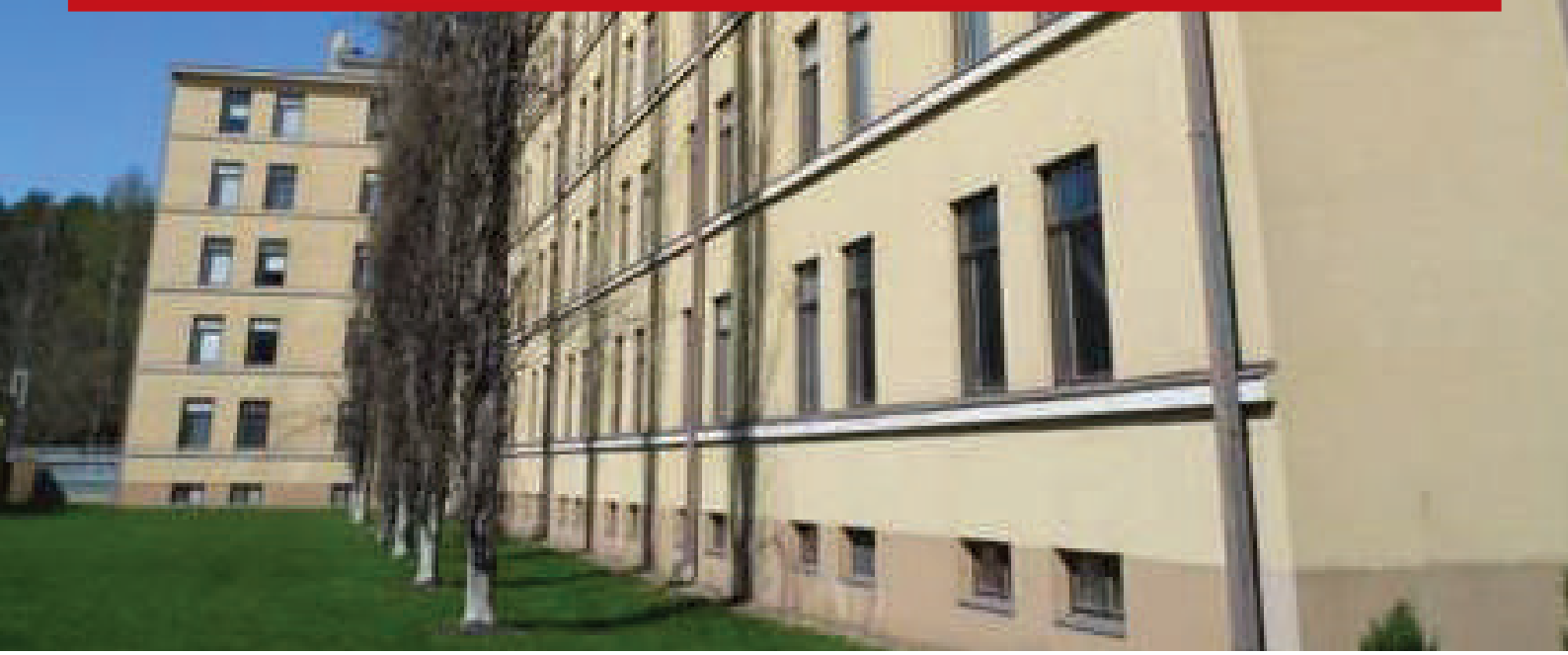
ENGINEERING TOMORROW

Case story | SEM-SAFE® high-pressure water mist system

Pikonlinna Hospital in Finland

Senior care center protected with SEM-SAFE® high-pressure water mist system for fire fighting

Danfoss Fire Safety A/S



Pikonlinna Hospital is a large hospital located in the Municipality of Kangasala, a town of 30,000 inhabitants located 17 km east of the City of Tampere, Finland. This facility consists of four wings, six floors and houses private senior care and nursing homes. The facility is undergoing constant refurbishment as the old hospital wings are being renovated one by one. Once completed, the facility will house, among others, an outpatient clinic, a physical training center, various health services for seniors, a retail shop and a restaurant.

History

The hospital was originally commissioned as a sanatorium for the treatment of tuberculosis in 1931. In 1968 the hospital was officially renamed as Pikonlinna Central Hospital and became a part of the Tampere University Hospital. Since 2008 the facility has been fitted with SEM-SAFE® high-pressure water mist system for fire fighting from Danfoss.

Building description

The hospital consists of two separate buildings connected by a subterranean walkway. The main building has six stories in four wings and a basement, and is constructed of concrete walls and ceilings. The total combined floor area of the hospital is approximately 15,000 m^2.

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SEM-SAFE® high-pressure water mist system
The hospital was fitted with a SEM-SAFE® high-pressure water mist fire fighting system. Installation work commenced in October 2008 and has been ongoing since, one floor and a wing at a time. The areas to be protected were empty of patients/residents at the time of the installation work, as the installation was timed to coincide with the renovation work schedule.

The system consists of the SEM-SAFE® electric pump unit, 4,900 m pipes (Ø12 mm, Ø22 mm, and Ø28 mm) and 1,300 nozzles.

The customer allowed Provacuum, Danfoss business partner in Finland, to install a test nozzle and a display facility in one empty room within the hospital building. This room has a sliding glass door, allowing potential customers, company trainees, authorities, etc. to view the high pressure water mist in action. The room is fitted with one Public Space Nozzle powered by the main pump unit in the building via a separate valve and a feed line.

Approving authority
The system design was approved by Alarm Control Alco Oy Ab, one of the three inspection companies accredited by the Finnish Safety Technology Authority. The design was then inspected by the Pirkanmaa Provincial Fire Department. The final installation was tested and inspected by Alarm Control Alco Oy Ab. Fire test criteria were not needed due to prior acceptance of the system's components.

The benefits of SEM-SAFE®
The benefits of the SEM-SAFE® high-pressure water mist from Danfoss are immense:
- Minimized water damage upon system activation.
- Easier installation.
- Aesthetic appearance compared to a sprinkler.

The owner of the care center explains:
"I prefer high-pressure water mist technology because of all the expensive equipment housed in this specific facility; it was the right choice due to its advantages and suitability for a historically valuable building."

"Provacuum provided me with a consultative role in finalizing the design parameters of the system and has supported us very well in interacting with the different authorities."

Pikonlinna Hospital, protected with SEM-SAFE® high-pressure water mist system from Danfoss.

SEM-SAFE® high-pressure water mist nozzle from Danfoss.

Example of SEM-SAFE® installation at Pikonlinna Hospital.

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Case story | SEM-SAFE® high-pressure water mist system

Katriina Hospital in Finland

Protecting life with SEM-SAFE® high-pressure water mist system for fir fighting

Danfoss Fire Safety A/S

Katriina Hospital is a medium-size hospital owned by and located in the City of Vantaa, the fourth largest city in Finland. This hospital consists of eight patient wards, a daytime operating facility and a geriatric outpatient clinic. The hospital also houses the Katriina Health Center for the area residents.

History

The original wing of the hospital was commissioned in 1959. The municipal nursing home, Katriinakoti, started its operations then, and had its name changed to Katriina Hospital in 1969. The hospital was expanded with a new wing in 1979-1980 and underwent major renovation works in 1991-1994 and in 2005. In 2010-2011, the hospital was fitted with SEM-SAFE® high-pressure water mist system for fire fighting from Danfoss.

Building description

The hospital consists of two separate buildings connected by a multi-level walkway. The old building has three stories and a basement, and is constructed of cast concrete walls and ceilings. The new building, consisting of four stories and a service basement, is made of bricks and mortar. The total combined floor area of the hospital is 12,700 m^2.

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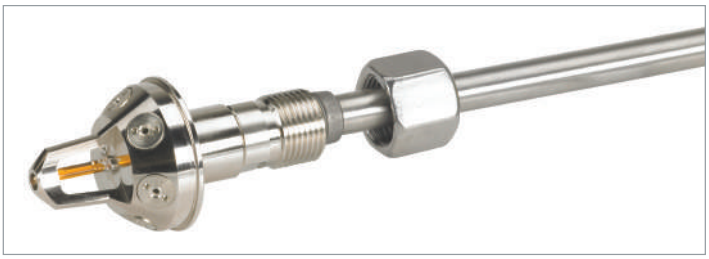
SEM-SAFE® high-pressure water mist system
The hospital was fitted with a SEM-SAFE® high-pressure water mist fire fighting system. The installation work commenced in October 2010 and was completed in March 2011, one month ahead of schedule. The hospital was in full operation 24/7 at the time of the installation work. It was absolutely crucial to cause as little disruption as possible to the patients, the staff and the hospital's operative environment in general.

The system is made up of the SEM-SAFE® electric pump unit, 5,000 m of pipes (Ø12 mm, Ø22 mm and Ø 28 mm) and 1,130 nozzles.

Approving authority
The system design was approved by Alarm Control Alco Oy Ab, one of the three inspection companies accredited by the Finnish Safety Technology Authority. The design was then examined and inspected by the Keski-Uusimaa Provincial Fire Department. The final installation was tested and inspected by Alarm Control Alco Oy Ab. Fire test criteria were not needed at this point, as the Danfoss fire test reports were provided in late 2008 to Inspecta Oy (the largest inspection company in Finland).

The benefits of SEM-SAFE®
Water mist was chosen instead of conventional sprinklers due to minimized water damage upon system activation and less troublesome retrofit installation.

Director of Public Construction and management of the Technical Board of the City Committee were:
- Very impressed by the small piping diameters, the visual appearance of the nozzles and the seemingly strong resistance to accidental discharge or vandalism.
- Extremely impressed with the Danfoss distributor in Finland, Provacuum Oy, with regard to the positive attitude and capability of adapting to the very busy hospital environment and interacting with the patients, staff and administration of the hospital.



SEM-SAFE® high-pressure water mist nozzle with stainless steel Ø12 mm pipe.

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Case story | SEM-SAFE® high-pressure water mist system

Isala Clinics in the Netherlands

Large-scale hospital project protected with high-pressure water mist for fire fighting

Danfoss Fire Safety A/S

In 2008, clearance was given to construct a new, large and innovative 104,000 m^2 hospital at the Sophia location on Dokter van Heesweg in Zwolle, Netherlands: the Isala Clinics. In 2009, the construction of the impressive 210 million Euro building started, the hospital being scheduled for opening in the latter half of 2013 when the employees and first patients will start using it.

Building description

The new Isala Clinics will become one of the largest non-university hospitals in the Netherlands. The complex includes space for offices, research and treatment facilities, nursing wards, laboratories and other functions spread out across four buildings.

The complex is particularly appealing because of the organic style of the architecture and the interior garden and green landscape.

The co-operation between Danfoss and Unica, official Danfoss business partner in the Netherlands, the client and the relevant authorities – the advisor, fire department and the inspection and certification agency R2B – has resulted in firm acknowledgement of the benefits provided by the SEM-SAFE® high-pressure water mist system for fire fighting. With all the tests and approvals in place, the decision was made to install SEM-SAFE®. Isala will become the first large-scale institutional project in the Netherlands to rely on high-pressure water mist protection.

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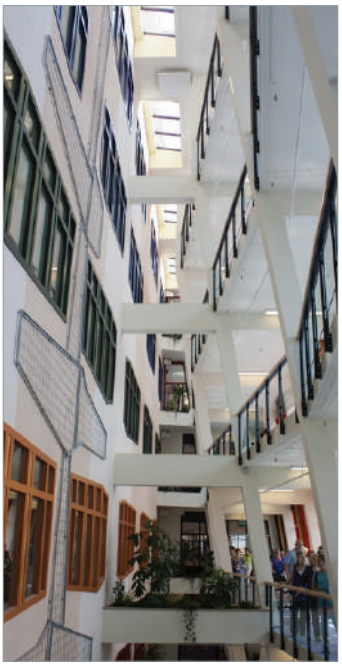
SEM-SAFE® high-pressure water mist system
In contrast to traditional sprinklers, the SEM-SAFE® high-pressure water mist uses less water and produces a high level of atomization. The water damage in case of a fire situation is therefore kept to a minimum.

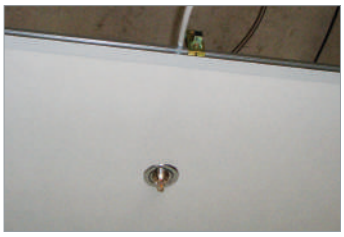
Water mist has excellent fire suppression properties, including capture of soot particles, strong reduction of radiant heat and rapid lowering of the temperature to acceptable levels. Furthermore, it does not require a large water buffertank or complicated water connections, and there are no major requirements for installation space, structural loads and leak tightness in the building. Isala will have two diesel pumps feeding the system and approximately 10,000 nozzles. The pipes run through a tunnel into shafts leading to the various parts of the building.

The new 'better house' consists of four connected units, the 'butterflies'. Flexibility was a high priority. The layout of a ward can be modified relatively easily without affecting the structural skeleton. Another major theme was sustainability. To this end, the Deerns engineering firm designed the technical installations, such as combined heat and power generation (dual source) and motion sensors for lighting.

Risk classification for the Isala project are:
- Ordinary Hazard 1 for most areas.
- Ordinary Hazard 3 for shopping areas.
- Ordinary Hazard 3 pre-action with automatic fire detection for special rooms.
- Deluge system with open nozzles and automatic fire detection in atria.

Awards
In December 2010, D2B (Designed to Build), the construction consortium responsible for realizing the building and the installations, received a gold award for environmental quality with compliments for the continued functioning of the old hospital without disruption, a clean construction site and pride in a building partner with complete trust in continued operations.





The SEM-SAFE® nozzles are reliable and will keep the water damage to a minimum in case of a fire situation.

By using soft colors and natural materials, Isala hospital promoted the well-being of its patience, visitors and employees.

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Case story | SEM-SAFE® high-pressure water mist system

Shanghai Shuguang
Hospital in China

The first land-based project in China using high-pressure water mist technology

Danfoss Fire Safety A/S

With a rich history that dates back to 1906, Shuguang Hospital is one of the first class general hospitals in China. It is divided in two parts: eastern and western branch. The eastern branch is located in Zhangjiang Hi-Tech Park, Pudong New Area. It covers more than 83,000 m^2 and has a capacity of 720 beds.

In 2004, the hospital has been provided with high-pressure water mist technology for fire protection and on the 23rd of April 2005 the branch was officially opened.

Shuguang Hospital is a modern and famous hospital, being one of the top 100 national hospitals. It is the 12 times winner of the Shanghai Civil Unit as well as has been appointed national model T.C.M hospital. The hospital has completed accreditation of ISO9001 and is the pioneer TCM hospital accredited by ISO90001 in China.

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SEM-SAFE® high-pressure water mist system

Fire test criteria

The system chosen for the Shuguang Hospital had to comply with NFPA750(2000), IMO Res. A.800-2001 as well as China's design code for automatic sprinkler fire systems.

The SEM-SAFE® high-pressure water mist system for fire fighting from Danfoss was therefore tested according to the fire test procedures described in the above standard. The purpose of the test was to prove that an automatic water mist system achieved better results than comparable tests with sprinkler systems.

After successful testing, the SEM-SAFE® high-pressure water mist system was approved by CNCF (the related China National Center for Quality Supervision).

To protect the Shuguang building, one pump unit with three high-pressure pumps PAH80 was used. A total of 224 nozzles were installed. The water mist system was first of all chosen over traditional sprinklers due to its high level of flexible and smaller space requirements. Secondly, the system is environmentally friendly and very safe, for example in connection with the evacuation of patients, because no chemical additives are used. Thirdly, with minimal consumption of water and virtually no water damage, it is very safe for the expensive medical equipment and apparatus.

The hospital is very satisfied with this efficient, environmentally friendly and maintenance free system.

Shuguang Hospital in China, protected with SEM-SAFE® high-pressure water mist system from Danfoss.

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Case story | SEM-SAFE® high-pressure water mist system

The New University Hospital (DNU) in Aarhus, Denmark

One of the largest water mist for fire fighting installations in Denmark's first super-hospital

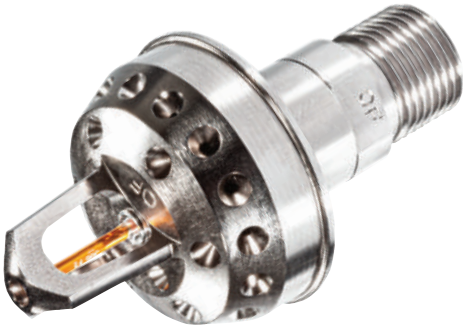
Danfoss Fire Safety A/S

The new University hospital in Skejby, Aarhus (DNU) is Denmark's first super hospital. The hospital will not only provide quality treatment, but will also be a prestigious learning and training centre with modern research facilities. The project is a pioneer for the development of "Healing Architecture" in the hospital sector and is designed to meet the future demands for patient treatment and procedures.

Building description

Construction started in 2012 and is expected to be finalized in 2020. Upon completion, the hospital will be the same size as a Danish provincial town, with its own buildings, streets and neighborhoods. DNU will be added to the existing three-storey Aarhus University hospital in Skejby to form a combined hospital complex of approximately 400,000 m^2 with buildings between four and eighteen storeys.

Ensuring fire protection for a structure of this size and with a large number of staff, patients and visitors is a high priority. In line with this state-of-the-art hospital, SEM-SAFE® high-pressure water mist system for fire fighting from Danfoss was chosen for fire protection of the DNU hospital.



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SEM-SAFE® high-pressure water mist system
The project has been the result of close collaboration between Danfoss, Kemp-Lauritzen (official Danfoss distributor in Denmark) and consulting engineering company, DNU Rådgivergruppen. The advantages of a high-pressure water mist system were solidly confirmed. All fire protection requirements were satisfied by choosing a SEM-SAFE® high-pressure water mist system.

Simplex CEN micro nozzles and VdS drilled nozzles have been chosen. The CEN nozzle has a large spacing of 5.5 meter, with its wide spray angle and the specially designed spray pattern. Upon project completion, a total of 30,000 nozzles will be installed.

High-pressure water mist has excellent fire suppression properties, including the capture of soot particles, strong reduction of radiant heat and rapid lowering of the temperature to acceptable levels. Fire is controlled efficiently, while water consumption and water damage is kept to a minimum. In case of system activation due to a fire, the clean-up is faster and there is minimum business interruption and impact on patient care.

The benefits of SEM-SAFE®
The benefits of SEM-SAFE® high-pressure water mist system are many in comparison with traditional sprinklers. The most important being the economic advantage, as SEM-SAFE® is a money saving solution. For DNU more than 11 million Euros were saved with SEM-SAFE® due to lower costs for building structure and design.

The superior cooling features of the SEM-SAFE® water mist system make it the perfect choice for glass facades, as it removes the risk of thermal stress cracks associated with traditional sprinklers.

Usually a lot of isolation material has to be used for vents in order to prevent any hot air being transported. With SEM-SAFE® this is avoided and significant savings are made.

The SEM-SAFE® system is characterized by small pipe dimensions and fewer nozzles, which results in considerable reduction of installation time and cost, impossible to achieve with a traditional sprinkler system.

The small pipe diameters make the system easy to integrate with other installations in a hospital. It is an optimal solution for modern hospitals as well as being highly suited for retrofitting existing buildings.

Fire safety consultants Kenneth Jaquet and Bertel Kjeldsen, Rådgivergruppen DNU I/S states:
"By installing a high-pressure water mist system at The New Aarhus University Hospital (DNU), we have selected the optimal technology when it comes to protecting the building, its fixtures and equipment in the event of a fire. This technology also allows for considerable savings in terms of building components.

The high-pressure water mist system has provided a high level of architectural freedom, such as the ability to mount nozzles in the moulding in corridor areas so that the ceiling can easily be removed to provide access to technical installations during service visits.

At DNU, the technology has also allowed planners to replace widely-used automatic fire doors in service corridors with high-pressure water mist curtains, which are a more reliable and operations-friendly solution. The building has also been equipped with high-pressure hose reels, which can be used by emergency response teams in the event of a fire. The high-pressure hose reels are an integrated part of the high-pressure water mist system, thus avoiding the need for a separate pipe network for traditional hose reels.

In a hospital construction with limited space for technical installations, the high-pressure water mist system is the optimal choice when using smaller and fewer pipe sizes, as it provides the utmost flexibility."

The innovation behind SEM-SAFE® has allowed for water curtains to replace traditional fire doors.

SEM-SAFE®

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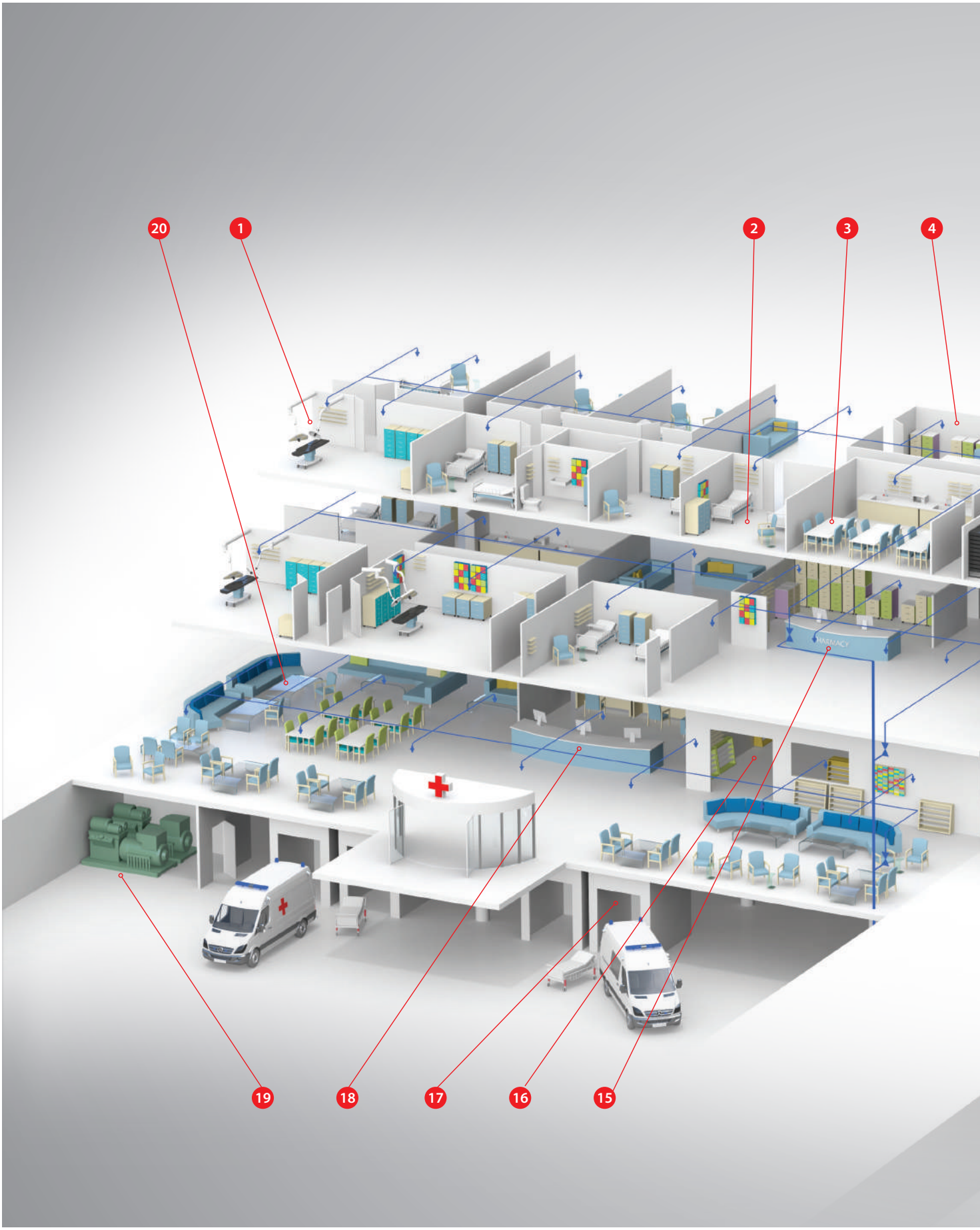
Hospitals

Optimum fire safety for hospitals with SEM-SAFE® high-pressure water mist system

Danfoss Fire Safety A/S

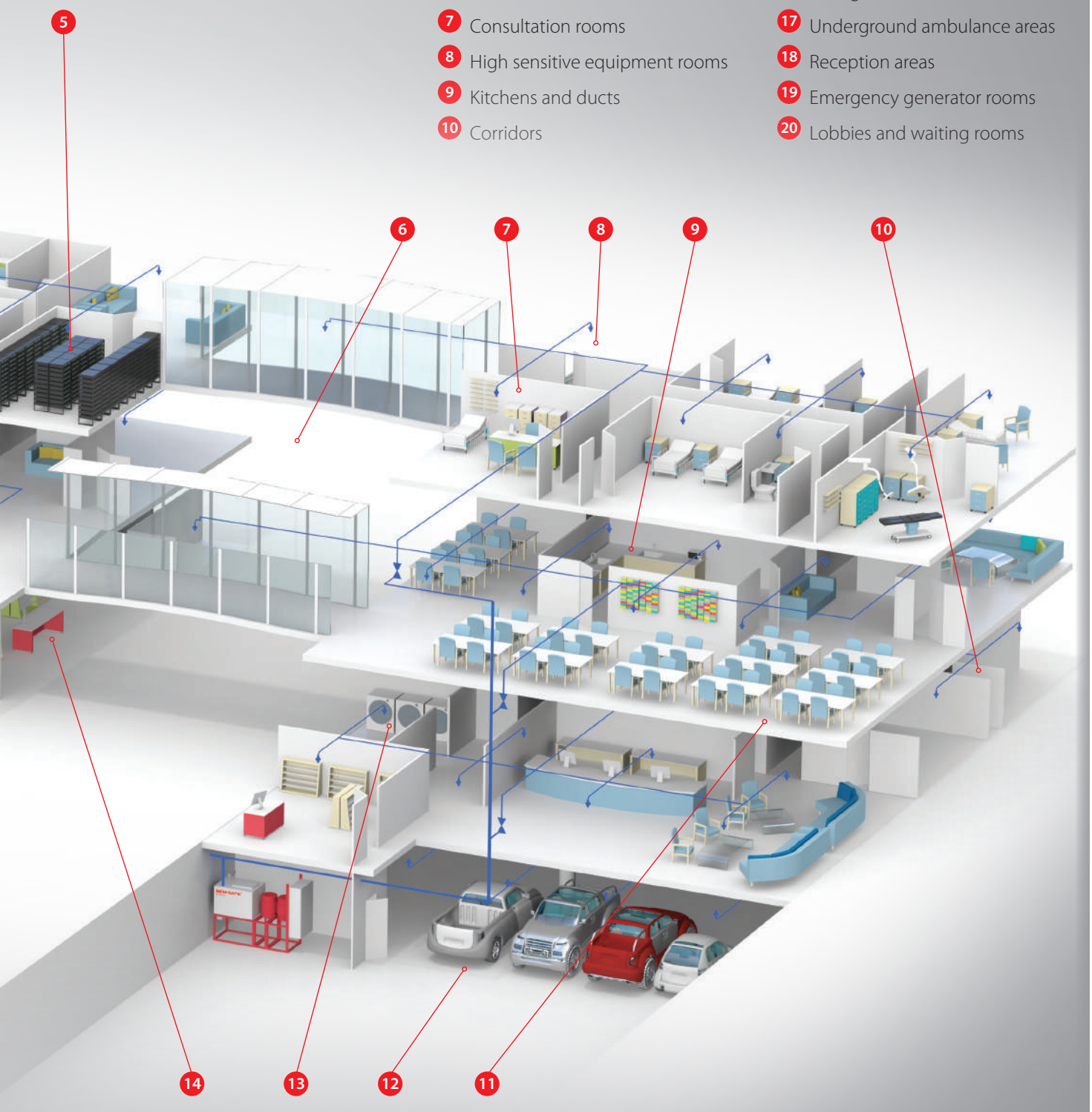
Cover page: *Shanghai Shuguang Hospital, protected with Danfoss SEM-SAFE® high-pressure water mist system*

SEM-SAFE® high-pressure water mist system
One single system to protect all areas in the hospital



Danfoss provides fire fighting solutions for the following areas:

1. Operating theatres
2. Patient rooms
3. Staff facilities rooms
4. Offices
5. Server rooms
6. Glass corridors
7. Consultation rooms
8. High sensitive equipment rooms
9. Kitchens and ducts
10. Corridors
11. Canteens
12. Car parks
13. Laundry rooms
14. Archives
15. Pharmacy / Shops
16. Storage areas
17. Underground ambulance areas
18. Reception areas
19. Emergency generator rooms
20. Lobbies and waiting rooms



SEM-SAFE® for hospitals

Need a fire fighting system that:

- Allows for safe evacuation?
- Keeps water damage to a minimum?
- Reduces downtime?
- Is environmentally friendly and 100% harmless to people?
- Is easy to integrate and blend in with other equipment in the hospital?
- Is the optimal technology for high-sensitive equipment?

Then SEM-SAFE® high-pressure water mist is your solution!

In line with the medical advanced equipment inside a hospital, Danfoss has developed a state-of-the-art fire fighting technology based on high-pressure water mist which provided optimum fire protection for personnel and surroundings.

Fire protection of hospitals

With small pipe dimensions, large coverage, minimal water consumption, a compact skid unit and simple design, SEM-SAFE® high-pressure water mist is the perfect choice to protect hospitals against fire, with reliability and cost saving in ming. The system is safe, efficient and environmentally friendly.

Safe evacuation of patients and staff

- The excellent properties of water mist make this fire fighting technology the best choice for protecting a hospital, where the priority in case of a fire is the safe evacuation of patients
- The system is only activated in areas, where fire is detected. Other areas in the hospital will not be affected

Functionality and aesthetic design

- The pipes are very small and easy to bend
- Perfect integration with other installation parts such as electrical, mechanical and plumbing equipment present in a hospital
- Aesthetics nozzle design

Substantial amount saved in damage control

- SEM-SAFE® uses corrosion resistant stainless steel pipes. The water coming from the pipes is clean water. In case of discharge, clean-up is easier, faster and with lower costs
- Reduced water damage

Simplicity and modularity

- Easy to install in modern hospitals, where the SEM-SAFE® installation will not disrupt any of the desired architectural features
- Perfect solution for old buildings, where valuable historical preservation is important
- The modular and compact SEM-SAFE® system can easily be expanded to cover new sections added to a hospital building

Benefits of SEM-SAFE® high-pressure water mist system

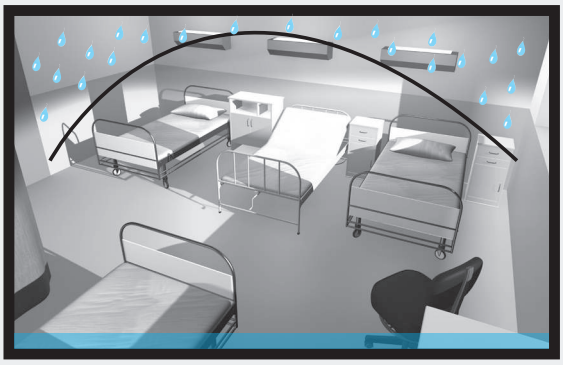
Tackles fire swiftly and efficiently

- Minimal consumption of water
- Radial heat is blocked efficiently. This helps in protecting against any structural damage by not allowing the flames to expand
- Gentle with the electrical equipment due to small water droplets. Therefore the functionality of the electrical equipment in the hospital is not disrupted and data is saved

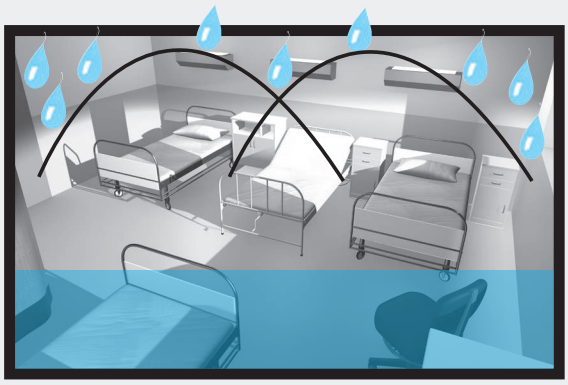
Cost saving solution

- With fewer nozzles required thanks to optimized spacing and the need for only one pump unit for all applications, installation cost and time as well as required service interventions are considerably reduced
- Our high-pressure pumps are water-lubricated and hence virtually maintenance-free
- With 30% fewer components compared to other competing systems, the SEM-SAFE® system is lighter and more compact. This allows for easier installation, simplified maintenance and valuable space saving
- Cost of water supply is significantly reduced due to less piping, reduced water demand from the water supply, lower taxes and no or significantly smaller water reservoirs
- No need for other technologies. SEM-SAFE® is the perfect solution for fire protection of more sensitive areas such as server rooms and archives

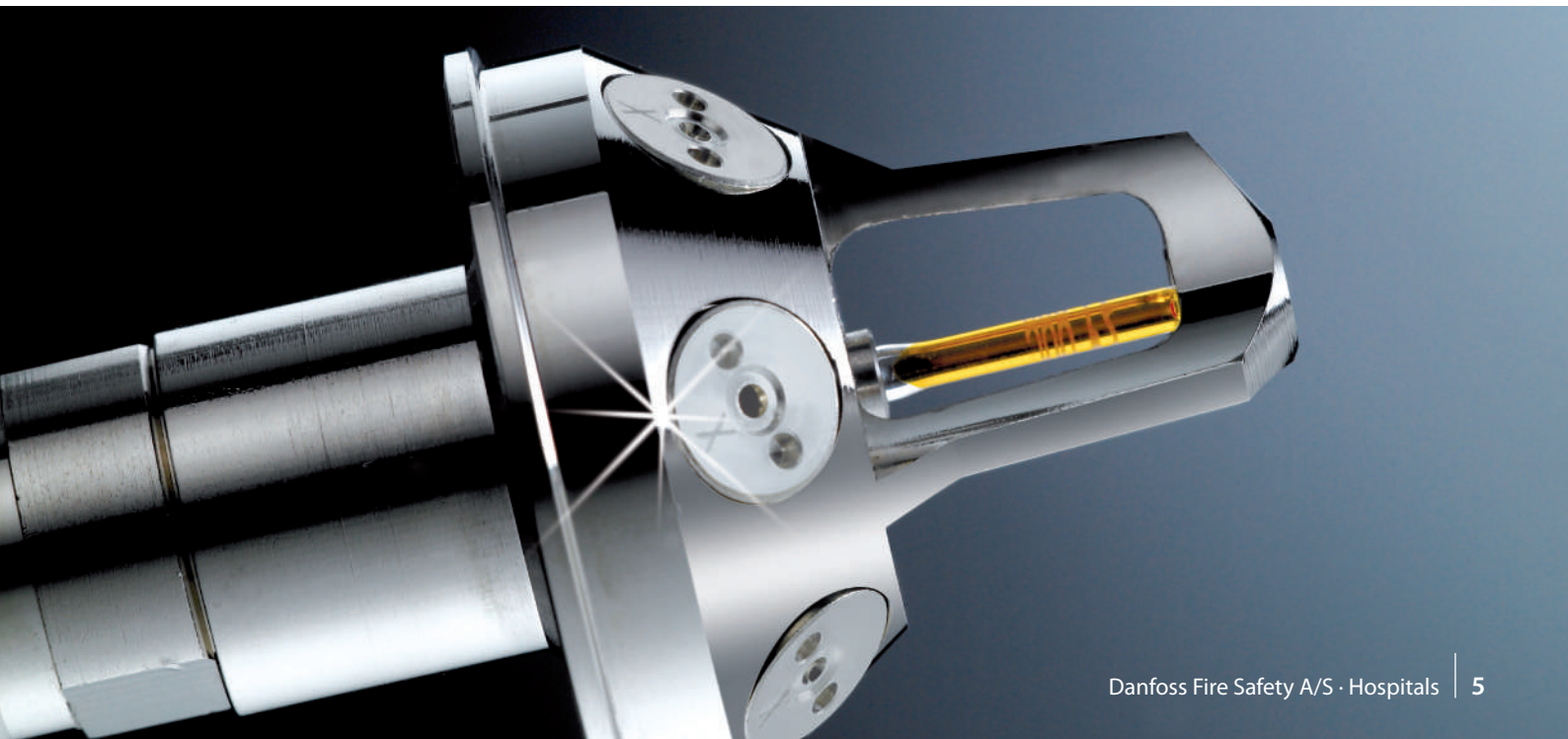
SEM-SAFE®



Traditional sprinkler



SEM-SAFE® uses up to 50% less water when compared to low-pressure water mist systems and up to 80% less water when compared to traditional sprinklers.



Proven experience across the world

For decades, Danfoss has been installing fire protection systems in both new and retrofit hospitals and nursing homes all over the world. The experience we build with each installation and project allows us to provide our customers with the best and most reliable fire fighting solution in the market.

The excellent fire suppression properties, and the system's advantages that allow for sustainability and reliable fire protection of buildings, people and the environment has made SEM-SAFE® the right choice for numerous hospitals, clinics and nursing care homes, such as:

- DNU Skejby University Hospital in Denmark, super hospital in Denmark protected with SEM-SAFE®
- Isala Clinics in The Netherlands, gold awarded hospital protected with SEM-SAFE®
- PTE 400 Hospital in Hungary, large-scale project
- Pikonlinna Hospital in Finland, senior nursing care centre
- Heidelberg Ethianum in Germany, elite surgery clinic

In-house design
We have the necessary experience and technological know-how to provide you with the optimal fire fighting system based on fire risk analysis for your hospital.

Tested and approved
The design of the SEM-SAFE® high-pressure water mist system is based on full scale fire tests. For industrial and commercial applications, approvals are obtained by testing according to specifications from, for example, FM, UL and ISO, as well as from the European guideline CEN/TS 14972 and approvals from DBI and VdS.

VdS

FM APPROVED

Internal HSE&Q system in accordance with

- DS/EN ISO 9001:2015
- DS/EN ISO 14001:2015
- DS/OHSAS 18001:2008

DS/EN ISO 9001:2015

DS/EN ISO 14001:2015

DS/OHSAS 18001:2008

The intelligent use of water

How does it work

For a fire to survive, it relies on the presence of the three elements of the 'fire triangle': oxygen, heat and combustible material. The removal of any one of these elements will extinguish a fire.

The **SEM-SAFE®** high-pressure water mist system goes further. It attacks two elements of the fire triangle: oxygen and heat. The uniqueness of high-pressure water mist is that it combines the suppression effect of gas and sprinkler systems. As well as removing the oxygen like a gas a gas system it simultaneously cools the fire like a traditional sprinkler. The cooling effect additionally lowers the risk of re-ignition.

A unique fire fighting system

The **SEM-SAFE®** high-pressure water mist system is a unique fire fighting system. When water is forced through nozzles, at high-pressure, a super-fine mist is formed that has a two-fold extinguishing effect. As well as cooling the fire like a traditional sprinkler, it simultaneously starves the fire of oxygen like gas systems. When the mist comes into contact with flames, it evaporates and expands minimum 1,700 times. The dense vapour created displaces the flames and quickly extinguishes the fire.

Decades of pioneering and engineering

As one of the acknowledged pioneers of high-pressure water mist technology, Danfoss operates in-house research, development and manufacturing facilities of all critical components: nozzles, pumps and valves.

This puts us in a unique position to maintain our technological leadership in the future. All our products are made of first-class materials and in a comprehensively tested design.

Nozzle

Pump

Valve

Danfoss high-pressure water mist nozzles

- Highest market spacing (5.5m)
- 100% capacity and spray pattern tested
- Aesthetic nozzle design

Danfoss high-pressure pumps

- Lubricated by water, making the pump maintenance free
- World's lightest and most compact
- 95% energy efficient and very low pulsation to reduce noise

Danfoss stainless steel valves

- Compact easy installation and operation
- Dirt resistant
- High-corrosion proof

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Total Solution Provider of Certified Fixed Fire Fighting Systems

Danfoss Fire Safety A/S, an integral member of the Danfoss Group, is a global leader in the sale, development, production and service/commissioning of certified fixed fire fighting systems under the brand name SEM-SAFE®.
We offer you unparalleled competitive edge through quality and reliable products, uncompromising performance and cost-effective fire fighting systems.

Innovation is our approach

We have been engineering and pioneering SEM-SAFE® fire fighting systems for decades. This gives us the experience and technological knowledge to provide a complete range of SEM-SAFE® fire fighting systems based on two key technologies: high-pressure water mist and low-pressure CO_2.

Engineering a safer tomorrow

From a modern high-rise building to a state-of-the-art university, from a wood church to a super hospital and busy international airport, SEM-SAFE® high-pressure water mist is the optimum fire fighting solution for any building type. The breakthrough that high-pressure water mist represents is to use the same method as traditional sprinklers, but to add the effect of converting the water into steam.

This means that the cooling effect is up to seven times higher than for traditional sprinklers. Combined with the oxygen displacement effect, this can reduce water consumption significantly compared to traditional sprinkler.

Besides a proven track record in buildings, we install SEM-SAFE® fire fighting systems in a wide range of vessels. Safety on board ships is critical, and this places great demands on fire fighting systems. No matter if the journey means transporting goods across oceans on a mega container ship, or a vacation trip to a beautiful island on a luxurious cruise, SEM-SAFE® fire fighting is the perfect choice to protect the vessel and passengers against fire, with reliability and cost-effectiveness in mind. For the demanding marine segment we offer two fire fighting technologies: SEM-SAFE® high-pressure water mist and SEM-SAFE® low-pressure CO_2.

Reaching even higher

Simplicity in design, obtained by using the most advanced technologies, results in the highest operation reliability. All our products are made of first-class materials and in a comprehensively tested design.

Danfoss is close by

Danfoss and its associates, regional offices and agents constitute a worldwide network that provides comprehensive technical support, installation, commissioning and repair services.

This network ensures that our reputation for fire fighting excellence is maintained and enhanced.

>50
years
of pioneering research & testing in fire fighting

SEM-SAFE®

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