NOVEL AIRE TECHNOLOGIES
HEAT & MASS TRANSFER PRODUCTS

DESI CCCANT DEHUMIDIFICATION WHEEL
NovelAire Technologies
Desiccant Dehumidification Wheel

Desiccant Dehumidification

The NovelAire Technologies Desiccant Dehumidification Wheel is designed to provide maximum moisture removal with a minimum pressure drop for those applications where humidity control is required. A desiccant dehumidification wheel provides the HVAC system designer another tool to control humidity effectively and efficiently particularly in the low humidity ranges. NovelAire Technologies offers a complete line of both high performance silica gel (WSG) and molecular sieve (LT3) desiccant wheels to meet all outlet humidity requirements.

- Improved indoor air quality
- Precise humidity control
- Both silica gel (WSG) and molecular sieve (LT3) desiccant wheels available
- Utilizes all types of regeneration energy
- Very low dewpoints achievable

The NovelAire desiccant wheels are used extensively in the well-known industrial markets for corrosion protection and humidity control for many industrial processes. Commercial applications include refrigerated warehouses, ice rinks, schools, supermarkets and hospitals. A residential and light commercial market is developing where small gas fired or hot water regenerated desiccant equipment is used for centralized humidity control. The ability to control home humidity in the 50% RH range improves comfort, saves energy with higher set point temperatures, and prevents the formation of mold and mildew—a potential problem that is of increasing importance to the homeowner.

Desiccant Cooling

The availability of waste heat from distributed generation projects along with the increased ventilation standards for improved IAQ, is revitalizing the desiccant cooling industry. With waste heat, desiccant cooling systems become extremely efficient while providing the additional benefit of independent temperature and humidity control.

The ASHRAE Standard 62-1989 (Ventilation for Acceptable Indoor Air Quality), describes a recommended target ratio of makeup air to return air for a variety of applications and building types. Building codes in the U.S. and abroad are becoming increasingly more comprehensive in addressing ventilation requirements. NovelAire’s line of actively regenerated desiccant wheels combined with sensible only wheels, heat pipes, DX coils, and/or indirect evaporative cooling provide the design engineer with many options to deal with the high latent loads associated with increased ventilation requirements.

A typical twin wheel system: a desiccant wheel for dehumidification, and a sensible wheel for heat exchange.
**Desiccant Types**

NovelAire offers both a high performance Silica Gel (WSG) desiccant and specialty Molecular Sieve (LT3) desiccant to meet the dehumidification needs of most applications. The differences in the desiccant properties are more clearly defined by their respective static adsorption isotherm curves, a measure of the desiccant’s ability to adsorb moisture under constant static conditions.

The isotherm curve for the WSG desiccant is more linear and rises to a high capacity at higher relative humidity. Conversely, the LT3 curve exhibits high desiccant capacities at lower relative humidity and flattens out as %RH increases. Therefore, the WSG desiccant wheels are recommended when the inlet %RH is high (>60%) and the primary goal is the removal of the largest quantity of moisture with the most efficient use of the heat input. If the inlet %RH is low (<50%) and the lowest possible outlet dewpoint is desired, then the LT3 desiccant wheels are preferred. Experience has shown that in many cases, the WSG desiccant wheels adequately meet the requirements of the application.

- **WSG** wheels used with high inlet %RH (>60%) and when efficient removal of moisture is required.
- **LT3** wheels preferred with low inlet %RH (<50%) and/or when low dewpoints are required.

**Features and Benefits**

The NovelAire desiccant wheels are constructed from a unique corrugated high temperature fiber-based media impregnated with a non-migrating water selective desiccant. Unlike other media, the desiccant is uniformly and permanently dispersed throughout the matrix structure in contrast to being coated, bonded, or synthesized onto the matrix, and therefore, is not susceptible to delamination or erosion of the desiccant material.

- Homogenous media--desiccant is permanently bound to the media.
- NovelAire desiccant wheels will not dust.
- Desiccant loading of > 75%.
- Tough, non-brittle media- resists damage.
- Wheel is completely water washable.
- High temperature resistant media for use with regeneration temperatures up to 350°F.
- Used with direct or indirect fired gas, electric heat, steam, and hot water regeneration.

**Cassettes**

- Heavy duty galvanized steel construction with removable side panels.
- Wheels are center supported, using a fixed shaft and internal maintenance-free bearings on smaller cassettes. Larger cassettes use a rotating shaft with external pillow block or flanged bearings.
- NovelAire’s unique adjustable, full contact silicon bulb seal design prevents air leakage for differential pressures of up to 8” wc.
- Drive system includes a heavy duty gear motor with chain drive and tensioner that eliminates wheel slippage.
- Cassette orientation available in a 75/25 or a 50/50 split.

Note: Detailed wheel and cassette specifications, as well as software selection programs, are available for download at www.novelaire.com
**Design Considerations and Control Strategies**

Control of moisture levels in spaces or process air streams is generally accomplished by either regulating reactivation heat or bypassing a portion of the air around the dehumidification wheel. The response time, energy efficiency, and dewpoint bandwidth determine what level of control is required. The degree of control varies from the simplest form of on/off control to maintain a space condition, to the most comprehensive which would include wheel bypass dampers (and perhaps face dampers) plus reactivation heat modulated to control an exit exhaust air temperature.

Humidity sensors vary in type, principle of operation, accuracy, and precision, and need to be chosen to suit the control requirements. Placement of sensors in well-mixed air streams is critical to performance monitoring.

Reactivation heaters should be equipped with suitable safety devices and interlocks to prevent overheating the wheel. The maximum operating temperature is 350°F. Separate high temperature cutouts should be provided if this temperature could be exceeded during operation. Reactivation airflow should be maintained and proven anytime reactivation heat is energized.

**Software Selection Program**

For a more comprehensive analysis of performance, NovelAire offers a model selection software program available for download at [www.novelaire.com](http://www.novelaire.com). The program models the performance of a wide array of input parameters to ensure the proper selection of desiccant wheel size and type.
Wheel Performance

NovelAire desiccant wheels are designed to operate with either a 25% area for reactivation and 75% area for process (25/75 split), or with 50% area for reactivation and 50% for process (50/50 split). Generally, the 25/75 split is used for industrial dehumidification, low dewpoint and compact desiccant cooling applications. The 50/50 split is more often used for commercial cooling applications, or application where low temperature waste heat is available for reactivation.

NovelAire desiccant wheels are designed to be reactivated with either electric resistance, (indirect) steam, (indirect) hot water, or direct (or indirect) fired natural (or propane) gas. Additionally, solar or waste heat sources may be utilized. NovelAire desiccant wheels are designed for regeneration temperatures up to a maximum temperature of 350°F.

In addition to the regeneration temperature and cassette zoning, several other factors influence the performance of the desiccant wheel. Process and regeneration inlet humidity and temperature, regeneration to process flow ratio, face velocity, and wheel rotational speed all has an impact on performance. The following curves show the relationship between some of these parameters on performance for the WSG desiccant wheel.
## Engineering Detail

<table>
<thead>
<tr>
<th>NovelAire Model No.</th>
<th>Flow Rate (scfm) 75/25</th>
<th>Flow Rate (scfm) 50/50</th>
<th>Wheel Diameter (mm)</th>
<th>Wheel Depth (mm)</th>
<th>Cassette Height/Width A (inches)</th>
<th>Cassette Depth B (inches)</th>
<th>Approx. Total Wt. (pounds)</th>
<th>Drive Motor (Hp)</th>
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Note: NovelAire desiccant wheels are offered in a standard depth of 200 mm. Optional 50mm, 100mm, 150mm and 400mm depths are available in some sizes. Please consult the factory for depth options and dimensional tolerances.