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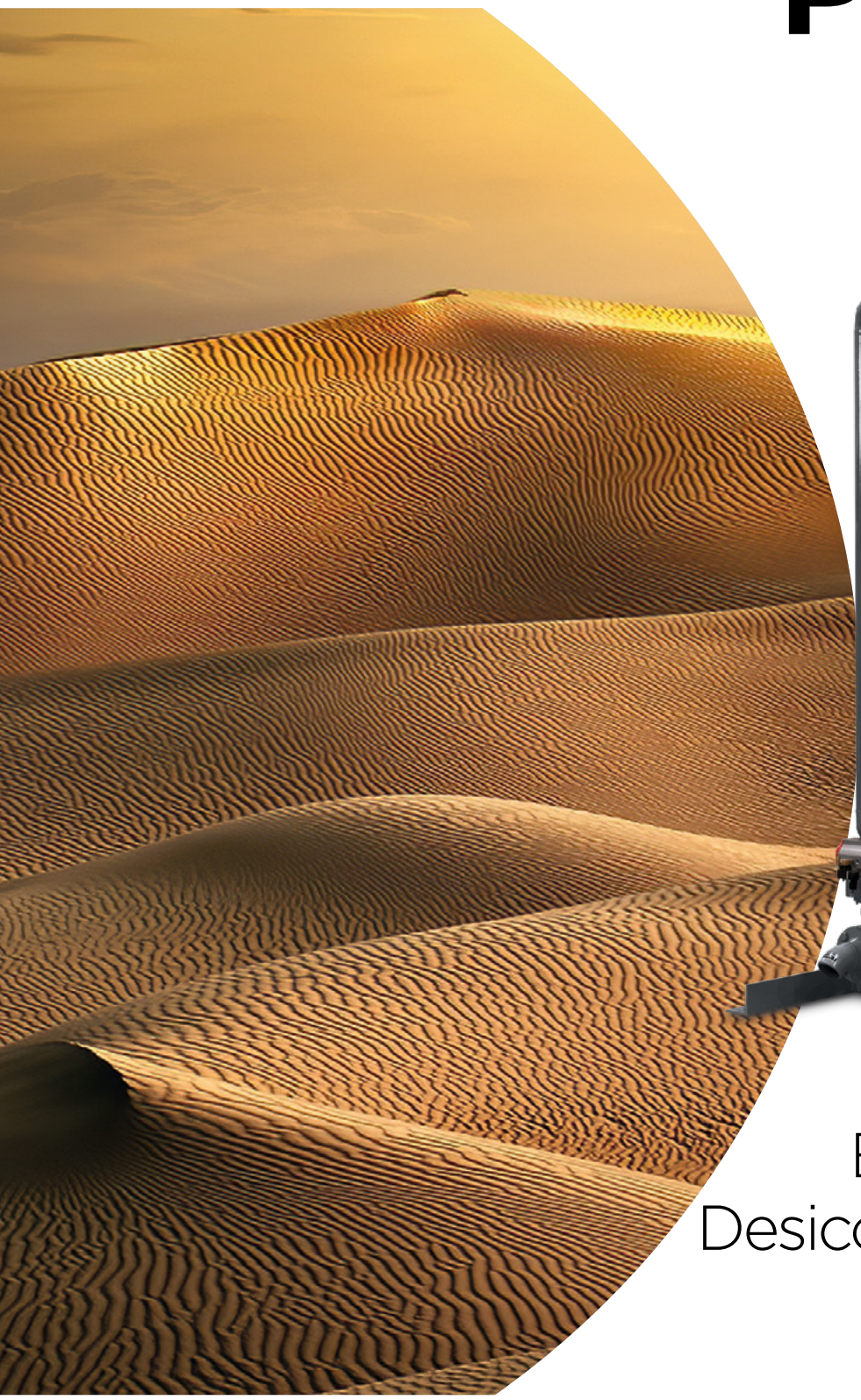



# Externally Heated Desiccant Compressed Air Dryers

## PHD Series

pneumaticproducts.com

300 - 3,200 SCFM

Pneumatic Products™

# PHD Series Dryers

## PHD Series Dryers Reduce Purge Air Energy Costs

For decades, compressed air users have relied on Pneumatic Products to deliver technology that reduces the cost of operation and improves the reliability of air driven processes. The PHD Series is engineered to deliver ISO 8573.1 Air Quality and reduce purge air consumption. In combination with our advanced Ambient Air Amplification ($A^3$) Purge Technology™, we offer externally heated purge desiccant dryers with dew point performance guaranteed from 300 to 3,200 scfm.

## The Pneumatic Products Guarantee

Pneumatic Products guarantees that PHD Series dryers will produce the design dew point while operating continuously at maximum rated flow (100% duty cycle) at CAGI ADF 200 inlet standards of 100°F inlet temperature and 100% relative humidity at 100 psig.

## -4°F to -40°F Pressure Dew Points

Applications that simply want seasonal protection against freezing are exactly what the standard PHD Series dryers are designed to address. ISO 8573.1 dew points between Class 2 and Class 3 are delivered automatically with the standard design. Class 2 (-40°F) dew points protect usage points from freezing during winter. Class 3 (-4°F) dew points keep air systems nice and dry all summer long. Applications that require Class 2 (-40°F) dew points year round simply need to select the Jet Injection option package.

| AIR QUALITY CLASS | SOLID PARTICLES MAXIMUM NUMBER OF PARTICLES PER $M^3$ | | | WATER VAPOR PRESSURE DEW POINT | | OIL TOTAL OIL CONCENTRATION: AEROSOL, LIQUID & VAPOR | |
|---|---|---|---|---|---|---|---|
| | 0.10 - 0.5 micron | 0.5 - 1.0 micron | 1.0 - 5.0 micron | °C | °F | mg / $m^3$ | ppm $_{w/w}$ |
| 0 | As specified by the equipment user or supplier and more stringent than class 1 | | | | | | |
| 1 | ≦ 20,000 | ≦ 400 | ≦ 10 | ≦ -70 | ≦ -94 | 0.01 | 0.008 |
| 2 | ≦ 400,000 | ≦ 6,000 | ≦ 100 | ≦ -40 | ≦ -40 | 0.1 | 0.08 |
| 3 | - | ≦ 90,000 | ≦ 1,000 | ≦ -20 | ≦ -4 | 1 | 0.8 |
| 4 | - | - | ≦ 10,000 | ≦ +3 | ≦ +37 | 5 | 4 |
| 5 | - | - | ≦ 100,000 | ≦ +7 | ≦ +45 | - | - |

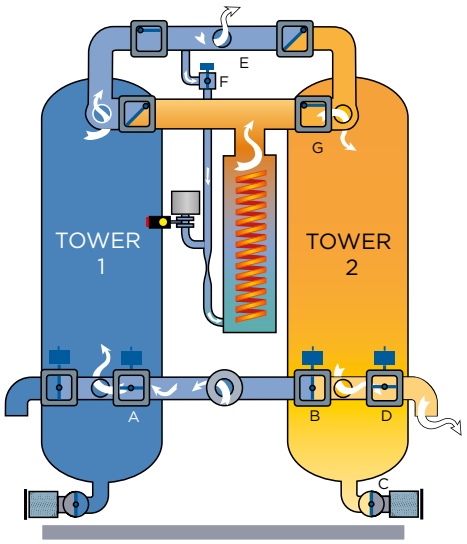
*Per ISO 8573-1: 2001(E)*

Since 1946, the world has turned to the Pneumatic Products brand for the quality and service demanded by the most critical of applications. Global leaders of industry require durable components that deliver unquestionable reliability. Our precision engineered components and designs deliver outstanding service life and operational longevity. Invest in our experience and gain annuities that will grow for years.

# How It Works

## Standard Design

Moist, filtered compressed air enters the pressurized on-line desiccant-filled drying Tower 1 through valve (A). Up-flow drying enables the desiccant to strip the air stream of moisture. Clean, dry compressed air exits through valve (E) to feed the air system. Tower 2 (when in regeneration mode) closes valve (B), then depressurizes to atmosphere through muffler (C). Valves (D & G) open and the heater turns on. A portion of dry compressed air (purge air) is diverted before exiting (E) and passes through the heater. Hot dry purge air desorbs the moisture from the desiccant as it flows down through Tower 2 to exit at valve (D). Once desorbed, the heater turns off and cool dry purge air continues to pass until the desiccant bed is cooled. Finally, valve (D) closes and Tower 2 is repressurized. At a fixed time interval, valve (B) will open and Tower 2 will be placed on-line to dry the bed and valves (A & D) will close. Operations will switch and Tower 1 will be regenerated.




*Shown with Jet Injection Option*

## Jet Injection Option Package

Whereas the standard design operates on a fixed time interval basis, Jet Injection versions manage the drying and regeneration cycles with precision for systems with variable air demands. The on-line Tower will continue to dry the air stream until the "moisture front" is detected. Only then will the switchover sequence begin. In regeneration mode the Jet Injection is engaged and a portion of dry purge air exits valve (F) to be injected into the Y-axis of the Jet Injection. A³ Purge Technology™ draws ambient air into the X-axis to desorb the desiccant at better than 1:1 amplification. Sensors detect the retreat of the moisture front, disengages the Jet Injection, eliminates the purge air usage and, initiates the repressurization cycle. The dry, pressurized off-line Tower will remain ready and isolated until sensors detect that the on-line drying Tower is saturated. Then, the switchover will occur and the process will repeat.

## Purge Air Operating Cost Comparison

Annual Cost of Compressed Purge Air
(constant operation at average air demand)

| AVERAGE AIR DEMAND | | REGENERATION COST BY TECHNOLOGY[1] | | |
|---|---|---|---|---|
| (flow) | (scfm) | HEATLESS (Industry average 15% purge) | PHD SERIES (Standard 7% purge) | PHD SERIES (Optional Jet Injection 6% purge) |
| 100% | 1050 | $20,585 | $9,606 | $8,234 |
| 90% | 945 | $20,585 | $9,606 | $7,411 |
| 75% | 788 | $20,585 | $9,606 | $6,176 |
| 50% | 525 | $20,585 | $9,606 | $4,117 |
| 35% | 368 | $20,585 | $9,606 | $2,882 |
| 20% | 210 | $20,585 | $9,606 | $1,647 |

[1] *Assumes 8760 hours, 10 cents per KwH, 5 scfm per HP*

## Dew Point Performance Table

| CONTROLLER | PRESSURE DEW POINT | | EMS ENERGY SAVINGS |
|---|---|---|---|
| | -40°F | -4°F | Automatic |
| Standard | S | G | - |
| Jet Injection Option | G | - | 3 |

*S – Seasonal*
*G – Guaranteed*
*3– Included*

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# Energy-Efficient Design

Soft-seated check valves for tight shutoff and durability

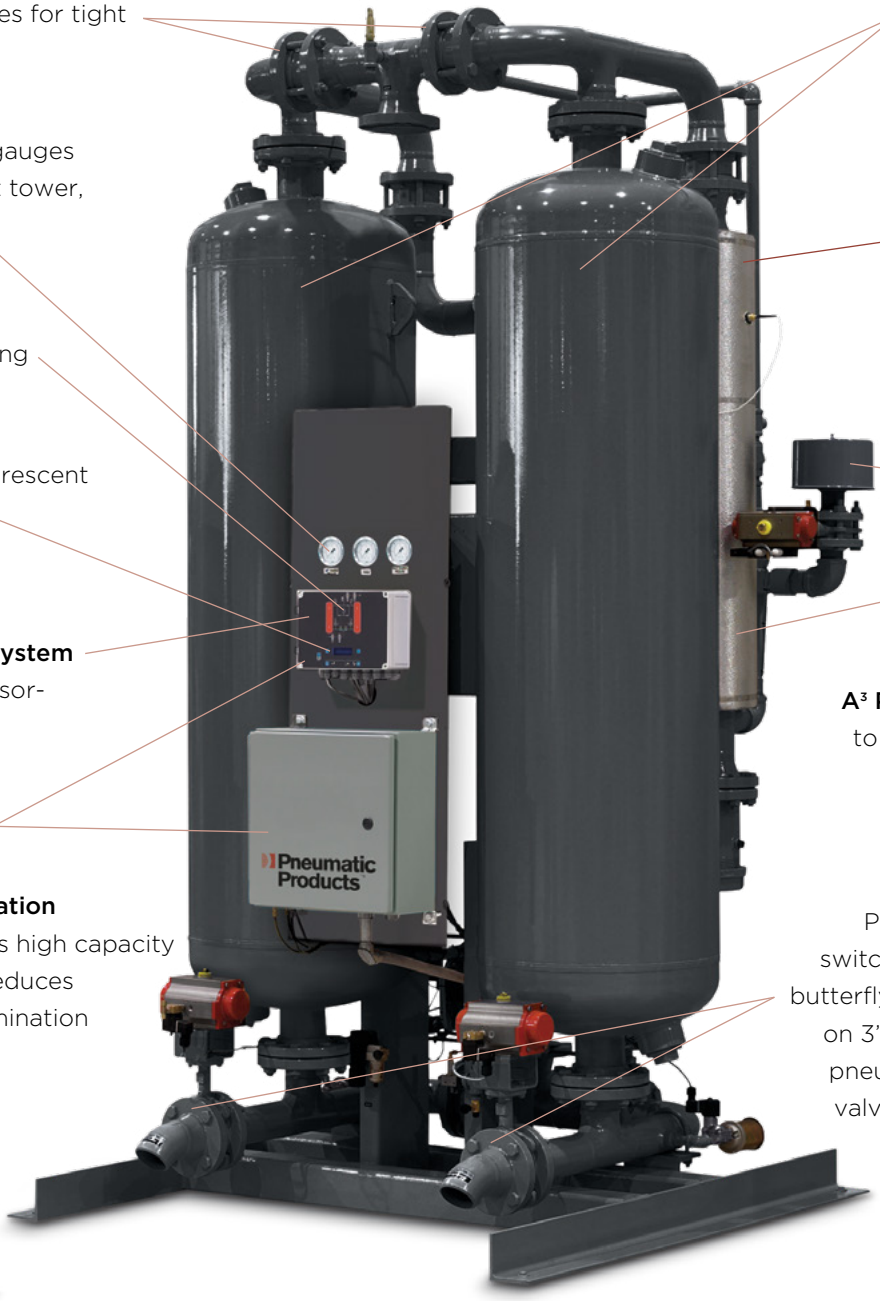
High-quality pressure gauges display left tower, right tower, and purge pressure

Function indicator LEDs for easy monitoring

Easy-view vacuum fluorescent text display is visible under any condition

**Energy Management System** advanced microprocessor-based control

NEMA 4 Construction




Towers filled with extra, high-grade activated alumina to deliver superior performance

Low-watt density heater saves energy and prevents premature desiccant aging

Heavy-duty air intake filter

Optional EMS controlled Jet Injection uses **A³ Purge Technology™** to reduce purge costs

Premium quality inlet switching/purge exhaust butterfly valves for long life on 3" and larger (Quality pneumatic angle-seated valves for smaller sizes)

**PCC & PCS Series Filtration**

- Pleated media offers high capacity
- Uniform pore size reduces downstream contamination

**Model Shown with Optional Features*

## Optional Jet Injection Energy Management System

Rugged temperature- & humidity-sensing technology embedded in the EMS control ensures dew point stability without the need for periodic recalibration. Constant desiccant bed monitoring uses algorithm-based protocols to deliver precise control of the A³ Purge Technology™. The Jet Injection is engaged and disengaged as needed to boost the airflow through the off-line tower. Bed regeneration cycles are managed with precision to deliver -40°F, Class 2 dew point, and reduce compressed purge air consumption to 6% or less.

*Jet Injection with A³ Purge Technology™*

## Maximum Savings and -40°F Pressure Dew Points

Select a Jet Injection (option A or B) option package to realize fast returns-on-investment. The A³ Purge Technology™ is controlled by the engagement cycles of the Jet Injection. Energy consumption to regenerate the desiccant bed mirrors your plant air demands. This process is governed by algorithmic logic embedded into the EMS Controller. Consistent -40°F pressure dew points are delivered while saving at least 9% on compressed purge air costs.

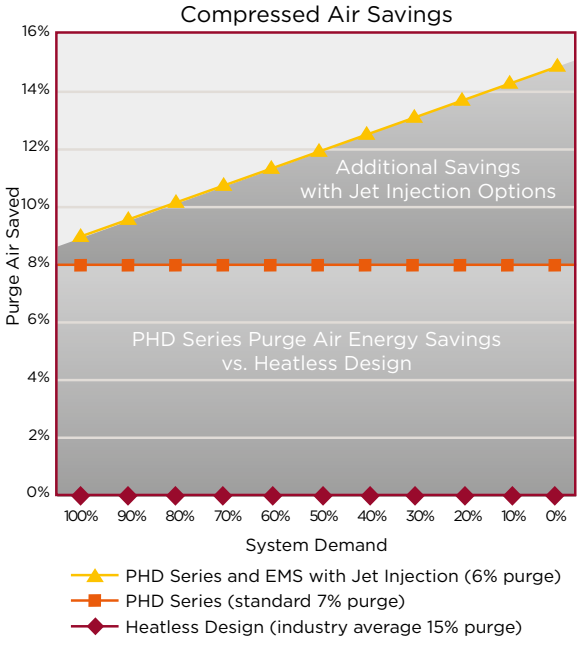
In many applications, the Jet Injection's compressed purge air requirements (6% or less) afford the selection of a smaller air compressor. System efficiencies become linear to the energy-saving potential of the dryer. Once the off-line desiccant bed has been regenerated, zero compressed purge air is required. This represents compressed air savings of up to 15% as compared to typical heatless designs.

## Annual Purge Savings vs. Heatless Design

*(1050 scfm System Profile Comparison)*

| AIR CAPACITY | AIR DEMAND | TIME (PER YEAR) | | PHD SERIES SAVINGS | | |
|---|---|---|---|---|---|---|
| Percent | (scfm) | Percent | Hours | Standard Design | Includes Option A or B | Savings with A or B |
| 100% | 1050 | 40% | 3,504 | $4,391 | $4,940 | $549 |
| 90% | 945 | 5% | 438 | $549 | $659 | $110 |
| 75% | 788 | 15% | 1,314 | $1,647 | $2,470 | $515 |
| 50% | 525 | 15% | 1,314 | $1,647 | $2,470 | $823 |
| 35% | 368 | 20% | 1,752 | $2,196 | $3,541 | $1,345 |
| 20% | 210 | 5% | 438 | $549 | $947 | $398 |
| Average | 555 | 100% | 8,760 | $10,979 | $14,718 | $3,740 |

*Annual savings (optional EMS with Jet Injection vs. standard PHD) $3,740*
*EMS option A – payback within 8.2 months*



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# Product Features and Specifications

## Controller Feature List

| | Controller Configuration | | |
|---|---|---|---|
| | Standard | Option A | Option B |
| **Pressure Dew Point** | | | |
| ISO Class 3 -4°F (-20°C) | G | — | — |
| ISO Class 2 -40°F (-40°C) | 3 | G | G |
| **Jet Injection** | | | |
| | — | 3 | 3 |
| **EMS Control** | | | |
| Automatic Energy Savings | — | 3 | 3 |
| **Vacuum Fluorescent Text** | | | |
| Digital Dew Point Monitoring | — | — | 3 |
| 2 Line, 16 Characters (high-visibility in darkness or sunlight) | 3 | 3 | 3 |
| **Languages** | | | |
| English, Spanish, French | 3 | 3 | 3 |
| **Power Recovery** | | | |
| Automatic Restart after Power Loss | 3 | 3 | 3 |
| **Dry Contacts** | | | |
| Remote Indication of Alarm | 3 | 3 | 3 |
| **Overlay w/Circuit Graphics & LED Indicators Alarm LEDs with Text Display** | | | |
| Tower Status - (drying switchover heat, cool, etc.) | 3 | 3 | 3 |
| Tower - Switchover, Failure (low heater temp/high heater temp) | 3 | 3 | 3 |
| Sensor Over-range & Under-range | 3 | 3 | 3 |
| Service Reminder | 3 | 3 | 3 |

*3 - Standard | G - Guaranteed*

## Table 1 Correction Factors

| PRESSURE | INLET TEMPERATURE °F (°C) | | | | | | |
|---|---|---|---|---|---|---|---|
| psig (kgf/cm²) | 60 (15.60) | 70 (21.10) | 80 (26.70) | 90 (32.20) | 100 (37.80) | 110 (43.30) | 120 (48.90) |
| 60 (4.2) | 1.03 | 1.01 | 0.99 | 0.8 | 0.58 | 0.43 | 0.32 |
| 70 (4.9) | 1.1 | 1.08 | 1.07 | 0.94 | 0.68 | 0.5 | 0.37 |
| 80 (5.6) | 1.17 | 1.15 | 1.14 | 1.08 | 0.79 | 0.58 | 0.43 |
| 90 (6.3) | 1.24 | 1.22 | 1.2 | 1.18 | 0.89 | 0.66 | 0.49 |
| 100 (7.0) | 1.3 | 1.28 | 1.26 | 1.24 | 1 | 0.74 | 0.55 |
| 110 (7.7) | 1.36 | 1.34 | 1.32 | 1.3 | 1.11 | 0.82 | 0.61 |
| 120 (8.4) | 1.42 | 1.4 | 1.38 | 1.36 | 1.22 | 0.9 | 0.67 |
| 130 (9.1) | 1.48 | 1.46 | 1.44 | 1.42 | 1.33 | 0.99 | 0.74 |
| 140 (9.8) | 1.53 | 1.51 | 1.49 | 1.47 | 1.44 | 1.07 | 0.8 |
| 150 (10.6) | 1.58 | 1.56 | 1.54 | 1.52 | 1.5 | 1.16 | 0.87 |

## Operating Conditions

| PHD MODELS | MAXIMUM WORKING PRESSURE psig | MINIMUM OPERATING PRESSURE psig | MAXIMUM INLET AIR TEMP. °F | MINIMUM INLET AIR TEMP. °F | MAXIMUM AMBIENT TEMP. °F | MINIMUM AMBIENT TEMP. °F |
|---|---|---|---|---|---|---|
| OPTION B | 150 | 60 | 120 | 40 | 120 | 40 |

## Inlet Flow

Inlet Flow capacities shown in the Specifications Table have been established at an inlet pressure of 100 psig (7kgf/cm$^2$) and a saturated inlet temperature of 100°F (38°C). To determine maximum inlet flow at other conditions, multiply the inlet flow from the Engineering Data Table by the multiplier from Table 1 that corresponds to your operating conditions.

## Dew Point

Outlet pressure dew point at rated inlet conditions of 100 psig (7kgf/cm$^2$) and 100°F (38°C) saturated. Dew point varies slightly at other conditions. Consult the factory to determine exact outlet pressure dew point at your operating conditions.

## Engineering Data – 300 thru 3200 scfm*

| MODEL | INLET FLOW[1] @100 psig 100°F scfm | HEATER RATED OUTPUT kW | AVERAGE kW | DIMENSIONS inches H | W | D | INLET/OUTLET CONNECTIONS inches | APPROX. WEIGHT lbs. | FILTRATION[2] |
|---|---|---|---|---|---|---|---|---|---|
| PHD-300 | 300 | 5 | 2.7 | 98 | 48 | 47 | 1.5" NPT | 1400 | PCS13401 |
| PHD-400 | 400 | 7 | 3.6 | 104 | 53 | 55 | 1.5" NPT | 1800 | PCS15001 |
| PHD-500 | 500 | 7 | 4.5 | 105 | 53 | 56 | 1.5" NPT | 1800 | PCS15001 |
| PHD-600 | 600 | 8 | 5.4 | 108 | 55 | 57 | 2" NPT | 2000 | PCS16001 |
| PHD-750 | 750 | 10 | 6.8 | 114 | 60 | 65 | 2" NPT | 2400 | PCS18001 |
| PHD-900 | 900 | 12 | 8.2 | 114 | 60 | 65 | 3" FLG | 2400 | PCS19501 |
| PHD-1050 | 1050 | 14 | 9.5 | 113 | 64 | 66 | 3" FLG | 2900 | PCS112001 |
| PHD-1300 | 1300 | 17 | 11.8 | 118 | 66 | 77 | 3" FLG | 3400 | PCC114003 |
| PHD-1500 | 1500 | 19 | 18.6 | 119 | 80 | 83 | 4" FLG | 5100 | PCC118003 |
| PHD-1800 | 1800 | 23 | 16.3 | 119 | 80 | 82 | 4" FLG | 5100 | PCC118003 |
| PHD-2200 | 2200 | 28 | 20.0 | 127 | 85 | 87 | 4" FLG | 7800 | PCC124004 |
| PHD-2600 | 2600 | 33 | 23.6 | 127 | 85 | 87 | 6" FLG | 7800 | PCC136003 |
| PHD-3200 | 3200 | 40 | 29.1 | 125 | 97 | 91 | 6" FLG | 9000 | PCC136003 |

1 *Performance data per CAGI Standard ADF 200 for Dual-Stage Regenerative Desiccant Compressed Air Dryer. Rating conditions are 100°F (37.8°C) inlet 100 psig (6.9 bar) inlet pressure, 100% relative humidity, 100°F (37.8°C) ambient temperature, and 5 psi (0.35 bar) pressure drop. * Consult factory for larger models.*

2 *Prefilter element type SU: Afterfilter element type HT.*

# Externally Heated Desiccant Compressed Air Dryers

## PHD Series

300 - 3,200 SCFM

Design features, materials of construction and dimensional data, as described in this bulletin, are provided for your information only and should not be relied upon unless confirmed in writing. Please contact your local sales representative for product availability in your region.

Pneumatic Products™

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