ENGINEERING TOMORROW

Case story | SEM-SAFE® low-pressure CO_2 system

CMA CGM **Benjamin Franklin**

Ultra large container protected with SEM-SAFE® low-pressure CO_2 for fire fighting

Danfoss Fire Safety A/S

Copyright Port of LA

Benjamin Franklin is the third vessel in a series of ultra large container ships for CMA CGM. It is the largest vessel ever to call port in the USA.

CMA CGM decided to build three 16,000 TEU vessels in Shanghai Jiangnan Changxing Heavy Industry, making them the first ship owner to look to China for this size vessel. The vessels were later upgraded to 18,000 TEU.

Due to the volume of the engine room and cargo holds, it was decided early on to go with a low-pressure CO_2 fire fighting system, as the amount of cylinders in a high-pressure system would be 600, which would take up a large space and result in tedious maintenance for the crew. The SEM-SAFE® low-pressure CO_2 system from Danfoss was chosen because of the technical know-how of the Marine Division and extensive reference list for low-pressure CO_2 systems.

The weight saving obtained by using the SEM-SAFE® low-pressure CO_2 system means the vessel can carry 6 containers extra, giving a significant increase in the revenue over the life time of the vessel.

Significant space saving with SEM-SAFE® for fire fighting

ENGINEERING
TOMORROW

SEM-SAFE® low-pressure CO_2 system

System description

The system used on board CMA CGM Benjamin Franklin is a low-pressure CO_2 system containing 27.8 tons of liquid CO_2, which is kept at a temperature of -18°C and a pressure of 20 bar by the 2 completely independent cooling units. (According to IMO SOLAS, the cooling system must be fully redundant).

Due to the high quality in design and manufacturing, these units run only an average of three hours per day. Furthermore the special insulation of the tank will maintain a stable temperature for approx. 48 hours without cooling.

As the first company in the world, Danfoss overcame the technical challenges involved with designing a low-pressure CO_2 system complying with class requirements to supply 85% of the calculated CO_2 concentration within 2 minutes for engine rooms of this size (38,000 m^3). Danfoss designed the system with three diptubes compared to the standard one. This posed another issue – what will happen to the internal pressure in the tank if three large valves were to be opened at the same time. Based on the many years' of experience of working with low-pressure CO_2 fire fighting, Danfoss found the solution in the form of the N2 booster unit, which was developed in cooperation with Force Institute.

As the keel laying of CMA CGM Benjamin Franklin was done after July 1, 2014, it was necessary to take MSC 339 (91) into consideration. The main challenges in this resolution is the time limit for release to cargo holds and the fact that it must be possible to make 1/3, 2/3 and full release based on the degree of filling in cargo hold. Taking security measures seriously and in order to live up to the time limit for release, Danfoss designed the system with larger distribution pipes, and therefore it was no longer possible to use the same pipes for smoke detection and release of CO_2.

CMA CGM had a desire to keep all release functions at the same location to avoid any excessive risks for the crew. As Danfoss values crew safety above all, a solution was found to design the system, with separate lines to all cargo holds, which results in a rather large manifold encompassing 12 distribution valves.

To simplify installation work, Danfoss included all these features on the same single frame, This greatly reduces any risk of making mistakes, as all components are pre-installed/wired and tested in the Danfoss workshop prior to shipment.

The high quality single skid mounted SEM-SAFE® low-pressure CO_2 system from Danfoss.

SEM-SAFE®

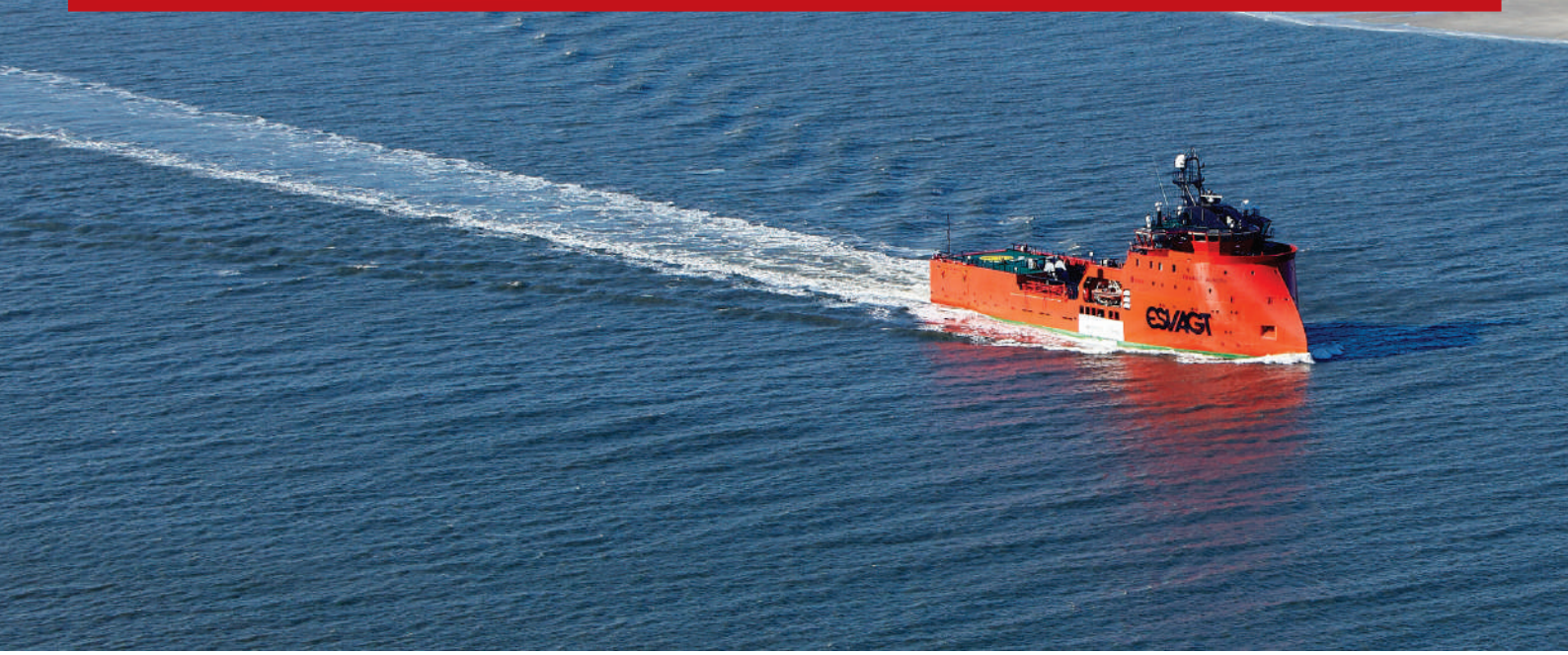
Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING TOMORROW

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

Reliable fire fighting on Esvagt Aurora

Danfoss Fire Safety A/S



SEM-SAFE® high-pressure water mist system was put to the test when fire broke out.

The Vessel Esvagt Aurora, a 87M Field ERRV (Emergeny Rescue and Recovery vessel), Ulstein X-bow design SX123, was built by the Spanish shipyard "Zamacona" and delivered to Danish shipowner "Esvagt A/S" in 2012. Esvagt A/S, a partly Maersk-owned company. Esvagt has a long tradition for using the SEM-SAFE® high-pressure water mist system from Danfoss and therefore the choice of fire fighting system was easy.

All Esvagt vessels are purpose-built for a variety of rescue operations, and an essential and mandatory focus area is therefore ship safety and the quality and operation of the installed fire fighting system.

System Description
The SEM-SAFE® system protects the engine room with both a total flooding - and local application water mist system. In addition to the system class requirements, a system with a back-up unit for emergency operation in case of total black-out has been developed in close corporation with Esvagt. The vessel is classed by DNV and DMA.

Mr. Kristian Ole Jakobsen COO at Esvagt A/S explains:
"By teaming up with Danfoss, we have together developed a state-of-the-art fire fighting system, which provides increased safety for our crews and vessels - a focus area which is an imperative request for us."

ENGINEERING
TOMORROW

SEM-SAFE® high-pressure water mist system

Fire broke out

11th October 2012, Esvagt Aurora unfortunately experienced an incident with leaking marine diesel oil which was dripping at a hot exhaust pipe of one of the diesel gensets, which led to a potentially ship-wrecking fire. The crew detected the fire and released the SEM-SAFE® high-pressure water mist system manually. In 2 minutes the fire was completely extinguished by the SEM-SAFE® high-pressure water mist system.

Mr. Kristian Ole Jakobsen continues:

"All onboard the vessel were very impressed by the capability and efficiency of the SEM-SAFE® high-pressure water mist system. The fire was extinguished in very short time and there is absolutely no doubt that the SEM-SAFE® system works and we fully trust its safety and reliability. Another major advantage is that we live-test the water mist system every month, and the crew is therefore fully aware of how to operate the system – AND that you are able to release the system without any prior precautions."

If the fire had not been detected by the crew, the automatic function of the SEM-SAFE® system would have released the system and extinguished the fire automatically.

After the fire was extinguished, the vessel sailed to port to check all functionalities, but the vessel could easily have continued operations without interruptions or jeopardizing the safety of the vessel.

Esvagt Aurora, protected by SEM-SAFE® high-presure water mist for fire fighting from Danfoss.

SEM-SAFE®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING TOMORROW

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

M/V **Olympic TBN**

Easy choice of fire protection system

Danfoss Fire Safety A/S

The vessel M/V Olympic TBN was built by the Norwegian shipyard Ulstein Verft A/S for Olympic shipping. Both Ulstein and Olympic had previously used the SEM-SAFE® high-pressure water mist system from Danfoss, and therefore the choice of fire fighting system was easy.

Project manager at Olympic Shipping A/S, Mr. Harald Hansen:
"We like the principle with water as extinguishing medium which is already available onboard. It is also positive that seawater can be used in case of low fresh water level and the extra back up by means of the bottle bank, which is intended for use in case of black out. Furthermore, the SEM-SAFE® system has a high safety level that rules out failures, and the system is easily operated."

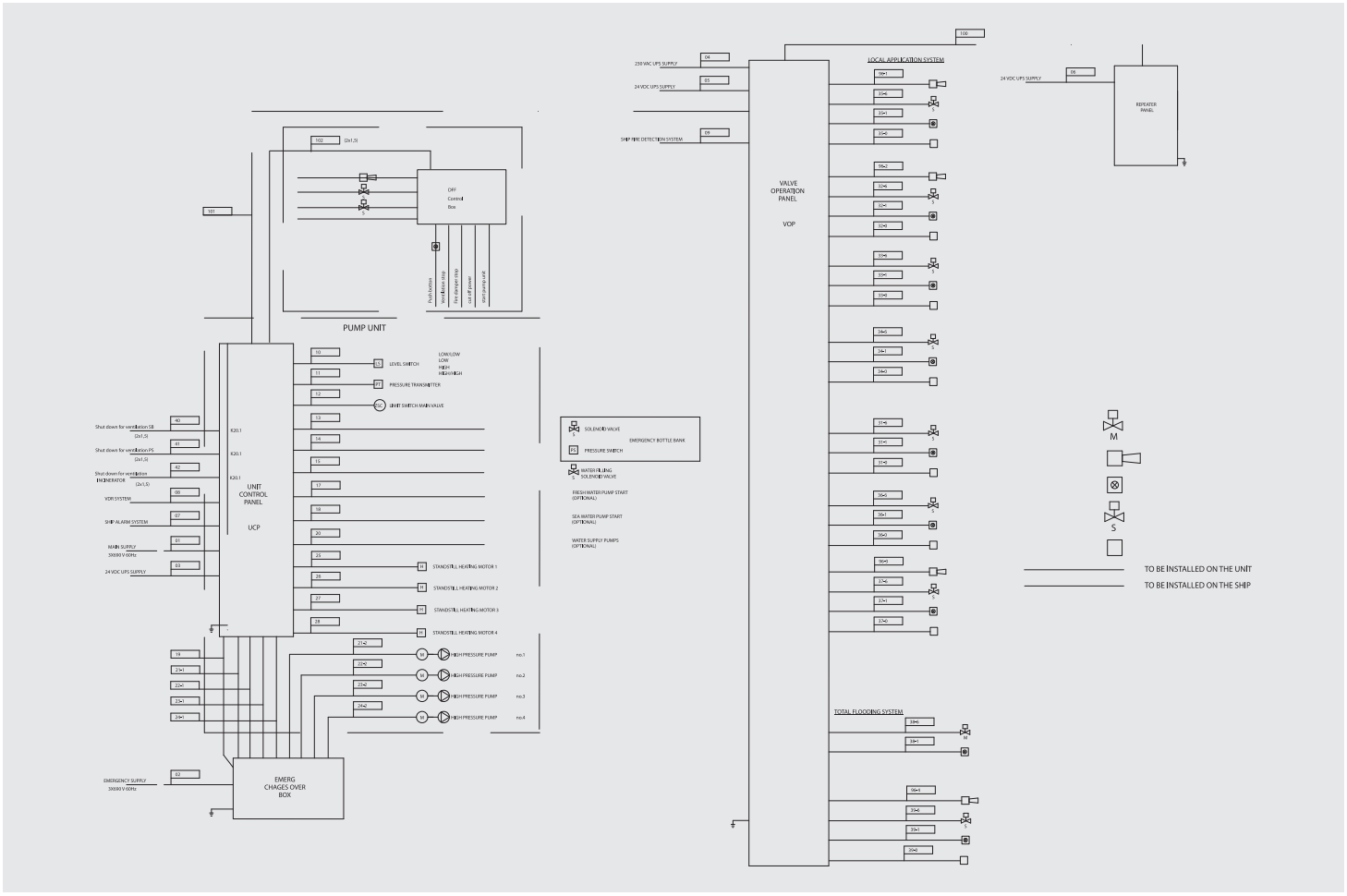
Through a series of projects, Ulstein Verft A/S and Danfoss have established a close cooperation with mutual understanding of the requirements of a water mist system, which not only has to be class approved but also easily accessed and operated. Danfoss not only delivers but also installs SEM-SAFE® systems at Ulstein Verft A/S, which means that the shipyard can concentrate on other installations. Upon completion, a service engineer goes through the entire system, and a commissioning with attendants from the shipyard, shipowner and class surveyor is performed.

ENGINEERING
TOMORROW

SEM-SAFE® high-pressure water mist system

The SEM-SAFE® water mist system was installed at the Multifunctional Platform Supply Vessel (MPSV) M/V Olympic TBN in 2008. The type of fire protection installed on the 4,900 tonnes deadweight vessel is total flooding in main engine room, inclu-ding bilge and casing plus switchboard room. In addition, local protection systems have been installed for each of the four main engines, fuel oil separator, boiler and incinerator. In total, 115 nozzles have been installed.

The 2,000x900mm pump unit consists of three main PAH 63/22kW pumps and one standby with a capacity of 318 l/min. Emergency change over box according to DNV rules. The bottle bank has a capacity of 1 minute water discharge in case of black out.



SEM-SAFE®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING TOMORROW

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

INS Vikrant

The largest warship and first aircraft carrier to be built in India, protected with a SEM-SAFE® high-pressure water mist system

Danfoss Fire Safety A/S

Cochin Shipyard Limited in India is building an aircraft carrier for the Indian Navy. The vessel named "INS Vikrant" formerly known as Project 71 Air Defence Ship (ADS) or Indigenous Aircraft Carrier (IAC) is scheduled for delivery in 2018.

The aircraft carrier displaces about 40,000 metric tons, is 262 metres long and has a tailored air group of up to thirty aircraft. It is powered by four gas turbines on two shafts, generating over 80MW of power. INS Vikrant will have capacity for a crew of 1,600 people. Upon completion, INS Vikrant will be the biggest warship ever built by Cochin Shipyard Limited. It has two take-off runways and a landing strip with three arrester wires, capable of operating STOBAR aircrafts including the indigenous LCA, as well as a range of helicopters.

The engine rooms of INS Vikrant are protected by the SEM-SAFE® high-pressure water mist system for fire fighting from Danfoss combined with a bilge foam protection system.

ENGINEERING
TOMORROW

SEM-SAFE® high-pressure water mist system

SEM-SAFE® high-pressure water mist is the optimum solution for the fire protection of engine rooms on INS Vikrant. The machinery space is protected by a dry pipework system with manual activation.

SEM-SAFE® is a high-pressure water mist based fire fighting system that utilizes micro-droplets released through nozzles in protected areas. It comprises a high-pressure modular pump unit, section valves to operate designated areas, piping and water mist nozzles.

Benefits of SEM-SAFE®

As soon as a fire is detected, the SEM-SAFE® system is activated. In comparison with traditional gaseous systems, the SEM-SAFE® system does not require crew evacuation prior to release. High-pressure water mist has excellent fire suppression properties against the range of fuels that can be found in machinery spaces. It cools the fire and simultaneously starves the fire from oxygen. Fire is prevented from spreading, making the system reliable and efficient. There is close to no water damage, making the post clean-up fast.

But most important, it keeps the navy vessel running as there is no downtime. In case of discharge, the SEM-SAFE® system does not require stopping operations on the ship in order to recharge the system. SEM-SAFE® is ready for re-use immediately after the first release. 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 INS Vikrant against fire, with reliability, low maintenance cost and crew safety in mind.

For protection of the bilge area, the customer has selected an AFFF (Aqueous Film-Forming Foam) system, also supplied by Danfoss.

Approvals and tests

The frame of the system is made of special reinforced material in order to resist shocks and vibrations.

The control panel of the SEM-SAFE® system complies with the standards for electromagnetic compatibility (EMC) and electromagnetic interference (EMI).

The SEM-SAFE® high-pressure water mist system has been designed in accordance with MIL-S-901D for Shock, MIL-STD-461F for EMI/EMC, MIL-STD-167/1A for Mechanical Vibrations, MIL-F-24385(F) for AFFF, IMO MSC/Circ. 1385 and IMO MSC/Circ. 1165 for E/R protection.

With the specially designed unit, Danfoss has performed multiple CFD simulations, where the unit had to perform in various scenarios. All criteria were successfully met.

SEM-SAFE®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING TOMORROW

Luxury yachts

Optimum fire protection for luxury yachts with **SEM-SAFE®** high-pressure water mist system

Danfoss Fire Safety A/S

History

The SEM-SAFE® high-pressure water mist system is a highly efficient fire fighting system for luxury yachts.

The SEM-SAFE® system is a true high-pressure water mist system operating at a 100 bar nozzle pressure. Its unique spray technique is very efficient in fire fighting for both accommodation, service areas, duct, deep fat fryers and as total flooding and local application systems for engine rooms.

The unique high-pressure technology, with probably the best spray system available anywhere, provides efficient fire fighting in spite of its very low water consumption. Consequently, a fire can be extinguished without causing serious water damage to furniture or equipment.

In addition, the low water consumption makes it possible to use very small pipes; typically, 28 mm main pipes and 10 mm distribution pipes. This means that the piping is easily installed and also easily hidden. The low weight and small dimensions, in conjunction with the beautifully designed nozzles, very often make the SEM-SAFE® system the preferred choice of architects and owners.

Yards and fitters like the system's easy installation, with its modular format, compact pump skids and the SEM-SAFE® installation system.The modular pump skid system offers great flexibility in fitting the pump units into the available space during construction. The flexibility of the system also includes specific nozzle designs and other customer based demands.

ENGINEERING
TOMORROW

SEM-SAFE® high-pressure water mist system

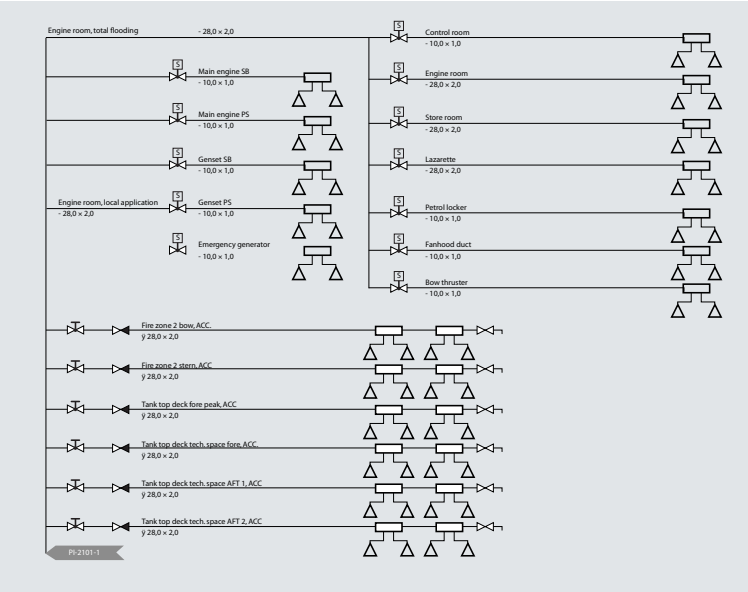
The SEM-SAFE® system is a total protection system for yachts, and conforms to the regulations IMO A 800 (19) and MSC/circ. 265 (84) for accommodation areas, IMO resolution MSC/circ. 1165 for engine rooms, IMO resolution MSC/circ. 1387 for local application, deep fat fryer and duct. All areas are served by a common pump unit.

The system consists of a pump unit, which serves all areas via section valves. In accommodation areas, the nozzles are activated only if the heat-sensitive glass bulb is broken. Full pressure is then activated and only nozzles with a broken bulb are released. Consequently, only the heat-affected area will be actively sprayed.

Engine rooms are covered by open nozzles for both local application and total flooding, which means that the nozzles in one section will be activated, either manually (for total flooding and local application) or by a detection system (for local application only). The fine mist created by the high pressure is so gentle to the hot surfaces and electrical equipment that there are no reasons to worry about major water damages if the system is released.

Approval levels and experience

Danfoss has gained valuable experience in the yacht market, where we have provided many specialised solutions.
SEM-SAFE® solutions are approved by all major classification bodies.



A typical SEM-SAFE® high-pressure unit fitted to yacht applications.

SEM-SAFE®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING TOMORROW

Marine application | SEM-SAFE® high-pressure water mist system

Reliable fire fighting in **accommodation areas**

Danfoss Fire Safety A/S

As one of the world's few manufacturers, Danfoss can offer protection of your accommodation areas with a true high-pressure water mist system approved to IMO A 800 and IMO resolution MSC/circ. 265.

The SEM-SAFE® high-pressure water mist system has an advantage over traditional sprinkler systems in that it uses only approx. 20% of the amount of water to cover a given area.

In addition, reduced pipe dimensions mean a considerable reduction in weight and allows installation in smaller spaces. As a consequence of the small pipe dimensions, installation is very easy and Danfoss has developed a fitting system making installation even easier.

If you experience accidental releases in public areas or cabins, the very low water quantity means that water damage is limited.

The nozzles used in accommodation areas are usually the closed type with a glass bulb that breaks at a set temperature. On stand-by, the system maintains only a low pilot pressure.

In addition, it is possible to integrate total flooding and local application fire fighting system to the same pump unit.

www.semsafe.danfoss.com | **SEM-SAFE®**

ENGINEERING
TOMORROW

SEM-SAFE® high-pressure water mist system

High-pressure water mist is water that, at a high-pressure of 100 bar, creates a fine mist. The fine water mist evaporates very quickly and the resulting steam starves the fire of oxygen, suppressing it. At the same time, the water evaporation creates the most efficient form of cooling. In this way, the fire is extinguished both by oxygen suppression and cooling, providing the advantages of both water and gas-based fire fighting.

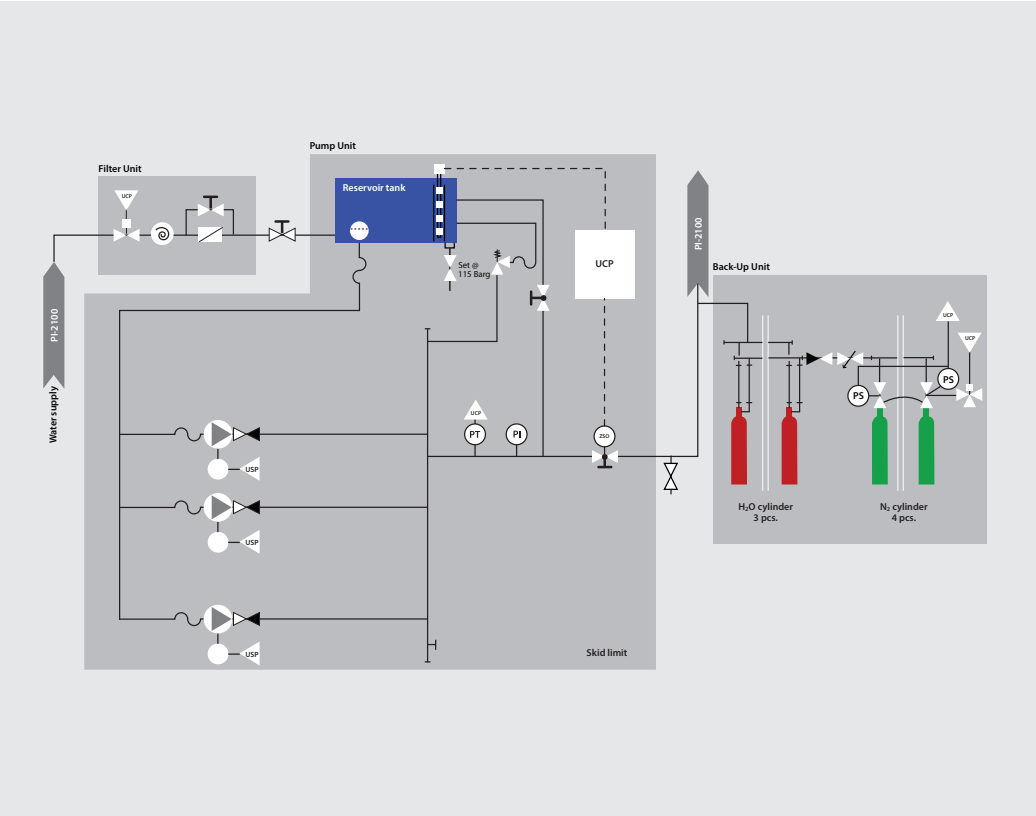
High-pressure systems only create high-pressure during extinguishing. High-pressure water mist will cool the areas around hot surfaces, and the water mist evaporates before it reaches the hot metal. In this way, shock cooling and changes in metal structures can be avoided.

Danfoss has been working with high-pressure water mist from the very beginning. This revolutionary system is finding its way into more and more application areas, offering an efficient system that is environmentally friendly as well as harmless to users.

Approval levels and experience

So far, our high-pressure water mist system is probably the world's most efficient system for accommodation and service areas. SEM-SAFE® systems have undergone extensive testing at the Sintef laboratory and have been found to meet all the requirements of the IMO regulations.

Today, we have the approval of all major classification societies.



Press fittings and section valve for the accommodation area.

SEM-SAFE®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING TOMORROW

Marine application | SEM-SAFE® high-pressure water mist system

Local application system for fire fighting

Danfoss Fire Safety A/S

The SEM-SAFE® high-pressure local application system for engine rooms is a well-proven, highly efficient and easy to install high-pressure water mist system that complies with IMO resolution MSC/circ. 1387.

Thanks to its flexibility, the standard system – which includes a detection and release system – is easy to set up to suit almost any requirement. The total cost of the system is low due to the small pipe dimensions, small number of nozzles, large coverage, very low water consumption, compact skid and the simple design.

In case of release, the SEM-SAFE® high-pressure water mist is extremely efficient in fire fighting and, in addition, is documented to be harmless to electrical installations with protection IP 23. The water mist itself is pure, fresh water under a minimum pressure of 100 bars at the nozzle heads.

ENGINEERING
TOMORROW

SEM-SAFE® high-pressure water mist system

The SEM-SAFE® high-pressure water mist system for local application is a fire fighting system for hazardous areas as described in IMO resolution MSC/Circ. 1387, main and auxiliary engines, boiler fronts, oil separators and incinerators.

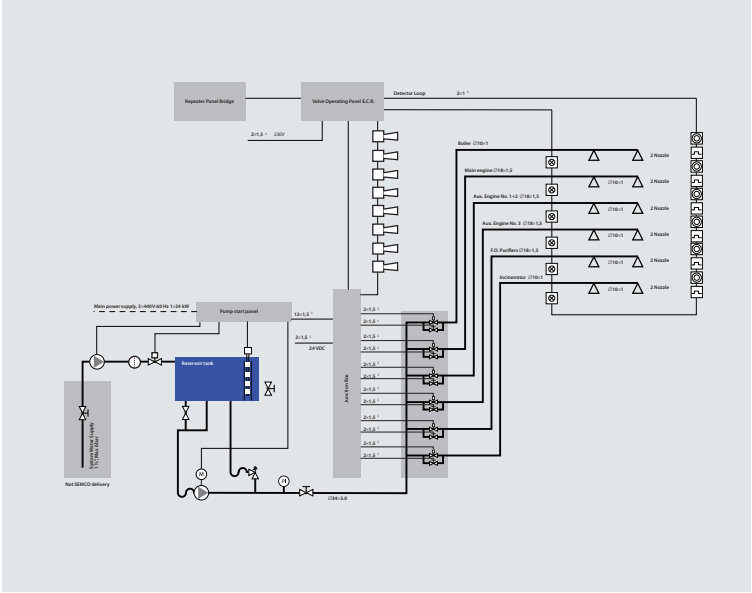
For unattended engine rooms, an addressable detection, alarm and release system should be installed. The system must be assessed in conjunction with the total protection system for the engine room, whether this is a gas, foam, or water mist system for total flooding.

The system consists of a pump unit skid with an electrical panel, ready for connection to the power and water supply. Section valves are remotely operated for each object that requires protection. The system comes with all nozzles, pipes and fittings, main lines, detection heads and alarm units for each section.

Approval levels and experience

The system is approved by all major classification bodies. The SEM-SAFE® high-pressure water mist local application system was one of the first systems on the market, even before the IMO 913 was defined. Consequently, it has a proven service record. In addition, the system was not designed just to comply with the test criteria of 913, but on the basis of real life experience, with a proven record of stopping one fire incident on a passenger ferry in a surprisingly short time with remarkably little damage to the engines and electrical installations.

Another advantage of the high pressure water mist system is that damage by shock cooling of, for example, cast parts is avoided.



SEM-SAFE®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING
TOMORROW

Marine application | SEM-SAFE® high-pressure water mist system

Reliable fire fighting in **engine rooms - total flooding**

Danfoss Fire Safety A/S

As one of the world's few manufacturer, Danfoss can offer protection of your engine room with a true high-pressure water mist. The design is according to the requirements in IMO resolution MSC/circ. 1165.

It can replace Halon or can be used as a substitute for traditional CO_2 systems. Our total flooding system with high-pressure water mist is based on pure water without any additives at all. The advantage of the SEM-SAFE® system is that the very small quantities of water it uses are harmless to personnel and equipment.

Even electrical equipment is left undamaged, provided that protection is better than IP 23.

It is possible to integrate fire fighting of local application and accommadation from the same pump unit.

www.semsafe.danfoss.com | SEM-SAFE®

ENGINEERING
TOMORROW

SEM-SAFE® high-pressure water mist system

High-pressure water mist is water that, at a high-pressure of 100 bar, creates a fine mist. The fine water mist evaporates very quickly and the resulting steam starves the fire of oxygen, suppressing it. At the same time, the water evaporation creates the most efficient form of cooling. In this way, the fire is extinguished both by oxygen suppression and cooling, providing the advantages of both water and gas-based fire fighting.

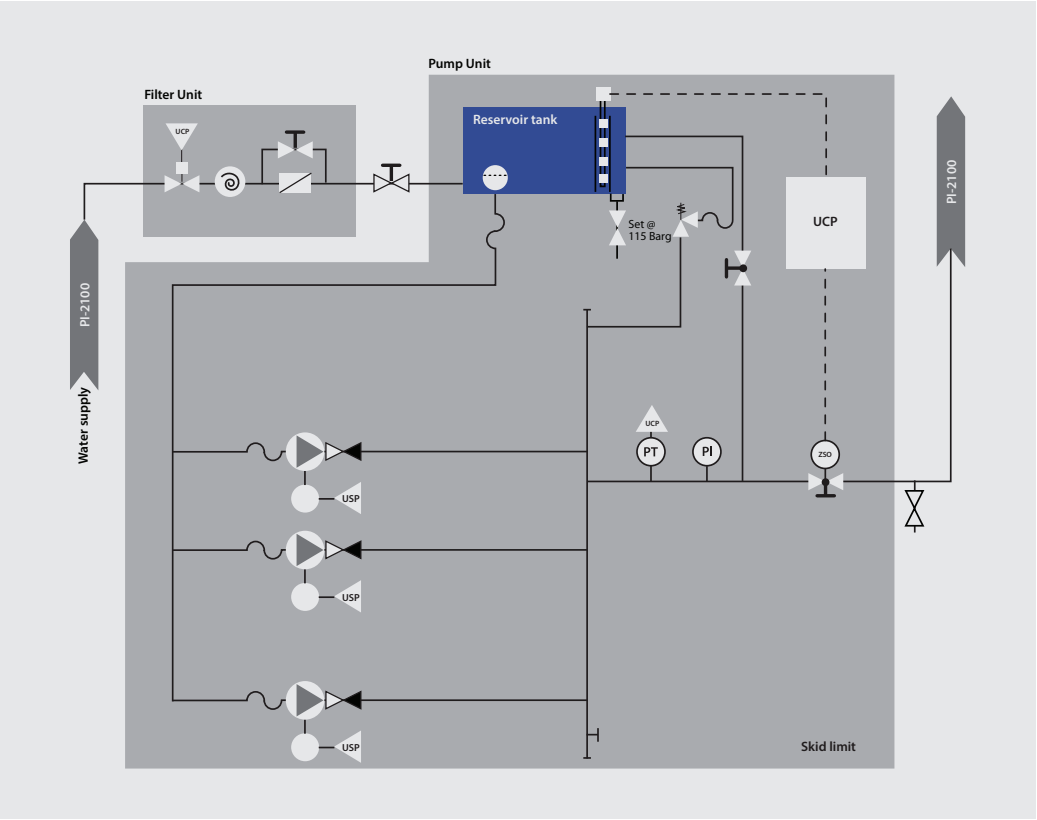
High-pressure systems only create a high pressure during extinguishing. High pressure water mist will cool the areas around hot metal surfaces and the water mist evaporates before it reaches the hot metal. In this way, shock cooling and changes in metal structures can be avoided.

Danfoss has been working with high-pressure water mist right from the start. This revolutionary new system is finding its way into more and more application areas, offering an efficient system that is environmentally friendly as well as harmless to users.

Approval levels and experience

We have already seen fires being almost instantly extinguished by the system after its release, thus saving repair costs and off-hire periods.

The SEM-SAFE® system is approved by all major classification societies.



Typical arrangement of section valves in an engine room.

SEM-SAFE®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING
TOMORROW

Service brochure

Global Service of fixed fire fighting systems on all types of vessels

Danfoss Fire Safety A/S

Service experts

using manufacturer approved spare parts

www.semsafe.danfoss.com | SEM-SAFE®

Servicing the smart way

Manufacturer approved service ensures high safety at low cost
The Service Department at Danfoss Fire Safety provides service, spare parts and technical support for ship owners and vessels worldwide.

Experience shows that periodic service carried out by the manufacturer or the approved service partners and the use of manufacturer approved spare parts is the best way to keep your fire fighting system in good operating condition at the lowest possible life cycle cost.

Fixed price service agreements for budget predictability
Regardless of whether you operate your own vessels or do so on behalf of others, a firm budget is essential for keeping costs under control.

Danfoss Fire Safety offers service contracts with fixed service prices. There are no additional costs, and price transparency is guaranteed. This means you always know what your servicing costs will be during the contract period.

Notification service facilitates advance planning
Danfoss Fire Safety keeps track of the due dates for servicing your fire fighting system. Well in advance, you will be contacted by one of our service planners and notified of the upcoming service.

Together we can plan the most convenient location for the service, taking the vessel's schedule into account.

Technical support ensures correct solutions
Do you need spares, but you don't know exactly which ones? Do you have a problem and can't find the cause? Our technical support staff are ready to assist you with issues like these, and many more. In addition, we have an extensive documentation database to help us to track down the components and spares you need.

Technical Supervisor performing service on a SEM-SAFE® high-pressure water mist system

Danfoss Fire Safety annual service on a SEM-SAFE® low-pressure CO_2 system

Advanced professional service: Looking after the essential details

Protect the value of your fire fighting system

Increase the lifetime of your system
By choosing Danfoss Fire Safety as your service provider, you are choosing the best possible care for your fire fighting system.

You can rest assured of properly functioning fire fighting equipment and systems thanks to comprehensive periodic service performed by our qualified Technical Supervisors. By dealing promptly with any potential minor deficiencies in your fire fighting system, we can help you avoid larger expenses and problems later on.

Familiarisation of vessel crew
Our Technical Supervisors have in-depth knowledge of the various systems we deliver.

When on board for carrying out service, they are always willing to share their knowledge with the crew and talk them through the operation of the system. This is a good way to enhance safety on board.

With Danfoss Fire Safety, you are assured of a full overview of the operational status of your fire fighting system after completion of service.

Emergency support 24/7/365
When you have a service agreement with Danfoss Fire Safety, you have access to our 24/7/365 hotline, where you can get the assistance you need for any emergency.

You can also contact our Service Department at our dedicated e-mail address:
firesafety.service@danfoss.com

Worldwide service
We consistently strive to deliver the best possible service. We have a global presence, but we act locally.

Our dedicated specialists are ready to help you arrange any service necessary to ensure your fire fighting system is working properly.

Our global service network ensures that you receive assistance promptly, no matter where you are.

Highly skilled service staff
All of our Technical Supervisors are highly trained and have the knowledge and expertise necessary to assist you with any service you need for your fire fighting system. They bring the right set of specialist tools designed for servicing Danfoss Fire Safety equipment.

Danfoss Fire Safety is a reliable service provider with DNV and Lloyds accreditation.

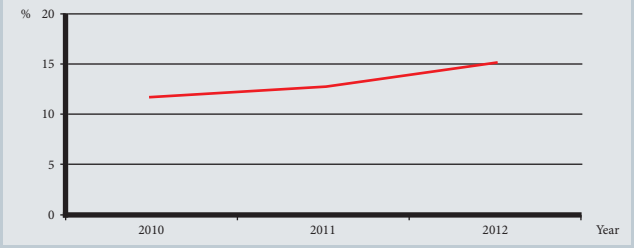
Original spare parts
When you purchase your spare parts from Danfoss Fire Safety, you benefit from direct access to original spare parts.

The spare parts we supply to you are the same as we use in production and for service. You are thus assured of receiving parts that fit perfectly with your equipment and will not impair the safety or lifetime of your equipment.

Our Service Department has access to original drawings and specifications, so they can ensure that the parts you receive are the right ones for your fire fighting system.

PSC statistics
The Port State Control statistics of the Paris MOU clearly show that deficiencies related to fire safety are the most common shortcomings found on inspected vessels. Delays due to fire safety deficiencies are costly and can be avoided by choosing an approved service provider such as Danfoss Fire Safety. That minimises your operational downtime.

Percentage of deficiencies related to fire safety



Source: Paris MOU on Port State Control

ENGINEERING
TOMORROW

Total Solution Provider of Certified Fixed Fire Fighting Systems

Danfoss Fire Safety A/S, 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 an 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

SEM-SAFE® high-pressure water mist is the optimum fire fighting solution for any building and ship 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 sprinklers.

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.

Whether 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 marine sector we offer the SEM-SAFE® high-pressure water mist system for fire fighting and the SEM-SAFE® low-pressure CO_2 system for fire fighting.

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 Fire Safety is close by

Danfoss Fire Safety 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®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING
TOMORROW

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 | 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

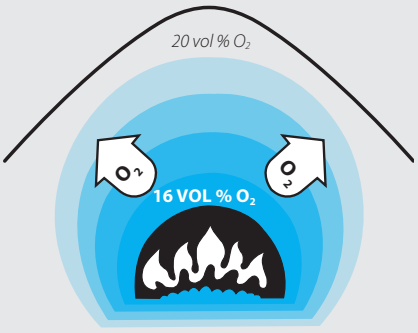
High-pressure water mist

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.

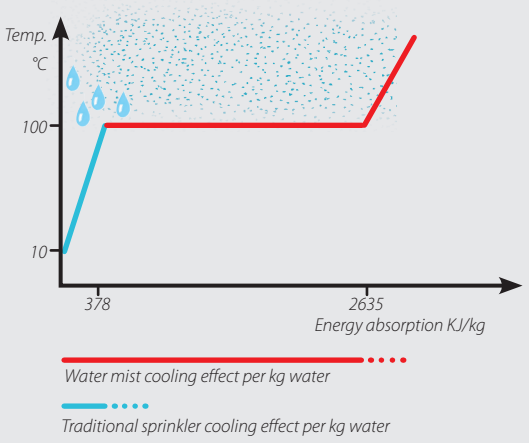


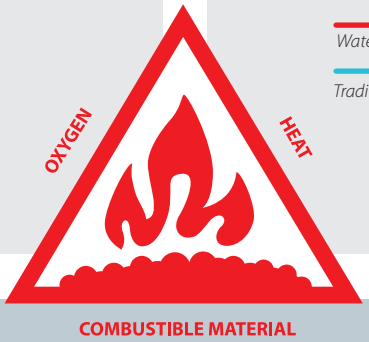
Heat

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.

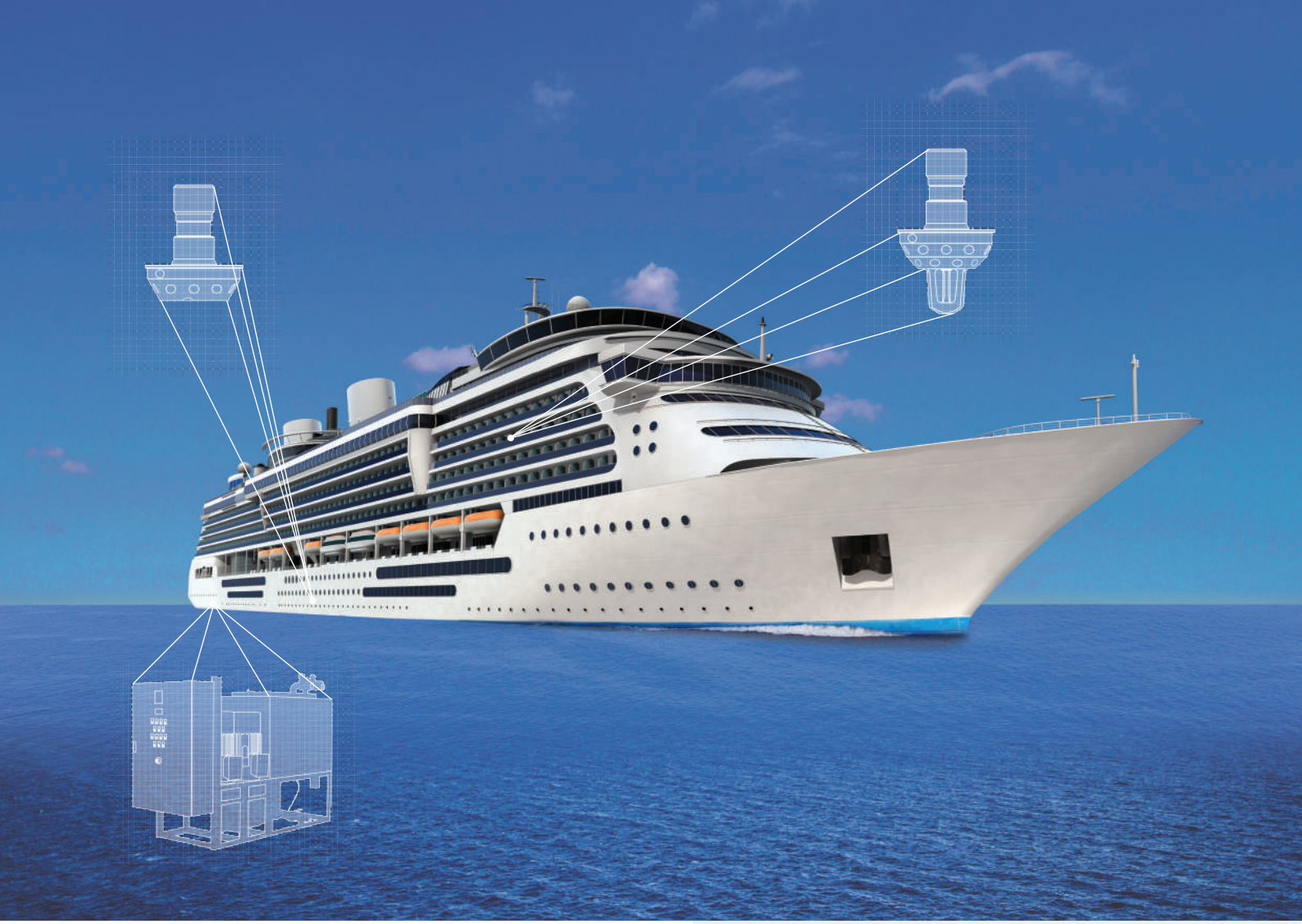
That's why high-pressure water mist cools more efficiently per litre of water: up to seven times better than can be obtained with one litre of water used in a traditional sprinkler system.





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 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 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 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.

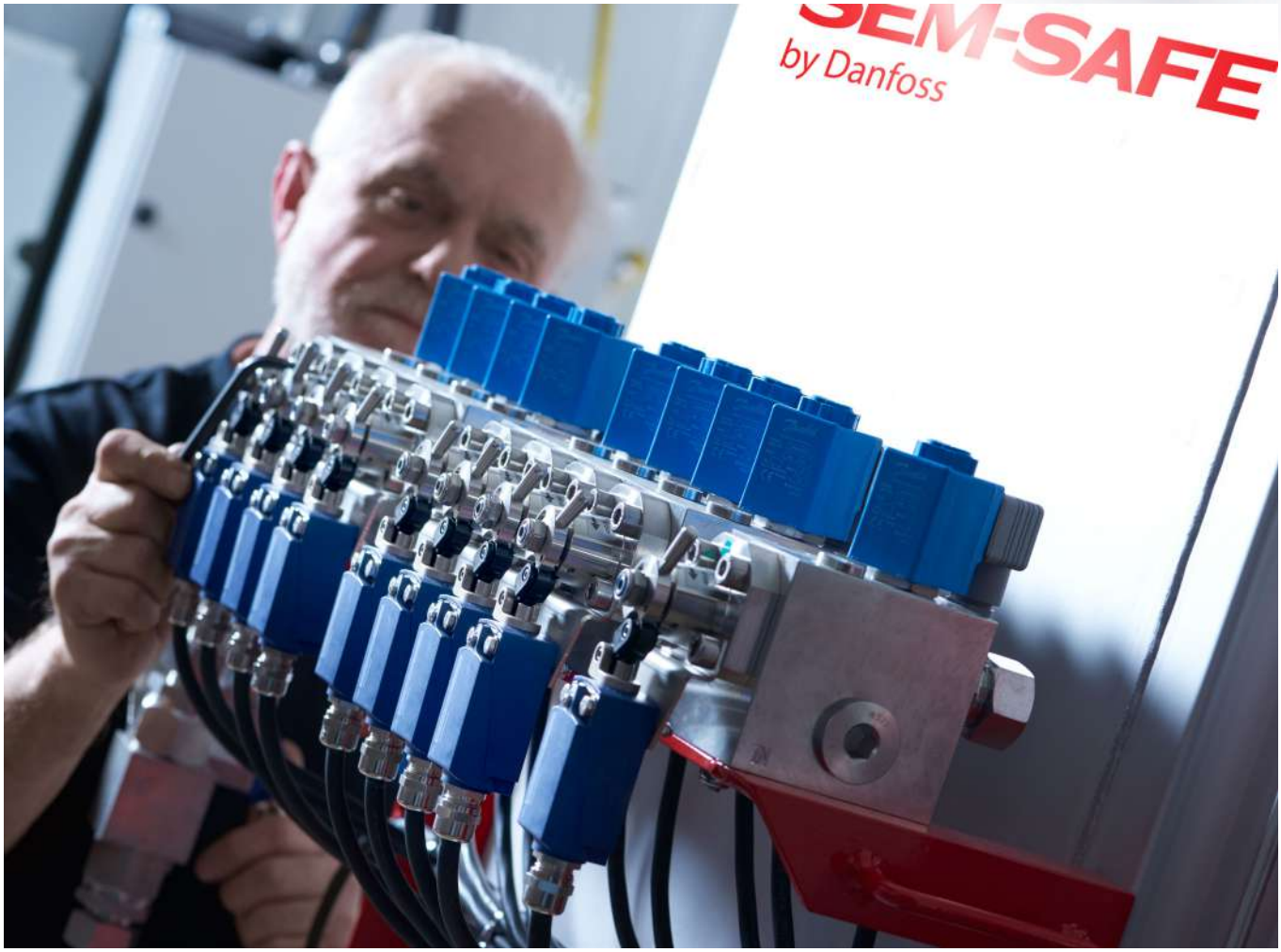
Benefits of SEM-SAFE®
high-pressure water mist system

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

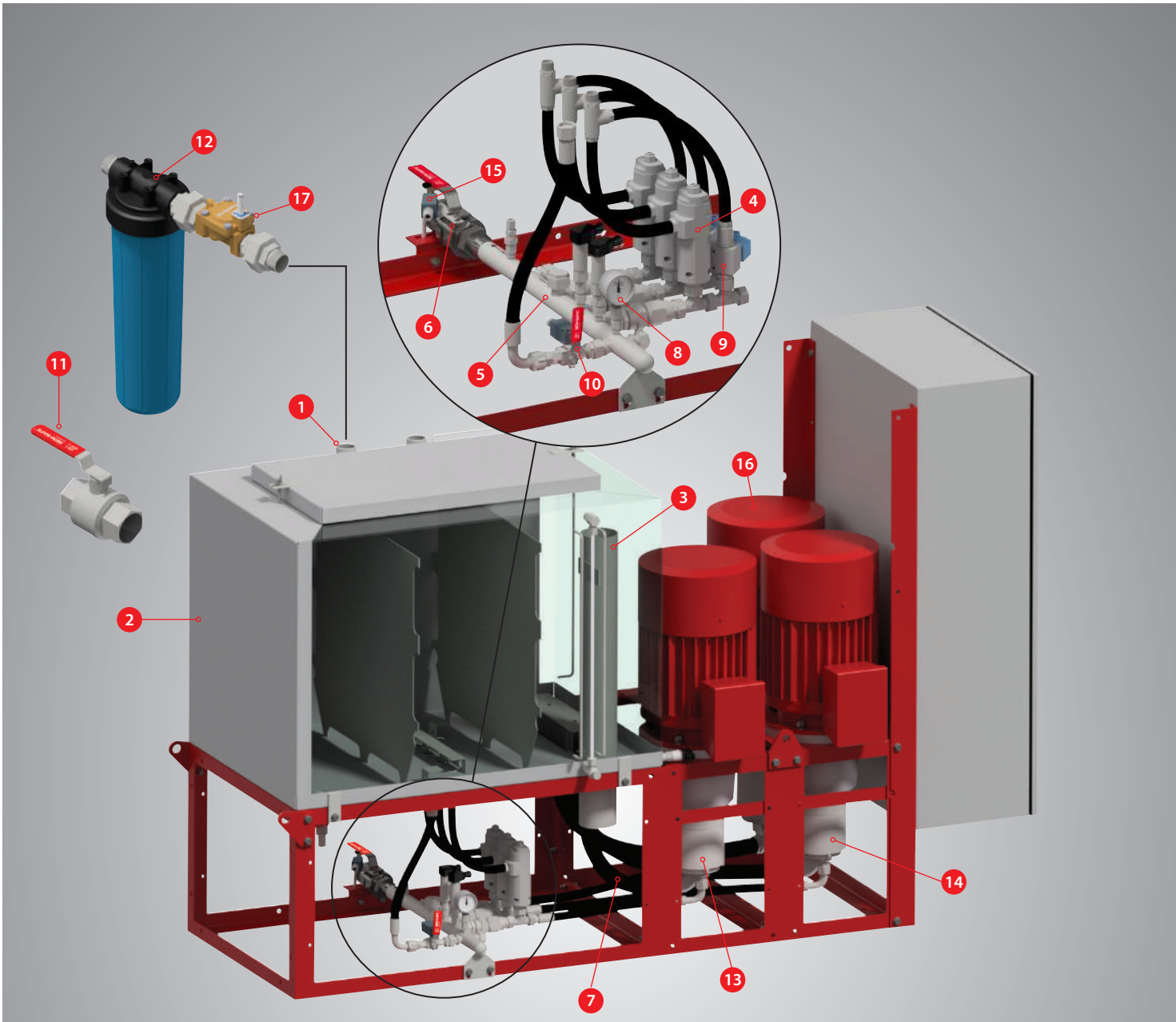
Less damage
- Water damage is kept at a minimum due to the low water consumption of the high pressure water mist system
- The SEM-SAFE® system can be deployed instantly, resulting in less damage
- Using only pure water, the SEM-SAFE® high-pressure water mist system gives you the best possible protection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

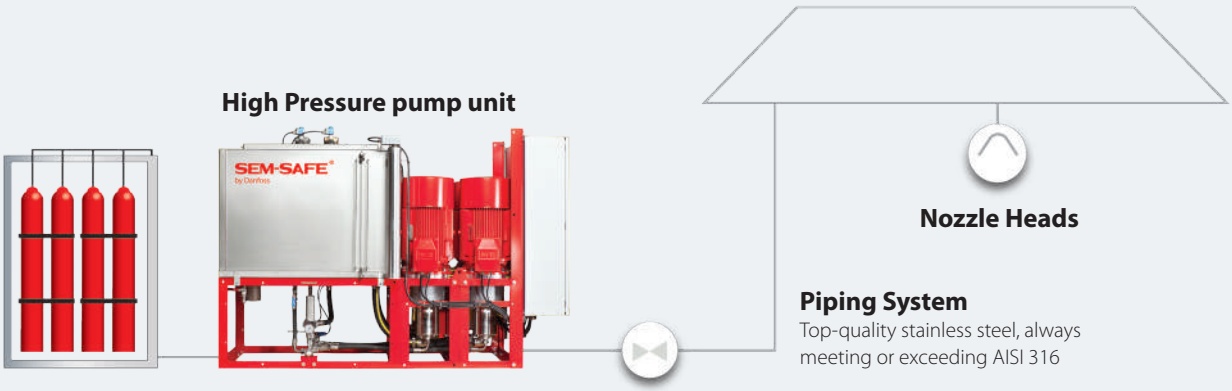
Pioneers of high-pressure water mist technology

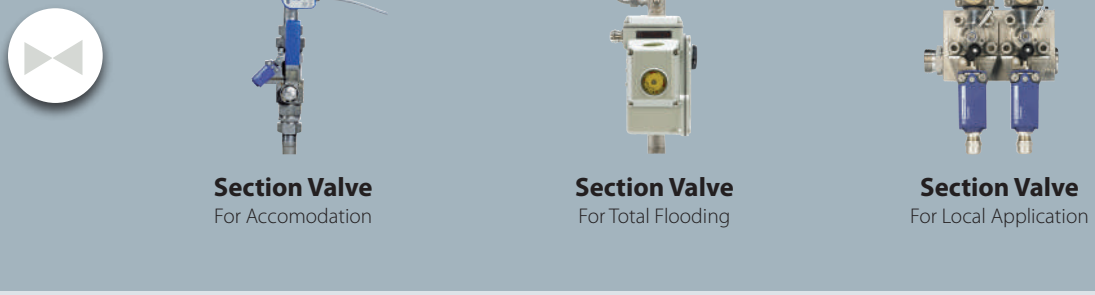
As one of the acknowledged pioneers of high-pressure water mist technology, Danfoss is a leading force in the market.

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 fighitng 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.





Section Valve
For Accomodation

Section Valve
For Total Flooding

Section Valve
For Local Application

Closed Nozzle
For Accomodation

Open Nozzle
For Total Flooding and Local Application

Open Nozzle
For Bilge

ENGINEERING
TOMORROW

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®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING
TOMORROW

Marine & Offshore

SEM-SAFE® low-pressure CO_2 fire safety system

Danfoss Fire Safety A/S

Easy installation and low maintenance cost

www.semsafe.danfoss.com | SEM-SAFE®

SEM-SAFE® low-pressure CO_2 fire safety system

The SEM-SAFE® low-pressure CO_2 systems are intended for use where large machinery and cargo spaces require protection with carbon dioxide. The advantage of the low-pressure system is that one single tank replaces a large number high-pressure CO_2 cylinders with an approximate saving of 50% in weight. The tank, main valves, distribution valves, refrigerators, cooling unit and associated controls are supplied prewired and ready assembled on a common steel frame.

The quantity of carbon dioxide is shown directly by an electronic gauge indicating the actual tons of CO_2 in the tank. The gauge unit is fitted with alarm contacts for warning of low CO_2 contents in the tank. Recharging after use is done directly from a truck.

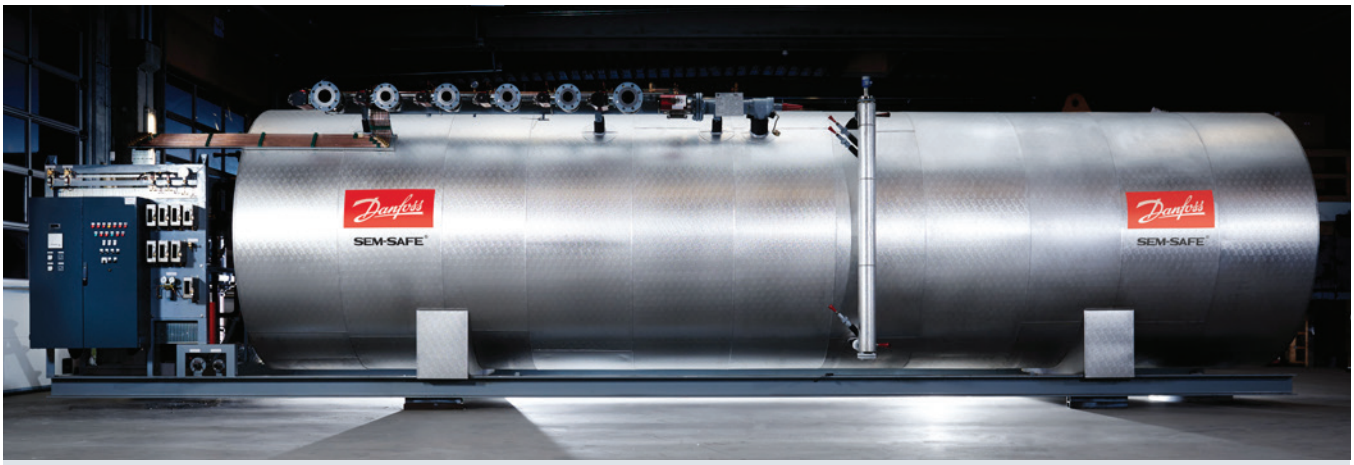
For large vessels the installation cost of a low-pressure CO_2 system is considerably lower compared to the installation costs of a high-pressure CO_2 system.

The system is designed to meet the requirements of the appropriate classification societies to which the vessel is being built.

Tank
The tank is constructed as a steel pressure vessel in accordance with the classification society requirements. The tank is equipped with two safety valves, which are fitted to a three way changeover valve, thus one safety valve is connected to the vessel if the other one is out of operation. The tank unit is supplied complete and ready for use, installed on a rectangular steel framework and held in position by thermally insulated supports. The tank is insulated with non-flammable polyurethane foam protected by an aluminium cover.

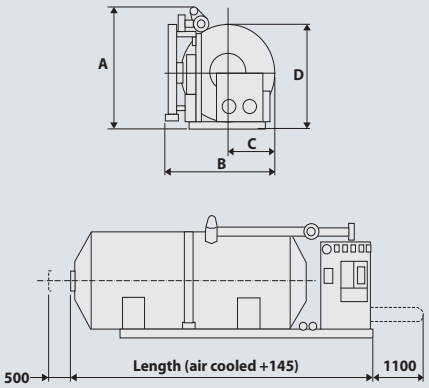
Cooling units
The cooling units are installed at the end of the tank on the support frame and are completely duplicated both mechanically and electrically. The refrigerant is environmentally friendly and the cooling circuits on the compressors and condensers are suitable for either seawater, fresh water or air-cooling. CO_2 is maintained at a temperature of –18°C, which is equivalent to a CO_2 storage pressure of 2.1 MPa.

CO_2 level indication
An electrical capacitance type liquid gauge is fitted and the meter is calibrated. The indicator has an accuracy of +/- 2% and is fitted with an alarm switch indicating minimum filling level.



Benefits
There are many benefits of the SEM-SAFE® low-pressure CO_2 system for fire safety compared to high-pressure CO_2 cylinders:

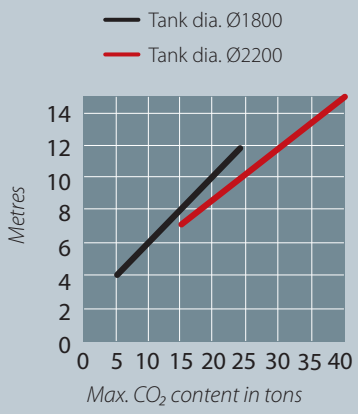
- Compact system with low complexity: one ready assembled and tested low-pressure CO_2 unit instead of hundreds of high-pressure CO_2 cylinders.
- "Plug & Play" installation.
- Low-maintenance cost: checking the content annually is done quickly and easy with low-pressure CO_2 unit as only one instrument needs to be read; high-pressure CO_2 requires time-consuming weighing of every cylinder and for many level indicators to be inspected.
- Lower system weight.
- Less space required: only 60m^2 for SEM-SAFE® low-pressure CO_2 unit compared to 150-300m^2 for high-pressure CO_2 cylinders.
- Easy installation and savings: between 100 and 200 man hours are required for the installation of the low-pressure CO_2 unit; installing high-pressure CO_2 cylinder can take between 400 and 1000 man hours.
- Fast re-filling after release: 12 man hours are needed for refilling a low-pressure CO_2 unit compared to 2,500 man hours required for high-pressure CO_2 cylinders.
- No need for pressure test after ten years.



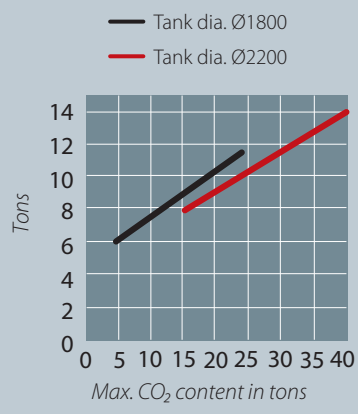
	TANK Ø1800	TANK Ø1900	TANK Ø2200	TANK Ø2400
A	2600 mm	2800 mm	3000 mm	3200 mm
B	2415 mm	2460 mm	2805 mm	3000 mm
C	1025 mm	1080 mm	1225 mm	1340 mm
D	2270 mm	2420 mm	2695 mm	2900 mm

Example of tank sizes

Length excl. air cooling



Weight empty



Controls

A pre-wired operating panel is installed at the end of the tank on the support frame, at which are grouped all controls and overload relays for the cooling units, tank pressure, level indicators, and various indicators and warning lamps. The panel is completely watertight and fitted with cable glands.

Valves and filling connections

The automatically operated main valve and distribution valves are ball valves fitted with manual override. The valves are sized so that the appropriate quantity of carbon dioxide will be discharged in accordance with the class requirements. To prevent ice formation on the valves, the main outlet pipe from the tank is located at the top of the tank as a continuation of the tank dip tube. The tank is filled by a truck through twin filling and balancing lines led from the tank to deck level port and/or starboard. Isolation valves and hose connections are fitted to these lines.

Release of carbon dioxide

Remote release of the required quantity of gas to a particular space is done from the release cabinets located as required. The release system utilises the CO_2 pressure from the tank to actuate the main valve and the distribution valve via a pressure-controlled valve, and these valves are arranged for remote operation from the release cabinets. When the appropriate quantity of carbon dioxide has been discharged, the main valve is closed automatically.

Distribution system

The distribution valve is connected to a computer-calculated piping system within the protected space and to which the CO_2 nozzles are connected. The piping is dimensioned so that the required quantity of gas will be discharged within the prescribed time and at no point in the piping system will the pressure fall below 10 bar which would cause freezing at the nozzles.

All designs and sizes are available on request.

Quality assurance

Danfoss 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-GL.

Our ongoing internal training programs make our employees – naval architects, sales engineers, project managers, service engineers etc. – fully qualified to handle our fire fighting systems for the marine industry. An important element is the use of an approved computer program for hydraulic calculations, which secures a quick and precise system design.

ENGINEERING
TOMORROW

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 wooden 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 sprinklers.

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. Whether 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 sector 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®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com

ENGINEERING
TOMORROW

Cruise ships

Reliable fire fighting for cruise ships with **SEM-SAFE®** high-pressure water mist system

Danfoss Fire Safety A/S

Safe return to port

www.semsafe.danfoss.com | SEM-SAFE®

Making cruise ships safer

The cruise ship industry is rapidly expanding, with more and more people choosing cruises as a preferred way to spend their holiday.

Cruise ships with capacity for thousands of passengers resemble floating cities which must function safely and efficiently both in harbour and at sea.

Ensuring passenger safety and the operation of the ship in case of a fire is a focus area for cruise ships, owners and operators. Dozens of fires occurred on cruise ships in the last 25 years. This places great demands on efficient fire fighting equipment as well as a well-trained crew.

There is a lot of advanced technology operating behind the scenes to ensure everything runs flawlessly.

Danfoss is constantly pushing boundaries for innovation in the pursuit of technological developments that make cruise ships safe, sustainable and competitive.

A safer tomorrow starts with SEM-SAFE®

The **SEM-SAFE®** high-pressure water mist fire fighting system from Danfoss uses micro droplets released through nozzles into protected areas.

It comprises a modular pump unit, valves, stainless steel piping and water mist nozzles.

SEM-SAFE® high-pressure water mist nozzles will activate immediately upon detecting a fire to ensure the best possible fire protection for passengers and crew on board the ship. Having a fixed high-pressure water mist system installed in the cruise ship will make the fight against fire more efficient with the ultimate goal of saving lives and limiting property damage.

The intelligent use of water for fire fighting on cruise ships

High-pressure water mist technology for fire fighting is one of the most effective means of handling fire on a cruise ship, whether it is in an engine room or a passenger cabin.

Through continuous research and development, Danfoss has pioneered the use of water for fire fighting and developed the **SEM-SAFE®** high-pressure water mist system for fire fighting on cruise ships.

The power behind SEM-SAFE® 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.

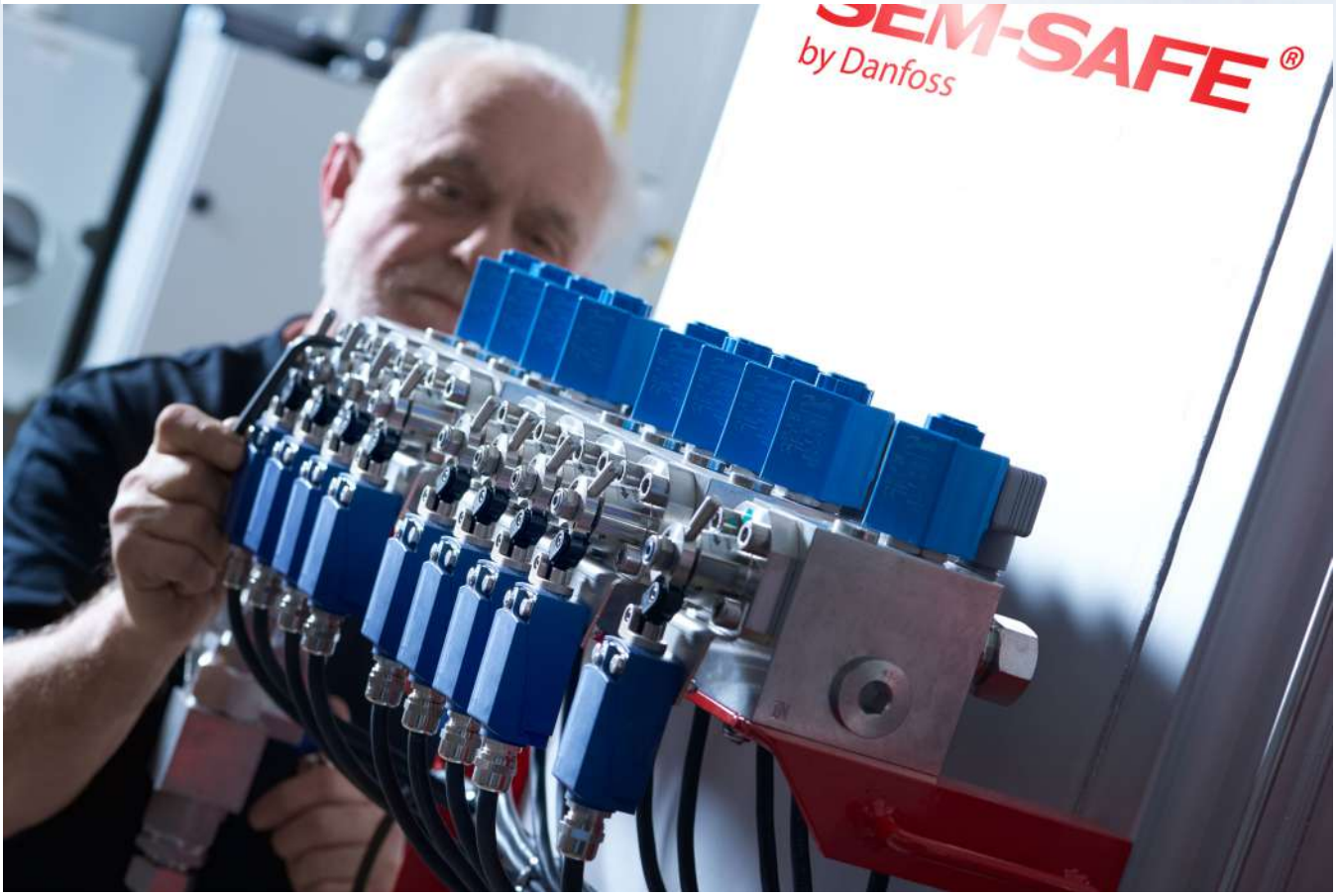
The **SEM-SAFE®** high-pressure water mist system goes further. It attacks two elements of the fire triangle: oxygen and heat. The uniqueness of high-pressure water mist is that it combines the suppression effect of gas and sprinkler systems.

As well as removing the oxygen like a gas fire suppression 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

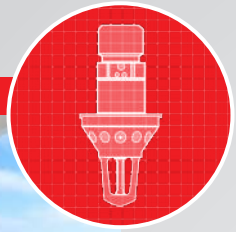
The **SEM-SAFE®** high-pressure water mist system is a unique fire fighting system. When water is forced through nozzles at high-pressure, a super-fine mist is formed that has a two-fold extinguishing effect. As well as cooling the fire like a traditional sprinkler, it simultaneously starves the fire of oxygen like gas fire suppression systems.

When the mist comes into contact with flames, it evaporates and expands a minimum of 1,700 times. The dense vapour created displaces the flames and quickly extinguishes the fire.

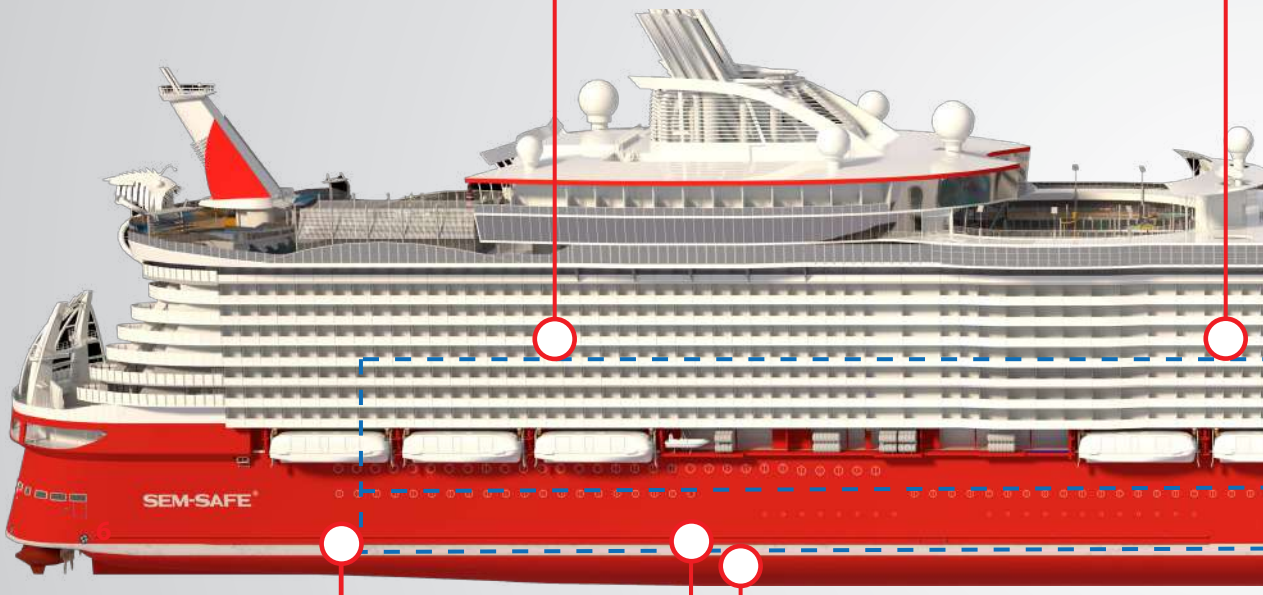


Total solution provider of fixed fire fighting system

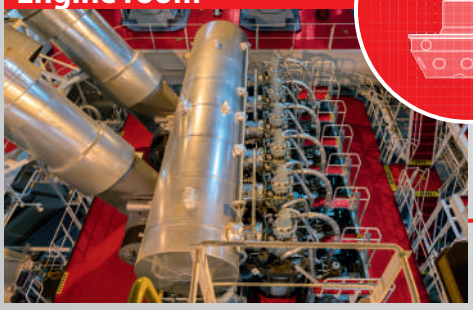
Balcony



Accommodation



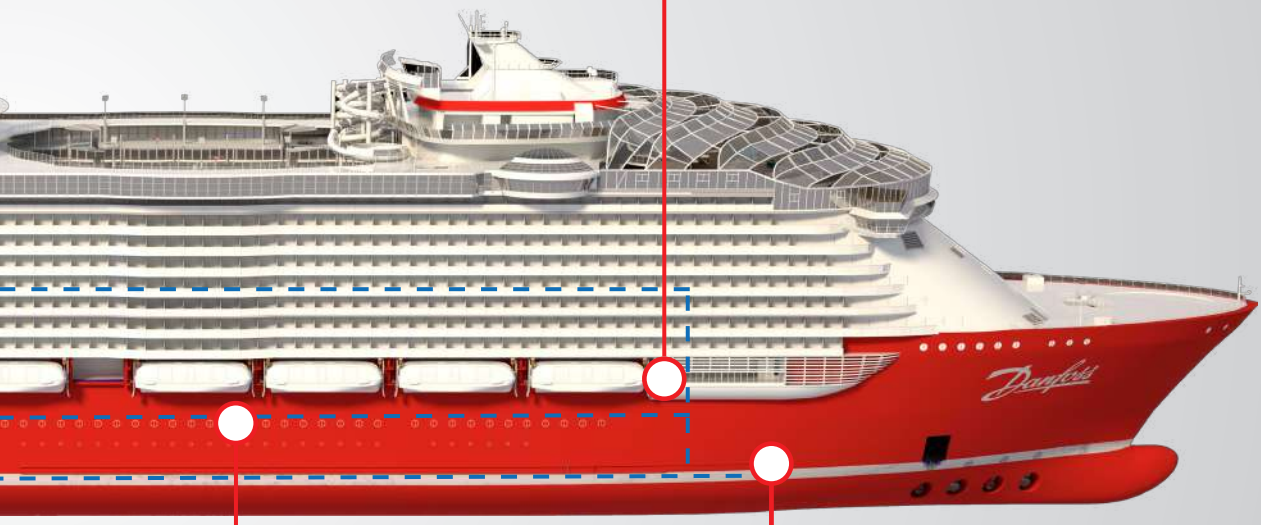
Engine room



Bilge

for cruise ships

Deep fat fryer & duct



SEM-SAFE® high-pressure water mist pump units

Cold store (pre-action system)

One fire fighting technology

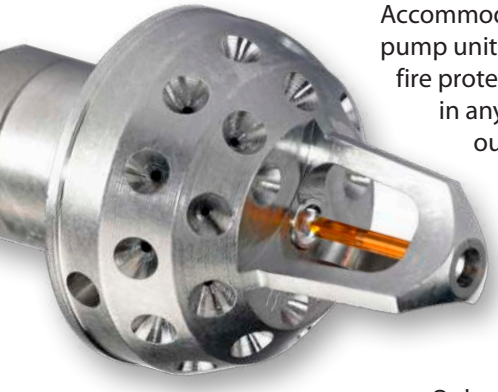
Total flooding

Danfoss offers **SEM-SAFE®** high-pressure water mist as a key engine room protection solution that allows doors.

The total flooding system is dimensioned with one section per fire zone and can be manually activated for both remote and local activation. Remotely activated, the system is operated from the valve operation panel outside the engine room, while local activation involves dedicated push-button operation, from outside the engine room.

The system releases water at high-pressure to cool hot metal surfaces. The water evaporates before reaching the hot surfaces, thus reducing the risk of shock cooling.

Tested in accordance with:	**Approved by:**
IMO MSC.1/Circ. 1165	DNV·GL, Lloyd's Register, ABS, BV, CCS



Accommodation

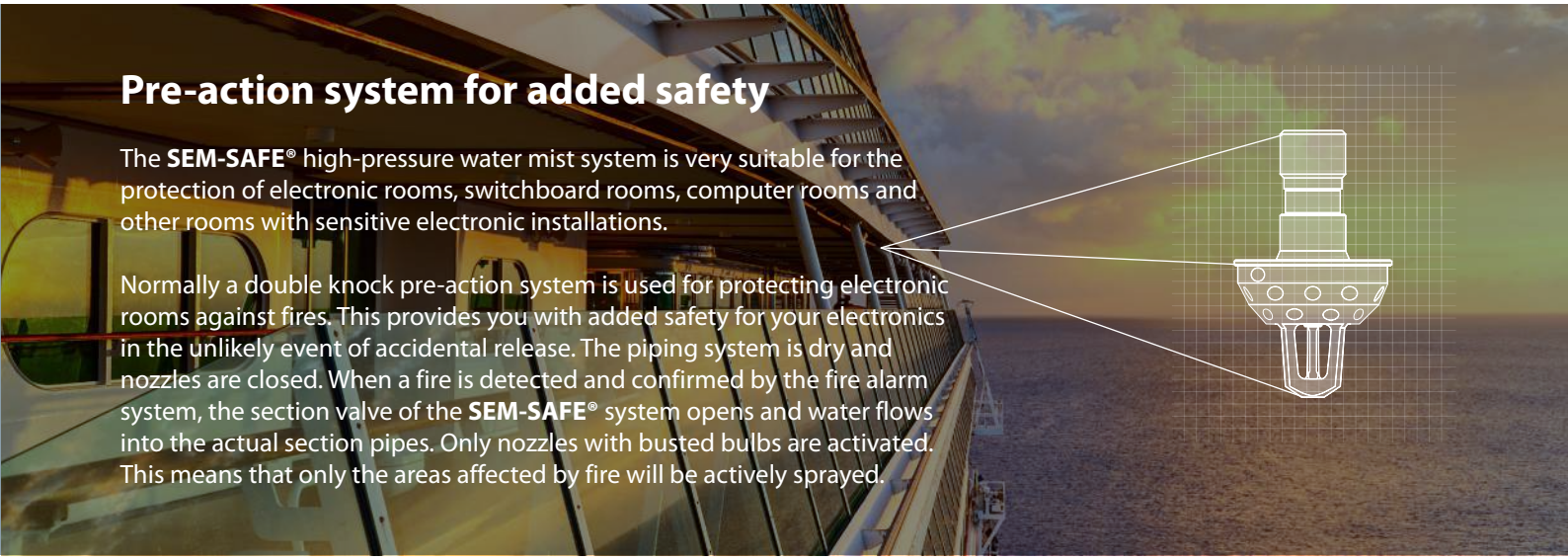
Accommodation areas can also be protected with the same **SEM-SAFE®** high-pressure water mist pump unit installed for total flooding and local application, making this a simple and cost-effective fire protection system. The **SEM-SAFE®** high-pressure water mist system can be easily installed in any accommodation area, such as public spaces, storages, corridors and cabins and even outdoor balconies. In standby, the system maintains a nozzle pressure of 10 -15 bar.

The **SEM-SAFE®** high-pressure water mist nozzles used in accommodation areas are usually the closed type with a glass bulb that breaks at a set temperature, e.g. 57°C.

If this happens, the high-pressure pump unit is automatically activated and water is forced through the nozzle at high-pressure and distributed as a fine mist.

Only nozzles with broken bulbs are activated, and as a result only overheated areas will be actively sprayed.

Tested in accordance with:	**Approved by:**
IMO MSC.265	DNV·GL, Lloyd's Register, ABS, BV, CCS



Pre-action system for added safety

The **SEM-SAFE®** high-pressure water mist system is very suitable for the protection of electronic rooms, switchboard rooms, computer rooms and other rooms with sensitive electronic installations.

Normally a double knock pre-action system is used for protecting electronic rooms against fires. This provides you with added safety for your electronics in the unlikely event of accidental release. The piping system is dry and nozzles are closed. When a fire is detected and confirmed by the fire alarm system, the section valve of the **SEM-SAFE®** system opens and water flows into the actual section pipes. Only nozzles with busted bulbs are activated. This means that only the areas affected by fire will be actively sprayed.

One fire fighting supplier

Local application

The **SEM-SAFE®** high-pressure water mist system for local application protects high-risk areas such as main and auxiliary engines, boiler fronts, oil separators and incinerators.

The **SEM-SAFE®** high-pressure water mist nozzles are dimensioned in sections, and all nozzles in the activated zone are released in the event of a fire. In standby mode, the system has dry piping, and section valves are remotely operated for each object requiring protection.

The local application system can be activated as follows:

- Automatically via the vessel's main fire detection system or by sensors connected to the valve operation panel
- Remotely from the valve operation panel situated outside the engine room
- Locally by pushing one of the dedicated push-buttons outside the protected area

Tested in accordance with:

IMO MSC.1/Circ.1387

Approved by:

DNV·GL, Lloyd's Register, ABS, BV, CCS, RINA, RMRS, USCG

Bilge

Danfoss has developed a dedicated **SEM-SAFE®** high-pressure water mist nozzle for protection of bilge areas of an engine room. This means that foam is replaced by high-pressure water mist, thus giving the ship owner and ship yard the great advantage of having to use only one fire fighting technology to protect engine rooms including bilge.

With a minimum water consumption and superior spacing, the **SEM-SAFE®** bilge nozzle has one of the best performances on the market. The bilge nozzle has been designed in accordance with guidelines described in IMO MSC.1/Circ.1165.

The innovative Danfoss bilge nozzle can protect bilge areas that are up to 1.5 m in height, which currently is the highest on the market.

The bilge system uses **SEM-SAFE®** high-pressure water mist nozzles of type BT that operate at minimum 60 bar. When activated, the pressurized water is discharged through the nozzle and forms a homogeneous water mist.

No additives are needed.

Tested in accordance with:

IMO MSC.1/Circ.1165

Approved by:

DNV·GL, Lloyd's Register, ABS, BV, CCS, RINA, RMRS

Did you know that ...

The Danfoss **SEM-SAFE®** high-pressure water mist system is the best fire fighting solution for special areas on board cruise ships.
Below we list a few of the special applications that can be covered by the Danfoss **SEM-SAFE® high-pressure water mist system:**

- Cable trays
- Suspended ceiling
- Atriums
- Cinemas
- Winches
- Mooring deck
- Passenger cooling areas
- Glass protection

High quality fire fighting components

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

Danfoss high-pressure water mist nozzles

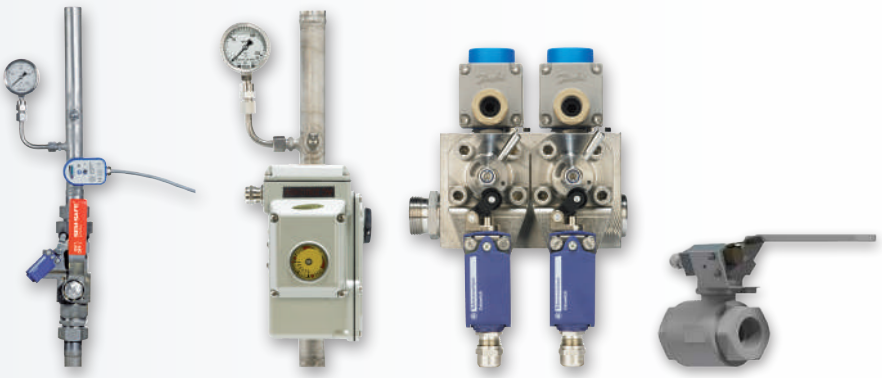
- High nozzle spacing for lower installation cost
- Aesthetic nozzle design to perfectly blend with the interior room design
- 100% tested for guaranteed nozzle performance

Danfoss high-pressure pumps

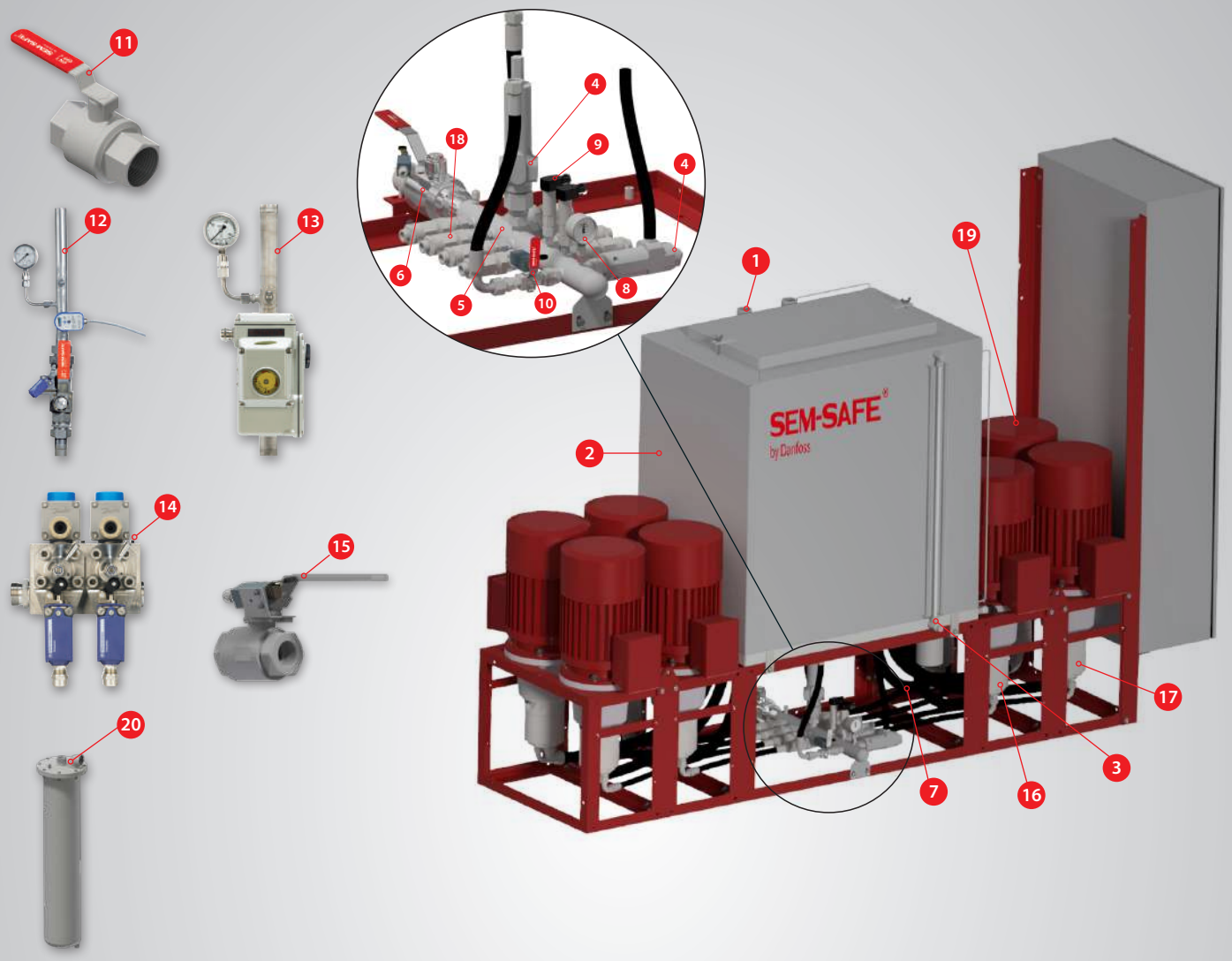
- Lubricated by water, making the pump maintenance free
- World's lightest and most compact design
- 95% energy efficient and very low pulsation to reduce noise

Danfoss valves

- Compact valves for easy installation and operation
- Dirt resistant, making the maintenance easier
- High-corrosion proof for longer product life time



SEM-SAFE® by Danfoss – System design



1 INLET CONNECTION
Fresh water or seawater supply to the buffer tank

2 PUMP UNIT TANK
Protects against dry-running

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 high-pressure pumps in the system

5 HIGH-PRESSURE MANIFOLD
Connects 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 pump unit 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 SECTION VALVE ACCOMMODATION

13 SECTION VALVE TOTAL FLOODING

14 SECTION VALVE LOCAL APPLICATION

15 ISOLATION VALVE

16 REDUNDANT PUMP
For total flooding and accommodation only: Standby pump for redudancy in case an additional pump is required

17 HIGH-PRESSURE PUMP
Supplies the required flow and pressure for the system

18 NON-RETURN VALVES
Supplied when multiple pumps are required

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

20 FILTER
10 micron rated inlet filter

Simplicity & aesthetic design

Scandinavian philosophy for design
- Beautiful nozzle design
- Freedom to choose any nozzle colour

Sustainability
- Environmentally friendly
- Harmless to people

Efficiency & modularity
- Plug & play
- Easy installation & servicing

High-performance
- Effective cooling
- Rapid local activation

Cost-saving solution
- Fewer nozzles due to optimized spacing
- Corrosion-proof stainless steel pipes
- Maintenance-free pump
- Minimum downtime

Danfoss SEM-SAFE® high-pressure water mist nozzle for fire fighting

Service experts - high level of service on Danfoss systems over mainstream competition

Servicing cruise ships in a smart way

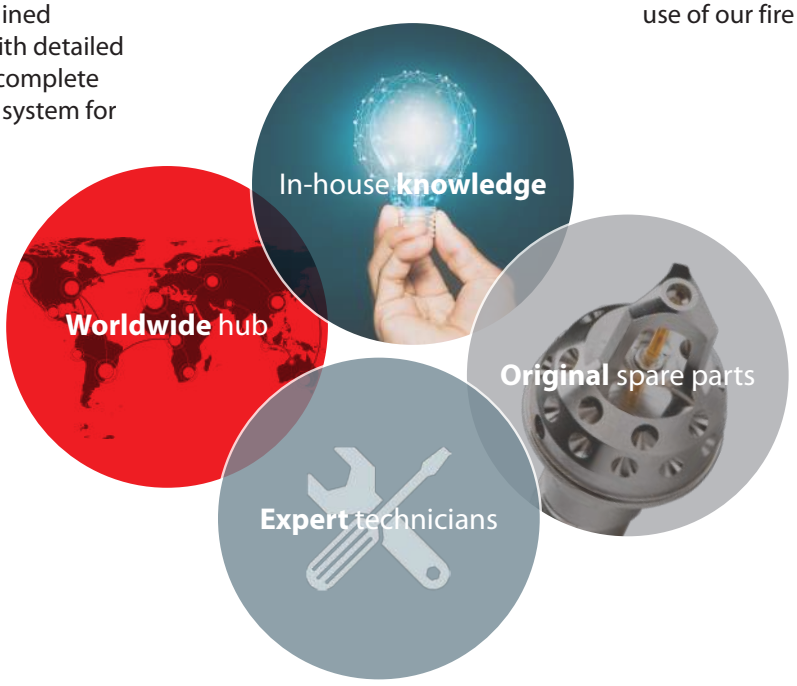
The Danfoss Service department provides service, spare parts and technical support for cruise ship owners and vessels worldwide. We are an after-sales service provider approved by several classification societies and we provide valuable and cost-saving overviews at multiple levels.

Our highly skilled and trained engineers provide you with detailed reports that present the complete status of the fire fighting system for each vessel area. We provide unique, comprehensive documentation accessible at any given moment. No matter where the ship is in the world, we are always close by via our network of service hubs.

We always perform our services in accordance with SOLAS, class, flag and our own manufacturing regulations.

All service interventions are thoroughly documented to facilitate the controlling task for the superintendent.

By relying on Danfoss service department, you also benefit from direct access to original spare parts. Moreover, our training facility can provide training for ship crews in the use of our fire fighting systems.

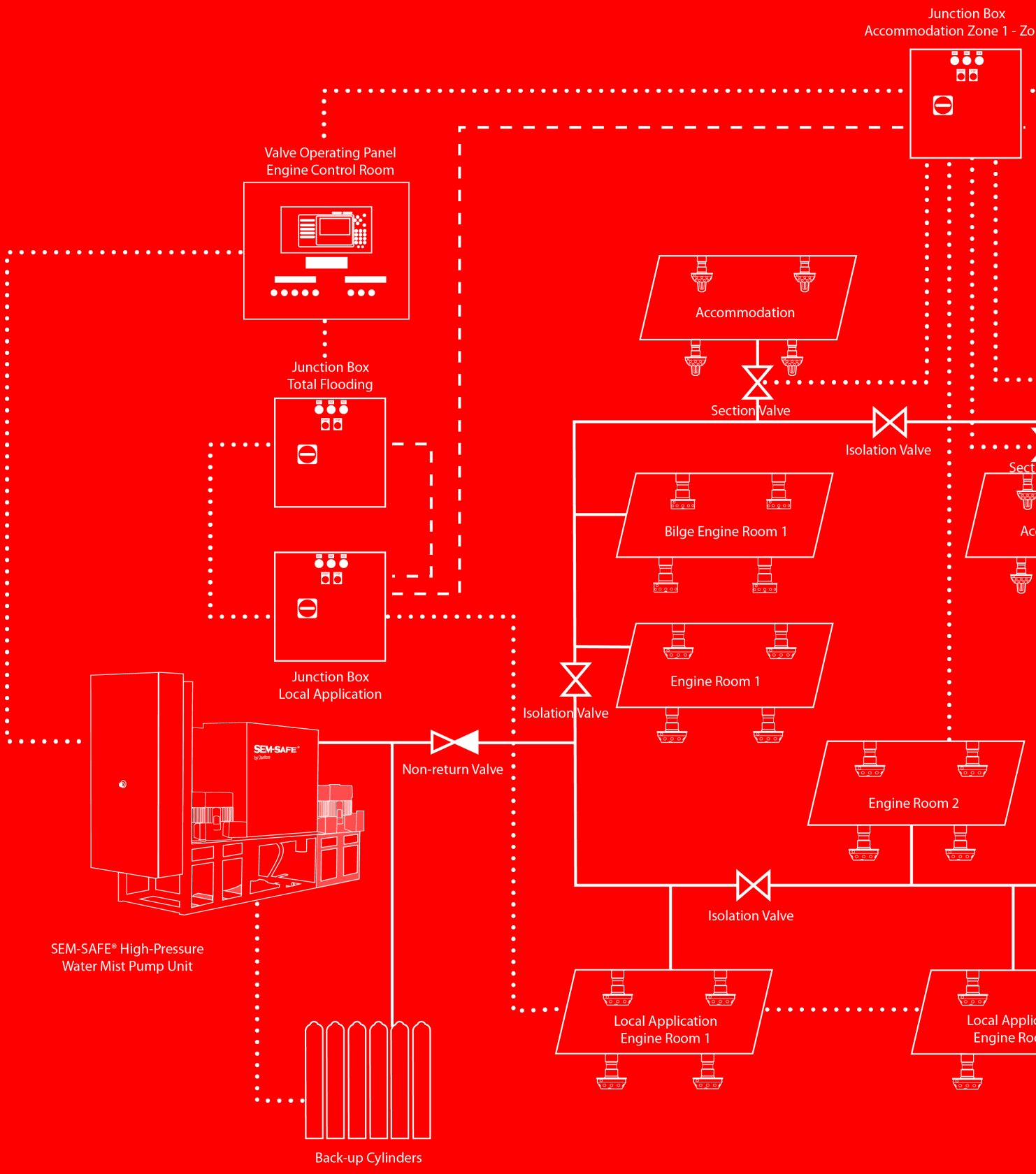


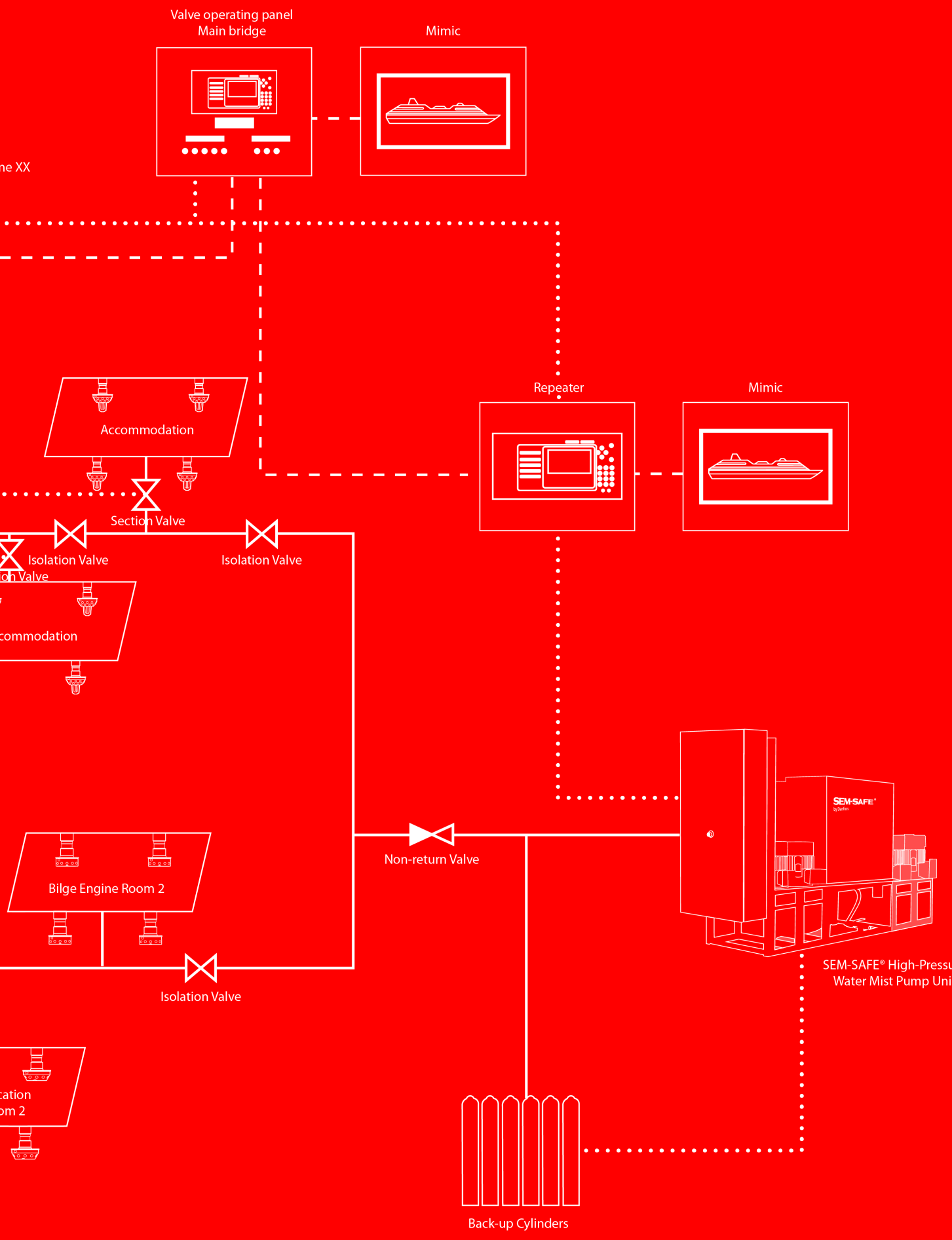
Proven experience

Danfoss has an extensive reference list within the marine sector, covering passenger, cruise, container, bulk carrier, tankers, Ro-Pax, Ro-Ro, PCTC, navy, patrol, supply and offshore.
We have 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,*** largest cruise liners
- ***DFDS King Seaways,*** busy passenger and cargo carrying vessel
- ***HSC Fjord Cat,*** one of the world's fastest passenger vessels
- ***Le Grand Bleu,*** one of the world's biggest yachts
- ***Global Mercy,*** state-of-the-art hospital ship
- ***Stena Germanica,*** larger cruise-ferry

Safe return to port




Valve operating panel
Main bridge
Mimic
Accommodation
Repeater
Mimic
Section Valve
Isolation Valve
Isolation Valve
Non-return Valve
Bilge Engine Room 2
Isolation Valve
SEM-SAFE® High-Pressure
Water Mist Pump Unit
Back-up Cylinders

ENGINEERING
TOMORROW

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 an 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

SEM-SAFE® high-pressure water mist is the optimum fire fighting solution for any building and ship 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 sprinklers.

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.

Whether 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 marine sector we offer the SEM-SAFE® high-pressure water mist system for fire fighting and the SEM-SAFE® low-pressure CO_2 system for fire fighting.

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®

Danfoss Fire Safety A/S · Middelfartvej 9 · DK-5000 Odense · Denmark
Tel. +45 7488 7800 · E-mail firesafety@danfoss.com · www.semsafe.danfoss.com