Active Desiccant Dehumidification

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Active Desiccant Dehumidifiers
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 Unit
For Dehumidification

Rooftop Cooling/Heating Units
For Temperature Control
Dry Ventilation Air Dries The Building

1. **Outdoor Air**
   - Hot and humid, it must be cooled and dehumidified.

2. **Ventilation Dehumidifier**
   - Dries the incoming air to a condition below the desired humidity set point

3. **Dry Ventilation Air**
   - Will remove the moisture loads generated inside 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**
  - FUNDAMENTALS – Chapter 22 – Sorbents & Desiccants
  - SYSTEMS & EQUIPMENT – Chapter 22 – Desiccant Dehumidification Equipment

- **Independent Publishers**
  - American Gas Cooling Center – “Desiccant System Application Guide”

- **Websites**
  - www.gri.org/desiccants
  - www.nrel.gov