Heated Regenerative Desiccant Dryers
AEHD Externally Heated, HRE Blower Purge, and HRS-L Zero Purge Series
Heated Regenerative Desiccant Dryers

As one of the world’s leading manufacturers of compressed air purification equipment, Donaldson has built a comprehensive engineering, manufacturing, and customer support network to meet the most demanding applications. With over 30 years of expertise in compressed air filtration and separation technologies, Donaldson manufactures a complete line of drying and filtration equipment using innovative designs that focus on energy efficient operation and reliable performance.

Our heated and heatless desiccant dryer offering ranges from a small, compact point-of-use dryer to large, special-engineered heated dryers designed per our customer’s specifications.

**Heated Systems**
- AEHD Externally Heated Series (150 - 3,000 scfm)
- HRE Blower Purge Series (600 - 10,000 scfm)
- HRS-L Zero Purge Series (600 - 10,000 scfm)
- Heat of Compression Systems & Specials

**Heatless* Systems**
- Ultrapac 2000 Series (3-60 scfm)
- AHLD Series (80 - 5,000 scfm)
- High/Low Pressure Gas/Air Systems & Specials

Desiccant compressed air dryers use a desiccant to adsorb the water vapor in the airstream. In the twin-tower design, one tower dries the air from the compressor, while the desiccant in the other tower is being regenerated to provide continuous operation. Desiccant dryers are generally referred to as either “heatless” or “heated.” Heatless dryers do not use any source of heat for regeneration other than heat given off during the drying, or adsorption, cycle. This is referred to as “the heat of adsorption.” However, heatless dryers will consume up to 15% of the process air they are drying during the regeneration cycle. Heated dryers, on the other hand, utilize an external heat source for regeneration and require little or no process air. Donaldson’s three heated desiccant dryer types use different methods for heating, and subsequent cooling and repressurizing, the air used for regeneration.

All Donaldson dryers are designed to give our customers the best value available in the industry – reliable performance to CAGI ADF 200 specification while consuming the lowest amount of energy possible.

* For more information on the Donaldson heatless systems, please refer to respective brochure.
Heated Regenerative Desiccant Dryers

Our Diversity is Your Advantage

Every compressed air system needs an air dryer.

All air compressors, regardless of size or type, “squeeze” water out of the air they compress. Since it takes about eight cubic feet of air at atmospheric pressure (14.7 psi) to make one cubic foot of compressed air at 100 psi, each cubic foot of compressed air contains eight times more water and contaminants than the ambient air. Compressed air becomes totally saturated and literally “rains” inside the receiver and piping system. On a day when the temperature is 90°F with a relative humidity of 69%, a 25-horsepower compressor will dump 13.6 gallons of water inside the system every 12 hours. A Donaldson high quality dryer will always pay for itself by reducing air distribution system costs, lengthening tool life, reducing maintenance downtime and system damage, which all contribute to quality operations.

Why desiccant air dryers? While refrigerated compressed air dryers will achieve a pressure dew point of +33°F to 40°F sufficient for a broad range of industrial applications including glass blowmolding, food processing, and clean room air conditioning, desiccant dryers achieve very low levels of moisture content, on the order of -40°F pressure dew point. Their cycles can be adjusted to achieve -100°F pressure dew point for applications requiring even lower levels of moisture, such as pneumatic paint spraying, air motors, pharmaceutical manufacturing, instrumentation and control systems, and cryogenic plants.

This translates into certain size ranges where the different dryer types are commonly used:

<table>
<thead>
<tr>
<th>Dryer Type</th>
<th>Initial Investment Cost</th>
<th>Operating Cost</th>
<th>Maintenance Cost</th>
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<tbody>
<tr>
<td>Heatless Desiccant Dryer</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Externally Heated Dryer</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Blower Purge/Zero Purge</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Our expert sales engineers are available to evaluate your application requirements and help you choose the best desiccant dryer for your needs. Whatever model you select, all Donaldson compressed air dryers are built in accordance with our high quality standards, using only superior components to ensure the long-lasting high value of your investment.
Heated Regenerative Desiccant Dryers

Reliability and Performance

The Donaldson AEHD Series Externally Heated Desiccant Compressed Air Dryer is a fully automatic, PLC controlled, self-contained unit offering a fail-safe design – in the event of power interruption and/or air loss, the purge exhaust valves close preventing damage to the dryer and the process. The combination of 1) high moisture capacity, premium grade, high crush strength activated alumina used in 2) optimally sized ASME code desiccant towers providing low velocity and high contact time through the adsorbent beds delivers long service life and consistent performance.

Features

- Fail-safe design: failure of power and/or pilot air causes the purge exhaust valves to close.
- Automated dryer control sequencing using a highly reliable programmable logic control (PLC).*
- Dryer operation and common alarms viewed on text display on enclosure door for each operation and troubleshooting.*
- Reliable non-lubricated high-performance inlet and purge exhaust valves are:
  - 316 stainless steel angle-body piston valves (150 to 500 scfm models).
- High temperature outlet check valves.
- Stainless steel body 3-way exhaust pilot solenoid valves.
- ASME code desiccant towers (6” vessels and larger).
- Repressurization valve and circuit for equal pressurization prior to switch over.
- Tower pressure gauges.
- Tower safety valves for over pressure protection.
- Removable, stainless steel desiccant bed support screens.
- Low watt density (15-22 watt/in²) heater with Incoloy** sheath elements for long life and corrosion resistance.
- Separate safety heater back-up contactor (from the heater cycling contactor) will open with the heater high limit alarm and de-energize the heater in the event of a catastrophic failure.
- 1-1/2” thick fiberglass insulation with aluminum jacket on dryer vessels, hot air lines, and heater for optimum performance, protection, and durability.

* See page 4 for more PLC and electrical features.
** Incoloy is a registered trademark of Special Metals Corporation.
**How The AEHD Series Works**

**Filtering and drying incoming air.** Hot, saturated compressed air is filtered as it passes through our 0.01 micron high-efficiency coalescing prefilter (F1, recommended option) before entering the dryer. Compressed air continues through the inlet valve (V1), is dried in the desiccant tower (T1), and exits through an outlet valve (V5) and final particulate filter (F2, recommended option), while the other desiccant tower (T2) is being regenerated.

**Desiccant regenerated in T2.** A portion of the dried air is diverted through purge valve (P3) at near atmospheric pressure and heated by the electric heater (or optional steam heater) to 400°F before passing through regeneration valve (V4) and into the regeneration tower (T2). The heated air removes moisture vapor from the desiccant surface.

Dryer operation is performed automatically by a programmable logic controller (PLC). The standard drying and regeneration time cycle is 8 hours. While one tower is drying incoming compressed air for 4 hours, the other tower is regenerating for 3 hours (heating time), then cooling for 50 minutes, and finally repressurizing to the line pressure for 10 minutes before switching over to the other tower. Switching from one tower to the other is performed only when both desiccant towers are at line pressure to prevent line surge and to minimize desiccant abrasion.

**Recommended Installation**
Heated Regenerative Desiccant Dryers

Automatic Controls for Fail Safe Operation

**Dryer operation indicators** shown in text display on enclosure door for ease of operation and troubleshooting listed below (RT = Right Tower; LT = Left Tower):

- RT drying
- LT drying
- RT depress
- LT depress
- RT heating
- LT heating
- RT cooling
- LT cooling
- RT repress
- LT repress
- RT dry air cooling
- LT dry air cooling
- RT in standby*
- LT in standby*
- Dryer hour meter

**Dryer common alarms** viewed in text display and turn on visual common alarm lights listed below:

- Heater high limit
- Purge air high limit
- Dryer hour meter
- High humidity (optional)
- Heater overload trip
- RT fail to depress or RT high press
- LT fail to depress or LT high press
- RT drying low press
- LT drying low press
- RT fail to repress
- LT fail to repress
- Low press on RT dry or LT standby*
- Low press on LT dry or RT standby*

**Switches and lights** mounted on enclosure door:

- Power on light
- Common alarm light
- Power OFF/ON switch
- Step cycle switch (for manually advancing dryer sequence for troubleshooting)
- Alarm reset pushbutton
- Dry air cooling OFF/ON switch
- Demand cycle OFF/ON switch*

**Other features** provided/controlled by PLC:

- Heater high temperature alarm circuit
- Regeneration purge air

**Other control features:**

- Common alarm dry contacts provided for customer remote indication
- Standard switching valve failure, or pressure monitoring, indication for safety and ease of troubleshooting

* Optional with demand cycle.
Heated Regenerative Desiccant Dryers

Dimensions & Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity¹ (scfm)</th>
<th>Connections (inches FNPT/ANSI)</th>
<th>Heater kW</th>
<th>Full Load Amps</th>
<th>Dimensions (inches)</th>
<th>Weight (lbs)</th>
<th>Desiccant both vessels (lbs)</th>
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<tr>
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<td>150</td>
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<td>2.5</td>
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<td>6.2</td>
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¹ Capacity based on -40°F pdp, 100 psig operating pressure, 100°F inlet temperature and 100°F ambient temperature according to CAGI ADF 200.
Ambient air temperature: 38-125°F; inlet air temperature: 40-110°F; operating pressure: 60-150 psig.
Standard power supply: 460V/60 Hz/3Ph
Standard electrical construction: NEMA 12 (dust proof)

Optional Features

- NEMA 4 (dust & waterproof) electrical construction.
- NEMA 7 (explosion proof) electrical construction.
- -100°F pressure dew point.
- Failure to shift alarm.
- Remote start/stop.
- Low ambient temperature package.
- Purge flow meter.
- Dew point* monitor.
- Demand cycle control with dew point monitor.
- Pre-piped filters and by-pass valve packages.
- Visual moisture indicator.
- Steam heated models.

* According to ISA, “The temperature referred to at a specific pressure at which water vapor condenses” is called dew point.

The International Standards Organization (ISO) has established the following air quality classifications relating to maximum size and concentration of particles, maximum pressure dew point and maximum oil content.

ISO 8573-1 Air Quality Classes

<table>
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<tr>
<th>Class</th>
<th>Max. Size (microns)</th>
<th>Concentration (mg/m3)</th>
<th>Max. pdp (°F)</th>
<th>Max. Oil Content (mg/m3)</th>
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<td>5</td>
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<td>-4</td>
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</table>

* Reported as ISO Class #,# (#Particle, PDP, Oil). E.g. ISO Class 2,4,2.
Heated Regenerative Desiccant Dryers

Leading Technology Reduces Operation Costs

The Donaldson HRE/HRS-L Heated Blower Purge Desiccant Compressed Air Dryers utilize atmospheric air for regeneration of the desiccant bed significantly reducing or eliminating the use of compressed purged air for regeneration, resulting in an overall reduction in the cost of operation. No process air is used during this phase of the overall dryer cycle. Process air is only consumed during depressurization and repressurization of the off-line tower and, in the case of the HRE, during cool-down of the regenerated bed. This amounts to an average 2% of the rated capacity of the dryer. The HRS-L dryer further reduces purge air consumption by utilizing ambient air for cool-down of the regenerated bed.

Features

• Purge air consumption reduced down to an average of 2% or less.
• Built-in energy management controls.
• Low pressure drop design for energy savings.
• Maximum desiccant volume for long life.
• High quality components for reliable service and long life.
• Unique HRE parallel flow to reduce or eliminate dew point and temperature spikes.
• Small footprint saves valuable floor space.
• Corrosion resistant finish.

• NEMA 4 electrical enclosures.
• Allen Bradley PLC control with panel view 300 display.
• Common alarm / pilot light.
• Failure to shift alarm.
• High performance butterfly valves.
• Stainless steel single body valves.
• Copper control air tubing.
• Water-cooled heat exchanger (HRS-L).
Heated Regenerative Desiccant Dryers

How The HRE Series Works

1. Wet compressed air, controlled by butterfly valves, enters the base of the on-line vessel (prefilter recommended).

2. As the compressed air passes through the desiccant bed, moisture is removed, lowering the dew point to -40°F.

3. Dry compressed air exits the top of the vessel, passes through a check valve and flows downstream to the use point (afterfilter recommended).

4. When the desiccant bed becomes saturated with moisture, it goes off-line and depressurizes to ambient through an angle-seat globe valve. A muffler attenuates the noise of depressurization.

5. After the off-line vessel has depressurized, a blower draws in ambient air for regeneration.

6. The ambient air is heated to 400°F, giving it the energy required to initiate and accomplish desorption, after which it passes through a check valve and enters the top of the regenerating vessel.

7. As the hot ambient air passes through the desiccant bed, water molecules are released from the surface of the desiccant and enter the airstream.

8. Hot regeneration air passes through a butterfly valve and exits to atmosphere.

9. At the end of the heating phase of the cycle, the desiccant bed, although regenerated, remains hot. The temperature of the bed must be lowered to minimize dew point and temperature spikes in the process air when the bed goes back on-line. This is accomplished by allowing a slipstream of dry process air, controlled by an angle-seat globe valve, to flow from the on-line vessel into the off-line vessel. This slipstream is also used to repressurize the off-line vessel after it has been cooled.

10. Unique to the Donaldson HRE is our parallel running period 10 minutes prior to vessel switchover. During this period, the incoming flow of wet compressed air is directed through both vessels. This step further reduces or eliminates the dew point and temperature spikes associated with heated dryers while minimizing the loss of purge air used during the initial cool-down. This step is not required with HRS-L dryers.

Dimensions & Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity' (scfm)</th>
<th>Connection</th>
<th>Heater kW</th>
<th>Blower HP</th>
<th>Full Load Amps</th>
<th>Dimensions (inches)</th>
<th>Weight (lbs)</th>
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<tr>
<td></td>
<td></td>
<td>ANSI FLG</td>
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<td>340</td>
<td>CF*</td>
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</table>

1 Capacity based on -40°F pdp, 100 psig inlet pressure, 100°F inlet temperature and 100°F ambient temperature according to CAGI ADF 200.
* Consult factory.
Heated Regenerative Desiccant Dryers

How The HRS-L Series Works

The HRS-L heated blower purge dryer incorporates a water-cooled heat exchanger which eliminates the need for purge air during the cool-down period. At the end of the heat cycle, a series of valves open or close creating a closed-loop between the air blower and vessel.

1. The hot air bypasses the heater and is directed through a water-cooled heat exchanger.
2. The blower circulates the cooled air back through the vessel.
3. As the cooled air passes through the desiccant bed, it picks up heat energy which is removed from the system via the water-cooled heat exchanger. The closed-loop cycle continues until the bed temperature is lowered to its operation point without the use of purge air.

Optional Features for HRE and HRS-L

- NEMA 4X (corrosive protection) electrical construction.
- NEMA 7 (explosion proof) electrical construction.
- -100°F pressure dew point.
- Low ambient temperature package.
- Dew point* monitor.
- Demand cycle control with dew point monitor.
- Pre-piped filters and by-pass valve packages.
- Visual moisture indicator.
- High output temperature alarm.
- Low ambient temperature alarm.

Dimensions & Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity (scfm)</th>
<th>Connection ANSI FLG (inches)</th>
<th>Heater kW</th>
<th>Blower HP</th>
<th>Full Load Amps</th>
<th>Dimensions (inches)</th>
<th>Weight (lbs)</th>
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<td>HRS-L-3500</td>
<td>3500</td>
<td>6 FLG</td>
<td>90</td>
<td>15</td>
<td>130</td>
<td>Height 135 Width 165 Depth 85</td>
<td>18,798</td>
</tr>
<tr>
<td>HRS-L-4000</td>
<td>4000</td>
<td>6 FLG</td>
<td>100</td>
<td>20</td>
<td>148</td>
<td>Height 140 Width 165 Depth 95</td>
<td>21,480</td>
</tr>
<tr>
<td>HRS-L-5000</td>
<td>5000</td>
<td>6 FLG</td>
<td>120</td>
<td>20</td>
<td>172</td>
<td>Height 150 Width 175 Depth 105</td>
<td>26,850</td>
</tr>
<tr>
<td>HRS-L-6000</td>
<td>6000</td>
<td>8 FLG</td>
<td>170</td>
<td>25</td>
<td>215</td>
<td>CF*** Width 175 Depth 105</td>
<td>32,220</td>
</tr>
<tr>
<td>HRS-L-7000</td>
<td>7000</td>
<td>8 FLG</td>
<td>200</td>
<td>25</td>
<td>275</td>
<td>CF*** Width 185 Depth 105</td>
<td>37,592</td>
</tr>
<tr>
<td>HRS-L-8000</td>
<td>8000</td>
<td>8 FLG</td>
<td>230</td>
<td>25</td>
<td>295</td>
<td>CF*** Width 195 Depth 105</td>
<td>42,966</td>
</tr>
<tr>
<td>HRS-L-10000</td>
<td>10000</td>
<td>10 FLG</td>
<td>280</td>
<td>25</td>
<td>340</td>
<td>CF*** Width 195 Depth 105</td>
<td>53,706</td>
</tr>
</tbody>
</table>

1 Capacity based on -40°F pdp, 100 psig inlet pressure, 100°F inlet temperature and 100°F ambient temperature according to CAGI ADF 200.

* According to ISA, “The temperature referred to at a specific pressure at which water vapor condenses” is called dew point.

** Consult factory.
Heated Regenerative Desiccant Dryers

Protection for your Investment

To protect the desiccant bed, the compressed air piping and the application itself, it is highly recommended that each desiccant dryer should be equipped with a high-efficiency prefilter and afterfilter.

The Donaldson Ultradeep® coalescing prefilter element provides excellent protection against liquid oil and water filtrate as well as particulate contamination. This is the perfect prefilter protection for the drying agent in your system. The retention rate of 0.01 micron particles is a remarkable 99.999%, made possible through our patented Ultrair® binder-free borosilicate glass filter media that also allows for a very low pressure drop.

The Donaldson particulate afterfilter element is made from the same borosilicate glass fiber media with a high temperature outer wrap. In this package, it is used as a final filter to protect the downstream airflow.

Capacity Correction Factors AEHD, HRE, and HRS-L Dryers

The leading manufacturers of compressed air and gas equipment in North America are organized in the Compressed Air & Gas Institute (CAGI). As the premier industry organization, CAGI has developed standards to protect users of this equipment. ADF 200 is the current standard for desiccant compressed air dryers. ADF 200 specifies the dryers performance to be rated at -40°F pressure dew point, 100°F inlet temperature, 100°F ambient temperature, and 100° psig system pressure. To adjust the dryer capacity from these “CAGI conditions” to your specific application, please use the correction factors below for differing inlet air temperatures (C1) and system pressures (C2).

<table>
<thead>
<tr>
<th>Capacity correction factors for inlet air temperature (C1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Temperature (°F)</td>
</tr>
<tr>
<td>Correction Factor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacity correction factors for system air pressure (C2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Pressure (psig)</td>
</tr>
<tr>
<td>Correction Factor</td>
</tr>
</tbody>
</table>

To Size the Dryer Capacity for Actual Conditions

\[
\text{Adjusted Capacity} = \text{scfm} \times C1 \times C2
\]

To calculate the capacity of a given dryer based on non-standard operating conditions, multiply the standard capacity by the appropriate correction factor(s).

**EXAMPLE:**
- Dryer Model: AEHD-500
- Standard Capacity: 500 scfm
- Actual Operating Conditions: 80°F inlet temperature: \( C1 = 1.15 \)
- 90 psig system pressure: \( C2 = 0.91 \)
- **Adjusted Capacity = 500 scfm \times 1.15 \times 0.91 = 523 \text{ scfm}**

To Select the Dryer Model for Actual Conditions

\[
\text{Adjusted Capacity} = \frac{\text{scfm}}{C1/C2}
\]

To choose a dryer based on a given flow at non-standard operating conditions, divide the given flow by the appropriate correction factor(s).

**EXAMPLE:**
- **Given Flow:** 500 scfm
- Actual Operating Conditions: 80°F inlet temperature: \( C1 = 1.15 \)
- 130 psig system pressure: \( C2 = 1.27 \)
- **Adjusted Capacity = 500 scfm / 1.15 / 1.27 = 342 \text{ scfm}**
- Selected Dryer Model: AEHD-350
Trust Donaldson Compressed Air & Gas to deliver a complete range of compressed air purification solutions that improve air quality throughout your plant - from the compressor room to all points of use. With over 30 years of expertise in compressed air filtration and separation, Donaldson manufactures a complete line of drying and filtration equipment in an innovative, cutting-edge design with energy efficient operation and reliable performance to increase your productivity and lower your operating cost for the air volume that fits your needs.

Donaldson Compressed Air & Gas offers a wide variety of solutions to reduce your energy costs, improve your productivity, guarantee production quality and help preserve the environment.

**PRODUCTS**

- Activated carbon filters
- Adsorption dryers
- Breathing-air purifiers
- Cartridge filters
- Chillers
- Condensate drains
- Coolers
- Cyclone separators
- Demisters
- Disposable filters
- Elements
- Emulsion separators
- Filters
- Fine filters
- Filter housings
- High-performance filters
- High-pressure filters
- Medical vacuum filters
- Membrane dryers
- Oil/vapor absorbers
- Oil/water separation systems
- Pre-filters
- Pre-separators
- Process filter elements
- Process filter housings
- Pure gas filters
- Refrigeration compressed air dryers
- Silicon-free filters
- Steam filters
- Sterile filters
- Submicro filters
- Systems engineering
- System solutions
- Vacuum filters
- Vent filters
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