

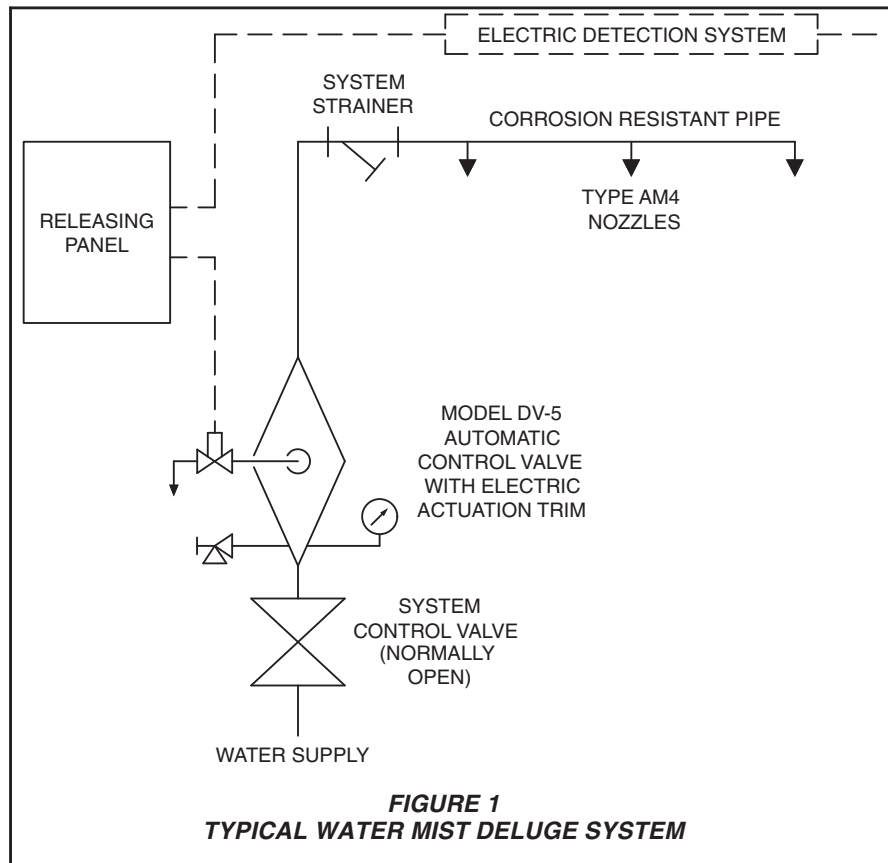
AquaMist Total Compartment Deluge System Using AM4 AquaMist Nozzles For The Protection Of Flammable Liquid Hazards

Approvals & Application Criteria

The Tyco® Type AM4 AquaMist Nozzles are listed by Underwriters Laboratories Inc. and approved by Factory Mutual Research Corporation with and without the optional Dust Cap for use as part of a hydraulically calculated, total compartment application, engineered system where the whole protected enclosure is flooded simultaneously. The listing and approval apply to the service conditions described below and the System Design Criteria section.

Total compartment application, engineered, water mist deluge systems utilizing the Type AM4 AquaMist Nozzles are suitable for use in the protection of machinery space and flammable liquid processing hazard compartments containing incidental Class A combustibles and Class B flammable or combustible liquids which represent a hazard no more severe than n-heptane, such as:

- Stationary internal combustion engines fueled by gasoline or diesel oil.
- Dipping, electrostatic coating, or cleaning processes using flammable or combustible liquids.
- Flammable or combustible liquid pumps, piping or containers under pressure such as may be used with hydraulic pumping equipment, engine drive generators, or chemical processes.
- Flammable or combustible liquid Incidental Operations as described in NFPA 30.
- In addition to the above Application Criteria which apply to both the UL



Listing and FM Approval, the Type AM4 AquaMist Nozzles are FM Approved for the protection of gas turbines in enclosures up to and including 45,203 ft³ (1280 m³).

Note: The Type AM4 Nozzles are not listed for use in the protection of rack or palletized storage of flammable or combustible liquids.

Refer inquires on applications involving flammable or combustible liquid hazards other than the above, applications involving compartments larger than 56,500 ft³ (1600 m³), or applications which represent a hazard more

severe than n-heptane to the Technical Services Department.

NOTICE

The AquaMist Total Compartment Deluge System described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association Standard NFPA 750, in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the performance of the system devices.

The owner is responsible for maintaining their fire protection system and de-

vices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Where Factory Mutual Approval is required for the installation, all hardware and components used in the system must be FM Approved and compatible (pressures, materials, etc.).

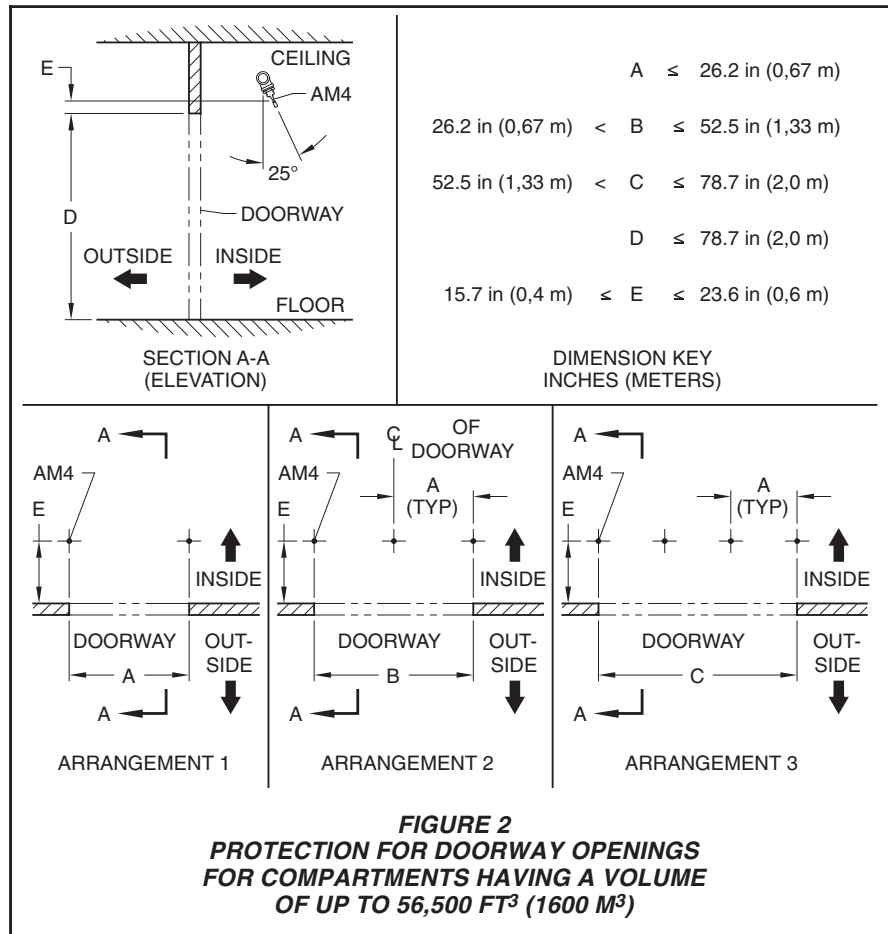
Protection Objectives

The Tyco® AM4 AquaMist Nozzles have been found to be effective for the extinguishment of a wide variety of exposed and shielded Class B hydrocarbon pool, spray, and cascading pool fires, as well as for combinations of incidental Class A and Class B fires, as described in the Approvals & Applications Criteria section and when installed in accordance with the System Design Criteria section.

Because of the operating principles of water mist systems, small, deep, low flash point liquid pool fires may only be suppressed, all depending on the degree of shielding or ventilation. However, such fires can be readily extinguished using a hand held, dry chemical extinguisher. Fire tests have shown that the spray pattern of a dry chemical extinguisher is not significantly affected by the spray from the AquaMist Nozzles, even when operated up to 16 feet (5 m) from the fire. Tests have also demonstrated that a smaller amount of agent is needed for fire extinguishment, with the AquaMist system operating, as compared to the quantity needed for free-burning fires of the same magnitude.

Tests have also shown that the spray from the AM4 Nozzles has high flame cooling and containment (shielding) capabilities. Consequently, there is the possibility that the heat release rate of small, ventilated, flammable liquid spray fires located in areas such as beneath a wide horizontal obstruction (with nozzles under the obstruction) or, at a ceiling-wall junction, may be reduced (suppressed) to the point that there will be an insufficient reduction in oxygen level to result in flame extinguishment. Therefore, it is necessary that the supply of all pressurized flammable or combustible liquids be automatically terminated upon system activation.

Copies of the fire test reports are available upon request from the Technical Services Department.



System Design Criteria

Pre-engineered water mist systems utilizing the Type AM4 AquaMist Nozzles are to be installed in accordance with NFPA 750, "Water Mist Fire Protection Systems", as well as the following system design criteria:

System Type:

- Deluge

Nozzle Type:

- AM4 (See TFP2204)

Compartment Size:

- Maximum volume:

| UL | FM |
|--|---|
| 56,500 ft ³ (1600 m ³) | 45,203 ft ³ (1,280 m ³) |

- Maximum ceiling height of 26 ft. - 3 in. (8 m).

Nozzle Pressure:

- Minimum 185 psi (12,8 bar).
- Maximum 250 psi (17,2 bar).

Nozzle Orientation:

- Pendant (vertically downward).

Ceiling Nozzle Spacing & Location:

- AM4 Nozzles located at the ceiling are to be installed at a maximum spacing of 13 ft.-1 in. x 13 ft.-1 in. (4 m x 4 m), with a maximum distance of 6 ft.-7 in. (2 m) from walls. The maximum area of coverage per nozzle is 172 ft² (16 m²). There is no minimum nozzle spacing requirement. The minimum number of nozzles per compartment is 2.
- AM4 Nozzles are to be installed with a Diffuser to ceiling distance of 7.9 to 47.2 in. (0,2 to 1,2 m).
- The minimum vertical distance between the AM4 Diffusers and the plane of protection is 39.4 in. (1 m).

Natural Ventilation Openings and Door Openings:

- Natural ventilation openings require fire rated closures that will automatically close upon system operation.
- The maximum total area of doorways without automatic fire rated closures, is 43 ft² (4 m²), assuming that these doorways are protected as follows:

For openings such as doorways up to 26.2 in. (0,67 m) wide and 78.7 in. (2 m) high, two AM4 Nozzles are to be installed 15.7 to 23.6 in. (0,4 to 0,6 m) inside the enclosure, along the vertical left and right edges of the openings and with the AM4 Diffusers between 15.7 to 23.6 in. (0,4 to 0,6 m) above the top of the openings (Ref. Figure 2, Arrangement 1). The nozzles are to be angled inward to the protected compartment at 25° from the vertical (Ref. Figure 2, Section A-A).

For openings such as doorways from 26.2 to 52.5 in. (0,67 to 1,33 m) wide and up to 78.7 in. (2 m) high, three AM4 Nozzles are to be installed 15.7 to 23.6 in. (0,4 to 0,6 m) inside the enclosure, with the AM4 Diffusers 15.7 to 23.6 in. (0,4 to 0,6 m) above the top of the openings. The centerline of the two outside AM4 Nozzles are to be located along the vertical left and right edges of the openings with the third nozzle to be located along the centerline of the openings (Ref. Figure 2, Arrangement 2). The nozzles are to be angled inward to the protected compartment at 25° from the vertical (Ref. Figure 2, Section A-A).

For openings such as doorways from 52.5 to 78.7 in. (1,33 to 2 m) wide and up to 78.7 in. (2 m) high, four AM4 Nozzles are to be installed 15.7 to 23.6 in. (0,4 to 0,6 m) inside the enclosure, with the AM4 Diffusers 15.7 to 23.6 in. (0,4 to 0,6 m) above the top of the openings. The centerline of each of the outer AM4 Nozzles is to be located along the vertical left and right edges of the openings, while the two central AM4 Nozzles are to be located equidistant between the outer nozzles (Ref. Figure 2, Arrangement 3). The nozzles are to be angled inward to the protected compartment at 25° from the vertical (Ref. Figure 2, Section A-A).

Forced Ventilation:

- All forced ventilation associated

fans and dampers are to be shut-off, upon system operation.

Obstructions:

- Additional AM4 Nozzles are to be located under ducts, catwalks, solid decks, and other horizontal obstructions over 39.4 in. (1 m) wide that are located below the ceiling mounted AM4 Nozzles. In the case of horizontal obstructions that are completely surrounded by spray, the maximum width and length of the obstruction may be increased to 78.7 in. (2 m) before additional AM4 Nozzles are required beneath the obstruction. These obstruction criteria do not apply to furniture such as tables, benches, and chairs.

In addition, nozzles are not required under open, fully gridded catwalks provided that the openings have a minimum horizontal dimension of 0.51 in. (13 mm), there is at least 60% open area, and the catwalks are not used for storage.

The maximum spacing between nozzles located under a horizontal obstruction, as a function of the distance between the nozzle diffusers and the plane of protection, is as follows:

| AM4 Nozzle Diffuser To Plane Of Protection In. (m) | Maximum Horizontal Spacing Of AM4 Nozzles In. (m) |
|--|---|
| >78.7 (2) | 157 in. (4) |
| 59.0 (1,5) to 78.7 (2) | 118 in. (3) |
| 39.4 (1m) to <59.0 (1,5) | 98 in. (2,5) |

- The maximum allowable vertical distance that the bottom of a vertical obstruction can be below the Diffuser of an AM4 Nozzle is as follows:

| Horizontal Distance From AM4 Nozzle To Obstruction In. (m) | Maximum Allowable Vertical Distance Below AM4 Diffuser In. (m) |
|--|--|
| Up to 30 (0,76) | 0 |
| >30 (0,76) to 40 (1,02) | 8 (0,20) |
| >40 (1,02) to 50 (1,27) | 20 (0,50) |
| >50 (1,27) to 60 (1,53) | 27.5 (0,70) |
| 60 (1,53) | 39 (1,00) |

- Non-continuous obstructions at the ceiling such as columns, bar joists, truss webs, and light fixtures are to be considered as vertical obstructions.

Corrosion Resistance:

- The AM4 Nozzles are only to be used in environments for where the austenitic stainless steel used for the nozzles will provide acceptable corrosion resistance, and the Buna-N material used for the Dust Caps, if fitted, will be resistant to deterioration.
- The pipe (tube), fittings, hangers, and hanger components must be suitable for use in the application environment.

Hydraulic Calculations:

- Hydraulic calculations for the water mist system are to be made as part of the design of the piping system, to verify that the minimum required flowing pressure is available at each nozzle in the design area. Pipe friction losses are to be calculated on the basis of the Darcy-Weisbach formula except where the Hazen - Williams formula is acceptable to the authority having jurisdiction.

- The maximum water flow velocity through the water mist system feed mains, cross mains, and branch lines is not to exceed 25 ft./sec. (7,6 m/s).

Main Pipeline Strainers:

- A corrosion resistant main pipeline strainer is to be located downstream of the automatic water control valve for the system. The strainer is to be provided with a clean-out port and a basket having maximum 0.059 in. (1,50 mm) openings.
- The main pipeline strainer is to be acceptable the authority having jurisdiction (e.g., Factory Mutual requires an FM Approved strainer and NFPA requires a listed strainer).
- The minimum sizes for the main pipeline strainers are as follows:

| Maximum Number Of AM4 Nozzles | Minimum Nominal Strainer Size In. (mm) |
|-------------------------------|--|
| 11 | 3/4 (20) |
| 18 | 1 (25) |
| 32 | 1-1/4 (32) |
| 44 | 1-1/2 (40) |
| 72 | 2 (50) |
| 104 | 2-1/2 (65) |
| 160 | 3 (80) |
| 215 | 4 (100) |

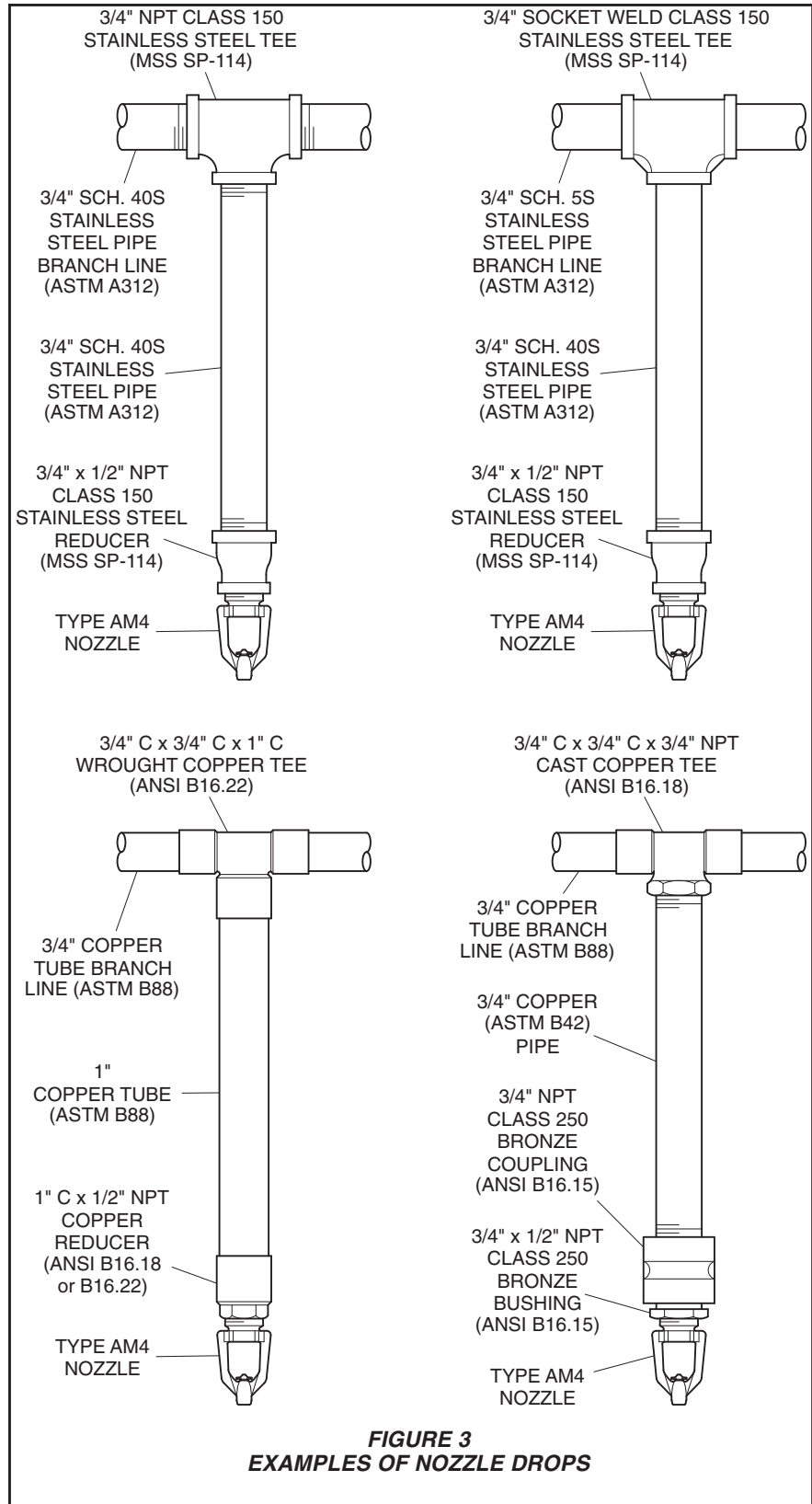
- The above strainer specifications are based on providing sufficient

basket area for common water supplies. For water supplies known to contain significant debris, the capacity of the strainer should be increased appropriately.

- The above specifications only apply to the strainer pipe size. The pipe size of other portions of the system feed main are to be sized, as appropriate, based on hydraulic calculations.

Sizes for System Pipe (Tube) And Fittings:

- Mains and branch lines are to be minimum 3/4 inch (DN 20) pipe or tube size.
- Nozzle drop nipples are to be as follows (See Figure 3 for examples):
 - minimum 3/4 inch (DN 20) size for Copper pipe per ASTM B42; or, Stainless Steel pipe per ASTM A312
 - minimum 1 inch (DN 25) size for Copper tube per ASTM B88
- AM4 Nozzles installed in side outlets of tee fittings must be such that the nozzle inlet strainer does not protrude into the inside of the pipe (tube) run. (Ref. Figure 4 for examples.)
- AM4 Nozzles may be installed directly into reducing elbow fittings on the end of armovers providing that the piping system is non-gridded and that flushing connections are provided at the end of the branch lines. The reducing elbow fitting must be of a type that will allow space for the nozzle inlet strainer. For example:
 - 3/4" C x 1/2" FNPT cast copper per ANSI B16.18,
 - 3/4" FNPT x 1/2 FNPT cast bronze per ANSI B16.15, or
 - 3/4" FNPT x 1/2 FNPT stainless steel per MSS SP-114.
- Rubber-gasketed fittings are not permitted for the connection of pipe (tube) in fire exposed areas. Listed rubber-gasketed fittings may be used for connecting piping system components in non-fire exposed areas.

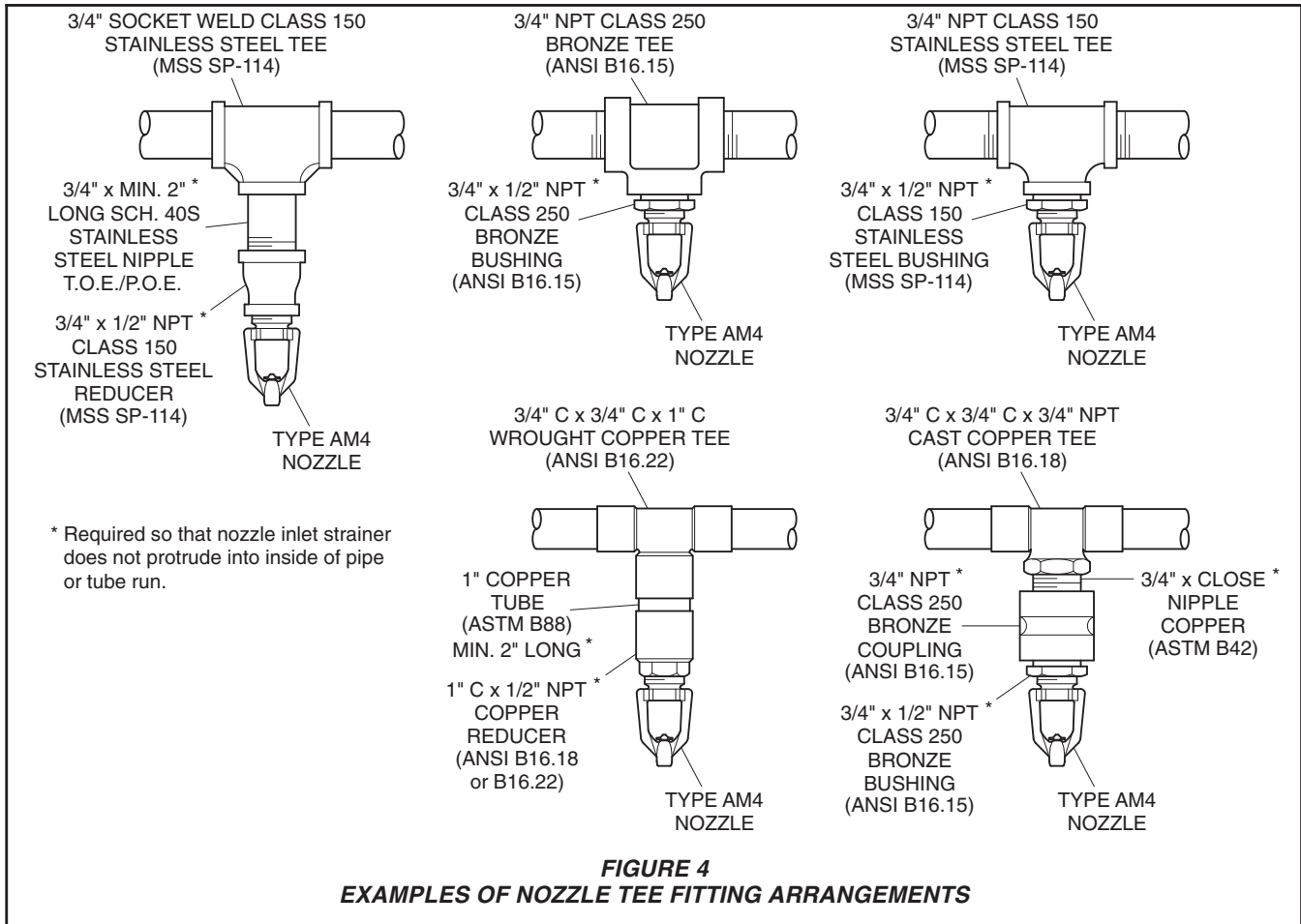


**FIGURE 3
EXAMPLES OF NOZZLE DROPS**

NOTICE

Failure to use the appropriately sized

nozzle drop nipples may impair system performance by restricting flow to the nozzle inlet strainer.



Material for System Pipe (Tube) and Fittings:

Selection and installation of pipe (tube) and fittings must be in accordance with the specifications of NFPA 750, "Water Mist Fire Protection Systems". The following list of bronze, copper, and stainless steel pipe and fittings are examples of pipe and fittings that are suitable for use in AquaMist Total Compartment Deluge Systems.

Other types of pipe (tube) and fittings may be used provided they have been investigated for suitability in water mist system installations, are listed for this service, and that they are installed in accordance with their listing limitations, as well as installation instructions.

• Copper

Threaded regular wall seamless copper pipe per ASTM B42 with Class 250 cast bronze threaded fittings per ANSI B16.15.

Seamless Type K, L, or M copper

water tube per ASTM B88 with cast copper alloy solder joint fittings per ANSI B16.18 or wrought copper alloy solder joint fittings per ANSI B16.22.

Note: Solder joint connections are to be brazed using filler metals of Class BCuP-3 or BCuP-4 per AWS A5.8 with a minimum melting temperature of 1300°F (704°C), and brazing fluxes, if used, are not to be of the highly corrosive type.

Note: Qualification of brazing procedures and brazers is to be in accordance with AWS B2.2 for the Copper and Copper Alloys Base Metal Group with the BCuP Filler Metal Group.

• Stainless Steel Pipe

Threaded Schedule 40S Type 304 or 316 stainless steel pipe per ASTM A312 with minimum Class 150 threaded cast stainless steel fittings per MSS SP-114.

Note: The sealant used for making up threaded stainless steel pipe con-

nections must be of a type that is rated for use with stainless steel.

Plain-end Schedule 5S or 10S Type 304 or 316 stainless steel pipe per ASTM A312 with minimum Class 150 socket weld cast stainless steel fittings per MSS SP-114.

Note: Pipe and fitting welding procedures must conform to the applicable requirements of NFPA 15, except that qualification of welding procedures and welders is to be in accordance with Level AR-1 of AWS 10.9.

Hangers:

- Selection and installation of the piping system hangers must be in accordance with the specifications of NFPA 13, except that the term "nozzle" is to be substituted for "sprinkler".

Enclosure Construction:

- The ceiling, walls, and floor of the compartment are to be non-combustible materials, as defined by NFPA

13, or have a Fire Resistance rating not less than the minimum specified water supply duration.

Gas Turbine Protection

- The Type AM4 AquaMist Nozzles are FM Approved for the protection of gas turbines without insulation mats. The axis of the turbine must be centered between two rows of nozzles. Each of the nozzles in these two rows must be located outboard of the turbine, with a minimum radial distance of 4 ft. (1,2 m) between the vertical axis of the nozzles and the closest part of the adjacent casing. This criteria applies anywhere along the length of the casing.

Water Supply:

- Potable or natural sea water.
- The water supply must be automatic.
- The water supply must be sufficient to provide a minimum nozzle flowing pressure of 185 psi (12,8 bar) for the following minimum specified duration time:

| Compartment Volume | Minimum Water Supply Duration, Min. UL/FM |
|---|---|
| Up to 28,230 ft ³ (800 m ³) | 30/40 |
| >28,230 to 45,203 ft ³ (>800 to 1280 m ³) | 45/50 |
| >45,203 to 56,500 ft ³ (>1280 to 1600 m ³) | 60/— |

Exception: Only where Factory Mutual Approval is not required, shorter water supply duration times may be used for compartments substantially smaller than 28,230 ft³ (800 m³) when additional fire tests, acceptable to the authority having jurisdiction, demonstrate that shorter times are acceptable. The minimum discharge times as indicated above must be used for installations intended to comply with Factory Mutual requirements.

- Pumps and pump controllers must conform to the applicable requirements of NFPA 20. Water tanks must conform to the applicable requirements of NFPA 22.

Valves And Pressure Gauges:

- Valves, valve identification, and pressure gauges must conform to

the applicable requirements of NFPA 15.

- System actuation valves are to be positioned outside of and as close as practical to the hazard being protected.

System Actuation:

- Pre-engineered water mist deluge systems utilizing AM4 Nozzles are to be provided with both automatic and manual means of actuation, utilizing a laboratory listed (e.g., UL Listed or FM Approved as applicable) method of automatic fire detection.

Exception: For other than Factory Mutual Approved installations, manual only actuation is permitted where acceptable to the Authority Having Jurisdiction. When designing systems for manual actuation only, consideration must be given to the nature of the hazard, as well as to the minimum temperature ratings of the system piping, the pipe joining method, and the piping supports.

- Detection, signaling, actuation, alarm, and control systems are to be installed, tested, and maintained in accordance with NFPA 70 and NFPA 72, as applicable.
- Adequate and reliable primary, as well as 24 hour minimum standby sources of energy, are to be used to provide for operation of the detection, signaling, control, and actuation requirements of the system.
- Operation of the system is to be by listed mechanical and electrical equipment.

Flammable and Combustible Liquid Piping Systems:

- The supply of all pressurized flammable or combustible liquids is to be automatically terminated upon system activation.

Exception: The supply of bearing lubrication fluids may be continued during the coast down time of machinery, such as turbine rotors, provided that the water supply is sufficient to provide protection during the entire coast down time.

Flushing Connection:

- Systems with underground water supply connections are to be provided with a suitable flushing connection at the inlet to the automatic water control valve for the system.

The flushing connection is to be of sufficient size to establish a flow rate not less than the water demand rate of the system.

- Suitable provision is to be made for the disposal of flushing water. Flushing water must be directed such that it will not cause accidental damage to property or danger to persons.

Control Of Run-Off:

- Adequate provision, commensurate with the nature of the hazard being protected, needs to be made to control or contain all liquids, including any spilled contaminant, within the area of the water mist fire protection system discharge. Refer to NFPA 15 and 30 for guidance.

Electrical Clearances:

- All of the water mist system components are to be located to maintain minimum clearances from unenclosed and uninsulated energized electrical components in accordance with NFPA 70.

Working Plans:

- Preparation, submittal, and approval of the working plans for the water mist system must conform with the requirements of the Authority Having Jurisdiction.

Spare Nozzles:

A minimum of 3 spare nozzles are to be provided for systems having less than 50 nozzles and, a minimum of 6 spare nozzles are to be provided for systems with 50 or more nozzles.

Operation

The mechanisms by which the Type AM4 *AquaMist* Nozzle spray acts to extinguish a fire can be a combination of the following factors, depending on the hazard:

- (1) Heat extraction from the fire as water is converted into vapor and the fuel is cooled;
- (2) Reduced oxygen levels as the water vapor displaces oxygen near the fire;
- (3) Dilution of flammable vapors by the entrainment of water vapor, to such an extent that the resultant mixture of vapor will not burn;
- (4) Direct impingement wetting and cooling of the combustibles; and,
- (5) Enveloping of the protected area to pre-wet adjacent combustibles, cool gases and other fuels in the area, as well as to block the transfer of radiant heat to adjacent combustibles.

In the case of Class A combustibles, a combination of factors (1), (2), (4), and (5) is involved. In the case of Class B combustibles, a combination of factors (1), (2), and (3) is normally involved.

Installation

All listed materials and devices are to be installed in accordance with their listing. All other materials and devices are to be installed in accordance with the applicable manufacturer's instructions.

NOTICE

Pipe, tube, and nipples are to have the burrs and fins removed after cutting. Apply pipe thread sealant to male threads only. When using Teflon[®] tape, do not start the tape any closer than one thread from the inlet of any pipe connection or the AquaMist Nozzles (strainer end).

In order to remove foreign materials that may have entered underground mains during the course of the installation, underground mains and lead-in connections to system risers are to be thoroughly flushed, as required by NFPA 750, before connection is made to the system piping. Refer to the Flushing Connection requirements under the System Design Criteria section.

Prior to installation, each pipe or tube section is to be swabbed internally, by running a clean rag, sponge, or other absorbent material down through it, as needed to meet the internal cleanliness requirements of NFPA 750.

Prior to installing the nozzles, the nozzle fittings must be plugged and all interior piping of the water mist system, as well as any attached appurtenances subject to a system working (service) pressure, is to be hydrostatically tested to 150% of the normal working pressure. The hydrostatic test pressure is to be maintained without loss of pressure for 2 hours. The loss in pressure is to be determined by either a drop in gauge pressure or visual leakage. Potable water supplied to the system through the Main Pipeline Strainer is to be used for the hydrostatic test.

To check for proper development of the nozzle discharge patterns, where practical, a full flow test of the system is to be made following installation of the nozzles and prior to placing the system in service.

System Resetting

After system operation due to a fire and upon verification that the fire has been extinguished, the *AquaMist* System must be reset as soon as possible.

Step 1. Shut down the Pump Skid and slowly close the System Control Valve to stop water flow from the *AquaMist* Nozzles.

Step 2. Open the system drain valve. Verify that the drain water is properly draining and not causing any physical damage.

Step 3. Reset the Releasing Panel.

Step 4. Clean the System Strainer.

Step 5. Clean and inspect the Pump Skid in accordance with the Pump Skid instructions.

Step 6. Reset the Model DV-5 Deluge Valve in accordance with its resetting instructions.

Step 7. Return the Pump Skid to service.

Step 8. Perform the System Test Procedure.

The system is now set for service.

After placing a fire protection system is returned to service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms

System Test Procedure

The system test procedure is to be performed monthly to verify proper operation of alarms and pump start-up. Refer to NFPA 750 for additional required testing.

NOTICE

Before closing a fire protection system control valve for inspection testing, or maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection system must first be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Testing the system will result in operation of fire alarms. Before testing a fire protection system that is in service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms.

Step 1. Open the Alarm Test Valve for the Model DV-5 Deluge Valve.

Step 2. Verify pump start-up and observe the water pressure gauge. Compare the reading to prior tests. Deviation in readings must be remedied.

Step 3. Verify proper operation of water flow alarms. Deviation in operation must be remedied.

Step 4. Close the Alarm Test Valve for the Model DV-5 Deluge Valve, and reset the alarm panel to silence alarms.

Step 5. Completely open the system

drain valve and compare the residual flowing pressure observed at the water pressure gauge and compare the reading to prior tests. Deviation in readings must be remedied.

Step 6. Slowly close the system drain valve.

Step 7. Return the Pump Skid to service following the Pump Skid instructions.

The system is now returned to service.

After placing a fire protection system is returned to service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms

Care and Maintenance

Care must be exercised to avoid damage to the AM4 *AquaMist* Nozzles - both before and after installation. AM4 *AquaMist* Nozzles damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced.

Water mist systems for fire protection service require regularly scheduled care and maintenance by trained personnel. It is recommended that the *AquaMist* Nozzles be periodically inspected for broken or missing Dust Caps, loading/obstructions, improper orientation, or other evidence of impaired protection. The inspections should be scheduled at least annually but more frequently if found to be necessary and, corrective action taken immediately to ensure that the *AquaMist* Nozzles will perform as intended in the event of a fire.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable requirements of NFPA 750, in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions.

Water spray fixed systems should be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Underground lead-in connections to the system riser are to be flushed at least annually, at a flow rate not less than the water demand rate of the system. The flushing operation is to be

continued for a sufficient time to ensure thorough cleaning.

The main pipeline strainer must be cleaned out after every system operation.

After every system operation, each AM4 Nozzle is to be removed for cleaning of the nozzle and its Inlet Strainer, unless observations under flow conditions or removal and inspection of a sampling of nozzles indicates that this is not necessary. In the case of the sampling method, it will be necessary to remove and inspect the nozzle at the beginning of each branch line or at both ends of each branch line for a gridded piping system. All of the nozzles must be removed for cleaning if more than 1/3 of the area of any nozzle inlet strainer is clogged with debris.

For systems with a natural sea water supply, the system piping is to be flushed through the nozzles with potable water at 185 psi (12,8 bar) minimum, for at least 30 seconds, after every system operation.

After system operation, the Dust Caps, where applicable, are to be refitted into the nozzle orifice as shown in Technical Data Sheet TFP2204. AM4 Nozzles with broken or missing Dust Caps are to be replaced.

NOTICE

Before closing a fire protection system control valve for inspection or maintenance work on the fire protection system that it controls, permission to shut down the effected fire protection system must first be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

After placing a fire protection system in service, notify the proper authorities and advise those responsible for monitoring proprietary and/or central station alarms.

Limited Warranty

Products manufactured by Tyco Fire Suppression & Building Products (TFSBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFSBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFSBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFSBP to be defective shall be either repaired or replaced, at TFSBP's sole option. TFSBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFSBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFSBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFSBP was informed about the possibility of such damages, and in no event shall TFSBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.