

Breathing air system

BSP-MT 10-95

Dokument-ID: DMN-BSP-MT10-95/R03



Operating instructions

CE 0525

Revision 03—2012/ EN

Declaration of Conformity

Parker Hannifin Manufacturing Germany GmbH & Co. KG
Hiross Zander Division

Im Teelbruch 118,
45219 Essen, Germany,

declare under our sole responsibility that the products

breathing air system

series BSP-MT 10-95

assembly type: assembly acc. to Art. 3 Nr. 2.2,

which this declaration refers to, conform to Directive **97/23/EG** and were subjected to a conformity assessment according to Annex III (Module A).

The assembly consists of pressure appliances according to the classification list (attached to the technical documentation provided by the manufacturer).

The following standards / technical specifications were used:

- harmonisierte Normen: DIN EN ISO 12100:2010, DIN EN 61000-6-2, DIN EN 60204
- European Pharmacopia 2000

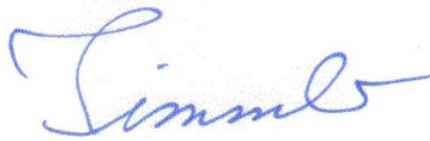
The following other EG directives were used:

- 2004/108/EG
- 2006/95/EG

Essen,

06.06.2011

Datum / Date



i. V. Dr. Jürgen Timmler
Leiter Technik und Entwicklung /
Manager Engineering and Development

Machine passport

Type designation	BSP-MT
Order no.	
Order ID.	
Build no.	
Vessel no.	
Vessel no.	
Vessel no.	
Year of manufacture	

It is the responsibility of the owner,

- to enter for the first time any appliance data not stated above,
- to keep these appliance data up to date.

The above-stated appliance data provide for a clear identification of the dryer and its components, and significantly facilitate any service measures.

Further important data on the dryer such as the details on the permissible operating pressure and the electrical connection are found on the type plate (for position of the type plate see page 8).

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General information

Manufacturer's details

Name and address



*Parker Hannifin Manufacturing Germany GmbH & Co. KG
Hiross Zander Division*

Im Teelbruch 118
D-45219 Essen

Phone ++49 (0) 2054 934-0
Fax ++49 (0) 2054 934-164

Internet www.parker.com/hzd
E-Mail zander@parker.com

Details on the dryer

Standard equipment

Breathing air system, hereafter referred to as dryer, consisting of:

- 1 double-chamber hollow section vessel, filled with drying agent
- 1 single-chamber hollow section vessel, filled with purifying agent
- 2 upstream filter
- 1 downstream filter
- Muffler
- Control system

Associated documents

- Operating instructions (present)
- Technical documentation (see annex)
- Circuit diagrams (see separate document)
- Operating manual for installed filters (separate document)

Notes on supplementary documents

Supplementary documents such as operating manuals for options or pertaining components must always be heeded. They contain additional information, e.g. regarding maintenance, and are therefore necessary for safe operation of the plant.

About these operating instructions

These operating instructions contain basic information on the safe use of the dryer.

Characters and symbols used

- ▶ Work steps that you have to carry out in the sequence stated are marked by black triangles.
- Lists are marked by a small box.

Note:

These notes provide you with hints and information on the safe and efficient handling of machines and devices.

**Warning!**

These safety notes warn against damage to property and help you to avoid such damage.

**Danger!**

These danger notes with a grey background warn against personal injury and/or danger to life and limb; danger notes help you to avoid serious or life-threatening situations for yourself and/or third parties.

Target group of these operating instructions

These operating instructions are intended for all persons working on and using the dryer. We assume that all such persons are specialist personnel according EN ISO 7396-1.

Operating instructions: handling

These operating instructions must be continuously available at the site where the adsorber is used. We recommend to prepare a copy and to keep the same in a safe and freely accessible place next to the adsorber. Keep the original document in a safe place.

For your own safety

The dryer has been built in accordance with the state of the art and the recognized technical safety regulations. Nevertheless, there is a risk of personal injury and damage to property when the dryer is used, if

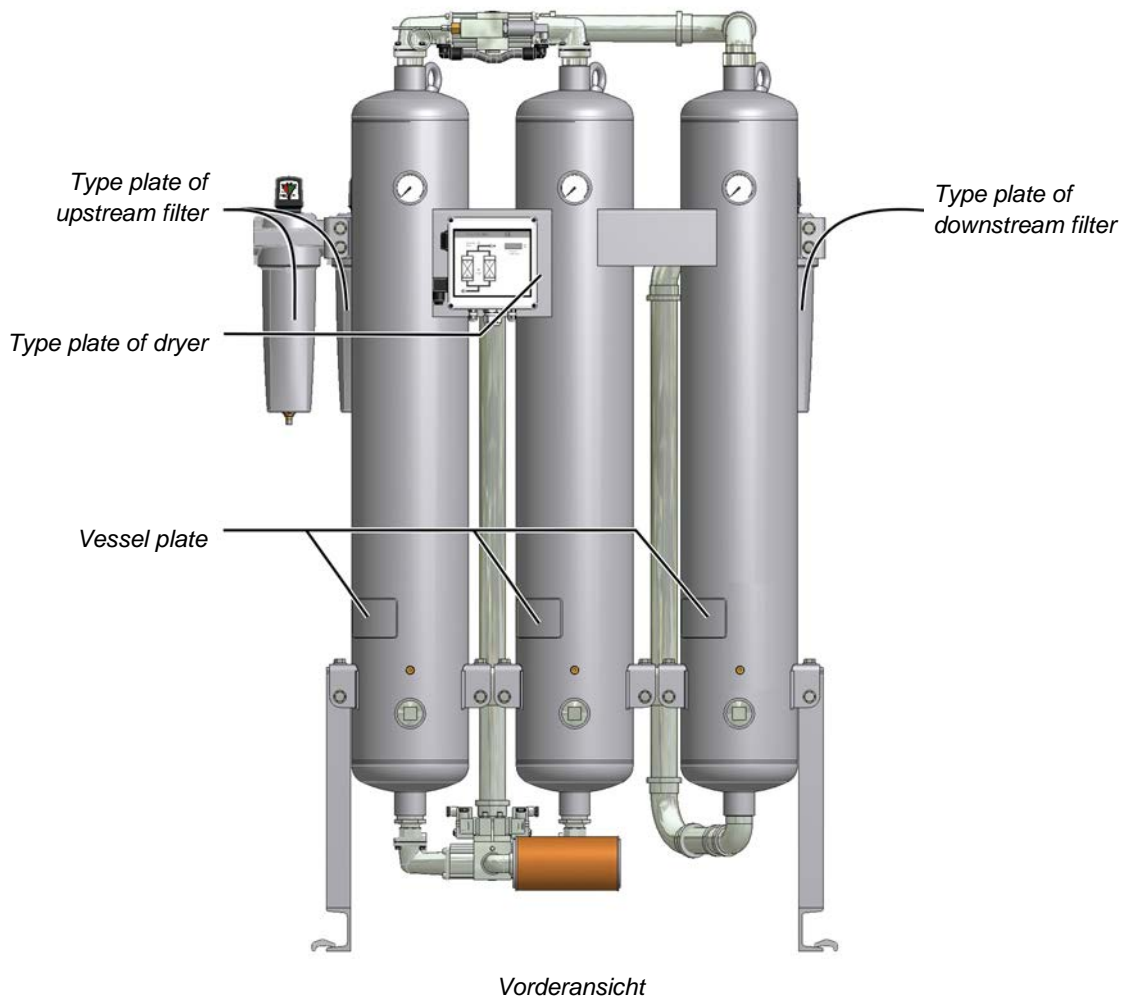
- it is operated by non-qualified personnel,
- not used within its intended design specifications,
- is repaired or maintained incorrectly.

Note:

For your own safety and to prevent machine damage, please note the information and safety notes in these operating instructions when working with the dryer.

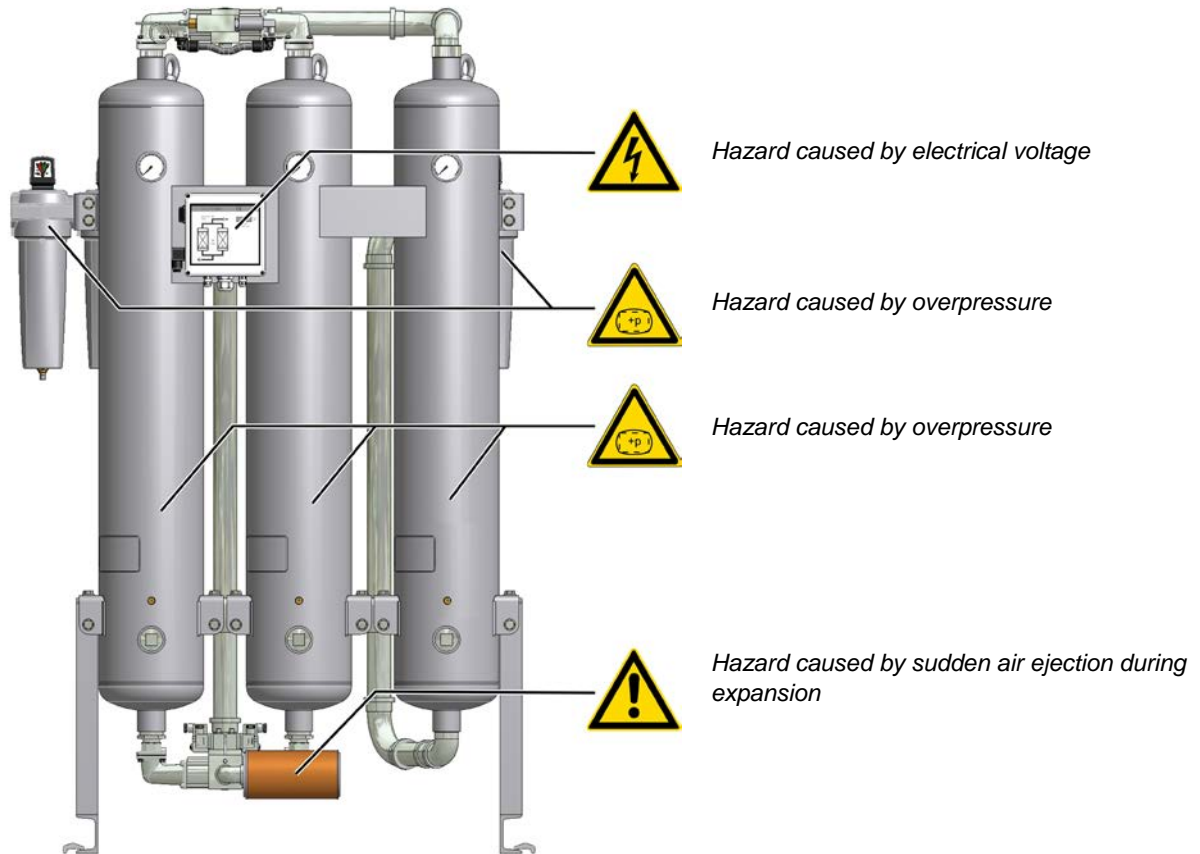
Signs and hazard areas on the dryer





Signs and labels



Please note these signs on the dryer. Keep them complete and always legible.

Hazard areas on the dryer



Hazard area	Symbol in operating instructions
<p>Warning against hazardous electrical voltage</p> <p>Different parts of the dryer carry electrical current. These parts may be connected, opened, and maintained by authorized specialist personnel only.</p>	
<p>Warning against overpressure</p> <p>The entire dryer is under pressure. Before commencing any work, the plant must be depressurised.</p>	
<p>Warning against sudden air ejection</p> <p>When the hollow section vessels are depressurised, air flows suddenly out of the sound absorber.</p> <ul style="list-style-type: none"> ■ This causes a sudden loud cracking noise. ■ Due to particles carried in the air flow, there is a very considerable risk of eye injury. <p>When working on the dryer, always wear eye and ear protection equipment.</p>	
<p>Risk of skidding</p> <p>When emptying and filling the hollow section vessels with drying agent, there is a risk of skidding caused by spilt drying agent.</p>	

Intended use of the dryer

The dryer is exclusively designed for the drying and purifying of compressed air. Depending on defined input conditions, the compressed air is processed for use as industrial breathing air in accordance with EN 12021.

The dryer is designed for compressed air, which is free from aggressive water, oil, and solid matter constituents.

As standard, the dryer is intended to be sited within a building and protected against the weather.

The dryer may be operated only in accordance with the data on the type plate and in accordance with the contractual conditions.

Suspected misuse

The dryer must not be misused as a climbing aid! Pipes, valves, and similar fittings have not been designed for such loads. They could fracture, tear off, or become damaged in another way.

General safety notes



For your own safety, when carrying out any work on the dryer comply with all applicable national safety regulations!

Personnel qualification

Only authorized and qualified specialist personnel may be tasked with the work on the dryer described in these operating instructions.

Conversions and modifications

Without prior approval by the manufacturer, no conversions and modifications must be made to the dryer! Any non-approved modifications may restrict the operational safety of the dryer and cause damage to property or personal injury.

Handling of drying and purifying agents

The drying and purifying agents used do not pose any risk to health. However, when filling and emptying the vessels with drying and purifying agents, increased dust generation may occur. Please comply with the following instructions:

- When handling drying or purifying agents, always wear a dust mask and eye protection!
- If a spillage occurs, any spilt drying or purifying agent must be taken up immediately. There is a risk of skidding!

Safety notes on specific operating phases

Transportation and siting

- During transportation all applicable national regulations for accident prevention must be complied with.
- Only use suitable and technically perfect lifting gear with a sufficient carrying capacity.
- Carefully secure the dryer during transportation.

Start-up



Warning against sudden air ejection!

During expansion the pressure is released suddenly through the muffler:

- **A loud expansion noise is caused which may damage your hearing.**
- **Particles carried in the air can injure your eyes or skin.**

Always wear eye and ear protection, therefore, when you are in the vicinity of the dryer!



Hazard due to a sudden release of pressure!

Never remove any parts of the dryer, or manipulate the same in any way, for as long as the plant is still pressurised! A sudden escape of pressure may cause serious injuries.

Before carrying out any work on the dryer, first depressurise the plant.

- Carry out all prescribed tests and checks.
- The factory settings on the control board in the switchbox must not be changed on any account without prior approval by the manufacturer.
- Before start-up, ensure that no tools or other foreign parts have been left lying in a part of the dryer where they might pose a hazard to the dryer being started up.

Emergency shutdown

To emergency shut-down the dryer heed to the following instructions:

- ▶ Close shut off valves upstream and downstream of the dryer (if applicable)
- ▶ Disconnect the electrical power supply (i.e. by switching the On/Off switch to **0**).
- The dryer is now off-line.
- ▶ If applicable, depressurise the dryer now.

Before re-commissioning of the dryer ensure that the emergency situation has been solved and that the dryer is not damaged.

Never commission a damaged dryer!

Monitor operation



Warning against sudden air ejection!

During expansion the pressure is released suddenly through the muffler:

- **A loud cracking noise occurs which can injure your hearing.**
- **Particles carried in the air flow act like bullets and can injure your eyes or skin.**

Always wear eye and ear protection, therefore, when you are in the vicinity of the dryer!

- Only operate the dryer within the permissible limits (see type plate). By operating the dryer in conditions that go beyond the defined values, the dryer is subjected to loads for which it has not been designed. This may cause functional defects.
- The more powerful the dryer is, the more noise may be generated during operation. Therefore, the operator must provide suitable protective equipment (e. g. ear protection).
- Check the dryer regularly for externally visible damage and defects. Any changes, even in its operating behaviour, must be reported immediately to the competent office or person.
- In the event of an emergency or if a safety-relevant disruption occurs (e.g. escaping compressed air, defective component), the dryer must be shut down immediately as described in the section on page 37). The unit may only be restarted after all defects have been eliminated.

Maintenance of the dryer and fault removal



Hazard due to a sudden release of pressure!

Never remove any parts of the dryer, or manipulate the same in any way, for as long as the plant is still pressurised! A sudden escape of pressure may cause serious injuries.

Before carrying out any work on the dryer, first depressurise the plant.

- Carry out maintenance work only when the plant has been shut down and depressurised!
- The factory settings on the control board in the switchbox must not be changed on any account without prior approval by the manufacturer.
- Bolt connections must be undone with care! Note ram pressure values! Otherwise emerging media may cause personal injury.
- Never carry out any welding on a vessel or change the same in any other way!
- Never use pipes and fittings as steps or holding points! The components might fracture, or the distortions which occur may cause internal damage on the dryer. There is a risk of injury by slipping off the components, components breaking off, and expanding compressed air!
- Never leave tools, loose parts or cloths in, at or on the dryer.
- Following maintenance work always test all flange and bolt connections for leak tightness and secure seating.

- Only use replacement parts that are suitable for the relevant function and meet the technical requirements stipulated by the manufacturer. This is always the case, if you use original replacement parts only.

Disassembly and disposal



Hazard due to a sudden release of pressure!

Never remove any parts of the dryer, or manipulate the same in any way, for as long as the plant is still pressurised! A sudden escape of pressure may cause serious injuries.

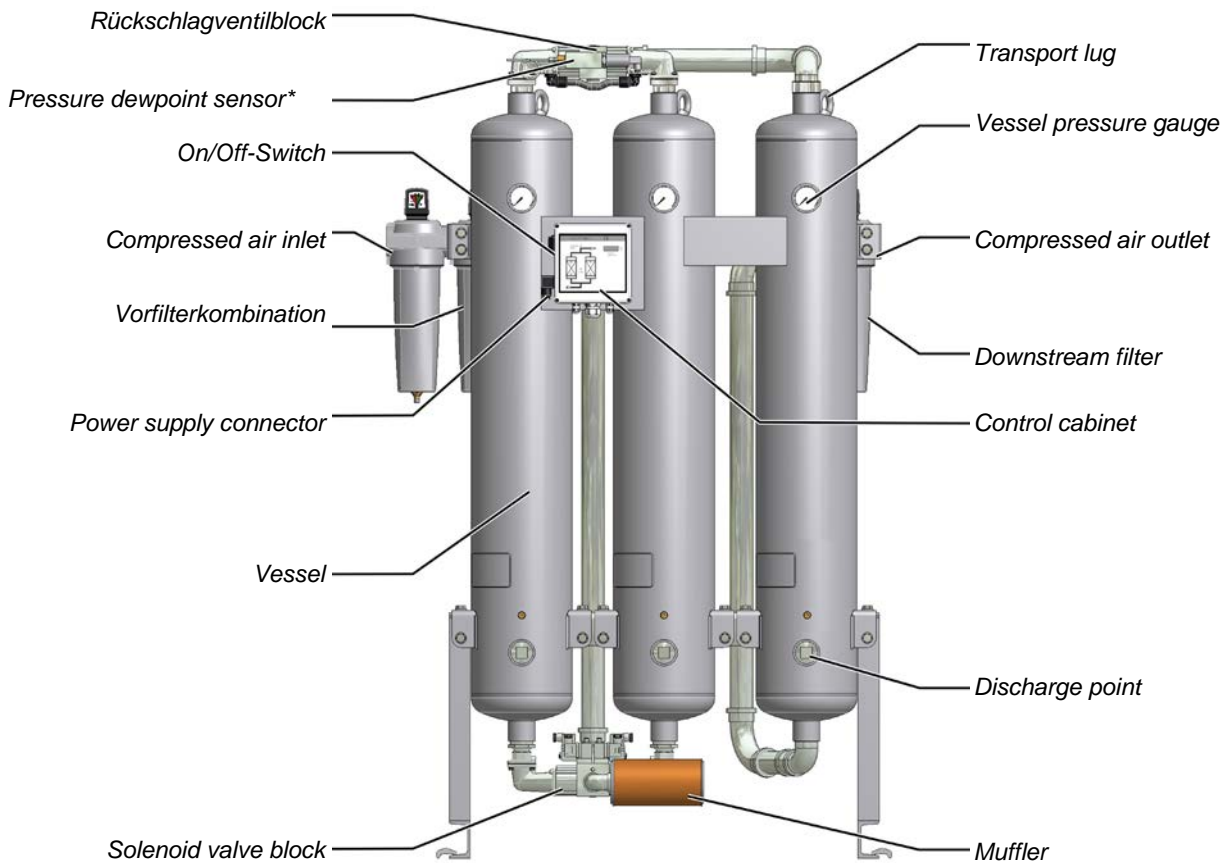
Before carrying out any work on the dryer, first depressurise the plant.

- Dispose all parts of the dryer, the drying and purifying agents and all other operating materials in an environmentally safe way and in accordance with all current statutory regulations. The waste code numbers of the drying and purifying agents can be obtained from the manufacturer.

Technical product description

Summary drawing

Front view



* Option

Function description

The dryer dries and purifies the compressed air supplied by the compressor and provides medical breathing air.

The air is thereby dried alternately in one of the drying agent vessels. The dried air is subsequently purified in the third vessel, whereby oil residue and other contaminants are removed.

Before the compressed air is fed into the dryer, it flows through upstream filters where dust, dirt, oil and water droplets are removed. Thus, the installed upstream filter is also used for extending the service life of the drying agent.

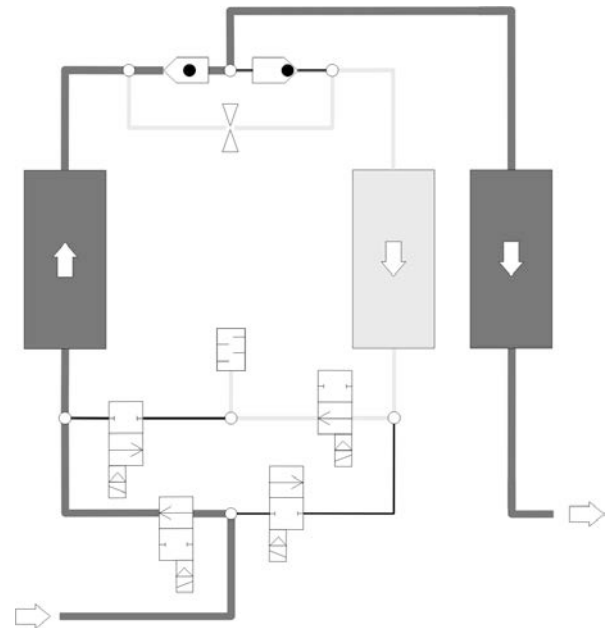
The installed downstream filters clean the compressed air from drying agent abrasions, before it is fed into the compressed air system.

The two vessels contain an extremely porous drying agent by means of which humidity is removed from the compressed air and stored just as in a sponge. The stored humidity is then removed again from the drying agent and re-introduced into the ambient environment.

To this end, the two vessels alternate between different operating modes. Whilst in one vessel, compressed air is de-humidified (adsorption), in the other vessel the humid drying agent is prepared for another charge (regeneration). These two states, which run in parallel during compressed air preparation, are described below.

Adsorption

Via a compressor, humid compressed air is supplied to the upstream filters. From here, the compressed air flows upwards through the absorption vessel, which is pressurised. In so doing, the drying agent dehumidifies the air. The dried compressed air is supplied to the pipe network via the purifying vessel and the downstream filter.



Adsorption in the left drying agent vessel.

Regeneration (running in parallel to the adsorption)

At the same time the other vessel is prepared for a renewed take-up of humidity. This process is called regeneration.

The regeneration is subdivided into three phases: expansion, dehumidification, and pressure build-up.

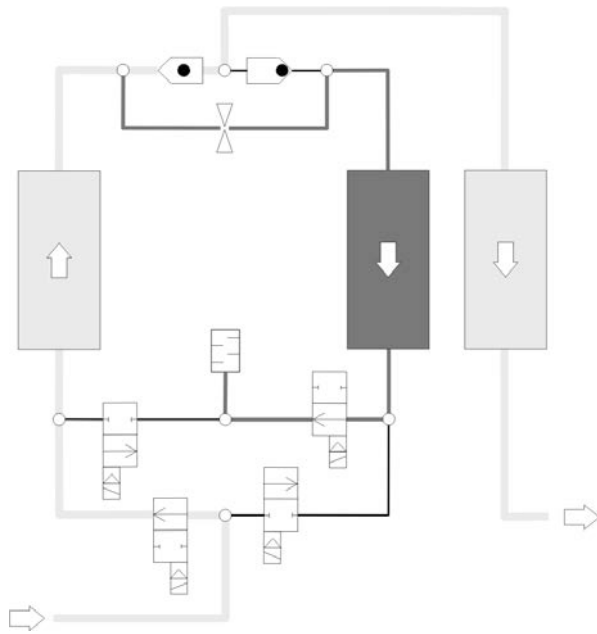
With the *dewpoint-sensing control* option, the regeneration phase is followed by a standby phase.

Expansion phase

During the expansion phase, the pressure in the regenerating vessel is released via the muffler down to ambient pressure within just a few seconds. The outflow of the compressed air becomes noticeable due to a sudden powerful flow noise at the muffler.

Dehumidification phase

Prior to being released into the purifying vessel, dried compressed air is bled by means of an orifice plate. This separate regeneration air flow is fed through the depressurised vessel.

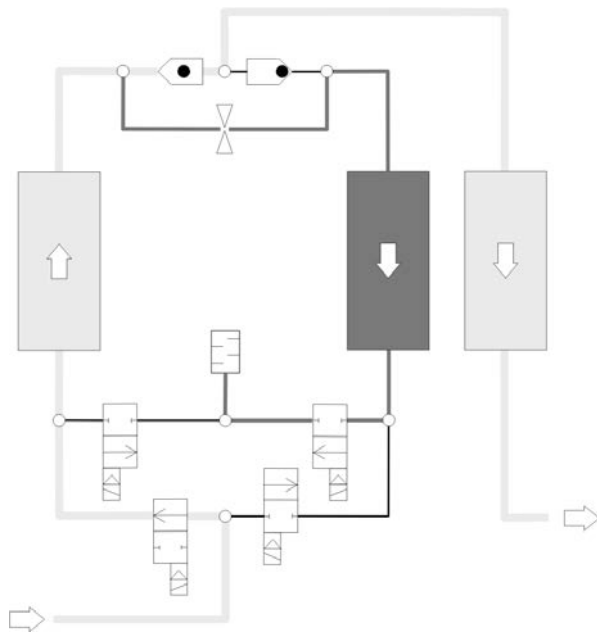


Regeneration in in the right drying agent vessel

The humidity stored in the drying agent is taken up by the air flow and expelled into atmosphere via the muffler.

Pressure build-up phase

After dehumidification the pressure in the regenerated hollow section vessel is built up to operating pressure, so that the switchover from regeneration to adsorption can take place at operating pressure level.



Pressure build-up in the right drying agent vessel

Standby phase (only with the dewpoint-sensing control option)

When in standby phase, the fully regenerated vessel is ready for absorption operation. The system is switched to this vessel, as soon as the measured dewpoint at the compressed air outlet has reached the set dewpoint value for switchover.

Switchover

When the drying agent in the adsorbing vessel has taken up a sufficient level of humidity, then the switchover between the vessels will be effected between the vessels. Following switchover, the above-described process is repeated, with the adsorption and regeneration now taking place in the respective different vessel.

Available options

The following options are available for the dryer:

- Start-up device
- Signalling contacts of control system and compressor synchronisation
- Regeneration gas return
- Dewpoint-sensing control
- Fine filter muffler
- Nozzle kit

Start-up device

A start-up device basically consists of a pressure holding device, which is located at the rear of the dryer. The pressure holding device ensures that pressure can build up in the dryer and adsorption take place.

It is always required when an empty compressed air reservoir or an empty compressed air system must be filled downstream of the dryer (e.g. following weekend shutdowns and when the pressure in the compressed air system can frequently drop below the stated operating pressure).

Signalling contacts of the control system & compressor synchronisation

The control system is equipped with a digital input for the synchronised operation with a compressor. This feature allows for synchronised and thus efficient dryer operation with discontinuous compressor operation.

Compressor synchronisation helps reduce energy costs, as the dryer can be operated independently of the compressor.

The compressor synchronisation controller is a higher-level controller than the pressure dew point controller (see below). When both options are in place, the compressor synchronisation controller is treated as the prime controller.

The control system can also be equipped with an optional operation signalling contact with which the dryer operation can be monitored from an external device. Dryers with the optional *dewpoint-sensing control* are equipped with such a contact as standard. It is used for the transmission of operating signals and for the output of dewpoint alarms.

Regeneration gas return

When the compressor is switched off, the regeneration gas return ensures that regeneration is continued, as soon as a certain compressed air volume is reached behind the dryer. The regeneration process must be continued and ended so that the drying agent does not become unusable prematurely.

Regeneration gas recirculation depends on the properties of the installed compressed air network and should be discussed with the manufacturer beforehand.

Dewpoint-sensing control

With a dewpoint-sensing control system, you can operate the dryer in fixed or variable cycles. In the fixed cycle, switchover is effected after a fixed time period (usually after 5 minutes). In the variable cycle, the switchover is effected in relation to the dew point reached and the charging of the drying agent. The adsorption time in the variable cycle amounts to 10 minutes maximum.

Fine filter muffler

A fine filter muffler is used to reduce the noise emission of the dryer to lower levels than the standard muffler can provide. If installed, the fine filter muffler replaces the original installed muffler.

Nozzle kit

In the case that the operating pressure deviates from the standard design pressure (7bar_e) it is possible that the amount of necessary regeneration air changes. This effect may have a negative impact on the cost-effectiveness of the dryer. To prevent this, it is possible to replace the built in regeneration air nozzle by a nozzle with a modified bore. This replacement optimizes the regeneration air consumption and therefore restores the energy efficiency of the dryer. To receive more information on this conversion, please contact the manufacturer.

Transportation, installation and storage



Danger due to incorrect transportation!

The dryer must be transported by authorized and qualified specialist personnel only. During transportation all applicable national regulations for accident prevention must be complied with. Otherwise there is a risk of personal injury.

Always adhere to the stickers and notes on the packaging of the dryer!

- Only use suitable and technically perfect lifting gear with a sufficient carrying capacity.
 - During transportation the dryer must be carefully secured against falling over.
- The manufacturer will not be liable for any damage caused by incorrect storage or incorrect transportation. Please note therefore the following instructions as well as the storage instructions on page 21.

Information on transportation packaging

Depending on the type of transportation, the dryer is delivered in different types of packaging:

- All transportation types: the apertures of the dryer are closed off by means of plugs.
- In addition, when transportation is effected by air: the dryer is packaged in a wooden box.
- In addition, when transportation is effected by ship: the dryer is packaged in a film material and in a wooden box.

If the packaging is undamaged

- ▶ The undamaged packaging should be removed only at the final installation site, as it offers protection against any weather influences.

What to do in the case of transport damage occurring?

- ▶ Check whether only the packaging or the dryer itself were damaged.
- ▶ Inform the haulier immediately in writing of any damages.
- ▶ Contact the manufacturer urgently in order to report the damage.



Warning!

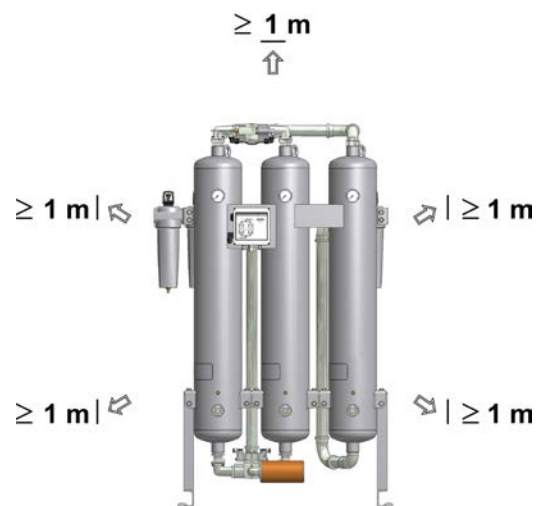
A damaged dryer must not be taken into operation! Damaged components may lead to functional faults and possibly cause further damage.

Transporting and installing the dryer

Requirements for the installation site

The conditions at the installation site have a large influence on the functional capacity of the dryer and the service life of the drying and purifying agents. In order to ensure a mode of operation, which is as continuous as possible, and low maintenance, the installation site must meet the following requirements:

- The installation site must be located within a building. Protect the dryer against moisture.
- The ambient temperature must not drop below +1,5 °C (34, 7 F).
- Heed the dryer's noise emission when selecting the installation location.
- The installation area must be level, firm and vibration-proof. It must have the necessary carrying capacity for the weight of the dryer. The weight of the dryer is specified in the technical data section of the annex.
- The dryer should be installed with sufficient spacing at the top, sides and rear, in order to be able to carry out maintenance work and change the drying and purifying agents without any hindrances (see figure).



Necessary spacing at the top and sides = min. 1 m

If in doubt, the installation site must be inspected by specialists. If you have any queries in this regard, please contact the manufacturer.

Transportation using lifting or forklift trucks



Warning against damage to property!

The dryer is delivered standing on its side on a transportation pallet. Top and sides have not been designed for mechanical loads. Therefore do not place any load onto the top face. Do not stack.

Therefore, always transport the dryer on a lifting or forklift truck.

The dryer should only be transported in an upright position.

- ▶ Secure the dryer on the lifting or forklift truck against sliding movements.
- ▶ Transport the dryer to its installation site.

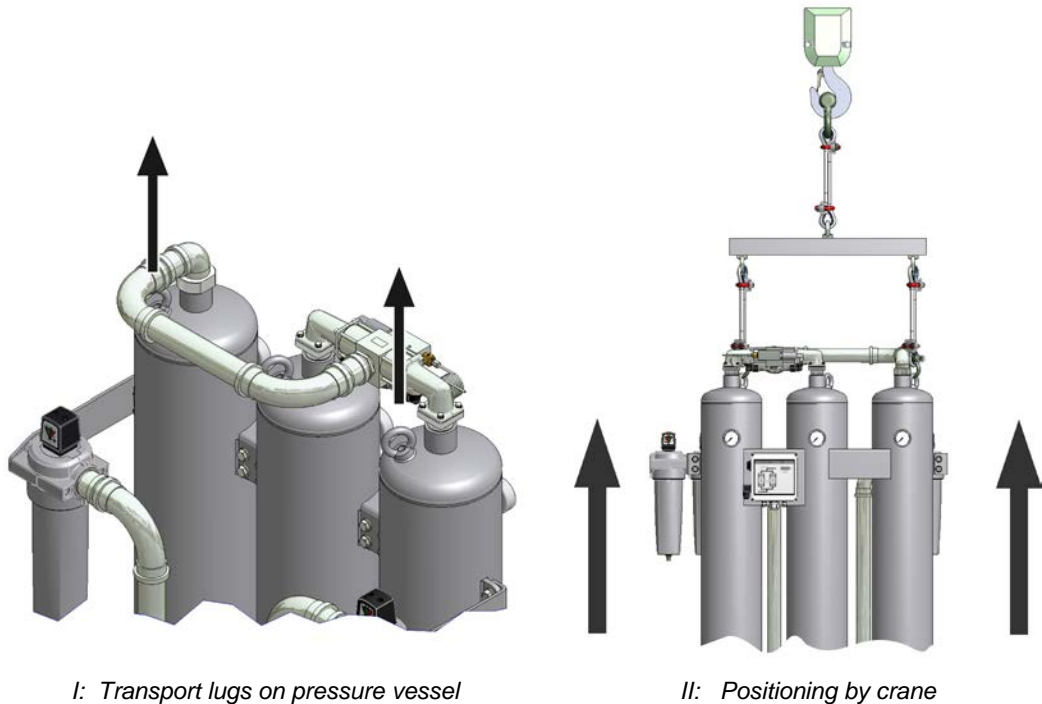
Installing the dryer



Caution!

Always use the lifting lugs at the top of the tank to lift the dryer. Use a lifting beam with a suitable spacing for this purpose. This will ensure the tanks cannot come in contact with the upper pipe bridge and thus damage it.

- ▶ Remove the packaging of the dryer.
- ▶ Attach suitable lifting gear to the transport lugs of the vessels (see figure I).
- ▶ Raise the dryer (see illustration II) and remove the transportation pallet.
- ▶ Place the dryer at its installation site.



I: Transport lugs on pressure vessel

II: Positioning by crane

Anchoring the dryer

- ▶ Use suitable attachment material to anchor the dryer to the floor.
- ▶ In the case of vibrating floors: place the dryer on suitable vibration dampers.

Storing the dryer

If the dryer is to be stored for an extended period of time, the storage location must meet the following conditions:

- The dryer must not be stored in the open air.
- The storage room must be dry.
- The storage room must be free from dust or the dryer must be covered by a protective sheet.
- The storage room must have an ambient temperature of at least +1 °C (33,8 °F).

In order to store the dryer proceed as follows:

- ▶ Take dryer out of operation as described on page 37.
- ▶ Ensure that the compressed air inlet valve installed by the owner, and the installed compressed air outlet valve installed by the owner, are both closed, and that the dryer is depressurised.
- ▶ Disconnect dryer from the compressed air system.
- ▶ Disconnect the dryer from the electrical power supply and all external lines.
- ▶ Use film material or similar to close the compressed air inlet apertures and compressed air outlet apertures on the dryer in order to protect them against contamination.
- ▶ If possible cover dryer with a protective sheet.

The dryer can now be stored for long periods.

Note:

If you wish to take the dryer back into service after an extended period of storage, please proceed as described for its first commissioning and start-up (see page 32).

Store drying and purifying agents

- ▶ Do not store drying and purifying agents in the open air.
- ▶ Protect drying and purifying agents against humidity.

Installation



Only authorized and qualified specialist personnel may carry out work on pipes and electrical systems.

As soon as the dryer has been set up at its installation location, you can install the compressed air infeed and outlet lines and make the electrical connections.

Preconditions for installation

For a correct installation the following preconditions must be met on the part of the owner.

- Connections and lines for the infeed and outfeed of compressed air must be provided.
- A compressed air inlet valve as well as a compressed air outlet valve must be installed by the owner, so that the dryer can be installed and maintained in a depressurised condition (see also the installation example on page 24).
- All pipes, couplings, and connections must have the correct diameter and match the operating pressure.



Hazard caused by exceeding the limit values!

A safety device must be provided in order to protect against the maximum permissible operating pressure from being exceeded.

The safety device must be installed so that the dryer is reliably protected from exceeding the maximum permitted operating pressure even when the temperature of the compressed gas increases.

The data required to meet these preconditions are contained in the technical documentation attached in the annex.



Warning!

If the above preconditions are not complied with, a safe operation of the dryer cannot be assured. Also, the functionality of the dryer may be detrimentally affected.

Connect piping

In order to ensure that the dryer operates optimally, the dryer must be assembled into the compressed air system free of all stresses.

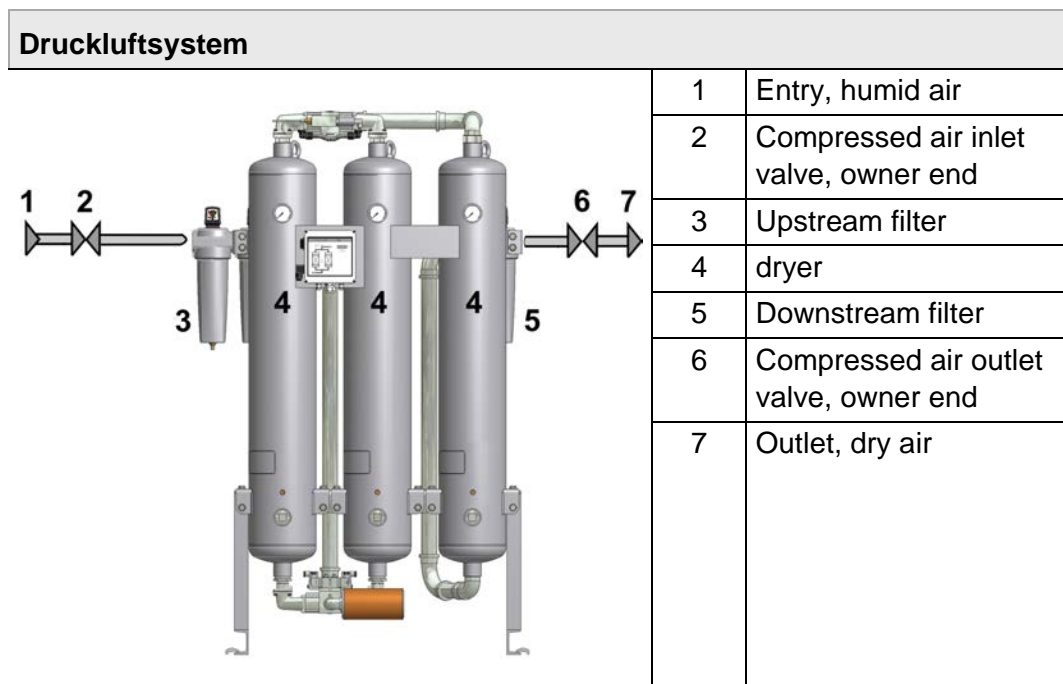
- ▶ Ensure before connection that all infeed and outfeed compressed air lines and valves are clean and undamaged.
- ▶ Check the bolt connections and retighten if necessary, as they could have worked loose during transportation.
- ▶ Remove plugs on the pressure inlet and outlet.



All piping must be free from any stress and tension whatever!
Pipes subject to stress may burst due to the load placed on them during operation. This may cause damage to property and personal injury.

- ▶ Use steel pipes to connect the dryer to the compressed air system.

The following figure shows an installation example.



Example of an installation

- ▶ The connection lines for the upstream filter (3) are to be installed at a slight incline in the direction of the upstream filter.
- ▶ One shutdown valve each (2, 6) is to be installed at the compressed air inlet and outlet ends of the dryer.

Installing the electrical connection



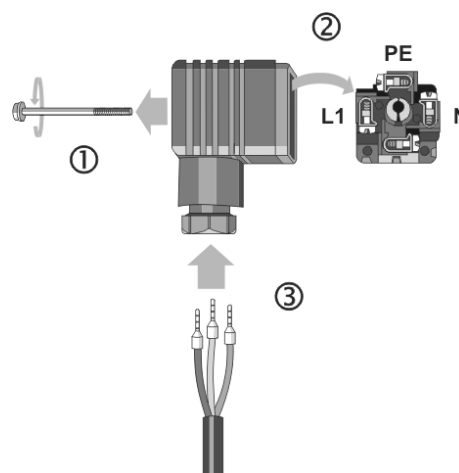
Warning against electrical voltage
Only qualified specialist personnel may carry out work on the electrical system!

Installing the supply cable

The components of the dryer have been connected to the control cabinet at the factory. You only need to connect the control cabinet to the electrical supply cable.

The switchbox is provided with a connector where electrical power must be connected.

- ▶ Ensure that the cross-section of the electrical supply cable corresponds to the power rating of the dryer and the electrical voltage provided by the customer.
- ▶ Make the electrical supply cable to the dryer voltage-free.
- ▶ Secure the electrical supply cable to the dryer against switch-on.
- ▶ Undo bolt (1) on the connector and withdraw connector with seal from the switchbox.
- ▶ Use a suitable tool to remove the terminal block from the connection box.
- ▶ Undo the PG union and pull the cable through the aperture (3). The exposed phase ends should not be longer than 35 mm max.



Connect electrical cable to device adapter

- ▶ Now make the cable connection as follows:
 - Earth to terminal PE
 - L1 to terminal 1
 - N to terminal 2

Terminal 3 is not used.

- ▶ Fit terminal block into the connector and use bolt to remount the connector with seal on the switchbox.
- ▶ In all phases the dryer must be protected against short circuits by means of fuses.
- ▶ In order to relief cable strain, re-tighten the PG union.

Connecting the external signalling lines

Note:

For the use of the dryer in redundant systems (according to the European Pharmacopoeia) with imposed control, we recommend

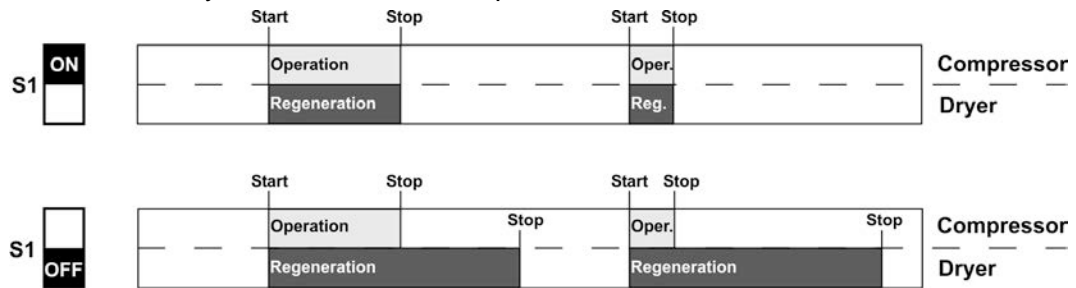
- operation of the dryer in synchronised compressor mode, and
 - operating intervals of minimum 24 hours,
- in order to achieve the desired dewpoint and regular cycles.**

For compressor synchronisation

The controller is fitted as standard with a digital input which makes the dryer regeneration dependent on operation of the compressor (switch S1 on the controller's circuit board, see also figure below).

If switch S1 is in the ON position, operation of the compressor and dryer regeneration run synchronously: When the compressor is stopped, the dryer regeneration also stops. When the compressor is restarted, regeneration also restarts.

If switch S1 is in the OFF position, any regeneration process which has been started, is always continued until completed.



To install the external line, proceed as follows:

- ▶ Connect the signalling line to the potential-free busbar connection of the compressor to terminals 1 and 2 on the control board (see circuit diagram)

Note:

The compressor synchronisation controller is a higher-level controller than the pressure dew point controller. When both options are in place, the compressor synchronisation controller is treated as the prime controller.

For operation monitoring system (optional)

Operators have the option to connect the dryer to a fault signalling system, connecting the respective line to a potential-free operation signalling contact. With this option, the following statuses and events can for example be transmitted to a remote control room:

- Dryer on (contact made)
- Power supply disconnected (no contact)
- Dewpoint alarm (only with *dewpoint-sensing control* option, no contact)

To install the external lines, proceed as follows:

- ▶ Connect the lines of the fault signalling system to relay K5 (see circuit diagram)

Check bolt connections

Before the initial start-up:

- ▶ Check all unions and bolt connections as well as the terminals in the control cabinet for secure seating; re-tighten if necessary.

Start-up



Warning!

The dryer must be taken into operation by trained personnel only! Untrained personnel does not have the required knowledge. Such personnel might cause serious faults.

Note:

You can order the initial commissioning and start-up from the manufacturer and have your personnel trained by the manufacturer. For telephone number, see page 6.

- Carry out all prescribed tests and checks.
- Before start-up, ensure that no tools or other foreign parts have been left lying in a part of the dryer where they might pose a hazard to the dryer being started up.

Requirements for initial start-up

For the first start-up the following preconditions must have been met:

- The pipe system is free from
 - scales
 - thread abrasions
 - welding beads and
 - other contaminations.
- All shutdown valves
 - of the compressed air inlet and outlet valves installed by the owner are closed.
- The dryer is correctly sited and installed.

Checks before start-up

Ensure that

- all pipe, cable and bolt connections on the dryer have been retightened,
- no pipes chafe against body edges,
- all mountings are perfectly secure,
- the electrical connections are in safe contact and in good condition,
- owner-end and pressurised parts such as safety valves or other devices are not blocked up by dirt or paint,
- all compressed air system parts which are pressurised (valves, hoses etc.) are free from wear symptoms and defects.

Setting times of the operating phases

In its standard version the dryer is delivered with a time-dependent control system. The phase sequence occurs in a fixed cycle.

With the optional dewpoint-sensing control, the dryer can also be operated at variable cycles (depending on the dewpoint).

The following table provides information on the duration of the individual phases.

Phase duration	Fixed cycle	Variable cycle
Adsorption	5 min	10 min, maximum
Regeneration, total	5 min	5 min
– of which: expansion time	~ 0.2 min	~ 0.2 min
– of which: dehumidification time	~ 4 min	~ 4 min
– of which: pressure build-up	~ 1 min	~ 1 min
Standby	—	~ 5 min, maximum

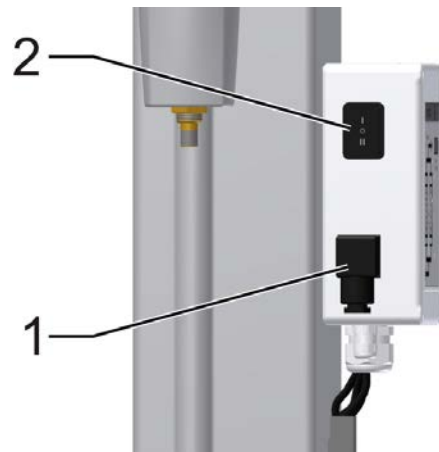
Overview of operating and control elements

ON/OFF switch

The ON/OFF switch (2) is located to the side of the switchbox and above the mains plug (1, see figure):

- If it is set to **0**, the power supply is disconnected and the dryer is switched off. The main valves (V1, V2) are open, while the expansion valves (V3, V4) are closed. This means that the air can circulate in the main processing direction, even if the dryer is switched off.
- If the switch is set to **I**, the dryer is switched on and begins to operate in fixed cycle mode (i.e. time-controlled).
- If the switch is set to position **II**, the dryer is switched on and begins to operate
 - with compressor synchronisation
 - in variable cycle mode (i.e. dewpoint-controlled).

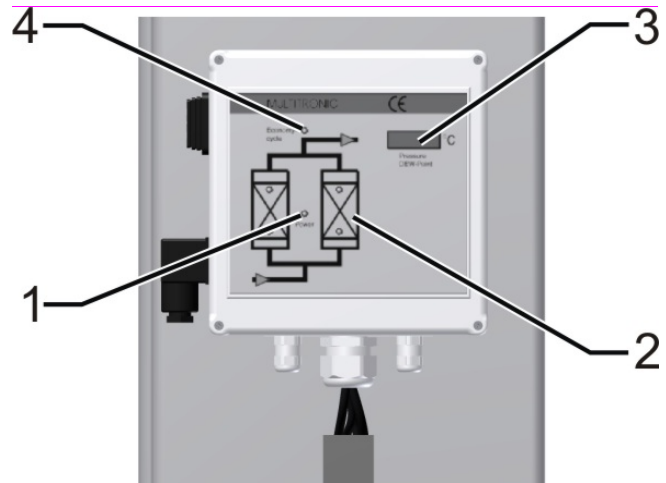
Position **II** is only relevant for operation with the optional *compressor synchronisation* and/or *dewpoint-sensing control*.



Switchbox with ON/OFF switch

Display panel

The display panel at the switchbox is equipped with LEDs (light emitting diodes) and a digital display, indicating the operating status of the dryer:



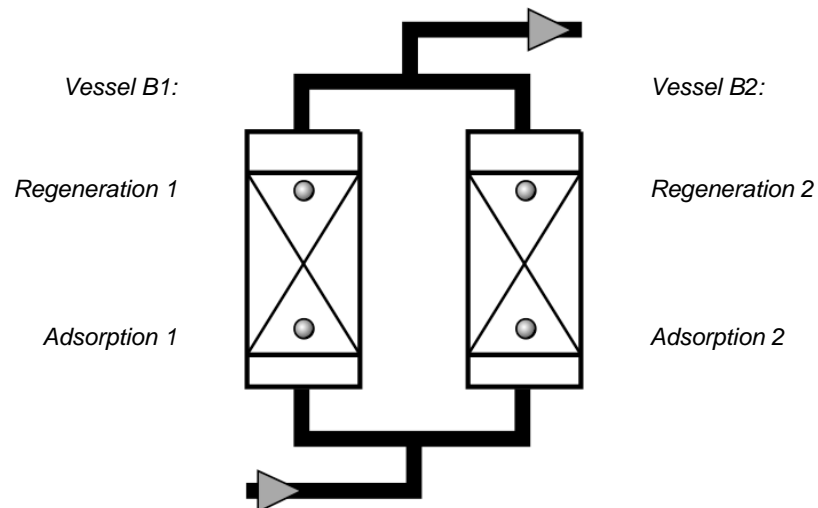
Display panel at the switchbox

LED Power (1)

LED is on when dryer is switched on.

Flow diagram (2)

The current operating phases of the dryer are indicated by means of 4 LEDs:



Depending on the operating phase, the following LEDs might be on simultaneously:

Adsorption B1 and regeneration B2 or
regeneration B1 and adsorption B2.

Digital display (3)

The digital display shows the individual programme steps and the respective remaining time. For details regarding the sequence of the individual processing steps and their duration, please refer to the logic control diagram, page 58.

Display	Explanation
2 215	Default display: The figure to the left indicates the current processing step; the figure to the right shows the remaining time in seconds. In this example, step 2 is being completed, whereby there are 215 seconds remaining.
SEr.	After 8000 operating hours, "SEr." (service) is displayed for periods of 1 minute, alternating with the default display. Notify the service personnel of the manufacturer, as a routine service is now due.
- 25	With the <i>dewpoint-sensing control</i> option, the display shows the currently measured dewpoint instead of the default data. The range of display is -100 °C (-148 °F) to +20 °C (68 °F). If the measured dewpoint exceeds the preset alarm limit (5 °C (41 °F) above the switchover value), the displayed dewpoint value is flashing.

With the optional *dewpoint-sensing control*, the following error messages might be displayed:

Display	Cause
+20	■ Upper measuring range limit exceeded
999	■ Dewpoint sensor defective
sens or -999	■ Dewpoint sensor not powered ■ Cable defective or disconnected ■ Sensor defective

LED Economy cycle (4)

This LED is only relevant in units that are equipped with the optional *dewpoint-sensing control*. The diode lights up when the dryer is switched on and in the standby phase and no regeneration air is required.

Vessel pressure gauge

On both vessels, pressure gauges are fitted which show the operating overpressure. The operating overpressure indicates the operating phase of the relevant vessel:

- During adsorption the pressure gauge should indicate the nominal operating overpressure.
- During regeneration the indication of the pressure gauge on the regenerating vessel
 - should decrease in the expansion phase from operating overpressure to 0 bar overpressure,
 - indicate an overpressure of 0 bar in the dehumidification phase.

With an increasing duration of operation, a higher overpressure can be indicated during regeneration. This overpressure during regeneration is also designated as dam pressure.

- The dam pressure should not exceed 0.3 bar, otherwise read the instructions on page 43.
- During the pressure build-up phase the indication on the pressure gauge should again rise to operating overpressure level.

Emergency shutdown

To emergency shut-down the dryer heed to the following instructions:

- ▶ Close shut off valves upstream and downstream of the dryer (if applicable)
- ▶ Disconnect the electrical power supply (i.e. by switching the **ON/Off** switch to **0**).
- The dryer is now off-line.
- ▶ If applicable, depressurise the dryer now.

Before re-commissioning the dryer ensure that the emergency situation has been solved and that the dryer is not damaged.

Never commission a damaged dryer!

Start up dryer



Warning against sudden air ejection!

During expansion the pressure is released suddenly through the muffler:

- A loud cracking noise occurs which can injure your hearing.
- Particles carried in the air flow act like bullets and can injure your eyes or skin.

Always wear eye and ear protection, therefore, when you are in the vicinity of the dryer!



Hazard due to a sudden release of pressure!

Never remove any parts of the dryer, or manipulate the same in any way, for as long as the plant is still pressurised! A sudden escape of pressure may cause serious injuries.

Before carrying out any work on the dryer, first depressurise the plant.

- The more powerful the dryer is, the more noise may be generated during operation. Therefore, the operator must provide suitable protective equipment (e. g. ear protection).
- Only operate the dryer within the permissible limits. By operating the dryer in conditions for which it has not been designed, functional faults may be caused.
- Depending on the size of the dryer and the compressed air network and the respective legal requirements in your country, it may be necessary to perform initialisation according to the directive for pressure equipment 97/23/EC.
- Check the dryer regularly for externally visible damage and defects. Any changes, even in its operating behaviour, must be reported immediately to the competent office or person.
- In the event of an emergency or if a safety-relevant disruption occurs (e.g. escaping compressed air, defective component), the dryer must be shut down immediately as described in the section on page 37). The unit may only be restarted after all defects have been eliminated.

Open compressed air supply and switch on dryer

Gehen Sie bei der Inbetriebnahme in der hier aufgeführten Reihenfolge vor.

- ▶ Sicherstellen, dass betreiberseitig installierte Drucklufteintritts- und -austrittsventile geschlossen sind (siehe Installationsbeispiel auf Seite 24).
- ▶ Sicherstellen, dass das Druckluftnetz vor dem Trockner unter Druck steht. Gegebenenfalls unter Druck setzen (Kompressor einschalten).



Slowly open compressed air inlet valve!

Avoid sudden pressure build-up in any circumstance! If pressure builds up too fast, this may cause damage to the dryer. Therefore, the compressed air inlet valve must always be opened quite slowly!

- ▶ Slowly open the compressed air inlet valve, installed by the owner, upstream of the dryer.
- ▶ Switch on dryer: to this end, set the ON/OFF switch to **I**.

If the dryer is taken into operation for the first time, or after a change of drying agent, the following intermediate step is meaningful. In the case of a restart situation, the following intermediate step can be skipped.

Operating the dryer for the first time (or after a change of drying agent) separately

Depending on the transportation and storage conditions, the drying agent in the vessels can already be loaded with humidity from the environment. At each first start-up it makes sense therefore to operate the dryer from some time separately from the compressed air system. This causes the drying agent in each vessel to be regenerated repeatedly and thus to be prepared optimally for the take-up of humidity.

Note:

Depending on the pressure dew point to be achieved, we recommend to operate the dryer at first start-up without compressed air consumption:

- for at least 4 hours at a pressure dew point of -25 to -40 °C or
- for approx. 3 to 5 days at a pressure dew point of -70 °C.

If you wish to take the dryer into operation in accordance with our recommendation, proceed as follows:

- ▶ Ensure that the compressed air outlet valve installed by the owner is closed.
- ▶ Keep the compressed air outlet valve closed for the time period recommended above.

Then the dryer can be taken into service in the compressed air system as described in the following section:

Operate dryer immediately in the compressed air system

- ▶ Ensure that the compressed air system downstream of the dryer is pressurised or that a start-up device (option, see page 17) was installed into the compressed air system directly downstream of the dryer.
The importance of this increases with the size of the compressed air system downstream of the dryer. Smaller compressed air systems can be pressurised also by means of compressed air fed through the dryer.



Slowly open compressed air outlet valve!

Avoid a sudden drop in pressure in any circumstance! If pressure drops too fast, this may cause damage to the dryer. Therefore, the compressed air outlet valve must always be opened quite slowly!

- ▶ Slowly open the compressed air outlet valve installed by the owner. Observe the vessel pressure gauge of the pressurised vessel. The pressure should not drop below the operating pressure (if poss.). If necessary, keep the compressed air outlet valve in a slightly open position until the compressed air system downstream of the dryer has filled up completely; only then should the valve be opened fully.

The dryer has then be taken into operation within the compressed air system.

In the event of a fault

In the event of an emergency or if a safety-relevant disruption occurs (e.g. escaping compressed air, defective component), the dryer must be shut down immediately as described in the section on page 37).

Then proceed as follows:

Remedy fault

- ▶ Look up possible cause of the fault, and how to remedy the same, in the table on page 48.
- ▶ Remedy fault.
- ▶ Repeat the start-up procedure.

Changing cycle mode

When *can* I change cycle mode?

If the dryer has been successfully commissioned and is equipped with one of the following options:

- *compressor synchronisation* or
- *dewpoint-sensing control*

it can be set to *economy cycle* mode.

When *should* I change cycle mode?

Cycle changes should be made during the pressure build-up phase and prior to switchover; during this phase, the pressure in both chambers is just below operating pressure so that a fast pressure build-up is prevented when the chambers are switched.

During this period, only the adsorption LED is on in the diagram, and the digital display shows step 4 or step 9 for the duration of 1 minute (see logic control diagram; not displayed with dewpoint sensing).

Which cycle modes can I choose?

If the dryer is connected to a *compressor synchronisation system* and is equipped with the *dewpoint-sensing control* option, these two optional devices can only be started together. The compressor synchronisation has thereby precedence over the dewpoint-sensing control.

With compressor synchronisation

If compressor synchronisation is enabled, the dryer can only be operated in conjunction with the compressor. As soon as the compressor is switched off, the dryer is automatically set to standby mode.

In standby mode, the control system remains on, and the dryer is ready for the next switchover, which is made as soon as the compressor is switched on.

Note:

The compressor synchronisation controller is a higher-level controller than the pressure dew point controller. When both options are in place, the compressor synchronisation controller is treated as the prime controller.

With dewpoint-sensing control (optional)

Dryers equipped with dewpoint-sensing control operated in variable cycle mode, based on the measured dewpoint of the dried air at the compressed air outlet. As soon as a certain dewpoint is reached, as the drying agent in the absorbing chamber is saturated, the chambers are switched.

The dewpoint at which a switchover is made is preset at the factory.

How do I change cycle mode?

- ▶ Wait until the dryer has reached the pressure build-up phase (phase prior to switchover).
One LED for *Adsorption B1/B2* is on in the flow diagram.

- ▶ Set the ON/OFF switch to position **II**.

The programme continues the cycle.

Monitoring dryer operation

The dryer operates fully automatically. However, you should carry out the regular checks described in the Chapter *Maintenance and repair of the dryer*.



Warning against sudden air ejection!

During expansion the pressure is released suddenly through the muffler:

- A loud expansion noise is caused which may damage your hearing.
- Particles carried in the air flow act like bullets and can injure your eyes or skin.

Always wear eye and ear protection, therefore, when you are in the vicinity of the dryer!

With dewpoint-sensing control (optional)

Display of dewpoint

If the dryer is equipped with a dewpoint-sensing control system, the digital display at the front of the switchbox shows the currently measured dewpoint. The range of display is -100 °C (-148 °F) to $+20\text{ °C}$ (68 °F).

If the set dewpoint is exceeded, the system automatically completes a switchover between the vessels. The dewpoint at which a switchover is made is preset at the factory.

- After commissioning or extensive maintenance work, check the dewpoint display at the dryer.

Under certain circumstances, the desired dewpoint is only reached after prolonged operation.

Error messages

If the measured dewpoint exceeds the preset alarm limit (5 °C (41 °F) above the switchover value), the displayed dewpoint value is flashing. In addition, an error message can be issued through the potential-free busbar.

Error codes and their causes:

Display	Cause
+20	■ Upper measuring range limit exceeded
999	■ Dewpoint sensor defective
sens or -999	■ Dewpoint sensor not powered ■ Cable defective ■ Sensor defective

For instructions on how to eliminate faults, see chapter *Identify and eliminate faults*

Shutdown and restart dryer

In the following cases, the dryer must be fully shut down and depressurised:

- In the event of an emergency or malfunction
- For maintenance work
- For dismantling



Risk of injury from escaping compressed air!

Never remove any parts of the dryer, or manipulate the same in any way, as long as the unit is pressurised! Suddenly escaping compressed air might cause serious injuries.

Prior to any work, release all pressure from the unit.



Caution!

Risk of damage to the dryer, if it is switched off during the expansion or drying phase.

During these phases, the pressure in the regenerating vessel is released to ambient pressure: If the main valve is opened, as the dryer is switched off, there is a sudden pressure build-up in the vessel. This might result in

- damage to the drying agent, and
- excessive abrasion, with negative impact on the regeneration capacity.

Before switching off the dryer, wait until it has reached the pressure build-up phase or is in standby mode (before switchover).

Note:

If the unit is equipped with a compressor synchronisation system, first switch off the compressor and then wait until the dryer has reached the standby phase before switching it off with the ON/OFF switch.

This ensures that the regeneration cycle is completed, and that the pressure in both vessels is at the same level.

Note:

As soon as the dryer is switched on again, the programme continues the cycle from the point at which it has been stopped.

Emergency shutdown

To emergency shut-down the dryer heed to the following instructions:

- ▶ Close shut off valves upstream and downstream of the dryer (if applicable)
- ▶ Disconnect the electrical power supply (i.e. by switching the On/Off switch to **0**).
- The dryer is now off-line.
- ▶ If applicable, depressurise the dryer now.

Before re-commissioning of the dryer ensure that the emergency situation has been solved and that the dryer is not damaged.

Never commission a damaged dryer!

Depressurising and shutting down the dryer

Close compressed air feed line

- ▶ Close the compressed air inlet valve (provided by the operator).

Disconnect voltage supply

- ▶ Switch off the dryer by setting the ON/OFF switch to position **0**.

Disconnect dryer from compressed air system

- ▶ Close the compressed air outlet valve installed by the owner.

Depressurise dryer

- ▶ Depressurise dryer, e.g. by opening the manual drain at the downstream filter.

If work is to be carried out on the electrical system

- ▶ Depressurise and shut down the dryer, following the instructions in the above chapter.



Risk of injury due to voltage-carrying parts!

The electrical supply cable and external power lines are live even after the dryer is switched off and, in the event of body contact, may cause serious injury! Before carrying out any work on the electrical system, the electrical supply cable and all external power lines must be made voltage-free!

- ▶ Make the electrical supply cable to the dryer voltage-free.
- ▶ Secure the electrical supply cable to the dryer against switch-on.

Restart

Depending on the fittings installed by the operator and the actual pressure conditions, the unit might have to be restarted at operating pressure. The following general rules apply:

- When switched off, the dryer is open in main flow direction. With the optional *start-up device*, the set minimum pressure must however be reached prior to restart.
- A return flow is only possible in connection with the optional *regeneration gas return* (and provided that the pressure outlet valve is open).
- If the dryer is equipped with a dewpoint-sensing control system, it is depressurised gradually, according to the read measuring current.

If compressed air system and dryer have remained at operating pressure

- ▶ Ensure that the compressed air inlet valve (provided by the operator) is open.
- ▶ Set ON/OFF switch to **I**. The programme continues the cycle from the point at which it was interrupted.



Slowly open compressed air outlet valve!

Avoid a sudden drop in pressure in any circumstance! If pressure drops too fast, this may cause damage to the dryer. Therefore, the compressed air outlet valve must always be opened quite slowly!

- ▶ Slowly open the compressed air outlet valve installed by the owner. The pressure should not drop below the operating pressure (if poss.). If necessary, keep the compressed air outlet valve in a slightly open position until the compressed air system downstream of the dryer has filled up completely; only then should the valve be opened fully.

The dryer is now in operation again and operates fully automatically.

If compressed air system and dryer have not remained at operating pressure

- ▶ If disconnected, reconnect the voltage supply of the dryer.
- ▶ Ensure that the manual drain on the downstream filter is closed.
- ▶ Pressurise and switch on the dryer as described in the section *Open compressed air supply and switch on dryer* on page 32.

The dryer is now in operation again and operates fully automatically.

After the purifying agent has been replaced

The newly filled purifying agent contains minute dust particles that can block the downstream filters. We therefore recommend to complete the following steps before you restart the dryer, in order to protect your equipment:

- ▶ Remove the housing base and the filter element from the downstream filter.



Wear eye protection and dust mask due to increased dust generation!

If the dryer is operated without downstream filter, there is a risk of increased dust generation.

In order to avoid any eye irritations, wear protective goggles!

In order to avoid any dust inhalation, wear dust mask!

Restart the dryer:

- ▶ Switch on the dryer and pressurise as described in section *Open compressed air supply and switch on dryer*, page 32.

The compressed outlet valve must be closed and the downstream filter housing must be open:

- ▶ Operate the dryer for approx. thirty minutes, blowing the dust particles off from the downstream filter.

Shut down the dryer:

- ▶ Close the compressed air inlet valve installed by the owner.
- ▶ Switch off the dryer by setting the ON/OFF switch to position **0**.

Reassemble the filter and commission the dryer (see the operating manual of the filter for the reassembly).

- ▶ Switch on the dryer and pressurise as described in section *Open compressed air supply and switch on dryer*, page 32.
- ▶ Check that the vessel and the downstream filter are leak tight.

Maintenance and repair of the dryer

In order to allow maintenance work on the dryer to be carried out efficiently and without danger for maintenance personnel, you should comply with the following instructions.

Notes on maintenance



Warning!

Maintenance tasks may be carried out only by authorized and qualified specialist personnel, and only with the plant in a switched off and depressurised condition.

Note:

In order to ensure perfect maintenance and reliable operation we recommend that you conclude a maintenance contract (For telephone number, see page 6).

When exchange or replacement parts are ordered, always state the dryer type and the build no. of the dryer. These data are found on the type plate attached to the control cabinet door.

- Carry out all maintenance work only when the plant has been shut down and depressurised!
- Bolt connections must be undone with care! Note ram pressure values! Otherwise emerging media may cause personal injury.
- Do not modify the factory settings of the control system in any way without prior consultation with the manufacturer.
- Never carry out welding work on a vessel or modify the same in any way!
- Following maintenance work, always check all flange and bolt connections for leakage and secure seating.
- Never use pipes and fittings as steps or holding points! The components might fracture, or the distortions which occur may cause internal damage on the dryer. There is a risk of injury by slipping off the components, components breaking off, and expanding compressed air!
- Never leave tools, loose parts or cloths in, at or on the dryer.
- Only use replacement parts that are suitable for the relevant function and meet the technical requirements stipulated by the manufacturer. This is always the case, if you use original replacement parts only.

Regular maintenance intervals

Note:

If a chamber has been depressurised, e.g. after completion of the expansion phase, and the pressure remains above 0 bar, the chamber is pressurised by what is known as ram pressure. This might be due to

- blockage at the muffler
- contamination of the perforated plates
- spent drying or purifying agent

To prevent such malfunctions, regularly service the dryer as described below.

The table provides an overview of the maintenance work to be carried out. The following pages describe some of these tasks. Maintenance work requiring the dryer to be largely disassembled is not described. We recommend to have this work to be performed by authorised specialists.

Component	Maintenance task to be carried out	Maintenance interval			
		daily	12 months	24 months	see page
Complete dryer	Carry out visual and function checks.	●			43
Vessel pressure gauge	Check dam pressure. For a dam pressure exceeding 0.3 bar: – Check muffler. – Check dust sieve. – Check drying agent.	●			43
Air quality	Must be check.		●		43
Sensor of optional dewpoint-sensing control system	Renew.		●		43
Muffler	Replace muffler after 1 year of operation and after renewing the dessicant.		●		44
fine filter muffler-dämpfer	Replace silencer element annually and after each desiccant change.		●		44
Purifying agent	Replace If the fed compressed air is humid, the maintenance interval is reduced to 6 months.		●		46
drying agent	Renew		●		46
Pilot valves	Renew		●		46
Main valves V1/V2	Renew.			●	46
Expansion valve V3/V4	Renew			●	46
Check valves V5/V6	Renew			●	46
Solenoid coils	Renew			●	47

Component	Maintenance task to be carried out	Maintenance interval			
		daily	12 months	24 months	see page
Upstream and downstream filters	Please see the enclosed operating instructions for the attached filters. Maintenance work has to be carried out as specified in this document.				

When carrying out any maintenance work, comply with the following safety instructions:



Danger!

There is a very considerable risk of personal injury, when carrying out work on the activated and pressurised dryer.

Before commencing any maintenance tasks always shut down the dryer as described on page 37, !



Warning against electrical voltage!

Only qualified specialist personnel may carry out work on the electrical system!



Instructions for use of the dongle

If the message **SEr.** is displayed on the display of the Multitronic controller, the dryer is due for servicing. The message appears, flashing every 60 seconds, once the preset number of operating hours (e. g. 8000 oh) has been reached. After maintenance has been carried out, you can use the dongle to reset the counter to 0 and delete the message from the display. A dongle is enclosed with every service kit. Each dongle can only be used once.

- ▶ Switch off the controller. Caution! The electric line is still live. Do not touch live parts!
- ▶ Open the lid to the Multitronic controller. The circuit board is housed underneath it.
- ▶ Slot the dongle into the dongle interface *X9 PC*.
- ▶ Press and hold the reset key *S3*.
- ▶ Switch on the controller. The following appears in the display:

for a short time then flashing	0.SET OFF
-----------------------------------	----------------------------

The service counter is then reset to 0.

If the following appears in the display:

for a short time then flashing	FAIL OFF
-----------------------------------	---------------------------

this means that the dongle has already been used once and cannot be used again.

- ▶ Switch off the controller again and remove the dongle.
- ▶ Dispose of the unusable dongle and use a new one.

Daily maintenance tasks

Carry out visual and function check on the complete dryer

- ▶ Check dryer for external damage or unusual noise generation.
- ▶ Duly eliminate any defects found.

If message **SEr.** is displayed, a routine service must be completed:

- ▶ Contact the service department of the manufacturer.

Clean dryer

- ▶ Remove any loose dust by means of a dry cloth, and, if required, also by means of a moist and well wrung cloth.
- ▶ Clean the surfaces with a moist well wrung cloth.

Check dam pressure

If, following depressurisation of a vessel, e.g. after the expansion phase, the overpressure has not decreased to 0 bar, then there is a residual pressure, designated as dam pressure, in the vessel.

- ▶ Check for dam pressure: if the dryer functions correctly, the respective pressure gauge indicates 0 bar. Then there is no dam pressure.

If the dam pressure is greater than 0.3 bar:

- ▶ Depressurise the dryer and shut it down (see page 37).

Dam pressure can be caused by:

- a blocked muffler,
- a blocked dust sieve or
- drying and purifying agent which is too old.

The respective necessary maintenance measures are described in the following sections.

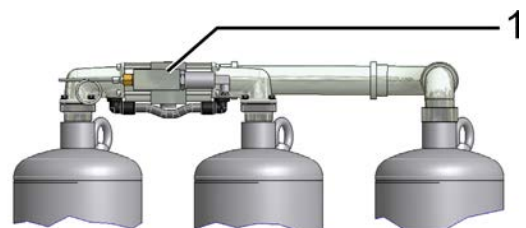
Maintenance work to be completed every 12 months

Check air quality en

Especially for critical applications, we recommend to annually check the quality of the processed medical breathing air (this check should be carried out by a qualified authority).

Renew dewpoint sensor

To ensure precision dew point measurement, it is recommended to replace the dew point sensor every year. This period depends however on the actual application and might thus be extended accordingly.



Dewpoint sensor (1)

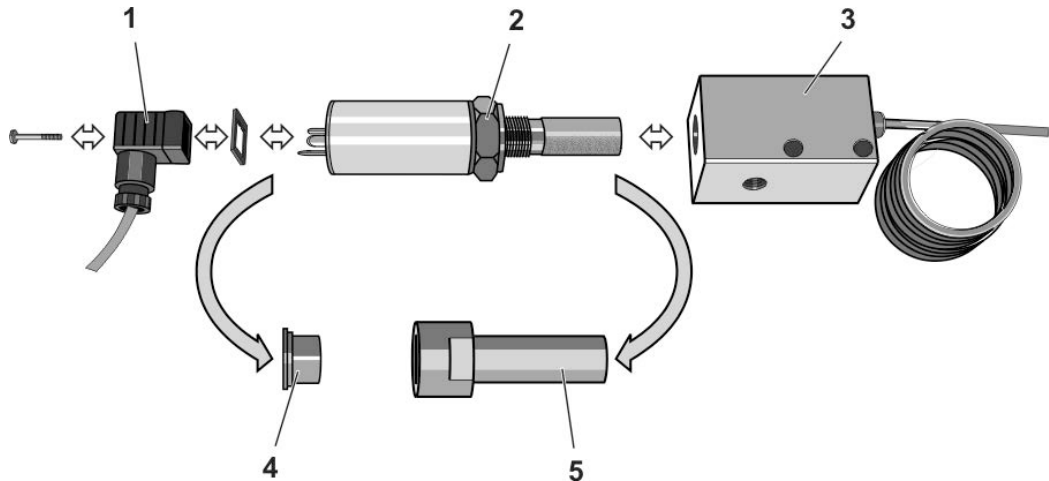


Warning!

The dew point sensor is a sensitive measuring device. It can be damaged if subjected to forceful vibrations or shocks. Therefore, please handle the dew point sensor with great care at all times.

In order to limit the impact on the dryer operation to a minimum, we recommend that you contact the manufacturer well in advance (for contact details, see page 6) and order a new dewpoint sensor. After receipt of the new pressure dewpoint sensor, replace the sensor as follows:

- ▶ Hold the box of the dewpoint sensor ready.
- ▶ Release pressure from dryer and shut down the unit (see page 37)



Installing / dismantling pressure dewpoint sensor

- ▶ Loosen the screw at the adapter (1) and disconnect signal cable with the adapter and seal.
- ▶ Remove dewpoint sensor from the sensor cell (3) by turning the nut (2).
- ▶ Take the new dewpoint sensor (2) from the box, remove the protective caps (4, 5) and screw it into the sensor chamber (3).
- ▶ Place seal onto sealing face; connect adapter (1) and secure it by tightening the screw.
- ▶ If no other maintenance work is to be carried out: Restart the dryer (see page 38).

Renew muffler

The dryer is equipped with a muffler. If the muffler becomes blocked, a dam pressure is generated which in extreme cases may cause the muffler to burst.



Hazard caused by blocked muffler!

Blocked mufflers can cause a dangerous overpressure to build up which may cause the mufflers to burst. Flying fragments may cause personal injury and damage to property.

Therefore, the mufflers must be replaced every 12 months and after each change of desiccant.



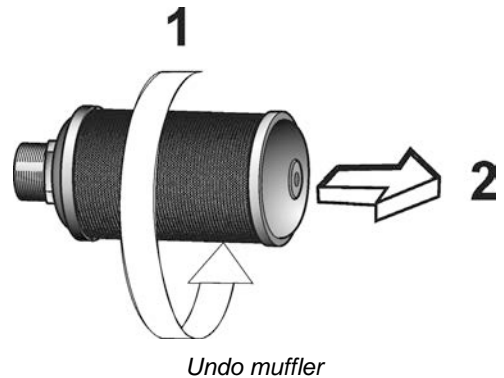
Warning against sudden air ejection!

During expansion the pressure is released suddenly through the muffler:

- A loud cracking noise occurs which can injure your hearing.
- Particles carried in the air flow act like bullets and can injure your eyes or skin.

Always wear eye and ear protection, therefore, when you are in the vicinity of the dryer!

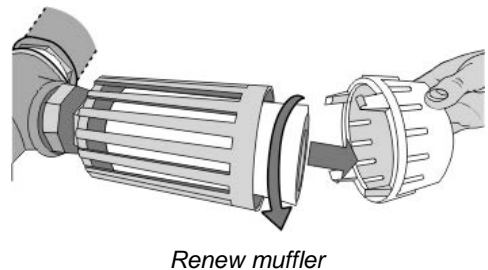
- ▶ Depressurise the dryer and shut it down (see page 37).
- ▶ Unscrew muffler as shown in the opposite figure.
- ▶ Replace muffler and secure it.



- ▶ Restart dryer (see page 38).

Replace the element in the fine filter muffler

- ▶ Depressurise the dryer and shut it down (see page 37).
- ▶ Undo knurled screw on the lid cap and remove cap.
- ▶ Unscrew old filter element. Arrows on the element bottom mark the direction of rotation.



- ▶ Insert new filter element and screw on tightly.
- ▶ Re-engage lid cap at the top section of the housing and fix in position by means of the knurled screw.
- ▶ Restart dryer (see page 38).

Notes on further maintenance work

Note:

In accordance with national regulations, a pressure vessel inspection may be prescribed to be carried out at regular intervals by an independent supervisory office.

For an inspection of the pressure vessel, the purifying- and drying agent must be removed.

When inspecting the pressure vessel, it is recommended to check the condition of all fittings such as e.g. sieve bottom and dust sieve, including gaskets. If necessary, these fittings must be cleaned or renewed.

In the event of comprehensive maintenance or repair tasks, contact the manufacturer.

Every 12 months

Replacing pilot valves

The pilot valves are part of every service kit and must be replaced every 12 months.

Renew purifying agent

Note:

To the layers of different purifying agent in chamber, you find an overview of technical data in annex.

The active surface of the purifying agent can be reduced by oil residue and other contaminants. The purifying agent must therefore be replaced once every 12 months (after approx. 8,500 operating hours). If the compressed air is insufficiently dried before it reaches the adsorber (see technical data in the appendix), the service life of the purifying agent can be considerably shortened. In this case, the agent must be replaced every 6 months (after approx. 4,000 operating hours).

Renew drying agent

The change interval depends very significantly from the degree of contamination in the compressed air (or the quality of the compressed air upstream filters). Oil, dust, and dirt particles cover the drying agent surface and reduce its effective surface, in part quite irreversibly.

Every 24 months

Replacing inlet valves (V1/V2) and check valves (V5/V6)

The inlet valves (main valves) and the check valves are part of the 24-month service kits. Replace them every 2 years as a precautionary measure.

Expansion valves (V3/V4)

In addition to the inlet valves and the check valves, the expansion valves have to be replaced every 24 months as a precautionary measure.

Replacing solenoid coils

Solenoid coils come with the 24-month service kits. Replace them every 2 years.

Identify and eliminate faults

The following table provides information on what designatory abbreviations are to be used for the various components. These designations are also found in the technical documentation.

Abbreviation	Component
PI	Pressure gauge
PDI	Differential pressure gauge
V1–V2 (Y1–Y2)	Main valves (solenoid valves)
V3–V4 (Y3–Y4)	Expansion valves (solenoid valves)
V5–V6	Check valves

Summary of faults

There are different fault types. In the case of most electrically caused faults (e.g. short circuit, defective fuse, etc.) the expansion valve closes and the regeneration is interrupted. In the case of some process faults, the dryer will continue to operate for some time. Other faults on the dryer become noticeable e.g. due to unusual noises and ran pressures.

The following table shows who is allowed to remedy a fault: the owner's specialist personnel or the manufacturer's service engineer.

Table of possible faults

Fault	Possible cause	Remedy	Spec. personnel	Service engineer
Excessive dam pressure during regeneration	Muffler or filter element of the muffler is contaminated.	Check mufflers or filter elements for contamination, clean if nec., and poss. renew.	●	●
	Expansion valve V3/V4 does not open correctly.	Check expansion valve for contamination, if nec. clean/renew.	●	●
	Dust sieves are contaminated.	Clean or renew dust sieves.	●	●
Vessel pressure is too low	Excessive differential pressure on the upstream filter.	Check differential pressure on the upstream filter, if. nec. renew filter element.	●	
No pressure build up	The compressed air system upstream of the dryer is not pressurised.	Check whether the compressed air system upstream of the dryer is pressurised. Remove any faults.	●	
	Solenoid valve Y1/Y2 does not open correctly.	Check supply voltage, cable, contacts and solenoid; replace, if necessary.	●	●
Excessive compressed air consumption	Leakage.	Check condensate trap at the upstream filter; clean, if necessary.	●	●
Dryer does not switch over	Solenoid valve Y1/Y2 does not open correctly.	Check supply voltage, cable, contacts and solenoid; replace, if necessary.	●	●

Fault	Possible cause	Remedy	Spec. personnel	Service engineer
	Solenoid valve Y1/Y2 cannot be opened properly (audible humming sound or valve flapping).	Check supply voltage. Check pilot valves; replace, if necessary.	●	●
	Control board defective.	Check fuse in supply line and in the switchbox; replace, if necessary.	●	●
	Power supply interrupted, cable broken.	Reconnect the unit to the power supply.	●	
	Compressor might be off.	Check compressor synchronisation circuit.		
	Error in control programme.	Restart programme.		●
No expansion	Solenoid valve Y3/Y4 cannot be opened.	Check supply voltage, cable, contacts and solenoid; replace, if necessary.	●	●
	Solenoid valve Y3/Y4 cannot be opened properly (audible humming sound or valve flapping).	Check supply voltage. Check pilot valves; replace, if necessary. Check valve bodies for contamination; clean or replace, if necessary.	●	●
Dryer is continuously bled	Solenoid valve Y3/Y4 cannot be closed properly (audible humming sound or valve flapping).	Check supply voltage. Check solenoid and diaphragm; replace, if necessary.	●	●
	Main valve V1/V2 does not open.	Check main valve, replace if nec.	●	●
Dryer is excessively bled	Solenoid valve Y1/Y2 cannot be closed.	Check solenoid and diaphragm; replace, if necessary.	●	●
Pressure dew point is not reached	Operating pressure is too low.	Increase operating pressure.	●	
	Compressed air volume flow is too high.	Reduce compressed air volume flow	●	
	Compressed air inlet temperature is too high.	Reduce compressed air inlet temperature or pre-connect a compressed air cooler.	●	●
	Control board is defective.	Check control board, if nec. renew.		●
	Differential pressure on the upstream filter is too high.	Check differential pressure on the upstream filter, if nec. renew filter element.	●	
	Condensate trap on the upstream filter does not work.	Check function of the condensate trap, if nec. clean or renew.	●	●
	Drying agent is contaminated or too old.	Check upstream filter for contamination, if nec. renew element.	●	
		Check drying agent for contamination, if nec. renew drying agent.	●	●
Regeneration gas too low.	Check function of expansion valve V3/V4 and muffler, if nec. renew muffler or filter element.	●	●	
	sensor is defective	Replace sensor	●	●

With dewpoint-sensing control (optional)

Fault code	Description of fault	Possible cause	Remedy	Specialised personnel	Service technician
+20	Upper measuring range limit exceeded	Drying capacity exceeded.	See instructions for commissioning. If the drying agent is wet, replace it.	●	
		Error in programme.	Restart programme.		●
999	Dewpoint sensor defective	Sensor defective or irreversibly contaminated.	Replace sensor.	●	●
sens or -999	Sensor not powered, or cable or sensor defective	Sensor, sensor cable or sensor adapter defective.	Visual inspection; check power supply (24 V to terminals 4 and 6). Replace defective component(s).	●	●
SEr	Display for service interval. Regular maintenance tasks must be carried out.	The display appears after every 8000 operating hours.	Inform the manufacturer's service staff and order the appropriate service kit. The package includes a dogle with which you can reset the operating hours counter after maintenance has been carried out. For instructions on how to use the dogle see the enclosed information sheet (in the service kit).	●	●

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Annex with technical documentation

This annex comprises the following information and technical documentation:

- Technical data
- Replacement and wear parts list
- Logic control diagram
- Flow diagram
- Dimensional drawing

Technical data

Operating Range

Site Selection	frost-free indoor installation in a non-hazardous environment
Ambient temperature	1,5 to 50 °C (24,7 to 122 °F)
Compressed air inlet temperature	20 to 50 °C (68 to 122 °F)
Max. operating overpressure	16 bar _e
Min. operating pressure	5 bar _e
Medium	Compressed air
Fluid group acc. to 97/23/EG	2

Electrical connection

Mains voltage, standard	230 V, 50-60 Hz
Protection class	IP65
Please heed to the type plate and the enclosed wiring diagram!	

Performance data

Model	Volumetric flow in m ³ /h	Nominal pipe ²	1. Upstream filter	2. Upstream filter	Downstream filter	Nominal Pressure in bar(e)	Nominal temperature in °C
BSP-MT 10	158	1	GL9ZLD	GL9XLD	GL9ZLDH	16	50
BSP-MT 15	210	1	GL9ZLD	GL9XLD	GL9ZLDH	16	50
BSP-MT 20	274	1	GL9ZLD	GL9XLD	GL9ZLDH	16	50
BSP-MT 25	371	1 1/2	GL11ZLD	GL11XLD	GL11ZLDH	16	50
BSP-MT 35	484	1 1/2	GL11ZLD	GL11XLD	GL11ZLDH	16	50
BSP-MT 45	589	1 1/2	GL12ZLD	GL12XLD	GL12ZLDH	16	50
BSP-MT 60	839	2	GL13ZLD	GL13XLD	GL13ZLDH	16	50
BSP-MT 75	1129	2	GL13ZLD	GL13XLD	GL13ZLDH	16	50
BSP-MT 95	1371	2 1/2	GL14ZLD	GL14XLD	GL14ZLDH	16	50

¹ m³/h, relating to 1 bara and 20 °C at the compressor suction capacity. Subsequently compressed to 13 bar_e and 35°C inlet temperature to the dryer at 100 % relative humidity – for pressure dewpoints of -25 °C and -40 °C.

² In accordance with DIN ISO 228 (BSP-P)

Noise emission

Noise level : +3 dB (A)¹	65 – 95 dB(A)
--	---------------

¹ relative to free field measurement, 1 m surr. field

Drying agent

Chamber 1	100 % drying agent		
Chamber 2	100 % drying agent		
Behälter 3	down	middle	top
	33 % activated carbon	33 % catalyst	33 % activated carbon

Dimensions

Please heed to the dimensional drawings and the according table containing dimensions and weight on page. 62.

Limits for breathing air

	Industrial breathing air				with breathing-air unit BSP-MT	Medical air
	Europe	UK	USA	Australia		Europe
	EN 12021	BS 4275	ANSI/CGA	AS 1715		Ph. European
Carbon monoxide CO	< 15 ppm	< 5 ppm	< 10 ppm	< 10 ppm	< 2 ppm	< 5 ppm
Carbon dioxide CO₂	< 500 ppm	< 500 ppm	< 1000 ppm	< 800 ppm	< 150 ppm	< 500 ppm
humidity H₂O	< 5 °C *	< 5 °C *	< 10 °F *	< 100 mg/m ³	< 15 ppm **	< 67 ppm
oxygen O₂	21 (±1) %	20 – 23 %	21,5 %	–	20,8 – 21,1 %	20,4 – 21,4 %
Oil quantity	< 0,5 mg/m ³	< 0,5 mg/m ³	< 0,5 mg/m ³	< 1,0 mg/m ³	< 0,003 mg/m ³	< 0,1 mg/m ³
odoriferous-/aromatic substance	frei	frei	frei	frei	frei	frei
Sulfur dioxide SO₂	–	–	–	–	< 0,1 ppm	< 1 ppm
nitrous gases NO/NO₂	–	–	–	–	< 1 ppm	< 2 ppm

* Pressure dewpoint below inlet temperature ; **Corresponding pressure dewpoint -50°C to -45°C at 7 bare
All values refer to customary concentration levels present in the inlet air

List of spare parts and wear parts

Note:

When exchange or replacement parts are ordered, always state the dryer type and the build no. of the dryer. These data are found on the type plate.

Service-Kits: Preventative Maintenance kits

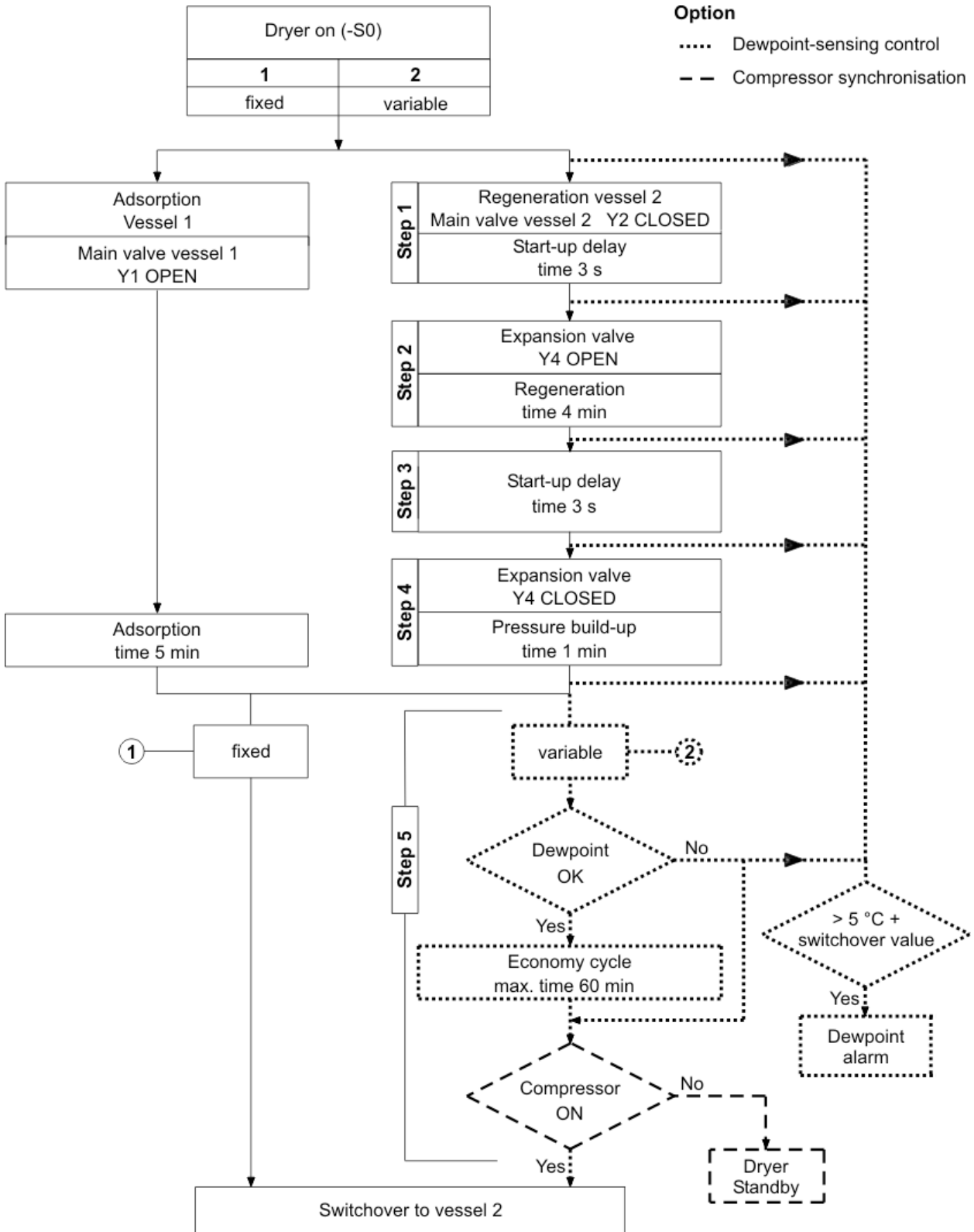
Order-ID.	for model	Maintenance interval	Scope of delivery
SKK10-K20/BP2/12	BSP-MT 10 to BSP-MT 20	12 and 36 months	Reset-module, muffler, filter elements, pilot-valves
SKK25/BP2/12	BSP-MT 25	12 and 36 months	Reset-module, muffler, filter elements, pilot-valves
SKK35/BP2/12	BSP-MT 35	12 and 36 months	Reset-module, muffler, filter element, pilot- valves
SKK45/BP2/12	BSP-MT 45	12 and 36 months	Reset-module, muffler, filter elements, pilot-valves
SKK60-K75/BP2/12	BSP-MT 60 to BSP-MT 75	12 and 36 months	Reset-module, muffler, filter elements, pilot-valves
SKK95/BP2/12	BSP-MT 95	12 and 36 months	Reset-module, muffler, filter elements, pilot-valves
SKK10-K20/BP2/24	BSP-MT 10 to BSP-MT 20	24 and 48 months	Reset- module, muffler, filter elements, inlet- expansion- and check valves, solenoid coils
SKK25/BP2/24	BSP-MT 25	24 and 48 months	Reset- modules, muffler, filter elements, inlet- expansion- and check valves, solenoid coils
SKK35/BP2/24	BSP-MT 35	24 and 48 months	Reset- modules, muffler, filter elements, inlet- expansion- and check valves, solenoid coils
SKK45/BP2/24	BSP-MT 45	24 and 48 months	Reset- modules, muffler, filter elements, inlet- expansion- and check valves, solenoid coils
SKK60-K75/BP2/24	BSP-MT 60 to BSP-MT 75	24 and 48 months	Reset- modules, muffler, filter elements, inlet- expansion- and check valves, solenoid coils
SKK95/BP2/24	BSP-MT 95	24 und 48 months	Reset- modules, muffler, filter elements, inlet- expansion- and check valves, solenoid coils

Desiccant and activated carbon packages

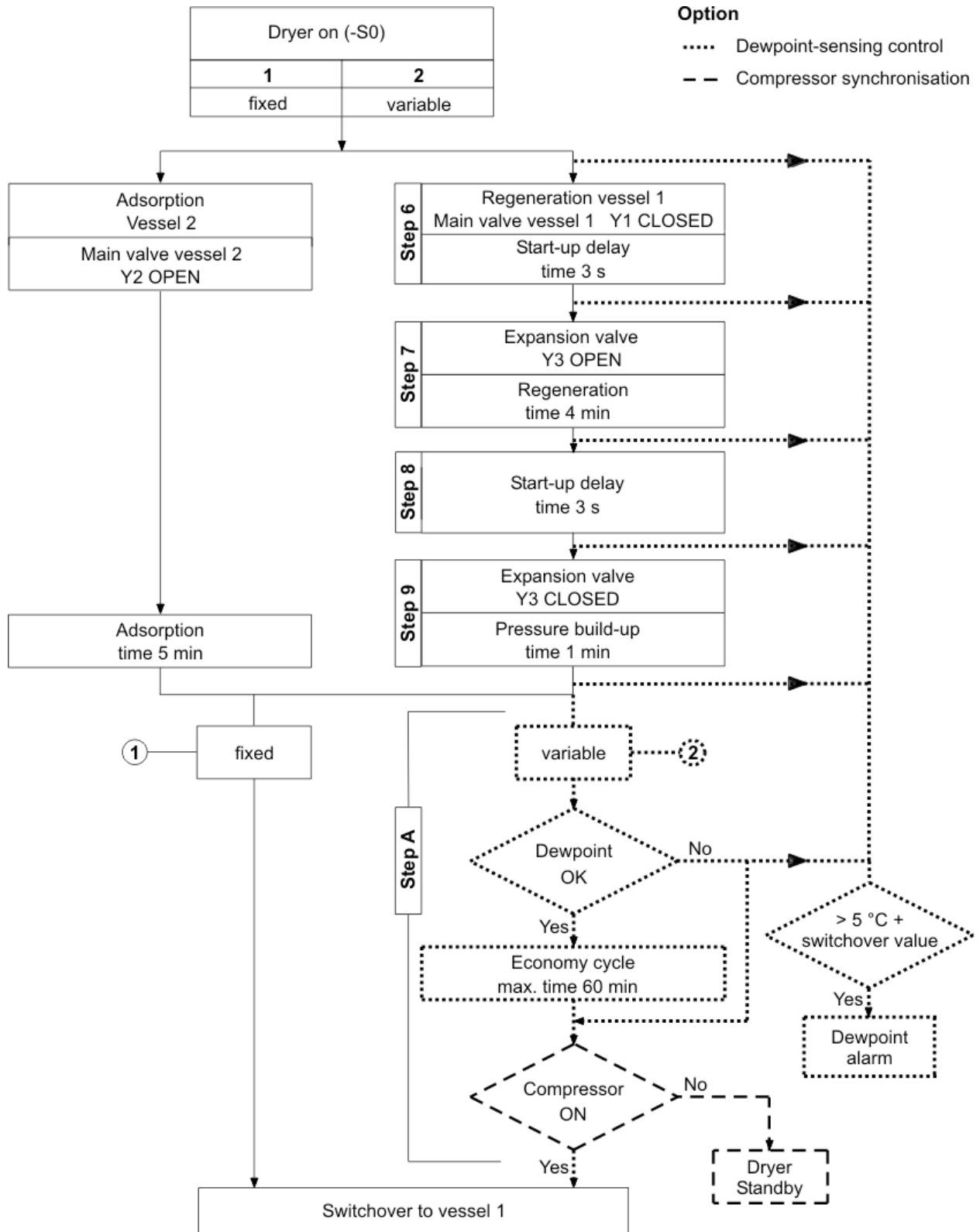
Order-ID..	BSP-MT 10	BSP-MT 15	BSP-MT 20	BSP-MT 25	BSP-MT 35	BSP-MT 45	BSP-MT 60	BSP-MT 75	BSP-MT 95
12 months – purifying agent									
DESPAC3AK	2	3		1	2		2		
DESPAC10AK			1	1	1	2	2	4	5
DESPAC4KTY	2	2	3	4	6	7	10	12	18
12 months – drying agent									
DESPAC6EF	2		1						
DESPAC20EF	1	2	2	3	4	5	7	9	12

Logic control diagram

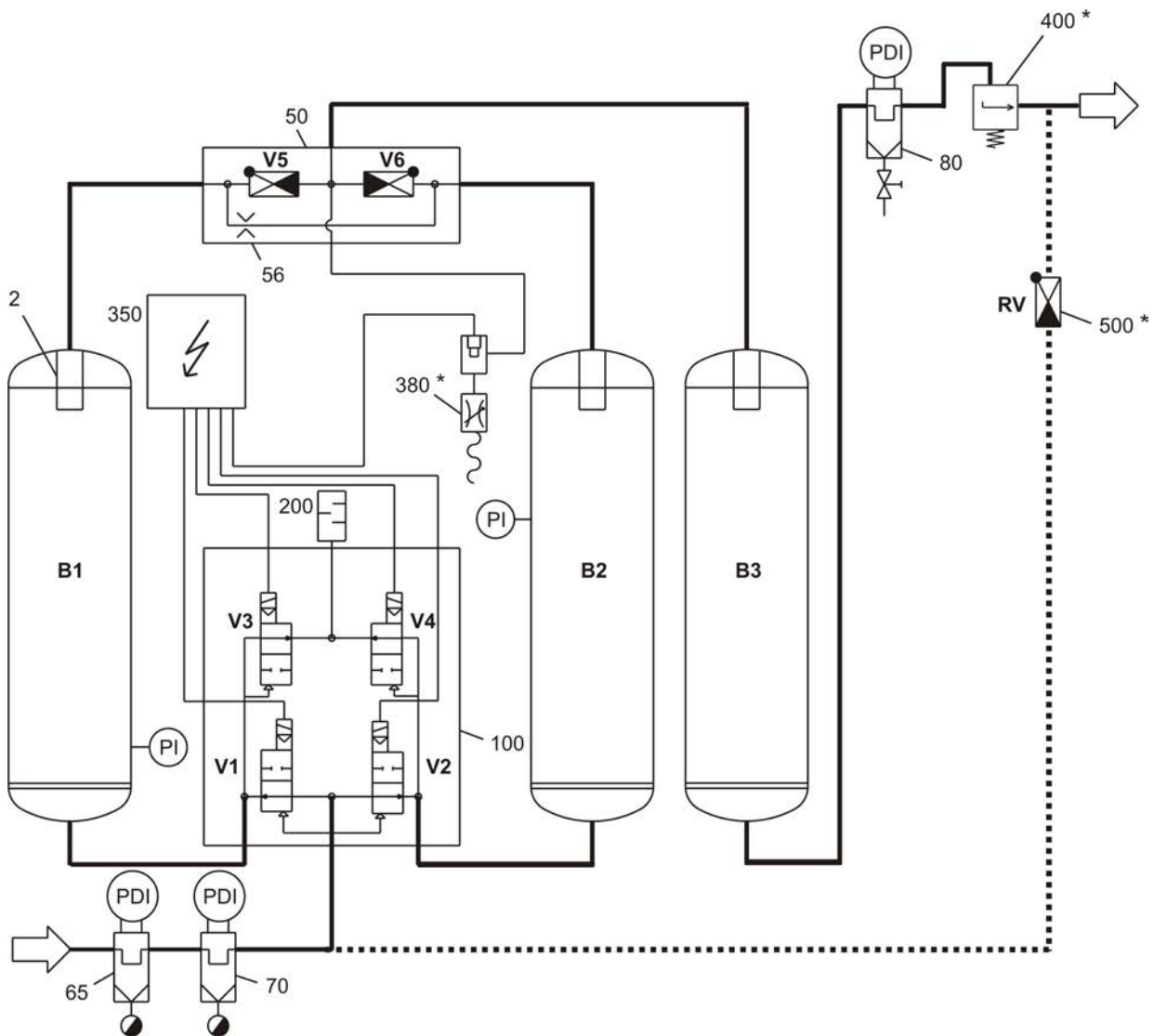
Adsorption in B1 and regeneration in B2



Regeneration in B1 and adsorption in B2



Flow diagram

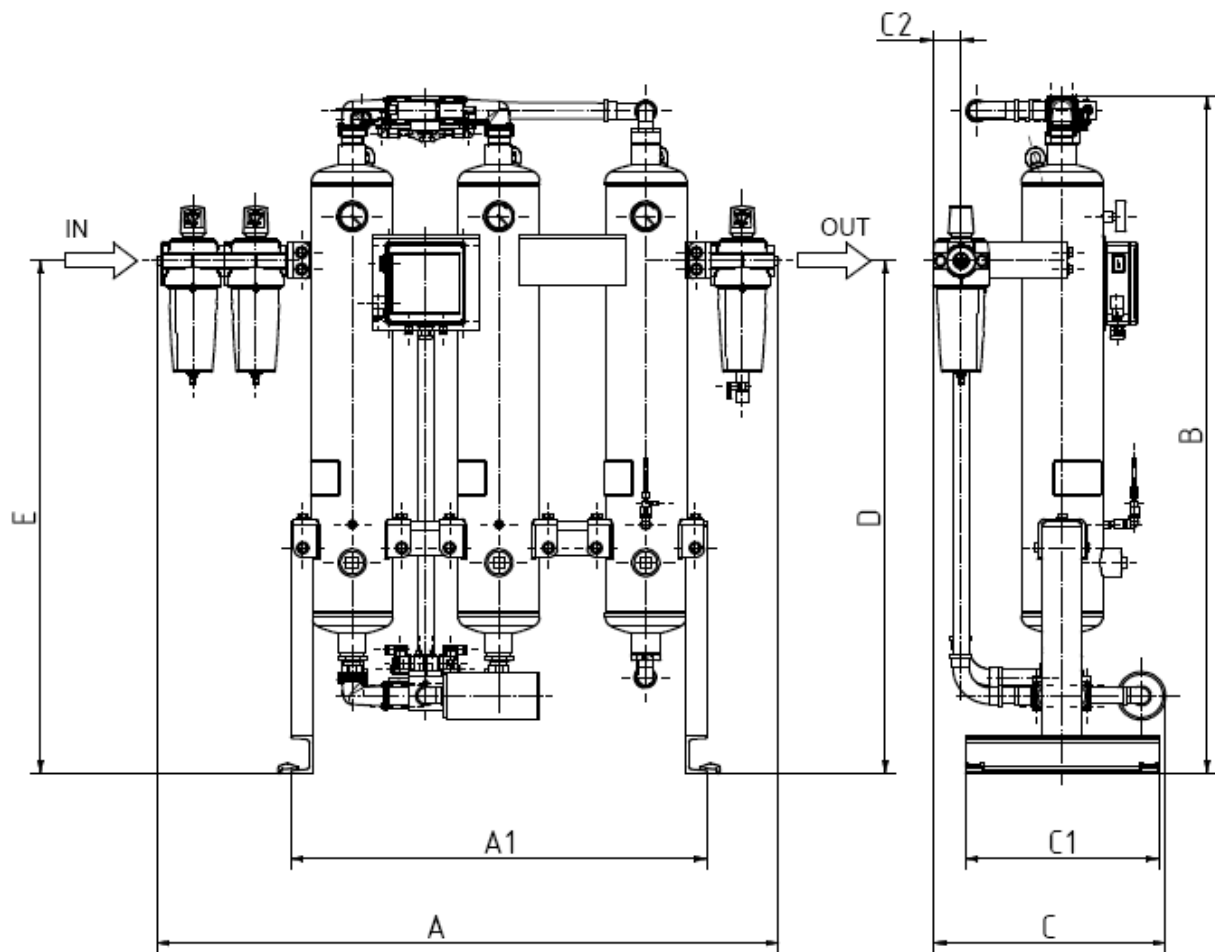


Pos.	Designation
2	Dust sieve
50	Check valve block V5–V6
56	Regeneration gas orifice plate
65	Upstream filter
70	Upstream filter
100	Solenoid valve block V1–V4

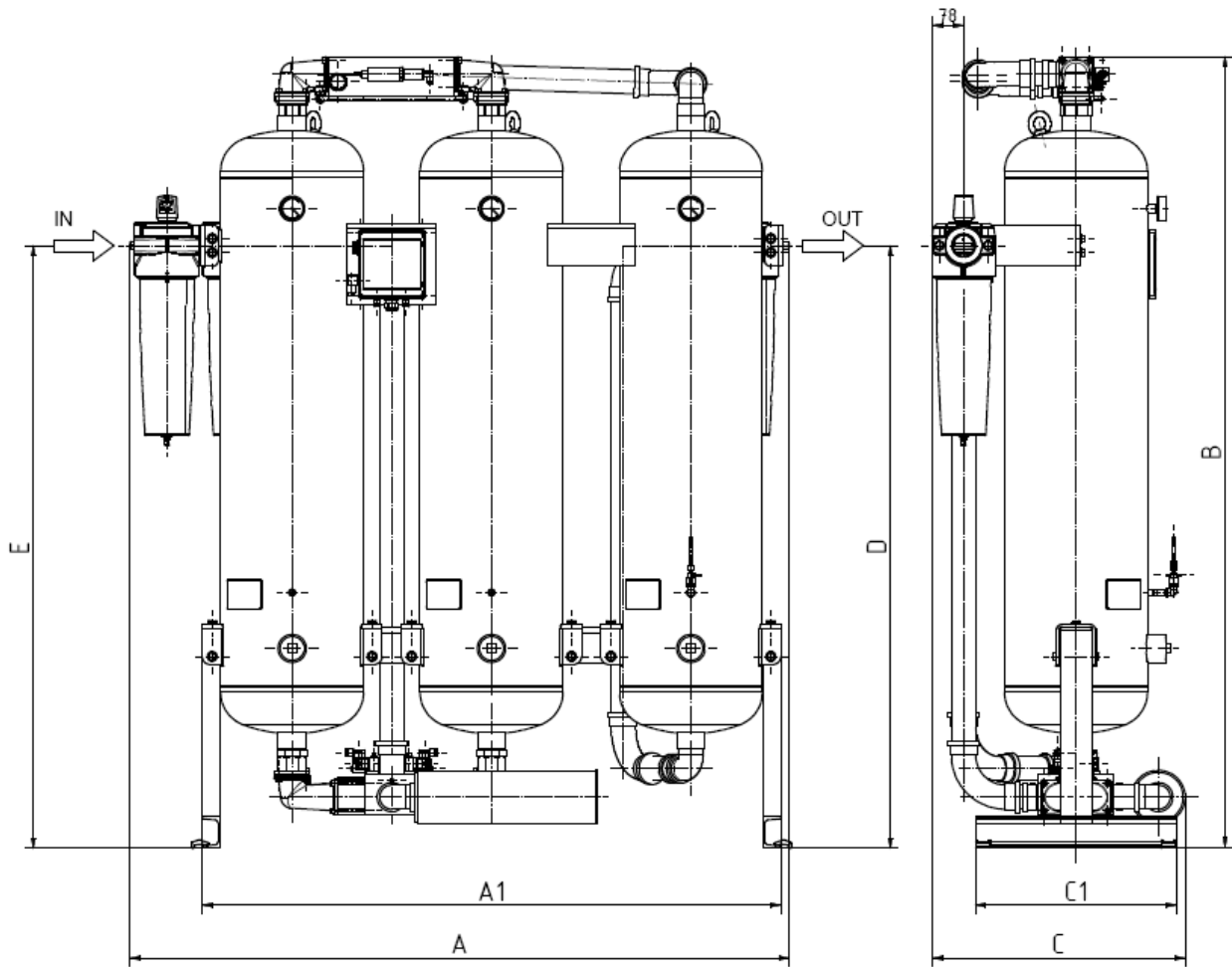
Pos.	Designation
200	Muffer
350	Control system
*	Optional devices:
380	Dewpoint-sensing unit
400	Start-up device
500	Regeneration gas return line

Dimensional drawing

BSP-MT 10 & BSP-MT 15



BSP-MT 20 – BSP-MT 95



Type	connection	Dimensions [mm]								Weight [kg]
		A	A1	B	C	C1	C2	D	E	
BSP-MT 10	G 1	1300	880	1420	490	400	60	1070	1070	165
BSP -MT 15	G 1	1300	880	1750	490	400	60	1320	1320	197
BSP -MT 20	G 1	1100	930	1530	490	400	60	1160	1160	197
BSP -MT 25	G 1½	1100	930	1760	530	400	60	1320	1320	239
BSP -MT 35	G 1½	1390	1220	1810	585	400	60	1320	1320	288
BSP -MT 45	G 1½	1460	1250	1820	605	400	80	1320	1320	342
BSP -MT 60	G 2	1515	1290	1870	635	500	80	1320	1320	437
BSP -MT 75	G 2	1670	1440	2000	640	500	80	1515	1515	564
BSP -MT 95	G 2½	1715	1490	2020	670	500	80	1515	1515	707