MARINE & OFFSHORE
Mist Elimination for air intakes

Let it blow!

Easy steps and choices for effective mist, rain and snow elimination.



Munters

Stop moisture at the bulkhead

Prevention that is three-fold

At sea, the battle against unwanted moisture is endless, but winnable. Modern mist elimination and snow, hail and droplet separation offers you a profoundly effective method to stop the moisture threat, right at the bulkhead.

Properly specified Mist Elimination solutions reduce risk in three primary areas:
Corrosion, Wet filters, Mold and Mildew.
Traditional solutions, such as conventional louvers, ventilators and swan necks do little or nothing to restrict damaging moisture flows from being carried inboard.

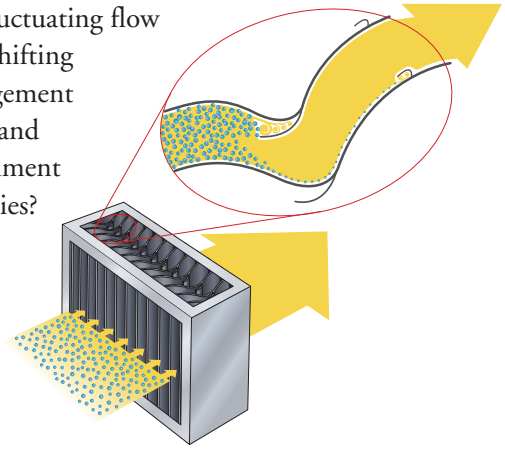
Special care must be given to the design of the Mist Elimination solutions. If wrongly designed, even a mist eliminator won't provide adequate protection against unwanted weather effects.

Specific short- and long-term mist elimination benefits include:

- longer filter life;
- lower pressure-drop and better energy efficiency;
- less corrosion in ventilation systems;
- increased up-time with dryer filters and less corrosion of sensitive machinery;
- reduced mold, bacterial growth, odors and corrosion;
- reduced maintenance costs and cycles;
- better climate for passengers and crew, interior furnishings, cargo spaces as well as sensitive instrumentation.

A simple concept with an artful solution

Certainly you'll agree that the basic concept of mist elimination and snow, hail and droplet separation is immediately understandable. However, combining the components to work together properly in various ranges of weather, wind and water loading is a challenge, even for specialists. Optimal performance comes from an understanding of condensation and fluid dynamics. This includes how droplets, snow and ice particles are generated in nature and how their behaviour changes depending on size. What dynamic properties do the various particles reveal with fluctuating flow rates, shifting impingement angles and entrainment capacities?



Mist, droplet and snow separation principle.

Basic design conditions

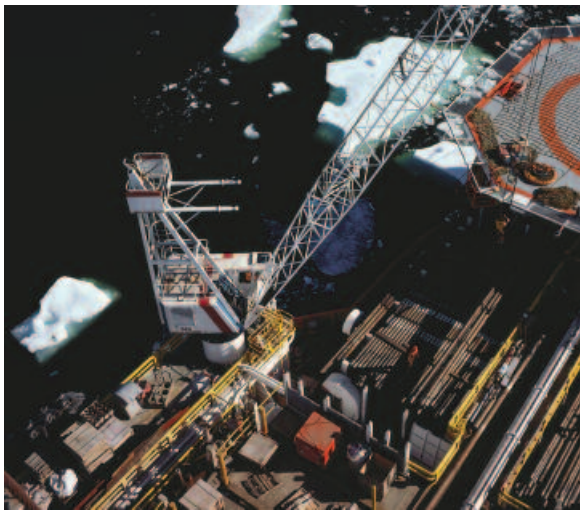
In general, for the design of a given unit, four basic conditions comprise the foundation for effective mist elimination: First, the smaller the droplet size range, the narrower the spacing should be between the profiles. Second, the higher the water load, the more separation chambers required. Third, efficient removal of salt-laden particles requires filter as well as coalescer components. And fourth, efficient removal of snow, hail and drifting snow particles requires profiles with heating devices and control units.

Of course, the specifics of your intake decision require looking at the unit in relation to its surroundings, notably weather conditions, physical location, flow requirements, and droplet-size distributions, which vary widely.

Falling mist	>30 µm
Fog	>10 µm
Heavy rain	up to 5,000 µm
Rain	>500 µm
Salt particles	>0.1 µm
Sea spray	>10 µm
Snow & hail	>1 mm

Working offshore and underway

Ventilation systems for offshore platforms and the vessels serving them often need protection from the worst to be offered by land and sea. Special care must be given to the air intakes when the temperature is close to or below 0 °C. The risk for icing is high, therefore the mist elimination is effective only with heating devices. In addition to the full range of weather conditions there are many types of harmful airborne solids to contend with. These include cement dust, barytes, drilling dust, flare carbon, mud-burning smoke and blasting grits from maintenance activities.



Even conventional vessels often encounter granular dusts, soot particles, occasional fibers, sulphates, magnesium as well as wet and dry salts, particularly when alongside for cargo handling and transfer operations. Effective mist elimination also pays for itself when shielding sensitive bridge instrumentation and cargo holds.



Engine room intakes require particular attention for one primary reason.

Efficiency is a must to keep engines running in critical situations. Of course there are also significant long-term protection benefits from improved overall operating conditions and the working-life economies that these bring. Passenger vessels certainly gain with better air quality as well as reduced corrosion in large interior climate installations.

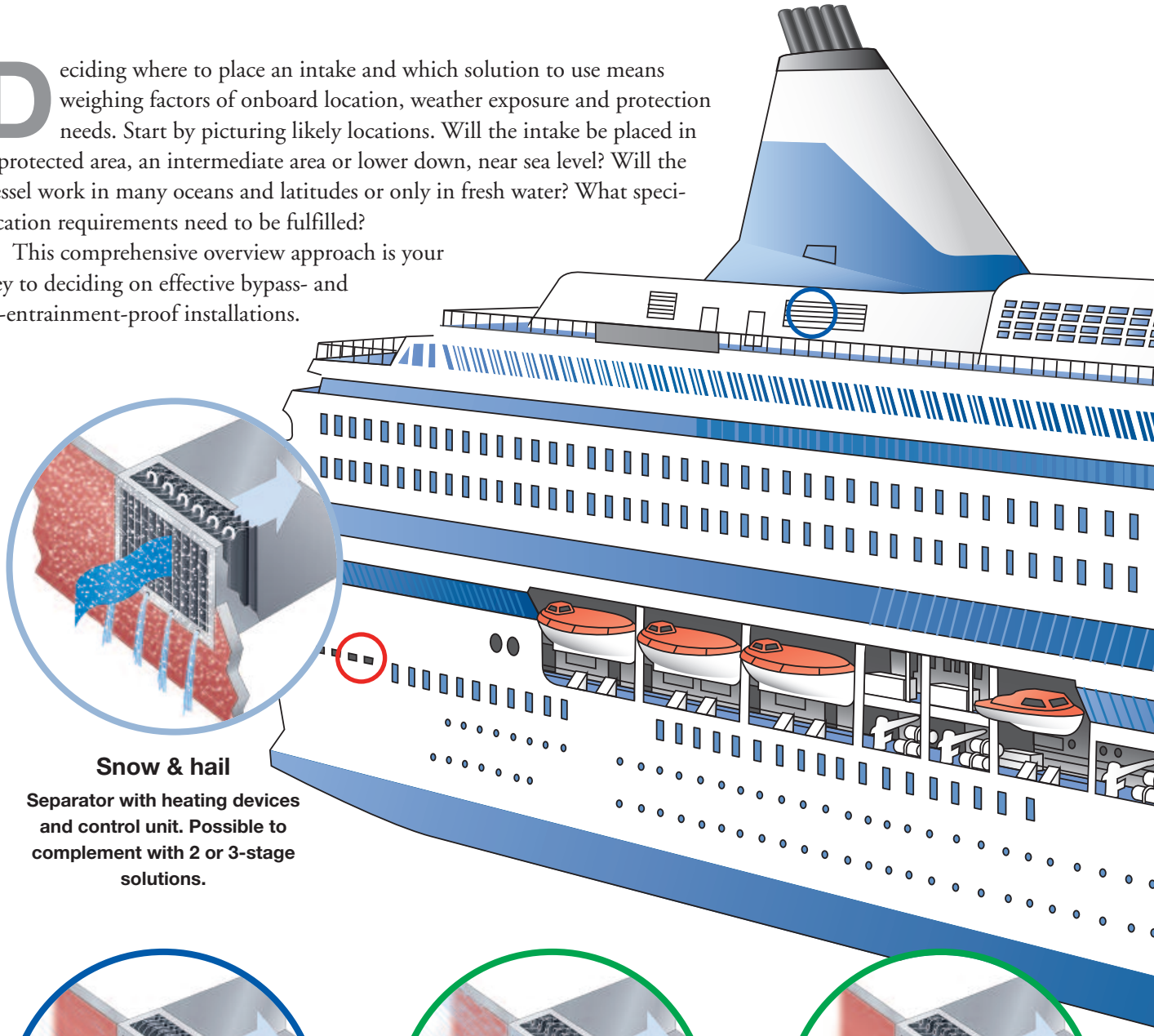


All air intakes on Birka Paradise are equipped with mist eliminators from Munters.

Getting it right, anywhere on board

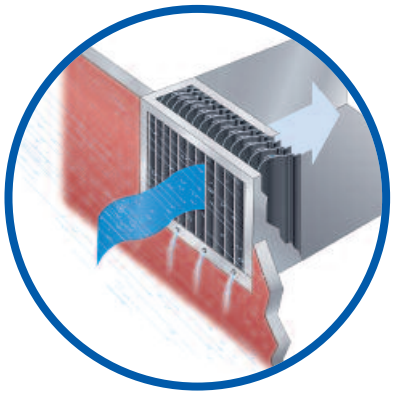
Deciding where to place an intake and which solution to use means weighing factors of onboard location, weather exposure and protection needs. Start by picturing likely locations. Will the intake be placed in a protected area, an intermediate area or lower down, near sea level? Will the vessel work in many oceans and latitudes or only in fresh water? What specification requirements need to be fulfilled?

This comprehensive overview approach is your key to deciding on effective bypass- and re-entrainment-proof installations.



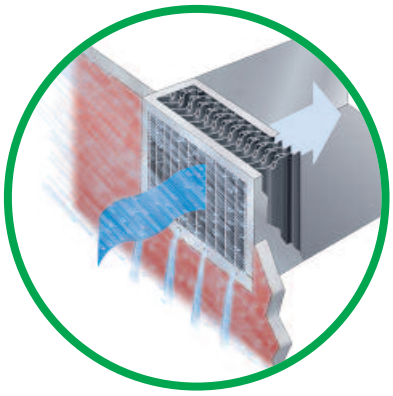
Snow & hail

Separator with heating devices and control unit. Possible to complement with 2 or 3-stage solutions.



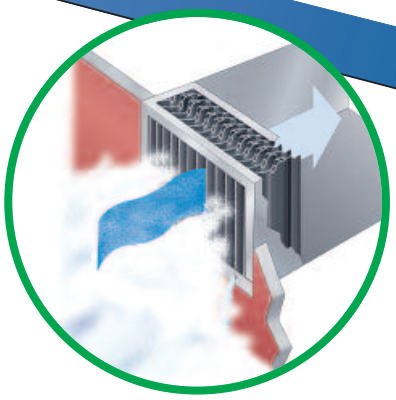
Rain

Single-stage protection for less severe conditions. Basic mist elimination and droplet separation with standard spacing between the profiles.



Heavy Rain

Greater protection with more convolutes and tighter profile spacing.



Sea spray

Possible reinforcement on intake face and addition of extra stages. Higher drainage capacity.

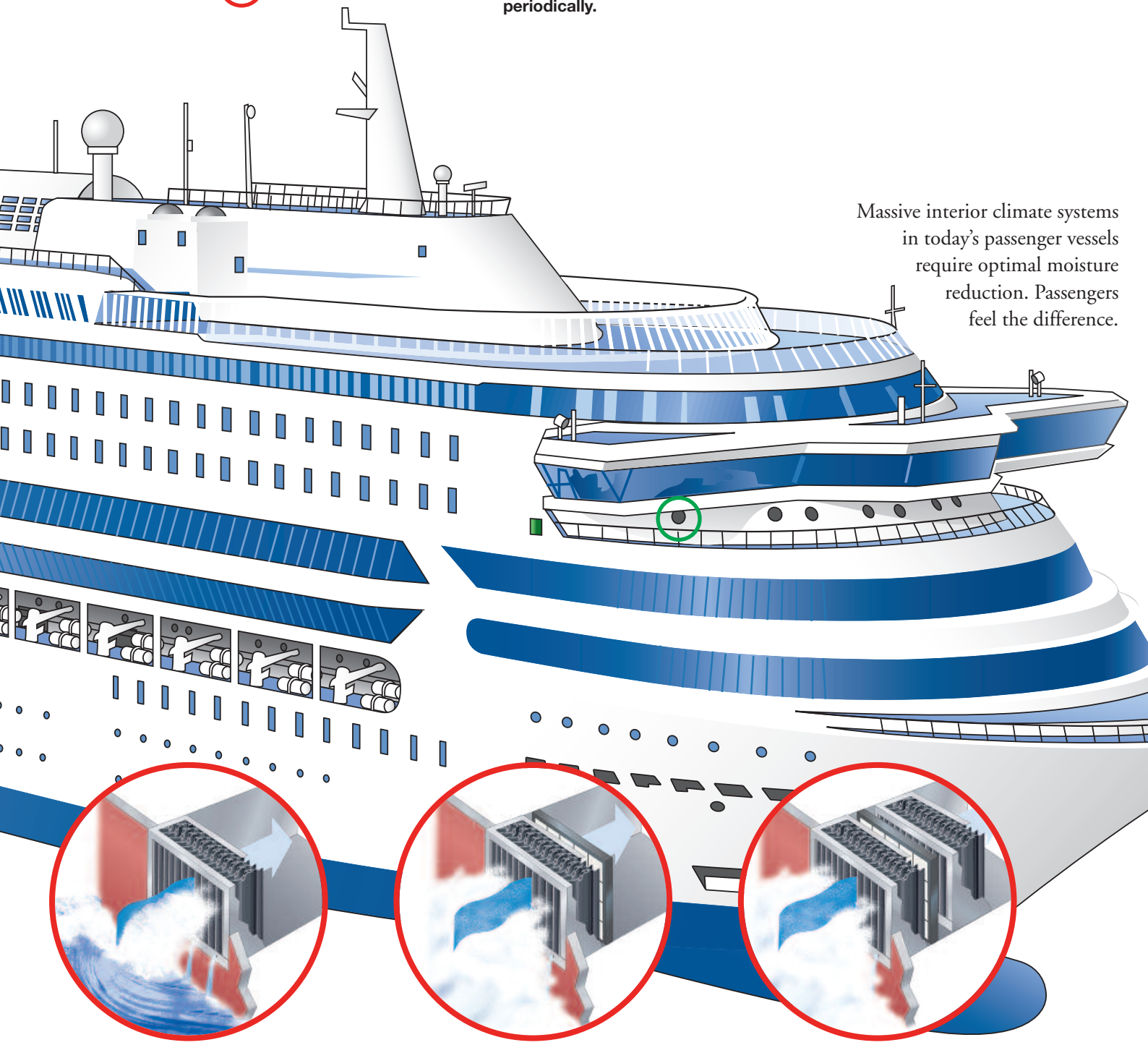
Anti-icing – On superstructure or hull. Exposure to rain, heavy rain, snow, hail and snow particles.

Protected areas – No direct exposure to immediate weather conditions. Distance from sea level 20 meters and more.

Intermediate levels – On superstructure or hull. Higher exposure to rain, heavy rain, and salt-laden sea spray and splash water at intake point.

Lower levels – Nearer water surface where harshest conditions will occur periodically.

Massive interior climate systems in today's passenger vessels require optimal moisture reduction. Passengers feel the difference.



Splash water/green water

Reinforced intake face. Extra profile convolutes and tight profile spacing. Maximum drainage capacity. Extra stages as needed.

Sea salt

For sensitive machinery removing salt-laden droplets may require a 2 or 3-stage solution with coalescers to strip away the smallest particles in the final air stream.

From engine room to bridge, fore and aft

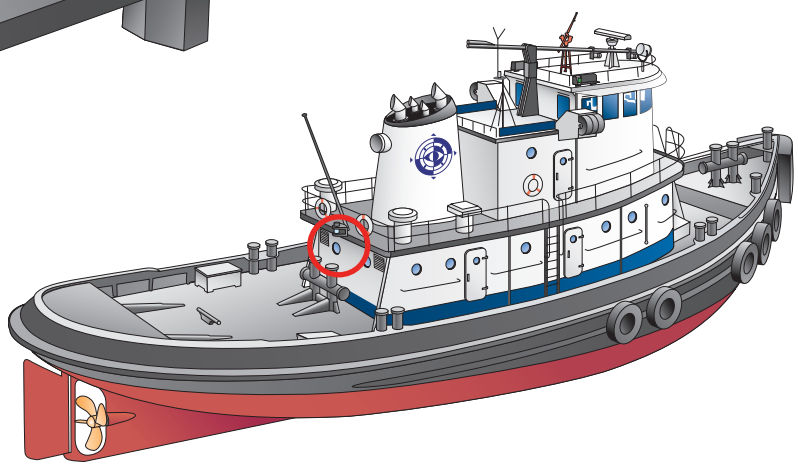
Mist Elimination shields vessels in every class and trade



Modern diesel and gas-turbine propulsion plants are more sensitive to protect with one- and two-stage solutions with adjustable efficiencies and pressure losses. Expensive to repair, yet easy to protect.



Offshore installations can't change course when bad weather comes through – yesterday's bow may be tomorrow's stern. These semi-static structures take a beating!



Smaller commercial vessels such as tug, police and fishing boats or military patrol crafts are always close to the action at the surface. Green water can easily reach upper levels.

Easy intake specification

The following factors become the input data necessary to specify a given intake solution.

Input check list:

✔ Where will the intake be located on hull or super structure?

Positioning and resultant air-flow angles will impact performance, for instance with sloping and over-hanging installations.

✔ What interior spaces or function is the air stream supplying?

Engine room intakes and ventilation systems on passenger vessels have particularly high needs for reduced moisture and salt content.

✔ What are the air flow and pressure drop parameters?

These are influenced by profile pitch and spacing as well as filter, coalescer stages and air velocities.

✔ What are the most severe conditions expected for the intake?

Will it protect against rain, heavy rain, sea spray, splash water/green water, snow, ice or salt and dust particles? What are the prevailing weather conditions, wind directions and dynamic wind velocities? (According to Beaufort wind scale.) Are exterior reinforcing louvers necessary for wave impacts? Intakes operating under the harshest conditions often need coalescers in a second stage for highly efficient moisture removal. Specially designed profiles with more convolutes are recommended for weather conditions with strongly altering wind directions.

✔ Alternatively what particle sizes need removal?

Falling mist	*>30 µm*
Fog	*>10 µm*
Heavy rain	*up to 5,000 µm*
Rain	*>500 µm*
Salt particles	*>0.1 µm*
Sea spray	*>10 µm*
Snow & hail	*>1 mm*

✔ Consider water loads.

Depending on the application, water loading can vary enormously, from a few liters/m^2/hour up to several hundred liters/m^2/hour over an intake face.

✔ Is extra salt protection necessary?

If so, what is the required salt-extraction content and filtering?

✔ Are there any material property considerations?

For instance, classification, corrosion protection or fire-resistance requirements.

At Munters, we can help you with advice and confirmation regarding specification details. Cross-referencing your parameters with prior installations in our database gives you a quick reference for an appropriately dimensioned solution.



A total range of protection

Our goal in Mist Elimination is to make selection and specification easy for quality ship builders and designers who insist on the best protection with minimal or no maintenance, for the life of the vessel.

Regardless of your need, Munters offers the full spectrum of mist eliminators and droplet separators – from moderate, to high and very high protection levels – via single-stage, two-stage, three-stage or anti-icing solutions. These are designated DF, DCF DFF and DFH, respectively.

Single-stage solutions. The DF range.

Offers good protection for forced- and naturally ventilated spaces. Suitable for all weather conditions, e.g. spray, mist, rain and heavy rain.

Two-stage solutions. The DCF range.

Combines inertial vanes with filter/coalescers. They are 100% humidity proof and and self-extinguishing according to DIN 53438 standards.

Filter/coalescers are according to EN779 in classes from G3 to F9.

A good choice for higher efficiency needs, including removal of salt-laden droplets and solids from an air stream.

Three-stage solutions. The DFF range.

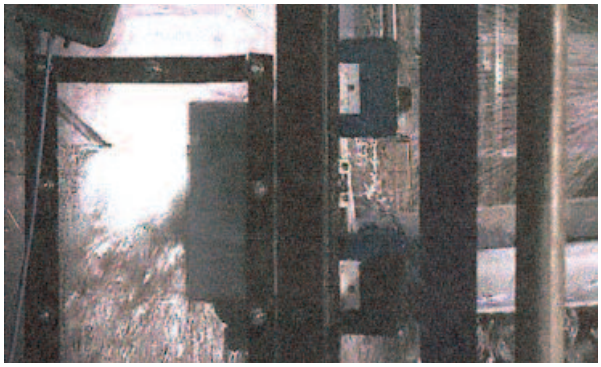
Places an additional inertial vane stage behind the second-stage coalescer. At higher velocities, carry-over from the coalescer panel is entirely captured in the third stage. Alternatively, final filters can be installed for dry salt removal.

Anti- snow & icing. The DFH range.

Consists of a separator and a control unit. Separator unit accommodates vertical profiles with heating devices. The control unit comes as a separate part and is installed in close proximity to the separator. DFH can be an integral part of the DCF and DFF unit.

Custom specifications, on request.

Custom or standard, our solutions feature compact design with the choice of marine-grade aluminum alloys, 316L stainless steel or powder-coated/ anodized housings.



Simulating heavy weather in the testing lab gives crucial insight into real-world conditions at sea.

The combination of water loading and efficiency requirements determine the equipment for your application. Just enter your scenario into the Application Matrix.

Elimination of	Intake location		
	Protected area	Open bulkhead	Close to sea-level
Rain	DF 2100/3800/4800	DF 2100/3800/4800	DF 3500
Heavy rain	DF 2100/4800	DF 3500/4800	–
Splash water	–	DF 3500	DCF
Sea spray	–	DF 3500/4800	DCF
Snow & hail	DFH	DFH	–
Salt	DFF	DFF	DFF

Consult our data sheets for detailed product information of specific mist eliminator and/or droplet separator. They are available on www.munters.com or at your nearest Munters sales office.

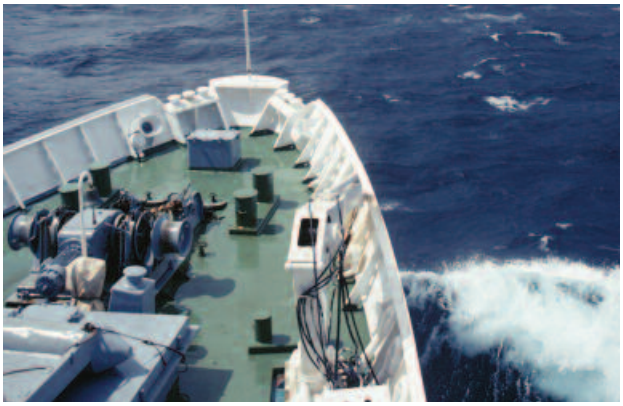
Features – Single-stage

- Low pressure-drop characteristics
- High separation efficiency
- Cover most weather conditions
- Effective and controlled drainage
- Robust construction
- Marine-grade materials
- Fully configurable for any installation requirement



Features – Two-stage

- High performance first-stage mist eliminator
- Low pressure-drop characteristics
- Highest separation efficiency
- Marine-grade materials
- Effective and controlled water drainage
- Configurable for most installation requirements including PDI-equipment
- Cleanable coalescers



Features – Three-stage

- High performance first- and third-stage mist eliminator or alternatively two filtration stages accommodating a coarse- and a fine-filter
- Highest separation efficiency
- Effective and controlled water drainage
- Marine-grade materials
- Custom made equipment for any installation environment
- Moisture separation maintained over the entire range of engine speeds
- Cleanable coalescers

Features – Anti- snow & icing

- Effective elimination of snow particles in very cold climates
- Prevents filters being plugged by snow
- Very low pressure drop leading to lower operating costs
- Marine-grade materials
- Custom made equipment for any installation environment
- Can be an integral part of a DCF or DFF unit

Every region, every ocean

Munters is the global humidity specialist. Our unrivalled knowledge and resources are available to benefit you with testing facilities, worldwide support and an exceptionally broad reference base to other industries.

Our experience in the marine and offshore segment spans half a century. Today, our sea-going specialties include H.A.M. and SCR technologies for cleaner diesel emissions as well as dehumidification for spray coatings in ship construction and for cargo hold protection. Munters services and solutions help users to achieve the climate they require. And control it. Consistently and cost effectively.

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