Industrial Gases

Ultradryer HRS+ 3500 - 8750
Heat-Regenerated Adsorption Dryer

PRODUCT DESCRIPTION

The Ultradryer HRS+ range is designed for drying of compressed air and nitrogen in a pressure range up to 10 bar.

The drying process is based on adsorption of water molecules out of a gas stream on hygroscopic desiccant materials. With this drying concept pressure dewpoints of -40°C (at 7 bar) or lower can be achieved.

The regeneration of saturated desiccant is done by using ambient air for the desorption of water and cooling the hot desiccant with ambient air as well. With this concept no compressed air is needed for the regeneration process.

The pressure vessels and all main process pipelines are made of steel material with flange connections.

An electrical control system with SIEMENS S7-1215C PLC and touch display SIEMENS KTP700 enables automated control of all phases of the drying and regeneration cycle. It includes the dewpoint monitoring and control system Ultraconomy for energy efficient and reliable operation.

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MAIN FEATURES & BENEFITS

- **Heat-regenerated adsorption dryer with zero-purge air regeneration and cooling concept**

Utilization of compression heat during heating process and ambient air cooling during cooling phase lead to energy-efficient desiccant regeneration without loss of compressed air.

- **Ultraconomy dewpoint control included**

Monitoring and control of dewpoint ensure full utilization of desiccant capacity and is the trigger to start the regeneration process. High energy and cost saving opportunity as well as full drying performance control.

- **Reliable and stable dewpoint performance even under challenging conditions**

Applied cycle-times (6 hours cycle) and special desiccant layer concept provide high operation safety and reliability.

- **Condition Monitoring and Data Transfer**

Several individual condition messages, signal inputs/outputs and alarm contacts available as standard. Controller is ready for upgrades with further monitoring and data transfer standard options.

INDUSTRIES

- Industrial Machinery

- Food Processing

- Electronics

- Automotive

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Technical alterations reserved (11/2025)

PRODUCT DESCRIPTION

The adsorption dryer is consisting of two adsorber vessels (AD1 / AD2) filled with desiccant. While one adsorber is in drying phase, the other adsorber is being regenerated.

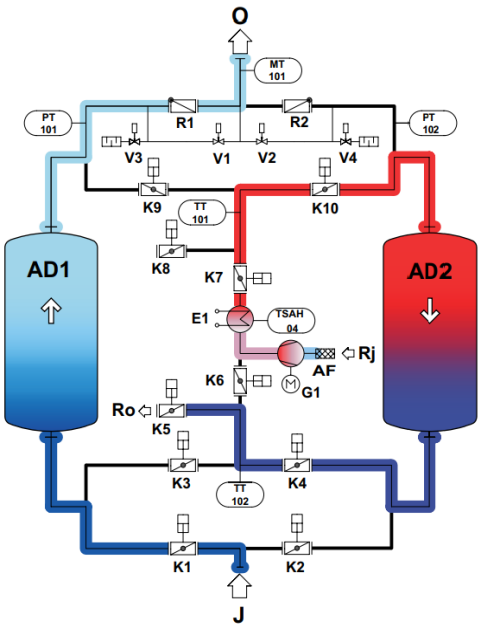
In the drying phase compressed air is entering the unit at the wet air inlet (J) and is led through the butterfly valve K1 (K2) into the adsorber AD1 (example shown here). It flows though the adsorber from bottom to top and adsorbs the humidity on the desiccant. Via a non-return valve R1 (R2) it flows to the dry air outlet (O). The dewpoint is measured by the dewpoint transmitter MT101.

While adsorber AD1 is in drying phase, adsorber AD2 is being regenerated. Therefore, the pressure in adsorber AD2 is released via valve V4 (V3) and ambient air is sucked-in via a radial fan (G1) and suction filter AF and is heated by an electrical heater (E1). Butterfly valve K7 is opened and butterfly valve K6 is closed. The desorption temperature is controlled by a temperature transmitter TT101. Via the butterfly valve K10 (K9) the heated air is flowing from top to bottom through the adsorber AD2 and is picking-up the water molecules which are adsorbed on the desiccant. The heated air is flowing through the butterfly valve K4 (K3) and butterfly valve K5 to the regeneration air outlet (Ro). The heating phase is finished when the setpoint on temperature transmitter TT102 is reached.

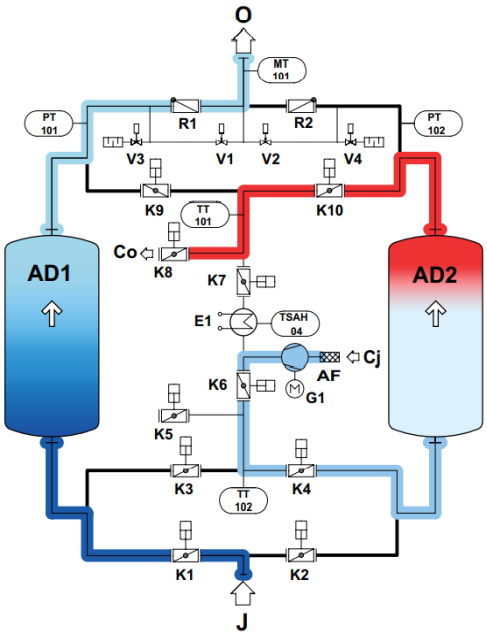
During the cooling phase butterfly valve K7 is closed and butterfly valve K6 is opened. The blower is still sucking in ambient air via suction filter AF and is leading the cooling air via butterfly valve KH4 (K3) from bottom to top through the adsorber AD2. Via butterfly valve K10 (K9) and butterfly valve valve K8 the cooling air is leaving the dryer at the cooling air outlet (Co). Cooling phase is finished when the setpoint on temperature transmitter TT102 is reached. At the end of the regeneration cycle the pressure in adsorber AD2 is built-up again by opening valve V2 (V1).

The switch-over for the adsorbers AD1 and AD2 from drying to regeneration or vice versa is triggered by controlling the dewpoint on transmitter MT101, when the dewpoint limit value is exceeded.

Drying + Heating Phases



Drying + Cooling Phases



J = Wet air inlet
O = Dry air outlet
Rj = Desorption air inlet
Ro = Desorption air outlet
Cj = Cooling air inlet
Co = Cooling air outlet

PRODUCT DESCRIPTION

FEATURES	BENEFITS
Heat-regenerated adsorption dryer with zero-purge regeneration and cooling concept	Utilization of compression heat during heating process and ambient air cooling during cooling phase lead to energy-efficient desiccant regeneration without loss of compressed air.
Ultraconomy dewpoint control	Monitoring and control of dewpoint ensure full utilization of desiccant capacity. High energy and cost saving opportunity as well as full drying performance control.
6 hours cycle and special desiccant layer concept	Reliable and stable dewpoint performance even under challenging conditions.
Welded steel vessels and flanged main pipeline design	Robust, long-life, leakage-proof and service-friendly design
6 dryer sizes from 3500 up to 8750 m³/h nominal flow capacity	Wide range of dryer flow capacities and connection sizes matching to user requirements.
Programmable logic controller Simatic S7-1215C	Controller ready for Industry 4.0 and various connectivity options. Opportunity for dryer condition and performance monitoring
Touch Panel KTP700	High operational comfort due to self-explaining menu. Indication of all operation data incl. dewpoint and function status as well as alarm and service messages on the main menu ensures high operating safety.
Valve position control incl. alarm message indication and failure management concept	Valve position control on main switch-over valves for reliable and safe operation.
230 V AC power supply for up to 4 condensate drains included	No external power supply needed; reduced installation effort and cost.
4 x condensate drain alarm inputs and additional 4 x individual alarm inputs included	Enhanced monitoring of compressed air system performance including individual alarm messages.
Dry gas / purge cooling on demand	Selectable purge cooling at extreme operation and/or ambient conditions for reliable and stable dewpoint performance.
Control box temperature control	Air-cooler fan, thermostat and filter for control box cooling included for safe operation at even challenging ambient temperatures.
Single conductor cable marking	Easy identification of cable connection for trouble shooting or replacement of electrical components.
High temperature resistant painting process	Long-life corrosion protection

PRODUCT DESCRIPTION

In addition to the features already included in the standard dryer configuration, a range of defined standard options are available.

OPTIONS	DESCRIPTION AND BENEFITS
ENERSAVE Concept	Optimized desiccant layer concept requires lower regeneration temperature and offers additional energy saving opportunities in a range of 10-14% less average power consumption (at nominal flow and conditions).
Adsorber vessel and pipeline insulation	Insulation of heater housing is already included in standard configuration. Further options of adsorber vessel insulation and upper and lower pipelines optionally available for saving of heat energy and protection against hot surfaces.
„Weekend STOP" Mode	Shut-off of air flow across dewpoint sensor and additional output on controller for closing a shut-off valve downstream the dryer when controller is switched off. Dryer remains under pressure during shut-down period (e.g. during weekend).
Differential pressure monitoring	Differential pressure transmitter for monitoring of differential pressure from inlet of dryer (or pre-filters) to outlet of dryer (or after-filters). Control of dryer and filter condition. Data are indicated on controller. Alarm set-point and indication possible.
Flow monitoring	Flow transmitter for monitoring of flow demand and characteristics at dryer outlet. Can be combined with energy monitoring option.
Energy monitoring and management	Energy management 1 without flow monitoring: Measurement of voltage, current and power consumption per hour. Energy management 2 with flow monitoring: Measurement of voltage, current and power consumption per hour and per m^3/h. Power consumption of dryer under control
Data communication options	Option 1: Communication Processor for MODBUS TCP/IP Option 2: MODBUS RTU Module Option 3: Profibus Module Data link to user network for full monitoring of dryer status, service and alarm messages and sensor data
MMC card	Back-up memory for original dryer program
Seaworthy Packaging	Packaging option for special transport / storage conditions
Further options on request	Individual dryer configuration as per customer's requirements and tailor-made solutions, also for other industrial gases available on request.

PRODUCT DESCRIPTION

TECHNICAL DATA	
Adsorber Vessel	
Pressure Vessel Material	Carbon steel
Design Data	Design pressure: 10 bar g Design temperature: 230°C
Design, Manufacturing and Testing	Acc. to EN 13445
Approval	Acc. to PED 2014/68/EU
Flow Distributor Material	Stainless steel
Piping	
Design Data	Flange pressure rating: PN16 Design pressure: 10 bar g Design Temperature: 230°C
Piping Material	Carbon steel
Design, Manufacturing and Testing	Acc. to AD 2000
Approval	Acc. to PED 2014/68/EU
Electrical Controller	
Design	Acc. to VDE / IEC
Power Supply	3 Phases / 400 V – 50 Hz
Control Voltage	24 V DC / 230 V AC – 50 Hz
PLC	Siemens S7-1200 with CPU 1215C
Touch Display	KTP 700
Protection Class	IP 54, acc. to IEC/EN 60529
Control Box Material	Carbon steel, powder coated, RAL 7035
Potential-Free Alarm Contact	Included
Main Switch	Included
Remote On/Off Contact	Included

Donaldson FILTRATION SOLUTIONS

PRODUCT DESCRIPTION

TECHNICAL DATA	
Nominal Standard Conditions	
Pressure Dewpoint	-40°C
Operating Inlet Pressure	7 bar g
Operating Inlet Temperature	35°C
Inlet Humidity	100% saturated
Operating Limits	
Media	Compressed Air / Nitrogen
Operating Pressure	4 – 10 bar g
Operating Temperature	5 – 40°C
Ambient Temperature	5 – 40°C
Maximum Temperature / Humidity Conditions Blower	35°C / 45% r.H. to 30°C / 60% r.H.
Installation	Indoor

INLET / OUTLET CONNECTION DIRECTION

HRS 3500 - 8750: On Dryer Front Side

PRODUCT DESCRIPTION

Technical Data				
HRS	Nominal Volume Flow (1 bar, 20°C) m^3/h[1)]	Pipe Connection Size	Installed Power kW	Differential Pressure mbar[2)]
3500	3500	DN100	44.5	80
4000	4000	DN150	52.5	120
5000	5000	DN150	71.0	100
6000	6000	DN150	86.0	90
7000	7000	DN180	95.0	80
8750	8750	DN200	115.0	100

[1)] Nominal flow at 7 bar g, 35°C; [2)] at nominal flow

SIZING

Type	Pressure Dewpoint (PDP)	Inlet Temp.	Operating Pressure (bar g)						
			4	5	6	7	8	9	10
			Correction Factor (f)						
HRS	-40°C	**30°C**	0.72	0.92	1.09	1.25	1.36	1.45	1.51
		35°C	0.55	0.70	0.86	1.00	1.12	1.25	1.37
		40°C	0.33	0.45	0.58	0.71	0.82	0.92	1.03

Sizing Example:

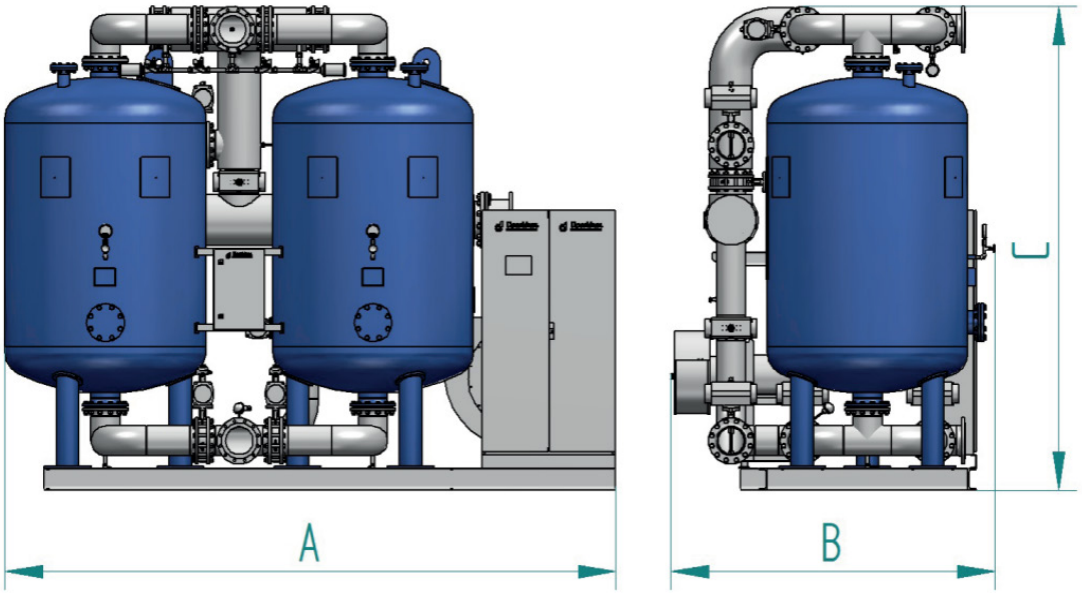
Volume flow V_{nom} = 4000 m^3/h, inlet temperature = 40°C, operating pressure = 6 bar g, PDP = -40°C

$$Vcorr = \frac{Vnom}{f} = \frac{4000\ m^3/n}{0.58} = 6897\ m^3/h$$

Calculated dryer size = HRS 7000

Donaldson FILTRATION SOLUTIONS

DIMENSIONS / WEIGHT



HRS	Flange Connection	Weight kg	A mm	B mm	C mm
3500	DN100	3790	3347	1785	3055
4000	DN150	4650	3447	1810	3173
5000	DN150	5790	3725	1910	3321
6000	DN150	6700	3905	2035	3409
7000	DN150	7260	4065	2187	3471
8750	DN200	9450	4564	2424	3589

For more information please contact your Donaldson Sales Representative and visit our website at **www.donaldson.com**.

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