Improving Indoor Air Quality

Propane-Fueled Desiccant Dehumidifiers

Few factors affect everyday life as much as the indoor environments where we live and work. High humidity levels indoors can produce harmful emissions from building materials, stimulate mold and bacteria growth, and cause condensation that stains walls and causes wall paper to peel. Indoor air contaminants can also trigger asthma attacks and allergic diseases. In order to ensure healthy indoor air quality, homeowners need to closely control both ventilation and humidity. Although dehumidifiers are widely used in commercial and industrial applications where corrosion protection and mold, mildew, and condensation control are needed, whole-house residential dehumidification equipment has failed to find a foothold in the marketplace, primarily due to high operating costs.

A new propane-fueled desiccant dehumidifier developed by NovelAire Technologies has the potential to revolutionize the way homeowners control indoor humidity, offering more cost-effective and energy-efficient alternatives to traditional dehumidifiers. Clean burning, compact, and energy efficient, the ComfortDry 400 uses desiccant dehumidification technology and a humidistat to maintain home humidity between 45 and 55 percent relative humidity (RH) for the prevention of mold and mildew.

Desiccant dehumidifiers also represent a remarkable opportunity for propane suppliers to further solidify their existing residential customer base of more than eight million residences in the United States by generating off-season sales and improving infrastructure efficiencies by spreading costs over more gallons per household. If the propane industry penetrates just five percent of this existing customer base with dehumidifier units, the market potential is approximately 96 million new off-season gallons per year.

High Humidity Leads to Mold Growth

Mold growth occurs when relative humidity levels rise above 60 percent, with temperatures between 50° and 90°F. Since it is not practical to completely eliminate mold indoors, humidity must be controlled in order to limit mold growth.

Magnified Mold Spores

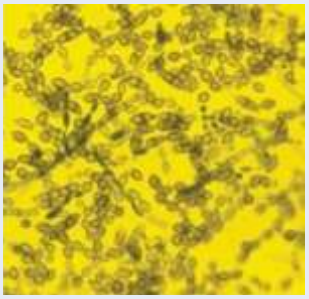


Photo courtesy of U.S. Environmental Protection Agency

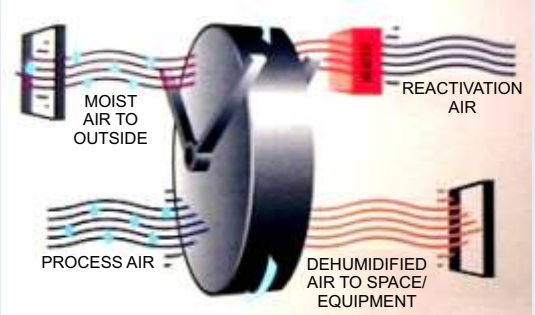
Project Description

The Propane Education & Research Council funded the research effort, *Residential Propane Desiccant Dehumidifier* (**Docket 11552**), which developed the NovelAire Technologies DD400-G. After performance testing and field demonstration in collaboration with Texas Railroad Commission's Alternative Fuels Research & Education Division (AFRED), a second generation unit—the NovelAire ComfortDry 400—was developed. PERC is currently funding *Validation & Commercialization of NovelAire's Desiccant Dehumidifier (ComfortDry 400)* (**Docket 12569**), through which the Gas Technology Institute (GTI) aims to:

- Lab test the NovelAire ComfortDry 400.
- Seek EnergyStar and LEED certification.
- Demonstrate 20 units in residential and retail settings.
- Develop a marketer sales guide and conduct market outreach activities.

NovelAire ComfortDry 400

NovelAire Desiccant Dehumidification Wheel



Operation of desiccant dehumidifiers is based on two counter-current air streams flowing through the wheel. Indoor air is drawn through the rotating desiccant wheel. The desiccant adsorbs moisture from the air stream and dry air is returned to the space. The moisture-containing portion of the wheel rotates into the regeneration section. Heat from a gas burner causes the desiccant to release moisture into the regeneration air stream, which is exhausted to the outside.

Project Implementation

After receiving user feedback from PERC's first project, NovelAire redesigned the first-generation dehumidifier unit as the smaller, lighter, easier to install, and more robust ComfortDry 400. While these changes will enhance the unit's marketability, it must first be tested and demonstrated in key market regions.

GTI plans to first review results of the tests that the Florida Solar Energy Center conducted on the ComfortDry 400 in January/February 2008. Based on these results, GTI will conduct in-house testing of the ComfortDry 400. This testing will consist of:

- Environmental chamber tests of dehumidification performance, the results of which will facilitate direct comparison to refrigerant dehumidifiers
- Accelerated life cycle tests to ensure durability and reliability
- Energy usage breakdowns and emissions measurements both before and after reliability tests to establish any degradation in performance

Lab tests will result in validation of humidity control performance, energy use, and reliability of the ComfortDry 400 desiccant dehumidifier, including comparisons to mechanical dehumidifiers on those same points.

GTI also hopes to achieve U.S. Environmental Protection Agency (EPA) EnergyStar and U.S. Green Building Council (USGBC) LEED Certifications for the ComfortDry 400. To accomplish this task, GTI is currently:

- Developing a rating standard for use in certifying the performance of desiccant dehumidifiers.
- Testing the ComfortDry 400 against the standard at a third-party laboratory.
- Identifying LEED points.

To further ensure the commercial success of the ComfortDry 400, GTI is working with PERC and AFRED on a 20-unit demonstration of the unit in propane marketers' homes and retail locations. These demonstrations are currently taking place in key dehumidification markets, including:

- 10 units in the Houston, Texas region
- 4 units in Florida
- 3 units in Missouri
- 3 units in Mississippi

Project Status: In Progress

- Lab testing, certification processes, and unit demonstrations are all currently underway.
- Market development, outreach activities, and development of the marketer sales guide is projected to commence in fall 2008.

Desiccant Wheels

Incorporating the latest breakthrough in adsorbent desiccant technology, NovelAire Technologies developed temperature resistant fiber-based substrate for humidity control applications. The patented substrate substantially increases moisture removal while keeping energy requirements low. Commercial desiccant dehumidifiers are currently installed in hospitals, retail, supermarkets, office buildings, clean rooms, and industrial sites.

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