

# 25th Anniversary of Water Mist Standard FM 5560 – Groundbreaking Standard to be Expanded

Introduced in 1995, FM 5560, Water Mist Systems, was the first comprehensive standard for water mist fire suppression systems anywhere in the world. As the standard hits the 25-year mark, the popularity and applications for water mist systems has grown from its origins in 1989 as an alternative to halon systems on board ships to an expanding range of land-based occupancies.

While it may seem obvious and expected, comprehensive water mist system-based testing and certification is not the norm around the world. Many products and devices are certified by various third-party laboratories to a range of standards, yet few are tested and certified as a complete system that has demonstrated its effectiveness to

perform its function in full-scale testing.

This year, FM Approvals will again enhance FM 5560 by adding new fire test protocols to enable the certification of water mist systems for use in two additional hazard categories: HC-2 and HC-3 (Fig. 1). Until now, FM Approvals has provided certification under FM 5560 for non-storage HC-1 occupancies, such as hospitals, churches, hotel rooms, apartments, and nursing homes.

HC-2 occupancies include casinos, food processing, schools, and electronic or electrical production. HC-3 encompasses occupancies such as manufacturing facilities, plastics processing, convention centers, and theaters.

## Water mist dilemma

“The challenge has been that by certifying systems for HC-1 occupancies exclusively, invariably there are other parts of many facilities that have higher hazard classifications,” says Dave Fuller, FM Approvals vice president and manager

of the fire protection group. “For those building owners who want to protect their entire facility with water mist, that presents a dilemma. In Europe especially, where water mist is very popular as a primary fire protection system, FM Global wanted to extend FM 5560 to meet this need.”

FM 5560, at more than 300 pages, is the most comprehensive Approval Standard and, like all FM Approvals standards, it is a living document that is regularly updated. Due to the complexity of water mist systems, each system requires a customized program for the evaluation of systems and system components.

Each water mist system must also be FM Approved for specific applications, which in some cases include volume limitations. There are currently 15 appendices, each one detailing the fire testing required for a specific occupancy, such as for the protection of combustion turbines, machinery in enclosures, non-storage occupancies and more.

## Backed by research

The extension of component and fire performance testing for water mist systems for use in HC-2 and HC-3 occupancies will be included in a new appendix. “This update to FM 5560 is at least three years in the making,” explains Fuller.

The water mist research was conducted in the Large Burn Laboratory at the FM Global Research Campus in West Glocester, Rhode Island, USA. In the research program, a series of fire tests were conducted (Fig. 2) to determine the ceiling height limits for effective water mist protection in open environments.

Both deluge and automatic nozzles were evaluated. All tests were conducted with FM Global Class 2 commodity (corrugated cardboard boxes) or cartoned expanded plastic (CEP) commodity. These standard commodities were used in the water mist research program as a

surrogate for non storage combustible loading in HC-2 and HC-3 occupancies.

The water mist fire testing program, conducted by FM Global principal scientist Dr Hong-Zeng (Bert) Yu, showed that HC-2 and HC-3 fires could be suppressed with deluge nozzle protection for ceiling heights up to 30 feet (9.1 m), and with automatic nozzle protection for ceiling heights up to 20 feet (6.1 m).

“Unlike conventional sprinkler protection, water mist systems vary widely in design making it necessary to evaluate their fire suppression effectiveness on an individual basis,” says FM Approvals senior engineer Jonathan Carpenter. “Where water mist protection will be the primary protection for a given occupancy, system reliability and availability will be considered as part of the Approval program.”

## Versatile fire protection

Today, water mist systems protect some of the most challenging environments in industry.

Carpenter notes that water mist systems are used extensively for the protection of data centers. “FM 5560 covers protection for data centers, above and below raised floors. The challenge is that in many facilities that are dedicated data centers or have a data center as part of their other operations, there may be approximately 10% of the building that falls into a higher risk category, such as HC-2 or HC-3. We want to provide certification for water mist systems for those areas as well.”

For most applications, water mist systems provide fast activation, high efficiency fire suppression, minimal water damage and environmentally friendly operation. The fine droplets in water mist (1,000 microns or less), absorb heat more efficiently than water drops from traditional sprinklers and vaporize more efficiently, which reduces oxygen available at the flame source thereby enhancing fire suppression.

The water mist systems certified by FM Approvals have undergone full-scale fire testing for specific applications as well as component-by-component evaluations. FM 5560 is the only comprehensive standard for water mist system evaluation, as well as the only standard recognized by the American National Standards Institute (ANSI) for water mist systems.



▲ Fig. 2 - Fire test of automatic water mist nozzles over cardboard boxes conducted under the moveable ceiling in the Large Burn Laboratory at the FM Global Research Campus in Glocester, Rhode Island, USA. As the fire grows, it triggers multiple water mist nozzles. The fine droplets are sucked into the base of the fire and flash to steam, depriving the fire of essential oxygen.

▼ Fig. 1 - Occupancy hazard classifications from FM Global Property Loss Prevention Data Sheet 3-26, Fire Protection Water Demand for Nonstorage Sprinklered Properties.

Hazard Category	Description	Examples
HC-1	Nonstorage areas with light overall combustible loading with limited combustibles used in processes or operations of low hazard. This includes combustible furnishings that are typically noncontinuous in well-subdivided areas. This hazard category does not include any incidental storage of plastics, or plastics used in the construction of walls and/or ceilings	<ul style="list-style-type: none"> <li>☐ Offices</li> <li>☐ Noncombustible manufacturing</li> <li>☐ Hospitals</li> <li>☐ Apartments</li> <li>☐ Churches</li> <li>☐ Hotel rooms</li> <li>☐ Libraries</li> <li>☐ Museums</li> <li>☐ Nursing homes</li> </ul>
HC-2	Lightly and moderately loaded nonstorage, nonmanufacturing, and manufacturing areas with ordinary combustibles. Areas with moderate continuous combustible loading with combustibles in processes, or operations of moderate hazard due to limited quantities of plastics or ignitable liquids.	<ul style="list-style-type: none"> <li>☐ Machine shops</li> <li>☐ Woodworking</li> <li>☐ Electronic assembly</li> <li>☐ Retail areas</li> <li>☐ Theaters</li> <li>☐ Food production</li> <li>☐ Casinos</li> <li>☐ Paper processing</li> </ul>
HC-3	Areas with generally continuous heavier combustible loading with limited quantities of ignitable liquids and/or heavier amounts of plastics.	<ul style="list-style-type: none"> <li>☐ Manufacturing</li> <li>☐ Plastics processing and molding</li> <li>☐ Garages</li> <li>☐ Convention centers</li> <li>☐ Printing plants</li> </ul>

## The format of prEN14972

EN 14972, Fixed firefighting systems — Water mist systems, consists of the following parts:

- Part 1: Design, installation, inspection and maintenance;
- Part 2: Test protocol for shopping areas for automatic nozzle systems;
- Part 3: Test protocol for office, school class rooms and hotel for automatic nozzle systems;
- **Part 4: Test protocol for non-storage occupancies for automatic nozzle systems;**
- Part 5: Test protocol for car garages for automatic nozzle systems;
- Part 6: Test protocol for false floors and false ceilings for automatic nozzle systems;
- Part 7: Test protocol for commercial low hazard occupancies for automatic nozzle systems;
- **Part 8: Test protocol for machinery in enclosures exceeding 260 m<sup>3</sup> for open nozzle systems;**
- **Part 9: Test protocol for machinery in enclosures not exceeding 260 m<sup>3</sup> for open nozzle systems;**
- Part 10: Test protocol for atrium protection with sidewall nozzles for open nozzle systems;
- Part 11: Test protocol for cable tunnels for open nozzle systems;
- Part 12: Test protocol for commercial deep fat cooking fryers for open nozzle systems;
- **Part 13: Test protocol for wet benches and other similar processing equipment for open nozzle systems;**
- **Part 14: Test protocol for combustion turbines in enclosures exceeding 260 m<sup>3</sup> for open nozzle systems;**
- **Part 15: Test protocol for combustion turbines in enclosures not exceeding 260 m<sup>3</sup> for open nozzle systems;**
- Part 16: Test protocol for industrial oil cookers for open nozzle systems.
- Part 17: Test protocol for residential occupancies for automatic nozzle systems.

— EN 17450 part 1-X: Requirements for watermist components such as nozzles, valves, filters/strainers, pumps



### FM Approvals' Role in European standards

FM Approvals has also been working at the European Committee level for many years to help develop water mist standards for use by the European Union (EU) and European Economic Area (EEA)

▼ **New fire test protocols are added regularly to Approval Standard 5560 to accommodate new applications. Here, a data center server room mock-up is used to test the effectiveness of water mist for use in protecting areas above raised floors. A second test protocol is available to test water mist systems for applications below raised floors.**

members. For more than 20 years, the European Committee for Standardization (CEN) has had a Technical Committee (TC) working toward this goal. A water mist Technical Specification (TS 14972) was introduced in 2008 and became a full draft standard—prEN 14792—in 2014.

According to the British Automatic Fire Sprinkler Association (BAFSA), prEN 14972-1, the standard for water mist system design, installation and maintenance, has passed a second CEN enquiry and is expected to be sent for formal vote this year. The prEN 14972-3 fire test protocol for offices, schools and hotels has also passed the CEN enquiry.

Additionally, three other fire test protocols—all based on FM 5560—will be introduced in the near future. In fact, seven of the 16 water mist fire test protocols included in prEN 14972 (Fig. 3) are derived from FM 5560.

According to Witali Engelhardt, FM Approvals operations vice president and manager of EMEA new business development, “The fire test protocols included in EN 14792 are mainly derived from three certification bodies—FM Approvals, VdS, and LPCB (BRE)—based on certain fast track criteria. For instance, the candidate protocol has to have been used in more than one country for more than two years; there must be more than one approved or certified system available based on the standard; and so forth.”

He adds, “While EN 14972, in its current status, will not be legally required at this point as the standard is not harmonized yet, industry and manufacturers are following these standards because of the other benefits they offer, such as standardized quality and safety, customer confidence and better access to markets. Most water mist manufacturers already offer FM Approved systems, so those manufacturers will probably not have to retest for EN 14972. They would comply automatically with both FM 5560 and EN 14972 requirements.”

◀ **Fig 3 - Test protocol applications (highlighted in yellow above) from FM Approvals' water mist standard, FM 5560, are a major component of the EU water mist draft standard, prEN14972. The EU standard, which is followed by water mist system manufacturers, is expected to graduate to full EN14972 status by the end of 2020.**

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