Active Desiccant Dehumidification

LEW HARRIMAN
Mason-Grant Consulting • Portsmouth, NH
www.MasonGrant.com

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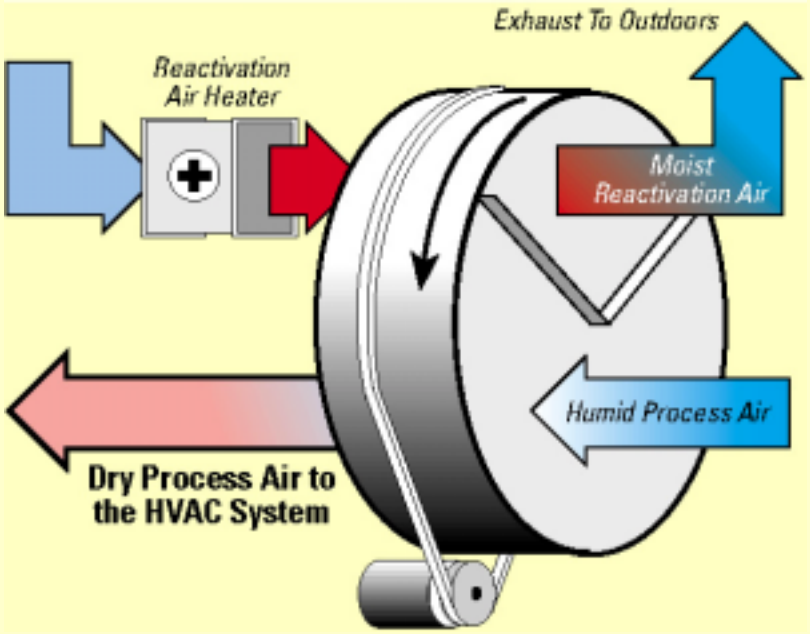
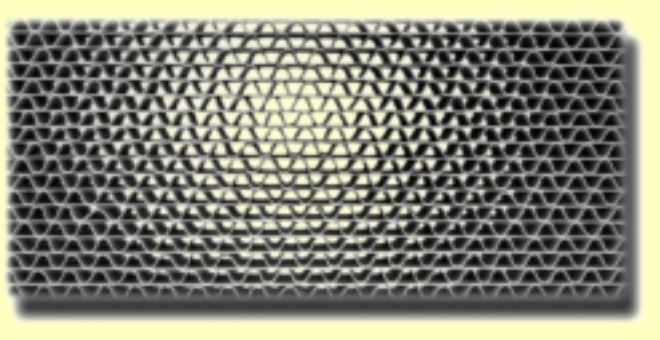
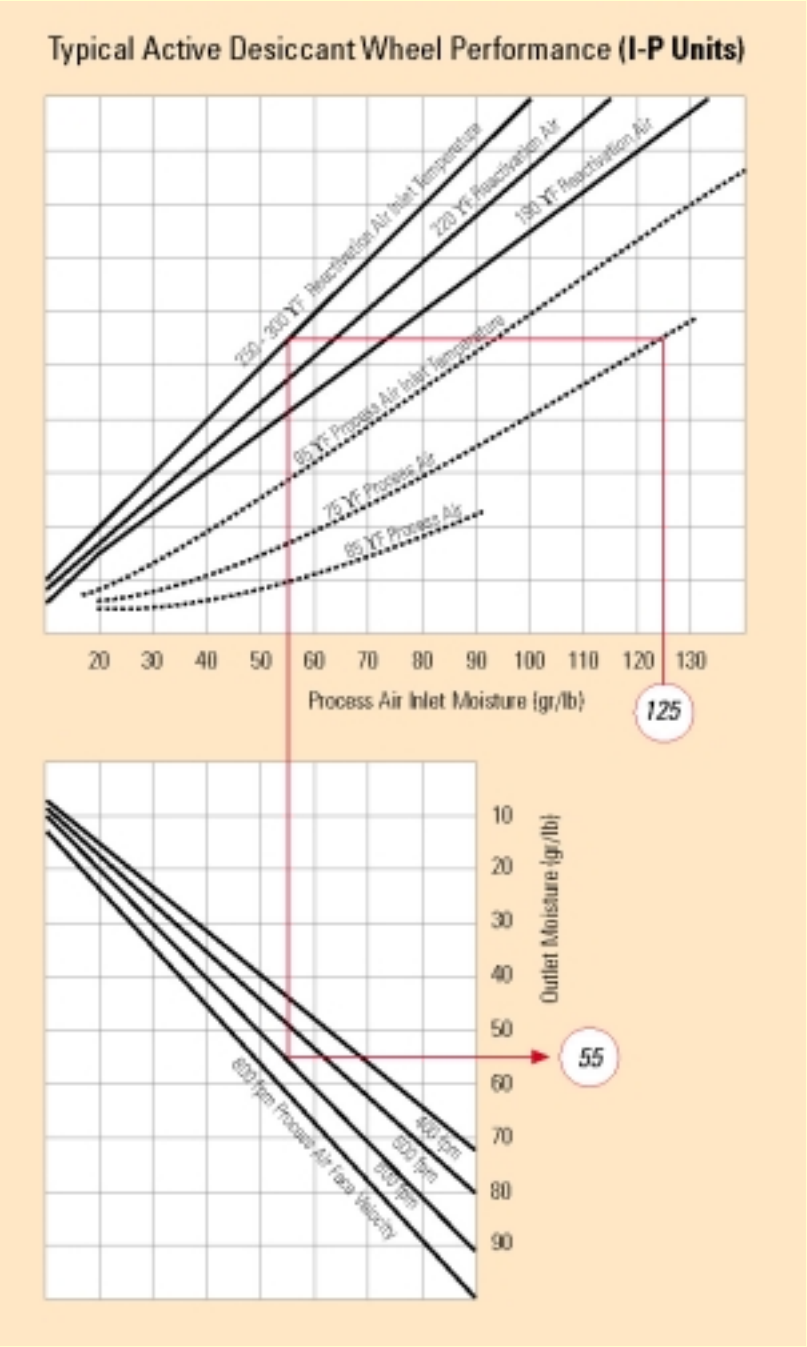


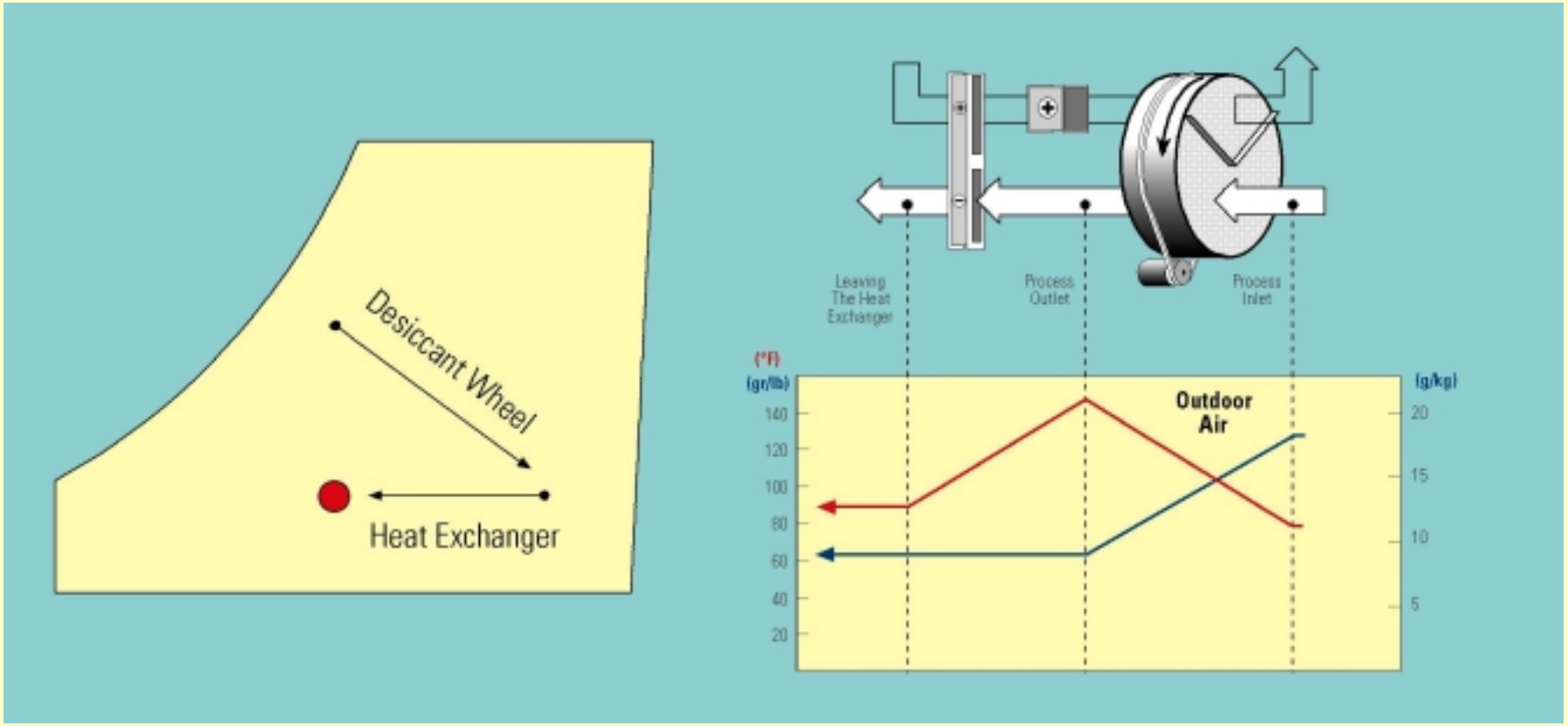


Dehumidification Performance Depends On:

- Process air inlet conditions
  - Moisture
  - Temperature
- Reactivation air temperature
- Process air velocity



Temperature Rise from Dehumidification



Advantages & Limitations of Desiccants (Compared to Mechanical DH)

- Advantages of Desiccants
  - Dries easily below 40°F dew point
  - Dries deeply – desiccant unit size usually smaller than mechanical DH
  - Responds in minutes – precise control is easy
  - Dries in cold weather – advantage for unheated storage and building drying
  - Can use cheap heat – reducing electric usage
  - Equipment sometimes costs less

- Limitations
  - Poor efficiency – 1500 to 4000 Btu/lb of water removed
  - Needs supplemental cooling in most applications
  - Support depends mostly on manufacturer (limited 3rd-party service)
  - Equipment sometimes costs more

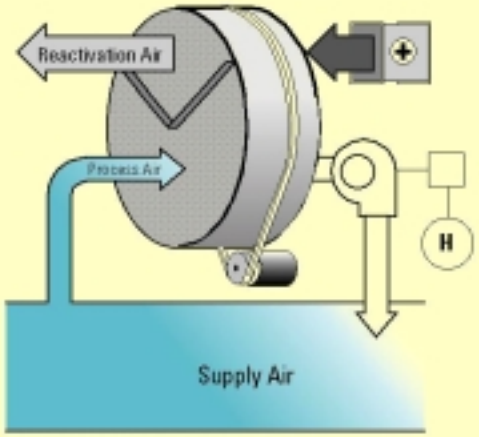
Solid vs. Liquid Desiccant Equipment

Desiccant Wheel Systems

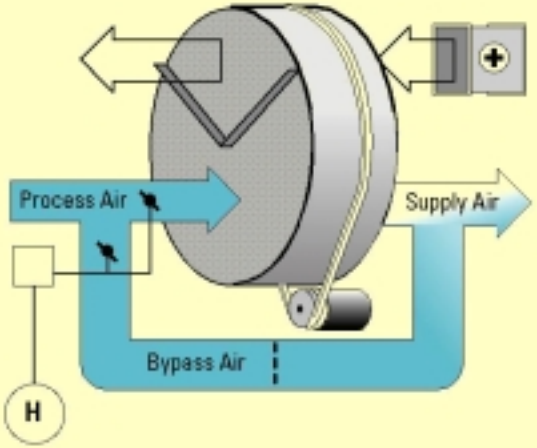
Liquid Desiccant Systems

Capacity Control Alternatives

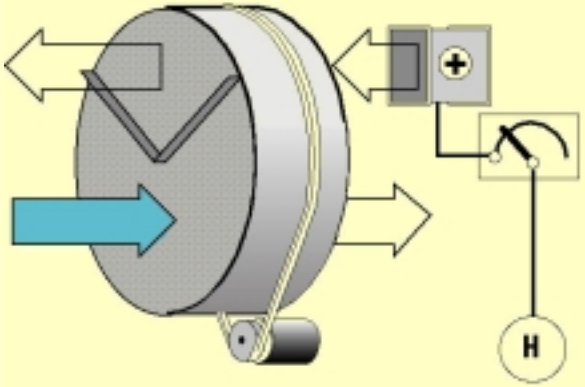
Process Fan Modulation



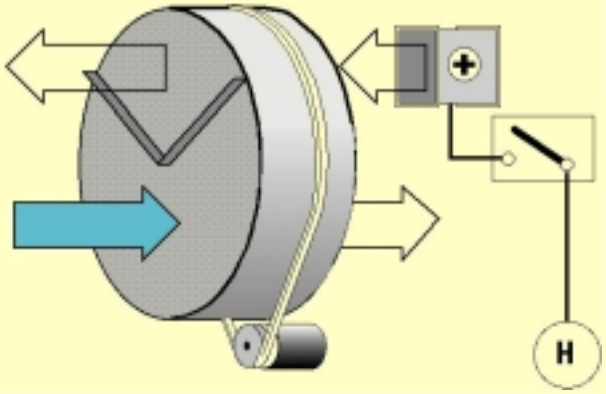
Variable Air Bypass



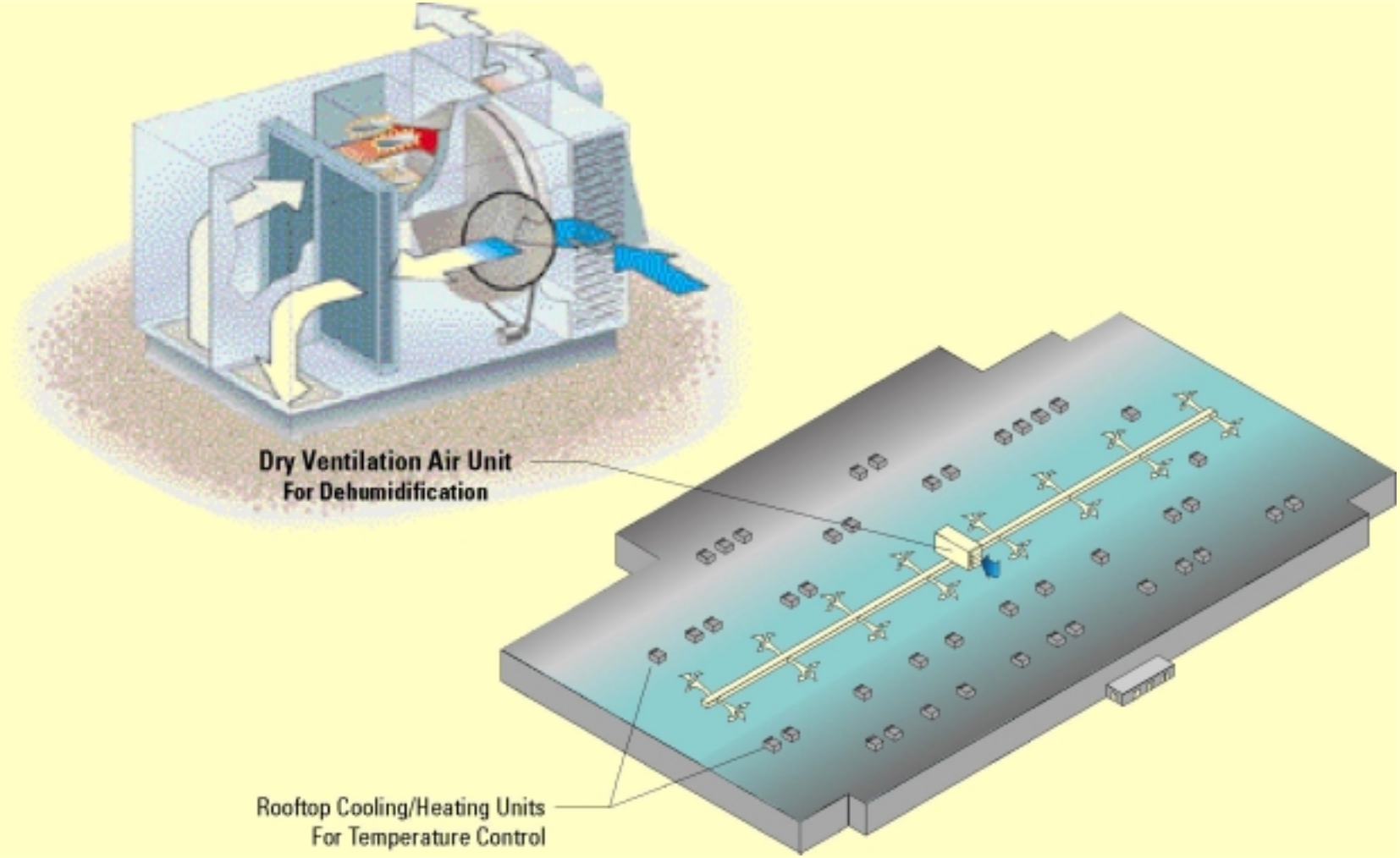
Reactivation Heat Modulation



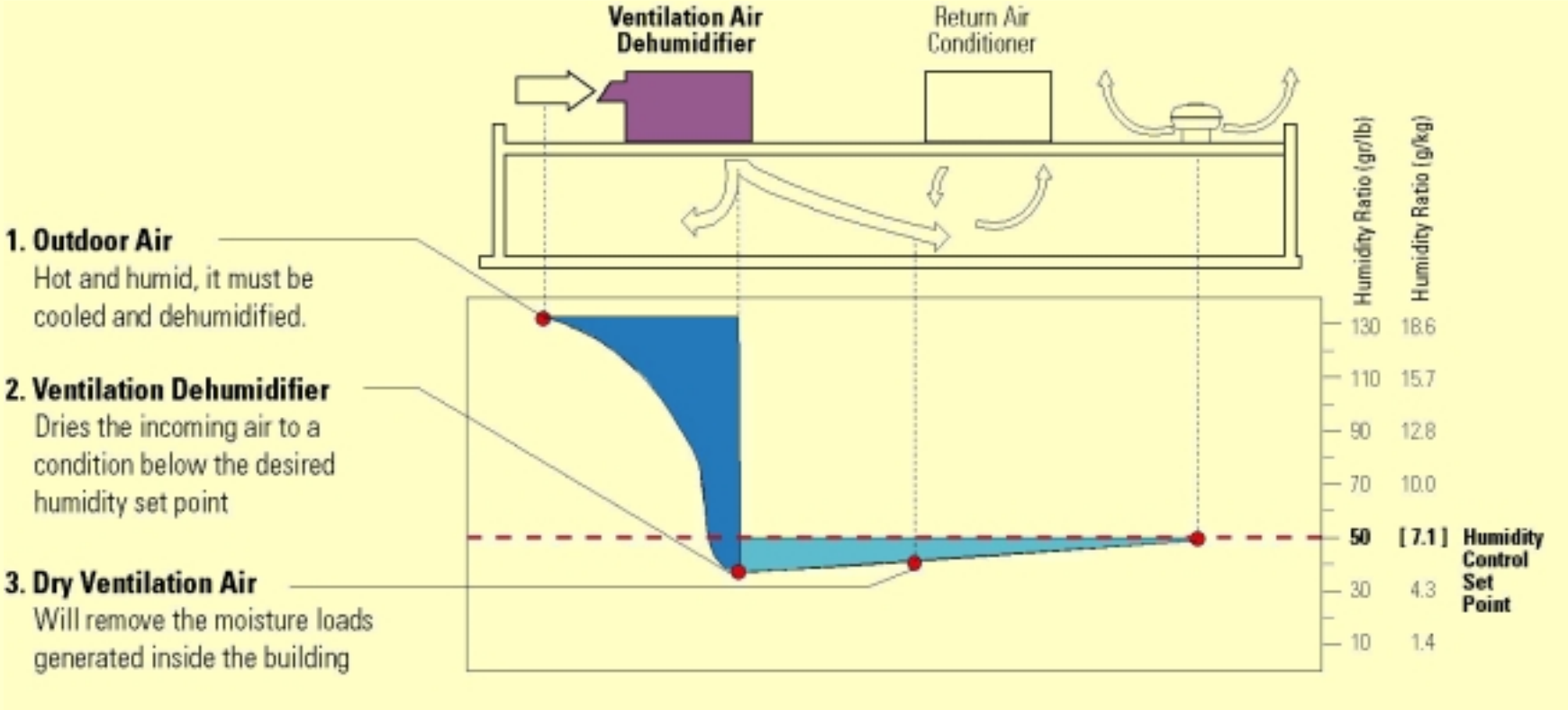
On-Off Reactivation Heat



Application Approach - Commercial Bldgs

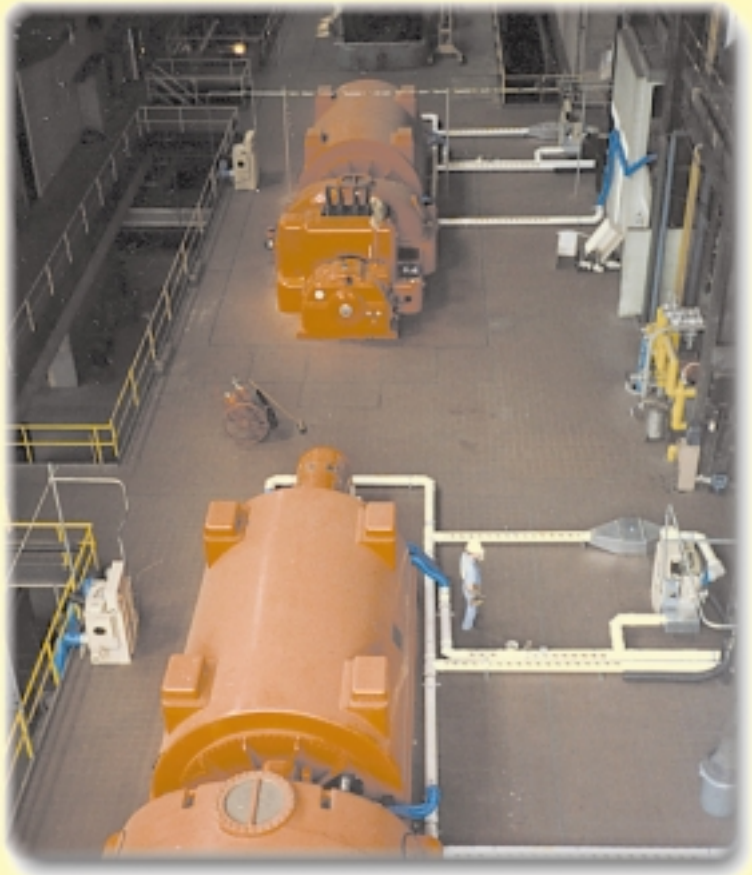


Dry Ventilation Air Dries The Building



Dry Storage Application Approaches

Dry The Whole Building



Dry The Object Alone

Desiccant System Costs

- Systems below 5,000 cfm – $6 to $25/cfm
  - 2,000 cfm makeup air DH w. DX cooling ± $12,000
  - 2,000 cfm integrated system w. DH plus DX pre & post cooling, heating, humidification ± $50,000
- Systems above 15,000 cfm – $4 to $15/cfm
  - 20,000 cfm makeup air DH w. heat pipe post cooling only, ± $60,000
  - 20,000 cfm integrated system w. DH plus DX pre & post cooling, heating, humidification ± $250,000

Recent Developments

- More wheel manufacturers
  - US, Japan, Sweden & India
- More equipment manufacturers
  - Lower prices when units are fitted closely to each application
- Deep-drying wheels (using high-temp reactivation)
  - 80-90 grain depression rather than 40-60

Tips & Traps for Applying Desiccants

- Use low-cost heat for preheating reactivation
- Don't bother with post-cooling – let the rest of the system carry the sensible load
- Size the unit for required moisture removal – NOT the supply air flow
- Air flow rate is critical – measure it, control it and change the filters once a month

More Information

- ASHRAE
  - New book: “Humidity Control Design Guide”
  - FUNDAMENTALS – Chapter 22 – Sorbents & Desiccants
  - SYSTEMS & EQUIPMENT – Chapter 22 – Desiccant Dehumidification Equipment
- Independent Publishers
  - American Gas Cooling Center – “Desiccant System Application Guide”
  - Munters – “The Dehumidification Handbook – 2nd Edition”
- Websites
  - www.gri.org/desiccants
  - www.nrel.gov