Data Centre Water Mist Solutions

IWMA Conference
Amsterdam, 28th October 2015

Dr T R Nichols CPhys MIFireE
Agenda

Data Centre Overview
• What we are protecting
• Current Options

New AquaMist ULF for Data Centre
• New FM solution for data processing areas
• FM solution for other areas within data centre
• Key features and advantages

Component Overview
• Discharge Nozzle: AM-29
• Deluge Valve DV-5
• Pump Skid Unit
• Discharge Nozzle: AM-30
• G-Press Pipe System
• Flexible Hose Connection

Summary
Data Centre Overview
What are we protecting?

- Data Processing equipment rooms / Halls
  - Large above-floor areas containing a high density of computers and energized cables. Multiple ventilation strategies.
  - Highly ventilated below-floor areas containing a high density of energized cables.
  - Concealed space protection
- Surrounding facilities with different hazard using also FM approved solutions
  - Offices & Corridors (HC1)
  - Generator Rooms (Machinery Spaces)
- Areas not covered by FM water mist approvals
  - Storage Areas
  - Electrical Risks (HV, LV, Battery)
Containment System Design – Cold Aisle
Containment System Design – Hot Aisle
Data Processing Equipment Room

Prior Options:

**Sprinkler Pre-action System**
- Water damage
- Large water tank size

**Clean Agent System**
- Large footprint
- Room integrity
- Pressure relief
- Collateral damage

**Water Mist System**
- Performance not proven in this environment

.... some limitations exist...
Risk Assessment

• What is the fire suppression system there to achieve?
  ▪ Protect cabinets?
  ▪ Protect Facility?
  ▪ Extinguishing and refill? OR
  ▪ Control and re-instate

• Considerations
  ▪ Ventilation
  ▪ Data Hall configuration
  ▪ Installation Cost
  ▪ Storage Space of protected equipment
  ▪ Maintenance Obligations & Cost
  ▪ Discharge
    – Cost to renew
    – Collateral damage
Data Centre Overview

- The most challenging risk to cover is **Data Processing Equipment Rooms** due to:

  - Delay system response because Pre-action systems are required
  - Impact of ventilation
  - Cables that can propagate fires into other areas

- Until now, no Water Mist system was FM Approved to achieve this
## Previous options with Water Mist

<table>
<thead>
<tr>
<th>Water Mist System</th>
<th>System Limitation</th>
<th>Risk Limitations</th>
<th>Classification</th>
<th>Design Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Only Wet Pipe Systems</td>
<td>Limited to non fire-propagating cables</td>
<td>HC-1</td>
<td>140 m² (minimum 9 nozzles)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Limited to non ventilated</td>
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**FM will no longer allow HC-1 to be used in any Data Processing Equipment Room**
Market Desirable solution

- Avoid the use of Wet Pipe System to reduce the risk of damaging electrical equipment

- **Maintain ventilation during system discharge** to reduce the impact on the operational efficiency on the Data Processing equipment Room

- Flexibility to Use Fire Propagating cables
Fire Test Overview
Test: Above-Floor Protocol
Test Protocol – Below Floor
New FM Approved Low Pressure Water Mist System, designed for modern Data Centres
Main Advantages

Propagating Cables Considered

- A Data Processing Equipment Rooms contains a high density of cables in trays located above servers and below the raised floors.
- New AquaMist® solution for Data Processing Equipment Rooms protect against the increased hazard inherent to fire-propagating cables. Above Floor and Below Floor.

- This allows greater flexibility in cable selection
Main Advantages

Ventilation is no longer a problem

- Ventilation is one of greatest challenges for a fire system

- The new AquaMist for Data Processing Equipment Rooms has been tested and approved to operate in a range of ventilated conditions.

- It guarantees rapid detection and discharge in a range of ventilated conditions

- Tyco offers two temperature rated solutions fully approved (57°C/135°F and 68°C/155°F).
Main Advantages

Suitable for Below-Floor installations

- AquaMist provides design flexibility for different layouts including local applications.

**AM-30**
- Full protection and local application of Below-Floor installation with upright nozzle AM-30

**AM29**
- Pendant nozzle AM-29 for Below-Floor local application
Main Advantages

Pre-action System

• To reduce the risk of damaging electrical equipment as compared with traditional Wet Pipe Nozzle system.

• Water doesn’t enter the piping network until a fire has been detected by the associated fire alarm and detection system.

• The new for Data Processing Equipment Room has been tested with discharge delay permitting a pre-action configuration.
Additional Advantages

**Save space and up to 80% of Water**

- Water Mist system alternative to equivalent designed pre-action systems can reduce the demand by up to 80% making it possible to reduce piping and water storage tank size.

![Comparison of Water Levels](image)

- Design area is based on quantity of nozzles therefore the amount of water doesn’t change if nozzle spacing is reduced.
Main Advantages

- Pre-action system
- Continuous protection
- Suitable for below-floor installations including local application
- Save space and up to 80% of water
- Ventilation is no longer a problem
- Propagating cables considered

Safer. Smarter. Tyco.™
## Today’s Design for Water Mist

<table>
<thead>
<tr>
<th>Water Mist System</th>
<th>Configuration</th>
<th>Risk Coverage</th>
<th>Classification</th>
<th>Design Area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-action</td>
<td>Fire-propagating cables</td>
<td>HC-2</td>
<td>Based on fire test results</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ventilated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-storage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FM now class Data Processing Equipment Rooms as HC-2**
# FM Approved Solution

- **FM Approved Solution**

## Certificate of Compliance

This certificate is issued for the following:

<table>
<thead>
<tr>
<th>System Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AQUAMIST Water Mist Systems for the Protection of Data Processing Equipment Rooms/Halls</td>
<td></td>
</tr>
</tbody>
</table>

**Prepared for:**
TYCO FIRE PRODUCTS, LP  
1467 ELMWOOD AVENUE  
CRANSTON, RI 02910  
UNITED STATES

**Manufactured at:**
TYCO FIRE PRODUCTS, LP  
1467 ELMWOOD AVENUE  
CRANSTON, RI 02910  
UNITED STATES

FM Approvals Class: 3560  
Approval Identification: 3053169  
Approval Granted: May 29, 2015

To verify the availability of the Approved product, please refer to [www.approvalguide.com](http://www.approvalguide.com) or [www.rothco.com](http://www.rothco.com).

Said Approval is subject to satisfactory field performance, continuing Surveillance Audits, and strict conformity to the constructions as shown in the Approval Guide, an online resource of FM Approvals.

Richard B. Dance  
Manager – Fire Protection Group  
FM Approvals  
1151 Boston-Providence Turnpike  
Norwood, MA 02062
AquaMist ULF for Other Areas within Data Centre
Hazard Category 1 – HC-1 “Lightly loaded non-storage and non-manufacturing areas with ordinary combustibles. Expect fires with relatively low rates of heat release in these occupancies”

*FM3-26 Fire protection water demand for non storage sprinklered properties*

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Description of Occupancy</th>
<th>Exceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartments</td>
<td>Lightly loaded nonstorage and nonmanufacturing areas with ordinary combustibles.</td>
<td>Libraries with stack rooms larger in size than defined in Appendix A; Facilities with storage of electronic and plastic media (see DS 8-9 ).</td>
</tr>
<tr>
<td>Atriums</td>
<td></td>
<td>Hospital laboratories where exposed storage and processing of flammable liquids is considered excessive (see the applicable flammable liquids data sheet).</td>
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<tr>
<td>Churches</td>
<td></td>
<td>Facilities with operations involving hydraulic fluid or flammable liquid, see DS7-32, DS 7-29, and DS 7-98; and for storage, see DS 7-32, DS 7-29, and DS 7-96.</td>
</tr>
<tr>
<td>Concealed spaces</td>
<td></td>
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<tr>
<td>Gymsalas</td>
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<td></td>
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<tr>
<td>Hospitals and hospital laboratories</td>
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<td>Hotel rooms</td>
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<td></td>
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<tr>
<td>Institutions</td>
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<tr>
<td>Kitchens</td>
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<td></td>
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<tr>
<td>Libraries</td>
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<tr>
<td>Meeting rooms in convention centers and hotels</td>
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<td></td>
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<tr>
<td>Metalworking shops with non- hydraulic cutting operations</td>
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<td></td>
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<tr>
<td>Mineral processing such as: glass, cement, ore treating, gypsum processing, etc.</td>
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<tr>
<td>Museums</td>
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<tr>
<td>Nursing or convalescent homes</td>
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<tr>
<td>Offices</td>
<td></td>
<td></td>
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<tr>
<td>Restaurant seating areas</td>
<td></td>
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<tr>
<td>Schools and universities classrooms</td>
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<td></td>
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<tr>
<td>Unused attics</td>
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</tbody>
</table>

**Hazard Category**

- HC-1
Generators (DRUPS), Transformers…..

Machinery Spaces:

- Enclosures with machinery such as internal combustion engines (excluding engine test cells), oil pumps, oil tanks, fuel filters, generators, transformer vaults, gear boxes, drive shafts, lubrication skids, diesel engine driven generators, and other similar equipment using liquid hydrocarbon fuel and/or hydraulic, heat transfer, and lubrication fluids with volatilities less than or equal to heptane;
- Enclosures with incidental use or storage of hydrocarbon ignitable liquids (also known as flammable liquids) of not more than two 55 gal (208 L) drums.

FM 5560 Approval Standard for water mist Systems
Main Advantage for

Light Hazard
- Offices
- Corridors

FM Approval HC-1

Machinery Spaces
- Generator rooms (DRUPS)
- Transformer Rooms

FM Approval Machinery Spaces

Certificate of Compliance

FIXED EXTINGUISHING SYSTEMS, WATER MIST SYSTEMS
This certificate is issued for the following product:

System Designation: Tyco Fire Suppression & Building Products Model AM27 Aquamaist®
Water Mist Nozzle for Use with Aquamaist® System

System Type: Water Mist System for Protection of Light Hazard Occupancies

Provisions: Use of FM Approved fire detection equipment is required. Use of FM Approved water delivery hardware (pump package, valves, etc.) is required.


Approved for: TYCO FIRE SUPPRESSION AND BUILDING PRODUCTS
451 NORTH CANNON AVENUE
LANSDALE, PA 19446
UNITED STATES

FM Approvals confirms that the products above have been found to comply with the following standards:
FM 5560 - Approved Standard for Water Mist Systems

Project Identifier: 3028412
Date of Approval: June 26, 2009

Richard B. DeToma
Manager, Hydraulics Group, FM Approvals

Date
How to solve limitations of Water Mist

• FM do not approve water mist for
  – Electrical Risks (HV/LV Switch, Battery Rooms)
  – Storage areas
• Approvals have limitations (e.g. height)

HOWEVER
• Can be combined with an FM designed sprinkler system
  – Saving costs (against separate system required for high pressure water mist)
  – Design hydraulics consistent
• Therefore all areas can be protected and follow FM requirement
Components
Components

- Discharge Nozzles AM-29
- DV-5 Deluge Valve Pre-action system
- Detection equipment, FM Approved
- Tyco Flexible Hose Connection and G-Press Piping
- Discharge Nozzles AM-30
- Pump Skid Unit
Discharge Nozzle: AM-29

- Low Pressure Nozzle
- Pendent Nozzle
- 2 activation temperatures
  - 135°F (57°C)
  - 155°F (68°C)
Deluge Valve: DV-5

- Pre-action system
- Single & double Interlock versions
- Suitable system to protect areas where there is a risk from water damage
- One-piece, diaphragm-style design
Pump Skid Unit

- Pre-assembled, self-contained control centre for the AquaMist ULF system
- Pre-wired and pre-piped
- Variety of configurations, water flow rates from 50 gpm (189 lpm) to 150 gpm (568 lpm)

* MMC FM Approved
Discharge Nozzle: AM-30

- Concealed Space Protection
- Low Pressure Nozzle
- Upright Nozzle
- 2 activation temperatures
  - 135°F (57°C)
  - 155°F (68°C)
G-Press Pipe Work

- Light Weight
- Installed quickly with single tool
- 10 Year Warranty
Flexible Hose connection

- Complete flexibility
- Installed quickly without large and expensive tools

(*) Image is referred at Tyco Flexible hose designed agree with FM Design Criteria
Summary
New AquaMist ULF for Data Centre

- FM Approved
- Continuous protection
- Protection against Propagating Cable fires
- Suitable for Below-Floor installations
- Pre-action System
- Can be combined with other solutions to protect beyond the area of installation: generator room, offices, circulation spaces, etc.
Thank You