

Operating Manual Adsorption Dryer DTS 45-1100

Version: 11/2010/EN



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1. General information

1.1 Manufacturer



FST GmbH

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! For any questions about the product, please contact the sales office !

In case of questions about the product, please specify the type and the manufacturing number. This information can be found on the type plate on the control box of the dryer. (→ Page 13)

General information

1.2 Dryer data

Model:	
Order no.:	
Manufacturing no.:	
Vessel no. (left/right):	
Year of manufacture:	
Date of commissioning:	

1.3 Contact data

Name:	
Company:	
Address:	
Phone / Fax:	
E-mail:	

The above dryer data differs for each dryer. Please fill in the fields according to the type plate and your contract documents. This data enables the manufacturer to clearly identify the dryer and simplifies service and provision of the proper spare parts.

Some of the information listed here and other important data can be found on the type plate of the dryer and on the type plate of the vessels. (→ Page 13)

1.4 Additional documents

- General arrangement drawing
- Process flow diagram
- Pneumatic diagram of the instrument air for valve actuators
- Wiring diagram
- Operating manuals of individual components

Note on additional documents

Additional documents (e.g. of the components) must be adhered to. They contain additional information, e.g. on maintenance, and are therefore necessary for safe operation of the dryer.

The customer is provided with pressure vessel documents, if applicable.

1.5 Warranty notes

For warranty information, please refer to our "General Terms of Sale and Delivery".

(→ www.fstweb.de)

In the following cases the warranty shall be void:

- If the safety notes and instructions of this operating manual and of the additional documents are not observed.
- If the dryer is operated or maintained by personnel who do not have the required qualifications. (→ see "Target group": (→ Page 7)
- If the dryer is used for anything other than its intended use. (→ Page 9)
- If aggressive substances in the compressed air or ambient air cause damage to the dryer.
- If parts other than genuine parts of the manufacturer have been used for maintenance and repair.
- If the dryer is operated although defects are evident.

1.6 About this operating manual

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

Target group

This operating manual is directed to all persons working on and with the dryer. We point out that these persons have to be qualified personnel who, because of their qualification and experience, are familiar with handling compressed air systems and electrical systems. If you are not experienced in using these systems, please ask the relevant experts for help. We highly recommend that commissioning and maintenance be carried out by the manufacturer or one of the authorised service partners.

Using the operating manual

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

The operating manual must be kept in the vicinity of the dryer and must be easily accessible.

When selling or hiring out the dryer, also provide this operating manual and all the additional documents to the new user. (→ Page 6)

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

All the information in this operating manual is valid at the time the manual is published. Due to component or workflow modifications at any time affecting dryer maintenance, the latest information should be available prior to maintenance work.

General information

Signs and symbols used

- Boxes are used for bulleted lists.
- 1) Enumerated lists point out that the working steps are to be carried out in a specified order.
- Cross references refer to information on a different page or in a different document.



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 serious injury or death.



DANGER !

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

2. Description of application

The dryer is used to remove moisture from compressed air for industrial use.

Typically, the dryer is used for drying compressed air from a compressor station.

During pre-treatment of the compressed air by means of separators and fine filters only the liquid water components can be removed from the compressed air. After this pre-treatment the dryer also removes the vaporous water components. The compressed air is dried until only a very low residual concentration of water vapour remains in the dried compressed air. This residual moisture content is measured as the pressure dew point in °C.

The dryer works completely automatically and is designed for continuous operation. Thanks to numerous communication interfaces and an optionally available moisture measuring system the dryer can be operated very economically.

2.1 Intended use

The dryer is exclusively designed for drying compressed air!

Using the dryer for drying other gases (e.g. pure nitrogen) must be agreed on with the manufacturer. It may be necessary to observe special safety directives.

The dryer is designed to be set up at a site that complies with the following requirements:

- Indoors
- Protected against weather impact
- Ventilated
- Frost-free
- Dry
- Zero to minimum dust-laden ambient air
- No vibration via floor or connected piping
- Ambient air must be free from aggressive and corrosive substances
- Ambient air must be free from substances that damage the desiccant or influence its effectiveness (e.g. ammonia or other alkaline-reacting substances, oil mist, water spray or drizzle)
- Free from dangers due to explosive atmospheres inside and outside the dryer. (The standard dryer version does not comply with ATEX.)

The dryer must only be operated with compressed air within the maximum allowable operating conditions.

The voltage supply must correspond to the specified values.

The maximum allowable operating conditions and the required voltage supply are specified on the type plate (→ page 13).

Modifications to the dryer or use of third-party parts may cause unpredictable danger and damage. These measures must only be carried out after previous check and approval of the manufacturer. Only use genuine spare parts of the manufacturer.

Description of application

Any other use is considered improper and therefore not permissible. The manufacturer accepts no liability caused by improper use.

Bitte beachten Sie, dass die Trocknungsleistung nicht auf diese mechanischen Belastungsgrenzen bezogen ist, sondern auf die nominalen Betriebsbedingungen (→ Seite 11) oder auf Betriebsbedingungen, die in der Planungsphase individuell für diesen Trockner ermittelt wurden.

The values specified on the type plate are mechanical design limits.

Please note that dryer performance is not defined to these mechanical design limits. Dryer performance is guaranteed for use under the "nominal operating conditions" as well as for a certain combination of the individual operating parameters, that has been established for this dryer in the planning phase (compressed air flow rate, pressure, temperature, desired pressure dew point, ambient temperature and ambient humidity).

For the nominal operating conditions please refer to the following table. (→ Page 11)

For a dryer designed to your individual operating conditions, please refer to your contract documents or contact the manufacturer.

Dryer performance cannot be guaranteed if the dryer is not operated within these operating conditions.

The supplied compressed air must be of the following quality:

- Free from aggressive and corrosive substances
- Filtered acc. to ISO 8573-1:2010 (1*:3)
- Free from substances damaging the desiccant

*= The compressed air should be saturated with moisture or only be slightly subsaturated. When using pre-dried compressed air (e.g. downstream of a fridge dryer) the dryer performance may be reduced.

During initial commissioning and after desiccant replacement in particular, pre-dried compressed air may negatively affect dryer performance.



In the event of pre-dried compressed air

For some days, operate the dryer using moisture-saturated compressed air in order to activate the desiccant. For this activation process the dryer control system should be set as follows:

- 1) Select the "**variable**" cycle mode. (→ Page 39)
- 2) Select a **dew point** limit value that can still be tolerated, however, it must not be worse than -10°C. (→ Page 40)

The dew point should become better within the next days.

- 3) Monitor the development of the dew point measured value for some days.
- 4) Select a **dew point** limit value that is approximately 10°C worse than the dew point that is usually reached, however, it must not be worse than -10°C.

Usually, dryer performance will be adequate after this procedure even when using pre-dried compressed air. If the dew point becomes worse again at a later point in time, the procedure must be repeated.

Example:

- The dryer is to be reaching a dew point of -40°C. However, in most cases it only reaches -30°C.
- Select the "**variable**" cycle mode and then a **dew point** limit value of -20°C.
- The adsorption phases of the dryer are now very long and thus the dryer is increasingly laden with moisture.
- After some days the dew point becomes better and reaches values around -55°C.
- Now, select a **dew point** limit value of -40°C. The dryer should now permanently be reaching good dew points.

2.2 Technical data

Dryer	Nominal volume flow rate	Compressed air connection	Weight	Height	Width	Depth	Installed heater power	Installed motor power	Exhaust air flow rate
	V [m³/h]*		[kg]	[mm]	[mm]	[mm]	[kW]	[kW]	[m³/h]**
DTS 45 V	430	DN 40	465	1960	1250	1120	4.5	0.85	130
DTS 55 V	530	DN 40	560	2210	1250	1120	4.5	0.85	130
DTS 65 V	650	DN 50	640	2250	1420	1205	8.0	1.60	220
DTS 85 V	830	DN 50	780	2280	1420	1205	8.0	1.60	220
DTS 125 V	1230	DN 80	1020	2680	1520	1260	11.0	2.20	270
DTS 155 V	1540	DN 80	1320	2700	1620	1310	14.0	4.00	350
DTS 215 V	2140	DN 80	1690	2750	1800	1400	18.0	5.50	525
DTS 250 V	2470	DN 100	1900	2850	1900	1450	28.0	8.50	850
DTS 300 V	2990	DN 100	2400	2880	2050	1520	28.0	8.50	850
DTS 380 V	3800	DN 100	2800	2950	2200	1620	35.0	8.50	850
DTS 430 V	4300	DN 150	3800	3190	2300	1650	35.0	8.50	900
DTS 500 V	4980	DN 150	4050	3210	2450	1730	40.0	8.50	1100
DTS 540 V	5390	DN 150	4220	3230	2500	1760	48.0	15.00	1650
DTS 650 V	6540	DN 150	5000	3500	2600	1850	58.0	15.00	1650
DTS 720 V	7220	DN 150	5650	3520	2700	1900	69.0	15.00	1650
DTS 860 V	8620	DN 200	6380	3590	2900	2000	74.0	15.00	1650
DTS 940 V	9400	DN 200	7520	3620	3000	2200	84.0	19.00	2190
DTS 1100 V	11100	DN 200	8730	3670	3200	2300	95.0	22.00	2480

* = Standardised to 1 bar(a) and 20°C as well as to the following operating conditions: 7 bar operating overpressure, 35°C inlet temperature and -40°C pressure dew point

** = Standardised to 1 bar (a) and 20°C at atmospheric pressure

Classification acc. to PED 97/23/EG	IV
Fluid group	2
Supply voltage	400 V, 50 Hz
Class of protection	IP54
Min. / max. allowable pressure (PS)	4 bar to 11 bar
Min. / max. allowable temperature (TS)	+1°C to +50°C
Allowable pressure loss in the exhaust air duct	20 mbar
Appropriate ambient air quality for regeneration	Dust contents < 50 mg/m³ Temperature +1°C to 40°C Absolute moisture < 14 g/m³
Noise pressure level (free-field measurement in distance of 1 m)	75 dB(A) to 90 dB(A)

Description of application



Individual operating conditions

Please contact the manufacturer when your operating conditions are not within the limits stated above.

Options adapting the dryer to your operating conditions can be provided for numerous special cases.



Pressure vessel

For further technical details on the pressure vessels, please refer to the pressure vessel documentation provided separately.

A routine inspection is required for the pressure vessels. In Germany, according to AD 2000 Code a routine inspection has to be carried out every 5 years by a notified body.

Please note that different national regulations may apply in other countries.

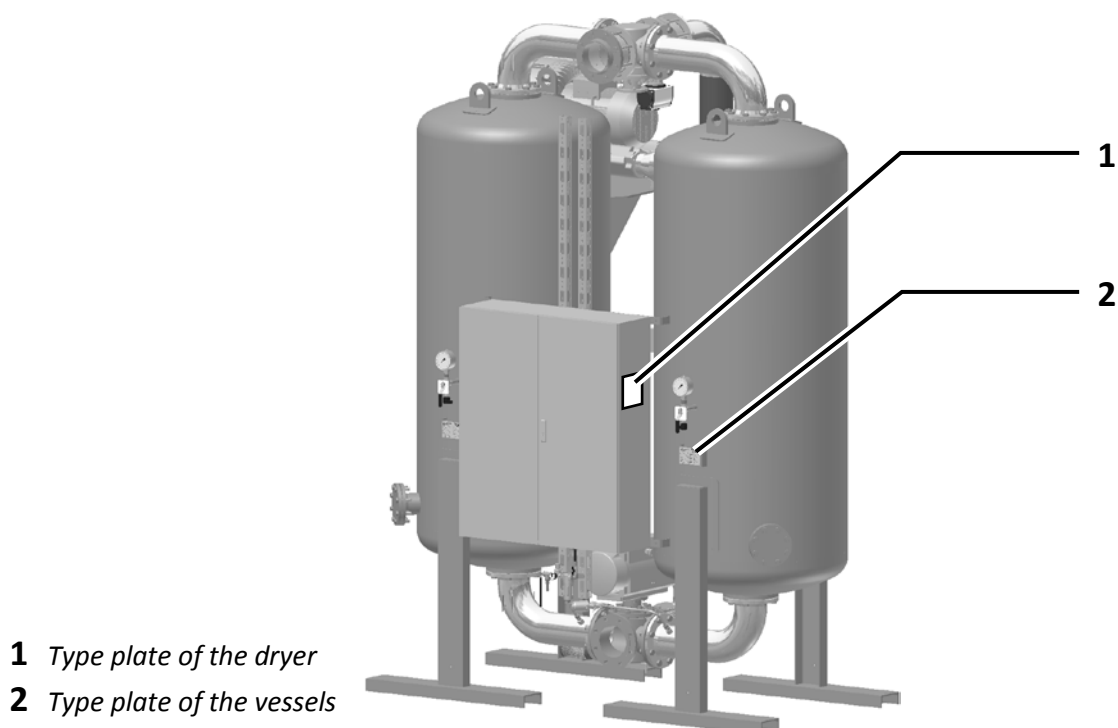
3. Safety notes

The dryer has been built according to state-of-the-art technology and recognised safety rules. However, there is a risk of danger that every person working with the dryer must be aware of. In particular, improper handling of compressed air and electricity may result in serious injury or death. If you are not experienced in using these systems, please ask the relevant experts for help.

**Note!**

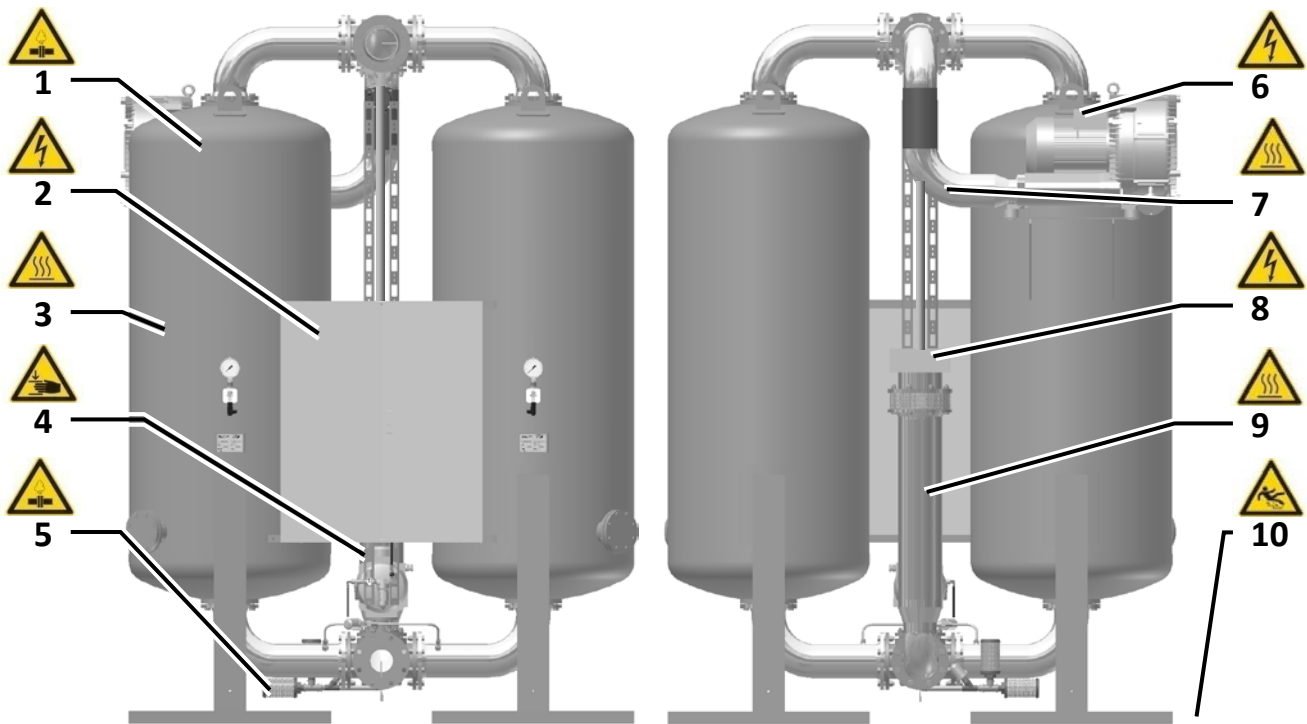
- In order to prevent personal injury or damage, the safety notes must be observed when using this dryer.
- Observe the specific safety notes in the relevant chapters.
- Observe the legal guidelines and the accident prevention regulations.
- Observe the safety notes of the local site regulations.

3.1 Signs and instructions



The type plates show important information. Make sure that the type plates are always clearly readable.

3.2 Danger zones at the dryer



1 Risk of injury from pressure-bearing parts

2;6;8 Risk of injury from electric voltage

3;9 Risk of burns at hot vessel and piping surfaces

4 Risk of crushing at cardan shaft during valve movement

5 Risk of injury from suddenly escaping compressed air

7 Risk of injury from hot exhaust air flow

10 Risk of slipping due to spilt desiccant



DANGER ! – Overpressure (1)

The dryer is under pressure.

Suddenly escaping compressed air may result in serious injury.

Do not carry out mechanical or electrical work on the dryer as long as the dryer is under pressure.



DANGER ! – Electric voltage (2;6;8)

The dryer is operated electric voltages up to 690 V.

Touching live parts may result in serious injury or death.

Work on electrical components must only be carried out by qualified and authorised personnel. Use a voltage detector to make sure the dryer has been disconnected from the power supply and that there are no live parts before starting maintenance work.

In the event of fire, do not extinguish the fire using water.





WARNING ! – Hot surfaces (3;9)

The surfaces of the vessels and pipes may reach temperatures above 150°C.

Unprotected touching of this surface may cause burns.

Avoid direct contact to these surfaces. Restrict access to the surfaces, if necessary, or install thermal insulation on the hot components. (→ Page 24)

Never store inflammable parts and material in the vicinity of the dryer.



WARNING ! – Risk of crushing (4)

The cardan shaft will automatically turn by 90° approximately every 6 hours. Touching the cardan shaft may cause parts of the body to be injured or twisted.

Do not hold on to the cardan shaft. Do not put your hand into the link joint of the cardan shaft.



WARNING ! – Suddenly escaping compressed air (5)

The dryer is depressurised approximately every 6 hours using a silencer. A loud and strong air-stream may carry small particles and cause injury.

Do not place any equipment in the vicinity of the silencer. The silencer must not be manipulated or removed. Always wear hearing protectors when working in the vicinity of the dryer.



CAUTION ! – Hot exhaust air flow (7)

Hot air escapes from the regeneration air outlet. The surface of the exhaust air duct may reach temperatures above 150°C. Unprotected touching of this surface may cause burns.

The installation room temperature will rise when not using an exhaust air duct.

Install an exhaust air duct out of reach of persons.



WARNING ! – Risk of slipping (10)

After desiccant replacement some amounts of desiccant may still remain on the floor.

The desiccant is very slippery and may result in serious fall injury.

Immediately remove residual desiccant properly from the floor.

3.3 General safety notes



DANGER ! – Overload

The dryer must only be operated with compressed air within the maximum allowable operating conditions. The operating conditions are defined on the type plate (→ page 13).

Exceeding the maximum allowable operating conditions may result in serious injury or death.

It is the duty of the operator to ensure that the connected pressure source is safe-guarded such that the maximum allowable operating pressure (PS) and the maximum allowable temperature (TS) are not exceeded.

Please also refer to section "Intended use" (→ page 9).

Safety notes



DANGER ! – Unauthorised modifications

Modifications to the dryer or the dryer control system may result in dangerous operating states. Violations may cause serious injury or death.

Never modify the dryer function by means of conversions.

Never carry out welding work on pressure-bearing parts.

Never change the control program of the dryer.

Any modifications of the dryer must be agreed on with the manufacturer and confirmed in writing.



DANGER ! – Suspected misuse

Using the dryer for unintended purposes may result in dangerous situations. Violations may cause serious injury or death.

Never use the dryer as a climbing aid.

Never use the dryer as a support for external weight loads.

Never use dryer components for unintended application purposes.

Please also refer to section "Intended use" (→ page 9).



WARNING ! – Risk of falls

The dryer must never be used as a climbing aid. The dryer components will not provide adequate support and parts of the dryer may break off. Disregard may lead to dryer damages and falls with serious injuries.

When working at height only use approved climb assist systems.



CAUTION ! – Desiccant dust

Using the desiccant may lead to mineral dust formation.

Desiccant dust may cause eye and respiratory tract irritations.

Wear eye protection and a dust mask when handling the desiccant.



Desiccant

The desiccant used is not subject to labelling requirements according to the Hazardous Substances Ordinance. Nevertheless, the common safety measures with regard to using chemicals apply.

The manufacturer will provide safety data sheets on request.

The desiccant may accumulate contaminants from the compressed air. Depending on the type of contamination there may be a risk of injury or damage when using the desiccant. As the type of contamination is not known to the manufacturer, the resulting risks cannot be evaluated in this operating manual.



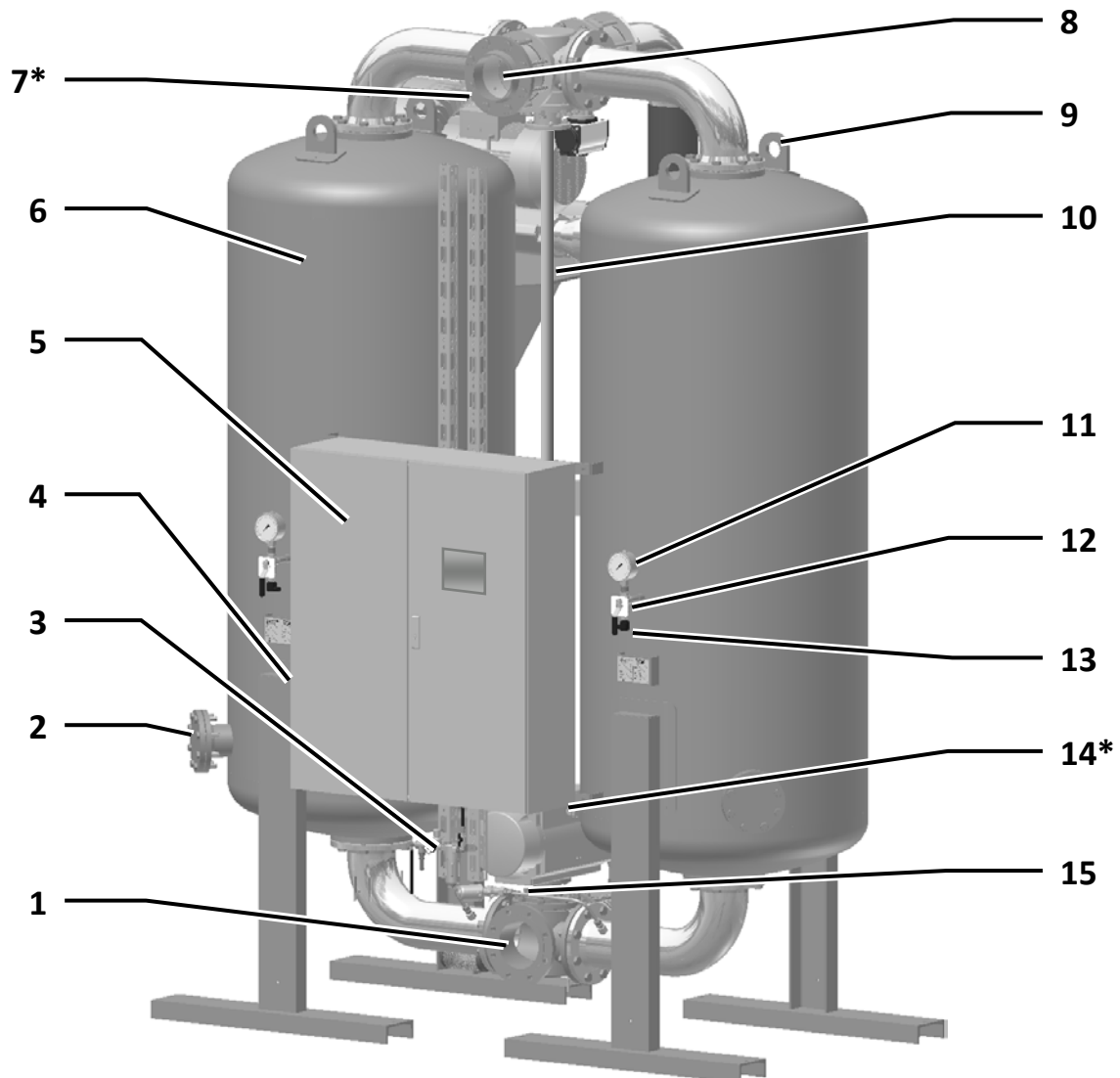
Additional safety notes

For additional safety notes, please refer to the relevant chapters.

4. Technical product description

4.1 Assembly drawing

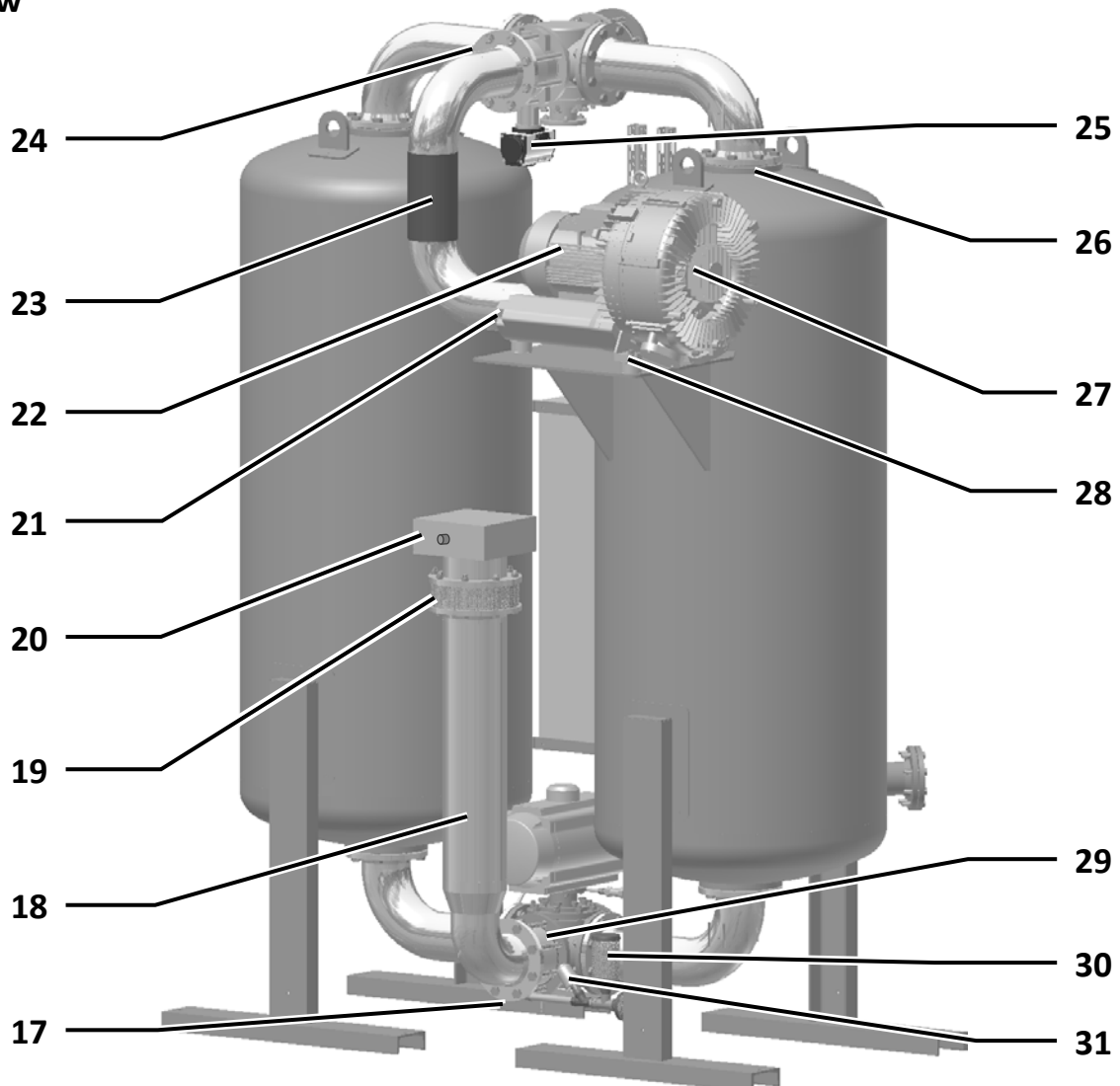
Front view



- 1** Compressed air inlet (GJ) / lower main valve with actuator (V1)
- 2** Desiccant drain
- 3** Instrument air filter
- 4** Main circuit breaker
- 5** Control box with touch panel
- 6** Vessel (A1, A2) with sieve tray (ST1, ST2)
- 7** Dew point sensor (MT01) (*optional)

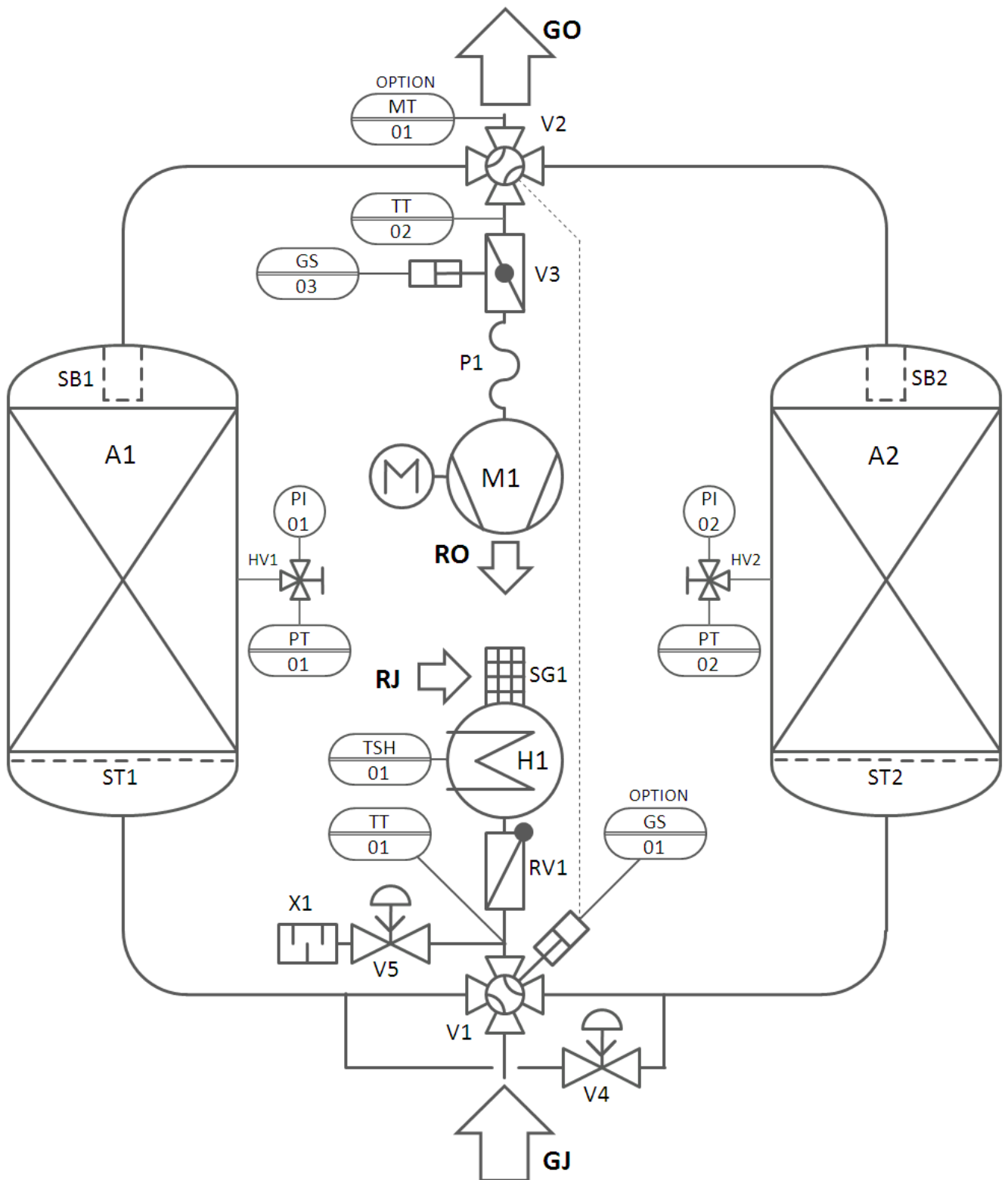
- 8** Compressed air outlet (GO) / upper main valve (V2)
- 9** Upper lifting lugs
- 10** Cardan shaft for connecting the main valves
- 11** Pressure gauge (PI01, PI02)
- 12** Manual valve for pressure measurement (HV1, HV2)
- 13** Pressure sensor (PT01, PT01)
- 14** Limit switch (GS01) (*optional)
- 15** Pressurisation valve (V4)

Rear view



- 17** Temperature sensor (TT01) for regeneration gas temperature control
- 18** Heater (H1) inside flow tube
- 19** Regeneration air intake (RJ) with protection grid (SG1)
- 20** Heater junction box with release button for temperature limiter (TSH01)
- 21** Regeneration air outlet on the blower (RO)
- 22** Blower motor with cooling fan (M1)
- 23** Flexible hose (P1)

- 24** Temperature sensor (TT02) for measuring the regeneration air outlet temperature
- 25** Regeneration air valve (V3) with limit switch (GS03)
- 26** Upper vessel opening with strainer basket (SB1, SB2)
- 27** Blower (M1)
- 28** Vibration absorber
- 29** Non-return valve (RV1)
- 30** Expansion silencer (X1)
- 31** Expansion valve (V5)



4.3 Function description

The operation principle of the dryer is adsorption. The principle of moisture adsorption is water molecules being attracted to a hygroscopic solid material (desiccant). This process is reversible and, after a regeneration phase, the desiccant can be reused for drying.

For compressed air drying the compressed air flow is led through a vessel containing the desiccant and brought into intensive contact with the desiccant. The desiccant removes moisture from the compressed air and stores it in its internal structure. With continuous moisture loading of the desiccant the dryer performance is reduced until the desiccant is saturated with moisture. The saturated desiccant then requires regeneration, i.e. the moisture stored in the inner desiccant structure is removed again. The desiccant can then be reused for drying.

Continuous operation of an adsorption dryer requires two vessels that are operated alternately. One vessel is used for drying the compressed air (adsorption). In the other vessel the regeneration phases are carried out. The change interval between adsorption and regeneration is 6 hours or longer.

Adsorption phase

Duration approx. 6 to 48 hours

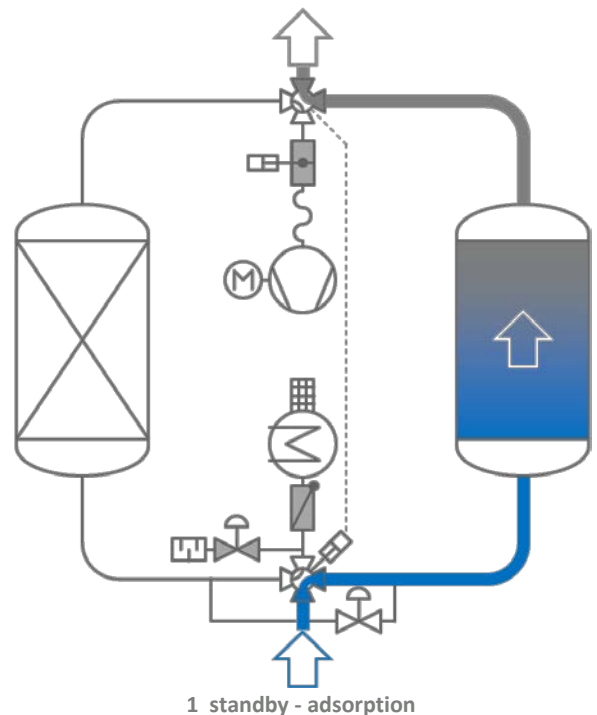
The moist compressed air is supplied from a compressed air source (e.g. compressor) to the compressed air inlet (GJ) of the dryer. The lower main valve (V1) forwards the compressed air to the vessel which is in "adsorption" mode (here A2). In the lower part of the vessel the compressed air is decelerated and distributed over the vessel cross-section. The compressed air passes the sieve tray (ST2) and slowly flows through the desiccant bed. The compressed air exits the vessel via the strainer basket (SB2) and is forwarded from the upper main valve (V2) to the compressed air outlet (GO).

The optional dew point sensor (MT01) checks the dryer performance at the compressed air outlet.

During this time the second vessel is in standby mode and waits for operation.

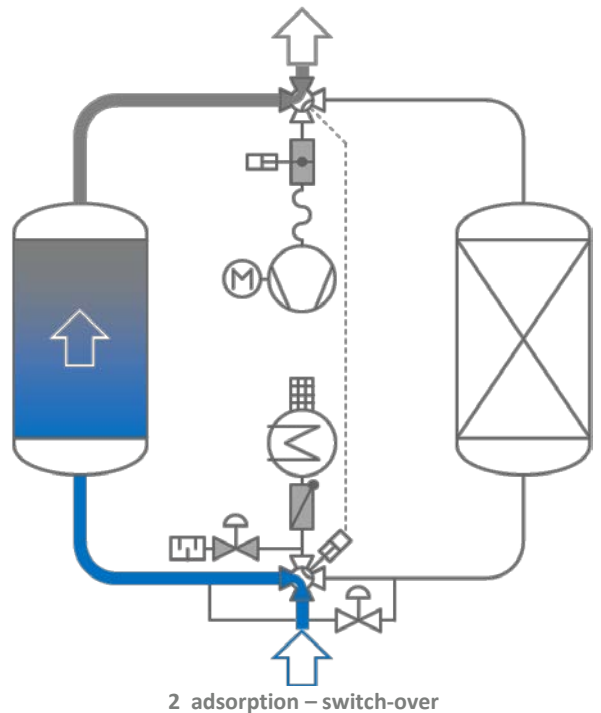
The adsorption phase is completed and the vessels are switched over if...

- "fixed" cycle mode has been pre-selected and a time of 6 hours has expired.
- "variable" cycle mode has been pre-selected and optional dew point measurement has reached the selected limit value. Switch-over of the vessels is carried out compulsorily after 48 hours at the latest.



For vessel switch-over the main valves (V1) and (V2) are switched synchronously using a common actuator. The compressed air flows from one vessel to the other. A free flow path through the dryer is available at any time during switch-over. As a result, the task of drying is passed on to the other vessel without interruption.

Now vessel (A2) has gone "offline" and vessel (A1) has gone "online".



Regeneration

Duration approx. 3 hours or longer

After the "wet" vessel (A2) has completed the adsorption phase and passed on the task to the second vessel (A1), the first vessel (offline vessel) runs the regeneration phases.

Regeneration is divided into the following phases:

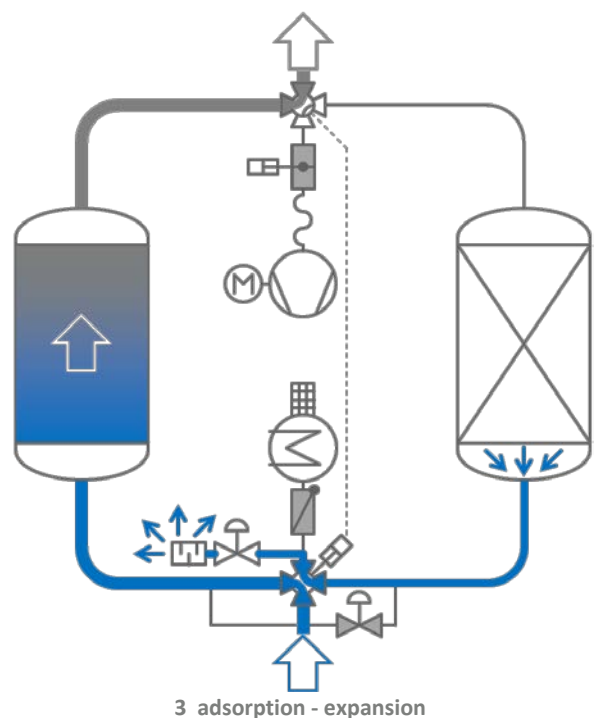
- Expansion
- Heating
- Cooling
- Pressurisation
- Standby

Expansion phase

Duration approx. 3 to 10 min

After vessel switch-over the expansion valve (V5) is opened and the "wet" vessel is depressurised. Via the silencer (X1) the compressed air flows to the outside.

The dryer control system monitors the vessel pressure using the pressure sensor (PT02). The next phase begins when the vessel pressure falls below the selected limit value.



Heating phase

Duration approx. 2 hours or longer

After the vessel pressure has almost reached atmospheric pressure, the regeneration air valve (V3) is opened, the expansion valve (V5) is closed, the blower (M1) is started, and the heater (H1) is switched on.

Ambient air is drawn in via the protection grid (SG1) and heated up by the heater (H1) to approximately 140°C to 180°C. Via the temperature sensor (TT01) the dryer control system controls the regeneration air temperature to maintain the selected value. The temperature limiter (TSH01) protects the heater against overheating. When exceeding the limit temperature set on the temperature limiter scale it switches off the heater.

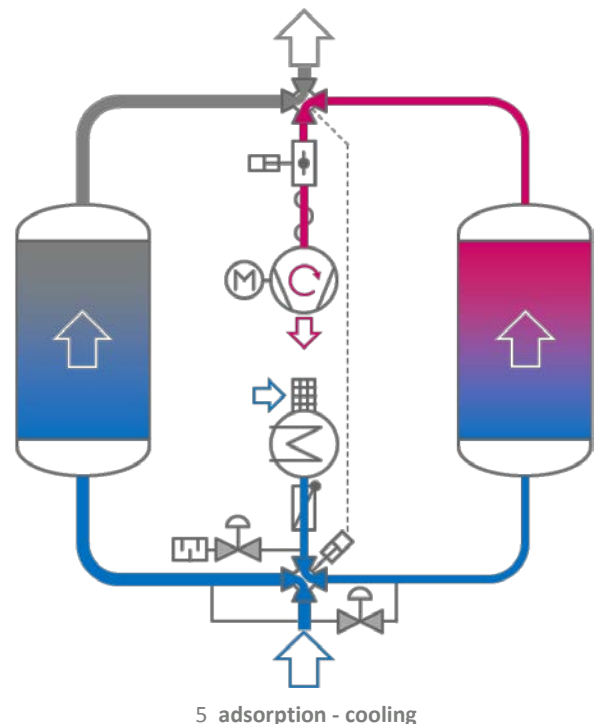
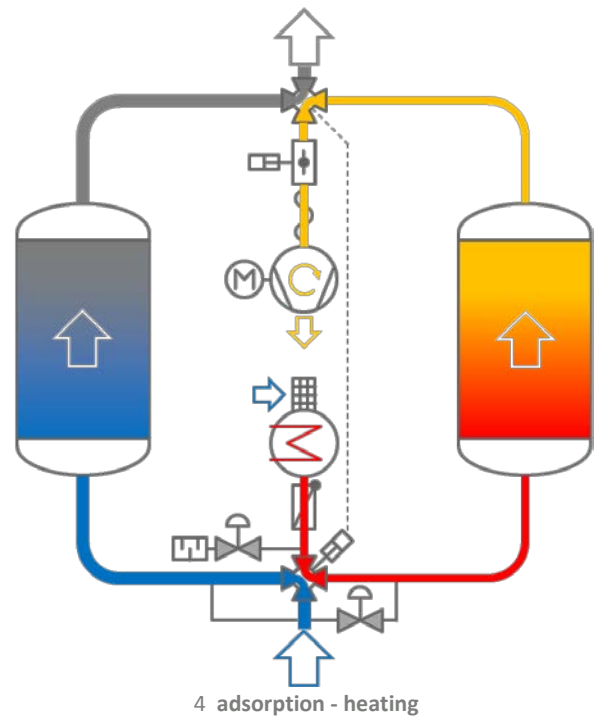
The hot regeneration air is distributed throughout the vessel cross-section and led through the desiccant. The heat in the regeneration air vaporises the water stored in the desiccant. In the form of steam the water, together with the regeneration air flow, is then led to the outside of the vessel. The warm, moist regeneration air flow is forwarded to the regeneration air outlet (RO) via the blower (M1).

As soon as the hot regeneration air flow has vaporised the water from the vessel, the temperature at the vessel outlet starts to rise quickly. Using the temperature sensor (TT02) the dryer control system recognises the rise in temperature and switches off the heater (H1) when reaching the selected temperature limit value. The heating phase is completed and the next phase begins.

Cooling phase

Duration approx. 1 to 2 hours

After the heater (H1) has been switched off, the blower (M1) continues to run and now draws cold regeneration air through the hot vessel. The regeneration air cools down the vessel and the temperature at the vessel outlet falls slowly. Using the temperature sensor (TT02) the dryer control system recognises the fall in temperature and switches off the blower (M1) when reaching the selected temperature limit value. The cooling phase is completed and the next phase begins.



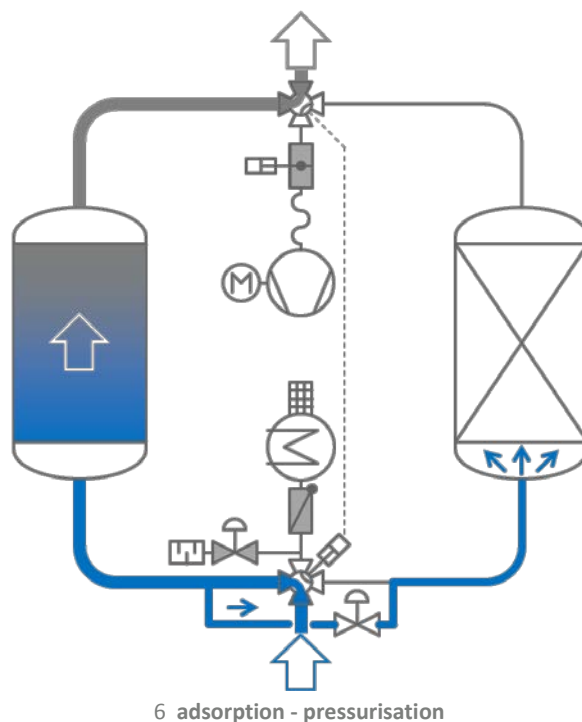
Pressurisation phase

Duration approx. 3 to 10 min

The pressurisation phase ensures that the two vessels have the same vessel pressure prior to vessel switch-over.

The regeneration air valve (V3) is closed and the pressurisation valve (V4) is opened. Compressed air flows from one vessel to the other.

Using the pressure sensor (PT02) the dryer control system monitors the vessel pressure and compares it to the pressure (PT01) in the other vessel. The next phase begins when the vessel pressure is almost the same in both vessels.

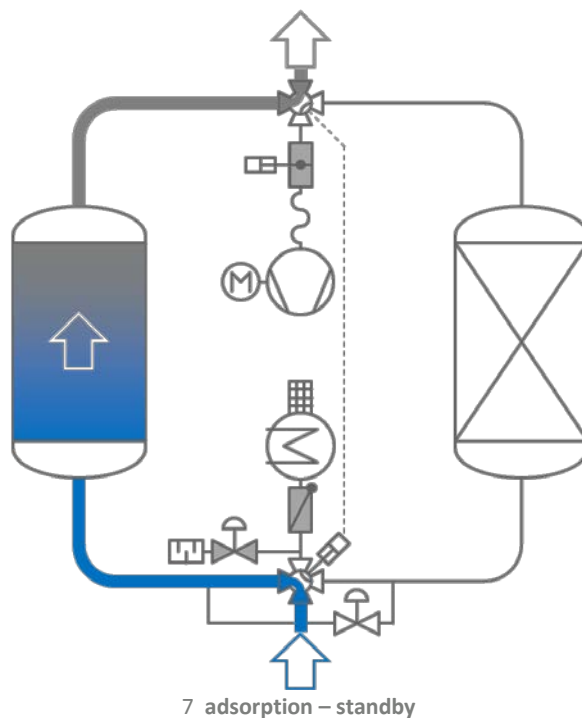


Standby

Duration approx. 0 hours or longer

Vessel regeneration is now complete and the vessel is immediately ready to operate. During this phase the pressurisation valve (V4) remains open. Vessel pressure in both vessels is permanently monitored using the pressure sensors (PT01, PT02). Vessel switch-over can only take place if the vessel pressure is the same.

When the current adsorption phase has been completed, the vessels are switched over and the process is restarted.



Monitoring the regeneration phases

The time of all the regeneration phases is monitored. The phases have a minimum and a maximum runtime. Within this time the progress of the phase is monitored by the relevant sensor and stopped in the event of reaching the selected limit value.

The above time and temperature values are variables which can be set individually for each dryer. Therefore, deviations from the above mentioned values are possible.

The minimum and maximum runtime and the limit values are indicated on the control system display.

When reaching the maximum runtime of the phase, a warning or alarm message is displayed accordingly. (→ Page 46)

4.4 Options

Various options are available for improved operation and special installation site conditions. For detailed information on the options or dryer modification to meet your operating and installation site requirements, please contact the manufacturer or the responsible sales partner.

Dew point sensor

Control of the adsorption phases changes from purely time-dependent vessel switch-over to load-dependent operation when using the dew point sensor. The dew point sensor allows for considerable energy savings and increased dryer performance.

Use of a dew point sensor is highly recommended.

Automatic start-up device (pressure maintaining valve)

The dryer must always be operated with an adequately high pressure in order to avoid excessive flow velocities in the dryer. There is a danger of damage to the dryer. (→ Page 63)

If the dryer is started against a pressureless compressed air network, the compressed air network must be filled through the dryer. To ensure adequate operating pressure in the dryer the manual valve behind the dryer must be throttled and only be opened very slowly.

In the event the dryer is frequently started against pressureless compressed air networks (e.g. after the weekend) or if there is no personnel available for the start-up procedure, an automatic start-up device is useful. It ensures that there is an adequately high pressure in the dryer at any time during operation.

Thermal insulation with touch protection

Insulating hot system parts has numerous advantages:

- Reducing the heat loss during regeneration and thus considerable energy savings
- Reduced heat dissipation into the installation room
- Improved and shorter desiccant regeneration process and therefore improved dryer performance
- Dryer can be operated in cool and windy environment
- Protection of persons against burns on hot dryer surfaces



Hot surfaces

The "thermal insulation" option meets the requirements of protection against accidental contact corresponding to most national regulations for accident prevention. Thermal insulation is mandatory in the event the operator does not provide restrictions for accessing the dryer.

Frost protection insulation with trace heating

In the event of ambient temperatures below +1°C all the wet-operated components must be protected against freezing. After evaluating the local conditions a suitable frost protection can be provided.

Intake nozzle for regeneration air

Usually, the regeneration air is drawn in from the environment directly on the dryer. If the ambient air at the place of installation contains dust, moisture or aggressive contamination, the regeneration air must be drawn in from the outside. For this purpose an intake nozzle can be provided on the dryer.

Intake filter for regeneration air

If the ambient air is heavily contaminated by dust, pollen or insects, the "intake nozzle for regeneration air" option can be extended by a filter.

Alternative heat sources for regeneration (heating phase)

Using electric power as a heat source is very expensive. Depending on the local availability alternative heat sources can be used for heating the regeneration air. The following combinations are available:

- Steam heat exchanger, for steam pressure of 7 bar and higher (replacing the electric heater)
- Combination of steam heat exchanger and electric heater, for steam pressure < 7 bar
- Combination of hot water heat exchanger and electric heater

After evaluating the local conditions a suitable solution can be provided.

Loop cooling

Warm and humid ambient conditions have a negative effect on regeneration, especially on the cooling phase. To avoid negative effects of the environmental conditions on the cooling phase, the regeneration air can be led in a loop during the cooling phase. The heat dissipates from the loop via a water-air heat exchanger. This option is recommended for warm and humid environments and is mandatory for tropical ambient conditions.

Paint-compatible version

Compressed air for paint work must be free from silicone and other paint-wetting impairment substances. For this purpose, the dryer can be manufactured with components and process materials that are free from these substances or approved for paint work by the automotive industry. The dryer is manufactured under normal shop-floor environments, however, with a special focus on cleanness. The product quality can therefore be considered "technically free from paint-wetting impairment substances".

Further options include:

- Special voltages: 415 V, 500 V, 690 V, ...
- Stainless steel versions (completely or partly)
- Alternative pressure vessel approvals (PED Module G, ASME U-Stamp, China-Stamp, GOST, ...)
- Additional pressure vessel documentation (drawing, stress calculation, material certificate 3.1, certificate of hydrostatic pressure test, welding documentation, ...)
- Safety valves (valve provided separately)
- Weather protection (rain protection, complete insulation, frost protection, increased class of protection (IP protection class), ...)

5. Operating elements

The following sections describe the dryer components used for dryer monitoring and dryer operation.

5.1 Main circuit breaker



The main circuit breaker disconnects the control box and the connected dryer components from the power supply.

0-OFF = power supply disconnected

I-ON = power supply switched on

The main circuit breaker can be protected against unintentional reclosing. Latch the main circuit breaker in the "I-OFF" position by inserting and locking a lock or a cable tie in the eyelet of the red rotary switch.



Switching off the dryer properly

Switching off the dryer during the heating phase directly via the main circuit breaker may damage the electric heater.

Do not use the main circuit breaker for directly switching off the dryer.

The dryer is switched ON and OFF using the touch panel. (→ Page 31)

Only use the main circuit breaker for direct dryer switch-off if the dryer must be immediately disconnected from the power supply for safety reasons.

5.2 Release button for temperature limiter



The release button for the temperature limiter can be found on the junction box of the heater.

If the control system displays the "**alarm heater limiter switch**" error message on the touch panel, the corresponding error can be removed here. (→ Page 46)

- 1) Wait until the heater has cooled down. The limiter can only be reset if the electric heater is in a cold state.
- 2) Remove the black protective cap from the release button.
- 3) Press the coloured release button. (You may not feel a click. Nevertheless, the limiter has been reset.)
- 4) Make sure that the error message is no longer relevant.
- 5) Screw the black protective cap on the release button again.

5.3 Pressure gauge



The PI01/PI02 pressure gauges indicate the relevant vessel pressure. In the event of a power failure the pressure gauges also indicate whether the vessel is under pressure.

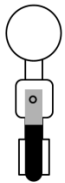
Compare the indicated value to the value on the touch panel in order to check the function of the PT01/PT02 pressure sensors. (→ Page 35)

For maintenance reasons the HV1/HV2 manual valve can be closed.

Remove the screws to the left and to the right of the hand lever.

Turn the hand lever in the position shown below.

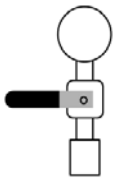
After maintenance, turn the hand lever back to normal position and insert the screws again.



HV1/HV2 valve positions:

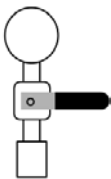
Normal position:

Vessel is connected to pressure gauge and pressure sensor



PT pressure sensor maintenance:

Vessel is only connected to pressure gauge



PI pressure gauge maintenance:

Vessel is only connected to pressure sensor

5.4 Valve position indications

All the automatically operated valves are provided with a position indication. For analysing an error the actual state of the valve can be compared to the state set in the control system. (→ Page 35)



The position of valves V4 and V5 is indicated by means of a small, coloured pin on the actuator.

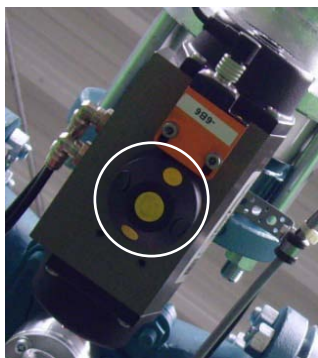
Pin protrudes approx. 2 cm from the actuator

= OPEN

Pin is almost completely inserted in the actuator

= CLOSE

Operating elements



The position of the V3 regeneration valve is indicated by means of a black-yellow cylinder on the actuator. A row of points or a line indicates the position of the valve disc.

Marking horizontally to piping installation direction = OPEN

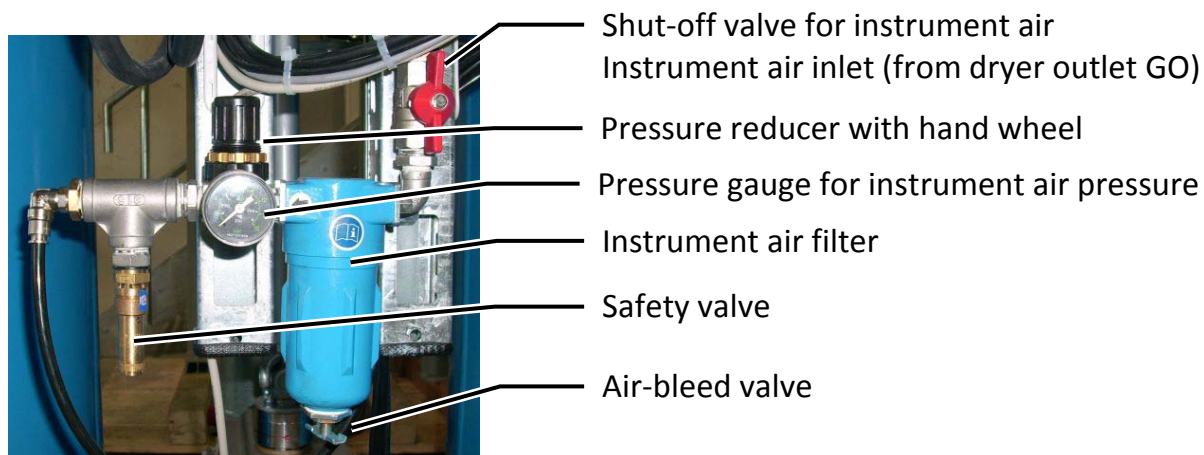
Marking vertically to piping installation direction = CLOSE



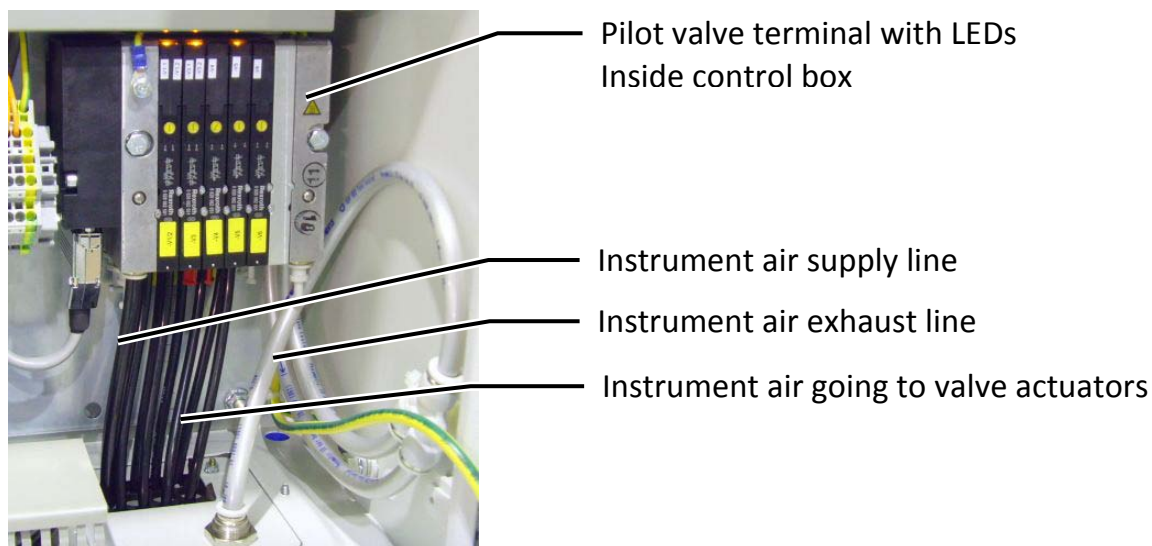
The position of the main valves V1 and V2 is indicated by markings on a small metal cylinder on both ends of the cardan shaft.

Grooves indicate the openings of the valve channels and a red line indicates which of the two flanges are connected to one another.

5.5 Instrument air supply and pilot valve terminal



Similar illustration!



Similar illustration!

The instrument air is supplied internally, i.e. from the dryer outlet, and forwarded to the pilot valve terminal via an instrument air filter and a pressure reducer. The electrical control signals from the dryer control system are pneumatically amplified using the pilot valve terminal and transferred to the valve actuators.

- 1) For maintenance of the instrument air supply cut off the instrument air at the small shut-off valve.
- 2) Open the air-bleed valve on the instrument air filter in order to depressurise the pilot valve terminal and the valve actuators. During this procedure monitor the pressure gauge on the pressure reducer.
- 3) After maintenance work the air-bleed valve must be reclosed and the shut-off valve reopened.

Make sure that the pressure reducer is set to a value of 6 bar to 7 bar. **The instrument air pressure must not exceed 8 bar!**

In the event of incorrect valve positions always check the instrument air pressure on the pressure reducer.

For a schematic diagram of the instrument air supply, please refer to the pneumatic diagram in the appendix.

5.6 Touch panel

The dryer is operated using a touch panel on the control box. Touching the screen allows for executing functions and requesting different information.



Delicate touch panel

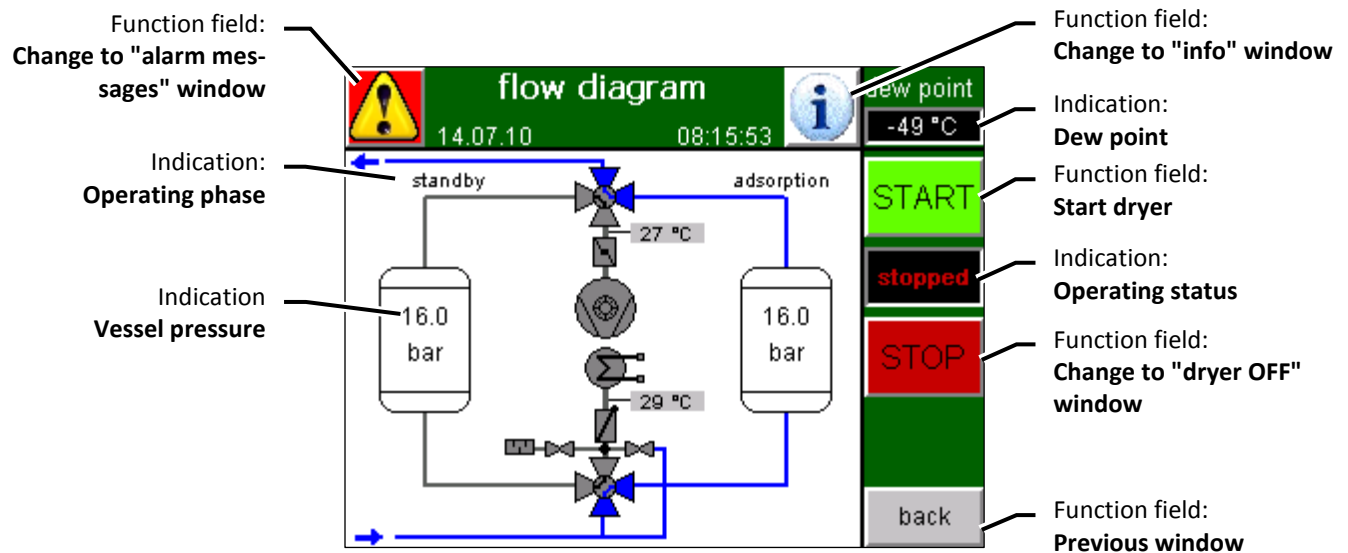
Hard or sharp-edged objects may damage the touch panel or render it unusable. Only operate the touch panel using the fingers or a soft object. The touch panel reacts to light pressure. Never attempt to activate a function field by means of intense pressing or tapping.


5.6.1 Overview of the operating elements

The user interface of the touch panel contains embossed functions fields. Touching these function fields using a finger or a soft object enables calling of the relevant functions.



Fields that are not embossed are used for indication only. These fields can only be activated when changing to a higher password level.

Menu window: "main menu"


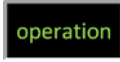




Press  to return to the previous menu window.


5.6.2 Starting and stopping the dryer control system

The "main menu", "status" and "process parameters" menu windows contain the  and  function fields.


The indicator between these two function fields shows the current state of the control system:

	=	The control system has been stopped. The dryer stops in the current state until the control system is restarted.
	=	The control system is running. The dryer performs the operating phases.
	=	Stop has been pressed and the dryer still is in the stopping sequence (see below). The indicator alternates between "stopped" and "operation".

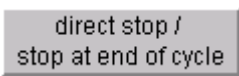
Press  to directly start the control system.

Press  to access the "dryer OFF" menu window (see below).

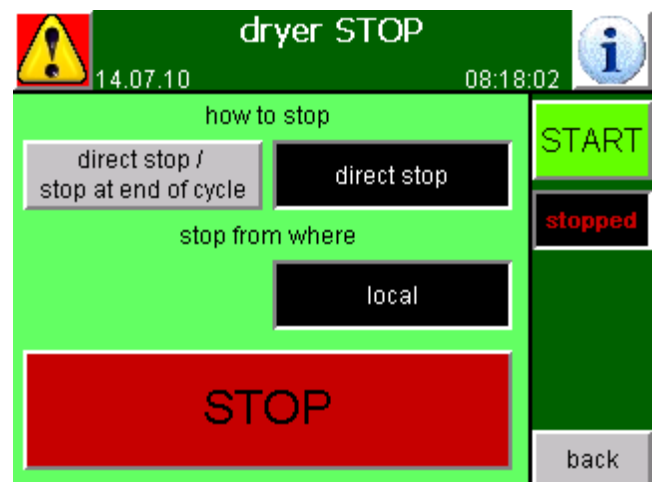
5.6.2.1 Menu window: "dryer OFF"

Press  in any window to access the "dryer OFF" menu window.

The dryer can be stopped by means of different stopping sequences.

Press  to change between the two different stopping sequences.

The black field to the right of the function field indicates the stopping sequence currently selected.



Press  to activate the selected stopping sequence.

Operating elements

"direct stop"

- The stopping process is started immediately.
- Valves V4 and V5 are closed.
- The electric heater is switched off.
- The blower is also switched off with a delay of a few seconds.
- After the blower has been switched off the dryer program is stopped.




Depending on the cycle phase the above mentioned events may have been fulfilled already. In this case the dryer program stops immediately.

This stopping mode should only be used if immediate stopping of the dryer is absolutely necessary.

"stop at end of cycle"

- The operating indicator alternates between "*stopped*" and "*operation*".
- The currently running regeneration phase continues running until reaching the pressurisation phase.
- After reaching the "pressurisation" phase the dryer program is stopped. The operating indicator shows "*stopped*".

This stopping sequence is recommended. It ensures that the dew point quality can definitively be achieved when restarting the dryer.

Press  →  →  to restart the dryer program. The currently running stopping sequence is interrupted and the dryer operates in normal mode.

The "Starting and stopping the dryer locally or remotely" section describes how to select the "local / remote" stopping sequence. (→ Page 46)



Direct stop ... during the heating phase

A "direct stop" during the heating phase will not always ensure adequate regeneration. After switching of the blower the temperatures at the heater may be very high. This may lead to malfunctions, and affects the heater service life.

We therefore recommend always stopping the dryer using the "stop at end of cycle" function. This function ensures that regeneration is performed properly and the heater is operated in a gentle mode.



Stop at end of cycle


"Stop at end of cycle" can also be performed when there is no more operating pressure. This mode is particularly suitable for weekend shutdown with the compressor switched off.

Stopping the dryer via the "stop at end of cycle" function ensures that all the dryer components have cooled down. In this way, maintenance work can be performed more easily.

The alternating operating indicator – "*stopped*" and "*operation*" – shows that the stopping sequence has been activated correctly.

5.6.3 Menu window: "alarm message"



The  function field is shown in each menu window and directly leads to the "alarm message" menu window.





There are two types of alarm messages:

1. **Alarms (red)** indicate errors that directly affect the program sequence. Alarms require immediate attention. It may be necessary for the operating personnel to take relevant measures.
2. **Warnings (blue)** indicate operating errors that do not directly affect the program sequence. However, warnings refer to a malfunction. Occasionally appearing warnings are not unusual. However, if similar warnings are repeated, it may be necessary for the operating personnel to take relevant measures.



A list of all the error messages, their meaning and measures to be taken can be found on → page 46.

In the event of new error messages the function field flashes in different colours.


- +   One alarm message or several alarm messages are indicated.
- +   One warning or several warnings are indicated.

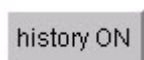
If all the error messages have been acknowledged and if no new error message is present the function field is not flashing.

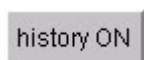
The number in the first column of the "alarm message" menu window indicates the message status:

- 1 = the message has appeared
- 0 = the message is no longer relevant (i.e. the reason of the message does no longer exist)
- X = the message has been acknowledged




Press  to acknowledge and mark the message. The message is removed as soon as the message is no longer relevant.




Press  to access all the messages from the past which are no longer relevant and have been acknowledged.



Use  to scroll through the list or to be directed to the beginning or to the end of the list.

5.6.4 Menu window: "info"


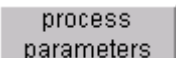


The  function field is shown in each menu window and directly leads to the "info" menu window.

All the important menu windows can directly be selected from the "info" menu window. Pressing a function field calls the according menu window.

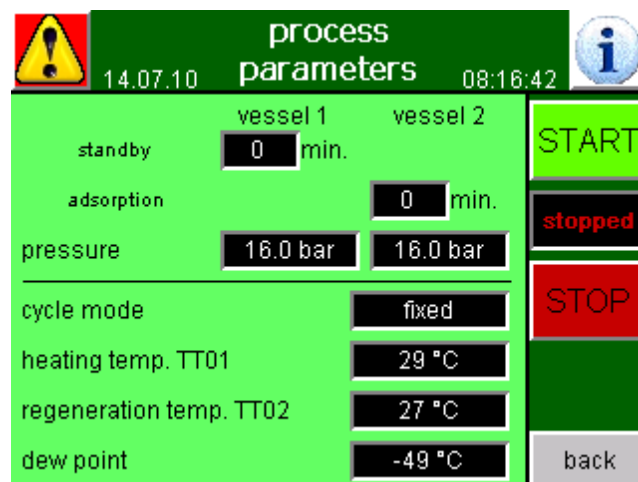


5.6.5 Menu window: "process parameters"


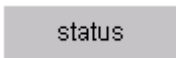
Press  →  to access the "process parameters" menu window.

This window shows the current status using measured values, the time elapsed, the selected operating mode and the current operating phase.

This window shows the dryer cycle progress at a glance.



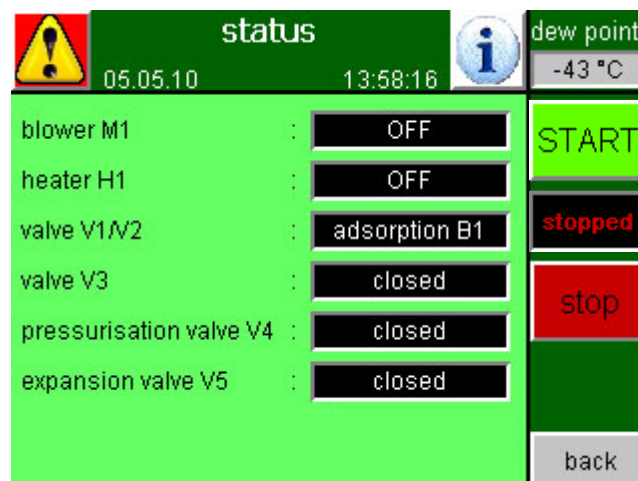
5.6.6 Menu window: "status"

Press  →  to access the "status" menu window.


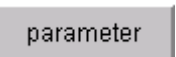
This window shows the operating states of the valves, the heater and the blower.

The states indicated correspond to the states of the outputs on the control system. Use this window to define the desired state of the components (compare → page 27).

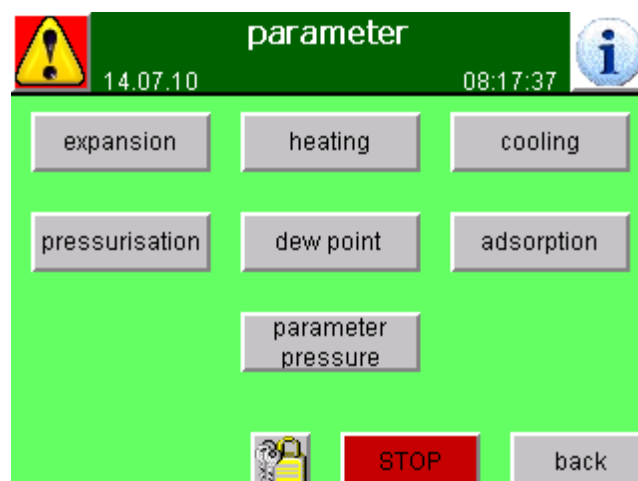
This menu window can be useful for troubleshooting because the desired state and the actual state of the components can be compared.



5.6.7 Menu window: "parameter"

Press  →  to access the "parameter" menu window.

A group of additional menu windows can be opened from this window. The additional menu windows can be used to read all the settings and limit values used for controlling the dryer.



Operating elements



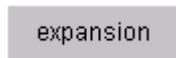
5.6.7.1 Menu window: "parameter expansion"

This menu window is part of the "parameter" group and compares the preset limit values to the current measured values or time values.

The grey fields indicate the preset limit values.

The black fields indicate the current measured values or the time elapsed.

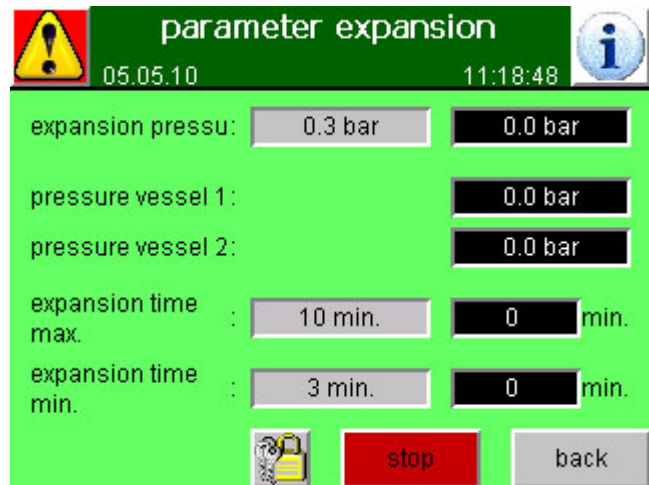
As soon as the measured value/time value reaches the limit value, the next program step will be executed.


Press  →  →  to access the "parameter expansion" menu window.

The expansion phase runs at least until the **expansion time min.** time limit is reached.



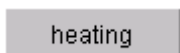
As soon as the vessel pressure reaches the **expansion pressure** limit value, the next program step will be executed.



In the event the vessel pressure does not reach the **expansion pressure** limit value within the **expansion time max.** time limit, an alarm message is displayed and the program is stopped until the limit value is reached.



parameter expansion		
expansion pressu:	0.3 bar	0.0 bar
pressure vessel 1:		0.0 bar
pressure vessel 2:		0.0 bar
expansion time max.	10 min.	0 min.
expansion time min.	3 min.	0 min.
 stop back		

5.6.7.2 Menu window: "parameter heating"

Press  →  →  to access the "parameter heating" menu window. This window comprises two screens.

Use  and  to change between the screens.

The heating phase runs at least until the **min. heating time** limit is reached.

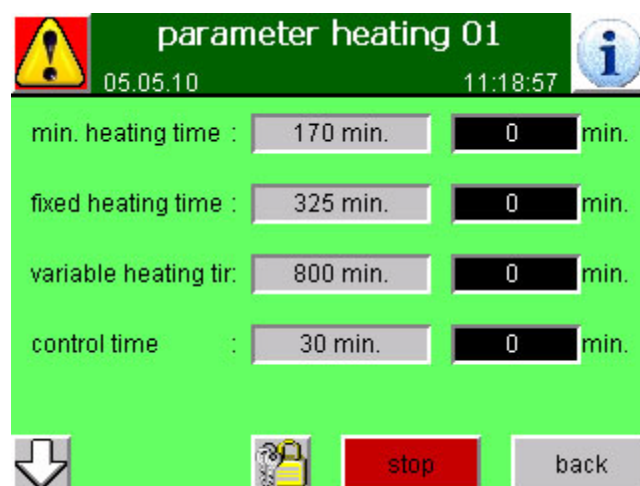
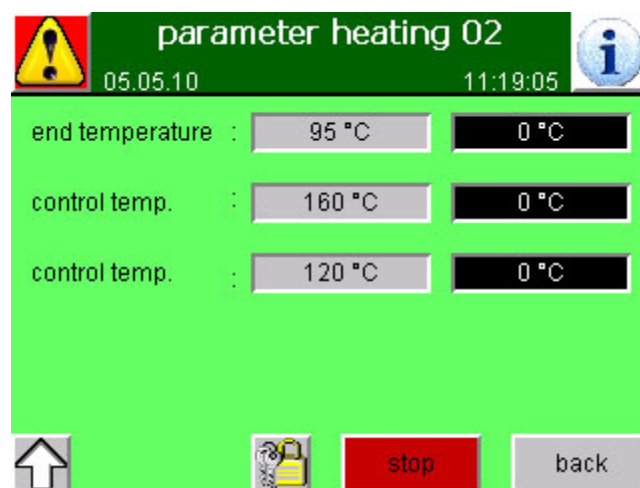
As soon as the temperature of the regeneration air exhausting from the vessel reaches the **end temperature** limit value, the next program step will be executed.

In "fixed" cycle mode:

In the event the temperature does not reach the **end temperature** limit value within the **fixed heating time** limit, a warning is displayed and the next program step will be executed.

In "variable" cycle mode:

In the event the temperature does not reach the **end temperature** limit value within the **variable heating time** limit, a warning is displayed and the next program step will be executed.







The **control temp.** is the setpoint for the temperature of the hot regeneration air flowing into the vessel. The control temperature is used for switching the heater on and off.

The temperature of the regeneration air flowing in must have reached the **control temp.** limit value within the **control time** limit. In the event the limit value is not reached, an alarm message is displayed.

Operating elements

5.6.7.3 Menu window: "parameter cooling"

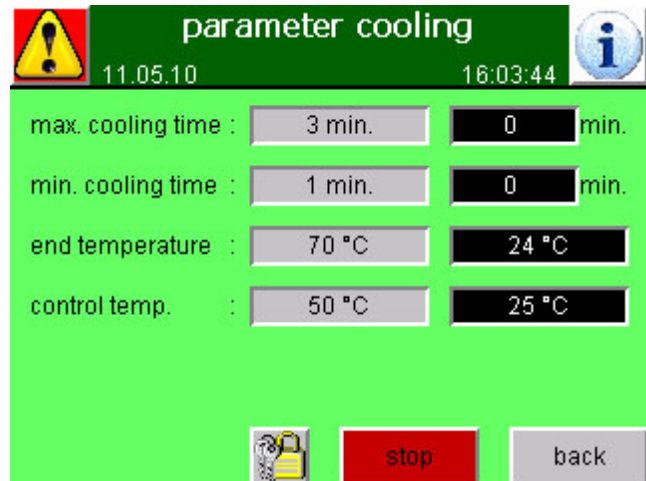
Press  →  →  to access the "parameter cooling" menu window.

The cooling phase runs at least until the **min. cooling time** limit is reached.

As soon as the temperature of the regeneration air exhausting from the vessel reaches the **end temperature** limit value, the next program step will be executed.



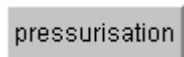
In the event the temperature does not reach the **end temperature** limit value within the **max. cooling time** limit, a warning is displayed and the next program step will be executed.

If, during the cooling phase, the temperature of the cold regeneration air flowing into the vessel exceeds the **control temp.** limit value, a warning is displayed.



Parameter	Value 1	Value 2	Unit
max. cooling time	3 min.	0	min.
min. cooling time	1 min.	0	min.
end temperature	70 °C	24	°C
control temp.	50 °C	25	°C

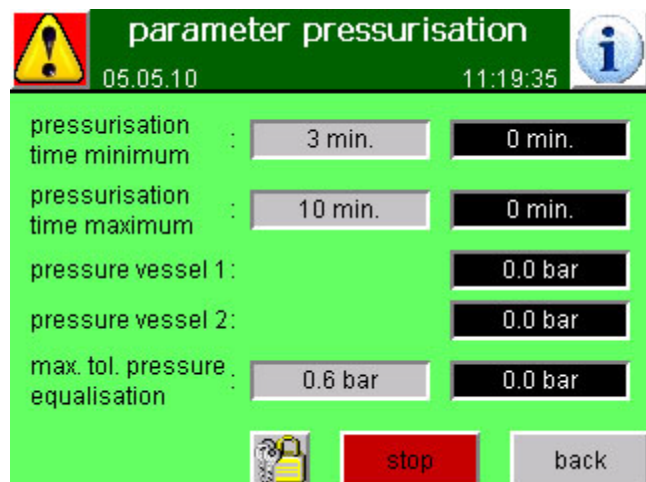
5.6.7.4 Menu window: "parameter pressurisation"

Press  →  →  to access the "parameter pressurisation" menu window.

The pressurisation phase runs at least until the **pressurisation time minimum** time limit is reached.




In the event the pressures in both vessels is equalised before reaching the **max. tol. pressure equalisation** limit value, the next program step will be executed.

In the event the pressures do not adjust within the **pressurisation time maximum** time limit, an alarm message is displayed and the program is stopped until the limit value is reached.



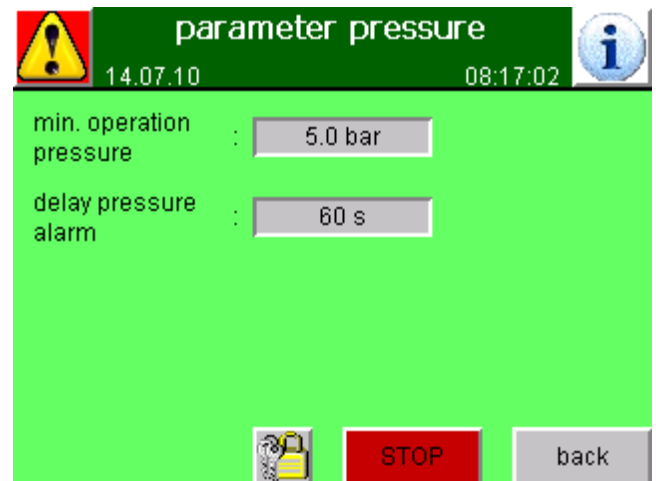
Parameter	Value 1	Value 2	Unit
pressurisation time minimum	3 min.	0	min.
pressurisation time maximum	10 min.	0	min.
pressure vessel 1		0.0	bar
pressure vessel 2		0.0	bar
max. tol. pressure equalisation	0.6 bar	0.0	bar

5.6.7.5 Menu window "parameter pressure"

Press  →  →  to access the "system parameter" menu window.


This window is used to define the parameters for operating pressure.


In the event the operating pressure falls below the **min. operation pressure** limit value, an alarm message is displayed after the **delay pressure alarm** delay time has elapsed.



Operating elements

5.6.7.6 Menu windows "parameter adsorption" and "parameter dew point"

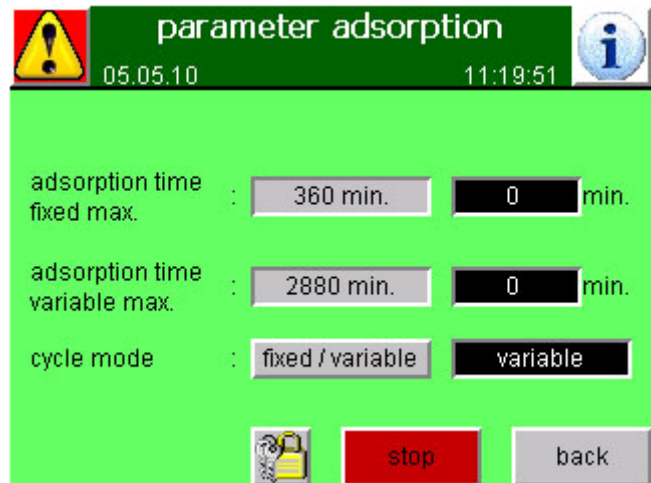
Press  → parameter → adsorption to access the "parameter adsorption" menu window.

Press  → parameter → dew point to access the "parameter dew point" menu window.

These windows are used to define the limit values for controlling the adsorption phase.

Cycle mode

- "fixed" = time-controlled adsorption phase
- "variable" = dew point-controlled adsorption phase



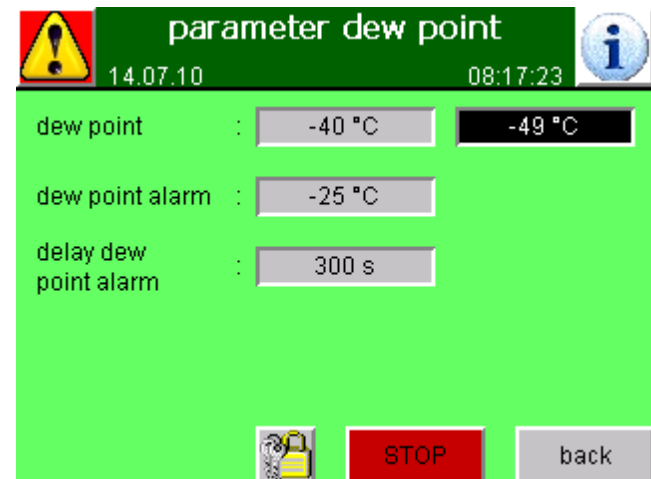
Section "Time control and dew point control" describes how to change between the two cycle modes. (→ Page 44)

In the "fixed" cycle mode the adsorption phase runs exactly until reaching the **adsorption time fixed max.** time limit.

In the "variable" cycle mode the adsorption phase runs until reaching the **dew point** limit value. However, the adsorption phase is stopped in any case when reaching the **adsorption time variable max.** time limit.

The minimum possible adsorption time is defined by the duration of the regeneration phase.



In both cycle modes regeneration always has priority over adsorption. Vessel switch-over can only take place when the regeneration phase has been completed.



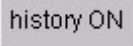
In the event the dew point measured value exceeds the **dew point alarm** limit value, an alarm message is displayed after the **delay dew point alarm** delay time has elapsed.



The "Setting the dew point limit value" section describes how to change the **dew point** limit value and the **dew point alarm** limit value. (→ Page 45)

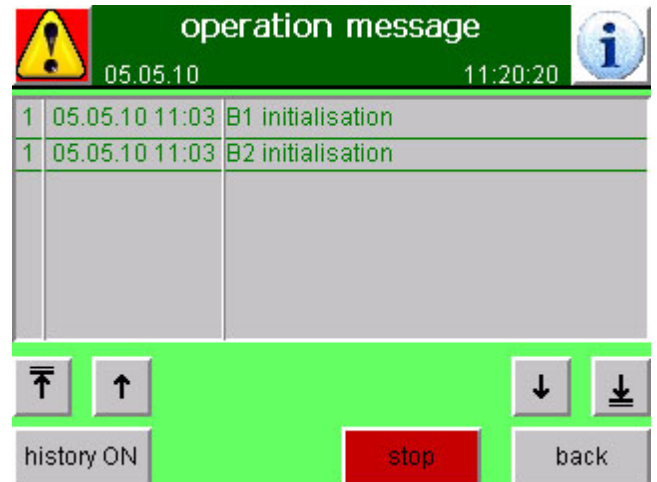
5.6.8 Menu window: "operation message"

Press  →  to access the "operation message" menu window.

This window shows the current operating phase.

Press  to access all the messages from the past which are no longer relevant.


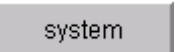
Use   to scroll through the list or to be directed to the beginning or to the end of the list.



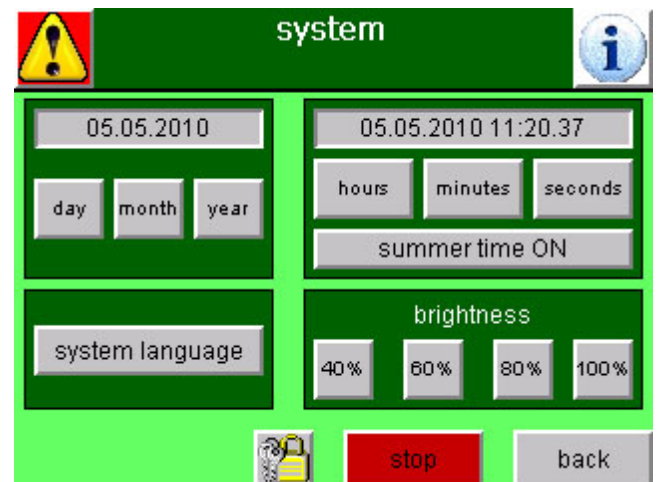
The number in the first column of the "operation message" menu window indicates the message status:

- 1 = the message has appeared
- 0 = the message is no longer relevant (i.e. this operating phase has been completed)

5.6.9 Menu window: "system"

Press  →  to access the "system" menu window.



This window can be used for the basic settings of the display.



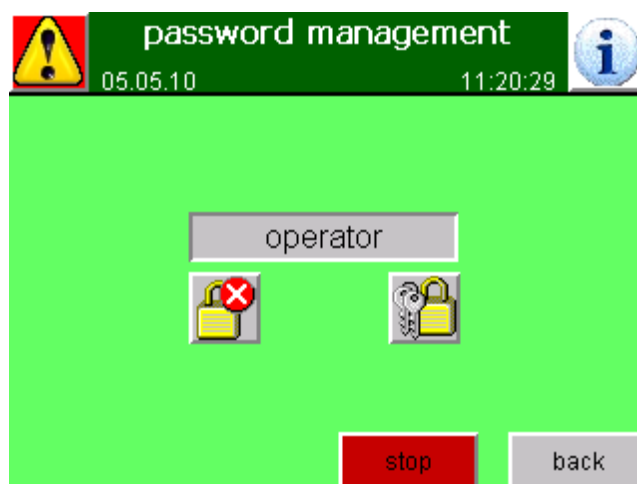
Press  →  →  →  to change the display language to English.

5.6.10 Menu window: "password management"

Press  →  to access the "password management" menu window.

Press  to log in on a password level or press  to log off from the password level.

For further information, please refer to the following pages.



5.7 Operation in the "operator" password level

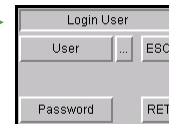
When logging in on the "operator" password level additional functions can be accessed.

5.7.1 Login

Most of the menu windows provide the login option.

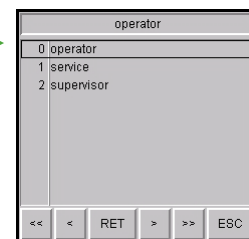
- 1) Press .


The "Login User" password menu appears.



- 2) Press .

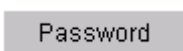
The user menu appears.




- 3) Select "operator" using the arrow keys and press  to select the highlighted user.

Alternatively, press  to quit the menu again.

The screen returns to the "Login User" password menu.

- 4) Press  in the "Login User" password menu.
A keypad appears.




- 5) Enter password "333" and press .

Alternatively, press  to quit the keypad again.

The screen returns to the "Login User" password menu.

- 6) Press  to log in.

Alternatively, press  to quit the password menu again.

The screen returns to the previously displayed menu window.

On the "operator" password level additional functions can be executed. These functions are described in the following.

5.7.2 Time control and dew point control

For a description of time control and dew point control, please refer to → page 20.

On the "operator" password level the **fixed / variable** function field is activated.

Press **fixed / variable** to change between the two cycle modes. The adjacent black field indicates the currently selected cycle mode.

Cycle mode

- "fixed" = time-controlled adsorption phase
- "variable" = dew point-controlled adsorption phase

The **"variable" cycle mode** can only be selected if the optional dew point sensor is connected.



Dew point control: "variable" cycle mode

When the dryer is optimally operated the desiccant is laden with water until the maximum drying capacity is reached. Dew point control enables the desiccant to be optimally laden even with load variations.

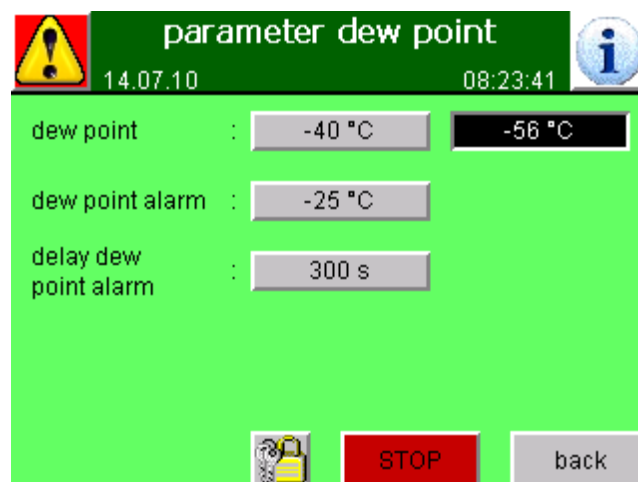
This has numerous advantages:

- A) The entire desiccant is used for the "drying work". This drying work activates the desiccant. The dew point quality is improved and the dryer spare capacity is increased.
- B) Less energy-intensive regeneration cycles have to be performed. The operating costs are reduced considerably.
- C) Effects on the desiccant due to temperature changes are reduced. Service life of the desiccant is increased.

"Fixed" cycle mode is useful in the event of a defective dew point sensor or if vessel switch-over is to be carried out for testing purposes.

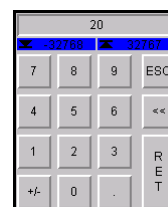
5.7.3 Setting the dew point limit value

On the "operator" password level the function fields for entering the **dew point** limit value and the **dew point alarm** limit value are activated.



- 1) Press or .

A numeric keypad appears.



- 2) Enter a new value and press to apply the new value. When entering the value make sure to enter the negative sign "-" in front of the number.

Alternatively, press to quit the numeric keypad again without changes.



Properly selecting the dew point limit value

The dew point limit value is a fixed control parameter which leads to vessel switch-over when exceeding the limit value. This means that it is not a "control button for setting the desired dew point". Setting a better dew point value does not improve drying performance but leads to an earlier vessel switch-over.

If the dew point limit value is set "too good" (i.e. better than the dryer performance under the given conditions), vessel switch-over and a new regeneration procedure is directly started upon completion of a regeneration phase. This rapid succession of regeneration cycles consumes unnecessary energy and reduces dryer performance.


How to select the **dew point** limit value properly:

- 1) Select a **dew point** limit value that can still be tolerated, however, it must not be worse than -10°C.
- 2) Monitor the development of the dew point measured value for some days of operation.
- 3) Select a **dew point** limit value that is approximately 10°C worse than the dew point that is usually reached, however, it must not be worse than -10°C.
- 4) Select a **dew point alarm** limit value that is at least 10°C worse than the **dew point** limit value.

Operating elements

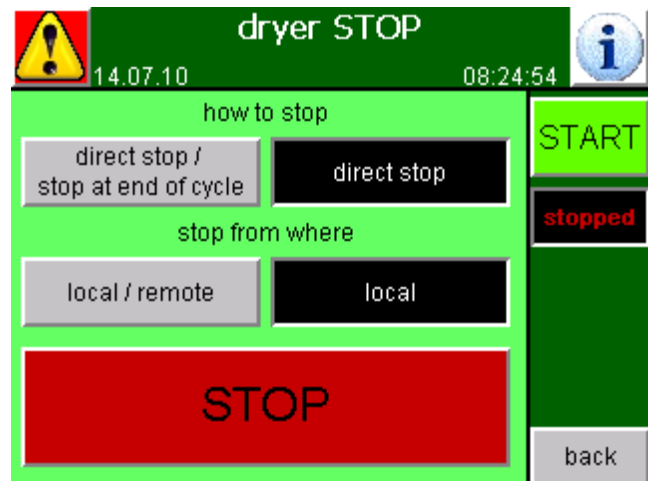
5.7.4 Starting and stopping the dryer locally or remotely

On the "operator" password level remote ON/OFF control can be performed.

Press  to change between the two options. The adjacent black field indicates the currently selected operating mode.

In "remote" control a digital input in the control box of the dryer is activated. The input can be operated by an external signal.

For details on connecting the external signal, please refer to the wiring diagram in the appendix.



If "remote" ON/OFF control is selected, starting and stopping the dryer via the control box is blocked. First, ON/OFF control must be set to "local" again. Then the "Start" and "Stop" functions fields will be activated again.



"Remote" ON/OFF control

If, during no-load operation, there is no flow of compressed air through the dryer for a longer time, the measured dew point value gradually becomes worse. This results in repeated vessel switch-over and regeneration cycles although regeneration is not required. Even if the measured dew point value remains on a good level, vessel switch-over and regeneration are started as soon as the maximum time has elapsed. This type of operation unnecessarily consumes energy.

The "remote" function stops the unnecessary regeneration cycles.

Using an external signal the dryer program can be stopped during no-load operation.

If a compressor is directly assigned to a dryer, the load contact on the compressor can be used as the external signal.

An optimum combination is as follows: "remote" and "stop at end of cycle".

5.8 Control system interfaces

Several interfaces in the control box enable signal exchange between the dryer and a higher-level control system. For details on the signal interfaces, please refer to the wiring diagram in the appendix.

Available signal outputs:

- 4...20 mA signal : Dew point
- 4...20 mA signal : Operating pressure
- Digital signal : Common alarm
- Digital signal : Common warning

Available signal inputs:

- Digital signal : Remote ON/OFF

5.9 Error messages and measures



DANGER ! – Electric voltage

The dryer is operated at electric voltages up to 690 V.

Touching live parts may result in serious injury or death.



Work on electrical components must only be carried out by qualified and authorised personnel. Use a voltage detector to make sure the dryer has been disconnected from the power supply and that there are no live parts before starting maintenance work.



In the event of fire, do not extinguish the fire using water.



CAUTION ! – Qualification and experience required

Persons working on and with the dryer have to be qualified personnel who, because of their qualification and experience, are familiar with handling compressed air systems and electrical systems. If you are not experienced in using these systems, please ask the relevant experts for help. We highly recommend that commissioning and maintenance be carried out by the manufacturer or one of the authorised service partners.

The following tables indicate the possible reasons of the error messages and the dryer reaction to these errors.

In addition, measures for restarting the dryer are listed. Please note that measures in the control box or in other electrical components must only be taken by qualified personnel.

In the event that error messages occur repeatedly, please contact the manufacturer or one of their service partners. The number in the first column is useful for communication purposes.

Please note that often the reasons may only be clearly recognised when looking at several error messages occurring simultaneously or consecutively. Please write down the time of the error messages listed consecutively as well as the operation messages listed during this time. (→ Page 41)

5.9.1 Error messages: alarms

No.	Error message	Indicating sensor Reason / event	Reaction of control system	Measure for restart
1	fault control voltage 24V	<u>Circuit breaker in control box</u> ■ Circuit breaker has triggered ■ Overvoltage ■ Short circuit ■ Open wire in signal loop	■ Program stopped ■ Blower= OFF ■ Heater = OFF ■ V4 and V5 = CLOSED	■ Check voltage ■ Release circuit breaker manually ■ Acknowledge message ■ Start up manually
2	Alarm blower circuit switch	<u>Motor circuit switch in control box</u> ■ Alarm contact on motor circuit switch has opened ■ Blower blocked or throttled ■ Blower runs in wrong direction ■ Overvoltage ■ Short circuit ■ Open wire in signal loop	■ Program stopped ■ Blower= OFF ■ Heater = OFF ■ V4 and V5 = CLOSED	■ Check voltage ■ Release motor circuit switch manually ■ Acknowledge message ■ Start up manually ■ Check regeneration air flow ■ Check direction of rotation of blower (→ page 64) ■ Monitor blower
No.	Error message	Indicating sensor Reason / event	Reaction of control system	Measure for restart

Operating elements

3	alarm heater limiter switch	<u>TS01 : limiter thermostat</u> <ul style="list-style-type: none"> Alarm contact on limiter thermostat opened Regeneration air flow insufficient Blower runs in wrong direction Heater was stopped during heating phase via "direct stop". (→ Page 31) Open wire in signal loop 	<ul style="list-style-type: none"> Program stopped Blower= OFF Heater = OFF V4 and V5 = CLOSED 	<ul style="list-style-type: none"> Press release button manually (→ page 26) Acknowledge message Start up manually Check direction of rotation of blower (→ page 64) Check regeneration air flow Check valve position (→ page 27)
4	runtime error valve V1 / V2	<u>GS01 : final position switch</u> <ul style="list-style-type: none"> Valve runtime of 30 sec exceeded Control pressure too low (→ page 5) Wrong position of valve Loose sensor Loose sensor connector Open wire in signal loop 	<ul style="list-style-type: none"> Program stopped until final position is reached 	<ul style="list-style-type: none"> Check error reason and correct, if required Program restarts automatically after error correction Acknowledge message See "Checking the signal loop" advisory note at the end of this chapter
5	runtime error valve V31	<u>GS031 : final position switch</u> <ul style="list-style-type: none"> Valve runtime of 30 sec exceeded Control pressure too low (→ page 5) Wrong position of valve Loose sensor Loose sensor connector Open wire in signal loop 	<ul style="list-style-type: none"> Program stopped until final position is reached 	<ul style="list-style-type: none"> Check error reason and correct, if required Program restarts automatically after error correction Acknowledge message See "Checking the signal loop" advisory note at the end of this chapter
6	alarm sensor loop PT01	<u>PT01 : pressure sensor</u> <ul style="list-style-type: none"> Loose sensor connector Open wire in signal loop Signal strength not within measuring range Short circuit 	<ul style="list-style-type: none"> During expansion or pressurisation => Program stopped 	<ul style="list-style-type: none"> Check error reason and correct, if required Program restarts automatically after error correction (start-up with 2 min delay) Acknowledge message
7	alarm sensor loop PT02	<u>PT02 : pressure sensor</u> <ul style="list-style-type: none"> Loose sensor connector Open wire in signal loop Signal strength not within measuring range Short circuit 	<ul style="list-style-type: none"> During expansion or pressurisation => Program stopped 	<ul style="list-style-type: none"> Check error reason and correct, if required Program restarts automatically after error correction (start-up with 2 min delay) Acknowledge message
8	alarm sensor loop	<u>MT01 : dew point sensor</u> <ul style="list-style-type: none"> Loose sensor connector Open wire in signal loop Signal strength not within measuring range Short circuit 	<ul style="list-style-type: none"> Program continues in "fixed" cycle mode and remains in "fixed" cycle mode 	<ul style="list-style-type: none"> Check error reason and correct, if required Acknowledge message Variable cycle mode may need to be reselected manually
9	alarm sensor loop TT01	<u>TT01 : temperature sensor</u> <ul style="list-style-type: none"> Loose sensor connector Open wire in signal loop Signal strength not within measuring range Short circuit 	<ul style="list-style-type: none"> Program continues In the event of open wire indication = 850°C and heater OFF Heating is already stopped after min. heating time 	<ul style="list-style-type: none"> Check error reason and correct, if required Acknowledge message
10	alarm sensor loop TT02	<u>TT02 : temperature sensor</u> <ul style="list-style-type: none"> Loose sensor connector Open wire in signal loop Signal strength not within measuring range Short circuit 	<ul style="list-style-type: none"> Program continues In the event of open wire indication = 850°C Cooling is only stopped after max. cooling time 	<ul style="list-style-type: none"> Check error reason and correct, if required Acknowledge message
11	operating pressure too low	<u>PT01 or PT02 * : pressure sensor</u> <ul style="list-style-type: none"> Measured value below min. operation pressure limit value (→ page 39) 	<ul style="list-style-type: none"> Program cannot be started Program stops before vessel switch-over 	<ul style="list-style-type: none"> Compare pressure gauges PI01/PI02 to indication on display Check error reason and correct, if required Program restarts automatically after error correction (start-up with 2 min delay) Acknowledge message

No.	Error message	Indicating sensor Reason / event	Reaction of control system	Measure for restart
12	pres. equal. for changeover not OK	PT01 and PT02 : pressure sensor ■ Max. tol. pressure equalisation limit value exceeded (→ page 38) ■ See also error message no. 18	■ Program stops before vessel switch-over	■ Compare pressure gauges PI01/PI02 to indication on display ■ Check error reason and correct, if required ■ Program restarts automatically after error correction (start-up with 2 min delay) ■ Acknowledge message
13	void			
14	max. expansion time exceeded	PT01 or PT02 **: pressure sensor ■ Maximum expansion time min. time limit reached and expansion pressu limit value still exceeded (→ page 36) ■ Serious leakage to the inside ■ Valve V5 does not open ■ Valve V4 does not close ■ Expansion silencer X1 blocked	■ Program stopped until limit value is reached	■ Compare pressure gauges PI01/PI02 to indication on display ■ Check for leaks and repair, if required ■ Check error reason and correct, if required ■ Program restarts automatically after error correction ■ Acknowledge message ■ See "Checking the signal loop" advi- sory note at the end of this chapter
15	void			
16	automatic start-up interrupted!	<u>Control system</u> When starting up the control system... ■ ... an ***error has been indicated OR ■ ... the dryer has been stopped OR ■ ... remote OFF has been triggered	■ Program cannot be started	■ Switch off control box via main circuit breaker and back on after some seconds ■ Acknowledge message ■ Start up manually
17	void			
18	pressure equalisa- tion not achieved	PT01 and PT02 : pressure sensor ■ Maximum pressurisation time maximum time limit reached and max. tol. pressure equalisation limit value still exceeded (→ page 38) ■ Serious leakage to the outside (e.g. via RV1 or V31 (V32)) ■ Valve V4 does not open ■ Valve V5 does not close	■ Program stopped until limit value is reached	■ Compare pressure gauges PI01/PI02 to indication on display ■ Check for leaks and repair, if required ■ Check error reason and correct, if required ■ Program restarts automatically after error correction ■ Acknowledge message ■ See "Checking the signal loop" advi- sory note at the end of this chapter
19	fault Can Bus	<u>Control system</u> ■ Connection physically interrupted	■ Program stopped ■ Blower= OFF ■ Heater = OFF ■ V4 and V5 = CLOSED	■ Check error reason and correct, if required ■ Acknowledge message ■ Start up manually
20	runtime error valve V32	<u>GS032 : final position switch</u> ■ Valve runtime of 30 sec exceeded ■ Control pressure too low (→ page 5) ■ Wrong position of valve ■ Loose sensor ■ Loose sensor connector ■ Open wire in signal loop	■ Program stopped until final position is reached	■ Check error reason and correct, if required ■ Program restarts automatically after error correction ■ Acknowledge message ■ See "Checking the signal loop" advi- sory note at the end of this chapter
21	No recipe loaded!	<u>Control system</u> ■ No parameter recipe loaded to the control system. Limit values and time limits are not defined.	■ Program stopped ■ Blower= OFF ■ Heater = OFF ■ V4 and V5 = CLOSED	■ Contact manufacturer or service partner
22	alarm has stopped sequence	<u>Control system</u> ■ *** error recognised	■ Reaction corresponds to the error present	■ Check error reason and correct, if required ■ Acknowledge message ■ Start up manually
23	cycle time exceeded	<u>Control system</u> ■ Internal PLC cycle check has negative result	■ Program continues	■ Switch off control box via main circuit breaker and back on after some seconds ■ Acknowledge message ■ Start up manually ■ Check hardware and replace, if re- quired

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No.	Error message	Indicating sensor Reason / event	Reaction of Control system	Measure for restart
24	Pressure implausible	<u>PT01 or PT02 **: pressure sensor</u> <ul style="list-style-type: none"> A pressure higher than 1 bar is present at the "regenerating vessel". Main valve V1/V2 was turned to wrong position (e.g. during maintenance) Pneumatic lines wrongly connected See also No. 14 	<ul style="list-style-type: none"> Program stopped Blower= OFF Heater = OFF V4 and V5 = CLOSED Program cannot be started 	<ul style="list-style-type: none"> Compare pressure gauges PI01/PI02 to indication on display Check valve and correct position, if required (only by service personnel) (→ page 27) Check error reason and correct, if required Program restarts automatically after error correction (start-up with 2 min delay) Acknowledge message See "Checking the signal loop" advisory note at the end of this chapter
25	error hardware configuration	<u>Control system</u> <ul style="list-style-type: none"> Hardware (I/O cards) was requested by control system but not found 	<ul style="list-style-type: none"> Program continues until consequential error occurs 	<ul style="list-style-type: none"> Switch off control box via main circuit breaker and back on after some seconds Acknowledge message Start up manually Check hardware and replace, if required

* = only the sensor on the "adsorbing vessel" is evaluated.

** = only the sensor on the "regenerating vessel" is evaluated.

*** = e.g. 24 V not present / CAN bus error / no recipe / implausible pressure / MCS blower

5.9.2 Error messages: warnings

No.	Error message	Indicating sensor Reason / event	Reaction of Control system	Measure for restart
101	manual operation ON	<u>Control system</u> <ul style="list-style-type: none"> Manual operation has been selected on the "service" password level 	<ul style="list-style-type: none"> Program cannot be started 	<ul style="list-style-type: none"> Switch off manual operation (only by service personnel)
102	automatic sequence start with V31 open	<u>GS031 : final position switch</u> <ul style="list-style-type: none"> Final position reports open valve Valve was turned to wrong position (e.g. during maintenance) Pneumatic lines wrongly connected See also message no. 5 	<ul style="list-style-type: none"> Program cannot be started 	<ul style="list-style-type: none"> Check valve and correct position, if required (only by service personnel) (→ page 27)
103	heating temperature not reached	<u>TT01 : temperature sensor</u> <ul style="list-style-type: none"> Preselected control temp. limit value <u>not</u> exceeded AND Control time limit set reached (→ Page 37) Heating performance inadequate No regeneration air flow 	<ul style="list-style-type: none"> Program continues 	<ul style="list-style-type: none"> Continue to monitor the process Check heating performance, if required (is control temp. set reached during heating process?) (→ Page 37) Check fuses in the control box Check current strength of heater Check regeneration air flow Check other error messages, if required
104	heating end temp. not reached	<u>TT02 : temperature sensor</u> <ul style="list-style-type: none"> Preselected end temperature limit value <u>not</u> exceeded AND Fixed or variable heating time set reached (→ page 37) Heating performance inadequate Regeneration air flow inadequate 	<ul style="list-style-type: none"> Program continues 	<ul style="list-style-type: none"> Continue to monitor the process Check heating performance, if required (is control temp. set reached during heating process?) (→ Page 37) Check fuses in the control box Check current strength of heater Check regeneration air flow Check other error messages, if required
105	cooling end temp. not reached	<u>TT02 (TT01) : temperature sensor</u> <ul style="list-style-type: none"> Preselected end temperature limit value not exceeded AND Max. cooling time limit reached (→ Page 38) Ambient conditions too high (→ page 11) Regeneration air flow inadequate 	<ul style="list-style-type: none"> Program continues 	<ul style="list-style-type: none"> Continue to monitor the process Check regeneration air flow Check ambient temperature and moisture at regeneration gas inlet Check other error messages, if required
106	automatic sequence start with V32 open	<u>GS032 : final position switch</u> <ul style="list-style-type: none"> Final position reports open valve Valve was turned to wrong position (e.g. during maintenance) Pneumatic line mixed up See also message no. 5 	<ul style="list-style-type: none"> Program cannot be started 	<ul style="list-style-type: none"> Check valve and correct position, if required (only by service personnel) (→ page 27)

No.	Error message	Indicating sensor Reason / event	Reaction of Control system	Measure for restart
107	please close valve V3!	<u>GS031 / GS032 : final position switch</u> ■ Final position reports open valve ■ Valve was turned to wrong position (e.g. during maintenance) ■ Pneumatic line mixed up	■ Program cannot be started	■ Check valve and correct position, if required (only by service personnel) (→ page 27)
108	expansion time min. has been set	<u>PT01, PT02 **: pressure sensor</u> ■ An invalid expansion time min. value has been entered and reset automatically (for service possible only)	■ Program continues	No measures required
109	pressurisation time min. has been set	<u>PT01, PT02 **: pressure sensor</u> ■ An invalid pressurisation time minimum value has been entered and reset automatically (for service possible only)	■ Program continues	No measures required
110	sequence stopped	<u>Control system</u> ■ Program was stopped	■ Program stopped	■ Start up manually
111	dew point too high	<u>MT01 : dew point sensor</u> ■ Dew point limit value exceeded (→ page 40) ■ Previous error ■ Error no. 104 or no. 105 has been reported previously ■ Dryer overload due to excessive entry conditions (→ page 11) ■ Inadequate regeneration due to excessive ambient conditions (→ page 11) ■ Measuring error of dew point sensor ■ Condensate entry into the dryer due to defective pre-filtration ■ Contaminated or aged desiccant ■ Control temp. not reached during heating (→ page 37) ■ See also "Pre-dried compressed air" advisory note (→ page 9)	■ Program continues	Usually, this error message is a consequential error. ■ Check previous error messages ■ Check compressed air entry conditions ■ Check ambient conditions ■ Check sensor calibration (calibration once a year is recommended) ■ Check filter upstream of dryer ■ Check desiccant for contamination and replace, if required ■ Check heating parameters ■ Continue to monitor the process
112	alarm vessel change-over 1/2	<u>PT01, PT02 : pressure sensor</u> ■ Max. tol. pressure equalisation limit value exceeded (→ page 38) See also error no. 18 ■ Measured value below min. operation pressure limit value (→ page 39) See also error no. 11 ■ Error in sensor loop PT01, PT02 See also errors no. 6 and no. 7	■ Program stopped	■ Compare pressure gauges PI01/PI02 to indication on display ■ Check error reason and remove, if required ■ Program restarts automatically after error removal (start-up with 2 min delay) ■ Acknowledge message
113	cooling temperature too high	<u>TT02 TT01 : temperature sensor</u> ■ Control temp. limit value exceeded (→ page 38) ■ Ambient conditions too high (→ page 11) ■ No regeneration air flow	■ Program continues	■ Continue to monitor the process ■ Check regeneration air flow ■ Check ambient temperature at regeneration gas inlet ■ Check other error messages, if present
114	expansion can't be finished	<u>PT01, PT02 **: pressure sensor</u> ■ Error in sensor loop PT01, PT02	■ Program stopped until signal returns and limit value is reached	■ Check signal from pressure sensor and remove error, if required ■ Program restarts automatically after error removal
115	pressurisation can't be finished	<u>PT01, PT02 **: pressure sensor</u> ■ Error in sensor loop PT01, PT02	■ Program stopped until signal returns and limit value is reached	■ Check signal from pressure sensor and remove error, if required ■ Program restarts automatically after error removal

* = only the sensor on the "adsorbing vessel" is evaluated.

** = only the sensor on the "regenerating vessel" is evaluated.



Checking the signal loop

A valve not moving to the correct position is often caused by an interruption of the signal loop controlling the valve and not by the valve itself. For troubleshooting, please check each step within the signal loop:

- 1) Check the valve position (→ page 27).
- 2) Check the desired state of the valve in the "status" menu window (→ page 35).
- 3) Check the LED on the output card of the control system.
- 4) Check the LED on the pilot valve terminal.
- 5) Check the control pressure signal for the valve actuator.

6. Transportation, setting up and storage

6.1 Transportation



DANGER ! – Damage

Damages of the dryer may lead to unpredictable hazardous situations.
Operating a damaged dryer may result in serious injury or death.
Never start to operate a damaged dryer.



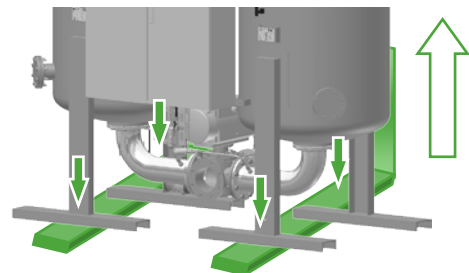
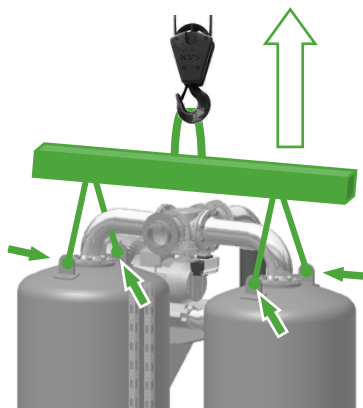
DANGER ! – Risk of tilting

The centre of gravity is in the upper part of the dryer.
Tilting of the dryer may result in serious injury or death.
During transport and during loading and unloading secure the dryer against tilting using the lifting lugs.

Although great care is taken damages caused by transportation cannot be ruled out. Therefore, always check the dryer for possible damages after transportation and packaging removal.

The haulage contractor and the manufacturer or the sales partner must immediately be informed about any damage.

- Make sure to provide adequate lifting equipment when transporting and loading or unloading the dryer.
- Persons responsible for transportation must be appropriately qualified.
- The dryer must only be lifted at the appropriate points using lifting equipment. (Transport pallet; base frame; support feet; lifting lugs at the top of the vessel) (→ see Figure).
- Transport the dryer in upright position. Horizontal transportation may lead to mixing of the different desiccant layers thus causing malfunctions. Please contact the manufacturer first if the dryer needs to be tilted for transportation.
- Take the dryer weight and the maximum allowable load of the lifting and transport equipment used into account.
- Do not remove the packaging material until the dryer is moved to its final place of installation.
- The national regulations for accident prevention must be adhered to.



6.2 Setting up

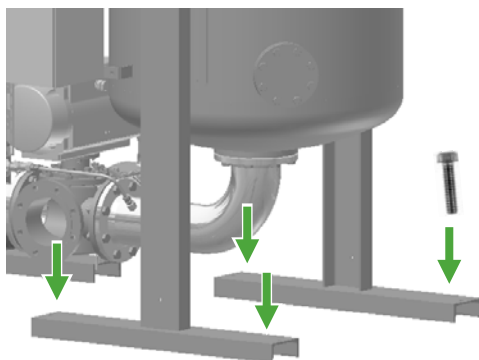
Please refer to section "Description of application" (→ page 9). Here, you will find a list of requirements on the installation site.

Important data of the dryer can be found in section "Technical data" (→ page 11).

Additional requirements on the installation site:

- The ground for dryer installation must be level and capable to carry heavy loads. Ground irregularities must be levelled in order for tensional forces not to occur in the piping of the dryer. When calculating the total weight, please take the additional load during a hydrostatic pressure test into account. The volume information on the vessel helps when calculating the additional weight.
- Because of noise emissions the installation site should not be in the vicinity of stationary workplaces.
- Keep a service distance to walls and other systems around the dryer of 1 m, minimum.
- During maintenance of the dryer components lifting equipment with adequate load capacity should be available and access of this equipment to the dryer must be ensured.
- The place of installation should not be in the vicinity of hallways in order to avoid risks to inexperienced persons.
- Set up the dryer such that the pressure gauge and the control system are clearly visible and can be operated properly.

We recommend anchoring the dryer into the ground using the holes in the vessel supports.



6.3 Storage

To maintain the dryer quality the dryer must be stored at a suitable location and properly prepared for storage.

The place of storage has to fulfil the following requirements:

- Indoors
- Protected against weather impact
- Frost-free
- Dry

If the dryer is to be stored immediately after delivery, it must only be protected against dust using an additional cover.

If the dryer has already been used for drying compressed air, please proceed as follows:

- 1) Disconnect the compressed air flow from the dryer.
- 2) Perform a regeneration procedure for each vessel without compressed air flowing through the dryer. This ensures the dryer to be stored with dry vessels.
- 3) Decommission the dryer. (→ Page 66)
- 4) Depressurise the dryer. (→ Page 67)
- 5) Disconnect the dryer from the electrical supply.
- 6) Disconnect the dryer from the compressed air system.
- 7) Close the inlets and outlets of the dryer using flange covers.
- 8) Place a desiccant bag in the control box and in the junction box of the heater.
- 9) Protect the dryer against dust using a cover.

To recommission the dryer after storage, please proceed as described for initial commissioning. (→ Page 60)



CAUTION ! – Moisture in electrical components

Long-term storage may lead to penetration of moisture into electrical components. This may result in short circuits or damages to these components.

Check the electrical dryer components for internal moisture.

The necessary actions must only be performed by a qualified electrician.

- Prior to commissioning an insulation resistance test must be carried out on the electric heater and on the blower motor.
- The insulation resistance to earth and between the individual phases must be checked.
- At a test voltage of 500 V the insulation resistance must not be below 25 kΩ.
- In the event the insulation resistance is too low, measures for drying the components must be taken. Please contact the manufacturer or one of the service partners.

7. Installation

7.1 Installing the connecting pipelines

**DANGER ! – Overpressure**

The dryer is under pressure.

Suddenly escaping compressed air may result in serious injury.

Do not carry out mechanical or electrical work on the dryer as long as the dryer is under pressure.

**DANGER ! – Overload**

The dryer must only be operated with compressed air within the maximum allowable operating conditions. The operating conditions are defined on the type plate (→ page 13).

Exceeding the maximum allowable operating conditions may result in serious injury or death.

It is the duty of the operator to ensure that the connected pressure source is safe-guarded such that the maximum allowable operating pressure (PS) and the maximum allowable temperature (TS) are not exceeded.

Please also refer to section “Intended use” (→ page 9).

**CAUTION ! – Hot exhaust air flow**

Hot air escapes from the regeneration air outlet. The surface of the exhaust air duct may reach temperatures above 150°C. Unprotected touching of this surface may cause burns.

The installation room temperature will rise when not using an exhaust air duct.

Install an exhaust air duct out of reach of persons.

**DANGER ! – Bursting components due to external forces**

The dryer components are not designed for externally applied forces and may burst due to additional load impact.

Bursting, pressure-bearing components may result in serious injury or death.

The support required for the connected pipelines has to be provided by the customer. Transmission of loads or stress into the connection flanges of the dryer is not permissible.

Proper installation is required for safe and error-free operation of the dryer.

Please observe the following steps when installing the compressed air pipeline (4) + (6):

- Make sure that the dryer and the compressed air system are free from pressure. If the compressed air system has to remain under pressure during installation, the shut-off valves have to be protected against unintentional opening. (2) + (8)
- The compressed air source (e.g. compressor) must be safe-guarded against exceeding of the maximum allowable operating pressure using safety equipment.
- The compressed air pipelines must be provided with shut-off valves used for disconnecting the dryer from the piping system (2) + (8). We recommend using shut-off valves with continuous opening behaviour (e.g. shut-off valves with gear handwheel). This behaviour avoids sudden pressure equalisation between the piping sections.
- We recommend using a bypass line (11) around the dryer.
- The pipelines must be suitable for use with the maximum possible operating pressure.

- The transfer points (flanges) have to be compatible to the dryer inlet and outlet with regard to nominal width, nominal pressure and type. (→ See general arrangement drawing in the appendix)
- Any vibrations or pulsation must not be transmitted to the dryer via the piping. This may damage the desiccant, the dryer control system or other components. If required, install compensators or pulsation absorbers in the pipelines to be connected.
- Wet pipelines upstream of the dryer (4) should be installed at a slope in order for condensate (water and oil) in the line to be discharged in flow direction. If installation of an upright pipeline is inevitable, a condensate drain must be provided at the lowest point of the pipeline. This avoids condensate from being accumulated in the pipeline and suddenly being swept away by the compressed air flow. These kinds of water shocks may damage the filter and dryer and must be avoided.
- Prior to closing the connected pipelines, please check that there are no objects or contaminations left in the pipelines.
- Remove the end caps from the dryer inlet and outlet.
- When checking the installation for leaks the maximum allowable operating pressure of the dryer must not be exceeded. (→ See specification on the type plate, page 13)
Never fill the dryer with water when performing a pressure test. Liquids will destroy the desiccant!

Please observe the following steps when installing the exhaust air duct (14):

- The nominal width of the exhaust air duct (15) should be at least the nominal width of the compressed air connections (GJ/GO).
- The exhaust air ranges from warm and humid to hot. An aggressive condensate may be produced in longer exhaust air ducts. Use corrosion-resistant materials. Install the exhaust air ducts at a slight slope towards the outlet (16). If required, a condensate drain must be provided at the lowest point of the exhaust air duct.
- The exhaust air duct (15) must not throttle the exhaust air flow. Reduced regeneration volume flow results in slow and sometimes inadequate regeneration. This may lead to reduced dryer performance and damage of the desiccant. Make sure that the pressure loss is low when designing the exhaust air duct. The pressure loss in the exhaust air duct must not exceed 20 mbar.
- The end of the exhaust air duct (16) must be installed such that rain may not enter the duct.
- The exhaust air duct (15) will become very hot. Install the exhaust air duct out of reach of persons. As an alternative, the exhaust air duct may be provided with a thermal insulation. Make sure that the outlet (16) of the exhaust air duct is installed in such a way that persons are not at risk and will not be affected.
- Install a protection grid against small animals on the outlet of the exhaust air duct (16).

Usually, the regeneration air is drawn in from the environment directly on the dryer. If the ambient air at the place of installation contains dust, moisture or aggressive contamination, the regeneration air must be drawn in from the outside. For this purpose an intake nozzle (17) can be provided on the dryer. (See section "Options" page 24)

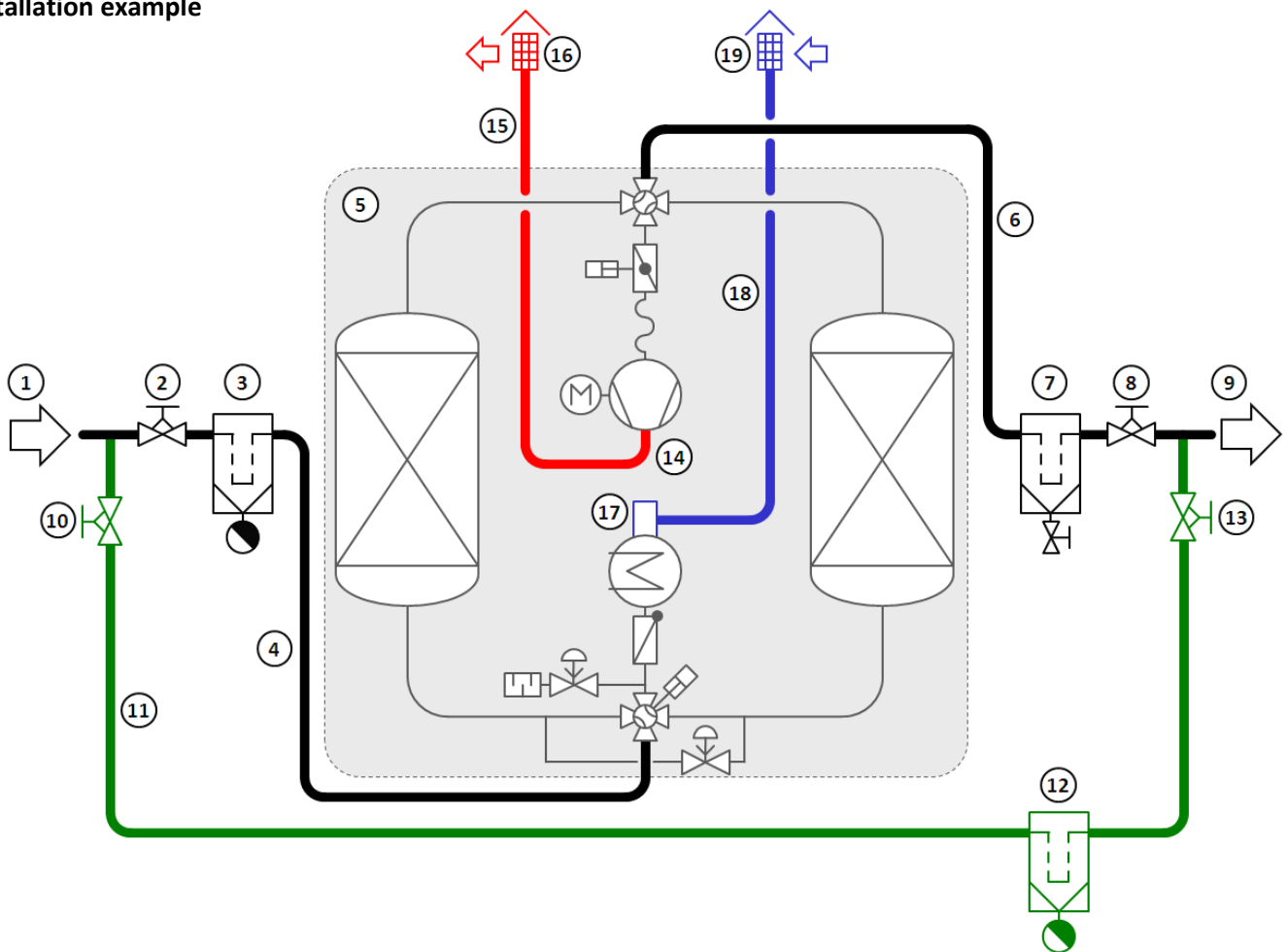
Please observe the following steps when installing the intake duct:

- The nominal width of the intake duct (18) should be at least the nominal width of the compressed air connections (GJ/GO).

Installation

- The intake duct (18) must not throttle the exhaust air flow. The sum of the pressure loss in the intake duct and exhaust air duct must not exceed 20 mbar.
- The end of the exhaust air duct must be installed such that rain may not enter the duct. (19)
- Install a bird protection grid on the outlet of the exhaust air duct. (19)
- Make sure that the end of the exhaust air duct and of the intake duct is installed in such a way that exhaust air (16) cannot flow back in the intake duct (19).

Installation example



- | | |
|---|---|
| 1 Compressed air inlet | 11 Bypass line |
| 2 Valve at compressed air inlet | 12 Bypass filter with condensate drain |
| 3 Upstream filter with condensate drain | 13 Bypass valve at outlet |
| 4 Compressed air pipeline at inlet | 14 Exhaust air outlet on blower |
| 5 Dryer | 15 Exhaust air duct |
| 6 Compressed air pipeline at outlet | 16 Exhaust air outlet with bird protection grid and rain protection |
| 7 Downstream filter with manual drain | 17 Intake nozzle for regeneration air (option) |
| 8 Valve at compressed air outlet | 18 Intake duct |
| 9 Compressed air outlet | 19 Exhaust air inlet with bird protection grid and rain protection |
| 10 Bypass valve at inlet | |

Please note that the scope of supply only comprises the dryer (5). Items (3), (7), (12) and (17) can be purchased optionally. All the other items have to be provided by the customer.

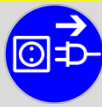
7.2 Installing the power supply



DANGER ! – Electric voltage

The dryer is operated at electric voltages up to 690 V.

Touching live parts may result in serious injury or death.



Work on electrical components must only be carried out by qualified and authorised personnel. Use a voltage detector to make sure the dryer has been disconnected from the power supply and that there are no live parts before starting maintenance work.



In the event of fire, do not extinguish the fire using water.



CAUTION ! – Qualification and experience required

Persons working on and with the dryer have to be qualified personnel who, because of their qualification and experience, are familiar with handling compressed air systems and electrical systems. If you are not experienced in using these systems, please ask the relevant experts for help. We highly recommend that commissioning and maintenance be carried out by the manufacturer or one of the authorised service partners.



DANGER ! – Moisture and contamination in electrical components

Moisture and contamination in electrical components may lead to damages resulting in unpredictable dangers for the operating personnel. As a consequence, short circuits and faulty circuits may occur.

Always keep the control box and the terminal box dry and free from contamination and foreign bodies.

Make sure the control box and the terminal box are securely closed during operation.



Qualified electrician required

Electrical connection of the dryer must only be carried out by a qualified electrician who is familiar with reading electro-technical documentation.

The dryer is supplied centrally with voltage via one connection point in the control box. All the internal control voltages are produced in the control box using transformers.

For the data required for connecting and securing the voltage supply, please refer to the wiring diagram (→ see appendix: wiring diagram – page: "cover sheet 2" (top left) and page: "power supply").



Communication interfaces

The dryer is provided with different signal inputs and outputs for dryer control and dryer monitoring. These communication interfaces are used to implement improved monitoring and economical operation of the dryer. For the interfaces, please refer to the wiring diagram (→ see appendix). Please also see section "Control system interfaces" (→ page 46).

8. Commissioning



CAUTION ! – Qualification and experience required

Persons working on and with the dryer have to be qualified personnel who, because of their qualification and experience, are familiar with handling compressed air systems and electrical systems. If you are not experienced in using these systems, please ask the relevant experts for help. We highly recommend that commissioning and maintenance be carried out by the manufacturer or one of the authorised service partners.

8.1 Requirements for initial commissioning

All the requirements for unhindered commissioning must be fulfilled, especially when commissioning is carried out by external qualified personal.

Make sure the following requirements for initial commissioning have been fulfilled:

- External qualified personnel have been informed about the commissioning date in good time (2 weeks in advance, minimum).
- External qualified personnel have been informed about the following in good time: special local conditions; site-specific safety guidelines; required safety instructions, if necessary; specially required qualifications, if necessary; special personal protective equipment.
- The place of installation can be freely accessed and entered without any risks.
- Neighbouring construction sites do not affect commissioning.
- The dryer is connected to the compressed air system using pipelines. (→ Page 56)
- The dryer is connected electrically and voltage supply is ensured. (→ Page 59)
- The compressor is ready to operate and personnel for starting and operating the compressor are present.
- Compressed air can be delivered to the downstream system. A volume flow rate of at least 40% of the nominal dryer performance can be led through the dryer.
- The dryer is classified pressure equipment (see declaration of conformity in the appendix). Prior to commissioning the dryer has to be approved by the local authorities according to the applicable national regulations. In the EU, the Pressure Equipment Directive 97/23/EC has to be observed.

Please check the following directly before commissioning:

- The operating limits must not be exceeded. (→ Page 9)
- The main circuit breaker is set to "0-OFF" and the control box is disconnected from the voltage supply. (→ Page 26)
- The shut-off valves provided by the customer and located upstream and downstream of the dryer are closed.
- The connections may have become loose due to dryer transportation. Make sure the piping connections, screwed joints and pneumatic lines are tightly secured. Tighten loose connections using the appropriate tools.
- Make sure the cable clamps in the control box are tightly secured. Tighten all the screw connections using the appropriate tools.

- Check all the components for visible damages. If there are defective components, commissioning of the dryer is not permitted.

**CAUTION ! – Moisture in electrical components**

Long storage may lead to penetration of moisture into electrical components. This may result in short circuits or damages to these components.

Check the electrical dryer components for internal moisture.

The necessary actions must only be performed by a qualified electrician.

- Prior to commissioning an insulation resistance test must be carried out on the electric heater and on the blower motor.
- The insulation resistance to earth and between the individual phases must be checked.
- At a test voltage of 500 V the insulation resistance must not be below 25 k Ω .
- In the event the insulation resistance is too low, measures for drying the components must be taken. Please contact the manufacturer or one of the service partners.

8.2 Starting the dryer



DANGER ! – Overpressure

The dryer is under pressure.

Suddenly escaping compressed air may result in serious injury.

Do not carry out mechanical or electrical work on the dryer as long as the dryer is under pressure.



DANGER ! – Electric voltage (2;6;8)

The dryer is operated at electric voltages up to 690 V.

Touching live parts may result in serious injury or death.

Work on electrical components must only be carried out by qualified and authorised personnel. Use a voltage detector to make sure the dryer has been disconnected from the power supply and that there are no live parts before starting maintenance work.

In the event of fire, do not extinguish the fire using water.



WARNING ! – Hot surfaces

The surfaces of the vessels and pipes may reach temperatures above 150°C.

Unprotected touching of this surface may cause burns.

Avoid direct contact to these surfaces. Restrict access to the surfaces, if necessary, or install thermal insulation on the hot components. (→ Page 24)

Never store inflammable parts and material in the vicinity of the dryer.



WARNING ! – Risk of crushing

The cardan shaft will automatically turn by 90° approximately every 6 hours. Touching the cardan shaft may cause parts of the body to be injured or twisted.

Do not hold on to the cardan shaft. Do not put your hand into the link joint of the cardan shaft.



WARNING ! – Suddenly escaping pressure

The dryer is depressurised approximately every 6 hours using a silencer. A loud and strong air-stream may carry small particles and cause injury.

Do not place any equipment in the vicinity of the silencer. The silencer must not be manipulated or removed. Always wear hearing protectors when working in the vicinity of the dryer.



CAUTION ! – Hot exhaust air flow

Hot air escapes from the regeneration air outlet. The surface of the exhaust air duct may reach temperatures above 150°C. Unprotected touching of this surface may cause burns.

The installation room temperature will rise when not using an exhaust air duct.

Install an exhaust air duct out of reach of persons.

If all conditions required for commissioning are fulfilled, the commissioning procedure can be started. Perform the following steps in the listed order.

8.2.1 Pressurisation of the dryer

**CAUTION ! – Pressure blows and overload**

Rapid opening of the valves may cause pressure blows and increased flow rates in the dryer. Pressure blows and increased flow rates may lead to damages of the dryer.



Open the valves **very slowly** and make sure that the flow noise does not become too loud. Pay special attention when opening valves that can be opened rapidly by means of a pivoting movement.

The dryer valves are controlled by compressed air which is supplied from inside the dryer. For this reason the first requirement for commissioning is reaching a minimum pressure of 4 bar in the dryer. Pressurise the dryer as follows:

- 1) Make sure the pressure gauges and pressure sensors are connected to the vessels. (→ Page 27)
- 2) Make sure the compressed air system upstream of the dryer inlet is under pressure. If necessary, the compressor must be started.
- 3) Open the valve upstream of the dryer inlet **very slowly** until hearing the first clear flow noise. Stop the procedure when the flow noise becomes loud.
- 4) Observe the vessel pressure gauges. Pressurisation can be monitored on one of the two pressure gauges. Make sure the pressure is only rising slowly. Pressurisation speed may not exceed 2 bar/min.
- 5) Check the system for leaks during pressurisation. In the event of leaks, pressurisation must be stopped and the leaks must be repaired. To repair the leaks the dryer has to be depressurised again. (→ Page 67)
- 6) If flow noise and a pressure increase is no longer present when further opening the valve, it can be opened completely.

8.2.2 Opening the outlet valve

Special attention must be paid if the compressed air system downstream of the dryer is free from pressure.

- 1) Open the valve downstream of the dryer outlet **very slowly** until hearing the first clear flow noise.
- 2) Observe the vessel pressure gauges. Make sure there is no sudden pressure drop in the vessel. The vessel pressure may not drop for more than 1 bar.
- 3) If flow noise is no longer present when further opening the valve, it can be opened completely.
- 4) Air can now freely flow through the dryer. If a volume flow is to be transferred via the dryer, commissioning should be performed quickly or the valve downstream of the dryer outlet should be closed again, in order for the dryer not to be overlaid with moisture during standstill.

**Automatic start-up device**

In the event the dryer is frequently started against a pressureless compressed air system, we recommend using an automatic start-up device. (→ Page 24)

The automatic start-up device prevents pressure blows and increased flow speeds from occurring even when the compressor is started automatically.

8.2.3 Checking the direction of rotation of the blower



WARNING ! – Solid particles in outgoing regeneration air

During blower operation solid particles may be expelled from the regeneration air outlet on the blower. There is a risk of eye and skin injuries as long as the exhaust air duct has not been installed.

Never look into the regeneration air outlet during blower operation.

The blower motor is supplied with current from three phases (L1, L2, L3). Depending on the sequence of the phases, the motor either rotates right or left. If the motor rotates in the wrong direction, regeneration cannot be performed and the electric heater may be damaged.

Check the blower for the correct direction of rotation as shown in the figure:

- 1) Prior to starting, please read the following action steps and section "Starting and stopping the dryer control system" (→ page 31).

The steps will have to be carried out quickly one after the other to be able to stop the program again rapidly when the motor rotates in the wrong direction. If the blower rotates in the wrong direction for some time, the electric heater may be overheated and damaged.

- 2) Set the main circuit breaker to the "I-ON" position. (→ Page 26)

The initialisation sequence runs on the touch panel until the main menu is shown.

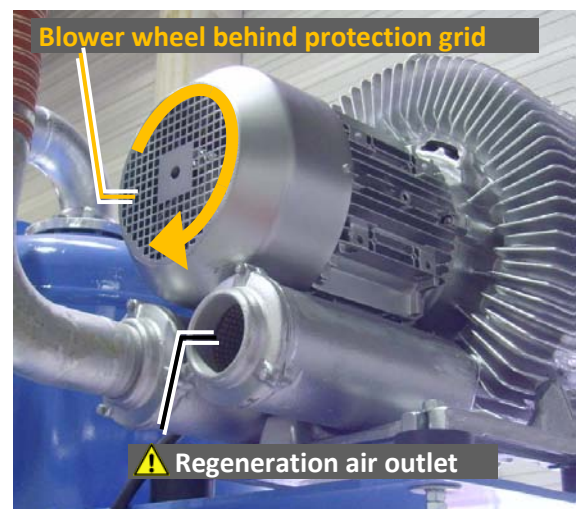
- 3) Start up the dryer as described in section "Starting and stopping the dryer control system".

Depending on the phase in which the dryer was stopped previously, it may take some minutes until the dryer is in the heating phase and the blower starts running.

- 4) As soon as the blower starts running immediately stop the dryer program as described in section "Starting and stopping the dryer control system".

The blower will continue to run for some seconds until the dryer control system switches off the blower.

- 5) Take a look at the blower wheel of the motor. If the blower wheel rotates in the direction shown in the figure, commissioning can be continued. If the blower wheel rotates in the wrong direction, the following steps need to be carried out.



8.2.4 Correcting the direction of rotation of the blower

**DANGER ! – Electric voltage (2;6;8)**

The dryer is operated at electric voltages up to 690 V.

Touching live parts may result in serious injury or death.

Work on electrical components must only be carried out by qualified and authorised personnel. Use a voltage detector to make sure the dryer has been disconnected from the power supply and that there are no live parts before starting maintenance work.

In the event of fire, do not extinguish the fire using water.

- 1) Set the main circuit breaker to the "0-OFF" position and secure it against unintentional reclosing. (→ Page 26)
- 2) Exchange two phases of the power supply with one another (e.g. from L1;L2;L3 to L2;L1;L3)
- 3) Carry out the steps again described in the above section.

If the blower wheel rotates in the direction shown in the figure, commissioning can be continued.

8.2.5 Starting the dryer program

- 1) Make sure the dryer is under pressure and that all the valves upstream and downstream of the dryer are opened in order for the compressed air to be able to flow through the dryer.
- 2) Set the main circuit breaker to the "I-ON" position. (→ Page 26)
The initialisation sequence runs until the main menu is shown.
- 3) Start up the dryer as described in section "Starting and stopping the dryer control system". (→ Page 31)
- 4) Acknowledge any alarm messages, if required.
- 5) If any alarm messages are present that cannot be acknowledged, please proceed as described in section "Error messages and measures". (→ Page 46)
- 6) If there are no additional alarm messages, the dryer has been commissioned properly.

Monitor dryer operation. The dryer now performs the phases described in section "Function description". (→ Page 20)

9. Shutting down and restarting the dryer

9.1 Shutting down the dryer in case of emergency

- 1) Set the main circuit breaker to the "0-OFF" position. (→ Page 26)
- 2) Close the valves upstream and downstream of the dryer.
- 3) The dryer has now been shut down.



Possible damage to the electric heater

The dryer may only be shut down using the main circuit breaker if immediate dryer standstill or immediate disconnection from the power supply is required.

9.2 Stopping the dryer

- 1) Stop the dryer as described in section "Starting and stopping the dryer control system".
- 2) Wait until the blower has stopped and the "stopped" operation message is displayed.
- 3) Compressed air must no longer flow through the dryer. Otherwise, it is overladen with moisture. Indication on the touch panel is still active. The dryer can be restarted at any time.

Please note that the dew point becomes worse after a certain standstill period. Worsening of the dew point is not a dryer error but is caused by external moisture slowly penetrating the static volume in the piping. As soon as the compressed air flows again, the dew point will also become better again.

9.3 Shutting down the dryer

- 1) Stop the dryer as described in the above section.
- 2) Set the main circuit breaker to the "0-OFF" position. (→ Page 26)
- 3) Close the valves upstream and downstream of the dryer.
- 4) The dryer has now been shut down.
- 5) Prior to working on the dryer it has to be depressurised.

9.4 Depressurising the dryer



WARNING ! – Exhausting pressure

Compressed air exhausting to the outside is very loud and may carry small particles. This may cause hearing damage as well as injuries of the eyes and of the skin.



Close the openings used for releasing the pressure by means of a silencer suitable for the pressure.

Open the valves for releasing the pressure only **very slowly**.



Always wear eye and hearing protectors when working in the vicinity of the dryer.

- 1) Close the valves upstream and downstream of the dryer.
- 2) Open the valve on the downstream filter. (→ Page 56)
- 3) Monitor the pressure on the pressure gauges of the dryer.
- 4) Wait until the pressure has dropped to 0 bar on both pressure gauges.
- 5) Wait until hot dryer components have cooled down prior to starting maintenance work.
- 6) For valve maintenance the pilot valve terminal and the valve actuators will also need to be depressurised. (→ Page 5)

9.5 Restarting the dryer

Please proceed as described in chapter "Commissioning". (→ Page 60)

If the relevant requirements have already been fulfilled, the corresponding steps of the chapter can be skipped.

10. Maintenance and repair

**DANGER ! – Overpressure**

The dryer is under pressure.

Suddenly escaping compressed air may result in serious injury.

Do not carry out mechanical or electrical work on the dryer as long as the dryer is under pressure.

**DANGER ! – Electric voltage**

The dryer is operated at electric voltages up to 690 V.

Touching live parts may result in serious injury or death.

Work on electrical components must only be carried out by qualified and authorised personnel.

Use a voltage detector to make sure the dryer has been disconnected from the power supply and that there are no live parts before starting maintenance work.

In the event of fire, do not extinguish the fire using water.

**WARNING ! – Hot surfaces**

The surfaces of the vessels and pipes may reach temperatures above 150°C.

Unprotected touching of this surface may cause burns.

Avoid direct contact to these surfaces. Restrict access to the surfaces, if necessary, or install thermal insulation on the hot components. (→ Page 24)

Never store inflammable parts and material in the vicinity of the dryer.

**CAUTION ! – Qualification and experience required**

Persons working on and with the dryer have to be qualified personnel who, because of their qualification and experience, are familiar with handling compressed air systems and electrical systems. If you are not experienced in using these systems, please ask the relevant experts for help. We highly recommend that commissioning and maintenance be carried out by the manufacturer or one of the authorised service partners.

Please observe the following requirements for maintenance:

- Observe the notes in section "Intended use". (→ Page 9)
- Observe the "Safety notes" and the "General safety notes" in particular. (→ Pages 13, 15)
- Provide the required spare parts. Only use genuine spare parts of the manufacturer. The manufacture provides prepared spare part packets. (→ Page 5)
- Maintenance must only be carried out if the dryer is depressurised and disconnected from the power supply.
- Wait until hot components have cooled down. We recommend stopping the dryer using the "stop at end of cycle" function. (→ Page 31)

Please observe the following when completing maintenance work:

- Make sure that all the flange connections and screwed joints are tight and sealed.
- Carry out a leak test.
- Make sure not to forget any tools, detergents or other objects in and around the dryer.
- Commission the dryer as described on → page 60.



Maintenance contract

It is possible to conclude a maintenance contract with the manufacturer or one of their service partners. A maintenance contract guarantees that the dryer has been maintained regularly by qualified personnel and that only genuine spare parts are being used.

For contact data, please refer to → page 5.

For communication purposes, please specify the type and the manufacturing number. This information can be found on the type plate on the control box of the dryer. (→ Page 13)

10.1 Regular maintenance intervals

Component	Maintenance activity	Every day	Every month	Every 12 months	Every 2 years	Every 4 years	See page
Dryer and dryer control system	Visual check and function monitoring	■					70
Protection grid (S3) on the heater (H1)	Clean		■				70
Dryer and dryer control system	Clean		■				70
Control box	Check if cable and terminals are securely fixed			■			70
Dew point sensor (MT01)	Calibration required			■			71
Instrument air filter	Replace filter element			■			71
Upstream and downstream filters	Replace filter element			■			71
Expansion silencer (X1)	Replace			■		■ *	71
Blower (M1)	Check/maintain shaft bearing				■		72
Valves (V4, V5)	Replace sealing set				■		73
Strainer basket (SB1, SB2)	Clean					■ *	73
Desiccant	Check/replace					■ *	73
Regeneration air valve	Replace rubber valve seat					■ *	75
Non-return valve (RV1)	Replace non-return valve					■ *	75

* = These activities should be carried out at the same time.

10.1.1 Visual check and function monitoring

- 1) Check the dryer for external damages.
- 2) Check the operating parameters of the incoming compressed air (pressure and temperature in particular). (→ Page 11)
- 3) Check the individual components for unusual noise development and leaks.
- 4) Check the error messages on the touch panel and, if required, proceed as described in section "Alarm messages". (→ Page 46)
- 5) Check if the condensate drains on the compressor and on the upstream filters are working properly.
- 6) Check the dew point.

10.1.2 Cleaning the protection grid

The ambient air is drawn in via the protection grid. Dust and small particles in the ambient air may clog the protection grid and thus the regeneration air flow is throttled. Therefore, the protection grid must be cleaned regularly.

- 1) Wait until the blower has stopped moving and regeneration air is no longer drawn in.
- 2) Remove any contamination from the protection grid using a cloth or a soft wire brush. Do not use inflammable detergents!
- 3) Make sure that the openings in the protection grid are free from contamination.



Heavily contaminated ambient air

If the ambient air at the place of installation contains dust, moisture or aggressive contamination, the regeneration air must be drawn in from the outside. (→ Page 24)
As an alternative, an intake filter can be used. (→ Page 24)

10.1.3 Cleaning the dryer and dryer control system

Make sure the surroundings are clean and tidy.

- 1) Clean the dryer surface using a slightly moist cloth. Do not use detergents containing acids or solvents.
- 2) Make sure the operating elements and the type plates can always be clearly read.
- 3) Keep water and metallic dust away from the electrical components.

10.1.4 Checking if cable and terminals are securely fixed

The cable connections may be loosened due to transportation or vibrations. To prevent malfunctions from occurring, all the cable connections must be checked to ensure that they are securely fixed. In the event of heavy vibrations, inspection must be carried out more frequently. The necessary actions must only be performed by a qualified electrician.

- 1) Decommission the dryer. (→ Page 66)
- 2) Depressurise the dryer. (→ Page 67)
- 3) Disconnect the electrical supply line from the dryer and protect it against unintentional reconnection.
- 4) Make sure the cables and terminals are securely fixed by tightening them, if required.

Only use tools approved for electrical work.

- 5) Replace any damaged or corroded components.
- 6) After the control box has been reclosed, the dryer can be recommissioned again.

10.1.5 Calibrating the dew point sensor

The dew point sensor (MT01) is subject to ageing which leads to inaccurate measurements over time. Oil vapour and other contamination may render the sensor unusable over time. To prevent operating errors from occurring the dew point sensor must be calibrated regularly.



Delicate dew point sensor

The dew point sensor contains a very delicate electronic system. Vibrations and shocks may lead to sensor damage. Handle the sensor with particular care.

- 1) Decommission the dryer. (→ Page 66)
- 2) Depressurise the dryer. (→ Page 67)
- 3) Loosen the screw at the sensor cable socket and remove the cable socket. The cable socket is kept at the dryer and will be reused.
- 4) Unscrew the sensor from the measuring socket using an appropriate wrench. Only hold the sensor at the hexagon of the sensor housing!
- 5) Insert a calibrated sensor of the same type in the measuring socket.
- 6) Plug the cable socket onto the calibrated sensor and tighten the cable socket.
- 7) Pressurise the dryer and commission the dryer again. (→ Page 66)



Replacement program

The manufacturer provides a replacement program for old dew point sensors.

- 1) Order a new dew point sensor.
- 2) Exchange the sensors upon receipt of the new sensor.
- 3) Send the old sensor back to the manufacturer. For this purpose, use the protective packaging of the new sensor. Only sensors that are undamaged can be recalibrated!
- 4) After receipt of the old, undamaged sensor the price difference of the new sensor and calibration will be credited. The old sensor remains at the manufacturer.

10.1.6 Replacing filter elements

The filter elements in the filters prevent particles and aerosols in the compressed air flow from entering the system. The filter elements in the filters will be clogged over time and thus the compressed air flow is throttled. To prevent operating errors from occurring, the filter elements have to be replaced regularly. Check the differential pressure gauge at the filter (if available). When exceeding approximately 350 mbar, the elements should be replaced. Replacement is due after one year at the latest.

- 1) Depressurise the filter.
 - For the instrument air filter see → page 5
 - For the upstream and downstream filters see → page 67
- 2) For filter replacement please proceed as described in the operating manual of the filter.

Maintenance and repair

10.1.7 Replacing the expansion silencer

The expansion silencer (X1) is contaminated by dust and condensate over time and thus the expansion air flow is throttled. To prevent operating errors from occurring, the expansion silencer has to be replaced regularly.

- 1) Decommission the dryer. (→ Page 66)
- 2) Depressurise the dryer. (→ Page 67)
- 3) Lock the connecting part between valve V5 and expansion silencer (X1) using an appropriate tool in order for valve (V5) not to turn.
- 4) Unscrew the old expansion silencer (X1) from the connecting part using an appropriate tool.
- 5) Screw the new expansion silencer (X1) in the connecting part and tighten it using an appropriate tool and some sealing tape.
- 6) Pressurise the dryer and commission the dryer again. (→ Page 66)



10.1.8 Checking the blower shaft bearing

Check the blower for unusual noise. A bearing damage is often preceded by strong noise development. We recommend preventive maintenance every two years.



Maintenance by manufacturer required

Replacing the bearings requires particular technical knowledge. Therefore, we recommend bearing replacement be carried out by the manufacturer.

10.1.9 Checking and replacing the desiccant / cleaning the strainer basket

**CAUTION ! – Desiccant dust**

Using the desiccant may lead to mineral dust formation.
Desiccant dust may cause eye and respiratory tract irritations.
Wear eye protection and a dust mask when handling the desiccant.

**WARNING ! – Risk of slipping**

After desiccant replacement some amounts of desiccant may still remain on the floor.
The desiccant is very slippery and may result in serious fall injury.
Immediately remove residual desiccant properly from the floor.

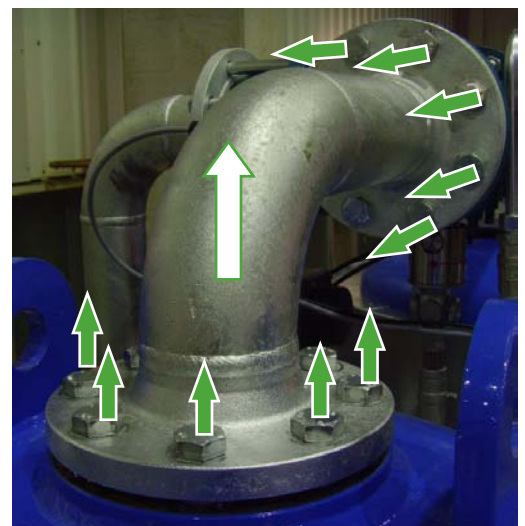
The desiccant is subject to ageing and its drying performance is reduced over time. The service life of the desiccant depends on numerous operating parameters and cannot be exactly predicted. The service life is approximately 3 to 5 years. Under very favourable conditions (e.g. oil-free compressed air) the service life may be considerably longer. The quality of the desiccant can be assessed quite well when monitoring the operating phases. If the adsorption phase is reduced significantly during operation in the "variable" cycle mode, the desiccant should be replaced. Desiccant replacement is generally useful as a preventive maintenance measure in conjunction with other repair work. (See advisory note below)

**WARNING ! – Risk of falls**

The dryer must never be used as a climbing aid. The dryer components will not provide adequate support and parts of the dryer may break off. Disregard may lead to dryer damages and falls with serious injuries.
When working at height only use approved climb assist systems.

Desiccant replacement is part of a large inspection run. At the same time, other maintenance activities should be carried out. (See maintenance table → page 69)

- 1) Decommission the dryer. (→ Page 66)
- 2) Depressurise the dryer. (→ Page 67)
- 3) Provide adequate support for the pipelines connected to the dryer and make sure the connection points are not subject to stress.
- 4) The pipe elbow is very heavy. Connect the pipe elbow to the lifting equipment suitable for lifting the load.
- 5) Remove the pipe elbows above the vessels. (To maintain stability of the piping system it is possible to only remove one pipe elbow and to carry out maintenance on one vessel after the other.)
- 6) Remove the strainer basket (S1, S2) and clean it from desiccant residues.



Maintenance and repair

- 7) Remove the seals and clean the flange surfaces from residues of the seals.
- 8) Provide an adequately sized container for the used desiccant. (Make sure to observe the volume information given on the vessel plate.)
- 9) Remove the used desiccant from the vessel using a suction device.
- 10) As an alternative, the desiccant can also be drained by opening the desiccant drain installed on the side of the vessel. The residues in the container can be removed using a conventional industrial vacuum cleaner.
- 11) Clean the nozzle of the desiccant drain and reclose the nozzle while using a suitable sealant.
- 12) Remove the used desiccant from the construction site.
- 13) Provide the new desiccant. Make sure to use two different desiccant types which create two separate layers in the vessel.
Distribute the different desiccant types equally to the two vessels.
In the event you are unsure which desiccant to fill in first, please contact the manufacturer.
- 14) Fill in the liquid waterproof desiccant first. It is the lower layer in the vessel.
- 15) Fill in the non-liquid-waterproof desiccant last. It is the upper layer in the vessel. This type of desiccant will disintegrate when getting in contact with liquid water.
- 16) Fill up the vessel almost to its full extent. Make sure that the strainer basket (S1, S2) can still be inserted in the vessel opening by slightly pressing on it. During operation the desiccant will be compressed to some extent and the desiccant volume will be slightly reduced.
- 17) Reinsert the strainer basket (S1, S2) into the vessel using two new seals.
- 18) Reclose the vessel using the pipe elbow. First tighten the screws only lightly. Then tighten completely in a crosswise manner.
- 19) Clean the bottom thoroughly from desiccant residues.
- 20) Slowly pressurise the dryer again. (→ Page 62) Carry out a leak test using a leak detection spray. In the event of leaks the dryer will have to be depressurised prior to repairing the leaks.

Please note that, directly after desiccant replacement, the dew point may become worse. The new desiccant will reach the full drying performance only after a longer operation period.

For the time directly after desiccant replacement it may be useful to select a dew point limit value as described in the "Properly selecting the dew point limit value" advisory note. (→ Page 45)



Taking the inspection intervals for the vessels into account

A routine inspection is required for the pressure vessels. In Germany, according to AD 2000 Code a routine inspection has to be carried out every 5 years by a notified body.

Please note that different national regulations may apply in other countries.

We recommend replacing the desiccant in the course of this inspection run at the latest.

Combine desiccant replacement and vessel inspection. The manufacturer provides desiccant replacement in conjunction with "measures parallel to approval".



Increased dust contents after desiccant replacement

Filling the new desiccant in the dryer results in increased dust contents in the vessels. In the first weeks after recommissioning the dust is forwarded to the downstream filter and the filter elements will deteriorate faster than during later operation. We therefore recommend to recommission the dryer using the old filter elements and to use the new filter elements and the new expansion silencer only after some weeks.



Desiccant

The desiccant used is not subject to labelling requirements according to the Hazardous Substances Ordinance. Nevertheless, the common safety measures with regard to using chemicals apply. The manufacturer will provide safety data sheets on request.

The desiccant may accumulate contaminants from the compressed air. Depending on the type of contamination there may be a risk of injury or damage when using the desiccant. As the type of contamination is not known to the manufacturer, the resulting risks cannot be evaluated in this operating manual.



Disposal

Dispose of the desiccant according to the local regulations.

Waste codes according to the Waste Catalogue Ordinance:

- Non-contaminated desiccant: 06 08 99
- Contaminated desiccant: The waste code will have to be determined by the waste producer taking the type of contamination into consideration. The desiccant must be disposed of in an appropriate disposal plant.

10.1.10 Replacing the rubber valve seat and the non-return valve

For replacing the rubber valve seat of regeneration valve (V3) and the non-return valve (RV1), please proceed as described in the manuals of the relevant manufacturer.

11. Appendix and technical documents

11.1 General arrangement drawing

Separate document

11.2 Process flow diagram

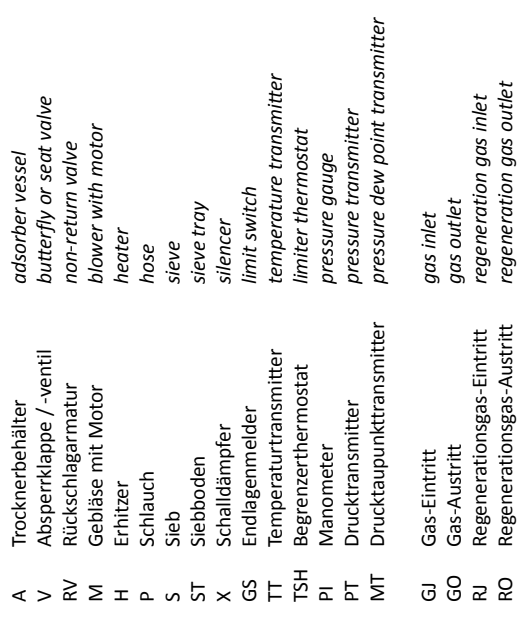
11.3 Pneumatic diagram

11.4 Wiring diagram

Separate document

11.5 Documentation of the individual components

Separate documents

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