



# SEM-SAFE®

High-Pressure Water Mist System





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.



# The intelligent use of water

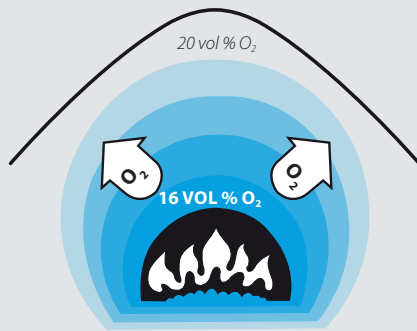
## High-pressure water mist

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.

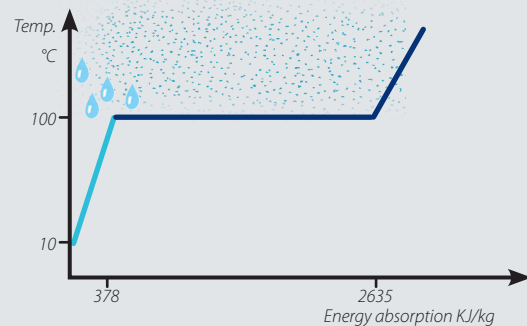


### Heat

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.



### 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®

## The system design



■ Sem-Safe® Pump Unit ■ Engine room, Total Flooding and Local Application ■ Accommodation ■ Deep Fat fryer and Duct in Galley

The SEM-SAFE® 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® 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® 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® water mist system in operation

SEM-SAFE® Water Mist System 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.

# The benefits of SEM-SAFE® 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® 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® 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

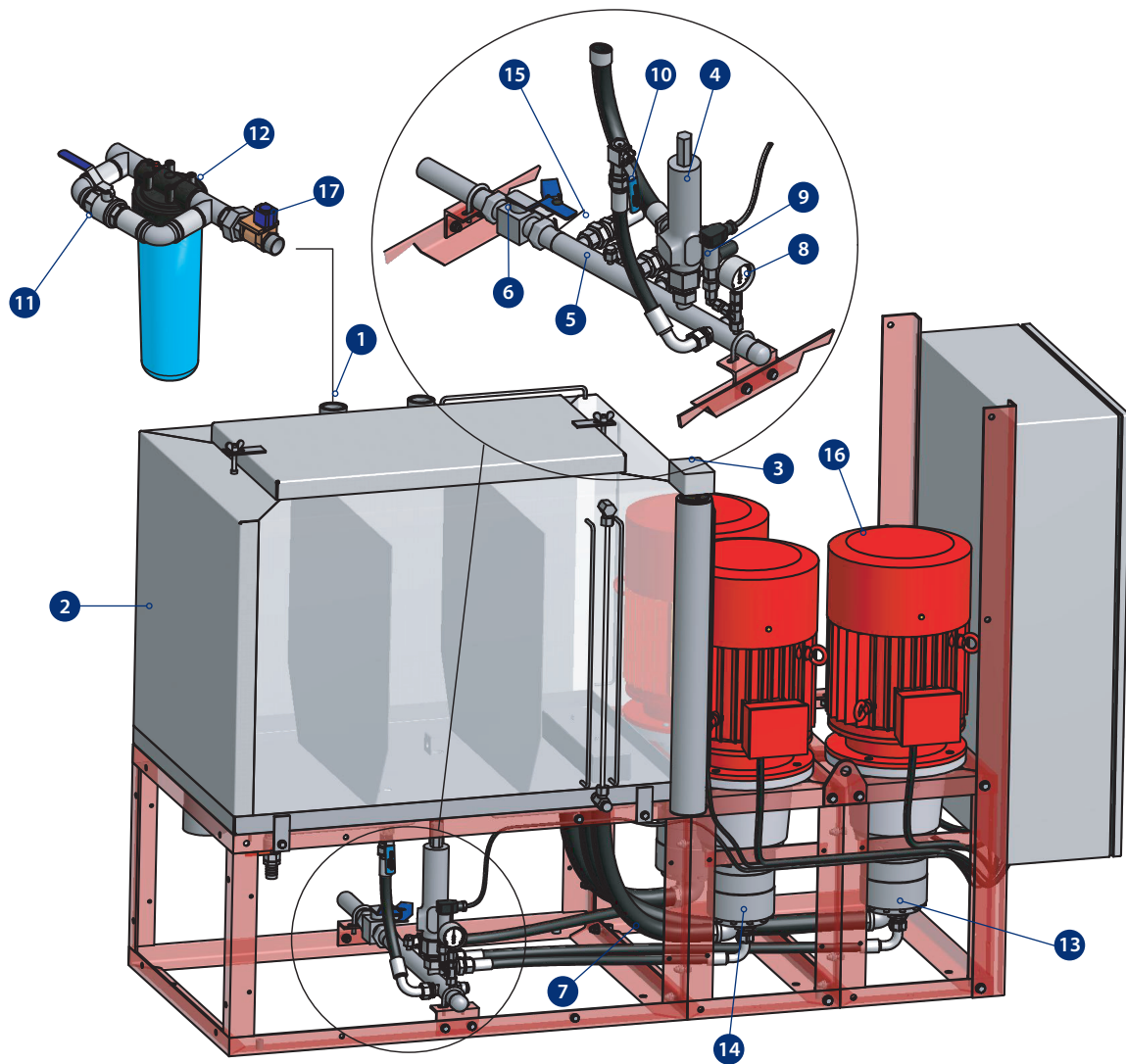
## No need for extra installations

- 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®

## 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

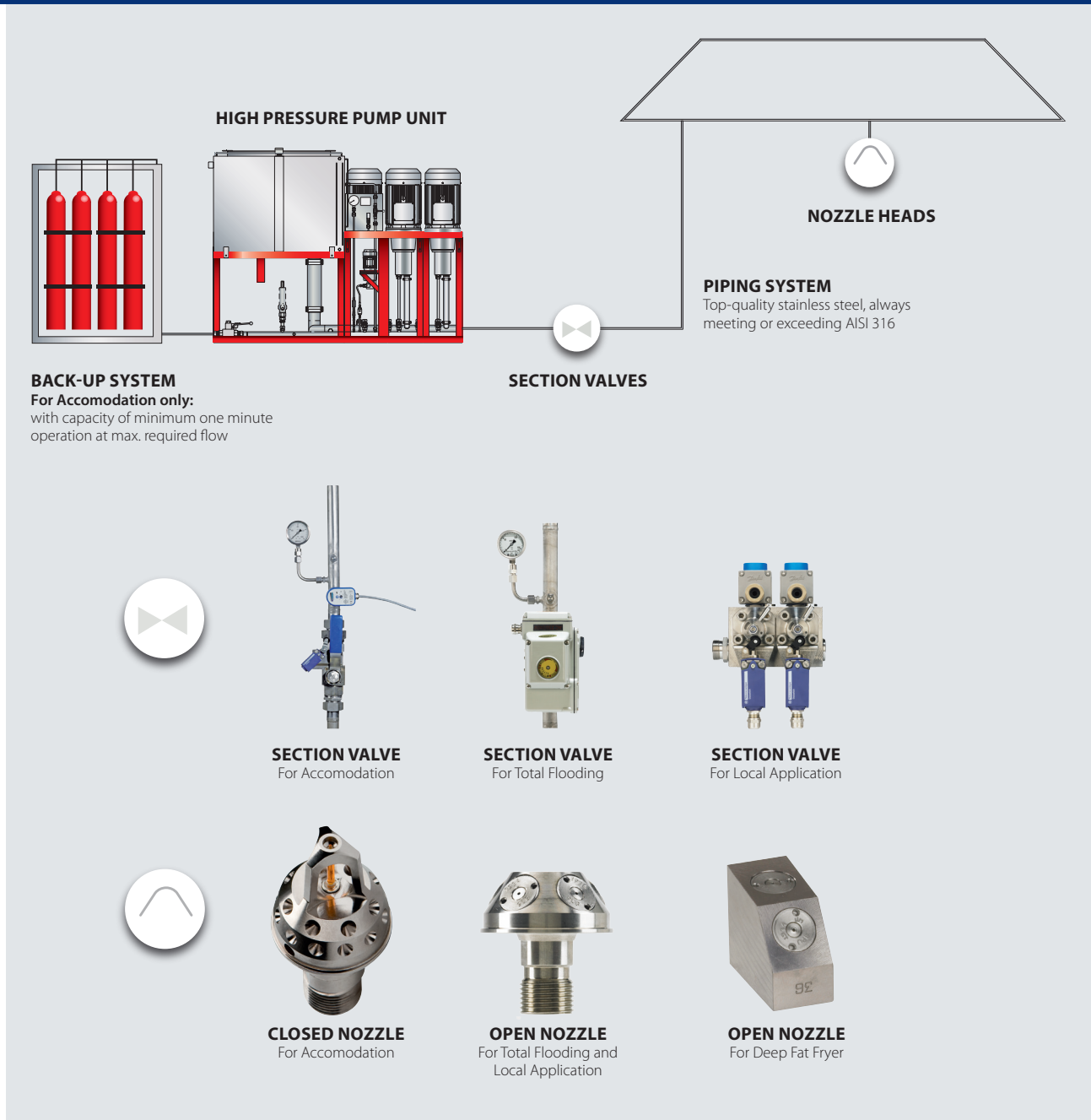
### 16 ELECTRIC MOTOR

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

### 17 INLET VALVE

Controlled by the level switch (position 3)

# Quick fire fighting



## Pioneers of high-pressure water mist technology

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

Danfoss Semco's fire fighting systems are recognised by all leading classification societies and national maritime authorities. Danfoss Semco HSE&Q system is in accordance with DS/EN ISO 9001:2008, DS/EN 14001:2004, and DS/OHSAS 18001:2008 and is certified by DNV.



# Danfoss Semco A/S

## History

Danfoss Semco A/S is a global leader in the sale, development, production and service/commissioning of certified fixed fire fighting systems. In 2006, two leading firms in the field, Danfoss A/S and Semco Maritime A/S, joined forces to form the present company, with Semco Maritime boasting over half a century of expertise in designing and installing fixed fire fighting systems. All the while, Danfoss has developed and delivered key components for the high-tech systems.

Today Danfoss Semco is an integral part of the Danfoss Group, Denmark's largest industrial manufacturing company with a daily output of more than 250,000 finished components. With more than 24,000 employees worldwide, Danfoss is truly a global company.

## Business areas

Our company is located in Odense, Denmark, and operates three main business areas.

Our water mist division comprises two business areas: the marine division and the industrial and commercial division. The former has pushed the boundaries for development and design to offer a wide range of solutions for numerous application areas on almost any type of vessel.

Within the industrial and commercial area, Danfoss Semco has a successful track record with different applications, ranging from complex fire fighting systems for museums and heritage sites to industrial applications, office buildings and universities.

Our gas and foam division is the world's largest low-pressure CO<sub>2</sub> based fire fighting systems supplier for the marine industry. This division supplies gas, foam and dry chemical powder systems worldwide.

## In-house manufacturing of key components

Danfoss Semco operates in-house research, development and manufacturing facilities of all critical components to ensure uncompromising performance and cost-effective systems. This puts us in a unique position to maintain our technological leadership in the future.

## Proven experience

Danfoss Semco has supplied fire fighting systems to more than 1,500 vessels, including world class ships, such as:

- *Allure of the Seas* and *Oasis of the Seas*, the world's largest cruise liners
- *Mærsk Mc-Kinney Møller*, the world's largest container ship
- *HSC Fjord Cat*, the world's fastest passenger vessel and holder of the record for the fastest transatlantic voyage
- *Island Constructor*, ship of the year in 2008
- *Le Grand Bleu*, one of the world's biggest yachts



The Anchor Handling Vessel "Maersk Tracer" is installed with a SEM-SAFE® high-pressure water mist fire fighting system.