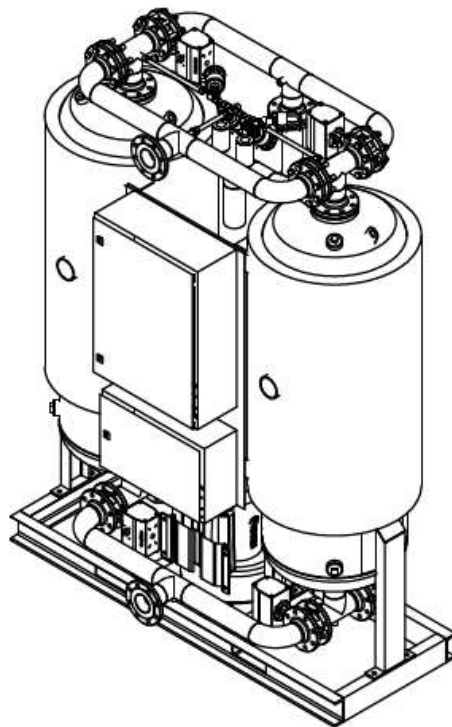


INSTALLATION AND OPERATING MANUAL

Heat Regenerated Adsorption Dryer **DRYBERG ADP**



Please read the following instructions carefully before installing the product. Trouble free and safe operating of the product can only be guaranteed if recommendations and conditions stated in this manual are respected.

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1- General information

1.1 Device information

Adsorption dryer model:	
Serial number:	
Year of production:	
Commissioning date:	
Type of towers:	
Left tower serial number:	
Right tower serial number:	

Please fill in the fields accordingly. Correct information enables proper and efficient maintenance of the device, selection of spare parts and technical support.

1.2 Supplier information

Name:	
Address:	
Telephone/Fax:	
e-mail:	

The data above differs from dryer to dryer. Please fill in the fields according to the type of the dryer you have. This data enables the manufacturer to clearly identify the dryer and simplifies service and provision of proper spare parts.

Some of the information listed here and other important data can be found on the type plate of the dryer and vessels. (→ See page 11)

1.3 About this operating manual

This operating manual contains all the technical information for transport, installation, operation, maintenance and decommissioning of the dryer.

1.4 Target group

This operating manual is directed to all persons working on and with the dryer. It is recommended that only qualified personnel who poses knowledge and experience with compressed air systems and electrical systems, operate the dryer. If you are not experienced in using these systems, please ask the relevant experts for help. It is highly recommended that commissioning and maintenance is carried out by the manufacturer or one of the authorized service partners.

1.5 Using the operating manual

Please read the operating manual and the additional documents carefully prior to installation/operation and follow the notes and instructions. Safe and proper operation of the dryer can only be guaranteed if the instructions are observed and followed. The safety notes must be observed in particular.

It is good practice to keep the operating manual in the vicinity of the dryer so as to be easily accessible.

The manufacturer accepts no liability for damages resulting from disregard of the operating manual.

All the information in this operational manual is valid at the time of publishing. Due to component or workflow modifications at any time affecting dryer maintenance, please make sure that the latest information is available prior to maintenance work.

Signs and symbols used

- Dots are used for bulleted lists.
- Cross references refer to information on a different page or in a different documents.



Note!

This symbol refers to matters that should be given special attention. Observing the notes helps to ensure safe handling of the product.



Tips and hints!

This symbol refers to matters that should be given special attention. Observing these advisory notes helps to ensure particular efficient operation of the product.



CAUTION!

This symbol indicates a possible harmful situation. When not avoiding this situation, there is a danger of injury or damage to the product or to adjacent system components.



WARNING!

This symbol indicates a possible dangerous situation. When not avoiding this situation, there is a danger of injury or death.



DANGER!

This symbol indicates an immediate impending danger. Not avoiding this danger could result in serious injury or death.



DANGER! Pressure

This symbol indicates an immediate impending danger due to pressure. Not avoiding this danger could result in serious injury or death.



DANGER! High voltage

This symbol indicates an immediate impending danger due to electricity. Not avoiding this danger could result in serious injury or death.



DANGER! Slippery

This symbol indicates an immediate impending danger due to slips. Not avoiding this danger could result in serious injury or death.



Wear a hardhat



Wear hearing protection



Wear eye protection



Wear a mask of respirator

1.6 Basics

Compressed air contains contaminants such as water, oil and particulates which must be removed or reduced to the acceptable level based on specific application requirements. Standard ISO8573-1 specifies air purity/quality classes for these contaminants. Humidity (water vapor content) is expressed in the terms of Pressure Dew Point (PDP) where Dew point is the temperature at which air is 100% saturated with moisture. When the temperature of the air falls to or below the dew point, condensation will occur. Reduction of water content down to pressure dew point +3°C is usually achieved with refrigerant dryers while for lower pressure dew points adsorption (also called desiccant) dryers are typically used.

1.7 Adsorption Dryers

Typical applications for the adsorption dryers are outdoor installations where the risk of freezing occurs and applications in which high air quality is required in terms of air dryness (PDP < +3°C) such as the process air in process industry (food and beverage, pharmaceutical, electronic, chemical ...).

The most common adsorption dryers are heatless regeneration adsorption dryers due to their simplicity reliability and relatively low investment costs. Heat regenerated dryers are more efficient than heatless dryers and as such are used for bigger applications with constant air consumption at or near nominal flow capacity.

1.8 Adsorption

Adsorption is a process where specific molecules adhere to the surface of a highly porous solid (adsorbent/desiccant) by electrostatic and molecular forces. The adsorbent is normally formed in sphere form beads. Adsorption takes place while air flows through a column filled with the beads/adsorbent. The rate of adsorption depends on several factors (type of adsorbent, relative humidity, inlet temperature, contact time, face velocity) and therefore is usually set/optimized for every individual application.

1.9 Appropriate Use



DRYBERG ADP series desiccant dryers are intended for highly efficient drying of compressed air. This appliance must be used only for the purpose for which it was specifically designed. All other uses are to be considered incorrect.



Specifically:

- A desiccant dryer can only be used for “GROUP 2” fluids (PED 97/23).
- A desiccant dryer **may not be used for explosive, toxic, flammable, corrosive and “GROUP 1” fluids (PED 97/23).**



Warning!

Internal corrosion can seriously reduce the safety of installation: check it during maintenance.

The manufacturer will under no circumstances be responsible for any damage resulting from improper, incorrect or unreasonable use.



Use genuine spare parts only. Any damage or malfunction caused by the use of non-genuine parts is not covered by the Warranty or Product Liability.

2- Safety instructions



Improper handling of compressed air systems/equipment and electric installations / equipment may result in serious injury or death.



Improper handling (transportation, installation, use/operation, maintenance) of DRYBERG ADP series dryer may result in serious injury or death. As a result of improper handling damage or reduced performance can occur.



The relevant safety at work and accident prevention regulations, plus operating instructions, shall apply for operating the adsorption dryer. The adsorption dryer has been designed in accordance with the generally recognized rules of engineering. It complies with the requirements of directive 97/23/EC concerning pressure equipment.



Ensure that installation complies with local laws for operation and routine testing of pressure equipment at the place of installation.



The operator/user of the adsorption dryer should make himself familiar with the function, installation and start-up of the unit.

All the safety information is always intended to ensure your personal safety. If you are not experienced with such systems please contact your local representative or manufacturer of the dryer for help.



- Before any kind of work is done on the dryer make sure that it is depressurized (additional to the dryer this also refers to the nearest upstream and downstream part of the installation) and disconnected from power supply.
- Do not exceed the maximum operating pressure or operating temperature range. Inspect the dryer, vessel type plate and read the manual.
- The permissible working temperatures and pressures for the adsorption dryer add-on parts are given under Technical data for those add-ons. The maximum temperature and pressure for an assembled system is the lowest maximum temperature and pressure of any individual part.
- It is necessary to ensure that the adsorption dryer is equipped with the corresponding safety and test devices to prevent the permissible operating parameters from being exceeded.
- Ensure that the adsorption dryer is not subject to vibrations that could cause fatigue fractures.
- The adsorption dryer should not to be subjected to any mechanical stress.
- The medium used may not have any corrosive components that could attack the materials of the adsorption dryer in a way that is not permitted. Do not use the adsorption dryer in hazardous areas with potentially explosive atmospheres.
- All installation and maintenance work on the adsorption dryer may only be carried out by trained and experienced specialists.
- It is forbidden to carry out any kind of work on the adsorption dryer, including welding and constructional changes, etc.
- Depressurize the system before carrying out any installation work.
- Wear respiratory protective equipment when working with an adsorbent. The adsorbent is a crumbling material that can produce fine dust which can cause respiratory complications if inhaled.
- Ensure that the adsorbent does not come into contact with liquid water. An exothermic reaction takes place when the adsorbent comes in contact with liquid water.
- While manipulating the adsorbent some adsorbent can fall on the floor. If this is the case be extremely careful and immediately clean the floor to prevent injuries such as falling on a slippery surface.



- Ensure that the adsorption dryer is installed as specified and that its components are not under any mechanical stress.
- Use original spare parts only.
- Use the device for the intended purpose only.
- The center of gravity of the dryer is positioned relatively high, thus care must be taken when installing or moving the dryer to minimize the risk of toppling over the dryer, which can cause serious injury or even death.
- When transporting please check and follow local regulations for lifting and transporting heavy objects.
- Note that a dryer can only be lifted using lifting lugs on the top of each vessel or with a forklift if it is firmly positioned on an appropriately sized pallet.
- Do not climb on the dryer.
- Do not use water to extinguish fire on the dryer or surrounding objects.
- Wear proper personal safety equipment (earplugs, earmuffs, safety goggles, safety helmet, safety gloves, safety shoes ...).

3- Technical data

TECHNICAL PARAMETERS

Operating pressure	4 – 11 bar	
Operating temperature (inlet)	1,5°C to 42,5°C (for temperature >35°C apply correction factor)	
Ambient temperature	1,5°C to 50°C (check also blower suction conditions)	
Pressure dew point	-40°C	
Voltage, Frequency	400V, 50Hz	
Protection class (controller)	IP 55	
Filter requirement (inlet)*	Super fine coalescing; residual oil cont. <0,01mg/m3; 0,01µm	
Filter requirement (outlet)*	Dust filter; 1µm	
Column insulation	OPTIONAL	
DRYER TYPES	ADP (standard)	
Desorption	Blower ambient air (vacuum)	Blower ambient air
Cooling	Blower ambient air (vacuum)	Purge air
Blower suction conditions	Max. 60%rh at 30°C	Contact manufacturer
Compressed air losses	0%**	2-3% (average)
DRYER TYPES	ADP (standard)	
Desorption	Blower ambient air (vac.)	
Cooling	Blower ambient air (vac.)	
Blower suction conditions max.	80% RH at 35°C 35% RH at 50°C	
Compressed air losses	0%**	

*If dryer is supplied without inlet filter compressed air class 1 (ISO 8753-1) for solid particles and oil should be provided to the inlet of the dryer.

**a small quantity of compressed air is used to repressurise the vessels, to operate the valves and to measure dew point

DRYER RATING ACCORDING TO ISO8573-1

Solid particles ⁽¹⁾	Water ^{(1),(2)}	Oil ⁽¹⁾
2	1-3	1

⁽¹⁾Typical result based on standard configuration and nominal operating conditions

⁽²⁾Depending on the specific design, class 2 when operated at nominal operating conditions.

MATERIALS

Columns, construction, support	Steel
Column inner protection	/
Column and construction outer protection	Epoxy painted
Desiccant support screen	Stainless steel
Valves	Brass, aluminium, steel, stainless steel
Seals	NBR, FKM
Fittings, Screws, plugs	INOX, brass, steel (zinc plated)
Lubricant	Shell cassida grease RLS 2
Outside protection	Powder paint coated (Epoxy-polyester base)
Desiccant	Silica gel

PRESSURE EQUIPMENT DIRECTIVE

PED 97/23/CE (Fluid group 2)

DRYBERG ADP 65 to DRYBERG ADP
155

Category 3, Module H

DRYBERG ADP 200 and up

Category 4, Module H1

CORRECTION FACTORS

To calculate the correct capacity of a given filter based on actual operating conditions, multiply the nominal flow capacity by the appropriate correction factor(s).

CORRECTED CAPACITY = NOMINAL FLOW CAPACITY x C_{OP} x C_{OT} x C_D

OPERATING PRESSURE

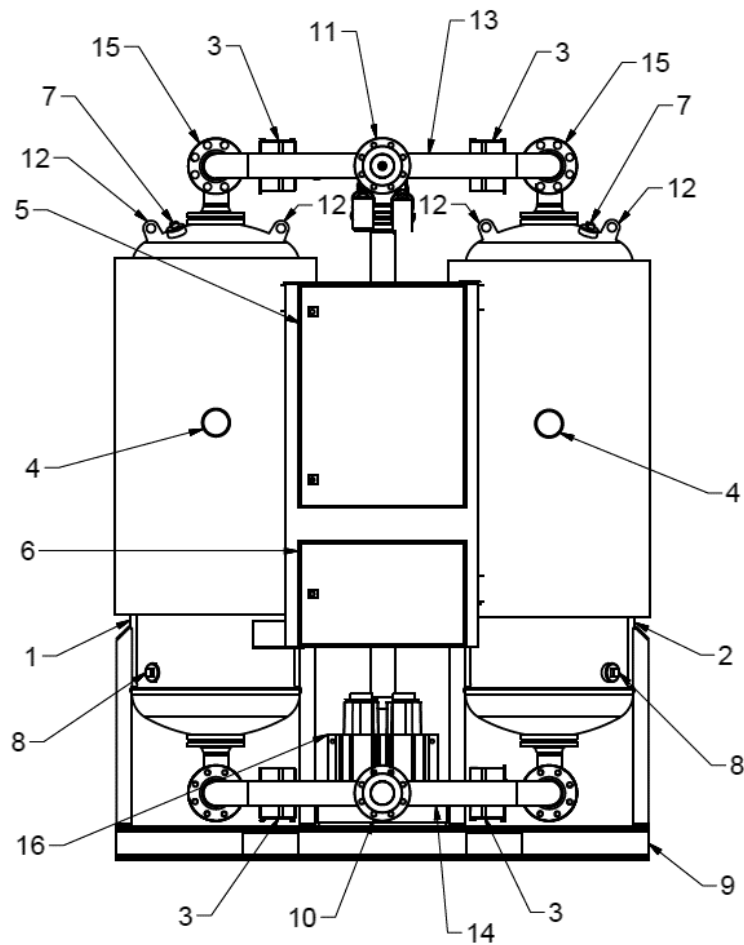
[bar]	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
[psi]	29	44	58	72	87	100	115	130	145	160	174	189	203	218	232
C _{OP}	0,38	0,5	0,63	0,75	0,88	1	1,13	1,25	1,38	1,50	1,63	1,75	1,88	2,00	2,13

OPERATING TEMPERATURE

[°C]	25	30	35	40	42,5	45
[F]	77	86	95	104	108	113
C _{OT}	1	1	1	0,7	0,52	0,48

For additional technical specification contact the manufacturer.

3.1 Components



Picture 2: Components



Note: The adsorption dryer displayed on the pictures of this manual is DRYBERG ADP 65.

- | | |
|-------------------------------------|-----------------------------------|
| 1. Vessel 1 (filled with adsorbent) | 8. Adsorbent discharge connection |
| 2. Vessel 2 (filled with adsorbent) | 9. Rig Base |
| 3. Butterfly Valve | 10. Inlet |
| 4. Manometer | 11. Outlet |
| 5. Control Box | 12. Lifting lugs |
| 6. Pneumatic Box | 13. Upper piping assembly |
| 7. Adsorbent filling connection | 14. Lower piping assembly |

15. Check Valve

16. Blower

3.2 Specifications

SIZES

Model	Conn. IN & OUT	Inlet flow [Nm ³ /h] ⁽³⁾	A [mm]	B [mm]	C [mm]	Mass [kg]	Vessel Volume [l]	Blower power [kW]	Heater power [kW]
DRYBERG ADP 65	DN50	390	1200	850	2250	1000	108	1,3	3,5
DRYBERG ADP 100	DN50	590	1500	900	2350	1400	167	1,6	5,5
DRYBERG ADP 130	DN50	780	1750	1000	2450	1800	221	1,6	7
DRYBERG ADP 155	DN50	930	1750	1250	2450	1900	266	1,6	8
DRYBERG ADP 200	DN80	1150	1900	1100	2480	2200	333	1,6	10
DRYBERG ADP 270	DN80	1600	1900	1350	2480	2600	474	4	14
DRYBERG ADP 330	DN100	1950	2200	1150	2550	3400	583	4	17
DRYBERG ADP 440	DN100	2530	2350	1150	2700	3800	769	7,5	22
DRYBERG ADP 500	DN100	2990	2500	1150	2750	4000	917	8,5	26
DRYBERG ADP 600	DN100	3680	2800	1350	2850	4800	1146	8,5	32
DRYBERG ADP 700	DN125	4100	3000	1350	3250	5100	1291	8,5	35
DRYBERG ADP 850	DN125	4990	3520	1450	3050	5900	1609	15	45
DRYBERG ADP 1010	DN150	6550	2520	1750	3500	7200	2166	15	56
DRYBERG ADP 1280	DN150	7700	2900	2000	3600	7900	2592	-	-
DRYBERG ADP 1650	DN200	10250	3200	2200	3600	12000	3584	-	-

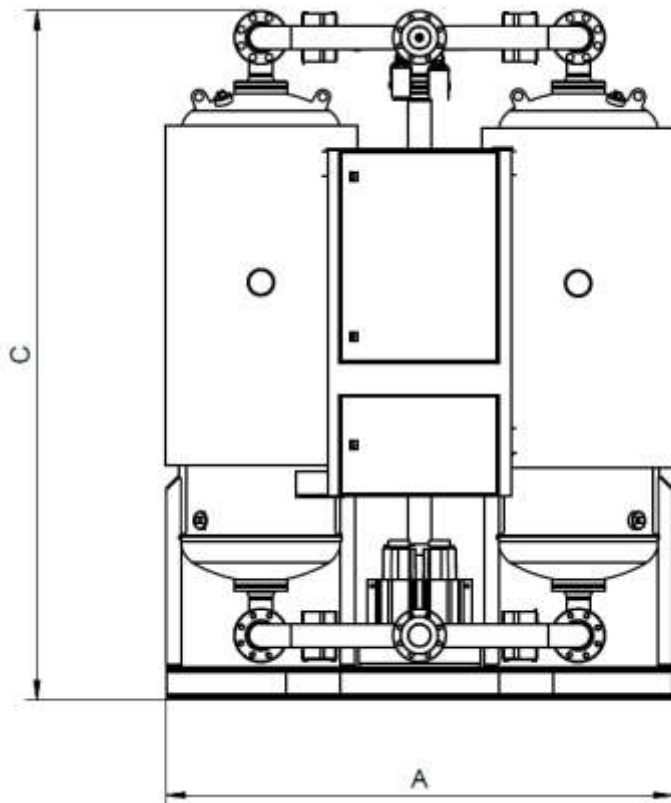
⁽³⁾Refers to 1bar(a) and 20°C at 7 bar operating pressure , inlet temperature 35°C and pressure dew point at outlet -40°C

Model	Conn. IN & OUT ⁽⁵⁾	Inlet flow Nm ³ /h ⁽³⁾	A [mm]	B [mm]	C [mm]	Mass [kg]	Vessel Volume [l] ⁽⁶⁾	Blower power [kW]	Heater power [kW]
DRYBERG ADP 65	DN50	390	1200	1300	2250	1400	108	1,3	3,5
DRYBERG ADP 100	DN50	590	1500	1400	2350	1900	167	1,6	5,5
DRYBERG ADP 130	DN50	780	1750	1500	2450	2300	221	1,6	7
DRYBERG ADP 155	DN50	930	1750	1700	2450	2400	266	1,6	8
DRYBERG ADP 200	DN80	1150	1900	1900	2450	3000	333	1,6	10
DRYBERG ADP 270	DN80	1600	1900	2100	2500	3200	474	4	14
DRYBERG ADP 330	DN100	1950	2200	2300	2600	4420	583	4	17
DRYBERG ADP 440	DN100	2530	2350	2500	2750	5000	769	7,5	22
DRYBERG ADP 500	DN100	2990	2500	2500	2750	5200	917	8,5	26
DRYBERG ADP 600	DN100	3680	2800	2700	2850	6240	1146	8,5	32
DRYBERG ADP 700	DN125	4100	3000	2700	2850	6700	1291	8,5	35
DRYBERG ADP 850	DN125	4990	3200	2900	2950	7700	1609	15	45
DRYBERG ADP 1010	DN150	6550	3520	2900	3050	9400	2166	15	56
DRYBERG ADP 1280	DN150	7700	3700	3100	3100	10300	2592	15	70
DRYBERG ADP 1650	DN200	10250	4300	3300	3550	15600	3584	22	95

⁽³⁾Refers to 1bar(a) and 20°C at 7 bar operating pressure , inlet temperature 35°C and pressure dew point at outlet -40°C

⁽⁵⁾Refers to dryer inlet and outlet connection without filters.

⁽⁶⁾Volume per vessel



Consult the technical documentation included with the dryer for exact general arrangement and dimension drawing!



If the documentation is lost or otherwise unavailable contact the supplier or manufacturer.

4- Description of operation

An adsorption dryer is intended to remove water vapor from the compressed air at the inlet in order to reach a desired dew point at the outlet.

During normal operation compressed air enters the adsorption dryer at the inlet and passes through the appropriate inlet control valve into the first tower (pressure vessel filled with adsorbent) where the process of adsorption takes place. In the tower the air passes through the adsorbent which removes the water vapor from the inlet air. After leaving the tower the dried compressed air leaves the adsorption dryer through the outlet.

A desorption is underway in the second tower. First the compressed air is released out of the pressure vessel. After the previous stage is complete the adsorbent in the vessel is heated with the heated ambient air from the heater. Desorption occurs and the water collected in the adsorbent is flushed from the adsorbent and is carried by the air through the appropriate release control valve after which it is discharged from the system by the blower.

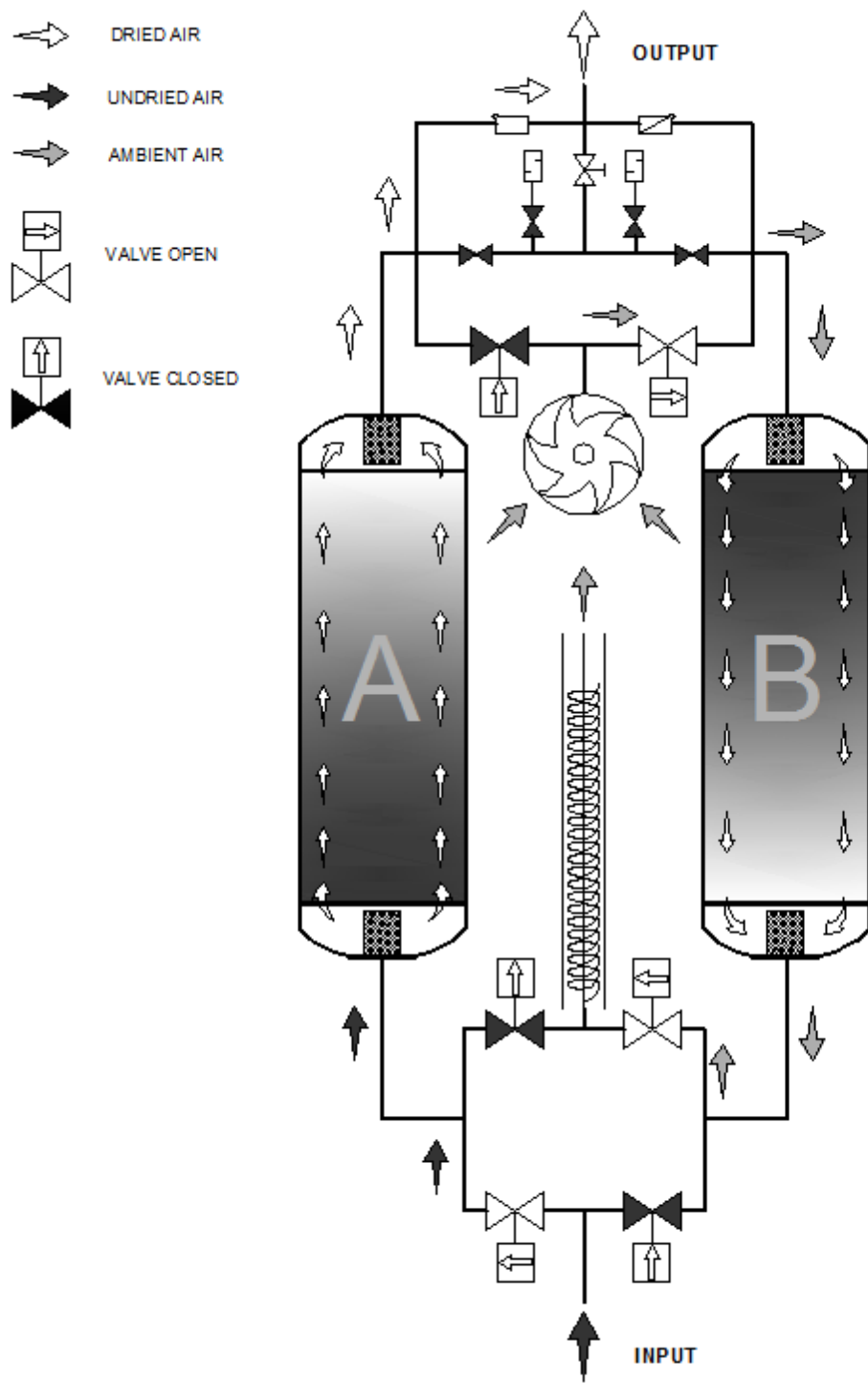
After a set time or when the outlet air reaches the appropriate limit temperature the heating stage stops, the heater is turned off and the cooling stage commences. This lasts up until a preset time or until the minimum temperature limit for cooling is reached.

After cooling stage is completed the vessel is filled with compressed air through the by-pass valves and the operating pressure is established in the vessel. The column is now ready and waiting for a switchover.

Switchover occurs after a set minimum time of 5 h 45 min or when the pressure dew-point at the outlet begins to rise. At this point the temperature equalization phase starts. During next 15 minutes the air will pass from inlet to the outlet through both columns. After 15 min the switchover is complete and desorption phase starts in the first column while adsorption continues in the second tower.



* For more information contact your supplier.



Example of adsorption in tower A and regeneration in tower B

5- Controller

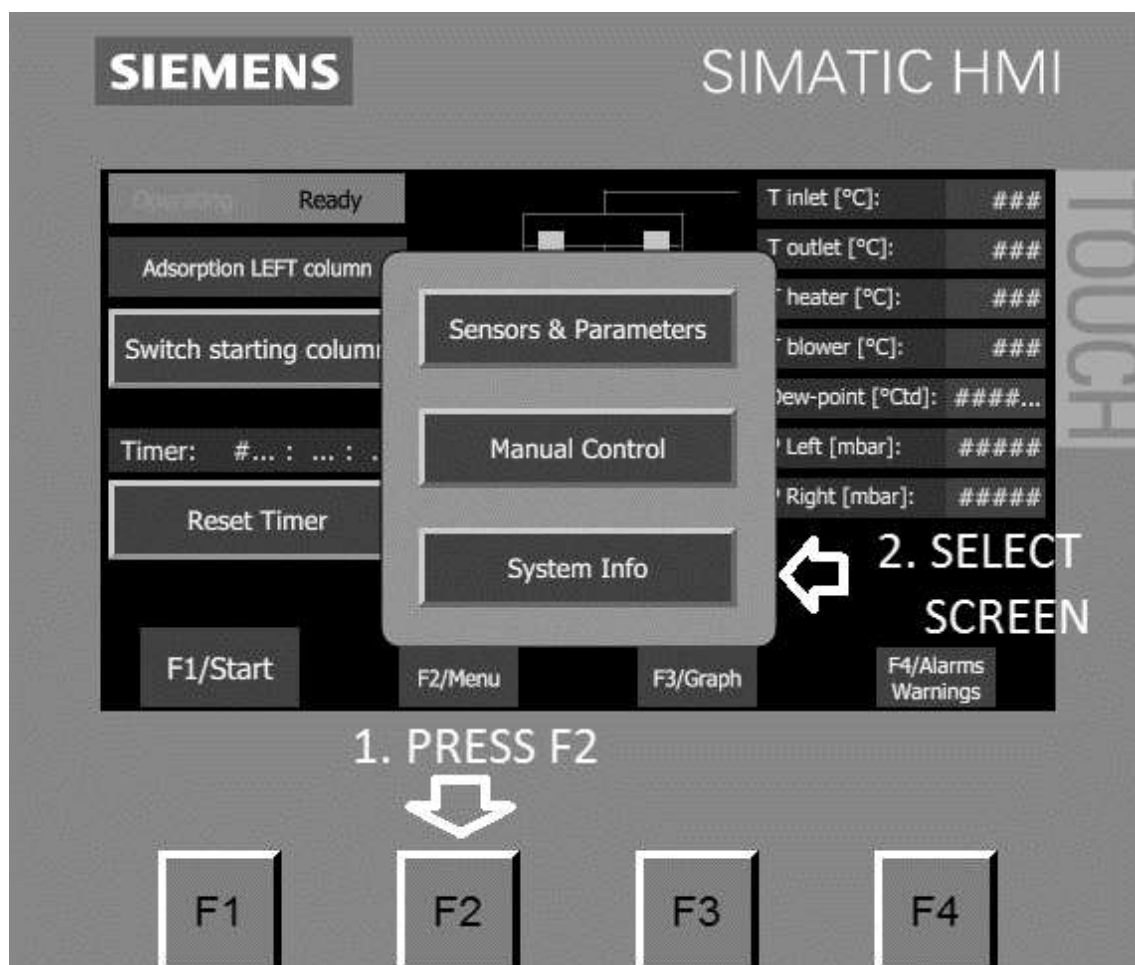
5.1 HMI Interface

HMI Interface of DRYBERG ADP dryer series is intended for monitoring of the process and adjusting parameters of the process.

HMI Interface is a touchscreen with four additional buttons F1, F2, F3 and F4. The Interface program consists of four screens:

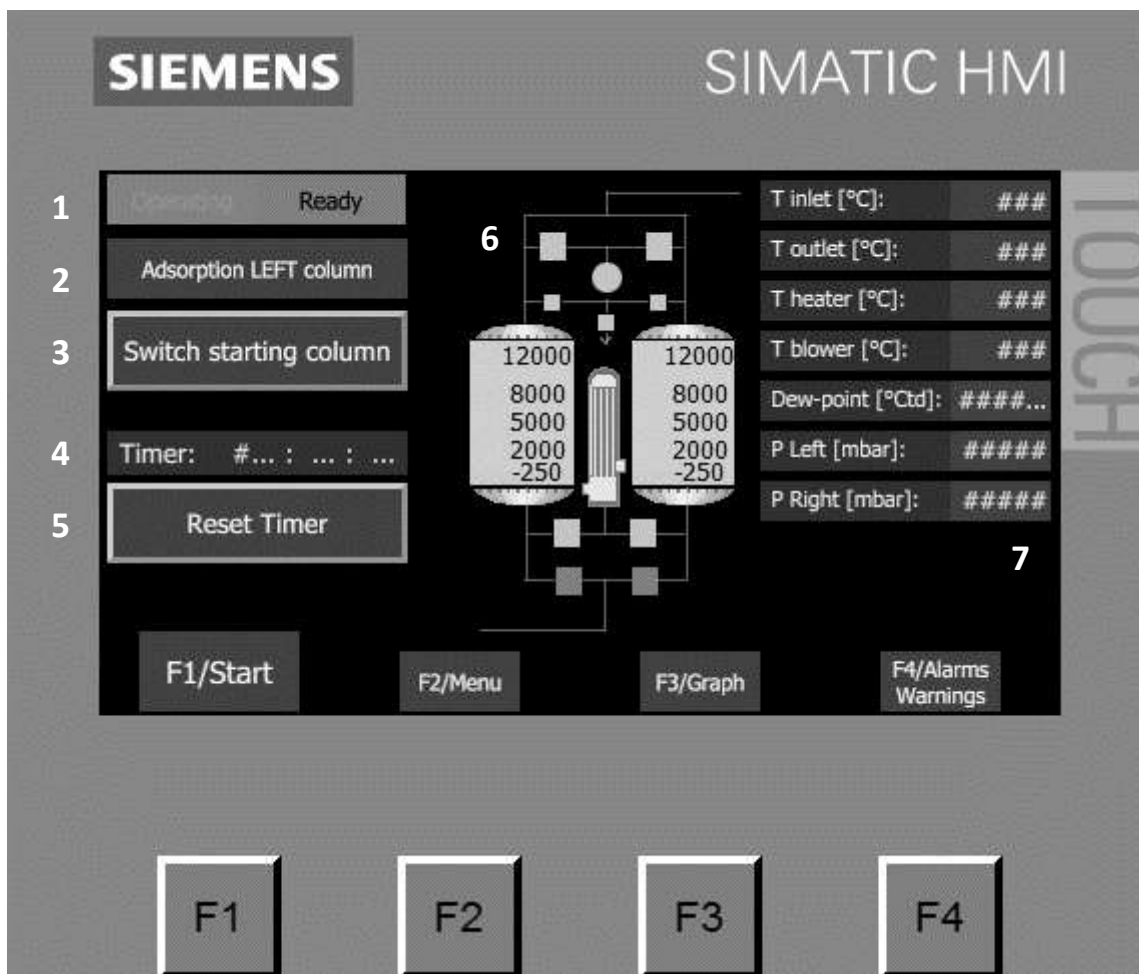
- Automatic Control
- Manual Control
- Sensors & Parameters
- System Info

To switch between the screens press F2 to open the menu and select the screen.



5.1.1 Automatic Control Screen

The **Automatic Control** screen enables the operator to monitor the drying process and sensor measurements. If the dryer is not in operation or it is stopped the operator can switch the drying column or reset the timer.



Automatic Control screen layout:

1. In the upper left corner the state of the dryer is indicated. Dryer either is *Ready* or *Operating*.
2. Indication in which column active adsorption is taking place.
3. This button allows operator to switch the column in which adsorption is going to take place. The button is only visible when the dryer is in *Ready*.
4. Timer showing the passed time of adsorption.
5. Button for resetting the timer. Pressing the button also interrupts the current desorption process and resets the dryer operation. The button is only visible when the dryer is in *Ready*.
6. Graphical representation of the dryer. Squares represent valves, circle represents the blower. Green is for OPEN/ON, gray is for CLOSED/OFF. When the heater is turned on is turns from gray to orange.
7. Sensor measurements.



Dryer start-up procedure:

1. Check if there is no error! The RED signal light on top of the control box is OFF.
2. Check if the pneumatic box is supplied with at least 4 bar(g)!
3. Select the drying column by pressing *Switch starting column* (3)!
4. Press the *Reset* (5) button to set the dryer to the starting position!
5. Press *F1/Start* to start the dryer operation.

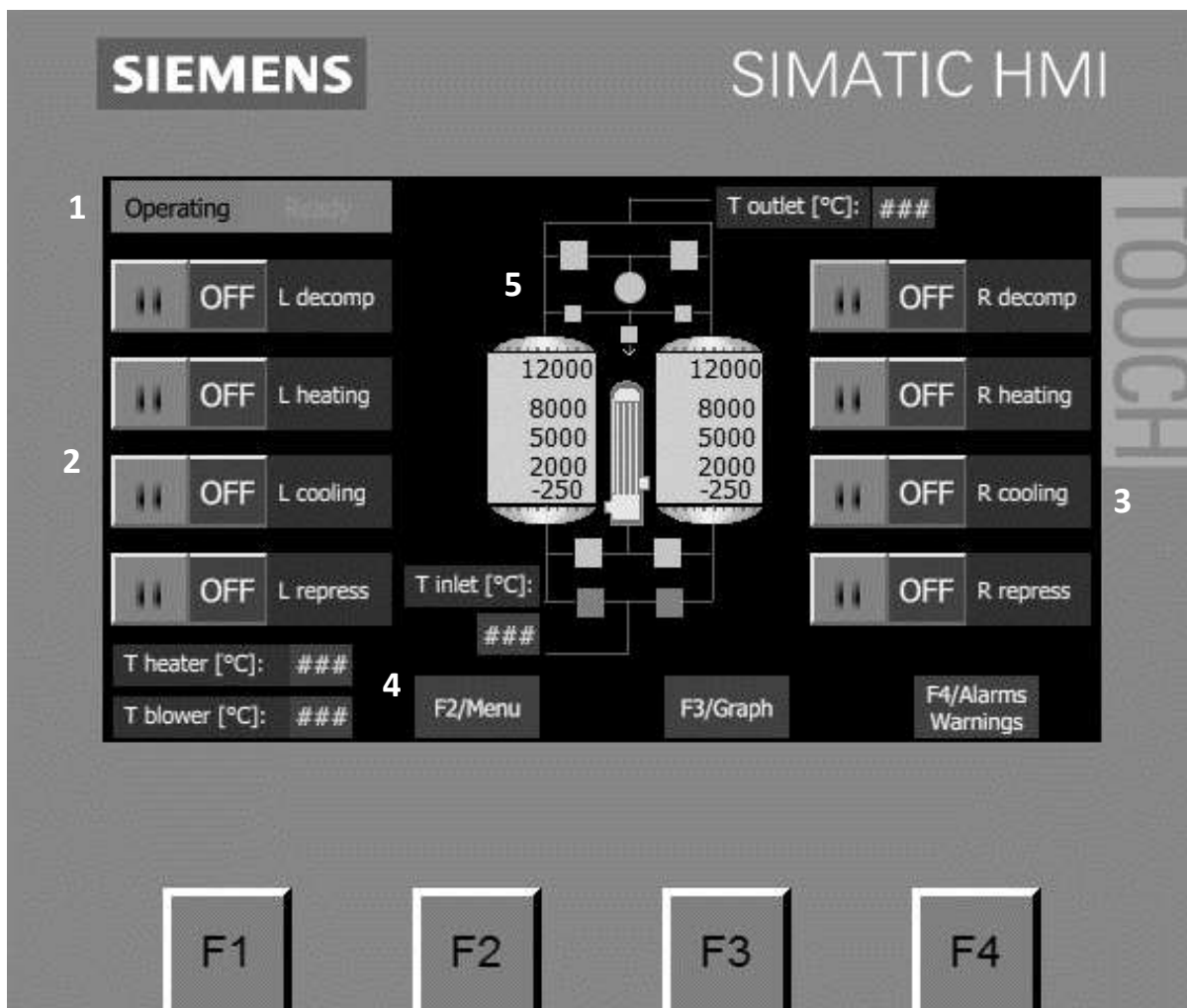


5.1.2 Manual Control Screen

The **Manual Control** screen enables the operator to control the desorption process manually through it's stages.

The process of desorption is always as follows:

1. Release of air from the pressure vessel until the pressure drops to atmospheric pressure (L decomp or R decomp is ON).
2. Heating of the adsorbent (L heating or R heating is ON).
3. Cooling of the adsorbent (L cooling or R cooling is ON).
4. Re-pressurization of the vessel until it reaches the working pressure (L repress or R repress is ON).



Manual Control screen layout:

1. In the upper left corner the state of the dryer is indicated. Dryer either is *Ready* or *Operating*.
2. Left column desorption stages control buttons.
3. Right column desorption stages control buttons.
4. Temperature sensor measurements.
5. Graphical representation of the dryer. Squares represent valves, circle represents the blower. Green is for OPEN/ON, gray is for CLOSED/OFF. When the heater is turned on is turns from gray to orange.



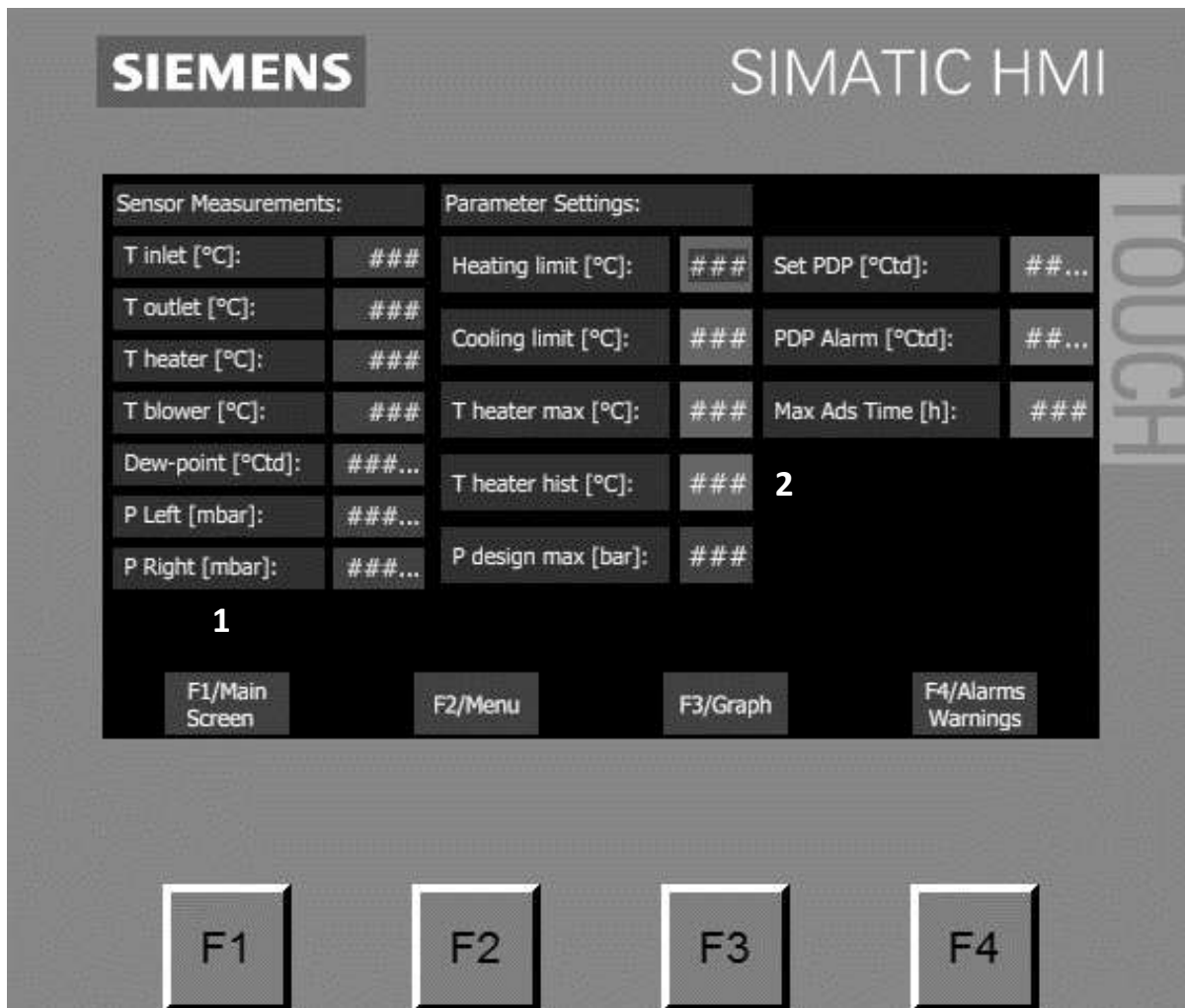
Manual Control considerations:



1. Switching between states it is recommend on one of the columns at the time.
2. Several states can be active at the same time.
3. Check the STATE MACHINE in the dryer technical documentation for exact information on the dryer states!
4. When passing from one state to the other turn the next state ON then turn the previous state OFF! This ensures a smooth transition.

5.1.3 Sensors & Parameters Screen

The **Sensors & Parameters** screen provides the operator with the information of sensor measurements and parameter settings. Operator can also set certain parameters in order to adjust the process to the operating conditions.



Sensors & Parameters screen layout:

1. Sensor measurements are current measurements of systems sensors.

2. Parameter settings represent the parameters that can be adjusted by the caretaker of the system. Care should be taken that parameters are set only by qualified and authorized personnel!

The process parameters that can be adjusted are:

Heating limit [°C]:

This parameter determines the upper desorption temperature limit of the air at the outlet of the vessel. Once this temperature is reached the heating of adsorbent is completed and the desorption process passes into cooling stage. If the heating limit temperature is not reached then the heating stage will complete at timer time **4 h 12 min**.

Cooling limit [°C]:

This parameter determines the lower cooling temperature limit of the air at the outlet of the vessel. Once this temperature is reached the cooling stage ends and the desorption process passes into waiting stage. If the cooling limit is not reached then the cooling will stop at timer time **5 h 30 min**.

T heater max [°C]:

This parameter determines the maximum temperature of the air at the outlet of the heater. Once this temperature is reached the heater will turn off.

T heater hist [°C]:

This parameter determines the lower limit of the heater regulation hysteresis. Once air is overheated above T heater max the heater is turned off, when the temperature of the air drops to below T heater hist the heater will turn on again.

Set PDP [°Ctd]:

This parameter determines the set pressure dew-point at the outlet of the dryer. The dryer will not switchover until the pressure dew-point rises above Set PDP or maximum adsorption time is reached, whichever comes first. **Values on the interval -40°C...-20°C.**

PDP Alarm [°Ctd]:

This parameter determines the alarm dew-point. Once this dew-point is reached a High dew-point warning will appear in the alarm and warning log.

Max Ads Time [h]:

This parameter determines the maximum adsorption time. This is the maximum time that the dryer will continue adsorption in one column without switching over if the pressure-dew point is lower than set pressure dew-point. **Minimum = 6h.**

5.1.4 System Info Screen

System Info screen provides such information as working hours, working cycles, manufacturer and supplier info. It also enables the user to switch the interface language if this option is available.

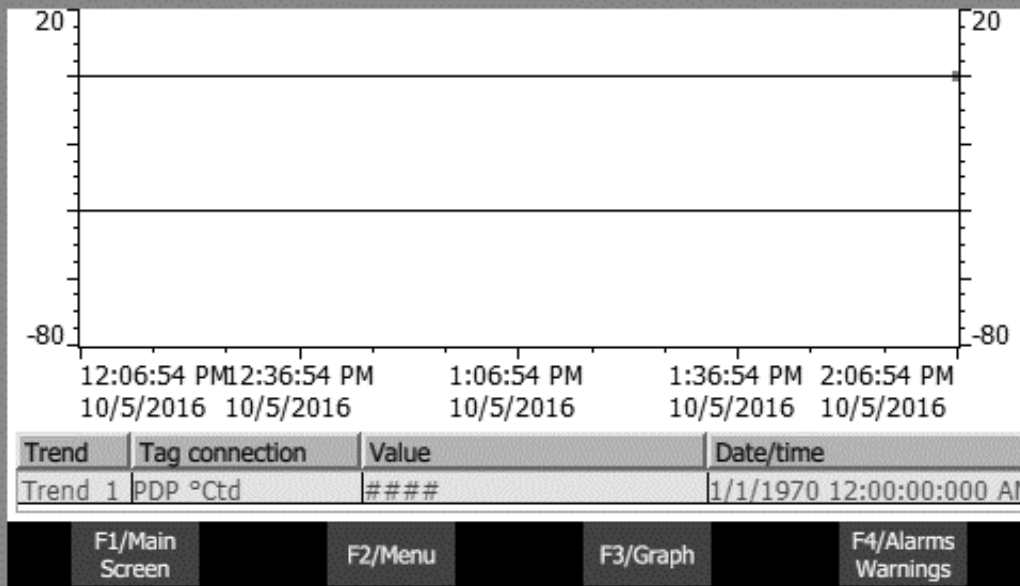


System Info screen layout:

1. Basic system information about the device, manufacturer and supplier.
2. Current system date and time. It can be set by the operator.
3. Working hours of the system.
4. Total operating cycles of the system. One cycle consists of two half-cycles during which each column has an active adsorption.
5. If the translation is available it is possible to change the interface operating language.

5.1.5 Graph, Alarms and Warnings

By pressing the F3 button while in any screen the operator can open a graph that shows the record of pressure dew-point values over time. The graph can be hidden by pressing the F3 button again.



By pressing the F4 button the operator can view the Warnings and Alarm lists that shows the warnings such as: high inlet temperature, high outlet temperature, high outlet pressure dew-point and system warnings.

No.	Time	Text	Date	
140001	2:06:55 PM	Connection disconnected: Conn ection_1, Station 192.168.2.29, Rack 0, Slot 1.	10/5/2016	\$
140023	2:06:55 PM	Error during time synchronization	10/5/2016	\$
140001	2:06:54 PM	Connection disconnected: HMI_	10/5/2016	\$
110001	2:06:54 PM	Change to operating mode 'onli	10/5/2016	\$
140001	1:51:53 PM	Connection disconnected: Conn	10/5/2016	\$
140023	1:51:53 PM	Error during time synchronization	10/5/2016	\$
140001	1:51:53 PM	Connection disconnected: HMI_	10/5/2016	\$
110001	1:51:53 PM	Change to operating mode 'onli	10/5/2016	\$
140001	1:39:27 PM	Connection disconnected: Conn	10/5/2016	\$
140023	1:39:27 PM	Error during time synchronization	10/5/2016	\$
140001	1:39:27 PM	Connection disconnected: HMI_	10/5/2016	\$
110001	1:39:26 PM	Change to operating mode 'onli	10/5/2016	\$



5.2 Signal tower

Signal tower can be found on the top of the dryer. It provide a visual indication of dryer status. The light colors from top to bottom are: red, orange and green. The meaning of each light is:

Light color	Explanation
RED	Errors: Motor protective switch activated Heater temperature protection activated Dew-point sensor malfunction Pressure sensor malfunction
ORANGE	Warnings: High inlet temperature High outlet temperature High operating pressure
GREEN	Connected directly to programmable logic controller electrical supply If the light is OFF then the controller is OFF

For more information on Errors and Warning check the chapter *13 Troubleshooting!*

5.3 PROFIBUS

PROFIBUS communication is optional and is enabled for those dryer that have a PROFIBUS module installed. PROFIBUS settings are as displayed bellow.

PROFIBUS address

Interface networked with

Subnet: PROFIBUS_1

Add new subnet

Parameters

Address: 10

Highest address: 126

Transmission speed: 1.5 Mbps

Operating mode

DP slave

Assigned DP Master: Not assigned

> I-slave communication

Transfer areas

...	Transfer area	Type	Master address	↔	Slave address	Length	Consistency
1	Dew-point	MS		←	Q 10...11	1 word	Unit
2	T heater	MS		←	Q 12...13	1 word	Unit
3	T blower	MS		←	Q 14...15	1 word	Unit
4	T inlet	MS		←	Q 16...17	1 word	Unit
5	T outlet	MS		←	Q 18...19	1 word	Unit
6	P left	MS		←	Q 20...21	1 word	Unit
7	P right	MS		←	Q 22...23	1 word	Unit
8	<Add new>						

PROFIBUS communication sends the data in integer format. The chart bellow gives value references.

Value	Unit
Dew-point	°Ctd x 10
T heater	°C x 10
T blower	°C x 10
T inlet	°C x 10
T outlet	°C x 10
P left	mbar
P right	mbar

6- Efficiency considerations

Efficiency of the heat regenerated adsorption dryer is primarily dependent on the length of the adsorption cycle in adsorbing column and the length of heating and cooling of adsorbent in the desorbing column (→ see **Description of operation**).

To ensure the most efficient and economical operation of the adsorption dryer the DRYBERG ADP series of dryers are supplied with four temperature sensors and a dew-point sensor. In this way the processes of adsorption, heating and cooling can be adjusted to suit the operating conditions.

If you want to use the adsorption dryer in a different system configuration or the operating conditions have changed, it is recommended that you contact your supplier for technical counselling.

It is helpful if you can provide the following information:

- Operating pressure
- Volumetric flow
- Ambient temperature
- Inlet compressed air temperature
- Inlet compressed air dew point

NOTE

In case pre-dried compressed air enters the dryer (e.g. refrigerant dryer is installed upstream adsorption dryer) efficiency can be reduced meaning dryer will not be able to maintain the desired dew point. Reduced efficiency can also appear in case of extremely dry adsorbent (e.g. at initial commissioning, after adsorbent replacement...).

If the above mentioned reduced efficiency appears try to operate with moisture saturated air for a while (usually 1 or 2 days).

7- Transportation

- Transportation should be done by appropriately qualified personnel.
- For transportation please check and follow local regulations for lifting and transportation of heavy cargo.
- Provide adequate lifting and transportation equipment.
- The dryer should only be transported in a vertical position.
- The center of gravity is positioned relatively high resulting in a heightened risk of toppling the dryer due to tilting, which can cause serious injury or even death.
- Note that the dryers up to dimension DRYBERG ADP 1600 can be lifted using the lifting lugs on the top of each vessel. Larger dryers should not be lifted by lifting lugs.
- In cases where the dryer is firmly attached to the standard pallet it can also be lifted by forklift. In this case the dryer needs to be additionally stabilized and secured to prevent tilting or falling.
- A dryer is typically supplied on a standard pallet and fixed on the pallet by four fixing screws. Untighten the screws to remove the dryer from the pallet!



Don not under any circumstance use dryer piping installation or welded brackets for lifting or stabilizing purpose.

The adsorption dryer could get damaged during transportation. Putting a damaged adsorption dryer into operation can result in injury or death! Check the adsorption dryer for any visible damage after removing the packaging. If the adsorption dryer is damaged contact the transportation contractor and supplier. A damaged adsorption dryer should not be put into operation!

8- Storage

In order to prevent damage to the dryer during storage make sure that the following requirements are fulfilled:

- The dryer can only be stored in a dry and clean indoor location.
- During storage the ambient temperature must not exceed the 1,5°C – 66°C range. For other storage temperatures please contact the manufacturer.
- Make sure that the inlet and the outlet of the dryer are closed with a plug.

In case you intend to store the dryer which has been in operation follow the procedure specified below:

- Close the outlet valve.
- Leave the dryer to operate for a while (min. 6h).
- Close the inlet valve.
- Depressurize the dryer. The dryer should get fully depressurized in one cycle.
- Disconnect the dryer from its electric power supply.
- Disconnect the dryer from its piping installation.
- Close inlet and outlet of the dryer with plugs.
- Use appropriate cover to protect the dryer from the dust.

9- Installation

9.1 General Installation Requirements

An DRYBERG ADP series adsorption dryer is designed to be installed in a place that meets the following requirements:

- Indoor installation (clean and dry)
- Non aggressive atmosphere
- Ambient temperature from 1,5°C to 50°C
- Non explosive environment (Standard version DOES NOT COMPLY WITH ATEX)
- Vibration free installation (refers to floor and piping)
- Cooling water max temp. 30°C

Compressed air which is supplied to DRYBERG ADP needs to meet the following requirements:

- Compressed air quality 2 for solid particles (if dryer is equipped with superfine coalescing filter 0,01 µm)
- Compressed air quality 1 for solid particles (if dryer is not equipped with superfine coalescing filter 0,01 µm)
- Compressed air quality 2 for oil (if dryer is equipped with superfine coalescing filter 0,01 µm)
- Compressed air quality 1 for oil (if dryer is not equipped with superfine coalescing filter 0,01 µm)
- Free from aggressive substances
- Free from substances which could damage adsorbent (if you are not sure about certain substance please contact manufacturer)
- Preferably compressed air should be saturated with moisture (100% relative humidity). Lower relative humidity can reduce efficiency.

Additional recommendations:

- It is recommended that the air that is leaving the dryer at the blower outlet is led through appropriate duct away from the dryer. The area of duct cross section should be larger than blower opening. This will help preventing overheating of the dryer components and prevent the suction of the moist warm air into the heater inlet.
- It is recommended that the space where the heat regenerated dryer is located is ventilated in order to maintain relatively low ambient air temperature in vicinity of the dryer.
- If the dryer is not insulated secure the access to the dryer area and provide proper warning signs for hot equipment.

9.2 Installation Layout

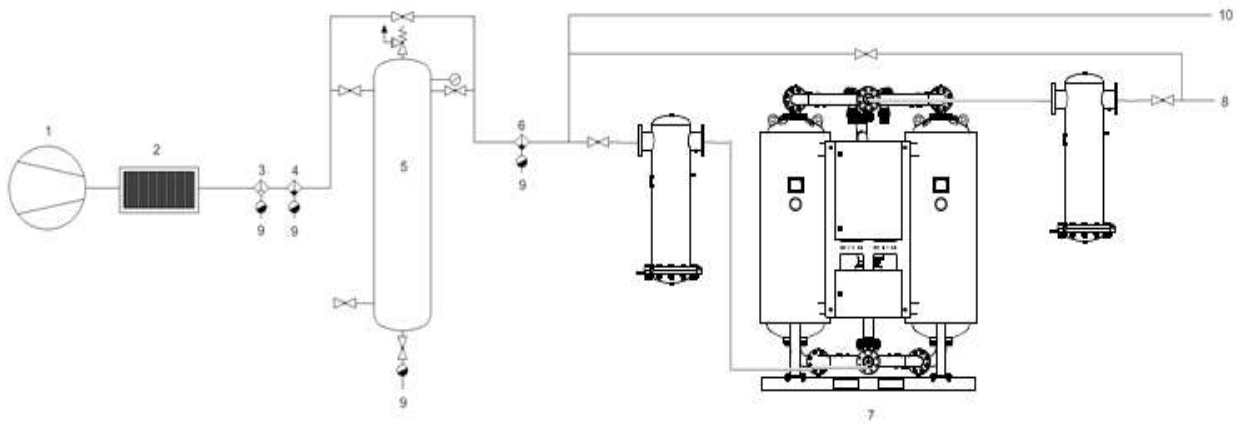


Below are two of the most common installation layouts for adsorption dryer. The schemes specified below are not obligatory but only provided as an example. Different arrangement of certain components is always possible.

- | | |
|--|---|
| 1 - Compressor | 6 – Fine filter (e.g. 0,1 μm) |
| 2 – Aftercooler | 7 – Adsorption dryer |
| 3 – Cyclone separator | 8 – Dry air outlet |
| 4 – Pre-filter (e.g. 3 μm) | 9 – Automatic condensate drain |
| 5 – Pressure vessel | 10 – Wet air outlet |

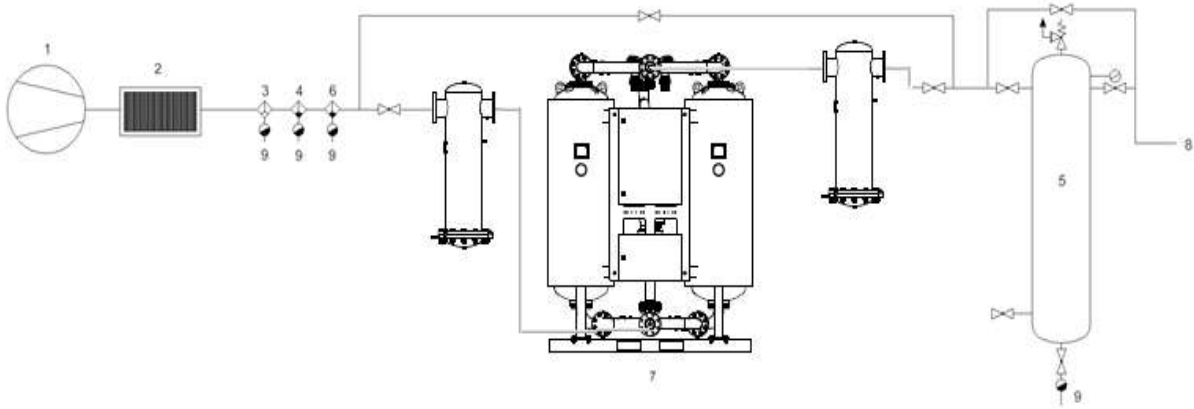
LAYOUT 1 (The dryer is installed downstream from pressure vessel)

- When only partial flow rate of the compressor is treated by the dryer.



LAYOUT 2 (The dryer is installed upstream from pressure vessel)

- When total flow rate of the compressor is treated by the dryer.
- When consumption of compressed air varies a lot or when short peaks of high consumption (higher than dryer/compressor capacity) are expected.



9.3 Installation Procedure



- Typically an DRYBERG ADP dryer is supplied on a standard pallet and fixed to the pallet by four screws.

- The dryer must only be lifted using lifting lugs on the top of each vessel or the designated fork lift cut outs.



- Remove the screws and the pallet to position the dryer to the desired location.

- The adsorption dryer should be installed in such a way that it is protected from environmental influences (example of proper installation would be a compressor station).

- Install the dryer in the area where people are normally not present because of noise emissions.

- It is recommended to leave 1 m of space around the dryer.

- Make sure that the adsorption dryer is protected against vibrations and other mechanical stress.

- The adsorption dryer should stand firmly on a horizontal surface. The inclination of the unit must not exceed $\pm 3^\circ$. If the system is not installed correctly it could not work properly. The best way to achieve this requirement is by screwing the adsorption dryer to such a surface through the appropriate openings on the legs. Fixing the dryer by screws is not obligatory.

- Compressed air pipelines (refers to the installation upstream and downstream from the dryer) must be provided with proper shut-off valves which enable the dryer to be independently installed or removed from the system.

- Install a super fine coalescing filter at the inlet side and an after-filter at the outlet side (only if dryer is not supplied with filters).

- Additionally check that upstream from the dryer sufficient air treatment is provided (e.g. aftercooler, cyclone separator, filter, condensate drains ...)

- Remove caps/plugs from the inlet and the outlet of the dryer.

- Connect the air supply to the inlet of the dryer.

- Connect the downstream piping line to the outlet of the filter.

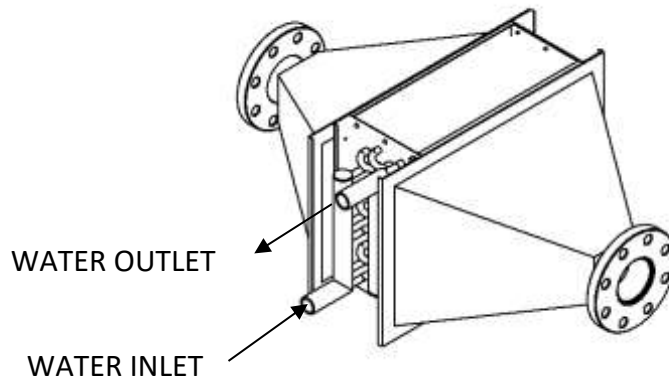
- It is recommended to make a bypass line.

- The duct for removal of regeneration air from the dryer should be installed. The inner duct diameter should not be smaller than the regeneration air outlet connection on the dryer. The duct should be resistant to temperatures of up to 160°C. Avoid twists and turns! Make sure that the released air does not reenter the dryer area!
- Connection to electric power should be done by a qualified expert. Make sure the voltage and the frequency on the mains correspond to the data on the type plate of the dryer. ($\pm 5\%$ tolerance is acceptable for voltage)
- Connect the dryer to electric power. It is obligatory to provide connection to the ground terminal.
- After the installation or maintenance the DRYBERG ADP adsorption dryer must be checked for leakage.
- Regulate the operating pressure so it matches with the value specified on the dryer type plate (SET FOR x bar).
- During normal operation loud noise (approximately 100dB) can be generated. Persons responsible for installation and the end user are responsible for correct installation of the dryer in order to prevent excessive noise emissions to the work environment. The installer and the end user are also responsible to install the proper safety signs at the installation site.
- Remove any packaging and other material which could obstruct the normal operation of the dryer.

10- Commissioning

10.1 Cooling water connections

Before attempting to start the dryer make sure that the cooling water is connected to the heat exchanger. The lower connection is the water inlet and the top connection is the outlet (unless specified otherwise).



10.2 Pressurization



Rapid pressurization of the dryer can cause damage to the adsorption dryer! The adsorption dryer should be pressurized extremely slowly through an appropriate valve at the inlet. During the pressurization process the outlet valve should remain closed and the adsorption dryer should not be operational.

Follow the pressurization procedure:

- Make certain that the outlet valve is closed.
- Make certain that the adsorption dryer is not in operation, the circuit breaker and the controller should be turned off.
- Open the inlet valve slightly until you hear first flow noise.
- Wait until you no longer hear flow noise.
- Fully open the inlet valve and wait until the tower manometers indicate that both towers are pressurized to the operating pressure.

10.3 Opening Outlet Valve



Opening of the outlet valve should be done extremely slowly especially when the system downstream of the valve is not pressurized.

Follow the procedure:

- Make certain that the adsorption dryer is not in operation, the circuit breaker and the controller should be turned off.
- Open the outlet valve slightly until you hear first flow noise.
- Wait until you no longer hear flow noise.
- Fully open the outlet valve.

10.4 Start-up

After the installation, pressurization and opening of the outlet valve procedures are completed the start-up procedure can be initiated.

Follow the start-up procedure:

- Visually re-check the installation.
- Make certain that the inlet valve is opened.
- Check the manometers to make certain that both towers are pressurized.
- Make certain that the outlet valve is opened.
- Listen for any leaking sound.
- Turn on the main switch.

10.5 Reaching the desired dew point

In some cases reaching the desired dew point can take time especially when trying to reach low dew points and when compressed pre-dried air is supplied to the dryer. When commissioning a new dryer keep in mind that the supplied desiccant is new and has not been activated yet.

There are two ways to activate the desiccant.

Activation can happen on its own. The dryer will activate the desiccant on its own over time, this will take longer.

The second way is to force the activation of the desiccant. This is done by operating the dryer using moisture saturated compressed air. For this the dryer control system should be set as follows:

Go to **SETTINGS** → **Set Parameter** → **PDP** and set **SP** (see pages 29-30) to a value that is still acceptable but not higher than -10°C .

Leave the dryer to run for a couple of days while monitoring the dew point.

Afterwards set the dew point back to the desired value. The dew point should now improve.

In most cases dryer performance should be adequate after this procedure has been performed, even when using pre-dyed compressed air. If the dew point becomes worse later in time the procedure must be repeated.



Example:

1. *The dryer is set to reach -40°C . However it is only reaching -30°C .*
2. *The dryer needs to be operating in dew-point dependent mode. Set the SP parameter to -20°C .*
3. *The adsorption phase is now longer and the dryer is saturating the desiccant with moisture.*
4. *After a couple of days of dew point monitoring the later improves and settles around -55°C .*
5. *This is a good indication that the desiccant is fully activated and the dew point can be set to it's original value, -40°C for this example. The dryer should now be permanently reaching the desired dew point.*

It is advised that the second method be done by trained and qualified professionals that have received training on how to use and service the dryer. **The second method only applies to dryers that can run in a dew point dependent regime.** Also dryer performance is guaranteed for use under “nominal operating conditions” and in some cases the conditions that have been established for the dryer in the planning phase (inlet temp., flow rate, pressure, desired dew point) and the manufacturer has been informed of.

11- Decommissioning

To decommission the DRYBERG ADP adsorption dryer follow the decommissioning procedure:

- Close the outlet valve.
- Leave the dryer to operate for a while (min. 6h).
- Close the inlet valve.
- Turn off the main switch.
- Disconnect the dryer from electric power supply.
- Make sure that the dryer is depressurized by inspecting the manometers.

To protect the desiccant during storage seal the inlet and the outlet of the dryer.

12- Maintenance

Valves, expansion silencers, strainers, adsorbent and dew-point sensor are subject to wear and need to be replaced according to the service intervals specified below.

PART	MAINTENANCE	1 day	1 month	1 year	2 years	4 years
Dryer operation	INSPECTION	x				
Complete dryer	VISUAL INSPECTION		x			
Pre/After filter element	REPLACE			x		
Expansion silencer	REPLACE			x		
Valves*	REPLACE				x	
Adsorbent**	REPLACE					x
Strainers	CLEAN/REPLACE					x
Dew-point sensor (optional)	CALIBRATION			x		
Heater	INSPECTION			X		
Blower	INSPECTION			x		



*Refers to moving parts and seals.

**For stable operation replacement of adsorbent is required after every 4 years of operation. However due to inappropriate use or unexpected inlet/operating conditions adsorbent can be damaged sooner and in this case replacement is required sooner.



It is necessary to wear respiratory protective equipment when working with the adsorbent. Adsorbent is a crumbling material that produces fine dust which can cause respiratory complications if inhaled.

12.1 Dryer Operation Inspection

- Inspect the operating parameters.
- Inspect the sensor readings.
- Check if the dew point is within expected limits.

12.2 Complete Dryer Inspection

- Do a visual inspection of the dryer and nearby installation and check if any damage is present on the dryer or on the nearby installation.
- Inspect operating parameters.
- Inspect controller and manometers readings.
- Check if the dew point is within expected limits.
- Check if the condensate drains upstream from the dryer are working properly.

12.3 Heater Inspection

- Inspect the graph on the interface to see the past temperature readings. Heater temperature should reach temperatures higher than 140°C in normal operation.
- Inspect the heater insulation. If insulation is damaged it should be fixed.

12.4 Blower Inspection

- Check if the blower is operating during normal operation. Due to operating noise of the blower it is quite obvious.
- If the blower is not working check the warnings log. Stop and turn OFF the dryer and check the motor protection status in the control box.

12.5 Filter Elements Replacement

- For filter element replacement consult the instructions for element replacement that can be found in the operating manual of the filter.
- Depressurize filter housing and part of the installation where the maintenance work will be performed before any kind of work.
- Turn off and depressurize the dryer if filters are installed on the dryer.
- Perform the commissioning procedure.

12.6 Expansion Silencers Replacement

- Decommission the dryer. Depressurize the dryer and turn it off (turn off electrical power).
- Remove the old expansion silencer and install a new one.
- Perform the commissioning procedure for the dryer.

12.7 Adsorbent Replacement

1. Decommission the dryer. Depressurize the dryer and turn it off (turn off the electrical power).
2. Make certain that the adsorption dryer is depressurized. You can check this by inspecting the manometers.
3. Provide a container in which you will be able to fill with used desiccant.
4. Remove the plug from lower side of the vessel and wait until all of the desiccant is released from the column.
5. Removal of adsorbent can also be done by using a suction device. In this case desiccant can be removed through the opening on the top.
6. Fill new desiccant into the column. Make sure that first water resistant desiccant is filled and after that the adsorbent is filled.
7. Fill the column until it is almost full. Make sure that you will be able to install the strainers.
8. Perform steps 4 to 7 on the other column.
9. Reinstall the strainers.
10. Reinstall the upper piping.
11. Clean the floor around the dryer.
12. Perform the commissioning procedure.

12.8 Dew-point Sensor Calibration



The dew-point sensor might become inaccurate over time. To prevent inaccurate readings it is recommended to do a dew-point sensor calibration yearly.

For the calibration procedure please contact the manufacturer.

13- Troubleshooting

13.1 High pressure drop

13.1.1 Oil in the Adsorption Dryer

Oil from a compressor can saturate and block filters. If the oil comes in contact with the adsorbent, it will destroy the adsorbent. If you see oil on the after-filter the adsorbent is destroyed, in which case the adsorbent should be changed together with filter cartridges.

Oil contamination can cause the dissolution of the adsorbent beads and can cause high pressure drop!

Check-up procedure:

1. Check the pre-filter and after-filter for signs of oil and/or other contamination!
2. Change the filter cartridges if needed!
3. If there is oil on the after-filter, change the adsorbent in both towers!
4. Service and/or improve pre-filtration!

Compressed air at the dryer inlet should be free of solid particles, oil particles and liquid water. For more information on proper air preparation see the chapter **Installation Layout!**

13.1.2 Control Valves Malfunction

The cause of high pressure drop could be malfunctioning control valves. In this case the pressure in the towers during adsorption phase will be much lower than the inlet pressure. In this case the control valve might have to be replaced.

13.1.3 Clogged Pre-filter and/or After-filter

Although the service interval for a pre-filter and after-filter is 12 months, the filters might have to be changed before the service interval if they are clogged. You can check the status of the filter on the differential pressure indicator on top of each filter housing.

13.2 High Outlet Dew-point

In normal operating conditions the DRYBERG ADP adsorption dryer maintains a pressure dew-point between -20 and -40 °C. The outlet dew-point is dependant on the inlet volumetric flow, inlet air temperature and operating pressure.

A new adsorption dryer could need a few hours of operation to reach a certain dew-point. This is due to the fact that the adsorbent adsorbs a certain amount of water vapour during production and installation. Depending on the amount of adsorbed water the dryer will need a certain amount of cycles to regenerate both towers enough to reach the desired dew-point.

Lower inlet temperatures and volumetric flows result in more effective adsorption process thus lower pressure dew-points. Higher inlet temperatures and volumetric flows result in higher pressure dew-points. Once the dew-point rises above -20 °C the adsorbent in the towers could be permanently damaged and might need to be replaced.

The following chapters describe the possible causes of high outlet dew-point.

13.2.1 Underdimensioned Adsorption Dryer

If the dryer is underdimensioned and the volumetric flow through the dryer is much higher than the dryer rating. The amount of adsorbent will be too small for drying the air that passes through it. Consequently the pressure dew-point could continue to rise towards the point where the adsorbent gets saturated and the inlet and outlet dew-point are equal.

See chapter **Technical data** for more dimensioning information and correction factors.

13.3.2 Liquid Water in the Towers

If there is no cyclone separator upstream from the dryer or if there is a malfunction of the drain on prefilter, liquid water could start to gather in the towers. DRYBERG ADP dryers have a bed of water resistant silica gel for protection in such cases but if the amount of liquid water is too great and it passes this bed the adsorbent will be destroyed and it will not adsorb the water vapour anymore. The result is a higher pressure dew-point.

Replace the adsorbent and service and/or improve pre-filtration.

For more information on proper air preparation see the chapter **Installation Layout**.

13.3.3 Oil in the Towers

If the compressor produces too much oil in the outlet air and this air reaches the adsorption dryer it will destroy the adsorbent and the pressure dew-point will get higher. In this case the protective bed of water-resistant silica gel will also get destroyed and the pressure dew-point will rise faster.

Check-up procedure:

1. Check pre-filter and after-filter for signs of oil and/or other contamination!
2. Change the filters cartridges if needed!
3. If there is oil on the after-filter, change the adsorbent on both towers!
4. Service and/or improve pre-filtration!
5. Service the compressor!

Compressed air at the dryer inlet should be free of solid particles, oil particles and liquid water. For more information on proper air preparation see the chapter **Installation Layout!**

13.3.4 Tower Fails to Depressurise

Description:

The vessel does not depressurize during after the switchover and desorption do not start.

Possible causes, inspection and fixing procedure:

1. **No power supply, controller is OFF:** Connect the power supply and turn ON the circuit breaker.
2. **Dryer is in a STAND-BY MODE:** Inspect the source of the STAND-BY signal.
3. **Faulty control valve:** Inspect the control valve coils. If one or more of the coils keep warming up considerably compared to other coils then the coil is malfunctioning and could be causing the failure to open the purge release valve during the regeneration/purge interval. Order the control valves service kit.
4. **Malfunctioning manometer:** In this case the dryer is operating correctly but a faulty manometer indicates that the tower has not depressurized. If the manometer is faulty it will show that the tower is pressurized even when the dryer is offline and unpressurised. Contact your supplier and replace the manometer.

13.4 Piping Leak

Description:

There is leakage on the steel piping.

Possible causes, inspection and fixing procedure:



The leakage on steel piping most frequently occurs after initial commissioning, decommissioning and re-commissioning or after extensive maintenance that puts a strain on fittings and piping.

1. **Leakage at initial commissioning:** All DRYBERG ADP adsorption dryers are tested for leakage as well as mechanical and electrical errors prior to packaging and shipping. Please review the transportation, handling and installation procedures. The steel piping can be replaced with standard readily available piping and fittings. Consult with the dryer supplier for technical support.
2. **Leakage after decommissioning and commissioning or extensive maintenance:** Review the procedures. The steel piping can be replaced with standard readily available piping and fittings. Consult with dryer supplier for technical support.

13.5 Dust from the Purge Diffusor

Description:

There is dust coming from the diffusor.

Possible causes, inspection and fixing procedure:

This can happen and is a result of the adsorbent beads rubbing against each other during transport. Unfortunately there is no getting around this.

Leave the dryer running and let the dust blow out. After the dust subsides the diffusors can be uninstalled, blown out with compressed air and reinstalled.

13.6 The dryer doesn't start

Description:

The dryer doesn't start.

Possible causes, inspection and fixing procedure:

1. Check the signal tower! If the RED light is ON there is a failure on equipment. Either a faulty sensor or blower motor. If the sensor is faulty one of the measured parameters will display faulty signal (example -4000 mbar). If the blower motor is faulty the blower will not start even in Manual Control mode. Turn of the dryer and check the motor protective switch!
2. There is no RED signal on the signal tower. Turn off the dryer! When turned on again press the Reset button on the main control screen!
3. There is no RED signal on the signal tower and the valves are not opening or closing. Check the pneumatic box and see if it has the process air of minimum 4 bar(g)!

13.7 Signal tower

Signal tower can be found on the top of the dryer. It provide a visual indication of dryer status. The light colors from top to bottom are: red, orange and green. The meaning of each light is:

Light color	Explanation
RED	Errors: Motor protective switch activated Heater temperature protection activated Dew-point sensor malfunction Pressure sensor malfunction
ORANGE	Warnings: High inlet temperature High outlet temperature High pressure dew-point High operating pressure
GREEN	Connected directly to programmable logic controller electrical supply If the light is OFF then the controller is OFF

13.7.1 Orange Light - Warning

The warnings do not stop the drying process, desorption process or the dryer operation. Warnings can be reviewed by pressing *F4/ Alarms Warnings*.

High inlet temperate:

High inlet temperature is considered inlet air temperature exceeding 35°C.

High outlet temperature:

High outlet temperature is considered outlet air temperature exceeding 35°C.

High pressure dew-point:

High pressure dew-point is any dew-point higher than the set *PDP Alarm* in *Sensors & Parameters* Screen.

High operating pressure:

High operating pressure is pressure in either dryer column that is exceeding the maximum allowable operating pressure of the system. **Reduce the pressure at the dryer inlet!**

13.7.2 Yellow Light - Error

The errors are considered to be failures of critical parts or processes of the dryer and require the dryer to be stopped and serviced in order to correct the cause of the failure.

Dew-point sensor malfunction:

The dew-point sensor is measuring dew-point outside of its measuring range of -100...+20°Ctd. This condition can be clearly visible in *Sensors & Parameters Screen*.

Example:

Dew-point [°Ctd]:

Pressure sensor malfunction:

The pressure sensor is measuring pressure outside of its measuring range on 0...16 bar(g). This condition can be clearly visible in *Sensors & Parameters Screen*. There is one pressure sensor for each column.

Example:

P Left [mbar]:

Motor protective switch activated:

The motor protective switch is used to protect the electric motor of the blower. If the burden of the motor is too great the amount of electrical current that is supplied to the motor increases which causes the motor protective switch to activate and disconnect the motor.



The motor protective switch may be reset but **it is recommended to search for possible causes of motor protective switch activation before continuing the dryer operation!** The possible causes for motor protective switch activation are:

- Closed valves which prevent the flow through the column and the dryer. Such condition triggers immediate activation of the motor protection.
- Debris in the blower.
- Clogged heater inlet.
- Clogged blower outlet.
- Malfunction of the blower.



To reset the motor protective switch, the dryer electricity supply should be turned OFF and the control box opened.

Heater temperature protection activated:

The purpose of heater temperature protection is to protect the heater and the dryer components from overheating. The electric heater is capable of generating temperatures that can melt the insulation or the zinc coating.



The temperature protection switch is set to 350°C. If the temperature is reached the heater is disconnected until the reset button is pressed inside of the heater housing. **The dryer electricity supply should be turned OFF before opening the heater housing!** The activation of temperature protection is not expected due to other protections in the dryer and is considered a critical failure.

14- Warranty Exclusion

The guarantee shall be void if:

1. The operating instructions were not followed with respect to initial commissioning and maintenance.
2. The unit was not operated properly and appropriately.
3. The unit was operated when it was clearly defective.
4. Non-original spare parts or replacement parts were used.
5. The unit was not operated within the permissible technical parameters.
6. Unauthorized constructional changes were made to the unit or if parts of the unit that may not be opened were dismantled.

15- P&ID and Wiring Diagram

Diagrams and schematics can be found in a separate dedicated technical document enclosed to each dryer.

16- Maintenance record

TYPE OF MAINTENANCE	DATE	SIGNATURE	NOTES
Commissioned			