

ENGINEERING
TOMORROW

Danfoss

Danfoss Fire Fighting

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

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AGENDA



- ✓ **I**ntroduction & Background for the Project
- ✓ **O**bjectives
- ✓ **M**ethod - **HPWM** Traditional Advantages
- ✓ **R**esults
- ✓ **C**omponents & Installation
- ✓ **M**ain 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.



DELAYED

Long Project delay.....

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

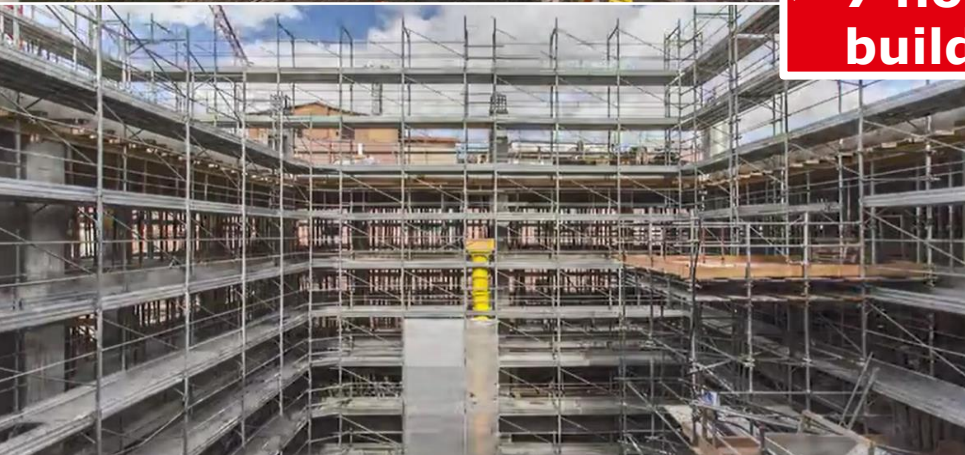
Traditional
sprinkler design

Successfully converted to

High-pressure
water mist design



✓ 14000 m²
✓ 7 floors of
building



Introduction & Background for the Project

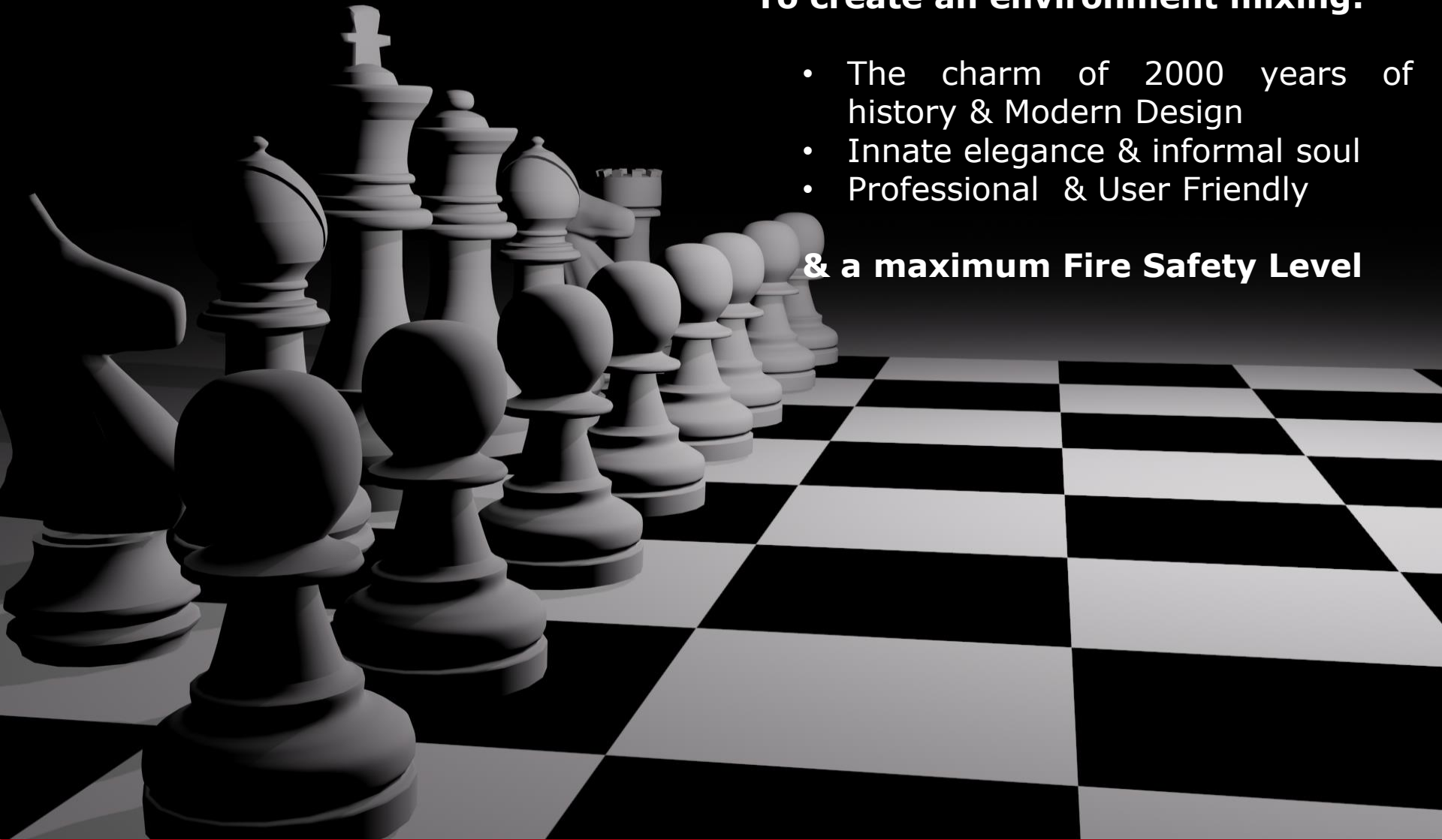


Objectives: Building Owner Requirements

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

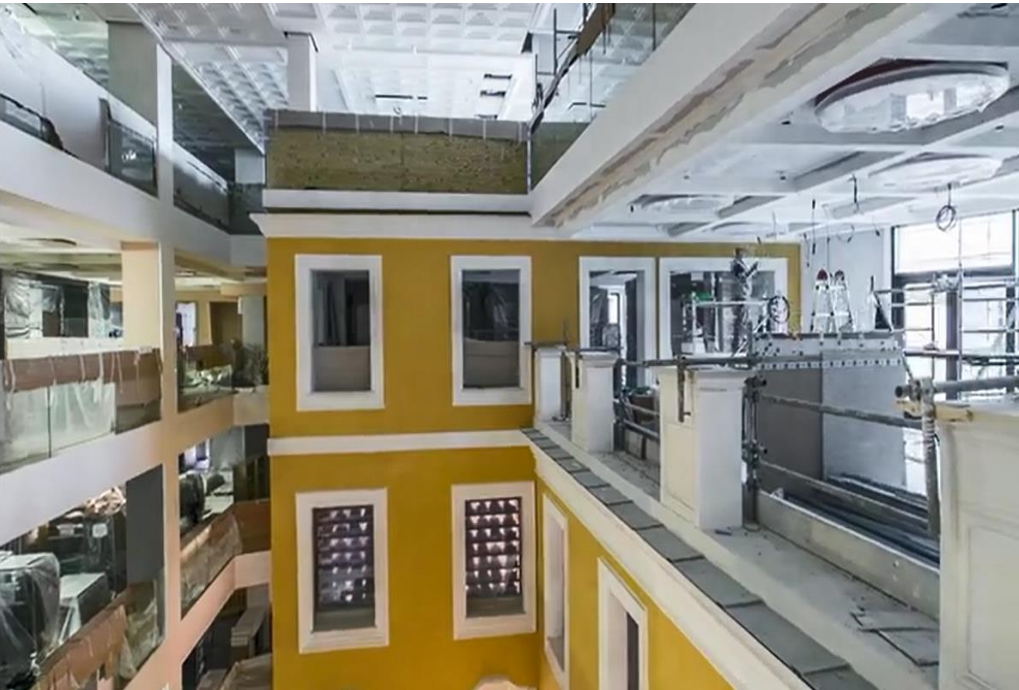
- Rome's timeless beauty is everywhere.
- Past and present unexpectedly together.
- For the first time, the **Aqua Virgo Aqueduct** inaugurated by August in 19 b.C. is visible in the Design Supermarket.



Objectives: Cavaedium

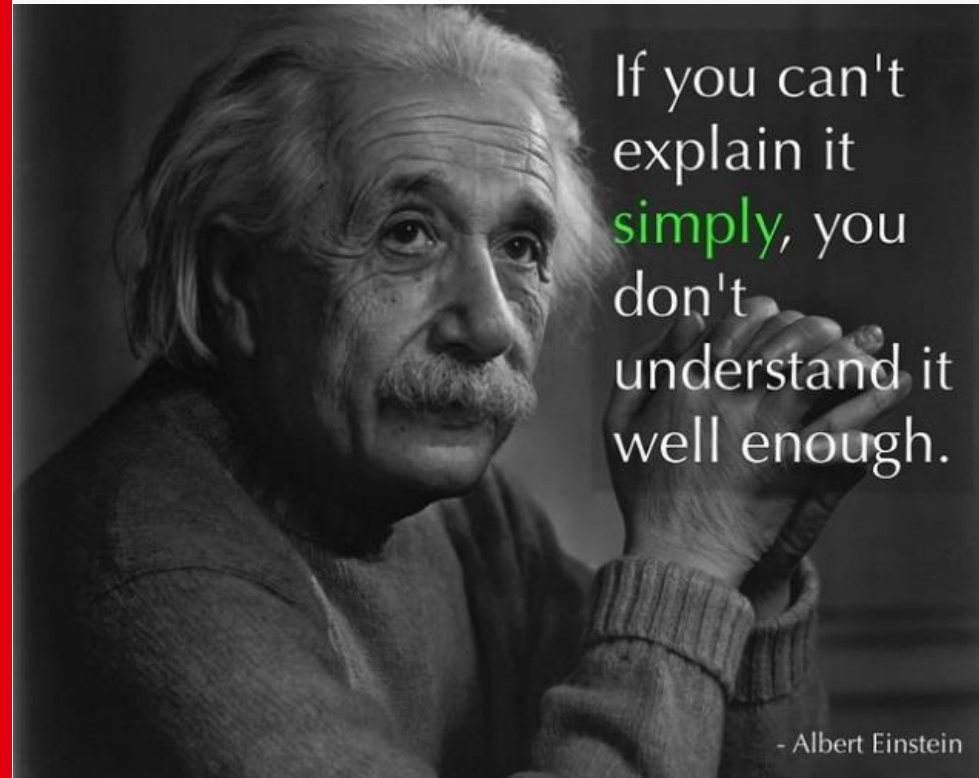
- A defining architectural element:

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.



If you can't explain it **simply**, you don't understand it well enough.

- Albert Einstein

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:

Higher spacing between nozzles



More than 30% reduction in the number of nozzles, pipes and fittings that need to be installed and reduction for storage space during installation

The temperature is quickly cooled to normal, resulting in quicker fire-fighting



No need to install fire doors and ventilation equipment

Preventing the risk of thermal stress that can cause cracks in glass



Major cost-saving through the possibility to specify thinner glass

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



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

Minimal damages to building, furniture, electrical installations, etc. and short down-time period



Minor risk of losing market shares, minor insurance costs

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



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.



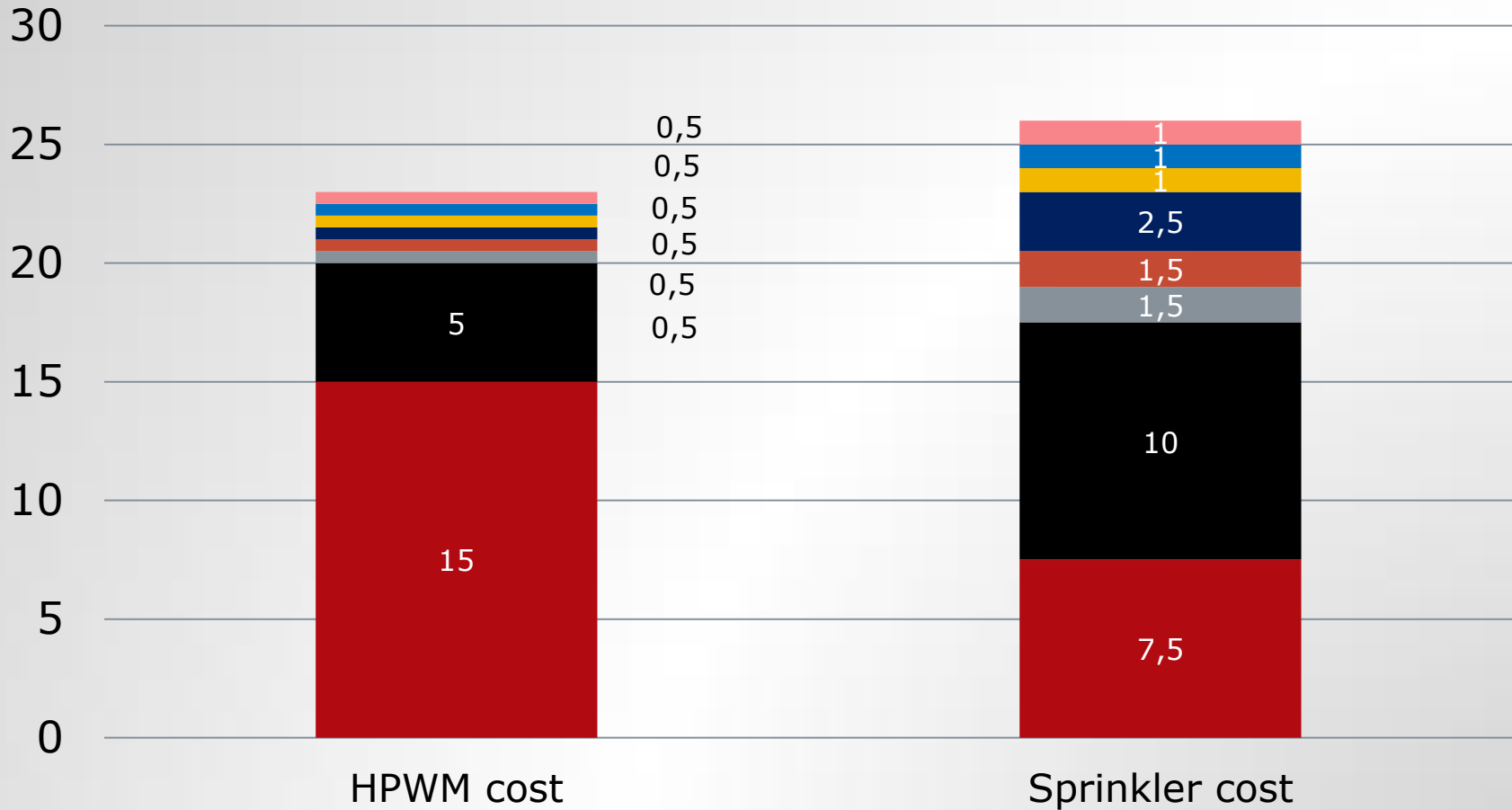
The weight of the installed water mist pipes, including water, is typically 85% less than a traditional sprinkler system. Installation is easier and up to 70% faster.

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



- Hardware
- Installation
- Construction extra-works
- Water supply
- Storage tank space
- Pump room space

Components & Installation

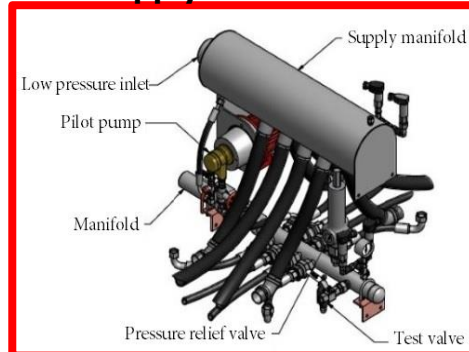
SEM-SAFE® High-Pressure Water Mist Wet Pipe System was installed, consisting of nozzles, pipe work, section valves and pump unit.

All key components are replaceable manufactured in-house.

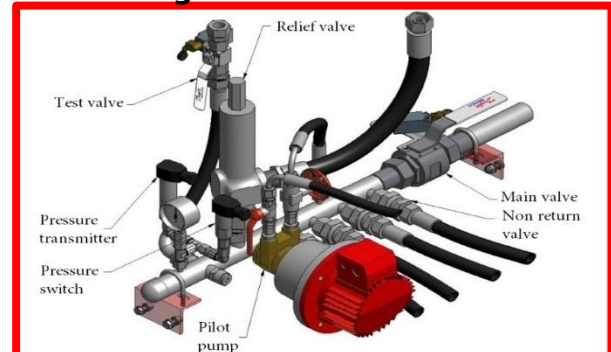
Filter Unit System



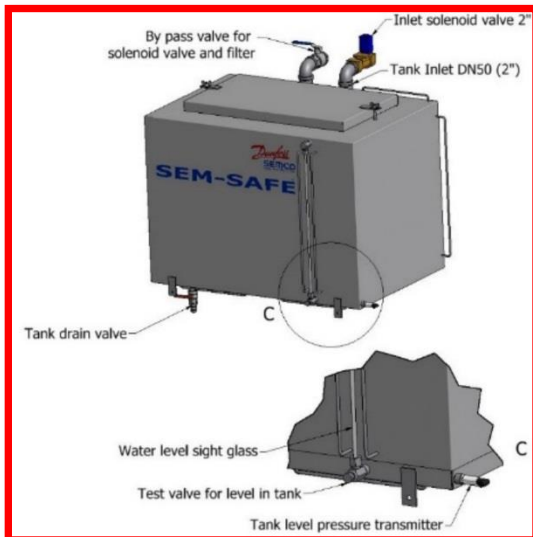
Supply Inlet Manifold



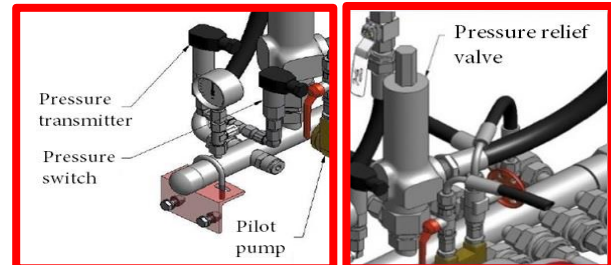
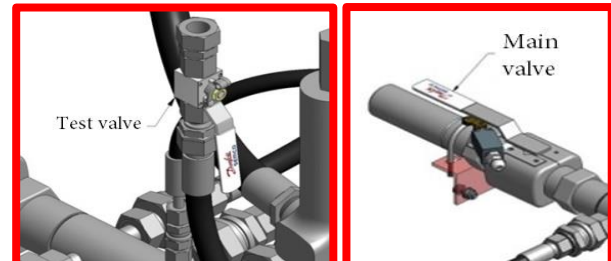
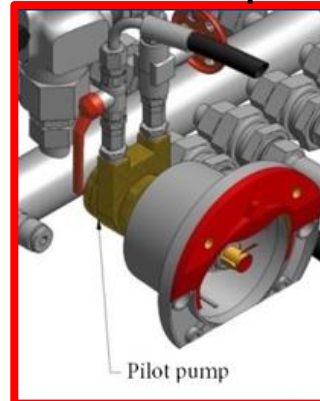
High Pressure Manifold



Tank on Unit



Pilot Pump



Components & Installation

SEM-SAFE® Nozzles



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

RAL 1000	RAL 1001	RAL 1002	RAL 1003	RAL 1004	RAL 1005	RAL 1006	RAL 1007
RAL 1011	RAL 1012	RAL 1013	RAL 1014	RAL 1015	RAL 1016	RAL 1017	RAL 1018
RAL 1019	RAL 1020	RAL 1021	RAL 1022	RAL 1024	RAL 1027	RAL 1028	RAL 1033
RAL 1033	RAL 1034	RAL 2000	RAL 2001	RAL 2002	RAL 2003	RAL 2004	RAL 2008
RAL 2009	RAL 2010	RAL 2011	RAL 2012	RAL 3000	RAL 3001	RAL 3002	RAL 3003
RAL 3004	RAL 3005	RAL 3007	RAL 3008	RAL 3011	RAL 3012	RAL 3013	RAL 3014
RAL 3015	RAL 3016	RAL 3017	RAL 3018	RAL 3020	RAL 3022	RAL 3027	RAL 3031
RAL 4001	RAL 4002	RAL 4003	RAL 4004	RAL 4006	RAL 4008	RAL 4007	RAL 4008
RAL 4008	RAL 5000	RAL 5001	RAL 5002	RAL 5003	RAL 5004	RAL 5005	RAL 5007
RAL 5008	RAL 5009	RAL 5010	RAL 5011	RAL 5012	RAL 5013	RAL 5014	RAL 5015
RAL 5017	RAL 5018	RAL 5019	RAL 5020	RAL 5021	RAL 5022	RAL 5023	RAL 5024
RAL 6000	RAL 6001	RAL 6002	RAL 6003	RAL 6004	RAL 6005	RAL 6006	RAL 6007



Components & Installation

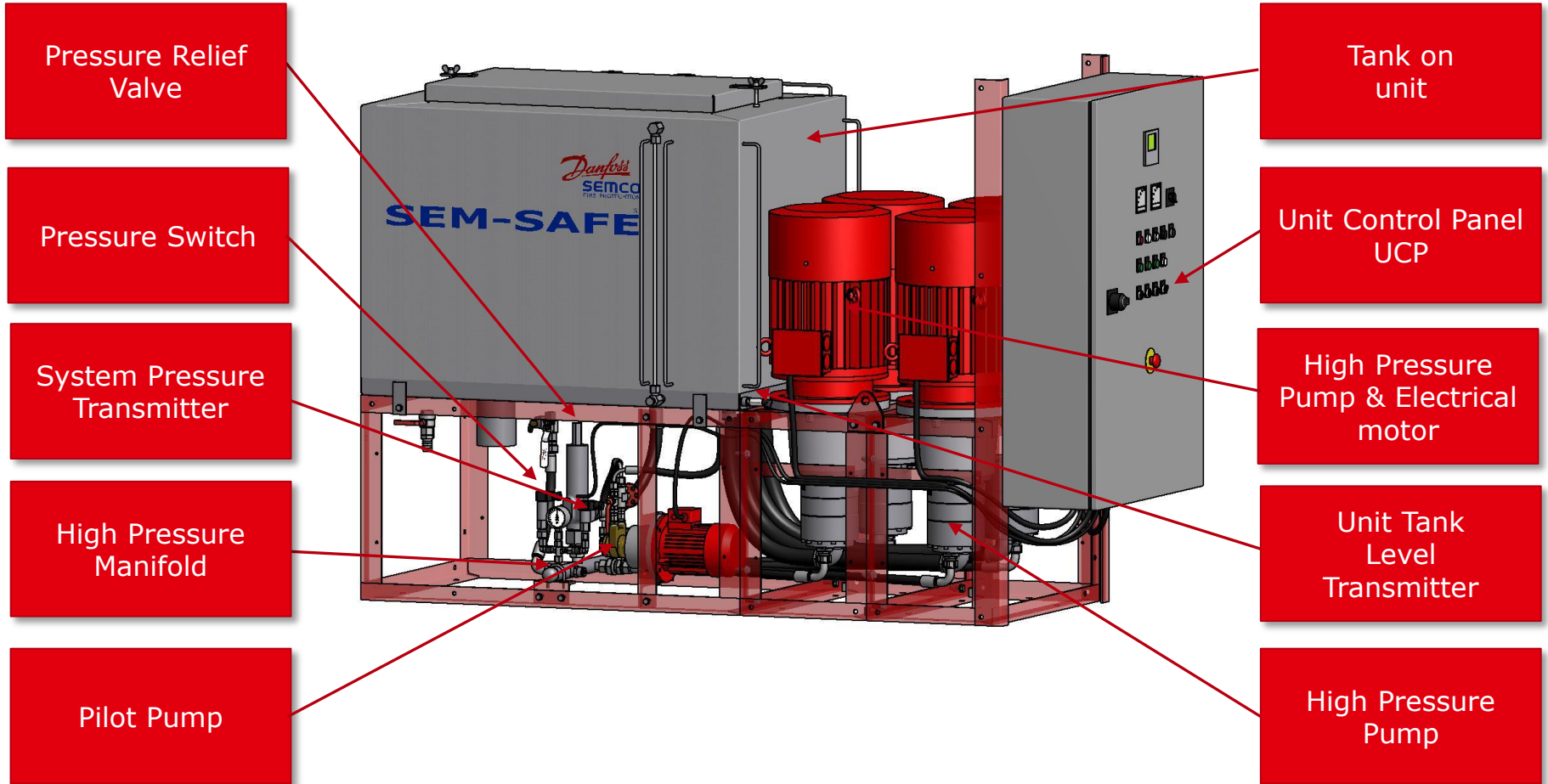
SEM-SAFE® valves



- ✓ Stainless steel valves
- ✓ Compact and modular

Components & Installation

SEM-SAFE® HP Water Mist Pump Unit



Components & Installation

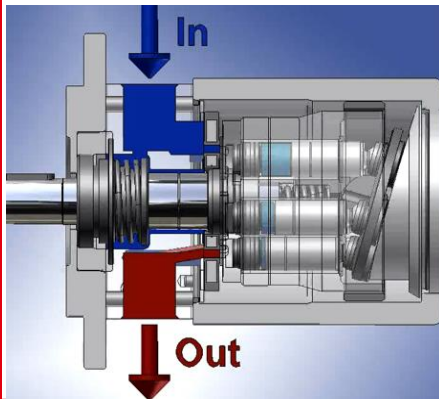
SEM-SAFE® HP Pumps & Electrical Motors

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

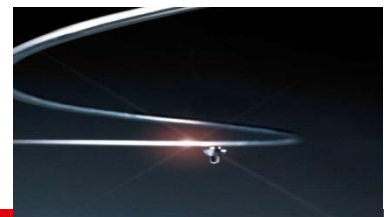


Pumps

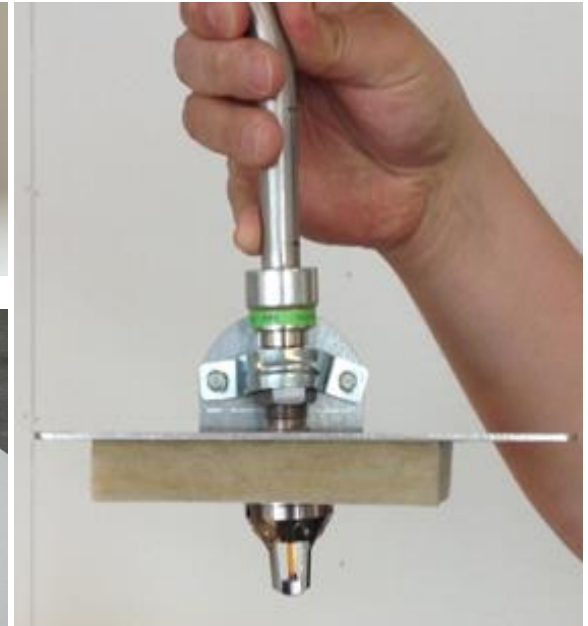


Motor

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.



"This really is an innovative approach, but I'm afraid we can't consider it. It's never been done before."

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

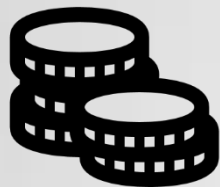
Savings for glass facades & glass in galleries.

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





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Danfoss Fire Fighting

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www.danfoss-semco.com