

# Ultra Low Flow AQUAMIST Systems for Protecting Non-Storage, Hazard Category 1 (HC-1) Occupancies: FM Approvals Criteria

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### Figure 1

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### Graph A

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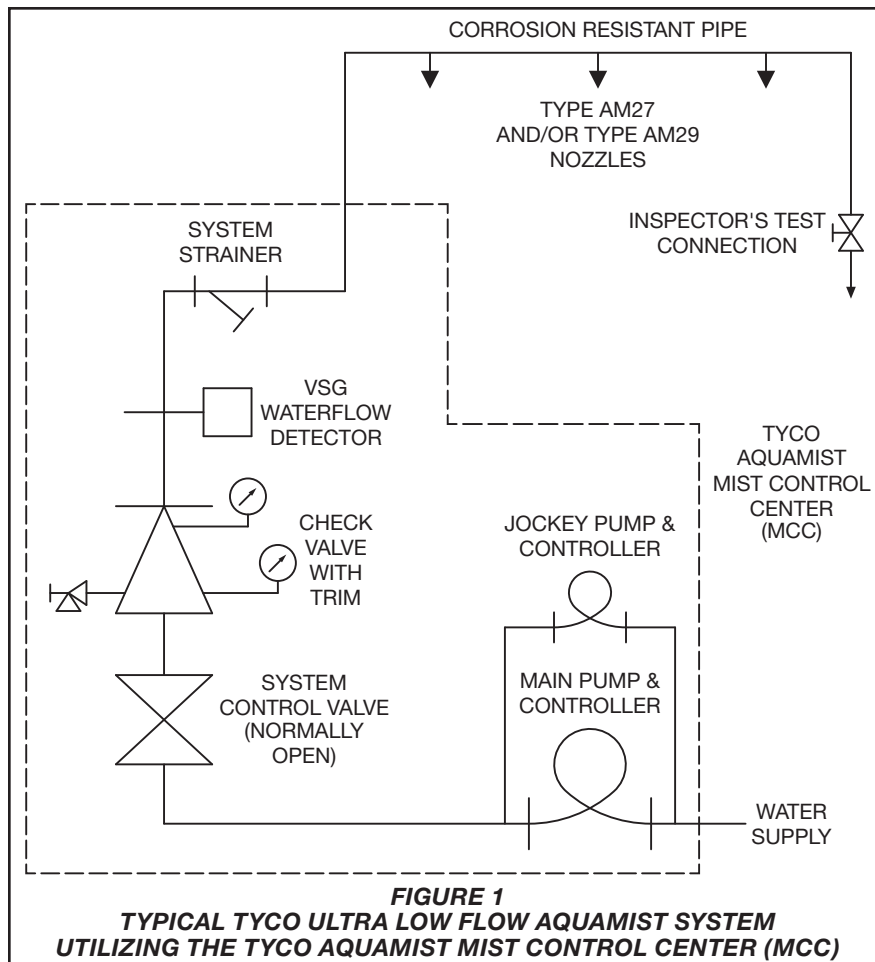


## Training

Training provided by Tyco Fire Protection Products (TFPP) is mandatory prior to the bidding, designing, procurement of components, installation, and maintaining of TYCO Ultra Low Flow (ULF) AQUAMIST Water Mist Systems. These systems are unique in their intent and design. Anyone involved at any level must thoroughly understand the limitations and capabilities of such systems.

## Approvals & Application Criteria

The TYCO Type ULF AM27 and Type ULF AM29 AQUAMIST Nozzles in a 57°C (135°F) temperature rating and in a natural brass finish are FM Approved when used as part of an engineered, wet pipe water mist system. In particular, the FM Approval testing was performed in accordance with FM Class 5560, Approval Standard for Water Mist Systems. Within this approval standard, Non-Storage, Hazard Category 1 (HC-1) Occupancies are noted to be defined in FM Global Property Loss Prevention Data Sheet No. 4-2. These HC-1 occupancies are limited to non-storage and non-manufacturing areas such as residential, offices, data processing areas without open storage of information media, meeting rooms, hotels, museum exhibit areas, restaurant seating areas, institutions, and schools.



Consulting FM Global Property Loss Prevention Data Sheet No. 4-2 is required for installation of an FM Approved Water Mist System.

**NOTICE**

The AQUAMIST System described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association (NFPA) 750, in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of this system.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.

All other hardware and components used in the system must be FM Approved and compatible (e.g., pressures and materials).

## Protection Objectives

The TYCO AQUAMIST System described herein offers an alternative to higher density automatic sprinkler systems for the protection of light hazard occupancies when installed in accordance with the System Design Criteria section.

Copies of the fire test report are available upon request from the Technical Services department.

## System Components

- TYCO Type ULF AM27 and/or Type ULF AM29 AQUAMIST Nozzles (Refer to Technical Data Sheets TFP2227 and TFP2229.)
- The TYCO AQUAMIST Mist Control Center (MCC) is FM Approved as a component of this system when configured as an On- or Off-Board Wet Pipe System. (Refer to Technical Data Sheet TFP2270.)

If the TYCO AQUAMIST MCC is not used, all equivalent hardware and components used in the system must be FM Approved and compatible (e.g., pressures and materials).

**Note:** Only use MCC Pump Skid models MCC-A, B and C in conjunction with components rated to a maximum pressure of 12 bar (175 psi).

## System Design Criteria

Engineered water mist systems utilizing the TYCO Type ULF AM27 and Type ULF AM29 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**  
Wet pipe

**System Size**  
Maximum 4830 m<sup>2</sup> (52000 ft<sup>2</sup>)

**Compartmented Protection Area**

- Type ULF AM27:  
Maximum 95 m<sup>2</sup> (1024 ft<sup>2</sup>)

**Exception:** Maximum compartment size does not apply to corridors that are being protected by one row of nozzles.

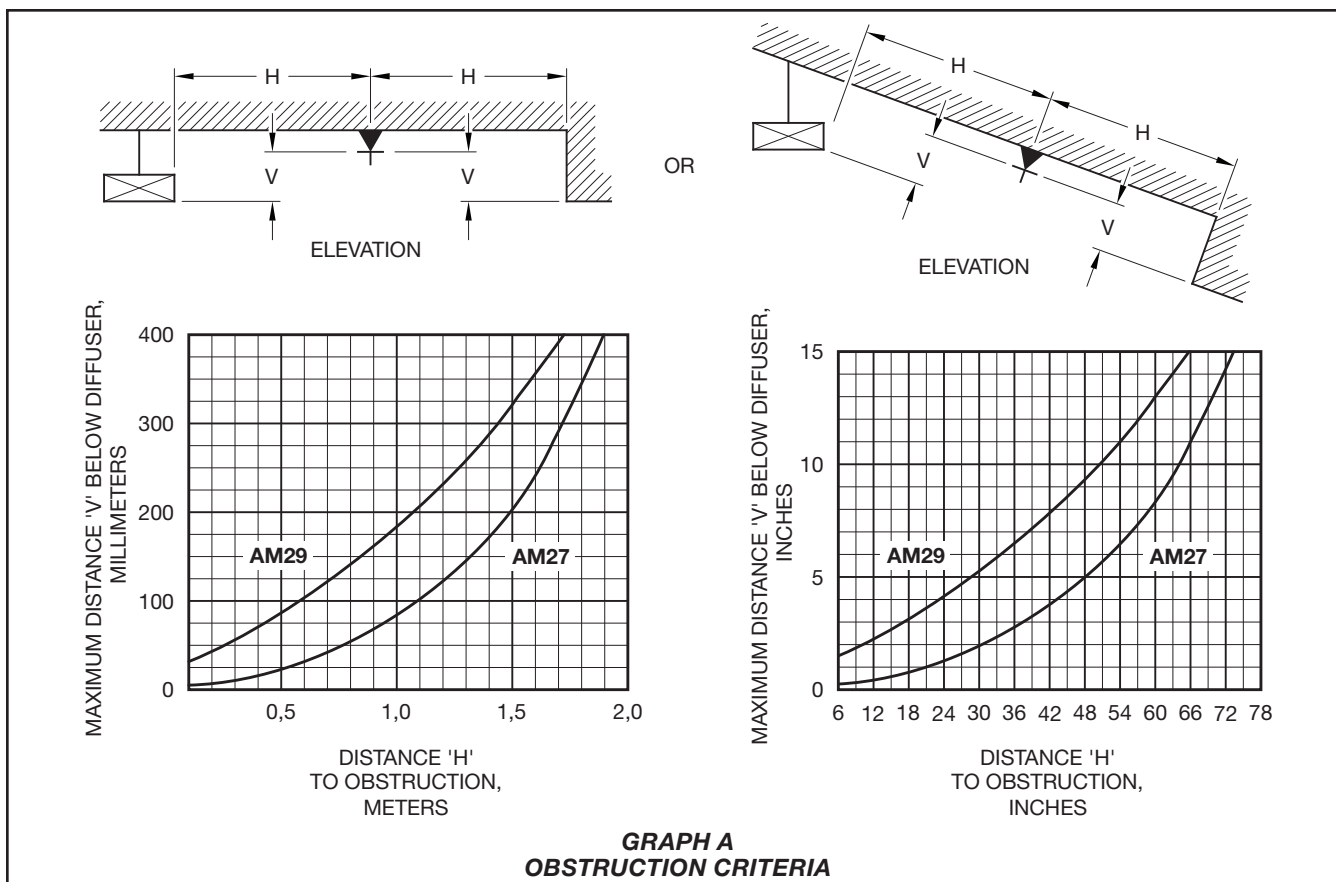
- Type ULF AM29: Unlimited

**Ceiling Height**

- Type ULF AM27:  
Maximum 2,4 m (8'-0")
- Type ULF AM29:  
Maximum 5,0 m (16'-5")

**Nozzle Spacing and Location**

- Type ULF AM27:  
Type ULF AM27 Nozzles are to be installed at a maximum spacing of 4,9 m x 4,9 m (16 ft. x 16 ft.), with a maximum distance of 2,4 m (8 ft.) from walls. The maximum coverage area per nozzle is 24,0 m<sup>2</sup> (256 ft<sup>2</sup>).



The minimum spacing to prevent non-operation of adjacent nozzles is 1,8 m (6'-0").

For non-recessed applications, the diffuser-to-ceiling distance must be 25 to 100 mm (1.0 to 4.0 in.).

For recessed applications, only the Style 20 Recessed Escutcheon may be utilized.

- Type ULF AM29:  
Type ULF AM29 Nozzles are to be installed at a maximum spacing of 3,7 m x 3,7 m (12 ft. x 12 ft.), with a maximum distance of 1,8 m (6 ft.) from walls. The maximum coverage area per nozzle is 13,4 m<sup>2</sup> (144 ft<sup>2</sup>).

The minimum spacing to prevent non-operation of adjacent nozzles is 1,8 m (6'-0" ft.).

For non-recessed applications, the diffuser-to-ceiling distance must be 40 to 100 mm (1.5 to 4.0 in.).

For recessed applications, only the Style 20 Recessed Escutcheon may be utilized.

**Nozzle Pressure**

- Type ULF AM27:  
9,7 to 17,2 bar (140 to 250 psi)
- Type ULF AM29:  
7,6 to 17,2 bar (110 to 250 psi)

**Water Demand Requirements**

- Type ULF AM27:  
The water supply shall be capable of supplying 60 minutes of water to the most remote 95 m<sup>2</sup> (1,024 ft<sup>2</sup>) area. For installations less than 95 m<sup>2</sup> (1,024 ft<sup>2</sup>) in area, the water supply shall be capable of supplying 60 minutes of water to all nozzles in the protected area.
- Type ULF AM29:  
The water supply shall be capable of supplying 60 minutes of water to the most remote 140 m<sup>2</sup> (1,500 ft<sup>2</sup>) area. For installations less than 140 m<sup>2</sup> (1,500 ft<sup>2</sup>) in area, the water supply shall be capable of supplying 60 minutes of water to all nozzles in the protected area.

**Water Supply**

Potable or natural sea water

In the case of natural sea water, provision must be made to precharge the system with fresh water, and after a system operation, the system is to be flushed with fresh water before it is once again precharged.

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

**Nozzle Temperature Ratings**

Utilize the lowest temperature rated Type ULF AM27 or Type ULF AM29 as a function of the maximum expected ambient temperature conditions.

- The 57°C (135°F) and 68°C (155°F) temperature rated Type ULF AM27 and Type ULF AM29 may be used with a maximum ambient temperature of 38°C (100°F).
- The 79°C (175°F) and 93°C (200°F) temperature rated Type ULF AM27 and Type ULF AM29 may be used with a maximum ambient temperature of 66°C (150°F).

**Note:** FM Approval is only for the 57°C (135°F) temperature rating.

**Ceiling Construction**

Ceilings are to be of smooth construction with a maximum slope of 5% (1/12).

**Nozzle Orientation**

Pendent (vertically downward)

**Nozzle Escutcheons**

Only the Style 20 Recessed Escutcheon may be utilized for recessed applications. (Refer to Technical Data Sheets TFP2227 and TFP2229 for installation dimensions.)

### Obstructions

The maximum allowable vertical and horizontal distance that the bottom of a vertical obstruction can be below the Type ULF AM27 or Type ULF AM29 Diffuser is provided in Graph A.

Non-continuous obstructions at the ceiling, such as beams and light fixtures, are to be considered as vertical obstructions.

### Corrosion Resistance

The Type ULF AM27 and Type ULF AM29 Nozzles are only to be used in environments for which the materials of construction specified in technical data sheets TFP2227 and TFP2229 will provide acceptable corrosion resistance. Direct any questions to TFP Technical Services.

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.

- Where the water flow velocity does not exceed 7,6 m/s (25 ft./sec.), hydraulic calculations may be made using the Hazen-Williams formula using a C=150 value for CPVC, brass, copper, or stainless steel pipe or tube.
- Where the water flow velocity exceeds 7,6 m/s (25 ft./sec.), the hydraulic calculations are to be made using the Darcy-Weisbach formula.

### Sizes for System Pipe (Tube) and Fittings

Mains and branch lines are to be minimum DN20 (3/4 inch) pipe or tube size.

Nozzle drop nipples are to be as follows:

- minimum DN20 (3/4 inch) size for CPVC pipe per ASTM F442 (SDR 13.5); Copper pipe per ASTM B42 -or- Stainless Steel pipe per ASTM A312
- minimum DN25 (1 inch) size for Copper tube per ASTM B88

When nozzles are installed in side outlets of tee fittings, the tee fittings must be such that the nozzle inlet strainer does not protrude into the inside of the pipe (tube) run.

When nozzles are installed in elbow fittings, the elbow fittings must be of a type that will allow clearance for the nozzle inlet strainer.

### 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 chlorinated polyvinyl chloride (CPVC), bronze, copper, and stainless steel pipe (tube) and fittings are examples of pipe and fittings that are suitable for use in AQUAMIST 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.

#### • CPVC

FM Approved solvent cement joined CPVC pipe and fittings for light hazard fire protection service may be used when installed per FM concealed or exposed installation criteria and the pipe manufacturer's instructions, except that the term "nozzle" is to be substituted for "sprinkler."

FM Approved CPVC pipe and fittings are suitable for use at a maximum service pressure of 12 bar (175 psi) and a maximum ambient service temperature of 66°C (150°F).

#### • Copper Pipe

Threaded regular wall seamless copper pipe per ASTM B42 with Class 125 or Class 250 cast bronze threaded fittings per ANSI B16.15 may be used. These combinations of pipe and fittings are suitable for use at a maximum service pressure of 13,8 bar (200 psi) when using Class 125 fittings; 27,6 bar (400 psi) when using Class 250 fittings; and a maximum ambient service temperature of 66°C (150°F) for either Class 125 or 250.

#### • Copper Tubing

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 may be used. In addition, copper tube and fittings per EN 1057 may be used. These combinations of tube and fittings, up to DN100 (4 inch), are suitable for use at a maximum service pressure of 17 bar (250 psi) and a maximum ambient service temperature of 66°C (150°F).

Solder or brazed joints are permitted for the connection of copper capillary fittings.

#### • Stainless Steel Pipe

GRINNELL G-PRESS Press-Fit Stainless Steel Pipe and Fittings or 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. Additionally, stainless steel pipe per DIN 17440 and stainless steel fittings per ISO 49 may be used.

The sealant used for making up threaded stainless steel pipe connections must be of a type that is rated for use with stainless steel.

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

These combinations of stainless steel pipe and Class 150 fittings are suitable for use at a maximum service pressure of 20,7 bar (300 psi) and a maximum ambient service temperature of 66°C (150°F).

### NOTICE

*Pipe and fitting welding procedures are to be in accordance with the applicable requirements of an installation standard which is approved by the authority having jurisdiction.*

### 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."

### Valves and Pressure Gauges

Valves, valve identification, and pressure gauges must conform to the applicable requirements of NFPA 750.

### Waterflow Alarms

Waterflow alarm systems are to be installed, tested, and maintained in accordance with NFPA 70 and NFPA 72, as applicable.

### 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.

#### NOTICE

*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.*

## Operation

The mechanisms by which the TYCO Type ULF AM27 and Type ULF AM29 AQUAMIST Nozzles spray acts to control Class A fires can be a combination of the following factors:

- heat extraction from the fire as water is converted into vapor and the fuel is cooled;
- reduced oxygen levels as the water vapor displaces oxygen near the fire;
- direct impingement wetting and cooling of the combustibles; and
- 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

## 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.

Any attached appurtenances, including the AQUAMIST Nozzles, subject to a system working (service) pressure of 12 bar (175 psi) or less are to be hydrostatically tested at 13,8 bar (200 psi) or, 3,5 bar (50 psi) in excess of the system working pressure, whichever is greater.

For system working pressures in excess of 12 bar (175 psi), the hydrostatic pressure test is to be performed at 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.

## System Resetting

After system operation due to a fire and upon verification that the fire has been extinguished, the TYCO 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 operated AQUAMIST Nozzles.

**Step 2.** Open the Inspector's Test Connection.

**Step 3.** Open the Check Valve drain valve. Verify that the drain water is properly draining and not causing any physical damage.

**Step 4.** Replace any operated or overheated Type ULF AM27 and/or Type ULF AM29 Nozzles.

**Step 5.** Clean the System Strainer.

**Step 6.** Clean and inspect the Pump Skid in accordance with the Pump Skid instructions.

**Step 7.** Close the Check Valve drain valve.

**Step 8.** Partially open the System Control Valve to allow the system to slowly fill with water.

**Step 9.** Close the Inspector's Test Connection when the water discharging from the Inspector's Test Connection is un-aerated.

**Step 10.** Return the Pump Skid to service and completely open the System Control Valve.

**Step 11.** Perform the System Test Procedure.

The system is now set for service.

After 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, obtain permission to shut down the affected fire protection system from the proper authorities and notify all personnel who may be affected by this action.*

*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 Inspector's Test Connection.

**Step 2.** Verify pump start-up; compare the residual flowing pressure observed at the Check Valve water gauges; and compare the reading to prior tests. Deviation in readings must be remedied.

**Step 3.** Verify proper operation of water flow alarms and that the retard time is the same as previous tests. Deviation in readings must be remedied.

**Step 4.** Completely open the Check Valve drain valve and compare the residual flowing pressure observed at the Check Valve water gauges. Compare the reading to prior tests. Deviation in readings must be remedied.

**Step 5.** Close the Check Valve drain valve and the inspector's Test Connection.

**Step 6.** Return the Pump Skid to service following the Pump Skid instructions.

The system is now returned to service.

After 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

TYCO Ultra Low Flow AQUAMIST Water Mist Systems must be maintained and serviced in accordance with this section.

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 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.

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

Exercise care to avoid damage to AQUAMIST Nozzles before, during and after installation. Never paint, plate, coat, or otherwise alter nozzles after they leave the factory. Replace nozzles damaged by dropping, striking, wrench twisting, wrench slippage, or the like.

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 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.

Fixed water mist systems for fire protection 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 strainers in the TYCO AQUAMIST Cabinet and TYCO AQUAMIST Pump Skid must be cleaned after every system operation.

Responsibility lies with the owner for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the requirements of the NFPA 750, in addition to the standards of the authority having jurisdiction. Contact the installing contractor or product manufacturer with any questions.

## Limited Warranty

For warranty terms and conditions, visit [www.tyco-fire.com](http://www.tyco-fire.com).