AIR DRYERS ON BULK STORAGE TANKS

WHAT IT DOES

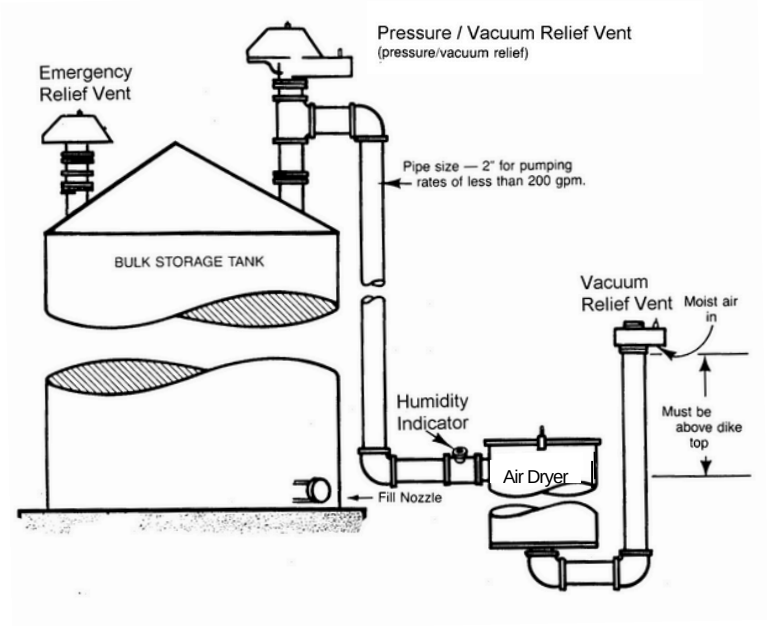
An air dryer on a bulk chemical tank helps protect product quality and the tank from corrosion by taking excess moisture out of air that enters the tank.



Image from Protectoseal. Series 782 air dryer.
https://www.protectoseal.com/specialty-valves-and-fittings/

HOW IT WORKS

Moisture laden air enters the tank system when product is withdrawn, or when the vapor space of the tank cools. This moist air is dried by the desiccant in the dryer before it enters the tank.



SIZING A DRYER

Work with the equipment vendor to select a proper sized dryer. Sizing is based on how much air enters a tank, how fast it enters, and the desired time before dryer service is needed. Selecting a dryer that is too small may cause a high pressure drop. If that happens, moist air may bypass the dryer by entering the backup vacuum relief vent. A small dryer will also result in shorter service cycles. Too large of a dryer may become cost prohibitive.

FUN FACT

Dryer is a noun for a machine or apparatus that makes things less wet. **Drier** is a comparative adjective that means more dry.

DESICCANT

Desiccants remove moisture vapor by adsorption and capillary condensation. Typically, they are inert, non-toxic, and non-flammable. Even when saturated with adsorbed moisture, they look and feel dry to the touch.

CALCIUM SULFATE

Calcium sulfate (gypsum) is used to make "Drierite" brand granular desiccants.

SILICA GEL

Silica gel is also a desiccant. Silica gel isn't actually a gel. It is a porous, granular form of silica manufactured from sodium silicate.

MOISTURE INDICATOR

Moisture indicators are usually regular desiccant that is impregnated with a compound, causing a color change when they reach their maximum moisture saturation. The indicator granules are placed in a window or pocket in the system to make the color easily visible. For instance, the indicator may change from blue (dry) to pink (saturated).

REGENERATION

Desiccants typically may be used repeatedly if regeneration is completed properly. The process requires high temperatures. See the "Regenerating Desiccant" section on page 2.

DRYERS VS. NITROGEN PADS

Moisture and oxygen both play roles in tank corrosion. Air dryers only reduce the moisture that enters the tank. Dryers do not reduce the oxygen present. Nitrogen padding a bulk tank reduces both oxygen and moisture levels, thus providing superior tank and product protection.

AIR DRYERS ON BULK STORAGE TANKS

SERVICE LIFE

Time between maintenance of an air dryer depends on how much moisture the dryer sees over time. Actual service life of the desiccant before it becomes saturated is affected by:

- Tank throughput (how much product is taken out)
- Flow rate (how fast product is removed)
- Daily temperature swings of vapor space and liquid
- Ambient humidity
- Vacuum and pressure relief settings and function
- Proper match of the dryer to the tank size

Specifying an exact service life is difficult. That is why most dryers use a moisture indicator which eliminates guesswork; it tells you when the desiccant is exhausted.

REPLACING OR REGENERATING DESICCANT BASED ON THE CALENDAR IS NOT SUFFICIENT unless history shows you are consistently servicing before the end of the service life. An area with relatively higher temperatures and humid conditions may overwhelm an air dryer too quickly to be practical. Nitrogen padding the tank may be required.

MOISTURE INDICATORS

Moisture indicators are usually regular desiccants that have been impregnated with a compound that provides a color change when it reaches maximum moisture saturation. The indicator granules are placed in a window or pocket in the system to make the color easily visible. For example, the indicator may change from blue (dry) to pink (saturated).

The color change is pronounced in order to signal when the drying agent should be replaced.

DRIERITE INDICATORS:
Active on left (blue). Saturated on right (pink).



Image from W A Hammond Drierite CO LTD.
https://secure.drierite.com/catalog3/page9.cfm?activeMenu=2

REGENERATING DESICCANT

Follow instructions from the manufacturer of your specific desiccant regarding regeneration, but some vendors of silica gel and calcium sulfate-based desiccants state their desiccant may be reused repeatedly by reactivating (drying) the granules. Some customers have reported waiting until a 90-100° F day and spreading the desiccant on a black tarp until it changes back to the original material color and presumably is reactivated. There is no data to show this works.

However, REACTIVATION ONLY WORKS AT SUFFICIENTLY HIGH TEMPERATURES according to a number of vendors.

For instance, the maker of Drierite desiccants state that regeneration temperature is crucial. Drierite states that absorbed moisture is chemically-bound to the calcium sulfate. Temperatures in the range of 400°-450° F are required to break these bonds and release absorbed moisture. Lower temperatures, regardless of heating time, will not regenerate DRIERITE unless applied under vacuum (26" Hg, 325° F or 28" Hg, 275° F). Drierite also warns not to overheat the desiccant because high temperatures can alter the crystal structure and render the desiccants permanently inactive [i].

Protectoseal specifies that their silica gel should be baked at 450° F for 8 hours [ii].

Another vendor of silica gel desiccant states their small cabinet canisters can be recharged in a conventional oven at 235° F for 3 hours [iii]. Drytech indicates that silica gel will release moisture at temperatures as low as 180° F, but they also note that as

P ambient temperatures increase, silica gel performance drops off drastically. While silica gel may be able to regenerate at lower temperatures than calcium sulfate-based desiccants, the gel may actually release moisture back into the atmosphere it is supposed to protect if ambient temperatures exceed 100°F [iv].

Successful regeneration assumes the granules are not contaminated with solids or other materials.

REPLACING DESICCANT

If it is not practical to regenerate desiccant, replacement desiccant can usually be obtained from the dryer vendor. Purchasing desiccant made for your specific dryer model will assure the correct volume, granule and pore size, and product type to best match the dryer size and cross-section.

When changing the desiccant, it is important to thoroughly clean out the inside of the dryer vessel, especially if it is constructed with mild steel. A shop vac works well to clean the inlet at the bottom of the dryer. That is where any loose material will collect. The mesh basket should be inspected, cleaned, and replaced if damaged. The PVRV needs to be inspected and cleaned to ensure proper operation. If there is a humidity sensor it should be inspected and replaced if necessary. Using color changing desiccant in the sensor device or window is critical for effective operation.

DISPOSING OF DESICCANT

If the desiccant has picked up a new color, such as brown, this may indicate it has absorbed a chemical. In this case, the desiccant should be disposed of in accordance with local and state regulations. In most cases, uncontaminated desiccant can be placed in a landfill.

VENDORS

Dryers and desiccant are often provided by the same distributor that provides bulk site pumps, piping, and other equipment. Below are dryer vendors who may point you to their distributors. This should not be considered an endorsement.

- The Protectoseal Company. Bensonville, IL. (630) 595-0800. www.protectoseal.com
- W A Hammond Drierite CO LTD., Xenia, OH. (937) 376-2927. www.drierite.com
- Drytech, Inc. Cookstown, NJ. (609) 758-1794. www.drytechinc.com

REFERENCES

[i] W A Hammond Drierite CO LTD. https://secure.drierite.com/catalog3/page19b.cfm
[ii] Protectoseal. https://www.protectoseal.com/PDF_VENTS/SPEC_SHEETS/780_SPEC.pdf
[iii] The Rust Store. https://www.theruststore.com/900-Gram-Rechargeable-Silica-Gel-Dehumidifier-P59C27.aspx
[iv] Drytech, Inc. https://www.drytechinc.com/types-of-desiccant/

NOTICE: The information, procedures, methods, and recommendations herein are presented in good faith and are believed to be accurate and reliable as of the publication date but may well be incomplete and/or not applicable to all conditions or situations. No representation, guarantee, or warranty is made as to the accuracy, reliability, or completeness of said information, procedures, methods, and recommendations. Nor is any representation, guarantee, or warranty made that application or use of any of the same will avoid hazards, accidents, losses, damages, or injury of any kind to persons or property, or give desired results, or that the same will not infringe patents of others. Nor does the information, procedures, methods, and recommendations herein represent the views of any organization or person other than that of the author unless explicitly noted. Readers must satisfy themselves as to the suitability of said information, procedures, methods, and recommendations prior to use. TELONE™ and Teleos Ag Solutions™ are registered trademarks of Teleos Ag Solutions, Inc. TELONE™ by Teleos is a federally Restricted Use Pesticide. Always read and follow label directions.