Donaldson
Ultrafilter®

Technical Data and Function Description

Adsorption Dryer *HRS-L*

Externally heat regenerated

Reliable

Economical

High reserve capacities

Service friendly

Easy to handle

Innovative

Doc.-No. : 0120 - 51

Donaldson

Adsorption Dryer HRS-L

- Desorption in counter current flow to the adsorption direction with externally heated blower air
- Cooling in a loop in co-current flow with blower air

ADSORPTION

The compressed air flows through the unit inlet (J) via the inlet valve (K1) and the flow distributor, passing through the bed of desiccant from bottom to top. The flow distributor ensures that the compressed air is evenly distributed throughout the adsorption vessel.

While the (still) humid stream of compressed air passes through the system, the vaporized water is adsorbed by the hygroscopic desiccant. The dried compressed air enters the compressed air network (O) via the upper outlet flow distributor and the outlet valve (R1). The drying process is terminated either after a certain time has elapsed or subject to the dew point (OPTION).

The adsorption proceeds from bottom to top (figure 1).

Legend:

J	=	wet air inlet
O	=	dry air outlet
Rj	=	desorption air inlet
Ro	=	desorption air outlet
Cj	=	cooling air inlet
Co	=	cooling air outlet

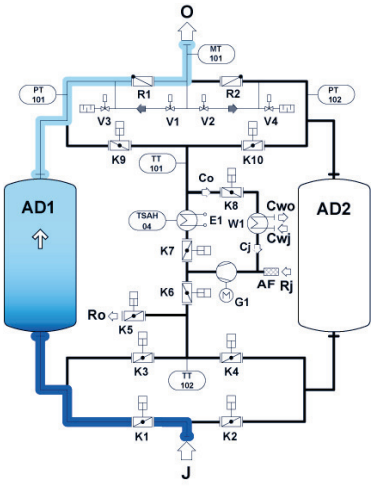

Fig. 1: AD1 Adsorption

ADSORPTION - DESORPTION

One adsorber is regenerated (here AD2) whilst adsorption takes place in the other vessel (here AD1) of the unit. Before the regeneration may begin in the respective adsorber, the pressure is slowly reduced to normal atmospheric level. Units of the HRS series use ambient air for their desorption (Rj).
A blower (G) compresses the ambient air to the pressure level needed for the regeneration. The resulting **temperature increase** positively affects the power needs of the downstream heater (E) which heats up the air from the blower until it has reached the required desorption temperature.

The heated air from the blower is led via the regeneration valve (K7,here K10) into the adsorber, which currently has to be desorbed (AD2). The air is equally distributed and flows through the entire bed of desiccant, evaporating the water contained in the desiccant (Figure 2). This water load is being driven out to atmosphere on the shortest way via the regeneration outlet valves (here K4,K5).

The heated ambient air cools down when flowing through the vessel as a result of the evaporation of the water. The temperature of the outgoing moist air is therefore not higher than the evaporation temperature (approx. 40-60°C).
The amount of moisture in the desiccant diminishes during the desorption process and the temperature at the regeneration air outlet (Ro) rises.

The desorption phase is terminated once the required process temperature has been reached.

In contrast to the direction followed by the adsorption, the desorption proceeds from top to bottom using externally heated blower air.

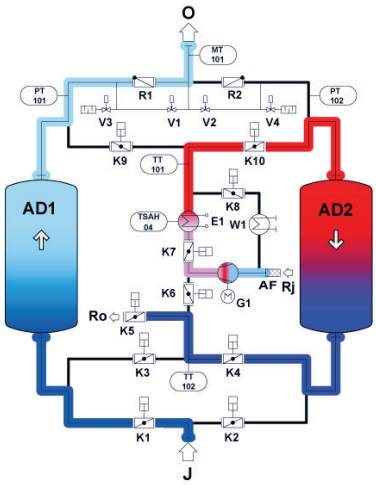

Fig. 2:
AD1 Adsorption / AD2 Desorption

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ADSORPTION - COOLING

For the subsequent cooling of the heated desiccant ambient air is used and led in a loop. This proceeds in the same direction of flow as the adsorption, i.e. from bottom to top.
Cooling in a loop avoids new entry of humid ambient air during the cooling phase, thus preventing a preloading of the adsorber.
No compressed air is consumed in the cooling process.
Starting the cooling phase, the regeneration valve K5 closes and the integrated cooler (W1) is activated to cool down the hot regeneration air.

The regeneration outlet valves (K6,K4,K10,K8) close after the cooling-down phase has come to a close. Subsequently the pressure is built up slowly in the regenerated adsorber vessel (here AD2). The pressure is balanced slowly (by valves V1 and V2), thus ensuring a careful and efficient use of the desiccant.

The standby phase begins as soon as the pressure has been balanced.

Cooling proceeds in a loop from bottom to top using blower air.

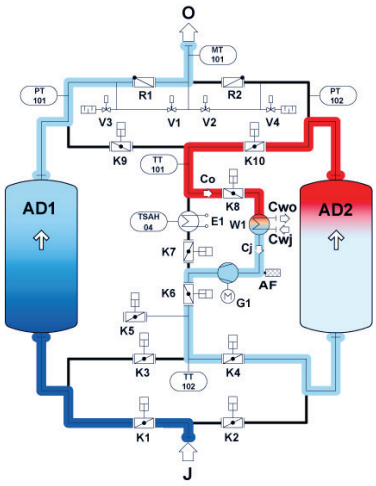


Fig. 3: AD1 Adsorption / Cooling

ADSORPTION - STANDBY

Whilst one adsorber (here AD1) is continuously in adsorption phase, the second one (here AD2) is ready to switch over.

The duration of the standby phase (Figure 4) is subject to various parameters. It is especially important whether the customer uses the facility regularly or irregularly.

There are two different ways to set the control function:

a. time dependent
b. dew point dependent (OPTION)

a. „Time dependent“ means that the cycle times are fixed, regardless of how much vaporized water is actually contained in the desiccant.

b. „Dew point dependent“ means that the cycle times depend on the amount of moisture present. The cycles are switched when a certain pre-set dew point has been attained at the outlet. The adsorption vessels are only switched over once the capacity of the adsorption agent to absorb moisture has been exceeded.

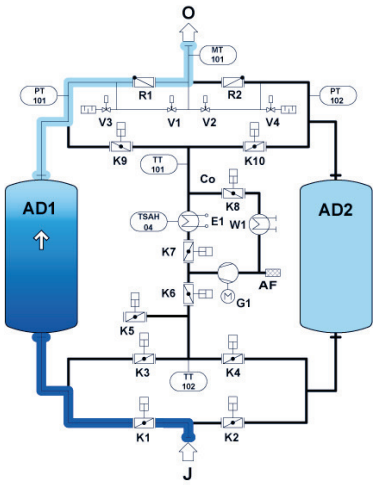


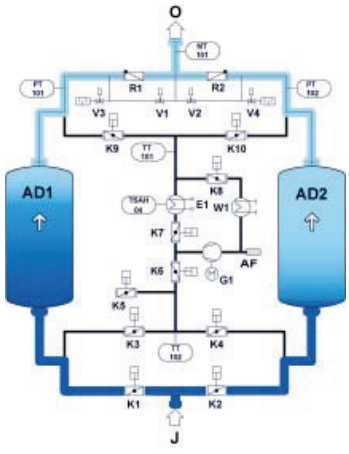
Fig. 4:
AD1 Adsorption / AD2 Standby

PARALLEL OPERATION

Before the adsorbers can be switched over (here from AD1 to AD2), they will (for a short period) be operated simultaneously.

For about ten minutes, the compressed air flows through both adsorber vessels (figure 5).

Fig. 5:
AD1 Adsorption / AD2 Adsorption



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SWITCHOVER PROCEDURE

The switchover procedure ends the parallel phase (Figure 6).

The switchover proceeds as follows:

a. disconnection of saturated adsorber (here AD1) from compressed air stream by closing the wet air inlet (here K1)
b. pressure release of saturated adsorber (here AD1) to atmospheric pressure (here by valve V3) Opening this small valve (pressure release valve), the compressed air within the saturated adsorber is led into the atmosphere via a silencer
c. Opening of regeneration valve (here K3) after completion of pressure release

Now the saturated adsorber starts its regeneration with the desorption phase.

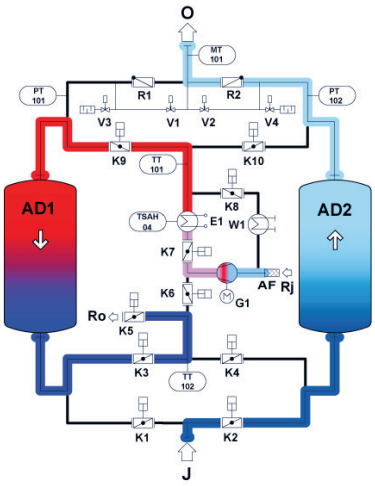

Fig. 6:
AD1 Desorption / AD2 Adsorption

OVERVIEW OF FUNCTIONAL SCHEME

		Adsorber 1	Adsorber 2
Total Cycle	Alternating Cycle	Adsorption	Pressure release
		Adsorption	Desorption
		Adsorption	Cooling
		Adsorption	Pressure built up
		Adsorption	Standby
		Adsorption	Adsorption
	Alternating Cycle	Pressure release	Adsorption
		Desorption	Adsorption
		Cooling	Adsorption
		Pressure built up	Adsorption
		Standby	Adsorption
		Adsorption	Adsorption

Switchover

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