

Dehumidification for Industrial Coating Applications

By:

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Reasons for Using Dehumidification

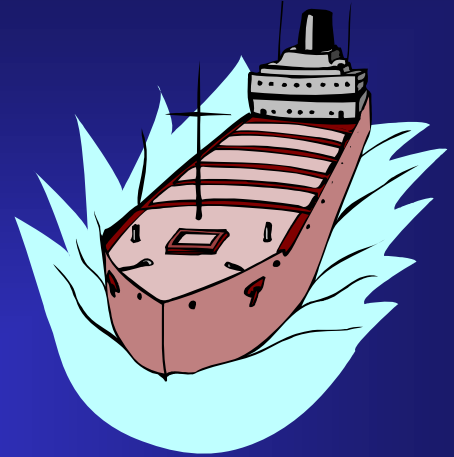


- Construction/Coating Schedules
- New VOC Regulations
- Paint Specifications
- Adverse Weather Conditions

Features & Benefits of Dehumidification

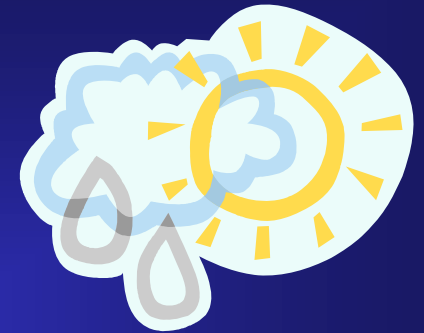
- Controls Humidity in Workspace
- Monolithic Coat: Ends Daily Blast and Coat Cycle
- Easier Inspections
- Creates Suitable Environment for Trades
- Eliminates Weather Delays
- Adds residual heat and helps to ventilate tanks.

History of Desiccant Dehumidification

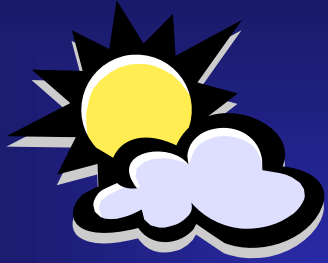


- Developed for commercial use for the U.S. Navy, which needed to keep the cargo holds of ships dry, during WWII.
- Honeycombe rotors designed in the 1950's by U.S. Navy Commander Oliver Colvin and Carl Munters.

Basic Psychrometrics



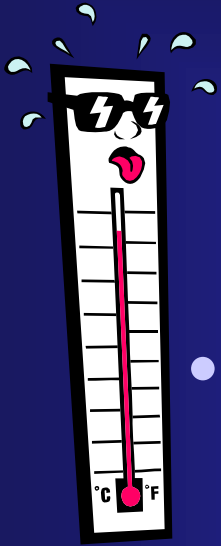
- The measurement of the heat and water vapor properties of air.
- Commonly used variables are temperature, relative humidity, and dewpoint temperature.
- You can figure out the dewpoint if you know at least two of the psychrometric variables.



Basic Psychrometrics

- Relative Humidity: A measure of the water in a given air sample, relative to its ability to hold moisture at that temperature.
- Warm air holds more moisture than cold air.
- 100% RH = Dewpoint (Saturation)
- Dewpoint: Water vapor will condense on surfaces when the dry bulb temperature falls below the dew point, or saturation, temperature.

Basic Psychrometrics



- Wet Bulb: Temperature at which water evaporates when air is blown over a wet surface (measured with a sling psychrometer).
- Dry Bulb Temperature: can be measured with a regular thermometer.
- Absolute Humidity: A measure of the specific moisture in the air, related in grains per pound of air.

PSYCHROMETRIC CHART

Linric Company

Desiccant System Engineering,
Engineering Software Development

Linric Company, Software Division

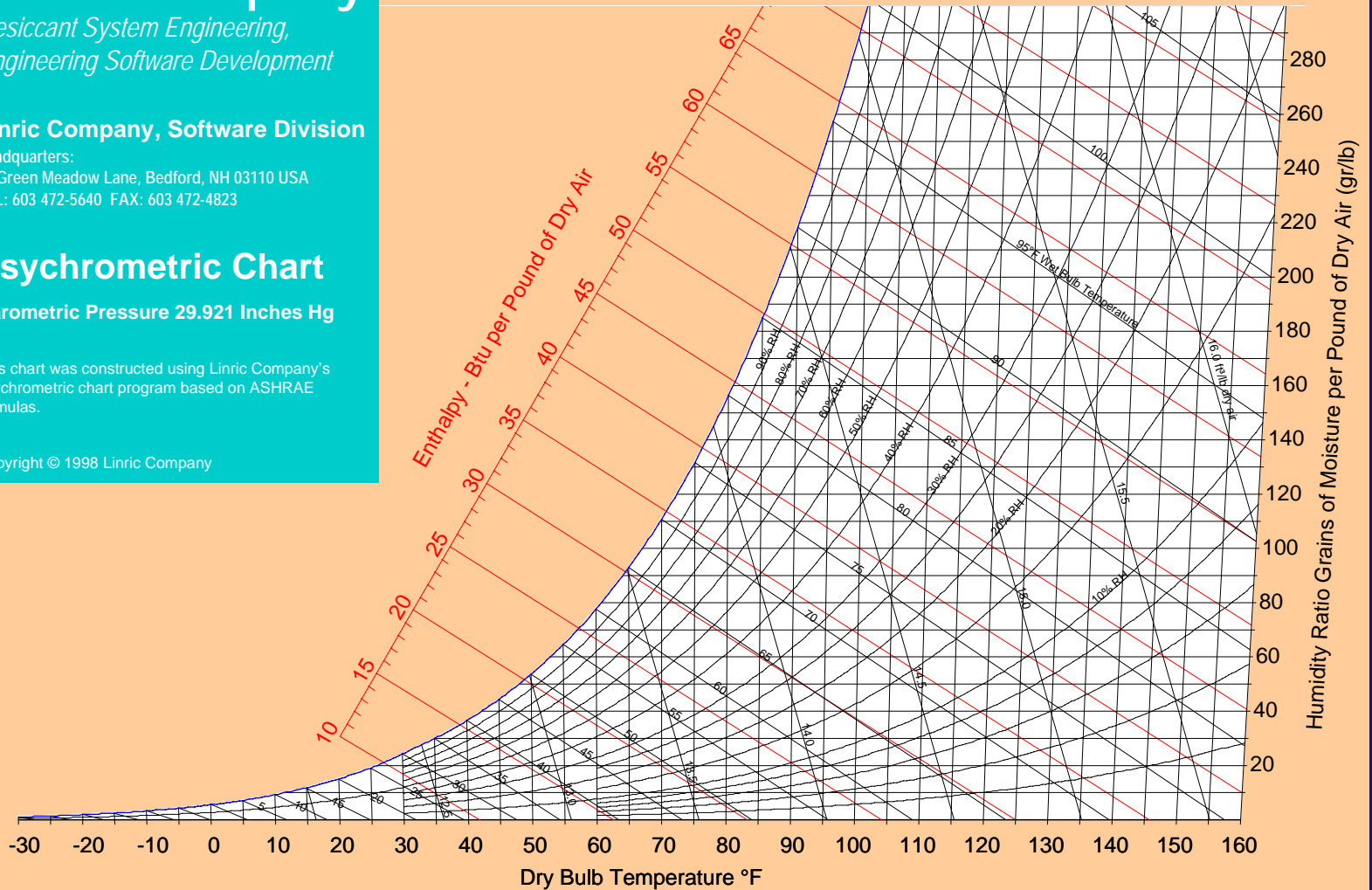
Headquarters:
44 Green Meadow Lane, Bedford, NH 03110 USA
TEL: 603 472-5640 FAX: 603 472-4823

Psychrometric Chart

Barometric Pressure 29.921 Inches Hg

This chart was constructed using Linric Company's
psychrometric chart program based on ASHRAE
formulas.

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L.A. Weather Data

Weather Data	December	May
Normal Daily Low Temperature	47.9° F	56.3 ° F
Relative Humidity (AM)	68%	83%
Dewpoint Temperature	37.6 ° F	51.21° F
Absolute Humidity	33 gr./lb.	55 gr./lb.

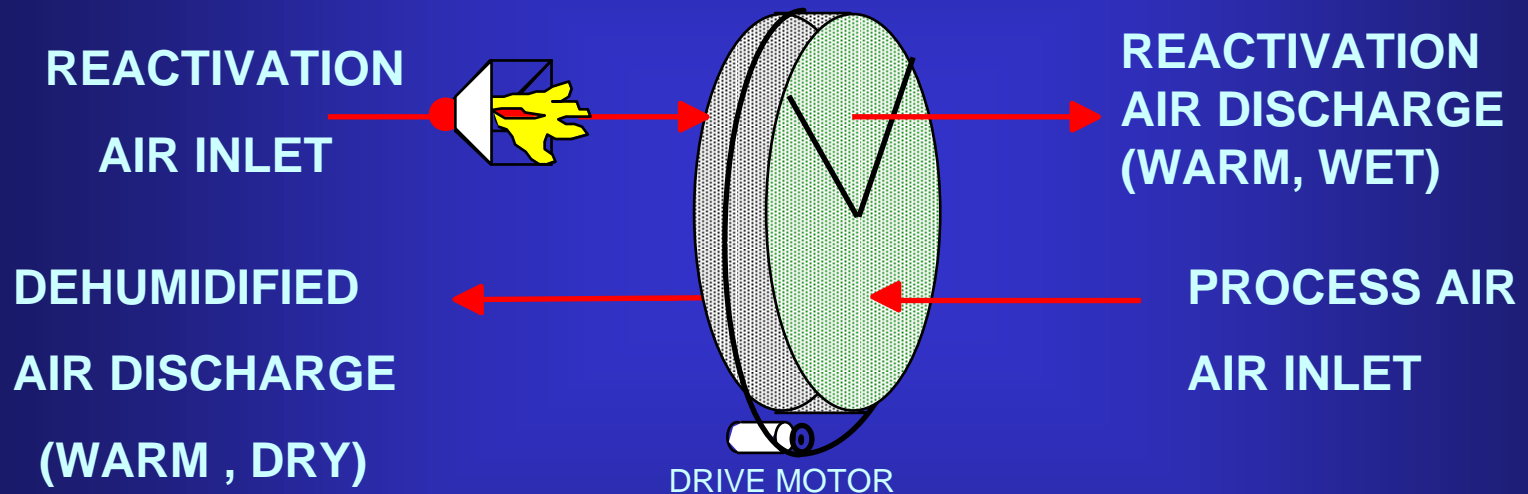
Desiccant DH Basics

- Desiccant dehumidifiers use a desiccant or “sorption” material to attract and hold moisture from the air. (Ex: Lithium Chloride & Silica Gel).



- The desiccant material can be reactivated or regenerated using thermal means, i.e., gas burners or electric heater coils.

How Desiccant Dehumidifiers Work



THE DESICCANT WHEEL ROTATES AT A FIXED SPEED TO TRANSFER THE MASS OF MOISTURE FROM THE SUPPLY AIR TO THE REACTIVATION AIR



Refrigerant Dehumidification

- Cooling of air to below its dewpoint.
- Most effective at high temperatures and high humidity (i.e.. Houston, TX).
- Ambient air is circulated over a system of refrigeration coils, where condensation occurs. The moisture is collected & removed.
- Air exits at a reduced temperature, reduced dewpoint and reduced absolute humidity.
- Sometimes used in conjunction with desiccant dehumidifiers, to post-cool the air stream and further lower the dewpoint.



Refrigerant Dehumidification

- Relatively low power requirements versus desiccant dehumidification.
- Does not work at low temperatures, somewhere between 40° and 65° F.
- At moderate and low temperatures, needs more air flow than desiccant for the same level of protection.

Heat vs. Dehumidification



- Does not decrease the moisture content, but it does increase the ability of the air to hold moisture.
- Heating decreases RH, but it does not change the dewpoint.
- It is difficult to maintain a proper dewpoint spread with heaters only.
- High temperatures may damage coatings & are uncomfortable to work in.

Data Needed for DH Planning



- Tank Size (Diameter & Height).
- Location of Tank.
- Proximity of Tank to Equipment.
- Space Available (Footprint).
- Weather Data.
- Coating/Project Specifications.
- What agency has fire jurisdiction?

Where is Dehumidification Used?

Tank Coating (Interiors)

Power Plants

Water Treatment Plants

Manufacturing Plants

Equipment Coating

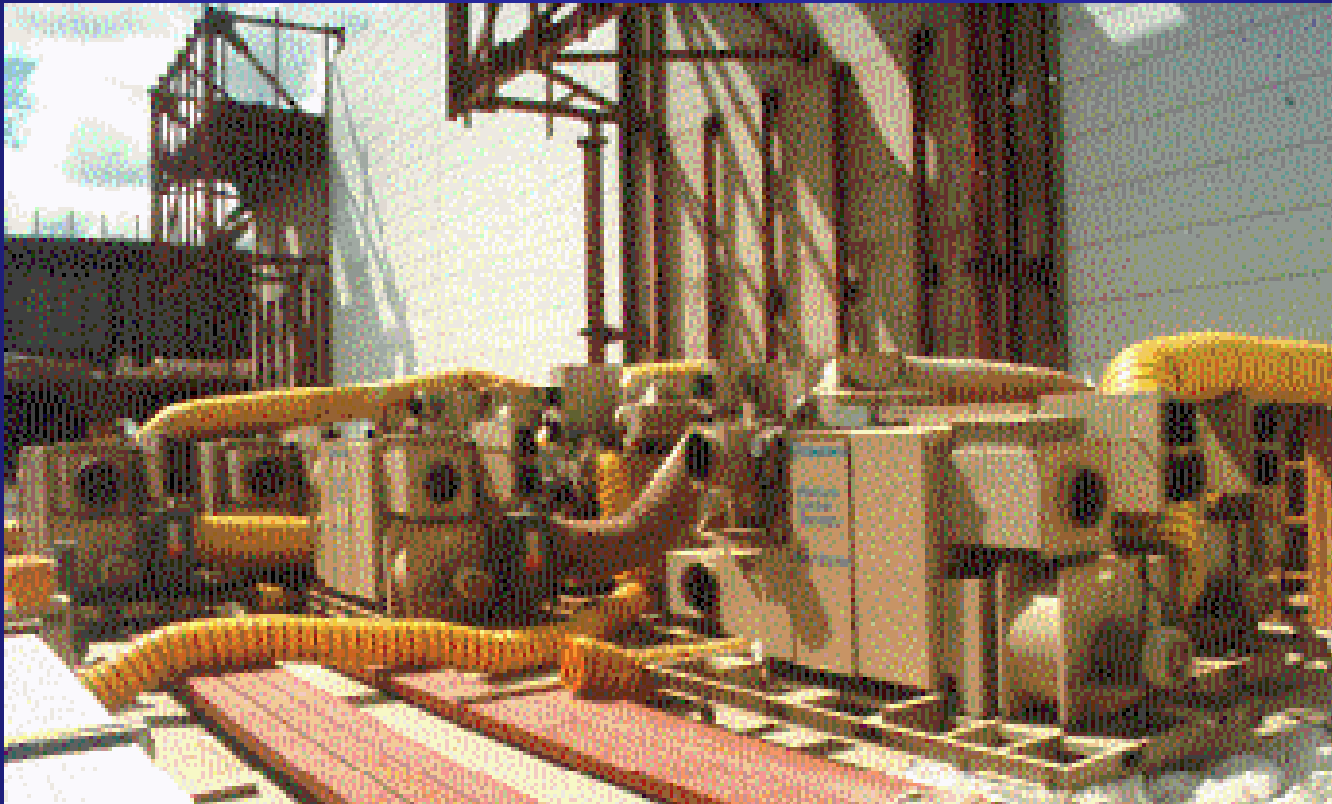
Buildings & Concrete Slabs

Dehumidification in a Storage Tank



Drying for Blasting & Coating

Semiconductor Plant



Drying for Epoxy Coating & Fireproofing

Concrete Drying



Remove Excess Moisture from Concrete

Water Treatment Plant



Remove Excess Moisture from Concrete

How much does it cost?

- Rental: a 4,500 cfm dehumidifier rents for about \$3,600 a month.
- Leasing: a 5,500 cfm dehumidifier will cost about \$1,400 a month.
- Purchasing: A 5,500 cfm dehumidifier, in an insulated cabinet, with both gas and electric reactivation will cost about \$48,000.00, plus tax and shipping.

How much DH do I need?

9,000 cfm DH – 2 million gal. tank

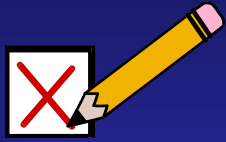
7,250 cfm DH – 1.5 million gal. tank

4,500 cfm DH – 1 million gal. tank

2,250 cfm DH – $\frac{1}{2}$ million gal. tank

1,125 cfm DH – $\frac{1}{4}$ million gal. tank

600/775 cfm DH – 150,000 gal. tank



Specifications

- Air Changes Per Hour (at least 2 for most tanks).
- Dewpoint Spread should be at least 17° F.
- Schedule of Operation (ideally 24 hours).
- Equipment: Desiccant dehumidifiers must use Silica Gel. Refrigerant DH is not usually acceptable, nor can heaters replace DH.
- Internal Relative Humidity less than 50%.
- If heaters are used, they should be electric, indirect fired or steam coil models only.
- Cannot re-circulate air from the space or from filtration equipment back through the dehumidifier.

References

- The Dehumidification Handbook, Second Edition
Lew Harriman, Cargocaire Engineering (1990)
- SSPC Procedure Handbook, #00-09
Surface Preparation & Painting of Tanks and Closed
Areas
Dr. Bernard R. Appleman & Others (2000)
Available for purchase at www.sspc.org

Web Links

- Global Center for Desiccant Technology:
<http://www.me.msstate.edu/GCDT/>
- Linric Company: Psychrometrics
<http://www.linric.com>
- Psychrometric Calculator (FREE):
<http://www.engx.com/Psychrometry/psychrometry.html>
- Government Weather Data Downloads (FREE):
<http://ftp.ncdc.noaa.gov/pub/data/ccd-data/>
- Current Weather Data:
<http://www.accuweather.com/>