

## BULK MATERIAL HANDLING



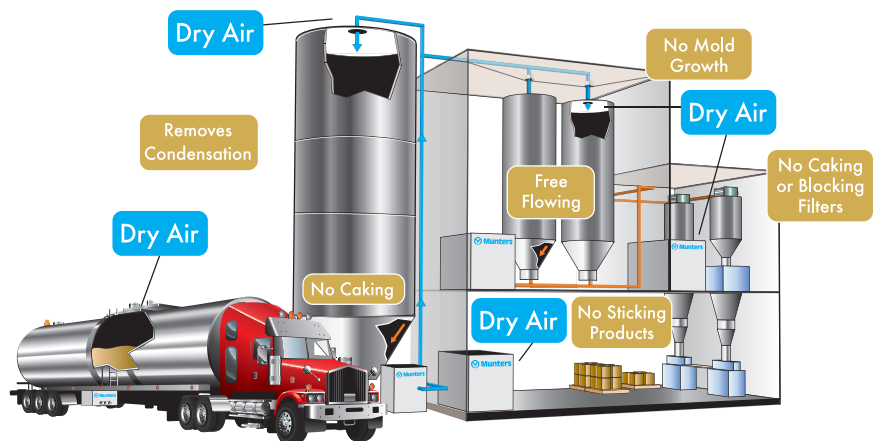
Desiccant dehumidification is used in silos to prevent condensation from forming and causing build-up on walls and clumping of ingredients.

# Bulk Handling Dehumidification Systems

Improve processing from start to finish

Hygroscopic products attract and retain moisture. From transporting of these materials to finished production and all stops in-between, any moisture problems can become costly.

Virtually every substance or compound has some affinity to absorb moisture from humid air and release moisture when the surrounding air is dry. In the case of hygroscopic ingredients, their affinity to absorb moisture from the air is particularly sensitive. This absorption of moisture causes many hygroscopic ingredients to stick and clump together. Once these products become sticky, they build-up inside railcars, silos, conveying lines and mixing machines. Build-ups cause product damage, blockages and disruptions in product flow, and further slows down processes in production, creating waste, sanitation and food safety problems, and overall causing costly downtime.



Munters systems are widely used to prevent condensation and other moisture related issues in all bulk handling and storage processes. By keeping the air dry and cool, silos, conveyors and mixing equipment operate more efficiently, reducing the cost and time required for cleaning.

## Dehumidification Protects Hygroscopics in Silos

Hygroscopic ingredients are commonly stored in silos. If humidity is high or if condensation occurs inside the silo, the products become sticky and slowly build-up on the silo walls and clump together. If an ingredient and the surrounding air are in equilibrium, the moisture content of the ingredient is proportional to the relative humidity of the surrounding air.



Dry air is fed into the blower used to convey ingredients from the truck to silos.

When a moist ingredient is brought into a dry environment, it will give up moisture until the water vapor pressure at its surface is the same as the vapor pressure in the surrounding air. Conversely, most ingredients absorb moisture from the air when the air contains more moisture than the product. For example, with condensation in silos, this condition occurs mainly at night when the temperature drops or during a sudden change in climate (i.e. a storm). The condensation forms on silo walls and ceilings when those surfaces become colder than the dew point of the surrounding air.

Sanitation issues and material handling problems resulting from material building up to silo walls cause costly downtime due to bacterial growth and ingredient lumping.

Dehumidifiers are used to keep the air inside the silo at a specified temperature and lower dew point to prevent problems from occurring.

The condition of the dehumidified air required is determined on a case-by-case basis depending on geographical climate conditions, indoor or outdoor silo locations, and ingredient characteristics.

## Pneumatic Conveying and Airveying Systems

Moisture regain causes many ingredients and powders that would otherwise convey smoothly, to stick together and build-up in conveying lines.

As air is compressed and the air volume decreases, the moisture content of the air remains the same. It is because the moisture content remains the same and the volume has decreased

that the actual dew point of the air increases, resulting in higher moisture vapor pressure.

Sticky ingredients or powders build-up inside conveying lines and interrupt flow. This then slows down the process, creating sanitation problems, increasing scrap and, consequently, causes costly downtime.

Many high volume manufacturing facilities receive their hygroscopic ingredients, such as sugar or calcium phosphate, by truck or railcar. The pneumatic conveying and airveying systems used to unload the ingredients from these trucks or railcars often experience ingredient sticking and conveying line build-up during periods of high humidity.

## Protect Product and Mixing, Blending Equipment

As product is conveyed through the processing plant, sometimes different ingredients or materials require mixing before the final product can be reduced. As in all parts of the conveying process, if the materials or ingredients are moisture sensitive, moisture regain can cause production or product issues.



Desiccant dehumidification is used to provide dry air to the ingredient stream to keep ingredients dry and the mixing and blending process smooth.

For mixing and blending of products, moisture problems can affect mixing time through overall product quality. Providing conditioned air at the correct humidity and temperature levels for the specific product can ensure the product is mixed correctly and efficiently.

## Design Requirements

Dehumidification systems for bulk material handling have similar design requirements. The designer should take into consideration the following information:

### Loads

When retrofitting or designing bulk material handling systems with dehumidified air, process

## Hygroscopic Examples

- Powders
- Salts
- Ingredients
- Plastics

## Benefits of Dehumidification

- Ensures quality of product
- Improves product flow
- Reduces product waste
- Prevents ingredient lumping and build-up
- Reduces production stops for cleaning
- Decreases drying time after sanitation

and reactivation air streams are usually drawn from outdoors. Using outdoor air is preferable due to the high probability of airborne product dust from the process.

If room air must be used, sufficient filtration should be added to the inlets of the dehumidifier to ensure that the air entering the dehumidifier is product free.

A secondary concern with using room air is placing the mechanical rooms or other rooms, where these dehumidifiers and pneumatic conveying blowers are located, under a negative pressure. The negative pressure could cause plant balance issues.

The advantages to using makeup air from the outdoors are that there are no room loads, (people or door openings influencing the dehumidifier load), and it is simple to accurately quantify the temperature and moisture loads. The dehumidification system takes outdoor air and delivers it at the condition determined during design for the storage or conveying system.

When designing dehumidification systems that use outdoor makeup air, be sure to design for worst-case summer and winter conditions. The summer conditions will determine the dehumidification and cooling load, the winter design may determine if process heating is required.

The summer and winter design temperatures are published in chapter 24 of the American Society of Heating, Refrigeration and Air Conditioning Engineer's (ASHRAE) "Handbook of Fundamentals."



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