ECO**TROC®** DDWB

Heat-regenerated desiccant dryer

Rev 01_0225_NA

Desorption by blower conveyed ambient air in counterflow direction to the adsorption process, cooling by blower conveyed ambient air

Zero Purge

Desiccant drying at it‘s best

State-of-the-art heat-regenerated desiccant dryers of the **ECOTROC® DDWB** series set a new industry standard. Energy efficiency, operational reliability and adaptability to local requirements and demands are key considerations for the **ECOTROC® DDWB** series.

Critical applications and large scale compressed air systems like pharmaceutical production, microchip manufacturing and steel plants require reliable compressed air quality and maximum energy efficiency. The larger the system, the higher the advantage of a true zero-purge desiccant dryer.

The ECOTROC®DDWB Plus-Effects +++

+ **Zero Purge**
+ exceptional energy efficiency
+ lower compressor capacity required (compared to blower purge designs)
+ linear dew points -› reliable compressed air quality
+ high quality components -› operational reliability and simple maintenance
+ intelligent control with dew point monitoring and load-dependent cycles
+ options: vessel insulation, heat recovery modules, heat-of-compression version, loop cooler version (PDP -94F possible)

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Functional principle

KSI provides outstanding solutions for compressed air and gas treatment. Dryers of the **ECOTROC® DDWB** series utilise the principle of adsorption to remove moisture from a compressed air or gas stream. In order to regenerate the saturated desiccant bed, a combination of PSA (pressure swing adsorption) and TSA (temperature swing adsorption) is applied. In comparison to a standard heatless desiccant dryer, the air used for regeneration purposes is heated to a temperature of over 250 F. This allows for higher saturation rates of the desiccant bed and therefore much longer cycle times. **ECOTROC® DDWB** heat-regenerated desiccant dryers use heated ambient air for regeneration of the desiccant bed, therefore operating with zero purge air requirement.

Although the **ECOTROC® DDWB** is more complex and has a higher initial investment than the standard DDN desiccant dryer range, the break-even point is usually reached within 12 - 24 months due to the savings in purge air.

Adsorption — Regeneration — Cooling — Switching

Incoming compressed air is flowing through the desiccant bed from below in the so-called „wet zone“ for pre-drying. Then the actual adsorption process takes place by adsorbing water molecules on the large inner surface of the desiccant.

Parallel to the adsorption phase in the first vessel the desiccant in the second vessel is regenerated.
For this purpose, ambient air is drawn in by a blower and heated in the downstream heater. The heated air (at ambient pressure) flows through the desiccant bed from top to bottom - in counterflow to the adsorption direction. A significant advantage of the DDWB: the upper third of the desiccant bed is heated extremely effectively. This section is especially important for reliably low pressure dew points.

After the regeneration phase has ended, the desiccant bed has been heated to well over 220 F. Before the desiccant is able to absorb moisture again, it must be cooled down to ambient temperature.

The desiccant bed is continuously heated, the moisture bound in the bed evaporates and is blown off to the atmosphere via the regeneration suction step. To monitor the regeneration phase, the temperature of the regeneration air blown off to the atmosphere is monitored. When a defined temperature threshold is reached, the heater can be switched off.

The moisture bound in the desiccant bed is now completely desorbed. As a result of the regeneration, the desiccant bed has heated up to well over 100 °C. Before the desiccant is able to absorb moisture again in the adsorption phase, it must therefore be cooled down.

In order to cool down the desiccant bed, the direction of the blower is reversed and therefore transports cool ambient air through the desiccant bed from bottom to top. Any moisture contained in the ambient air is adsorbed in the lower third of the desiccant bed, the so-called “wet zone”. This feature of the DDWB process ensures that the upper part of the desiccant bed, the section responsible for reaching the desired dew point, stays unsaturated and ready for adsorption.

After the cooling phase has been completed (monitored by the outlet temperature of the cooling air) the regenerated desiccant bed is ready for the switch-over phase. Until the intelligent control inititates this phase, the dryer will stay in stand-by mode and allow for extremely long phases without blower or heater consuming energy. This phase is critical for the energy efficiency of the DDWB series, as it can last several hours and lead to cycle times as long as 24 hours or more.
Once the load dependent control initiates the switching phase, pressure in the regenerated vessel builds up. When operating pressure is reached, the dryer will direct the process flow through both vessels for a short period of time, avoiding dew point peaks. The vessel saturated with moisture is now de-pressurized and the regeneration phase begins again.

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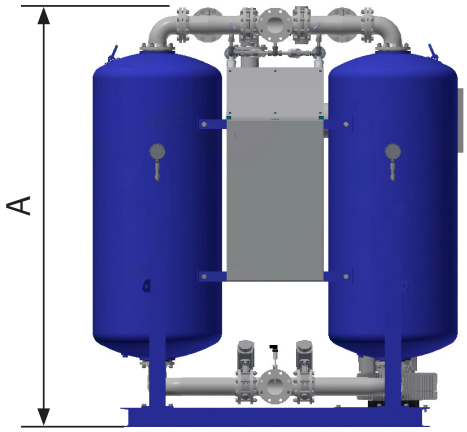
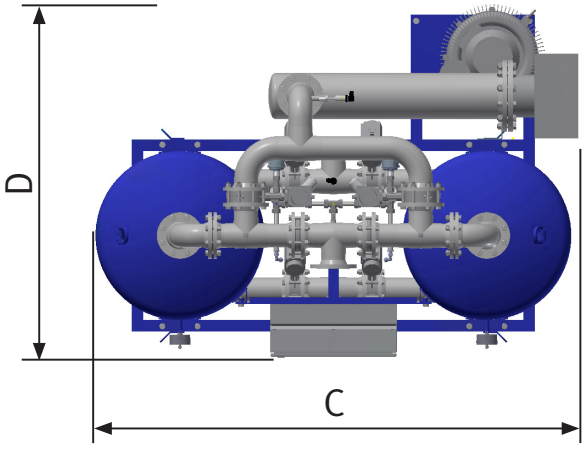
Performance data and dimensions

Type	Capacity*	Dimensions (mm)			Connection	Weight
	cfm	A	C	D		kg
DDWB235	235	2,260	1,750	1,030	2" flange	1,200
DDWB410	410	2,310	1,860	1,180	2" flange	1,400
DDWB590	590	2,390	1,920	1,280	3" flange	1,500
DDWB825	825	2,420	1,920	1,320	3" flange	1,900
DDWB1000	1,000	2,480	2,120	1,450	3" flange	2,300
DDWB1175	1,175	2,550	2,180	1,480	3" flange	2,800
DDWB1475	1,475	2,640	2,400	1,520	4" flange	3,400
DDWB1765	1,765	2,630	2,500	1,580	4" flange	3,600
DDWB2060	2,060	2,790	2,750	1,900	4" flange	4,000
DDWB2355	2,355	2,890	2,800	1,990	6" flange	4,800
DDWB2950	2,950	2,870	2,910	2,040	6" flange	5,600
DDWB3535	3,535	3,000	3,400	2,350	6" flange	6,300
DDWB4120	4,120	3,000	3,500	2,280	6" flange	7,200
DDWB4825	4,825	3,100	3,600	2,500	6" flange	8,000
DDWB5590	5,590	3,300	3,800	2,600	8" flange	9,000

** calculated at 14.5 psi (abs.) and 68°F at 101 psi operating pressure, 95°F inlet temperature*
*** Insulation including vessel head and heater.*

Dimensional drawings





Specifications	
Pressure dew point (PDP)	-40 °F
Media	Compressed air
Min. operating pressure	58 psi g
Max. operating pressure	160 psi g (DDWB 235 ... 1765) 145 psi g (DDWB 2060 ... 5590)
Colour	blue RAL 5010
Connection	ANSI B16.5

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Correction factors DDWB

Inlet temperature	Working pressure						
°F	psi g						
	58	73	87	102	116	131	145
86	0,71	0,86	1	1,15	1,18	1,25	1,37
95	0,62	0,75	0,87	1	1,12	1,25	1,37
104	0,38	0,53	0,67	0,82	0,92	1,07	1,21
110	---	0,33***	0,45**	0,54**	0,61*	0,72	0,8

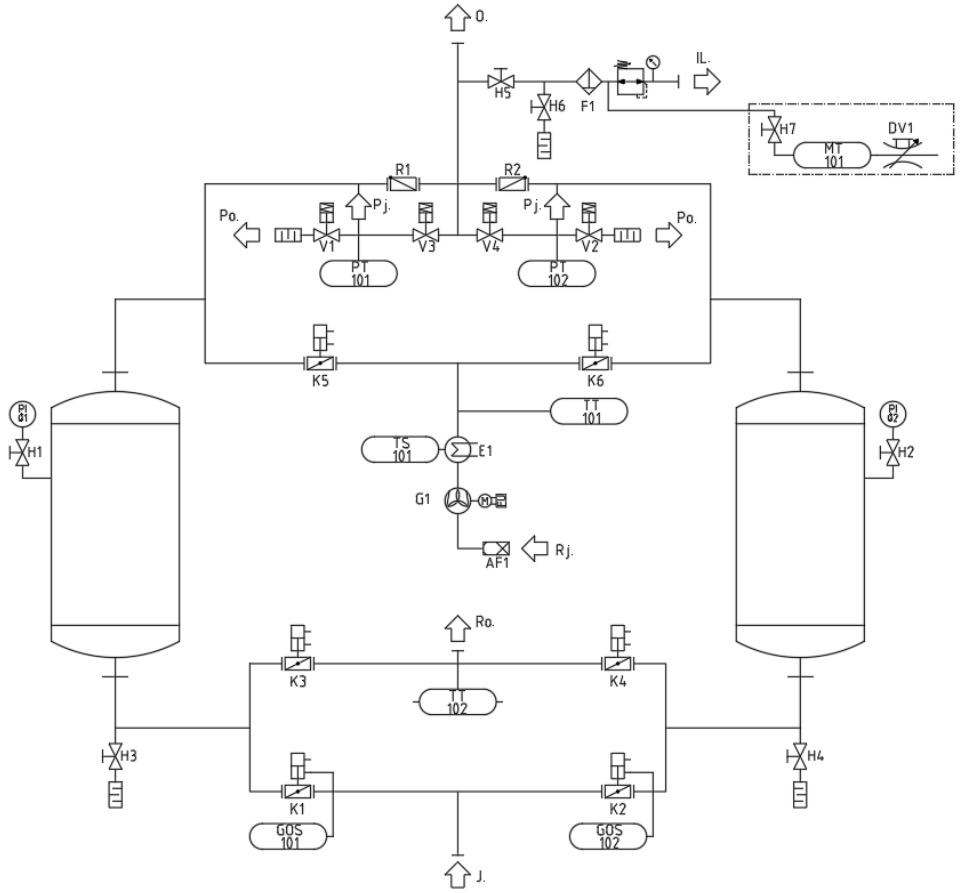
* PDP -30 °C / ** PDP -25 °C / *** PDP -20 °C

Please multiply the capacity of the filter with the correction factor in the above table to get the corrected capacity.

Guidance for determinating the dryer size:

Inlet volume flow V_{eff}:	1,178 cfm	
Operating pressure:	102 psi g	$V_{corr} = V_{eff} / K1 = (1,178\ cfm) / 0,82$
Inlet temperature:	104 °F	$V_{corr} = 1,437$ cfm
Required PDP:	-40 °F	
Correction factor K1:	0,82	chosen dryer size: DDWB1475

Flow diagram



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Application

Installation site	Inside in non-aggressive atmosphere				
Ambient humidity max.	25% r.h at 104 °F	37% r.h at 95 °F	50% r.h at 86 °F	70% r.h at 77 °F	90% r.h at 68 °F
Ambient temperature max.	95 °F for blower inlet, ambient 120 °F				
Ambient temperature min.	35 °F, in temperatures < 60 °F dryer insulation is recommended				
Operating pressure	58 to 160 psi g				
Flow medium	Compressed air and nitrogen				
Pressure dew point	-4 °F / -40 °F / -94 °F (only with loop version)				

* calculated at 14.5 psi (abs.) and 68 °F at 101 psi g working pressure

Technical features

Regeneration by heated ambient air in counter flow with drying direction
Cooling by ambient air in parallel flow with drying direction
No purge air requirement - Zero Purge
Complies with ASME code requirements
The following standards and manufacturing processes were used as a basis for production: DIN EN ISO 12100, DIN EN 1050, DIN EN 50081, DIN EN 50082, DIN EN 60204, DIN EN ISO 9001:2015 (comprehensive quality management), ASME B31.3:2020, NFPA 70, NFPA 79, UL 508A

Further data	
Power supply	380 - 500 V / 50 - 60 Hz (other options on request)
Protection class	IP 54
Motors	Motors of the side channel blowers are built according to DIN EN 60034 / DIN IEC34-1, IE3, thermal class F. Voltage tolerance 10%
Pressure sensors	2-wire technology, measuring range 0 - 232 psi, output signal 4-20 mA
Temperature sensors	PT 100: Measuring range -58 °F - 750 °F
Pressure dew point sensors	2-wire technology, measuring range -148 °F - 68 °F, output signal 4-20 mA

Approvals for pressure equipment

EU	**Approval for fluid group 2 according to Pressure Equipment Directive 2014/68/EU, Module H1 (Category IV)**
North America:	**ASME U/UM, CRN (on request)**

Quality assurance

Development/manufacture	**DIN EN ISO 9001**

Air purity class acc. to ISO 8573-1:2010

Solid particles	**-**
Humidity (gaseous)	**Class 3 (PDP -13 °F), class 2 (PDP -40 °F), opt. class 1 (PDP -94 °F)**
Residual oil	**-**

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Maintenance plan

The following maintenance plan ensures safe and trouble-free operation. These should be observed by the operator.		
daily	entire dryer:	visual and functional check
	pre-filter (opt.):	check function of condensate drain
	reservoir:	check back pressure on manometer
weekly	pre- and post-filter:	check differential pressure, if ›5 psi, replace filter element
monthly	intake filter:	check intake opening for regeneration gas
semi-annual	control cabinet:	check screw connections and terminals for tightness, retighten if necessary. (in case of strong vibration: shorten maintenance interval)
annually	pre- and post-filter:	replace filter element
	silencer:	replace silencer element
	control air filter:	check, clean or replace if necessary
	pressure dew point sensor:	replace
every 2 years	blower:	check and replace if necessary
	pressure transmitter:	check and replace if necessary
	temperature sensor:	check and replace if necessary
	pressure gauge:	check and replace if necessary
	dust sieve:	check for contamination and clean or replace if necessary
every 5 years	desiccant:	check desiccant for contamination and replace if necessary.

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The control

The heat regenerated desiccant dryers of the **ECOTROC® DDWB** series are equipped with a Siemens SIMATIC S7 1200 PLC with 7“ touch panel, which allows easy access to status, settings, alarm messages and diagnostic information.

The control system features an intuitive and user-friendly menu. The dashboard shows the current operating status with all relevant parameters, such as operating pressure in each vessel, operating temperature in the regeneration process and pressure dew point. The configuration can be adjusted by trained and authorised personnel with access to the required passcodes.

Various additional features are available and can be activated. For diagnostics, all alarms and warnings are logged and are available in the menu. Historic data visualised as curves can be displayed on the control itself. Connection options (Modbus, Profibus etc.) are available on request and allow integration in IT infrastructure.