

ENGINEERING  
TOMORROW

*Danfoss*

Marine & Offshore

# Optimum fire safety for all marine applications with **SEM-SAFE®** high-pressure water mist

Danfoss Fire Safety A/S

Minimum  
downtime with  
**SEM-SAFE®**  
for fire  
fighting

[www.semsafe.danfoss.com](http://www.semsafe.danfoss.com)

**SEM-SAFE®**



For centuries, water has been used to fight fires. In 1806, the first patent was filed in London describing a perforated pipe concept for a fire protection system.

This was followed in 1860 by the first sprinkler patent. Later, more advanced sprinkler heads were developed, including bulbs. The common feature of this development was the use of water as a fire fighting medium for cooling the fire.



*"Esvagt Bergen" protected with SEM-SAFE® high-pressure water mist*

# The intelligent use of water

## High-pressure water mist

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.

A high-pressure water mist system goes further. It attacks two elements of the fire triangle: oxygen and heat.

## Oxygen

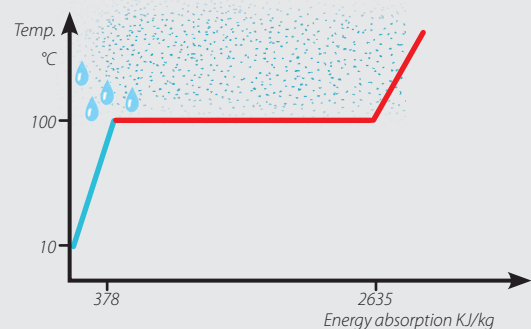
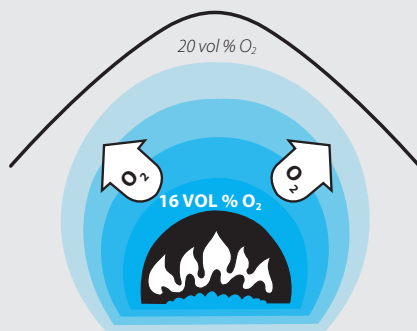
The very small droplets in a high-pressure water mist system quickly absorb so much energy that the droplets evaporate and transform from water to steam, because of the high surface area relative to the small mass of water. This means that each droplet will expand more than 1,700 times, when getting close to the combustible material, whereby oxygen and combustible gasses will be displaced from the fire, meaning that the combusting process will increasingly lack oxygen.

## Heat

To fight a fire, a traditional sprinkler system spreads water droplets over a given area, which absorb heat to cool the room. Due to their large size and relatively small surface, the main part of the droplets will not absorb enough energy to evaporate, and they quickly fall to the floor as water. The result is a limited cooling effect.

By contrast, high-pressure water mist consists of very small droplets, which fall more slowly. Water mist droplets have a large surface area relative to their mass and, during their slow descent towards the floor, they absorb much more energy. A great amount of the water will follow the saturation line and evaporate, meaning that water mist absorbs much more energy from the surroundings and thus the fire.

That's why high-pressure water mist cools more efficiently per litre of water: up to seven times better than can be obtained with one litre of water used in a traditional sprinkler system.



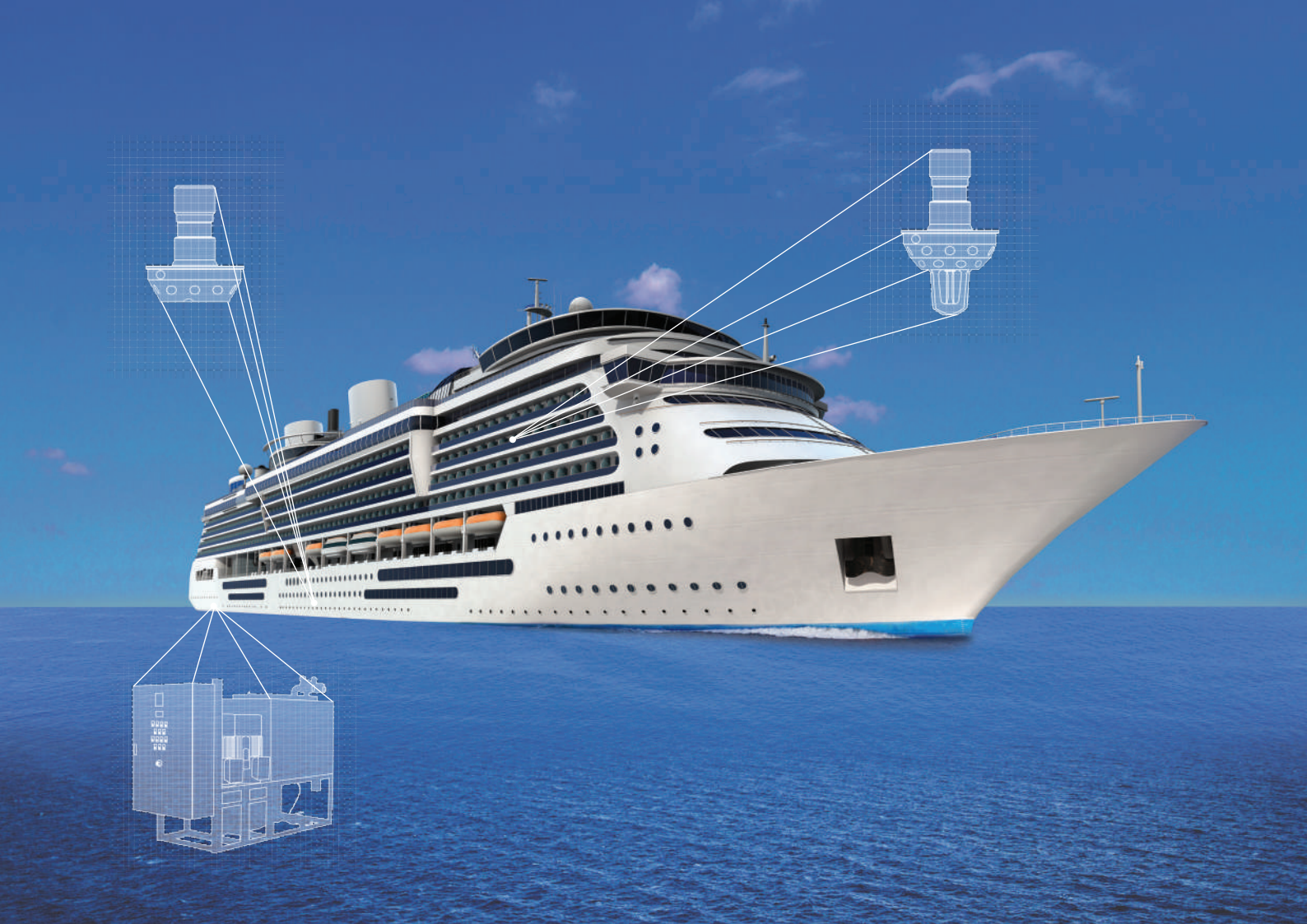
Water mist cooling effect per kg water .....  
Traditional sprinkler cooling effect per kg water .....



## Conclusion

The uniqueness of water mist is that it combines the suppression effect of gas and traditional sprinkler systems. As well as removing the oxygen like a gas system, it simultaneously cools the fire like a traditional sprinkler. The cooling effect additionally lowers the risk of re-ignition.





## SEM-SAFE® by Danfoss

The SEM-SAFE® high-pressure water mist system is a unique fire fighting system. By forcing water at a high-pressure through nozzles, an extremely fine mist is created. Water is supplied via a pump unit. For every ship type, the SEM-SAFE® pump unit can supply all water mist applications. This is beneficial because you only need one unit for all applications, and it is easy to add more sections and applications, if needed. In addition, servicing of only one unit is easier and less costly.

### SEM-SAFE® high-pressure water mist system – for accommodation areas

On stand-by, the system maintains a pipe pressure of approx. 12 bars. When the temperature exceeds a given level – for example, 57 °C – the heat-sensitive glass bulbs mounted in the nozzle heads melt. At this point, the high-pressure pump is automatically activated and water is forced through micro-nozzles at very high pressure (100 bar) to create a fine mist. Importantly, only those nozzles with melted bulbs are actually activated. This means that only the heat-affected area will be sprayed.

### SEM-SAFE® high-pressure water mist system – for engine rooms

On stand-by, the system has dry piping. The local protection system will activate automatically when sensors have detected heat, smoke or a flame, depending on type and application. The nozzles are dimensioned in sections and all nozzles in the activated zone will be released. The total flooding system is dimensioned with one section per fire zone and is activated manually either from the valve operation panel (VOP) in the engine control room or the mimic panel on the bridge.

### SEM-SAFE® high-pressure water mist in operation

During operation, the high-pressure pump draws water from the non pressurized stainless steel buffer tank and forces it through a non-return valve to a high-pressure manifold. From here, it is distributed to the relevant section(s) via the main valve. A pressure relief valve controls the pump pressure and has the ability to return the full pump capacity to the buffer tank.

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

## Quick fire fighting

- As water mist both cools the fire and removes the oxygen, it results in quicker fire fighting
- Due to the cooling effect of water mist, re-ignition is avoided
- The SEM-SAFE® high-pressure water mist system is ready for re-use immediately after a fire

## Less damage

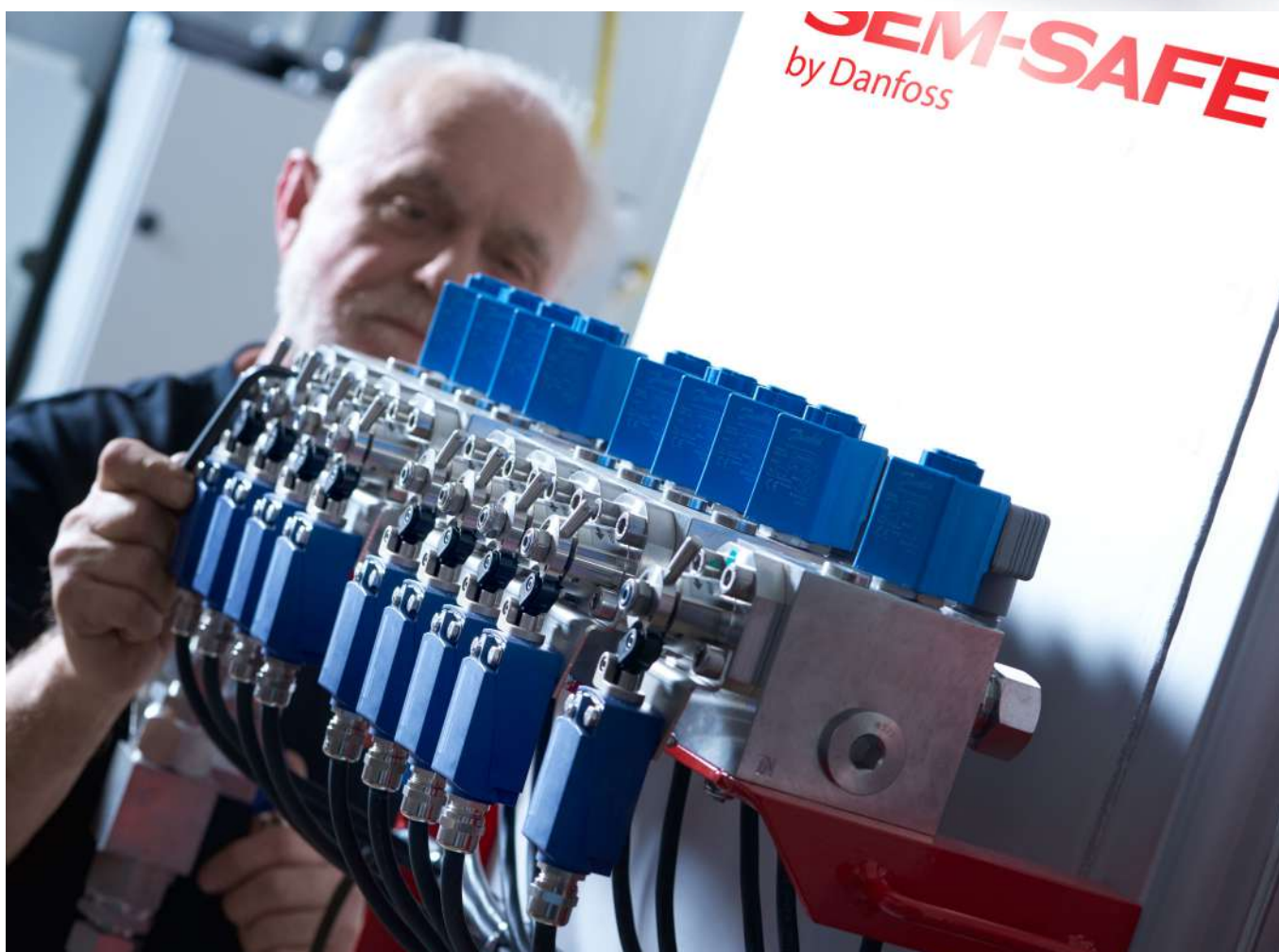
- Water damage is kept at a minimum due to the low water consumption of the high pressure water mist system
- The SEM-SAFE® system can be deployed instantly, resulting in less damage
- Using only pure water, the SEM-SAFE® high-pressure water mist system gives you the best possible protection of equipment and human lives

## Reduced down time

- The reduced amount of damage often means less down time, resulting in much lower costs
- There is no need to fill up cylinders, thus saving expensive refilling time and overall costs

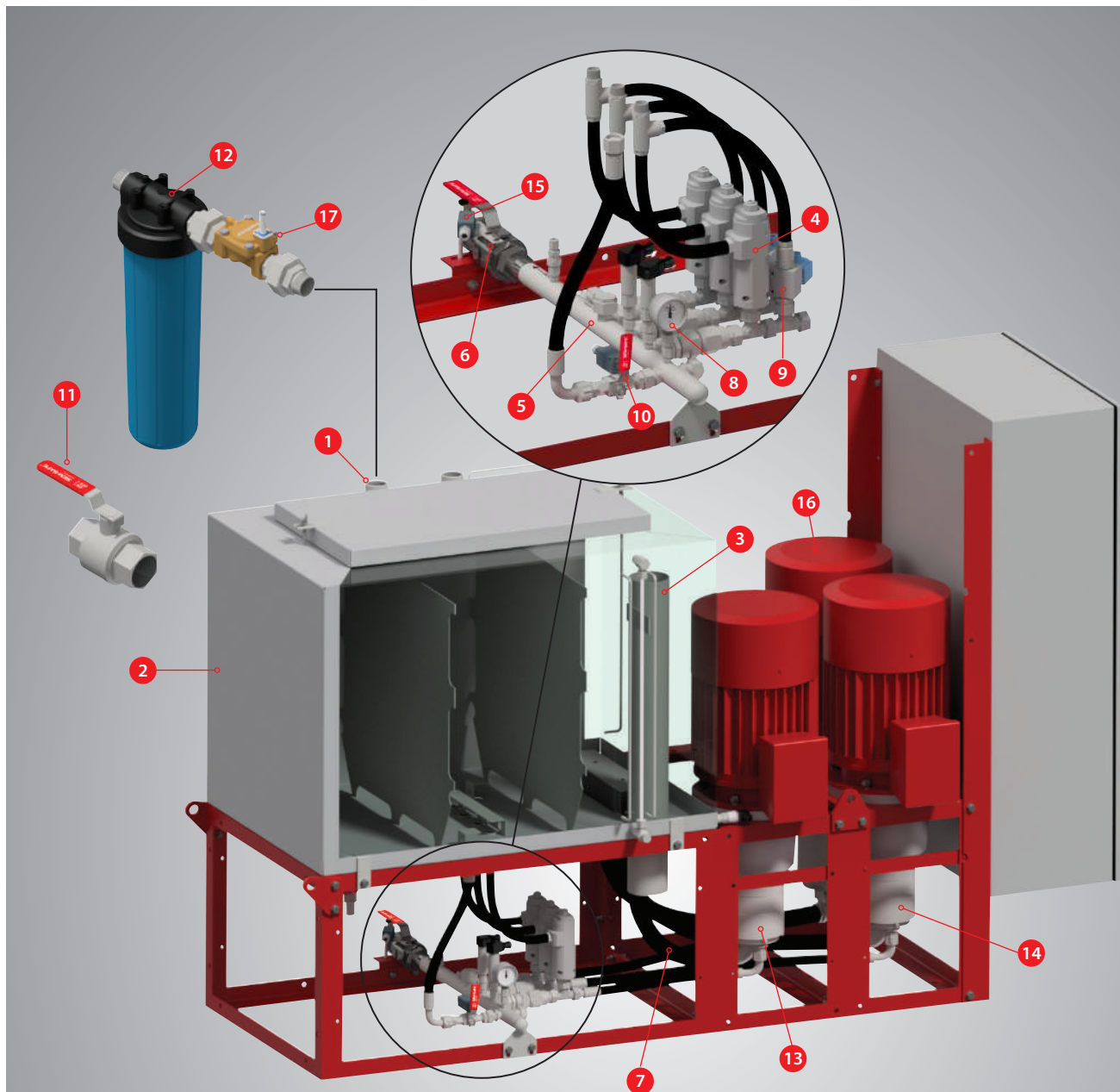
## No need for extra installations

- The pump unit takes up little space and needs no special room or safe storage
- Easy and fast installation is possible due to small pipe sizes and low system weight





# SEM-SAFE® by Danfoss – The system design



**1 INLET CONNECTION**

Fresh water or seawater supply to the buffer tank

**2 BUFFER TANK**

Minimum capacity of one minute operation at max. required flow

**3 LEVEL SWITCH**

Controls fresh water and seawater inlet, low level alarm and pump shutdown to avoid dry-running

**4 PRESSURE RELIEF VALVE**

Controls the system pressure (100-140 bar). Discharge line back to tank

**5 HIGH-PRESSURE MANIFOLD**

Connects the high-pressure pumps and the pilot pump in the system

**6 MAIN VALVE**

Can be closed for test purposes (no high-pressure/water in system pipes)

**7 INLET HOSE**

Supplies the pumps with water from the buffer tank

**8 PRESSURE GAUGE**

Indicates the operating pressure

**9 PRESSURE TRANSMITTER**

**For accommodation only:** Controls the standby pressure and start-up of high-pressure pumps when system pressure drops and the system is activated.

**For total flooding and accommodation only:** The pressure transmitter also controls the start-up of additional pumps until system pressure is reached

**10 TEST VALVE**

For simulating system activation and running the pump unit without pressure/water in the system pipes (main valve closed)

**11 BYPASS VALVE**

Only used if filter becomes contaminated during fire fighting

**12 FILTER**

10 micron rated inlet filter

**13 REDUNDANT PUMP**

**For total flooding and accommodation only:** Standby pump for redundancy in case one of the other pumps malfunctions

**14 HIGH-PRESSURE PUMP**

Supplies the required flow and pressure for the system

**15 NON-RETURN VALVES**

Supplied when multiple pumps are required

**16 ELECTRIC MOTOR**

Drives the high-pressure pumps (10-33 kW each)

**17 INLET VALVE**

Controlled by the level switch (position 3)

# Reliable and efficient

## Pioneers of high-pressure water mist technology

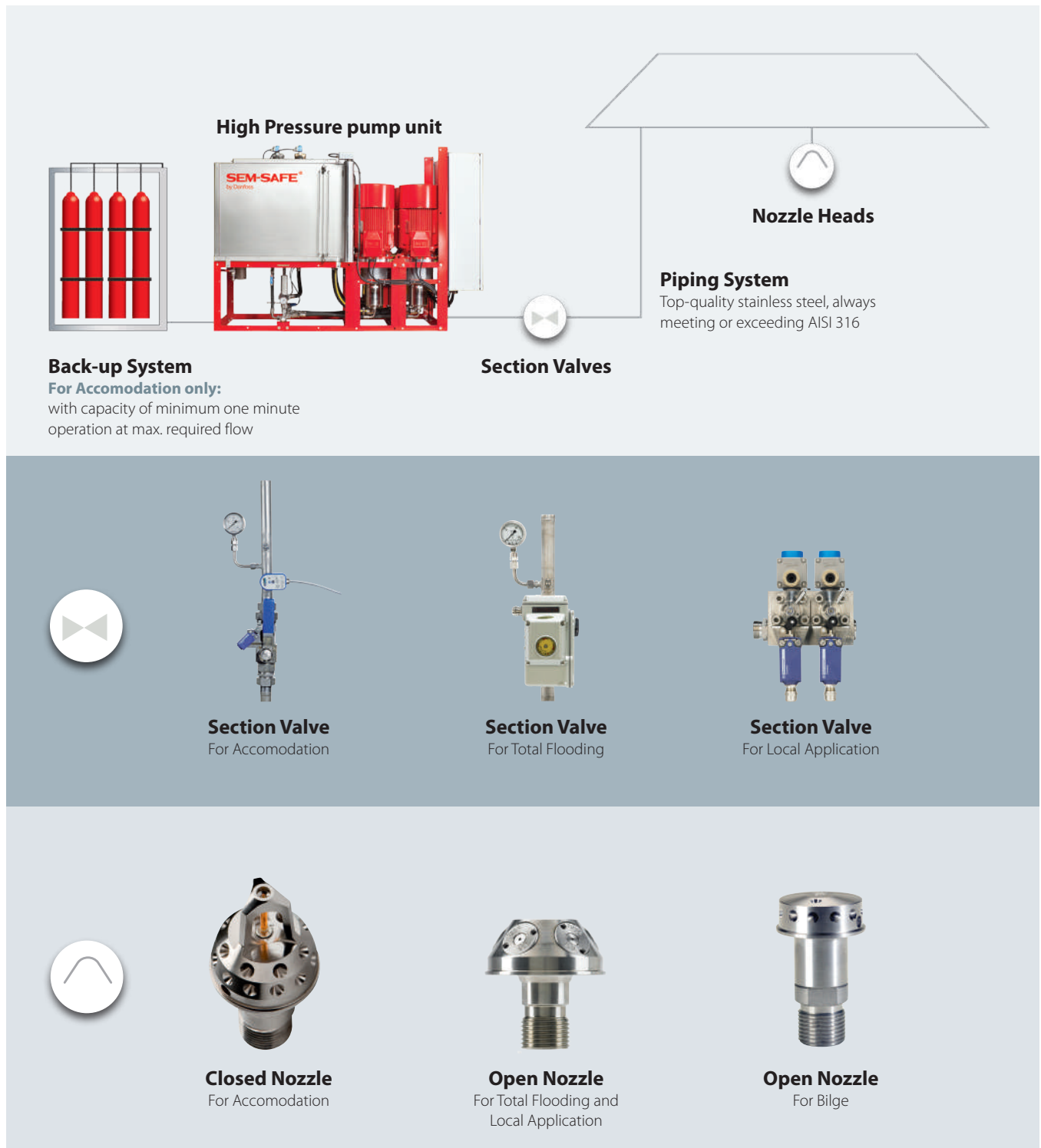
As one of the acknowledged pioneers of high-pressure water mist technology, Danfoss is a leading force in the market.

Danfoss is the only water mist supplier with direct access to its own development and production of all three key components needed for a top quality, cost-effective, high-pressure water mist system: nozzles, pumps and valves.

All our products are made of first class materials to a comprehensively tested design.

The SEM-SAFE® fire fighting system from Danfoss are recognised by all leading classification societies and national maritime authorities.

Danfoss Fire Safety HSE&Q system is in accordance with DS/EN ISO 9001:2015, DS/EN 14001:2015, and DS/OHSAS 18001:2008 and is certified by DNV.



# 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<sub>2</sub>.

## 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<sub>2</sub>.

## 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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