Danfoss Fire Fighting

High-Pressure Water Mist systems for the protection of shopping centres in historical city centres

Presenter: Antonio Terio
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AGENDA

✓ Introduction & Background for the Project
✓ Objectives
✓ Method - HPWM Traditional Advantages
✓ Results
✓ Components & Installation
✓ Main Conclusions & Recommendations
Introduction & Background for the Project

- La **RINASCENTE**, a retail corporation, has always lived in the city’s heart, to give a surprising shopping experience every time.

- Only something truly special can be born in what is called “the heart of the city”.

- A palace was bought in the center of Rome to host the new flagship store of the brand:
  - Spaces designed by the talents of architecture & design
  - Ancient ruins brought to light & visible to all
  - The unique panorama of Rome from the top, taking the breath away
Introduction & Background for the Project

• Sprinkler systems are usually used for the protection of OH3 occupancies according to EN12845, e.g. selling rooms, shopping centres, consumer markets & shops.

• When new shopping centres are created within a palace that is restored in the historical centre of an art city, there are many installation issues to be considered.

A demand for water mist fire protection systems has arisen when it was very challenging to find a place for the water reservoir.
Introduction & Background for the Project

Traditional sprinkler design

Successfully converted to

High-pressure water mist design

- 14000 m²
- 7 floors of building
Introduction & Background for the Project

RINASCENTE

14,000
TOTAL SQUARE METERS

800
BRANDS FEATURED

1,852
DAYS OF RENOVATION

4,720
TONS OF STEEL USED

96
WINDOWS ON THE FAÇADE
Objectives: Building Owner Requirements

To create an environment mixing:

- The charm of 2000 years of history & Modern Design
- Innate elegance & informal soul
- Professional & User Friendly

& a maximum Fire Safety Level
Objectives: Aqueduct

- Rome's timeless beauty is everywhere.
- Past and present unexpectedly together.
- For the first time, the **Aqua Virgo Aqueduct** inaugurated by August in 19 B.C. is visible in the Design Supermarket.
Objectives: Cavaedium

• A defining architectural element:

The cavaedium = a central court that brings light and splendour to every floor.
Objectives: **Fire Safety Strategy**

- Starting point: **reduce the total cost** for building & the running costs of ineffective working processes.
- Fire safety initiatives should **support** instead of restrict the flagship store processes & flows.
- Due to the **characteristic of water mist**, it was natural to base the fire safety strategy on water mist applications.
- It was easy to convince both the builders & the architects, that the **water mist applications were the right way to reach the overall environment requirements** for the Project.
Objectives: Performance Based Approach

Water Mist is not a new Technology and it is in common use:

- to protect buildings and other objects from heat exposure from fires.
- for fire extinguishing in enclosures.
- as self-protection by firefighters (practical experiences from fire department).

In addition:

- According to the Italian building regulation’s requirements to fire safety, ordinary noncomplex building can be built after a pre-accepted collection of codes for fire safety initiatives.
- Another story was to convince the local authorities about all possible less known non-traditional advantages of HPWM solution......!
Method - HPWM Traditional Advantages

Key Benefits of effective fire protection with HPWM were appreciated by the end user as well as the idea to change the firefighting technology in the way to solve the problem of the water reservoir.

A comparative analysis between the conventional sprinkler system and the high-pressure water mist system was carried out in close cooperation with the fire consultant responsible for the fire strategy and the architect.

Technical aspects were considered in the comparative analysis (e.g. water consumption, water damage, quantity of nozzles and fittings, sizes of pipes, etc.), as well as availability and reliability for a proper high-pressure water mist nozzle designed in accordance with the recommendations given in the CEN TS 14972 and with the aesthetic options requested by the architect (e.g. painted nozzles).
**Method - HPWM Traditional Advantages**

Higher cooling capability (up to 7 times better than traditional sprinkler) results in:

<table>
<thead>
<tr>
<th>Description</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher spacing between nozzles</td>
<td>More than 30% reduction in the number of nozzles, pipes and fittings that need to be installed and reduction for storage space during installation</td>
</tr>
<tr>
<td>The temperature is quickly cooled to normal, resulting in quicker fire-fighting</td>
<td>No need to install fire doors and ventilation equipment</td>
</tr>
<tr>
<td>Preventing the risk of thermal stress that can cause cracks in glass</td>
<td>Major cost-saving through the possibility to specify thinner glass</td>
</tr>
</tbody>
</table>
Method - HPWM Traditional Advantages

Minor droplets size and fast evaporation of water, while sufficient speed to penetrate the fire means less water:

- Reduced water consumption, no need for large water supply reservoir
- Minimal damages to building, furniture, electrical installations, etc. and short down-time period
- Due to the compact dimensions and the high-quality material the pipes are made of, a water mist system will not compromise the architectural design, increasing architectural freedom

Size for water supply reservoir is 66% less plus space saved for other money-generating activities (rooftop bar)

- Minor risk of losing market shares, minor insurance costs
- System flexibility, modular design, easy to extend to cover more sections
Method - HPWM Traditional Advantages

HPWM is a minimal invasive technology, piping network is easier to integrate into both retrofit installations and new buildings and easier to handle due to the low weight of the pipes:

- Small stainless-steel pipes AISI 316
- Piping network is maintenance free (no corrosion)
- Most of bends can be made by hand, while press fittings are used on the larger pipes.
- The weight of the installed water mist pipes, including water, is typically 85% less than a traditional sprinkler system. Installation is easier and up to 70% faster.
- No pressure drop’s issues allow to minimize the number of different pipe sizes (e.g. max. one size of pipes for the nozzles, max. of two sizes ring pipe on each floor, max. one size main pipe from pump unit to the floors).
- Few pipe sizes lead to better prices, less waste, fewer types of fittings, faster installation.
Results

<table>
<thead>
<tr>
<th>HPWM cost</th>
<th>Sprinkler cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>15</td>
</tr>
<tr>
<td>Installation</td>
<td>5</td>
</tr>
<tr>
<td>Construction extra-works</td>
<td>0,5</td>
</tr>
<tr>
<td>Water supply</td>
<td>0,5</td>
</tr>
<tr>
<td>Storage tank space</td>
<td>0,5</td>
</tr>
<tr>
<td>Pump room space</td>
<td>0,5</td>
</tr>
<tr>
<td>2,5</td>
<td>1</td>
</tr>
<tr>
<td>1,5</td>
<td>1</td>
</tr>
<tr>
<td>1,5</td>
<td>0,5</td>
</tr>
<tr>
<td>1,5</td>
<td>0,5</td>
</tr>
<tr>
<td>10</td>
<td>7,5</td>
</tr>
</tbody>
</table>
SEM-SAFE® High-Pressure Water Mist Wet Pipe System was installed, consisting of nozzles, pipe work, section valves and pump unit.

All key components are manufactured in-house.
Components & Installation

SEM-SAFE® Nozzles

- 100% tested
- Less water consumption
- Fully optimized nozzle program for different applications
- High spacing
Components & Installation

**SEM-SAFE® valves**

- Stainless steel valves
- Compact and modular
Components & Installation

**SEM-SAFE® HP Water Mist Pump Unit**

- Pressure Relief Valve
- Pressure Switch
- System Pressure Transmitter
- High Pressure Manifold
- Pilot Pump
- Tank on unit
- Unit Control Panel UCP
- High Pressure Pump & Electrical motor
- Unit Tank Level Transmitter
- High Pressure Pump
Components & Installation

**SEM-SAFE® HP Pumps & Electrical Motors**

The high-pressure pumps are stainless steel, water-lubricated positive displacement pumps with multiple pistons mounted in a rotating cylinder, which reduce ripple and pulsation in the discharge water stream.

A typical **SEM-SAFE®** High-Pressure Water Mist Pump Unit consists of 1 to 8 electrically driven, stainless-steel high-pressure pumps.

During **SEM-SAFE®** High-Pressure Water Mist Pump Unit activation, high-pressure pumps are pumping water from the water supply to the manifold, discharging it to sections of the protected area.

- Light & compact high-pressure pump design
- Danfoss pumps are multi-axial piston pumps made in corrosion resistant stainless steel
- Water is used as a lubricant, making the pumps virtually maintenance free
Components & Installation

Press Fittings & Tools
**Main Conclusions and Recommendations**

High Pressure Water Mist fire protection systems should be considered for the protection of shopping centres in historical city centers as a suitable & competitive option.

In this case study the HPWM “solution” shows to be a cost-effective solution, leaving more space for other money generating activities and providing a lower total cost of ownership.

However, a comparative analysis with a conventional sprinkler system must be conducted on the specific project to identify and quantify the savings and benefits.

If only traditional advantages are considered, the only differences from the traditional sprinkler system could be just limited to a lower demand of water, smaller droplets, smaller pipes, easier installation, etc. and increased costs.
Main Conclusions and Recommendations

Working with performance-based fire safety and water mist is quite challenging:

• It requires precise, analytical and specific documentation in all aspects.

• The theoretical part isn’t common knowledge, and often very complicated to explain for the local authorities.

The water mist standards are focused on controlling or suppressing a fire, like traditional sprinkler systems.

Very often only the equivalency with sprinkler systems are documented.

The important cooling effect and absorption of radiation are only indirectly included in the fire test protocols. The capability to control smoke & gasses from the fire is not included at all.
Main Conclusions and Recommendations

The base function of the water mist system can be documented through the fire test report issued by an international recognized third-party laboratory and/or through the approval certificate issued by an international notified body.

If we just use the standard documents for a water mist system as documentation, we just get a modern fire suppression system.

*It's like buying a new Mercedes Benz without the engine!*
Main Conclusions and Recommendations

Cooling Effect

- **HPWM** has superior capabilities to absorb heat from the fire and is characterized by effective cooling of combustion gases in enclosure and steel structures.

Absorption of Radiation

- **HPWM** is characterized by effective absorption of heat radiation (the transfer of heat from a fire caused by electromagnetic waves).

Smoke & Gasses Control:

- **HPWM** helps controlling smoke and reduction of soot & particles from a fire.

These effects can be calculated and verified by CFD-calculations.
Main Conclusions & Recommendations

- Evacuation & rescue measures
- Fire brigade's intervening
- Fire safety installations
- Fire & smoke spread
- Constructions

- If we are able to conduct a fire performance safety analysis based on:
  - Typical fire safety focus areas
  - Acceptance criteria for human safety
  - Acceptance criteria for fire safety in relation to fire & smoke spread

- Then we can take additional advantages of HPWM superior characteristics for “indirect savings”.
Savings & Add Values - Additional Advantages

Savings for glass facades & glass in galleries.

Savings for isolation & insulation of ventilation system, numbers of fire & smoke dampers in ventilation system plus added value by keeping the ventilation system for smoke extraction running, during a fire.

Savings for structural design, insulation of steel, insulation of breach through fire sections, piping etc. plus added value as lower temperature secure options for reduced dimension of the steel structure.

Savings for vertical fire spread plus added value as smoke in general is reduced.

Savings for water curtains instead of automatic fire doors plus reduced service cost at water curtain compared to higher service cost of alternative solution with automatic fire doors.
“Rome is an attitude”

• The charm of Rome is timeless.
• Rome wasn't built in a day.
• Neither was la Rinascente.
• After 11 years of work, at the 7th floor you'll be in love with the unique view of 2000 years of history on the rooftop of the Eternal City from la Rinascente Via del Tritone's Terraces, sipping a drink....

High Pressure Water Mist Technology has given its own contribute!
THANK YOU