objectives:

- **Fire control** limits the size of a fire by distributing water to decrease the heat release rate and pre-wet adjacent combustible materials, while controlling ceiling gas temperatures to avoid structural damage.
- **Fire suppression** is the sharp reduction of a fire's rate of heat release and the prevention of regrowth.
- **Fire extinguishment** is the complete suppression of a fire until there are no burning combustibles.

3. APPLICATION

Local application systems are used to protect a specific object or hazard. An example may be protection of a piece of equipment in a large compartment.

Total compartment systems protect the entire volume of the enclosure. The open nozzles are positioned in a grid so that water mist discharges uniformly throughout the entire compartment.

Zoned application systems are arranged to protect hazards in a predetermined portion of the compartment. Water mist is delivered on a zone-by-zone basis rather than throughout the total compartment. This may be used where the water demand for a total compartment system would be beyond the capability of the available water supply.

4. COMPONENTS AND WATER SUPPLY

- All water mist system components shall be **listed** for their intended use. Each manufacturer has listed their components for one or several types of hazards.
- The characteristics of the **nozzles** are very similar to those of sprinklers. Closed or open nozzles are available depending on the type of application (local, total compartment or zoned).



Electro Pump Unit – ©Hi-Fog - Marioff

- Like sprinkler systems, water mist systems may be arranged as a **wet pipe, dry pipe, preaction or deluge system**. Depending on the operation method, the system can be activated by a **fire detection system** or the thermal activation of the nozzles.
- A centrifugal or positive displacement **pump** (typically electric motor-driven) is used to deliver the required water flow and pressure in single fluid systems.



Nitrogen used to deliver water – ©Sinorix H2O Jet - Siemens

- An **atomizing medium**, typically compressed air or nitrogen, is used to deliver water in twin fluid systems.
- The **water supply** may be public or private, such as a dedicated water tank; however, it must be reliable and equivalent to potable water or natural seawater with respect to particulates.

ARC RECOMMENDATIONS

Automatic sprinkler protection is normally preferred over a water mist system **when there is an adequate and reliable water supply available**.

When the installation of a water mist system is being considered, contact ARC to discuss your specific needs. Water mist systems are not appropriate for all hazards and should only be installed for applications that have been proven by fire testing.

The following recommendations, while not all inclusive, will ensure the water mist system is adequate and reliable protection for the hazard:

1. Select a **reputable contractor** who has significant experience in the design, installation maintenance, and testing of water mist systems. Companies that manufacture and install their own systems are preferred over companies that purchase components from the manufacturer except if a strong partnership agreement between the manufacturer and the company is available. While ARC doesn't approve companies, a list of acceptable companies may be provided upon request.

2. The system should be **designed, installed, maintained, and tested** in accordance with the latest edition of NFPA 750, *Standard on Water Mist Fire Protection Systems*, or an equivalent internationally recognized standard. The system should be listed for the specific hazard through full-scale fire testing conducted by an internationally recognized laboratory, such as VTT, FM, VdS, SP or CNPP.
3. **Plans, specifications, hydraulic/pneumatic calculations, and operational sequence** should be submitted to ARC for review and acceptance prior to system installation.
4. Where practical, conduct a **full flow acceptance test** witnessed by ARC.
5. The system should be **inspected, tested, and maintained** in accordance with the latest edition of NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, or an equivalent internationally recognized standard.

REFERENCES

- NFPA 750, *Standard on Water Mist Fire Protection Systems*
- FM Global Data Sheet 4-2, *Water Mist Systems*
- VdS 3188en, *Guidelines for Water Mist Sprinkler Systems and Water Mist Extinguishing Systems (High Pressure Systems), Planning and Installation*
- IMO MSC/Circ. 1165/1269/1387/1272/265
- XP CEN TS 14972
- APSAD D2, *Document Technique Brouillard d'eau*

QUESTIONS OR COMMENTS?

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Reference ATT 21/18/03

Tech Talk is a technical document developed by ARC to assist our clients in property loss prevention. ARC has an extensive global network of more than 100 property risk engineers that offers tailor made, customer focused risk engineering solutions.

Design: AGCS Graphic Design Centre