High Pressure Water Mist Systems

State of the Art Fire Fighting Technology with Benefits for the User
Presentation Content

- Motivation for Water Mist System Development
- Water Mist Principles
- Technology Benefits
- Standard and Approval Process
- High Pressure Water Mist Components
- High Pressure Water Mist Applications
- Hospital Case Study
- Conclusion
Drawbacks of Conventional Technologies

Sprinkler Systems

- Large water discharge, thus potential water damages
- Two dimensional fire fighting effect
- Large pump, piping and storage requirements

Gas Extinguishing Systems

- Enclosure essential for efficiency
- Pre-warning times required
- Large cylinder storage requirements
- Minimal cooling effect / difficulties with smouldering fires
Water Mist Technology Principles

- Cooling by heat absorption via large surface
- Inerting by local oxygen displacement

<table>
<thead>
<tr>
<th>Droplet diameter</th>
<th>Reaction surface per litre of water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1mm</td>
<td>2 m² (Convent. Technologies)</td>
</tr>
<tr>
<td>0.1mm</td>
<td>20 m²</td>
</tr>
<tr>
<td>0.01 mm</td>
<td>200 m² (High Pressure Water Mist)</td>
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</tbody>
</table>
Cooling / Heat Attenuation Effect

- Safe environment for people
- Protection of nearby objects from radiant heat
- Prevention from flash over

Energy binding potential of 1 l of water:
- 335 kJ heating from 20°C to 100°C
- 2257 kJ by transition from liquid to gas
Local Inerting Effect

Local inerting by displacement of oxygen at the fire source

Volume enlargement of 1 litre of water by evaporation:
1 l, liquid ➞ 1650 l, gaseous

Oxygen reduction only at the source of the fire

High Pressure Water Mist Systems
Benefits of Water Mist Technology

High Pressure Water Mist

- Safe for people / No pre-warning time required
- High cooling effect / Reach of hidden fires
- Negligible effect on electric components
- Minimal water consumption, thus consequential water damages
- Minimal operation interruptions / Minimal down-times
- Space saving installation and retrofit with small bore pipes
- Small pump rooms and water storage tanks
System Design and Approval Process

- Water mist systems are designed and installed based on NFPA 750, CEN TS 14972, FM 5560, VdS 3188 and IMO standards
- Full scale fire tests are essential to verify system performance and generate system layout parameters
- Standards define fire test scenarios for each individual applications concerning
  - Fire load
  - Arrangement of fire load
  - Ventilation conditions
  - System pass / fail criteria
Test Scenarios Based On

- CEN TS 14972
- VdS 3188
- FM 5560
- IMO MSC 1168
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System Certification for Industrial Risks

- Cable tunnels
- Generators
- Turbines
- Transformers
- Flammable liquid storage areas
- Paint booths
- Machinery spaces
- Deep fat fryers
- Machinery local protection

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Fire Tests for Ordinary Hazard Risks

Test Scenarios Based On

- CEN TS 14972
- VdS 3188
- IMO A 800
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System Certification for Ordinary Hazard Risks

- Offices
- High rise buildings
- Hospitals / Care homes
- Laboratories
- Hotels
- Libraries / Archives
- Heritage buildings
- Museums
- Data centres
- Car parks

High Pressure Water Mist Systems
Nozzles

• Nozzle spray pattern must be adapted to the risk
• Open nozzles in deluge systems
• Glass bulb operated nozzles in wet, dry pipe or pre-action systems
• Filtration is of great importance

Wall Hydrants

• Manual water mist fire fighting gun
• Effective fire fighting at strategic places
High Pressure Water Mist System Components

Pipework
- Small pipe diameters (12 to 50 mm)
- High durability due to stainless steel pipes and fittings (AISI 316)

Section Valves
- Section valves for deluge, wet, dry pipe or pre-action systems
Pump Systems
- Modular and compact design
- Pressure ranges from 100 to 140 bar
- Low water flow rates
- Small break tank sizes
- Electrically and diesel driven units

Cylinder Systems
- Stand alone systems
- Low refilling cost
- Nitrogen as propellant
High Pressure Water Mist Applications

- Flammable Liquid Storage
- Paint Booths
- Hydraulic Areas
- Machinery Spaces
- Turbines
- Generators
- Deep Fat Fryers
High Pressure Water Mist Applications

- IT Rooms
- Data Centres
- Telecommunication Areas
- Cable Tunnels
- Underground Stations
High Pressure Water Mist Applications

- Heritage Buildings
- Museums
- Theatres
- Hospitals
- Laboratories
- Care Homes
- Libraries
- Archives
Modern buildings are often designed openly and transparent with preference of exposed glass and steel structures.

Fire protection becomes a challenge due to wide spread open connections between parts of the building.

Though conventional sprinkler systems are used to compensate missing fire partitions, water mist technology is valued to offer extended cooling, thus preventing fire propagation and securing escape conditions.
Protection of the Hospital LKT Baden near Vienna (Austria)

- One of the most modern and advanced hospitals in Europe located next to Vienna
- 6 operation rooms, 450 beds
- Overall hospital floor area is 60,000 m²
- 3 connected buildings (pavilions) each having 3 levels
- 6 years construction time with completion in 2016
- 190 Mio. Euro investment
Hospital Case Study

Fire Protection Requirements

• Missing compartmentation between entrance hall and pavilions to be compensated by an automatic fire fighting system to prevent fire propagation

• Control and suppression of fires in the entrance hall (e.g. cafeteria, meeting areas)

• Protection of exposed glass facades and steel structures to avoid structural fire protection measures
Protection Concept

- Protection concept based on a wet high pressure water mist system for all areas adjacent to the entrance hall
- System design based on OH1 risk classification with 72 m² operational area (room + ceiling void) for 60 minutes operation time
- Challenge due to ceiling height up to 12 m in the entrance hall
Protection Concept

- Nozzle layout based on sprinkler alternative fire test results up to 5 m ceiling height
- For ceiling heights up to 12 m, specific fire tests have determined the nozzle layout
- Wet system in the entrance hall ceiling with reduced nozzle spacing along all glass facades
- Wet system in all rooms and false ceilings (3 levels) adjacent to the entrance hall in the 3 pavilion buildings
Protection Concept

• System design to operate up to 14 nozzles along glass facades (26 m) in the entrance hall respectively 72 m² operational areas in the adjacent buildings (820 nozzles)

• High pressure pump with 4+1 x 120 l/min at 120 bar (one redundant pump unit)

• 2 x 2000 l break tank with infill from town‘s main water supply for 60 minutes system operation

• 1 alarm valve and 10 zone valves
Conclusion

• High pressure water mist allows for architecturally pleasant solutions for buildings with extended cooling potential to prevent fire propagation and additional protection of exposed glass and steel structures to secure safe escape routes for people

• System design must be part of the overall fire safety concept of the building and be evaluated by fire experts and authorities having jurisdiction based on full scale fire test results
Thank You for Your Attention!

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