Process Freezer Application Guide

Humidity Control for Process Freezing:

Improve production and product quality all year round

Munters

Munters is the world leader in dehumidification

Munters is the largest manufacturer of dehumidifiers in the world. Since developing the first desiccant dehumidifier in the late 1930's, Munters has continued to innovate in the fields of dehumidification and energy recovery. Our long history and extensive expertise in dehumidification makes us the premier choice for your dehumidification needs.

WHY DEHUMIDIFY?

- ☐ **Fewer Defrost Cycles**
- ☐ **Improved Product Quality**
- ☐ **No Process Interruptions**
- ☐ **Improved Worker Safety**

Process freezing operations are high-volume, fast-paced production systems that must operate continuously to make a profit. High levels of humidity in production facilities (especially during the summer) can cause expensive and unproductive interruptions because of the need to defrost evaporators and remove ice from conveyors, floors and walls.

With a Munters desiccant dehumidifier, ice buildup and defrost cycles in spiral and blast freezers are significantly reduced, ensuring smooth, high-speed operations all year round. A Munters dehumidifier removes the moisture from the air before it can accumulate as ice on your equipment. Unlike conventional refrigeration-based dehumidification, Munters units use advanced desiccant technology. The benefits are substantial, including improved profits as well as peace of mind.

Get to the point, the dewpoint.

THERE ARE TWO BASIC FREEZER DESIGN PRINCIPLES:

- ☐ **Remove the moisture at its source**
- ☐ **Maintain low dewpoint so ice doesn't form**

The principal design concerns for food freezers are quantifying the moisture infiltration and determining the appropriate control dewpoint. All other design decisions are factored based on these two points.

If the installation is already in place, the designer's job is as simple as taking surface temperature readings on the walls, floor and conveyor supports where ice formation needs to be at a minimum. The control dewpoint will be slightly below that surface temperature.

In some cases, the temperature is so low that it would be economically impractical to maintain the dewpoint low enough to prevent all ice formation. It may be necessary to determine what temperature is economically feasible and assume that there will be some ice formation, but at a much reduced rate.

The lower the air dewpoint, the more efficient your refrigeration system becomes. The result is less frost on ceilings and

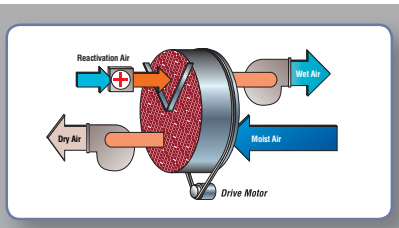
conveyors. By removing the moisture at its source—before entering the cold space— the system will cost less to buy and less to operate.

Determine the Loads

Moisture loads come from moist air infiltrating through doors and conveyor openings as well as moisture evaporating from the product.

Product Moisture – Water vapor from the product is relatively easy to quantify by simply weighing the product entering and leaving the freezer. The difference in weight is largely moisture. If the product is wrapped before freezing, this load will be close to zero.

Infiltration Air – Factory or outside air entering the space carries the largest moisture load. Air enters as a door is opened or continuously through openings around conveyors. In both cases, it is important to reduce this load to a minimum through the use of entry tunnels and vestibules. Additionally, door openings inside on the freezer should be limited to minimum.



Desiccant Wheel Illustration

The Munters Solution

Munters dehumidifiers have a desiccant wheel that rotates slowly between two primary airstreams, process and reactivation. In the process airstream water vapor is removed as it passes through the desiccant wheel. This dehumidified air is then delivered to a manufacturing process or space. The wheel then rotates into the reactivation sector where a heated airstream is passed through the wheel. The desiccant wheel releases the water vapor to this airstream.

In contrast to cooling, the desiccant process becomes more efficient as the temperature of the air decreases. Munters units have no difficulty producing air dewpoints of -30° F and lower. This allows you to create dry, wintertime moisture conditions during the summer.

Since the Munters unit removes moisture from the air to levels below the evaporator's temperature, it no longer freezes on cold surfaces in the room, which means refrigeration equipment operate more efficiently, with fewer evaporator defrost cycles, fewer conveyor jams due to ice build-up and safer, less slippery floors.

Process Freezer Types

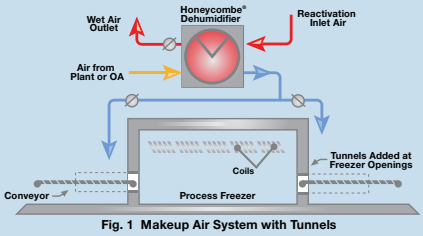


Fig. 1 Makeup Air System with Tunnels

No Vestibule (Fig. 1) —Frequently a spiral freezer or blast freezer is built without a vestibule. While vestibules are often impossible to install for space reasons, conveyor tunnels are essential to minimizing icing inside the freezer. Figure 1 explains the system graphically. Air is taken from the ambient plant (or outside air if the plant has a negative pressure), processed through the dehumidifier and supplied to the conveyor tunnels. The air should be enough to maintain a minimum of 100 FPM air velocity for the conveyor openings.

Vestibule System (Fig. 2)—When space allows, the vestibule system may be all that is required to minimize moisture in the process freezer. It has the advantages of low cost and simplicity in installation. Figure 2 explains the system graphically. Air is taken from the vestibule, processed through the dehumidifier and returned to the vestibule area just in front of the freezer conveyor entrance. This ensures that any air that infiltrates into the freezer is dry air with a moisture level below the temperature of the evaporators.

The dehumidifier can be switched on by a condensation controller, set to maintain the air at a specific dew point.

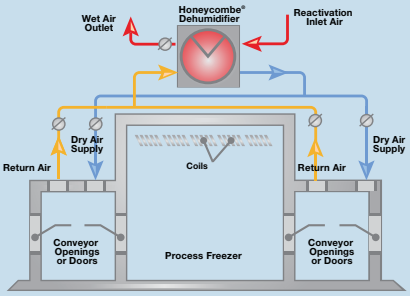
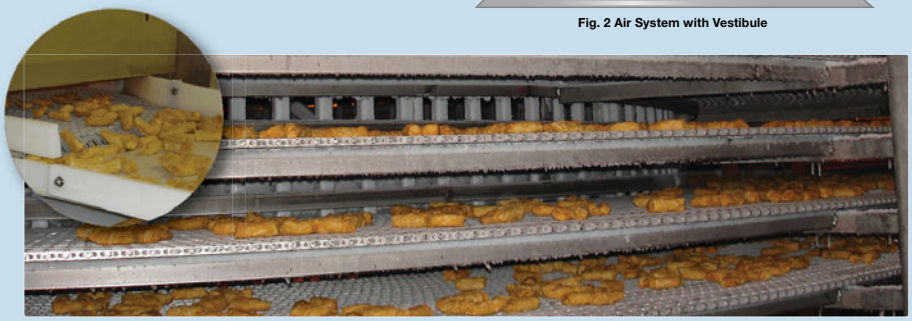


Fig. 2 Air System with Vestibule



Key Considerations

In the winter, there is much less water vapor in the air, so defrost problems are tremendously reduced. The ideal solution would involve reducing the moisture in the summertime to that low wintertime level.

Airflow regulation —Maintaining proper pressurization is an important aspect of system design. To ensure proper system balance, locate air control dampers in places suggested by figure 1 or 2. As in any air system, it is important to size dampers so appropriate airflow can be fixed without setting the damper too close to the totally open or closed positions.

Insulation —Ductwork carrying cold air outside the vestibules or plant must be insulated to avoid condensing moisture.

Cost —Both first cost and operating cost can be kept to a minimum by reducing moisture load. Conveyor tunnels, vestibules and reducing door openings will all reduce the load. Dehumidifier operational cost can be minimized by installing a reactivation energy modulation control. This device monitors reactivation to determine the amount of energy necessary to fully reactivate the desiccant, while minimizing energy consumption.

Conventional Systems can not efficiently remove moisture

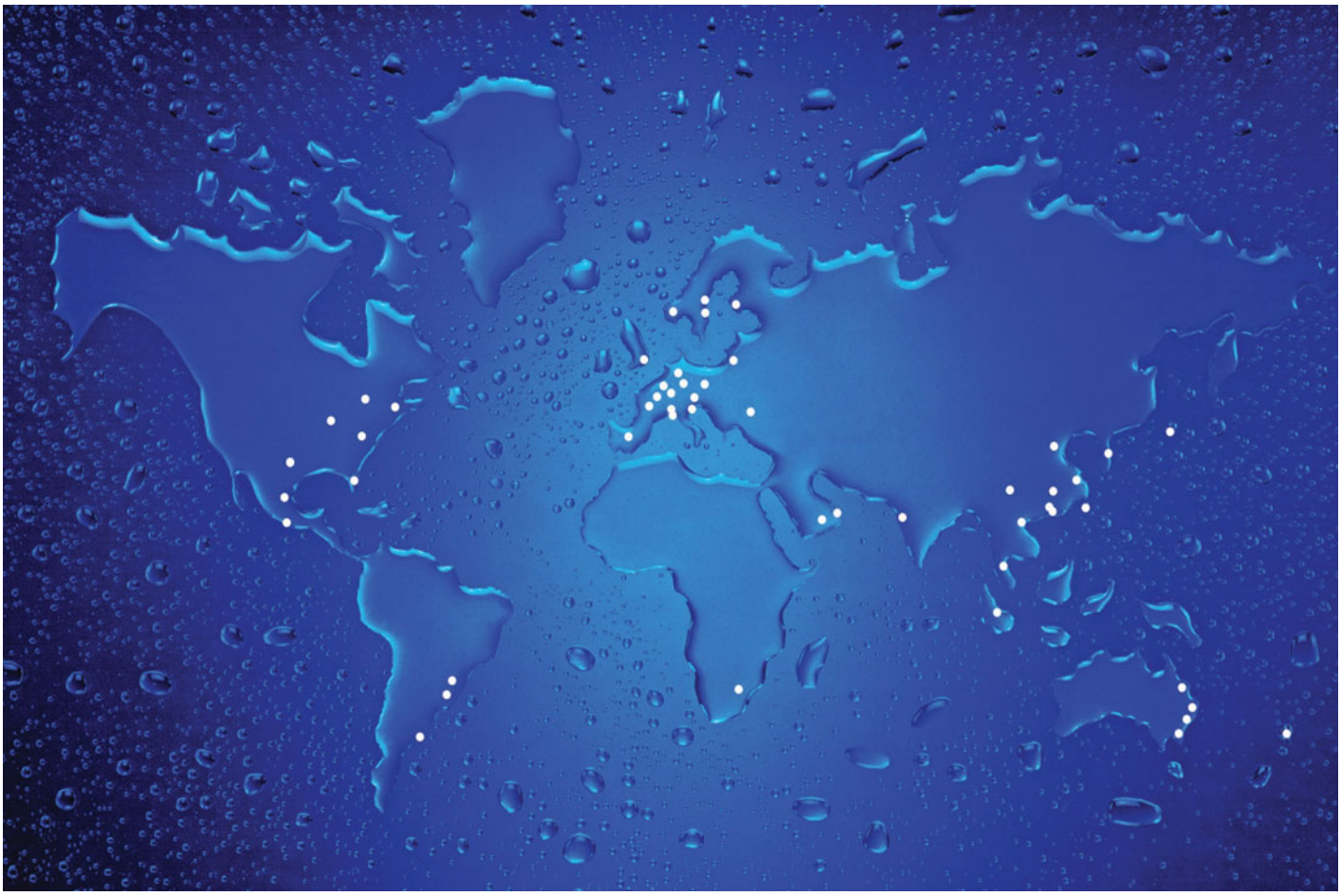
Process freezing systems are designed to remove sensible heat from a product rapidly and efficiently. They accomplish this cooling either by direct product contact as in a plate hardener, or indirectly by cooling the air that circulates around the product.

However conventional systems are not designed to efficiently remove latent heat—moisture—from the air in the freezing chamber.

While cooling coils can be automatically defrosted, ice on conveyors and floors must be removed manually, causing production to slow down or stop. Additionally, the defrosting of coils adds a heat load to the freezer and takes the coil "off line", which can impact the freezers ability to keep cold temperatures. This means that product cooling rates can vary with coil frost, yielding uneven production quality.

For some freezers, the need for a defrost cycle causes production to stop or slow down due to the loss in capacity. This causes expensive and unnecessary delays.

To reduce icing, the moisture in the air must be reduced. Refrigeration systems lack the cooling capacity to produce low air dewpoints when humidity is high. The coils freeze with condensed moisture before a low dewpoint can be achieved. Additionally, when coils do moisture removal, air is discharged at saturation (meaning the process air can not hold any additional moisture). When air is discharged at saturation, it does not have the ability to absorb any product or infiltration moisture load.



Munters is a global leader in energy efficient air treatment solutions.

Munters manufactures engineered products that can economically control humidity and temperature, provide energy recovery, and/or utilize direct or indirect evaporative cooling for comfort, process and environmental protection. With permanent or temporary solutions, Munters offers a wide variety of options to meet specific climate, application and budget requirements. Munters has net sales approaching $1 billion USD with more than 20 manufacturing facilities across the globe and sales offices in over 30 countries. Munters employs approximately 4,300 people worldwide.

For more information see www.munters.us

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