WATER MIST SYSTEMS

INTRODUCTION

National Fire Protection Association (NFPA) documents describe a level of fire protection agreed on by persons representing a variety of interests. The guidance in these documents does not reflect unique conditions or special considerations, such as system performance under adverse conditions. Nor does NFPA guidance reflect the increased system reliability that AXA XL Risk Consulting recommends for high valued properties.

This PRC Guideline takes a position on the provisions of NFPA 750 that AXA XL Risk Consulting believes require clarification or changes. To understand the position, this PRC Guideline must be read with a copy of NFPA 750. The provisions of the NFPA document are not repeated.

POSTION

General

Although water mist systems are closely akin to both sprinkler and gaseous extinguishing systems, they are not currently a replacement for sprinkler protection in large open areas or in applications that have not been proven by large scale testing as part of the listing process. In addition, water mist systems are not necessarily a replacement for all gaseous agent applications. Large scale testing must prove water mist's suitability for specific applications.

Water mist systems are currently listed in the United States for light hazard occupancies where ceiling heights do not exceed 16.5 feet, local applications involving flammable or combustible liquids, enclosed machinery spaces involving flammable or combustible liquids, flammable liquid processing hazards in enclosures, industrial oil cookers, wet benches and similar processing equipment and computer room underfloor areas. Within each of the listings there are specific defined design constraints which must be followed for the system to perform as specified in the design. The design constraints are outlined in the listing and within the system manufacturers design and installation manual.

Water mist systems suppress or extinguish fires using the following mechanisms:

- Reduction of radiant heat due to surface cooling of the water mist.
- Reduction of oxygen concentration adjacent to the fuel surface by oxygen depletion and air dilution.
- Dilution of fuel vapor by the fire.
- Direct impingement of water droplets on the combustible material.
- Pre-wetting of adjacent Class A combustibles and cooling gases or other fuels in the area.

Advantages of water mist systems when compared with inert gas systems are:

- Water mist is non-toxic
- Water mist provides cooling.
- Water mist is less sensitive to openings in the enclosure.
- Water mist has a distinct advantage where the weight of the required agent is a concern.
- Water mist also has a cleansing action, which helps remove products of decomposition and combustion. The airline industry is researching the possible use of water mist systems on commercial airplanes to provide in-hull fire protection using minimal amounts of water.

Disadvantages of water mist systems when compared with inert gas systems are:

- Water mist is more affected by obstructions. Systems are most effective when mist is directly exposed to the fire. Obstructions usually require additional nozzle protection.
- Water mist systems have larger, more complex piping systems.
- Fires with low heat release rates may not be extinguished by water mist systems.
- Water mist systems may take a longer time to extinguish fires.
- Water mist systems are normally pre-engineered and extrapolation of the system beyond the design criteria is not possible.

Some of the hazards presently under study include:

- Fuels for engines and boilers.
- Electrical cables in confined areas.
- Shipboard and hotel accommodation spaces.
- Parking garages
- Ordinary hazard 1 occupancies
- Vehicular tunnels
- Wood framed residences

Component Listing

There are more than 30,000 water mist systems currently installed worldwide. The majority of these systems are not listed by organizations within the United States and Canada. Organizations outside the United States which do list water mist systems include: VdS (Germany), BSI (England), VNIIPO (Russia) and CNBOP (Poland). Most of the water mist systems being developed are pre-engineered systems however there are several U.S. listings for light hazard occupancies. Large scale fire tests are required by all listing organizations before the protection system is listed. This is because there is no design procedure that would allow extrapolation of test results beyond the hazard or configuration tested. Until listed engineered system designs are available, it is vital that the design parameters not be altered from those that were found to be acceptable during full-scale fire tests for a specific application.

Conditional acceptance of water mist systems is permitted on a case-by-case basis. Acceptance of a particular system must not be construed as blanket acceptance. The installer must agree to make any necessary system modification once the equipment becomes listed.

Piping And Tube

All piping, valves and system fittings from the system strainer to the nozzle should be either stainless steel or copper. Currently, hot dipped galvanized pipe and fittings are not recommended for water mist systems because of the potential for the coating to flake over time and plug strainers or the small orifice nozzles.

Hangers/Supports

The requirement for hangers to be listed has been modified to allow unlisted hangers to be used. In all instances hangers supporting pipe or tubing should be listed or detailed calculations should be submitted verifying the hangers or supports design will exceed the design stress.

Pump Power And Automatic Detection Supply

Even though the pump power supply does not require an independent service feed , it must; however meet all other reliability criteria outlined in NFPA 20 and NFPA 70.

Standby power supplies for the detection system must be capable of operating the system in the standby mode for at least 24 hours and then be capable of actuating the system for the period of time called for in the listing.

Signaling System Circuits

Where protection systems are critical and system actuation depends solely on the electrical actuation (no mechanical emergency manual release), use a Class A initiating circuit in the signaling system.

Design Objectives

Effective water mist system operation is extremely sensitive to nozzle placement. Full scale tests of equipment spaces have disclosed that moving a nozzle several inches has resulted in failure to extinguish the test fire.

Water mist systems are very occupancy-dependent. It is anticipated that the overwhelming majority of systems will be of the pre-engineered type. The specific application must be tested as part of the listing process.

Effectiveness of a system designed for enclosed spaces is dependent on enclosure variables. Systems are listed for maximum compartment volumes, length/width dimensions, ceiling heights and the size and number of openings allowed in the protected space.

Water mist systems usually work better with intense fires. Testing for design purposes includes both large and small scale fires. If small fires cannot be extinguished with water mist, a more appropriate type of extinguishing system should be used.

Duration

The quantity of water, additives (if used) and atomizing media (if used) required should be based on fire extinguishment as defined in section 8.3.1.3. If the system is designed to control or suppress a fire than the quantity of water, additives and atomizing media may be depleted before outside intervention can provide extinguishment. Where control or suppression is the objective, the water supply duration should be based on the occupancy and the water supply duration recommended for automatic sprinkler protection.

Working Plans

All equipment essential to the proper operation of the extinguishing system must be listed by a nationally recognized testing laboratory. Individual system components for engineered systems must be listed or for pre-engineered systems, the system must be listed.

If not listed, the manufacturer must be actively pursuing a listing at a laboratory acceptable to the AXA XL Risk Consulting. In the latter case, the installer must agree to update the installed equipment to conform to the requirements needed for listing without charge to the user.

Plans for review shall include all items outlined in NFPA 750 as well as the following general items:

- Copy of the system design and installation manual.
- Complete details on the hazard being protected.

- Manufacturer's literature on every component to be used in the system, including nozzles, filters and screens, pipes/tubes and fittings, pumps, compressors, wiring, detectors and control panel.
- Detailed drawings and schematics showing locations of mist nozzles and detectors.
- System installation drawings including water and air piping, and wiring for detection and actuation systems.
- System design parameters for detection and extinguishing systems.
- Reports of full-scale performance tests of water mist on that hazard.

Approval Of Water Mist Systems

Further guidance for installation, review and testing can be found in the various subsections of PRC Guidelines Section 13. Much of the water mist protection philosophy is similar to other types of extinguishing systems.

A full flow test of the system should be conducted where practical to determine system coverage, identify any obstruction patterns and verify that all piping and nozzles are flowing free and clear. Where possible equip the last nozzle with an indicating pressure gauge to verify system end head pressure.