



Operating Manual Adsorption Dryer DTS 15-100 HPI

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1. General information

1.1 Manufacturer



Filtrations-Separations-Technik

! 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 over the control box of the dryer (\rightarrow page 12).

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 identify the dryer and simplifies the 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 the type plate of the vessels (\rightarrow page 12).

1.4 Additional documents

- General arrangement drawing
- Process flow diagram
- Wiring diagram
- Operating manuals of individual components

Note on additional documents:

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

The guarantee does not cover the following cases:

- If the safety notes and instructions in this operating manual or additional documents are not observed.
- If the dryer is operated or maintained by personnel who do not have the required qualifications
 (> see "Target group").
- If the dryer is not used according to the intended use (→ page 9).
- If aggressive substances in the compressed air or the ambient air cause damage to the dryer.
- If no original parts of the manufacturer are used for maintenance and repairs.
- If the dryer continues to be operated although there is a proven defect.

1.6 About this operating manual

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

1.6.1 Target group

This operating manual is intended for all persons who work on and with the dryer (e.g. installer, operator, service technician, ...).

We point out explicitly that these persons must be qualified personnel who, due to their relevant technical education, training and/or experience, are capable of recognising risks and avoiding hazards that occur during the use of compressed air systems and electrical systems.

If you are not experienced with such systems, you should call in expert help. We strongly recommend that commissioning and maintenance be carried out by the manufacturer or one of its authorised contractors.

1.6.2 Using the operating manual

Please read these operating instructions and additional documents carefully **before** installation and commissioning and follow the instructions. the regulations and instructions are observed. In particular, observe the safety instructions.

The operating manual must be kept in an easily accessible place near the dryer.

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

The manufacturer does not accept any liability for damage resulting from disregarding the operating manual.

All information in this operating manual is valid at the date of publication. Because the components and operating workflows can be modified at any time and these modifications affect the maintenance of the dryer, **the latest information should be available before carrying out any maintenance work.**

General information

1.6.3 Signs and symbols used

- Boxes are used for bulleted lists
- 1) Numeration emphasises that the instructions for action are to be carried out step by step in a given order.
- → Cross-references refer to information on another page or in another document.



Note!

This symbol refers to matters that should be given special attention. Observing the notes helps to ensure the 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 the 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. A typical application is the treatment of compressed air from a compressor station.

During the pre-treatment of the compressed air by 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 fully automatically and is designed for continuous operation. Thanks to various communication interfaces and an optional moisture measurement system, the dryer can be operated especially economically.

2.1 Intended use

The dryer is intended exclusively for drying compressed air! Use of the dryer for drying other gases (e.g. pure nitrogen) must be agreed upon with the manufacturer beforehand. It may be necessary to observe special safety guidelines.

The dryer is designed for installation in a site that complies with the following requirements:

- indoors
- protected against weather impact
- air-conditioned
- frost-free
- dry
- zero to low dust exposure
- no vibrations via floor or connected piping
- ambient air free of aggressive and corrosive substances
- ambient air must be free of substances that damage the desiccant or influence its effect (e.g. ammonia and other substances with a basic reaction; oil mist; water spray mist).
- free from dangers due to explosive atmospheres inside or outside the dryer. (The dryer is not ATEX-compliant in its standard version)

The dryer must only be operated with compressed air within the maximum permissible 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 (\rightarrow page 12).

Modifications to the dryer or the use of third-party parts can lead to unpredictable dangers and damage during operation. These measures may only be carried out after prior inspection and approval by the manufacturer. Only use genuine spare parts from the manufacturer.

Any other use is considered improper and is not permitted. The manufacturer accepts no liability for damage caused by improper use.

The values indicated on the type plate are mechanical design limits. Please note that dryer performance is not defined to these mechanical design limits, but to the "nominal operating conditions" (\rightarrow page 10) as well as to operating conditions that were individually established for this dryer during the planning phase.

The drying performance is guaranteed for the "nominal operating conditions", as well as for a specific combination of the individual operating parameters (compressed air volume flow, pressure, temperature, desired pressure dew point, ambient conditions).

The individual design for your operating conditions can be found in your contract documents or can be requested from the manufacturer.

If the dryer is operating in conditions different from these, the drying performance cannot be guaranteed.

The compressed air supplied must be of the following quality:

- free from aggressive and corrosive substances
- filtered according to ISO 8573-1:2010 (1:*:3)
- free of substances that damage the desiccant

2.2 Technical data

Dryer	Nominal volume flow rate	Compressed air connection	Weight	Height	Width	Depth
	V [m³/h]**		[kg]	[mm]	[mm]	[mm]
DTS 15 HPI	150	G 1"	142	1700	550	405
DTS 20 HPI	200	G 1"	180	1710	550	390
DTS 25 HPI	260	G 1"	220	1720	550	380
DTS 30 HPI	320	G 1 ½"	255	1760	669	480
DTS 40 HPI	410	G 1 ½"	288	1820	669	490
DTS 60 HPI	590	G 1 ½"	380	1850	669	490
DTS 80 HPI	770	G 2"	440	1980	838	563
DTS 100 HPI	1000	G 2"	510	2000	838	590

Classification acc. to PED 2014/68/EU	DTS1030: II DTS40100: III
Fluid group	2
Supply voltage	230V 50-60Hz (optional 115V 50-60Hz und 24V-DC)
Class of protection	IP54 (@ Steuerung Typ C15)
Min. / max. allowable pressure (PS) ***	4 to 16 bar
Min. / max. allowable temperature (TS)	+2 to +50 °C

^{*} For pressure dew points 0 to +10 °C. For minus values, please contact the manufacturer.

^{**} Standardized 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.

^{***} A pressure relief device with a setting pressure of maximum 16 barg and sufficient capacity (equal or more than the compressor) shall be installed by the operator on the pressure source or the supply line.

Noise pressure level (free-field measurement in a distance of 1 m)

up to 100 dB(A)1****

with the option "2-stage expansion" < 85dB(A)



Individual operating conditions

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

Options for 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 separately supplied pressure vessel documentation.

Pressure vessels are part of systems requiring inspection that must be inspected before commissioning, after modifications requiring inspection and at regular intervals. The inspection intervals for periodic inspections are determined by national regulations. It may be necessary to involve a notified body when carrying out the inspection.

^{****} Intended use of personal hearing protection/exposure levels → see the current edition of the national regulations

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!

- To prevent personal injury or damage, safety notes must be observed when using this dryer.
- Observe the specific safety notes in the relevant chapters.
- Observe the legal guidelines and 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 Danzer zones at the dryer



- **1;5** *Risk of injury from pressure-bearing parts*
- **2;6** *Risk of injury from electrical voltage*
- **3** Risk of injury from suddenly escaping compressed air
- **4;7** *Risk of injury from hot surfaces*
 - 8 Risk of slipping due to spilt desiccant



DANGER ! – Overpressure (1;5)

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.

Use appropriate protective equipment when working on pressure components.

Safety notes



DANGER ! – Electric voltage (2;6)

The dryer is operated with an electrical voltage of up to 230 V. Touching live parts can lead to serious injuries and 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 case of fire, do not extinguish with water.



WARNING ! - Suddenly escaping compressed air (3)

The dryer is depressurised approximately every 12 hours using a silencer. A loud and strong airstream may carry small particles and cause injury. Startle reactions can also cause falls or similar injuries.

Do not place any equipment in the vicinity of the silencer. The silencer must not be manipulated or removed

Always wear appropriate ear protection when working in the vicinity of the dryer.



WARNING ! – Hot surfaces (4;7)

The surfaces of the vessels and pipes may reach temperatures up to 75°C.

Unprotected touching of this surface may cause burns. Startle reactions can also cause falls or similar injuries.

Avoid direct contact with these surfaces.

Always use personal protective equipment when working with or on hot components. Never store inflammable parts and material in the vicinity of the dryer.



WARNING ! – Risk of slipping (8)

After desiccant replacement, some amounts of desiccant may remain on the floor. The desiccant is very slippery and may result in a 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 (\rightarrow page 12).

Exceeding the maximum allowable operating conditions may result in serious injury or death. The operator has 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. A pressure relief device with a setting pressure of a maximum of 16 barg and sufficient capacity (equal to or more than the compressor) shall be installed by the operator on the pressure source or the supply line.

Please also refer to the section "Intended use" (\rightarrow page 9).



DANGER ! - Unauthorised modifications

Modifications to the dryer or the dryer control system can lead to dangerous operating conditions. Violation may cause serious injuries and death. Never modify the function of the dryer! Never carry out welding work on pressure-bearing parts! Never change the control programme of the dryer! All modifications to the dryer must be agreed upon in advance with the manufacturer and approved 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 the 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. Disregarding may lead to dryer damage 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 Regulation (EC) No 1272/2008. Nevertheless, the common safety measures concerning 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 handling 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 2-stage expansion (V5) with silencer (X2)* regeneration gas outlet (RO)
- 2 Desiccant drain nozzle
- **3** Vessel (A1, A2) with sieve tray (ST1, ST2)
- **4** Control box with display and function keys
- **5** Lugs for truck transport

- **6** Safety temperature limiter (TSHA01+02)
- 7 Pressure gauge (PI01, PI02)
- 8 Upper check valve block (RV1, RV2) with dew point sensor (MT01)
- **9** Upper vessel opening with strainer basket (SB1, SB2)
- **10** Temperature sensor (TT03+04) under insulation
- **12** Expansion silencer (X1)

^{*} optional



Rearview

- Earthing connection
- Manual drain valve (HV1) on after-filter
- After-filter with filter element and differential pressure gauge (DPI02)
- Compressed air outlet (GO)
- Lifting lugs
- *Pressure transmitter (PT01+02)*
- Electrical heater (H1+2) with integrated temperature sensor (TT01+02) and solid-state relais SSR
- *Regeneration gas line with orifice (O1+O2)*
- Purge air valve (V6) for backup mode*
- 22 Compressed air inlet (GJ)
- *Pre-filter(F1) with filter element and differential pressure gauge (DPI01)*
- 24 Condensate drain (D1) and condensate outlet (CO)
- Solenoids (Y1, Y2, Y3, Y4)
- 26 Lower valve block (V1; V2; V4; V4)

^{*} optional

4.2 Process flow diagram

Symbolic diagram of the dryer components, their locations and interconnections.



- A Dryer vessel
- D Condensate drain
- F Filter
- H Heater
- HV Manual shut-off valve
- MT Dew point sensor
 - **O** Orifice for regeneration flow
 - PI Pressure gauge
- **PDI** Differential pressure gauge
- **PT** Pressure transmitter
- **RV** Check valve

- SB Strainer basket
- **ST** Sieve tray
- **TSHA** Safety temperature limiter
 - **TT** Temperature transmitter
 - V Valve
 - **X** Silencer
 - **CO** Condensat outlet
 - GJ Gas inlet
 - GO Gas outlet
 - **RO** Regenration gas outlet

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 approx. 12 hours*.

Adsorption phase

Duration approx. 12 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 pre-filter (F1) removes dust and liquids from the compressed air flow. The lower valve block (V1-4) 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 (RV2) to the after-filter. In the after-filter, desiccant dust is removed from the compressed air and the compressed air is led 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.



1 Stand-By - Adsorption

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

- ... "fixed" cycle mode has been pre-selected and a time of 12* hours has expired.
- "variable" cycle mode has been pre-selected and optional dew point measurement has reached the selected limit value. Switchover of the vessels is carried out compulsorily after 48 hours at the latest.

For vessel switchover, the main valve (V1) is opened and shortly later the main valve (V2) is closed. The compressed air flow changes from one vessel to the other. A free flow path through the dryer is available at any time during the switchover. 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. 5..8 hours*

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
- Purging (regeneration) Heating
- Purging (regeneration) Cooling
- Pressurisation
- Standby (ECO)

Expansion phase

Duration approx. 1 min*

After vessel switchover, the expansion valve (V4+V5**) is opened and the "wet" vessel is depressurised. Via the silencer (X1+X2**) the compressed air flows to the outside.

As soon as the pressure in the vessel has dropped, the next phase begins.



3 Adsorption - Expansion

Heating

Duration approx. 4,5 hours*

After the vessel pressure has almost reached atmospheric pressure, dried compressed air (regeneration gas) flows out of the vessel (A1) via the orifice (O2) into the vessel (A2). The expanded air is passed through a heating element (H2) and heated up.

The hot regeneration air is distributed throughout the vessel cross-section and led through the desiccant. The moisture from the desiccant is adsorbed by the regeneration gas flow and led via the expansion valve (V4+V5*) out of the vessel to the regeneration gas outlet (RO). Via the silencer (X1+X2*), the now humid regeneration gas flow reaches the outside.

Using the temperature sensor (TT04) the dryer control system recognizes the temperature rise and switches off the heater (H2) when reaching the selected temperature limit value. The heating phase is completed and the next phase begins.



4 Adsorption – Heating

Cooling

Duration approx. 4,5 hours*

After the heater (H2) has been switched off, the dried and depressurized regeneration gas is fed cold into the vessel.

The cold pressureless regeneration gas is distributed throughout the vessel cross-section and led through the desiccant. The heat stored in the desiccant and vessel wall is adsorbed by the regeneration gas and led out of the vessel via the expansion valve (V4+V5*) to the regeneration gas outlet (RO).

After the vessel has cooled down, the cooling phase ends and the next one begins.



4 Adsorption – Cooling

Pressurisation phase

Duration approx. 5 min*

The pressurisation phase ensures that the two vessels have the same vessel pressure before vessel switchover.

The regeneration air valve (V4+V5*) is closed and the compressed air continues to flow from vessel (A1) via the orifice (O2) into vessel (A2) until the vessel pressure in both vessels is approximately equal.

After a fixed preset time interval* has expired the pressurisation phase is ended and the next phase begins.



5 Adsorption – Pressurisation

Standby

Duration approx. 0 minutes to max. 60 hours*

Vessel regeneration is now complete and the vessel is immediately ready to operate. During this phase, both vessels stay connected via the regeneration line and thus the pressure in both vessels stays equal throughout the complete stand-by phase.

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



6 Adsorption - Standby

Note:

* = The above time values are variables which can be pre-set individually for each dryer. Therefore, deviations from the above-mentioned values are possible.

** = V5+X2 only with the option "two-stage expansion"

4.4 Options

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

Dew point sensor

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

The use of a dew point sensor is highly recommended.

Automatic start-up device (pressure maintaining valve)

The dryer must always be operated with adequately high pressure to avoid excessive flow velocities in the dryer. There is a danger of damage to the dryer (\rightarrow page 50).

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, that 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 adequate high pressure in the dryer at any time during operation.

2-Stage expansion (V5)

The regeneration gas flow is blocked with the valve (V5) until the pressure has been released via the small silencer (X1). As soon as the vessel pressure has dropped below 1 bar, the valve (V5) opens. The residual pressure from the vessel is released and regeneration can begin.

This option enables a particularly quiet operation of the dryer without a loud "expansion bang".

Backup Mode

This "hot-regenerated adsorption dryer" can also be operated as a "cold-regenerated adsorption dryer" (backup mode). In backup mode, the dryer can be operated without pre-drying (e.g. if the refrigeration dryer fails). In this operating mode, approx. 15% of the compressed air is used for purging. The vessels change at a much shorter interval of approx. 3 min. The dew points that can be reached in this operating mode are approx. -40°C DPD.

Further options include:

- Alternative pressure vessel approvals (DGRL Module G, ASME U-Stamp, China-Stamp, EAC, ...)
- Additional pressure vessel documentation (drawing, stress calculation, material certificate 3.1, certificate of hydrostatic pressure test, welding documentation, ...)
- Weather protection (rain protection, complete insulation, frost protection, increased class of protection (IP protection class), ...)
- Stainless steel versions (completely or partly)

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.



CAUTION ! – Pressure blows in the vessel during regeneration The main valves open when the power supply is interrupted

Please note that if the power supply is interrupted, both main valves are opened. This means that a regenerating vessel is then abruptly pressurised via the opening main valve. This can result in damage to the dryer.

We, therefore, recommend only interrupting the power supply via the main switch when both vessels have the same pressure (e.g. towards the end of the operation phase "pressurisation" or "standby").

Only use the main switch to switch off the dryer directly if it is necessary to disconnect the dryer from the power supply immediately for safety reasons.



Switching off the dryer

The dryer has only a low current consumption in the "stopped" state. We recommend that the dryer continues to be supplied with voltage even during longer standstill periods. Stopping the dryer without interrupting the power supply can be realised by pressing the "Start/Stop" key on the display or an input signal "Remote ON/OFF" on the dryer control.

5.2 Release button for temperature limiter



The release button for the temperature limiter (TSHA01+02) can be found on the left and right sides of the dryer control cabinet.

If the red signal indicator "collective alarm" on the control box lights up, this may have been triggered by one of the two temperature limiters (TSHA01 or 02) in the dryer vessels (A1 or A2).

The temperature limiters protect the vessels from exceeding the max. allowable vessel temperature. The malfunction can be remedied by pressing the green button on the manual release.

- 1) Wait until the vessel has cooled down. The limiter can only be reset if the vessel is in a cold state.
- 2) Remove the black protective cap from the release button.
- Press the coloured release button. (You may <u>not</u> feel a click. Nevertheless, the limiter has been reset. If necessary, a rod, pin or screwdriver is required as an aid for unlocking.)
- 4) Make sure that the error message is no longer relevant.
- 5) Screw the black protective cap on the release button again.

5.3 Differential pressure gauges on the filters



The pre-and after-filter of some dryers are fitted with differential pressure gauges. The differential pressure gauge gives evidence of the condition and the degree of contamination of the filter element.

For further information and instructions please refer to the manual of the filter and the differential pressure gauge.

5.4 Pressure gauge



The vessel pressure of each vessel is shown on their respective pressure gauge PI01 / PI02.

The pressure gauges allow monitoring of the proper function of the dryer. When the display shows "**Heating**" or "**Cooling**" the corresponding pressure gauge should indicate a pressureless vessel.

5.5 Valve position indications

Only with the options "two-stage expansion" and "BackUp mode".

All angle seat valves have a position indicator. For error analysis, the actual state of the valve can be compared with the setpoint state from the control system.



The position of valves V5 and V6 is indicated through a small, coloured pin on the actuator:

The pin protrudes approx. 2 cm from the actuator	= OPEN
The pin is almost completely inserted in the actuator	= CLOSE

5.6 Control system

The dryer is operated via a display on the control box.

5.6.1 Menu window HOME / Function keys and display

Headline —	Pres	ssure Dew	Point	16:05:49 23.03.2023
Display field –	Set Value: -40 °C	54	n: -20 °C	→ ✓ tp
Funktion keys —		≡ \ \ ¢ *	* ×	ON
Headline	Here you can find out which m	nenu window you a	re in.	
	Press the function key to	o enter the alarm m	ienu.	
	Furthermore, the current time	e and date are displa	ayed.	
Display field	Here you can find out current	data on the operati	on of the dryer.	
	Press the grey arrow keys level.	or to access	other windows a	at this menu
Funktion keys	Press one of the function keys	to move to anothe	r menu level.	

5.6.2 Funktion keys

	Alarm display and alarm key:					
\land	The indicator colour switches from white to red when an alarm is present.					
<u> </u>	The indicator colour switches from white to blue when a warning is pending.					
	Pressing the button takes you to the ALARM window					
	HOME key:					
	Pressing the button takes you back to the HOME window (main view).					
	BACK key:					
Ð	Pressing the button takes you back to the previously shown window.					
	FLOW DIAGRAM key:					
ഹ്ന	Pressing the button takes you to the flow diagram window.					
J	In the flow diagram window, the currently selected flow paths are displayed graph- ically.					
	TREND key:					
~	Pressing the button takes you to the trend display.					
	In the trend display, all measured values are shown in graphical form over time.					
	MONITOR key:					
(\mathbf{z})	Pressing the key takes you to the main monitor window.					
~ <u></u>	At menu level MONITOR, the current measured values, digital inputs and outputs as well as programme sequences are displayed in various windows.					
	MESSAGE key:					
	Pressing the key takes you to the MESSAGE window.					
	In the MESSAGES window, the current programme step is displayed with a timestamp of when it was changed to this programme step.					
	PARAMETER key:					
<u></u> በሳተ	Pressing the key takes you to the main PARAMETER window.					
QΙΥ	At menu level PARAMETERS, the limit values/control parameters for the operation of the dryer are displayed.					
	SYSTEM key:					
10 00	Pressing the button takes you to the SYSTEM window.					
	In the SYSTEM window, the date, time, language, etc. can be set.					

	SERVICE key:
2	Pressing the button takes you to the SERVICE window.
	In the SERVICE window, information on the construction number, software version, operating hours, etc. can be provided.
	ON/OFF and OFF/ON keys:
	By pressing the button, you reach the ON/OFF window.
	In the ON/OFF window, the dryer can be switched on and off.
	It is also possible to switch between "local ON/OFF" and "remote ON/OFF" operations.

5.6.3 Menu window "Outlet Values"

The outlet parameters "pressure", "temperature" and "dew point" are displayed in this window.



For the "Pressure" and "Temperature", the measured values of the sensors of the vessel currently in operation are used for this display.

Press the arrow key to return to the HOME window.

5.6.4 Menu window "Process flow"



In this window, the currently selected flow paths are displayed graphically.

Press the violation content of the display.

5.6.5 Menu window "Trend"

In this window, all measured values are displayed graphically in their chronological sequence.



The zoom keys, the grey arrow keys and the scroll bar can be used to vary the time and section.

5.6.6 Menu window " Monitor "

Within the menu level "MONITOR", the current measured values, digital inputs, digital outputs and programme steps are displayed in different windows. You can switch between the windows of this menu level by

clicking on the grey arrow keys \rightarrow or \leftarrow .

5.6.6.1 Menu window "Monitor INPUT"

16:25:55 **Monitor INPUT** 23.03.2023 24 °C AE00 (X2.2) 9.6 bar AE04 (X2.6) **TT01** PT01 **25 °C** AE01 (X2.3) TT02 PT02 9.7 bar AE05 (X2.7) **21 °C** AE02 (X2.4) -54 °C **TT03** MT01 21 °C AE03 (X2.5) TT04 **BackUp Remote** TSHA01 DE03 (X1.14) TSHA02 Remote ON ON

In this window, the values of the analogue and digital inputs are displayed.

5.6.6.2 Menu window "Monitor OUTPUT"

In this window, the values of the analogue and digital outputs are displayed.

<u>_</u> !	Monitor OU	ITPUT	16:26:41 23.03.2023
\leftarrow			\rightarrow
V1 D A00 (X1.3)	H1 SSR DA06 (X	1.9) Alarr	n 📃 DA08 (X4.1/2)
V2 🔵 DA01 (X1.4)	H2 SSR DA07 (X	1.10) Warn	ing 🛑 DA09 (X4.3/4)
V3 D A02 (X1.5)	H1 Relay 🛛 DA00 (X	.6.3) Oper	ation 🔵 DA10 (X4.5/6)
V4 D A03 (X1.6)	H2 Relay 🛛 DA01 (X	6.4)	
V5 DA04 (X1.7)	Pressure Dew Point	-54 °C	10.1 mA AA00 (X3.3)
V6 🔵 DA05 (X1.8)	Operation Pressure	9.6 bar	13.6 mA AA01 (X3.4)
	Outlet Temp.	24 °C	7.8 mA AA02 (X3.5)
			ON

5.6.6.3 Menu window "Monitor Sequence"

In this window, the current operating phases of both containers are displayed with the expired time.

Мо			or	nitor S	nitor Sequence				16:32:38 23.03.2023		
Sequence	er n	ormal operati	on	Initializa	tion 🛛 🔵 🔵	S	equencer	er BackUp-Mode			
	A1		A2			A1		A2			
Adsorption		853 min		0 min	Adsorption		0 s		0 :		
Parallel		0 s		0 s	Parallel		0 s		0 :		
Change over	Ō	0 s	Ō	0 s	Change over		0 s		0 :		
Depressurisation	Ō	0 min	Ō	0 min	Depressurisation		0 s		0 :		
Heating	Õ	0 min	Õ	0 min	Regeneration		0 s		0 :		
Heating extension	Ŏ	0 min	Ŏ	0 min	Pressure equalisation	iti	0 s	Ō	0 :		
Cooling	Ō	0 min	Ō	0 min	Standby		0 s) 0 :		
Cooling extension	Ŏ	0 min	Õ	0 min							
Pressure equalisation	Ŏ	0 min	Õ	0 min							
Standby	ŏ	0 min	ŏ	415 min							
		6							ON		

5.6.6.4 BACKUP MODE (Option)

With the option "BACKUP MODE", it is possible to switch from normal operation "warm regeneration" to the operating mode "BACKUP MODE" = "cold regeneration" in this window. In the BACKUP MODE operating mode, the dryer can be operated without pre-drying (e.g. in case of failure of the refrigeration dryer).

In BACKUP MODE, the vessels are changed approx. every 3 min. The regenerating vessel is purged with dry, expanded compressed air taken from the dryer outlet. Valve V6 is opened for this purpose. During regeneration, 15...20% of the nominal volume flow of the dryer is required. The regeneration efficiency is large enough that the dryer can now also be operated with saturated compressed air. However, a decrease in the pressure dew point may occur, as the cold regeneration is less efficient than the warm regeneration. However, a pressure dew point of -40°C is usually achieved.

Before the control unit switches to cold regeneration, all regeneration steps on the regenerated vessel must be completed. In this case, the regeneration is carried out at an accelerated rate. Heating is terminated immediately and cooling is accomplished three times faster than usual. This is possible because more purge air is available in BACKUP MODE. Only after 'Pressure Equalisation', when both vessels have equalised the pressure, does the dryer change from normal operation (warm regeneration) to BACKUP MODE (cold regeneration).

BACKUP MODE is an emergency mode that should only be used in special cases. (e.g. failure of the refrigeration dryer; failure of a heating system; etc.).

In the BACKUP MODE, the "dew point control" is switched off. This ensures that the adsorber vessels are only loaded with a small amount of water and that a switch back to normal operation can take place without longer dew point peaks.

5.6.7 Menu window "MESSAGES"

In the MESSAGES window, the current programme step is displayed with a time stamp. The time stamp indicates when the programme step was changed. I.e. the time corresponds to the start of the programme step.



Pressing the history key displays previous messages. The timestamp of the older messages corresponds to the time at which the programme step was completed.

5.6.8 Menu level "PARAMETERS"

The limit values/control parameters for the dryer operation are displayed in the menu level PARAMETERS.

The set limit values (target values) are highlighted in grey.

-58°C The CURRENT values are highlighted in black

By pressing the grey arrow keys or you can switch between the windows of this menu level.

5.6.8.1 Menu window "Parameter Dew Point"

In this window, you can enter the limit value of the dew point control. The adsorber vessels are switched when the limit value "dew point setpoint" is exceeded. Furthermore, the limit value for the dew point alarm and a time delay for the dew point alarm can be set.

Parameter	r Dew P	oint	16:34:12 23.03.2023
BackUp-Mode Configuration			\rightarrow
Dew Point Set Point	-40 °C	-54°C	
Dew Point Alarm	-20 °C	-54 °C	
Alarm delay	300 sek	0 sek	
			ON

5.6.8.2 Menu window "Parameter Adsorption"

In this window, the operating mode of the dryer can be changed between time control and dew point control. With time control, the vessel change is triggered exclusively via the entered time limit "Adsorption time with time control".

With dew point control, the vessel change is triggered by exceeding the limit value "dew point setpoint". The vessel change is triggered at the latest when the set time limit "max. adsorption time dew point control" has been reached.

Parameter Ad	n	16:35:43 23.03.2023	
Control Mode	fix / var.	var.	\rightarrow
Adsorption time for time control	720 min	A1 856 m	A2 in 0 min
Max. adsorption time dew point control	2880 min	856 m	nin 0 min
Parallel operation	120 s	() s 0 s
Change over	10 s	() s 0 s
			ON

The time limits and other settings on the following menu windows are password protected. They are for the operator's information only.

5.6.8.3 Other windows of the "PARAMETERS" menu level

The limit values and actual values for all further programme steps are displayed in other windows on the PA-RAMETERS menu level. These windows are for the operator's information only.

5.6.9 Menu window "Basic Settings"

The current time and date of the dryer control can be set in the settings window. To do this, press the key in the fields with a grey background so that the input mask appears.



5.6.10 Menu level "SERVICE"

Various information about the control system and the dryer is displayed in the SERVICE menu level.

By pressing the grey arrow keys or you can switch between the windows of this menu level.

5.6.10.1 Menu window "SERVICE"

The window Service displays information about the software version and other information about the dryer.

$\underline{\land}$	SER	VICE	16:37:28 23.03.2023
\leftarrow			
Serial No.	D000000		
Softw.Vers.	DTS_HPI_V1_12		
C 🏫	•	🔄 🏈	ON

5.6.10.2 Menu window "Data Download"

In the DATA DOWNLOAD window, a download of the data stored in the memory of the dryer control can be carried out. This data can be sent to the manufacturer for analysis.

D	ata Download	16:42:05 23.03.2023
\leftarrow		
USB status	no USB	
Download start in	0	
Download activ	FALSE	
Download progress	0	
Download status		
	OOWNLOAD	ON



- 1) Switch the dryer control to OFF and wait until both vessel pressure gauges indicate the same pressure.
- 2) Open the control box of the dryer.
- 3) Insert a USB stick into the designated place on the back of the control box.
- 4) Wait until the USB stick is displayed as "USB connected" in the "USB status" field.
- 5) Press the function key "DOWNLOAD". The download starts with a delay of a few seconds.
- 6) Wait until the "Download Status" field shows "Done. USB stick can be removed" appears.Ziehen Sie den USB-Stick wieder aus der Steuerung
- 7) The data on the USB stick can now be sent e.g. by mail to the manufacturer for evaluation.

5.6.11 Menu window "ALARMS & WARNINGS"

In the ALAMRS & WARNINGS window, alarms are shown in red and warnings in blue. The time stamp indicates when this alarm occurred. Pressing the history button displays older notifications.

	LARMS & WARNINGS	16:42:56 23.03.2023
16.03.2023 12:35:53	deltaP regeneration too low	-
16.03.2023 12:35:53	"Common_alarm_active"	
16.03.2023 12:09:17	deltaP regeneration too low	
16.03.2023 12:09:17	"Common_alarm_active"	
16.03.2023 12:07:13	deltaP regeneration too low	
16.03.2023 12:07:13	"Common_alarm_active"	
14.03.2023 19:43:31	"Common_alarm_active"	
14.03.2023 19:43:31	deltaP regeneration too low	
14.03.2023 19:26:04	"Common_alarm_active"	
14.03.2023 19:26:04	deltaP regeneration too low	
•		•
	STORY QUIT OFF	ON

Alarms are serious faults in the dryer that make the further operation of the dryer difficult or impossible. You should react to alarms immediately.

Warnings are deviations from the ideal dryer operation. If the same warning occurs repeatedly, you should investigate the causes.

5.7 Error messages and measures

Please follow the described safety instructions when working on 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.

Use appropriate protective equipment when working on pressure components.



DANGER ! – Electrical voltage

The dryer is operated with an electrical voltage of up to 230 V. Touching live parts can lead to serious injuries and 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 case of fire, do not extinguish with water.

The following tables explain the possible causes of error messages and the reaction of the dryer to these failures.

Furthermore, measures are mentioned that enable the dryer to be restarted. Please note that the interventions in the control box or other electrical components mentioned here must only be carried out by qualified electricians!

If an error message occurs repeatedly, please contact the manufacturer or one of its contractual partners. The running number in the first column will help you with communication.

Please note that the reason for the error can often only be identified in the context of several error messages occurring at the same time or in succession. For communication purposes, please note the time of the successively listed error message as well as the operating messages listed during this period.

5.7.1 Alarm messages

No.	Error message	Sensor/Cause/ Event	Control unit reaction	Rectifying errors / Restart
1	"Sensor alarm TT01 too high" "Sensor alarm TT02 too high" "Sensor alarm TT03 too high" "Sensor alarm TT04 too high"	 PT100-Temperature sensor TT01; TT02 in the heating elements: or PT100-Temperature sensor TT03; TT04 on the side, at the lower part of the vessels: At the input of the control unit, a resistance value of >212Ω is measured for the PT100 tem- perature sensor (corresponds to >300°C). Sensor failure Cable break 	 Temperature display shows 1000°C in case of ca- ble break Programme is stopped Heater = OFF The programme continues to run automatically when the cause of the alarm has been resolved. 	 The electrical connection between the sensor and the control unit is poor (e.g. due to oxidised contacts.) Check the terminals for tightness. Disconnect the sensor from the control unit and measure the resistance across the sensor. At room temperature (20°C) you should measure a resistance of approx. 108 Ohm. Replacing the defective sensor Check all connections from the sensor to the control unit for proper contact or short-circuit to earth.

No.	Error message	Sensor/Cause/	Control unit	Rectifying errors / Restart
2	"Sensor alarm TT01 too low" "Sensor alarm TT02 too low" "Sensor alarm TT03 too low" "Sensor alarm TT03 too low"	PT100-Temperature sensor TT01; TT02 in the heating elements: or PT100-Temperature sensor TT03; TT04 on the side, at the lower part of the vessels: At the input of the control unit, a resistance value of <80 Ω is measured for the PT100 temperature sensor (corresponds to <-50°C).	 Temperature display shows a value <-50°C Programme is stopped Heater = OFF The programme continues to run automatically when the cause of the alarm has been resolved. 	 There is a short circuit in the sensor or the lines and terminals between the sensor and the control unit. Check the connection points for loose wire ends and short circuits. Disconnect the sensor from the control unit and measure the resistance across the sensor. At room temperature (20°C) you should measure a resistance of approx. 108 Ohm. Check all connections from the sensor to the control unit for short circuits. Check wiring. With a PT100 temperature sensor, the resistance between the red and white wires is measured.
3	"Sensor alarm MT01 too high"	Dew point sensor MT01: A current signal of >20mA is present at the input of the con- trol unit	 The programme continues to run automatically. The control unit changes the vessels as soon as regen- eration is finished. 	 the dew point sensor indicates an internal electrical error by a current signal of approx. 23mA => replace the dew point sensor! The current signal of the pressure sensor should be between 4mA and 20mA. In the "Monitor OUTPUT" menu window, the current signal currently present at the input of the control unit is displayed. You can check the current signal with a multimeter if you connect the multimeter to the signal loop in series.
4	"Sensor alarm MT01 too low"	Dew point sensor MT01: A current signal of <3.5mA is present at the input of the con- troller	 The programme continues to run automatically. The control unit changes to the control mode "Time control". The control unit automatically switches back to the "Dew point control" control mode when the cause of the alarm has been eliminated. 	 The electrical connection between the sensor and the control unit is poor (e.g. oxidised contacts). Line resistance too high or short circuit to "ground". Check the terminals for a tight fit. Check the connection points for loose wire ends and short circuits. The current signal of the sensor should be between 4mA and 20mA. In the "Monitor OUTPUT" menu window, the current signal currently present at the input of the control unit is displayed. You can check the current signal with a multimeter if you connect the multimeter to the signal loop in series. Replacing the defective sensor Replacing the sensor cable
5	"Sensor alarm PT01 too high" "Sensor alarm PT02 too high"	 Pressure transmitter PT01; PT02: A current signal of >20mA is present at the input of the control unit 	 Programme is stopped Heater = OFF The programme continues to run automatically when the cause of the alarm has been resolved. 	 The current signal of the sensor should be between 4mA and 20mA. In the "Monitor OUTPUT" menu window, the current signal currently present at the input of the control unit is displayed. You can check the current signal with a multimeter if you connect the multimeter to the signal loop in series.

No.	Error message	Sensor/Cause/ Event	Control unit reaction	Rectifying errors / Restart
6	"Sensor alarm PT01 too low" "Sensor alarm PT02 too low"	Pressure transmitter PT01; PT02: A current signal of <3.5mA is present at the input of the con- trol unit	 Programme is stopped Heater = OFF The programme continues to run automatically when the cause of the alarm has been resolved. 	 The electrical connection between the sensor and the control unit is poor (e.g. oxidised contacts). Line resistance too high or short circuit to "ground". Check the terminals for a tight fit. Check the connection points for loose wire ends and short circuits. The current signal of the sensor should be between 4mA and 20mA. In the "Monitor OUTPUT" menu window, the current signal currently present at the input of the control unit is displayed. You can check the current signal with a multimeter if you connect the multimeter to the signal loop in series.
7	"Sensor alarm xT0x too high" (xT0x = free assigna- ble analogue input of the control. E.g. for dew point at inlet MT02)	Transmitter xT0x: A current signal of >20mA is present at the input of the con- trol unit	The programme continues to run automatically.	 The current signal of the sensor should be between 4mA and 20mA In the "Monitor OUTPUT" menu window, the current signal currently present at the input of the control unit is displayed. You can check the current signal with a multimeter if you connect the multimeter to the signal loop in series.
8	"Sensor alarm xT0x too low" (xT0x = free assigna- ble analogue input of the control. E.g. for dew point at inlet MT02)	Transmitter xT0x: A current signal of <3.5mA is present at the input of the con- trol unit	The programme continues to run automatically.	 The electrical connection between the sensor and the control unit is poor (e.g. oxidised contacts). Line resistance too high or short circuit to "ground". Check the terminals for a tight fit. Check the connection points for loose wire ends and short circuits. The current signal of the sensor should be between 4mA and 20mA In the "Monitor OUTPUT" menu window, the current signal currently present at the input of the control unit is displayed. You can check the current signal with a multimeter if you connect the multimeter to the signal loop in series.
9	"ALARM Tempera- ture limiter TSHA01" "ALARM Tempera- ture limiter TSHA02"	 Temperature limiter TSH01; TSH02: The temperature limiter TSHA01 or TSHA02 has been trig- gered. The temperature in the regeneration vessel is too high. The heater control is defective. Possibly the electronic relay SSR in the connection box of the heater has a short circuit. Wire break in the signal line 	 Programme is stopped Heater = OFF The programme continues to run automatically when the cause of the alarm has been resolved. 	 Check the temperature of TT01 or TT02 on the control unit display. Remove the black protective cap on the side of the control box (left or right) and press the green button until the alarm is reset. A reset is only possible when the vessel has cooled down! If the error occurs again, please check the SSR for function and replace it if necessary. Check all connections from the sensor to the control unit for good connection or short-circuit to earth.

No.	Error message	Sensor/Cause/ Event	Control unit reaction	Rectifying errors / Restart
10	"ALARM deltaP regeneration too low"	 Pressure transmitter PT01 and PT02: The pressure difference between the two vessels has dropped to under 3 bar. The operating pressure has fallen to under 3 bar. Internal leakage (defective valve) flows into the regenerating vessel. => The pressure difference is no longer sufficient to carry out regeneration 	 Programme is stopped Heater = OFF The programme continues to run automatically when the cause of the alarm has been resolved. 	 Check the pressure conditions on the pressure gauges PI01 and PI02 of the dryer. Difference > 3bar? Check solenoid valve coils of valve V3/ V4. Triggered, functioning coils become warm. => Check by hand if the coil of the regeneration valve (V3 or V4) on the front of the lower valve block is warm. Check the system's operating pressure. Operating pressure > 3 bar? Check the dryer for unusual flow noises.

5.7.2 Warning messages

No.	Error message	Sensor / Cause / Event	Control unit reaction	Rectifying errors / Restart
1	Warning dew point too high	Dew point sensor MT01:Overload of the dryer due to deviating operating conditions	n.a.	Check the operating conditions of the compressed air dryer

5.7.3 General malfunctions

No.	Error message	Sensor / Cause / Event	Control unit reaktion	Rectifying errors / Restart
1	The control unit is not ready for operation (display remains black)	 Power supply to the control box not available The main switch is not switched on GFCI/ FC11circuit breaker is activated Fuse FC21 of the 24VDC voltage is blown. 	 V1 and V2 ape open V3 and V4 are closed Both vessels pressurised 	 Check voltage Turn the main switch to position "I - ON" Manually unlocking GFCI / FC11circuit breaker Replace fuse FC21
2	Deviation of the pressure dew point displayed on the controller to separate meas- urement	 The scaling of the connected pressure dew point sensor differs from the scaling stored in the control unit. The external measurement is performed at a different pressure. Malfunction of the separate measurement due to moisture in the piping system. Low compressed air flow 	n.a.	 Check the scaling of the sensor (Factory setting of the controller: 4mA=-100°C; 20mA=+20°C) The measurement of the dew point sensor takes place under full operating pressure. Check that the pressure at the external sensor occurs at the same pressure. Dew point measurements are only comparable if they occur in the immediate vicinity. If "moisture-retaining components" (activated carbon adsorbers; storage tanks;) or "moisture-permeable components" (polymer seals or pipes;) are installed in between, the measurements can differ significantly. Moisture penetrating the system from the outside is particularly significant when the compressed air flow is low or at a standstill.

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 ! - Tipping, falling objects

The centre of gravity is in the upper part of the dryer. Tilting the dryer may result in serious injury or death. During transport, loading and unloading secure the dryer against tilting using the lifting lugs. Special care must be taken when working or standing under suspended loads. Poorly or insufficiently secured loads can fall and catch persons in the danger zone. Serious injuries can result. Always use appropriate protective equipment when loading the dryer.

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 an upright position. Horizontal transportation may lead to the mixing of the different desiccant layers thus causing malfunctions. Please contact the manufacturer first if the dryer needs to be tilted for transportation.
- Please note the weight of the dryer and the maximum load of the lifting and transport equipment used. Information on the weight of the dryer can be found in section 2.2 on page 10 of this operating



- of the dryer can be found in section 2.2 on page 10 of this operating manual.
- 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 the section "Description of application" (\rightarrow page 9). Here, you will find a list of requirements on the installation site. Important data about the dryer can be found in the section "Technical data" (\rightarrow page 10).

Additional requirements on the installation site:

- The ground for dryer installation must be level and capable of carrying heavy loads. Ground irregularities must be levelled 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 to avoid risks to inexperienced persons.
- Set up the dryer such that the pressure gauge and the control system are 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 by closing the valves up- or downstream of the dryer. But the dryer must still be kept under pressure so that regeneration air can flow.

- Change the control setting to "CYCLE MODE FIX" (Time-controlled mode: Each vessel remains online for 12 hours).
- 3) Operate the dryer for at least 24 more hours without compressed air flowing through the dryer. After 24 hours both vessels were regenerated. This ensures the dryer is stored with dry vessels.
- 4) Decommission the dryer (\rightarrow page 52).
- **5)** Depressurise the dryer (\rightarrow page 52).
- 6) Disconnect the dryer from the electrical supply.
- 7) Disconnect the dryer from the compressed air system.
- 8) Close the inlets and outlets of the dryer using flange covers.
- 9) Place a desiccant bag in the control box.
- **10)** Protect the dryer against dust using a cover.

To recommission the dryer after storage, please proceed as described for initial commissioning (\rightarrow page 48).



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.

Use appropriate protective equipment when working on pressure components.



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 (\rightarrow page 12). Exceeding the maximum allowable operating conditions may result in serious injury or death.

The operator has 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. A pressure relief device with a setting pressure of a maximum of 16 barg and sufficient capacity (equal to or more than the compressor) shall be installed by the operator on the pressure source or the supply line.

Please also refer to the section "Intended use" (\rightarrow page 9).



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 the safe and error-free operation of the dryer.

Please observe the following steps when installing the compressed air pipeline (1) + (1):

- 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 (7) + (13) have to be protected against unintentional opening.
- The compressed air source (e.g. compressor) must be safeguarded against exceeding the maximum allowable operating pressure using safety equipment (e.g. a pressure relief device 2) with a setting pressure of a maximum of 16 barg and a sufficient capacity (equal to or more than the compressor)).
- The compressed air pipelines must be provided with shut-off valves (7) + (13) used for disconnecting the dryer from the piping system. We recommend using shut-off valves with continuous opening behaviour (e.g. shut-off valves with stem or gear handwheel). This valve behaviour avoids sudden pressure equalisation between the piping sections.
- We recommend using a bypass line (16) around the dryer.
- The pipelines must be suitable for use with the maximum possible operating pressure.

- The transfer points (threaded of flanged connections) have to be compatible with the dryer inlet and outlet concerning nominal width, nominal pressure and type (→ see general arrangement drawing).
- 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 (8) should be installed at a slope for condensate (water and oil) in the line to be discharged in the flow direction. If the 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.
- Before 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 12). Never fill the dryer with water when performing a pressure test. Liquids will destroy the desiccant!

Installation example



- **1** Compressed air source (e.g. compressor)
- 2 Pressure relief device
- **3** *Pre-filter with condensate drain*
- 4 Valve at the pre-drying device inlet
- **5** *Pre-drying device (e.g. refrigeration dryer) with condensate drain*
- **6** Bypass line incl. valve for the pre-drying device
- 7 Valve at the compressed air inlet
- 8 Compressed air pipeline at the adsorption dryer inlet
- **9** Adsorption dryer pre-filter with condensate drain
- **10** Adsorption dryer

- **11** Adsorption dryer after-filter with manual drain
- **12** Compressed air pipeline at the adsorption dryer outlet
- **13** Valve at the compressed air outlet
- **14** Compressed air outlet
- **15** Bypass valve at the dryer inlet
- **16** Bypass line
- **17** Bypass filter with condensate drain
- **18** Bypass valve at the outlet
- **19** Expansion silencer
- 20 Condensate line
- 21 Pressure maintaining valve

Please note that the standard scope of supply only comprises the dryer 0 in the grey outline.

7.2 Installing the power supply



DANGER ! – Electrical voltage

The dryer is operated with an electrical voltage of up to 230 V.

Touching live parts can lead to serious injuries and 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 case of fire, do not extinguish with water.



CAUTION ! – Qualification and experience required

Persons working on and with the dryer have to be qualified personnel who, because of their qualifications 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

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

For the data required for connecting and securing the voltage supply, please refer to the wiring diagram (\rightarrow stored in the control box).

Der Anschluss der Spannungsversorgung erfolgt an der Einspeiseklemme im Schaltschrank des Trockners:

- 1) Use a cable that is sufficiently sized for the voltage and power consumption of the dryer when connecting the dryer to the power supply (→ see wiring diagram).
- 2) Make sure the power supply is switched OFF and secure it against unintentional reclosing.
- 3) Connect the single phases according to the specifications in the circuit diagram.



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 (\rightarrow stored in the control box). The connection of the signal cables is done via the cable glands on the bottom side of the control box:

- 1) Open the housing of the control box.
- 2) Individual ports for each IN and OUT signal are available on the circuit board. The allocation of these ports is shown in the wiring diagram.
- 3) Choose the cable type according to the details stated in the wiring diagram.
- 4) Connect the leads of the signal cable according to the information in the wiring diagram.

8. Commissioning



CAUTION ! – Qualification and experience required

Persons working on and with the dryer have to be qualified personnel who, because of their qualifications 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 personnel.

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; special required qualifications, if necessary; and 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 (\rightarrow page 44).
- The dryer is connected electrically and voltage supply is ensured (→ page 46).
- 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 as pressure equipment. Before commissioning the dryer has to be approved by the local authorities according to the applicable national regulations. In the EU, the Pressure Equipment Directive 2014/68/EU has to be observed.

Please check the following directly before commissioning:

- The operating limits must not be exceeded (\rightarrow page 9).
- The main switch is in the "0-OFF" position and the control box is disconnected from the voltage supply (→ page 24).
- 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!



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.

8.2 Commissioning 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.

Use appropriate protective equipment when working on pressure components.



DANGER ! – Electrical voltage

The dryer is operated with an electrical voltage of up to 230 V. Touching live parts can lead to serious injuries and 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 case of fire, do not extinguish with water.



WARNING ! - Suddenly escaping compressed air

The dryer is depressurised approximately every 12 hours using a silencer. A loud and strong airstream may carry small particles and cause injury. Startle reactions can also cause falls or similar injuries.

Do not place any equipment in the vicinity of the silencer. The silencer must not be manipulated or removed

Always wear appropriate ear protection when working in the vicinity of the dryer.

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 oft he 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 damage 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 using a pivoting movement. Wear appropriate ear protection when working on the dryer.

The dryer values 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 compressed air system upstream of the dryer inlet is under pressure. If necessary, the compressor must be started.
- 2) Open the valve upstream of the dryer inlet **very slowly** until you hear the first clear flow noise. Stop the procedure when the flow noise becomes loud.
- 3) Observe the vessel pressure gauges. The pressurisation can be monitored on one of the two pressure gauges. Make sure the pressure is only rising slowly. Pressurisation speed may not exceed 3 bar/min.
- 4) 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 52).
- 5) If flow noise and a pressure increase are 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 you hear 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, for the dryer not to be overloaded with moisture during a 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 (\rightarrow page 23). The automatic start-up device prevents pressure blows and increased flow speeds from occurring even when the compressor is started automatically.

8.2.3 Starting the dryer

- 1) Make sure the dryer is under pressure and that all the valves upstream and downstream of the dryer are opened for the compressed air to be able to flow through the dryer.
- Turn the main switch to the "I-ON" position (→ page 24).
 The initialisation sequence on the touch panel runs until the main menu is displayed.
- 3) Start the dryer by pressing the ON/OFF key \bigcirc



- 4) Quit any alarm messages that may be pending
- If any alarm messages are present that cannot be acknowledged, please proceed as described in the section "Error messages and measures" (→ page 37).
- 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 the section "Function description" (\rightarrow page 19).



Dew point quality

Please note that the dew point may be lower than desired directly after the first start-up. The desiccant will only reach its full drying capacity through prolonged operation, i.e. through a high loading of the desiccant with moisture.

If necessary, select the dew point limit value for the time directly after commissioning as described below.

- 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 lower than -40°C.
- Now, select a dew point limit value of -40°C. The dryer should now permanently be reaching good dew points

9. Shutting down and restarting the dryer

9.1 Shutting down the dryer in case of emergency

- 1) Turn the main switch on the control box to the "0-OFF" position (\rightarrow page 24).
- 2) Close the valves upstream and downstream of the dryer.
- 3) The dryer has now been shut down.

9.2 Stopping the dryer

The dryer can be stopped by ...

pressing the ON/OFF key



opening of the compressor contact by remote ON/OFF operation.

Compressed air must no longer flow through the dryer. Otherwise, it is overladen with moisture.

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) Close the valves upstream and downstream of the dryer.
- 3) The dryer has now been shut down.
- 4) Before 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 to the eyes and the skin. Close the openings used for releasing the pressure using a silencer suitable for the pressure. Open the valves to release 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 after-filter (\rightarrow page 44).
- 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.

9.5 Restarting the dryer

Please proceed as described in the chapter "Commissioning" (\rightarrow page 49).

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.

Use appropriate protective equipment when working on pressure components.



DANGER ! – Electrical voltage

The dryer is operated with an electrical voltage of up to 230 V. Touching live parts can lead to serious injuries and 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 case of fire, do not extinguish with water.



CAUTION ! – Qualification and experience required

Persons working on and with the dryer have to be qualified personnel who, because of their qualifications 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 the section "Intended use" (→ page 9).
- Observe the "Safety notes" and the "General safety notes" in particular (→ pages 12, 14).
- Provide the required spare parts. Only use genuine spare parts of the manufacturer. The manufacturer provides prepared spare part packets (→ page 5).
- Maintenance must only be carried out if the dryer is depressurised and disconnected from the power supply.

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 48.



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 \rightarrow 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 (\rightarrow page 12).

10.1 Regular maintenance intervals

The following table gives an overview of routine maintenance tasks. The required activities are described on the following pages.

Component	Maintenance activity	Daily	Monthly	Annually	Every 2 years	Every 4 years	See page
Dryer and dryer control	Visual check and function monitoring						54
Dryer	Clean						55
Control box	Check if cable and termi- nals are securely fixed						55
Dew point sensor (MT01)	Calibration required						55
Pre- and after-filter	Replace filter element						56
Expansion silencer (X1)	Replace					*	56
Valves (V1-V4 + RV1-2)	Replace sealing set						57
Strainer basket (SB1, SB2)	Clean					*	57
Desiccant	Check/replace					*	57
* = These activities should be carried out at the same time.							

10.2 Visual check and function monitoring

- 1) Check the dryer for external damages.
- Check the operating parameters of the incoming compressed air (pressure and temperature, in particular, → page 10).
- 3) Check the individual components for unusual noise development and leaks.
- Check the error messages on the touch panel and, if required, proceed as described in the section "Alarm messages" (→ page 36).
- 5) Check if the condensate drains on the compressor and the upstream filters are working properly.
- 6) Check the dew point.

10.3 Cleaning the dryer and dryer control

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 read.
- 3) Keep water and metallic dust away from the electrical components.

10.4 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, the inspection must be carried out more frequently. The necessary actions must only be **performed by a qualified electrician**!

- 4) Decommission the dryer (\rightarrow page 52).
- **5)** Depressurise the dryer (\rightarrow page 52).
- 6) Disconnect the electrical power supply from the dryer and protect it against unintentional reconnection.
- 7) Make sure the cables and terminals are securely fixed by tightening them if required. Only use tools approved for electrical work.
- 8) Replace any damaged or corroded components.
- 9) After the control box has been reclosed, the dryer can be recommissioned again.

10.5 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 (\rightarrow page 52).
- 2) Depressurise the dryer (\rightarrow page 52).
- 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 (\rightarrow page 52).



Replacement program*

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

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

10.6 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 (\rightarrow page 52).
- 2) For filter replacement please proceed as described in the operating manual of the filter.

10.7 Replacing the expansion silencer



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.

Use appropriate protective equipment when working on pressure components.

The expansion silencer (X1) is contaminated by dust and by 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 (\rightarrow page 52).
- 2) Depressurise the dryer (\rightarrow page 52).
- Unscrew the old expansion silencer (X1) from the connecting part using your hands or an appropriate tool.
- Screw the new expansion silencer (X1) into the connecting part and tighten it using your hands or an appropriate tool and some sealing tape.
- Pressurise the dryer and commission the dryer again (→ page 52).



^{*} This service is only available within the EU.

10.8 Replacing the sealing set of the valves (V1-4) and the check valves (RV1-2)

The valves and check valves are subject to natural wear and must be replaced at regular intervals. Spare part kits containing all parts required for proper maintenance can be purchased from the manufacturer or one of his service partners

10.9 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 remain on the floor. The desiccant is very slippery and may result in a 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 "CYCLE MODE - VAR" mode, the desiccant should be replaced. Desiccant replacement is generally useful as a preventive maintenance measure in conjunction with other repair work (\rightarrow 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. Disregarding may lead to dryer damage 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 (\rightarrow see maintenance table on page 54).

- 1) Decommission the dryer (\rightarrow page 52).
- 2) Depressurize the dryer (\rightarrow page 52).
- 3) Remove the upper check valve block above the vessels by loosening the pipe fittings on the pipe bends and the pipe leading to the after-filter.



- 4) Remove the strainer basket (S1, S2) and clean it of desiccant residues.
- 5) Remove the sealing material and clean the thread surfaces from the residues of the sealing material.
- 6) Provide an adequately sized container for the used desiccant. (Pay attention to the volume indication on the vessel plate.)
- 7) Remove the used desiccant from the vessel using a suction device. 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.
- 8) Clean the desiccant drain nozzle and reseal the nozzle using the appropriate sealing agents.
- 9) Remove the used desiccant from the construction site.
- 10) 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.
- **11)** Fill the desiccant into the vessels. Fill the vessels almost full so that the sieve basket (SB1, SB2) can still be inserted into the vessel opening with slight pressure. The desiccant will compress slightly during operation and reduce its volume slightly.
- **12)** Reinsert the strainer basket (SB1, SB2) into the vessel using an appropriate sealing material.
- 13) Place the upper check valve block back onto the vessels (A1, A2) and close the elbow connector. Tighten the screw connections only slightly at first and then tighten them completely.
- **14)** Clean the floor thoroughly from desiccant residues.
- **15)** Slowly pressurise the dryer again (\rightarrow page 50). Carry out a leak test using a leak detection spray. In the event of leaks, the dryer will have to be depressurised before repairing the leaks.



Dew point quality

Please note that the dew point may decrease slightly directly after a desiccant change. The new desiccant will only reach its full drying capacity after prolonged operating time, i.e. by loading the desiccant with a high level of moisture.

If necessary, select the dew point limit value for the time directly after the desiccant change as described below.

- 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 lower than -40°C.
- Now, select a **dew point** limit value of -40°C. The dryer should now permanently be reaching good dew points.

^{*} Different applications require different desiccant fillings. Even a filling with only one type of desiccant is possible and common. Please investigate for the correct type and quantity of desiccant before you order the replacement desiccant. The manufacturer holds records of the desiccant filling used for each individual dryer(→ page 5). Please state the dryer serial number in your correspondence (→ page 6).



Taking the inspection intervals for the vessels into account

Pressure vessels are part of systems requiring inspection that must be inspected before commissioning, after modifications requiring inspection and at regular intervals. The inspection intervals for periodic inspections are determined by national regulations. It may be necessary to involve a notified body when carrying out the inspection.

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 recommissioning the dryer using the old filter elements and using 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 Regulation (EC) No 1272/2008. Nevertheless, the common safety measures concerning 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 handling 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 European Waste Catalogue:

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

11. Dismantling and disposal



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.

Use appropriate protective equipment when working on pressure components.



DANGER ! – Electrical voltage

The dryer is operated with an electrical voltage of up to 230 V. Touching live parts can lead to serious injuries and 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 case of fire, do not extinguish with water.

If damage occurs to the dryer in the course of its use which cannot be prevented or repaired by regular maintenance and repair, and safe operation of the dryer can no longer be guaranteed, the dryer must not be operated any longer. After decommissioning, the dryer must be disconnected from the power supply, drained and dismantled. If using cranes or other lifting equipment to remove or load the components, these must have an appropriate load-bearing capacity. In some cases, it is advisable to first remove the unit from the work surface and dismantle it in a suitable place without possible access by unauthorised personnel.

- First, take the dryer out of operation and depressurise it. Proceed as described in 9.2 to 9.4 and observe the safety instructions listed there (→ page 52).
 If the compressed air system must be kept under pressure during disassembly, the shut-off valves must be secured against accidental opening. In this case, the installation of a bypass line around the dryer is recommended.
- 2) Disconnect the dryer from the power supply.
- 3) Support the piping connected to the dryer sufficiently before disconnecting it from the dryer.
- 4) Remove the upper valve block above the vessels by loosening the pipe fittings on the pipe elbows and the pipe leading to the after-filter and drain the dryer as described in the chapter "Checking and replacing the desiccant / Cleaning the strainer basket" (→ page 57).
- 5) Now disassemble the emptied dryer into components. When dismantling components, ensure that suitable cutting procedures and tools are selected. If necessary, vessels should be checked for possible internal deposits before dismantling.



WARNING ! - Part under tension

Mechanical connections on pipelines or frame parts can be under tension. When the connection is loosened, tension is released and can cause components to move abruptly or be flung away. Heavy components can fall. Persons in the hazardous area may suffer bruises or impacts. Especially when working at heights, serious falls may result.

Proceed carefully when working on mechanical components and use appropriate protective equipment.

After disassembly, individual components of the dryer must be disposed of according to their type (electrical waste, metal scrap, desiccant) in a professional manner in compliance with local regulations or, if necessary, recycled. For the disposal of desiccants, please observe the instructions in the chapter "Checking and replacing the desiccant / Cleaning the strainer basket" (\rightarrow page 57).

If you are not familiar with the work involved in dismantling measures, it is advisable to have them carried out by a specialised and authorised specialist company.

12. Technical documents

Technical documents such as

- general arrangement drawing,
- process flow diagram,
- pneumatic diagram,
- spare part lists,
- technical documentation of installed components, etc.

can be requested from the manufacturer (\rightarrow page 6) or, if available, can be downloaded online from the manufacturer's homepage (\rightarrow <u>www.fstweb.de</u>).