

Marine Dehumidification for Cargo Care and Vessel Protection



Marine Dehumidification

2



Transporting cargo by sea

Ever increasing international markets dictate that more and more goods are transported around the world. The marine environment is susceptible to many changes in climate. Over short distances, large changes in weather, air and sea temperature, and humidity can be experienced. Whilst most materials are safe from temperature fluctuations, they are often not safe from humidity.

Humidity - a constant threat

At sea, humidity is a constant threat to ships and their cargo. Levels of humidity are controlled by weather systems. Because weather conditions change locally and globally, so does humidity. Water will always try to evaporate into the atmosphere. The amount of moisture in the air is generally referred to as absolute humidity. However, as temperature is a determining factor, the amount of moisture air holds at a given temperature for a fixed mass is often referred to as Relative Humidity or "RH".

Damage through moisture

When the levels of humidity rise, relative humidity increases and condensation may occur, causing many problems.

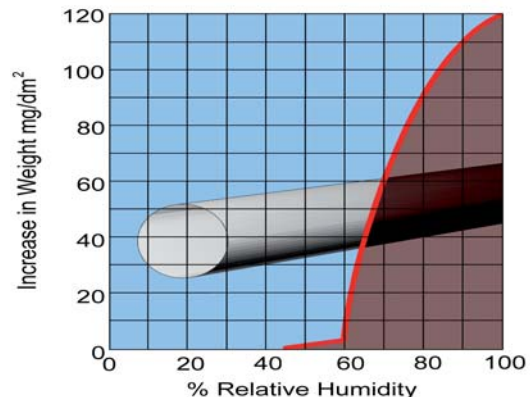
Corrosion

Steel corrosion increases exponentially above 60%RH at the surface of the metal, ie long before condensation appears. This corrosion may not even be visible at the first instance. A corrosion process cannot start unless oxygen and water are present. So if the moisture film on the surface of

the metal is reduced, the corrosion process halts. The combination of a salt laden environment and humid air will even accelerate the corrosion process at lower humidity levels, as will combinations of metals with different galvanic potential.

In case of transformation of steel and aluminium coils, condensation and any liquid water must be avoided at all cost. Capillary activity will suck moisture between the coil layers, causing corroded stains that will render the metal unusable in many industrial applications such as the automobile industry. If incidents occur, a dry environment is the best guarantee that the moisture is drawn from the coils again.

Corrosion Rate of Steel



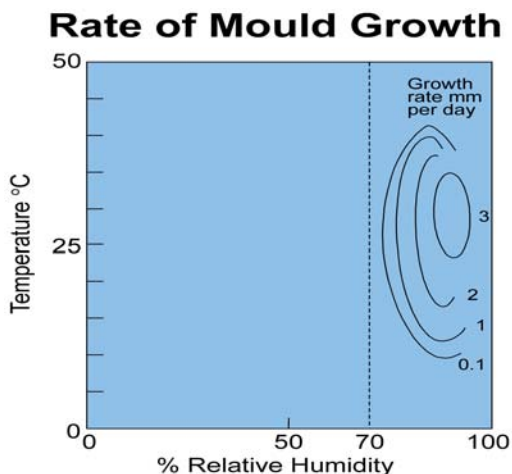
Absorption of moisture by hygroscopic materials

Hygroscopic materials, such as paper, wood, textiles, granulates and different types of powder,

absorb moisture when humidity is high. These products strive to maintain a balance with the relative humidity of the surrounding air. Powders may stick together making them difficult to convey. Hygroscopic materials will be damaged by drops of condensation.

Mould and bacteria

Mould and bacteria form if humidity is too high. Mould forms when humidity exceeds 70% RH.



Understanding moisture

There are five main sources of moisture load acting upon cargo holds:

1. Moisture in the air inside the cargo hold.
2. Moisture in the air outside leaking into the hold.
3. Moisture in the air outside, mechanically ventilated into the hold.
4. Moisture emitted from the cargo itself.
5. Rain water in the hold.

As the vessel travels through changes in climate, the air properties within the hold change. Condensation will occur when the dewpoint is reached. This can cause untold damage to the ship's fabric, ferrous goods and paper.

Sailing from cold to warmer climates

The air temperature within the cargo hold will change with ambient air and sea temperature. The hull section that is submerged is often cooler than the section above the waterline. As the sea is keeping the submerged hull cool, the cargo and hold fabric remain cool. The air within the hold will cool rapidly on a cold surface such as the cargo or the hull. When the temperature is reduced to a level where air cannot physically retain its

moisture in the form of vapour it releases it as liquid. The result is that condensation will occur on the cargo. The hull and the hatches. This temperature is often referred to as the "dewpoint temperature". When cargo emits moisture, the same process will occur.

Sailing from warm to colder climates

The cargo may be loaded on a warm day when there is a lot of moisture in the ambient air. This ambient air will become sealed inside the hold. As the ships sails, it may encounter cool weather conditions that will affect the temperature of the ship and hence the air temperature of the ship and hence the air temperature within the hold. As this air becomes cooler, it's relative humidity increases. This is because the air still contains the same amount of moisture as when the cargo hatches were sealed. The relative humidity can easily rise above 80% RH, which accelerates corrosion, and condensation occurs on the hull.

When it comes to preventing damage caused by moisture, there is a simple solution. Remove it.

Dehumidification- the natural solution

Materials are damaged when exposed to high relative humidity. Most materials will be preserved and unaffected when humidity is maintained below 50% RH.

The only reliable protection, irrespective of weather conditions, is dry air produced by a desiccant dehumidifier.

Traditional ventilation will not solve moisture problems

The traditional method of solving moisture problems has been to ventilate holds and other spaces. However, this is conditional on the outside air having a low moisture content, i.e. moisture problems can only be solved when the outside air is dry. At sea, this condition is rare.



Dry Cargo Quality Protection

4 Cargo damaged by moisture results in claims and costs money

Every year, cargo worth millions is damaged by high humidity. Condensation can occur directly on cargo or on the underside of hatch covers. The droplets of water can fall on the cargo and cause untold damage.

Products made of metal can corrode. Hygroscopic cargoes absorb moisture and sometimes even mould forms during the voyage. Cartons become soft and give an unattractive impression when they reach the end user. Damage caused by moisture results in dissatisfied customers and claims that take in time and cost money. Insurance companies allow lower insurance premiums when cargo is transported in a controlled environment.

A reliable insurance against damage caused by moisture is to install quality desiccant dehumidification systems on board ships.

Dehumidification of holds and containers increases transport quality

Desiccant dehumidifiers have been used for 50 years to protect hygroscopic cargoes from moisture damage and protect steel from corrosion.

Industry is demanding dry, safe transportation and guaranteed moisture-controlled environments on board. Many ship owners realise the advantages of this and are now installing systems. Small, compact dehumidifiers are used to deal with moisture in containers.



Advantages of Dehumidification

- Faster drying
- No wasted time in port
- Permanent condensation prevention
- No cargo damage through moisture
- Energy-efficient
- Simple to operate
- Faster loading times
- Reduced rain delay



Protection of Ships and Equipment



Ships are made of steel and are equipped with pipes, fittings and valuable electronic equipment. Many areas are below the waterline, which results in major condensation problems. However protecting steel and equipment by controlling humidity has not been self-evident. Instead, advanced paint systems have been used to protect the ship and its equipment from corrosion.

Dehumidified areas reduce maintenance costs

- Reduced maintenance and less stringent coating requirements.
- No condensation
- No corrosion of steel
- Greater reliability for electrical and electronic equipment.

Void spaces and cofferdams

Since iron and steel begin to corrode when humidity exceeds 50%RH at the surface of the metal, steel can be protected with dry air. On board a ship, there are many inaccessible spaces where it would be preferable to avoid maintenance and recoating.

Other steel structures that are dehumidified on the inside instead of coated are bridge stantions. The total cost is vastly reduced with dehumidification.

Piping tunnels, pump and valve spaces

Keeping these spaces dry protects the equipment so neither pipes nor surrounding steel surfaces need to be coated. Control equipment is protected.

Stores

Since most materials are sensitive to moisture, it is important that the humidity in the stores and areas where spare parts are kept is controlled. A controlled environment means that condensation is avoided and these areas do not need to be insulated.

Electrical and Electronic equipment

Ships are fitted with sensitive electrical and electronic equipment. Contact corrosion begins when humidity exceeds 40%RH. Dry air is the most effective way of protecting this type of equipment.

Bow thrust room

The bow propeller is rarely used, which means that the equipment powering the propeller is exposed to high humidity for long periods. The high humidity in this space gives rise to corrosion problems. We also, know that the electrical resistance decreases when an electric motor is exposed to humidity. This can result in starting difficulties and large costs. Installing a dehumidifier can cost about the same as hiring the services of a tug on a one single occasion.

Other areas of concern:

Steering gear room

Cranes

Spaces containing fire fighting, life-saving equipment and life saving vessels

Other spaces containing sensitive equipment

All KNRM Rescue boats have dehumidification equipment



KNRM Rescue Boat

Surface Preparation, Coating and Tank Drying

6



Large, cool metal surfaces like ship interiors and chemical storage tanks must be periodically re-coated. Coating manufacturers will not guarantee the life of the coating unless the contractor can prove the surface was clean and dry when the coating was applied. Contractors now use desiccant dehumidifiers so they can blast and coat regardless of the weather. Dry air lets them keep a cleaned surface free from condensation indefinitely, which means they can schedule coating operations more economically. Dehumidifiers provide better coatings for end users and lower costs for contractors

Using desiccant dehumidifiers to dry tanks on board chemical tankers is becoming increasingly common. The reason for this is that the drying process must be fast. In addition the cargo owners are demanding that the chemicals do not contain moisture and other pollutants on delivery.

Many chemicals products are hygroscopic and absorb moisture. In order to avoid contamination, it is important that the tank is sufficiently dry. The moisture content in the air must be below the dewpoint of the surface before the tanks is filled with chemicals.

In coated tanks, the coating often absorbs water. To extract the water absorbed by the paint after cleaning the tank, it is important that the air is sufficiently dry so that the least amount of water possible remains in the tank when it is filled with chemicals. The most economical method of achieving this is to dry the holds with air dehumidified to a low dewpoint in a desiccant dehumidifier.

Advantages

- Faster drying times no lost time in port
- No condensation
- Less risk of the cargo being contaminated by moisture.
- Energy-efficient and simple system since surplus heat can be used to power the dehumidifying process.

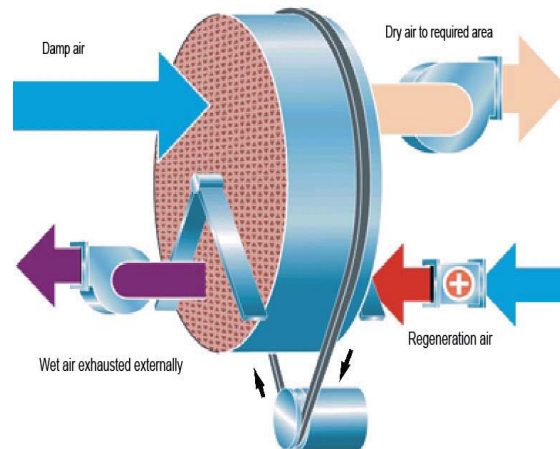
Small Craft Dehumidification



Environmentally friendly technique

There is always moisture in the air, irrespective of temperature and since ships operate in both warm and cold climates, it is important to choose a dehumidifying technique which functions well at both low and high temperatures.

Munters' dehumidifiers work according to the absorption technique. This means that the air to be dried passes through a rotor impregnated with a hygroscopic drying agent. The drying wheel rotates slowly and the moisture contents in the air is reduced as the water is absorbed by the drying wheel. The moisture is then extracted from the dehumidifier's reactivation zone. This moisture can then be vented to the atmosphere or condensed into water and drained away to the bilges.



Munters dehumidifiers can banish problems of damp and condensation during long-term seasonal lay up. Symptoms such as stale and musty atmospheres, and condensation can be eradicated with Munters dehumidifiers which dry the damp atmosphere, so protecting interior fabric and electronics.

Dehumidification equipment reduces the moisture level within the yachts during lay up thereby reducing weight and increasing a vessel's speed during races.

After a yacht has been sailing and is docked, Munters dehumidifiers remove moisture from inside the yacht, off sails and maintain crew kit and provisions. Every ounce of weight is important in competitive yachting. Dehumidifiers eliminate excess moisture whenever the boats are in dock, contributing towards high performance in races. Dry air is pumped through the interior of yachts when they are not sailing. The dehumidifier absorbs any excess moisture and vents it into the external atmosphere.

Dehumidifiers are also used to dry sails and tackle prior to repair work being carried out. Munters small dehumidifiers are quiet in operation, consume low energy and have slim dimensions, adaptable for tight applications such as small boats.

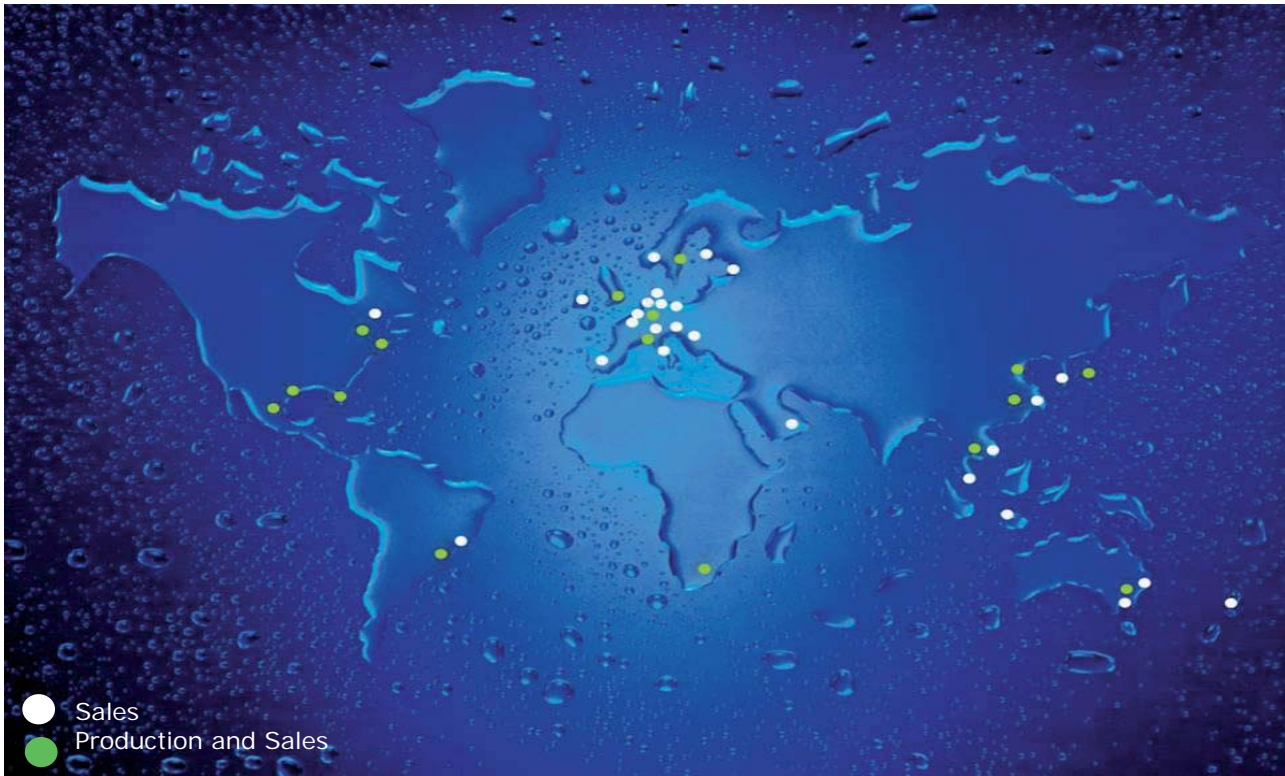
Since heat is used to reactivate the drying agent, surplus heat from the ship's machinery can be used to extract the moisture from the rotor. This means that the operating cost is very low. The dehumidifiers can also, be powered by electricity.

The dehumidifiers are easy to install and take up little space.

Service

All mechanical equipment requires service at regular intervals, filter replacement and routine checks can be carried out by personnel on board. Monitoring systems are easy to install and Munters guarantees the availability of original spare parts. We are able to deliver parts on site rapidly or provide a maintenance kit.

Our international network of engineers can install and maintain your system so that everything will work with maximum efficiency, at all times.



An international name, where the customer comes first

Munters has offices in 27 countries and when it comes to desiccant dehumidification technology is the global market leader. Munters has 4,000 employees and more than 300 branches around the world. It is the worldwide humidity control specialist, providing products and services for dehumidification, humidification and air cooling.

Munters DH Industrial Division is concerned with air conditioning using dehumidification – as well as production and sales of dehumidifiers, engineering, customer service and sorption air conditioning.

Munters shares ideas within its international network, giving the Group an outstanding reputation as a reliable, fast-acting and customer-orientated expert in air conditioning.

Munters philosophy of customer satisfaction is central to our decision-making. When developing and manufacturing our systems, we see happy customers as our number one target. And this is what our employees strive to ensure every day.

www.munters.com

AUSTRALIA Tel +61 2 8843 1580 munters.nsw@munters.com.au	AUSTRIA Tel +43 1 6164298-0 luftenfeuchtung@munters.at	BELGIUM Tel +32 3 458 24 34 info@muntersnv.be	BRAZIL Tel +55 41 3317 5050 munters@munters.com.br	CANADA Tel +1 905 858 5894 dhinfo@munters.com	CHINA Tel +86 10 8048 1121 info@munters.com.cn
DENMARK Tel +45 4495 3355 info@munters.dk	FINLAND Tel +358 9 8386 030 info@munters.fi	FRANCE Tel +33 1 3411 5757 dh@munters.fr	GERMANY Tel +49 40 73416-01 mgd@munters.de	ITALY Tel +39 0183 5211 marketing@munters.it	JAPAN Tel +81 3 5970 0021 mkk@munters.co.jp
KOREA Tel +82 2 761 8701 munters@munters.co.kr	MEXICO Tel +52 722 270 4030 munters@munters.com.mx	NETHERLANDS Tel +31 172 43 32 31 vochtbeheersing@munters.nl	NORWAY Tel +47 2312 6700 service@ateam.no	POLAND Tel +48 58 320 01 00 dh@munters.pl	SINGAPORE Tel +65 6744 6828 info@munters.com.sg
SOUTH AFRICA Tel +27 11 971 9700	SPAIN Tel +34 91 610 09 02 marketing@munters.es	SWEDEN Tel +46 8-626 6300 avfuktning@munters.se	SWITZERLAND Tel +41 52 3438886 info.dh@munters.ch	UNITED ARAB EMIRATES Tel +971 4881 3026	UNITED KINGDOM Tel +44 8708 505 202 dryair@munters.co.uk
UNITED STATES Tel +1 978 241 1100 dhinfo@munters.com					

