

Adsorption dryer

for generation of lab application suited air
that is free of carbon dioxide

K-MT LAB



Operating instructions

Rev. 02—2013/EN

398H272168



Declaration of Conformity

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

Im Teelbruch 118

D – 45219 Essen Kettwig

hereby declares with sole responsibility, that the products

compressed air adsorption dryer

series K-MT 3–8

assembly type: assembly acc. to Art. 3 No. 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:

- harmonized standards: DIN EN ISO 12100-1, DIN EN ISO 12100-2, DIN EN 1050, DIN EN 50081, DIN EN 50082, DIN EN 60204

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

Manufacturer's Declaration

We,

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

Im Teelbruch 118, 45219 Essen, Germany,

declare under our sole responsibility that the products

Compressed Air Adsorption Dryer

K-MT 1-2

to which this declaration refers,

- comply with the basic requirements of the directive for pressure equipment 97/23/EG,
- but must not bear the CE mark due to Art. 3 Para. 3, 97/23/EG.

The quality control system is monitored by *Lloyd's Register Quality Assurance GmbH, Hamburg* (code no. 0525).

The following standards and technical specifications were applied:

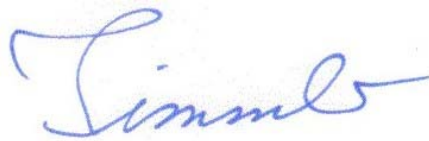
- harmonised standards: DIN EN ISO 12100-1, DIN EN ISO 12100-2, DIN EN 1050, DIN EN 50081, DIN EN 50082, DIN EN 60204

The following additional European directives were applied:

- 2004/108/EC
- 2006/95/EC

Essen,

06.06.2011



Datum / Date

i. V. Dr. Jürgen Timmler

Leiter Technik und Entwicklung /

Manager Engineering and Development

Machine passport

Type designation	K-MT__LAB
Order no.	
Project no.	
Build 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 9).

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General information

Manufacturer's details

Name and address



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Details on the dryer

Standard equipment

Dryer, comprising

- 1 double-chamber hollow section vessel, filled with drying agent
- 1 upstream filter
- 1 downstream filter
- Pressure reducer
- Muffler
- Control system

Associated documents

- Operating instructions (present)
- Circuit diagrams (see separate document)
- Operating manual for the filters

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, e.g. fitters or electricians.

Operating instructions: handling

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

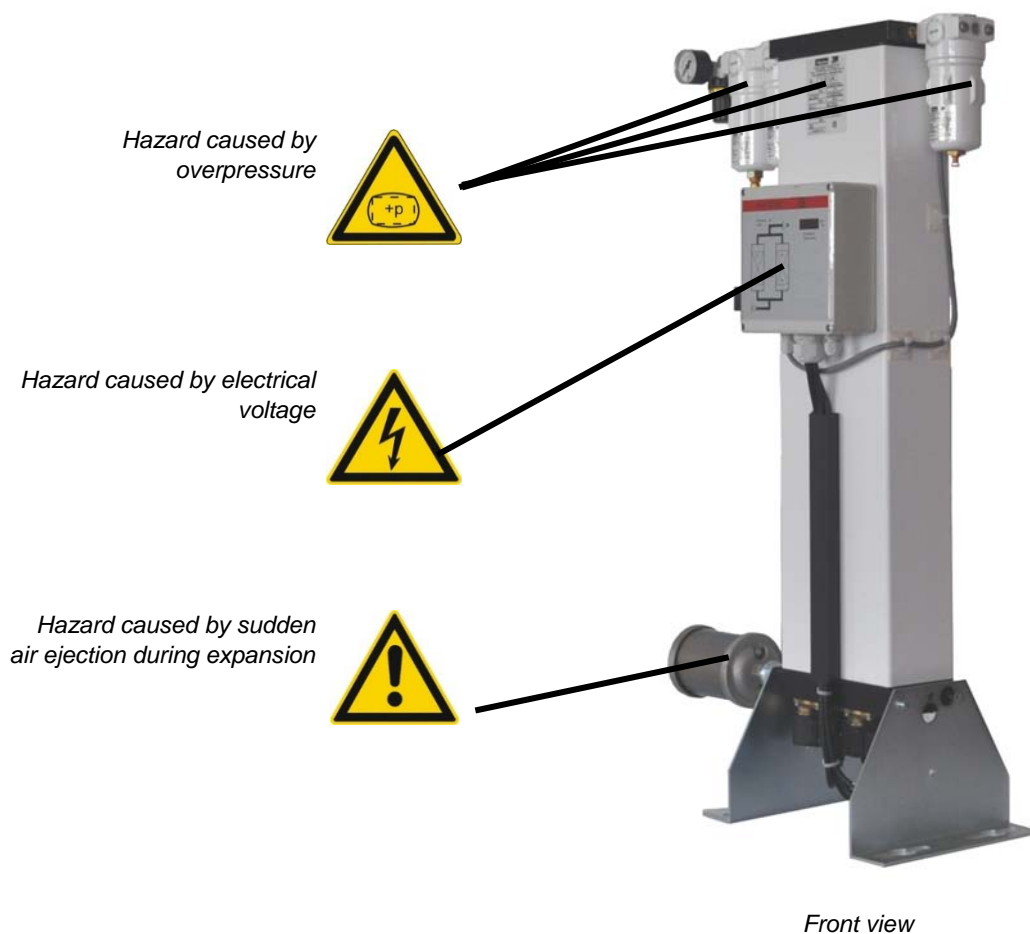
For your own safety and to prevent machine damage, please note the information and safety notes in these operating instructions when working with the dryer.





Signs and hazard areas on the dryer

Signs and labels

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

Hazard areas on the dryer



Hazard area	Symbol in operating instructions
Warning against hazardous electrical voltage Different parts of the dryer carry electrical current. These parts may be connected, opened, and maintained by authorized specialist personnel only.	
Warning against overpressure The entire dryer is under pressure. Before commencing any work, the plant must be depressurised.	
Warning against sudden air ejection When the hollow section vessels are depressurised, air flows suddenly out of the sound absorber. <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. When working on the dryer, always wear eye and ear protection equipment.	
Risk of skidding When emptying and filling the hollow section vessels with drying agent, there is a risk of skidding caused by spilt drying agent.	

Intended use of the dryer

The dryer is exclusively intended for drying compressed air. Depending on defined input conditions, it dries compressed air for industrial use.

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 drying agents

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

- When filling drying agents, wear a dust mask and eye protection!
- If a spillage occurs, any spilt drying 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.

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

- In the event of an emergency, immediately close the compressed air supply line and set ON/OFF switch of the dryer to position **0** to disconnect it from the power supply. Afterwards depressurise the dryer (see also chapter , page 30).

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), immediately close the compressed air supply line and set the ON/OFF switch of the dryer to **0** in order to disconnect it from the power supply. Afterwards depressurise the dryer (see also chapter , page 30). 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 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 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.

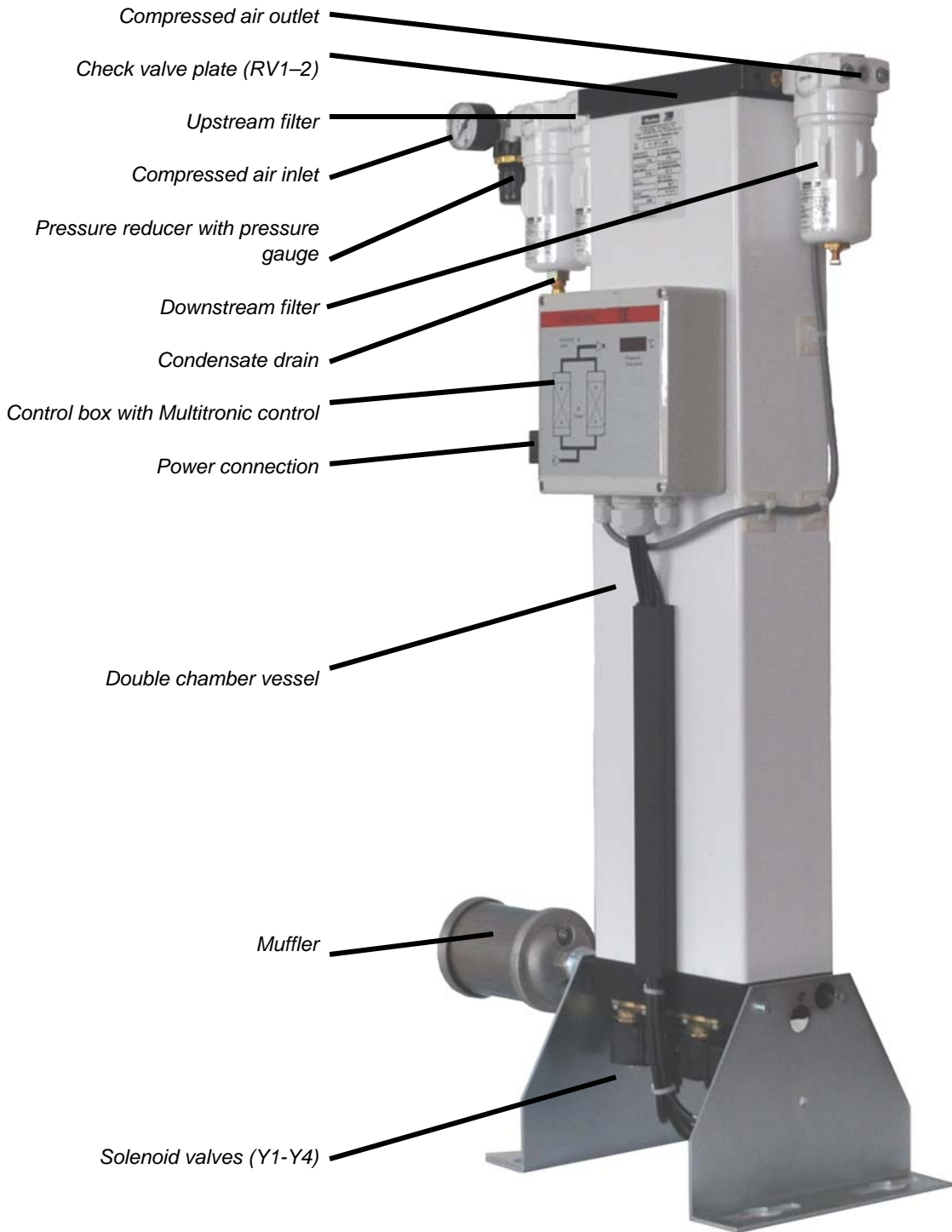
Before carrying out any work on the dryer, first depressurise the plant.

- Dispose all parts of the dryer, the drying agent, 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 agents can be obtained from the manufacturer (for the manufacturer's address see page 7).

Technical product description

Summary drawing

Front view



Function description

The dryer dries the compressed air supplied by the compressor and makes it available for industrial use.

Upstream filters clean the compressed air and remove dust, dirt, oil, and water droplets, before the compressed air reaches the dryer. Thus, an upstream filter is also used for extending the service life of the drying agent.

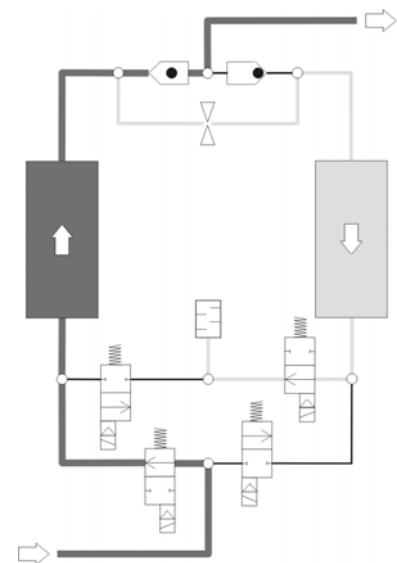
Downstream filters clean the compressed air from drying agent abrasions, before it is fed into the compressed air system.

The two chambers of the hollow section vessel 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 chambers 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 filter. From here, the compressed air flows upwards through the absorption chamber, which is pressurised. In so doing, the drying agent dehumidifies the air. The dry compressed air is supplied to the pipe network via the downstream filter.



Here, adsorption is shown in the left chamber.

Regeneration (running in parallel to the adsorption)

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

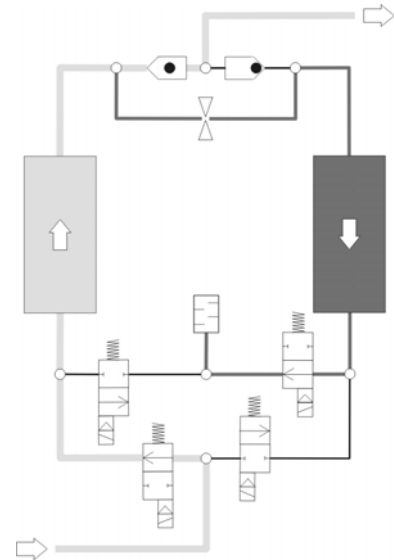
The regeneration is subdivided into three phases: expansion, dehumidification, and pressure build-up.

Expansion phase

During the expansion phase the pressure in the right chamber 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

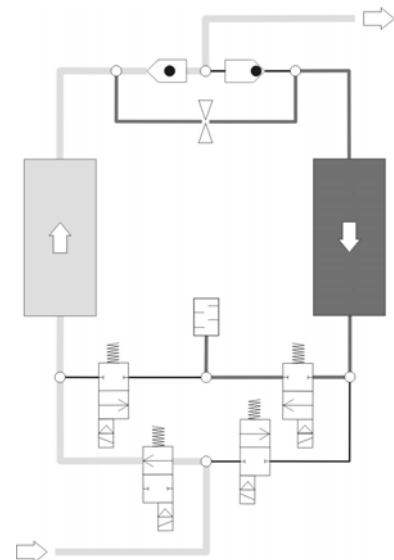
Prior to being released into the pipe network, dried compressed air is bled by means of an orifice plate. This separate regeneration air flow is fed through the depressurised chamber. The humidity stored in the drying agent is taken up by the air flow and expelled into atmosphere via the muffler.



Here, regeneration is shown in the right chamber.

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

Switchover

When the drying agent in the adsorbing chamber 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.

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.

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 19.

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. You will find the telephone number on page 7.



Warning!

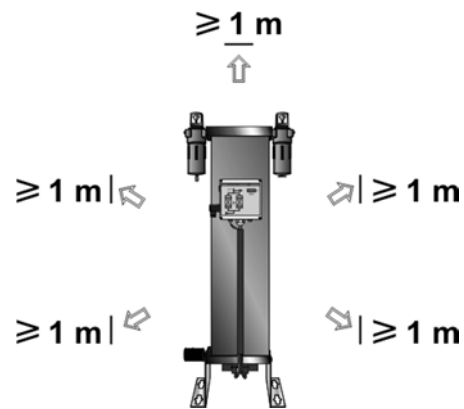
A damaged dryer must not be taken into operation! Damaged components may lead to functional faults and possibly cause further damage.

Transporting and installing the dryer

Requirements for the installation site

The conditions at the installation site have a large influence on the functional capability of the dryer and the service life of the drying agent. 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 °C (33,8 °F). If necessary, an auxiliary heater is to be provided.
- Heed the dryer's noise emission when selecting the installation location.
- The installation area must be level and firm. 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 agent 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 (for details see page 7).

Transporting and installing the dryer



Warning against damage to property!

Dependent on its size, the dryer is delivered in a cardboard box or in horizontal position on a transport pallet. Top and sides have not been designed for mechanical loads.

Do not place any load onto the top face. Do not stack.

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

- ▶ Secure the cardboard box or pallet on the lifting or forklift truck against sliding movements.
- ▶ Transport the dryer to its installation site.
- ▶ Remove the packaging of the dryer.



Note the weight of the dryer!

Depending on its size, the dryer may weigh up to approx. 80 kg. Take this into account with regard to the following work steps!

- ▶ Carefully place the dryer in an upright position.
- ▶ Place the dryer at its installation site.

Anchor dryer to the floor

The upright stand profiles of the dryer are provided with pre-drilled anchorage bores (see figure).

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

Mount dryer on the wall

The stand profiles can be rotated by 90° towards the rear side of the dryer and secured in this position (see arrow in above figure).

- ▶ Remove the screws at the muffler and the stand profiles. Rotate the stand profiles by 90° until the auxiliary holes for the securing screws and the muffler are aligned with each other. Retighten the screws securing the stand profile and the muffler.
- ▶ Use suitable attachment material of sufficient carrying force to anchor the dryer to the wall.

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 30.
- ▶ 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 27).

Store drying agents

- ▶ Do not store drying agents in the open air.
- ▶ Protect drying 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.
- 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 connection lines for the upstream filter are to be installed at a slight incline in the direction of the upstream filter.
- ▶ One shutdown valve each is to be installed at the compressed air inlet and outlet ends of the dryer.

Installing the electrical connection



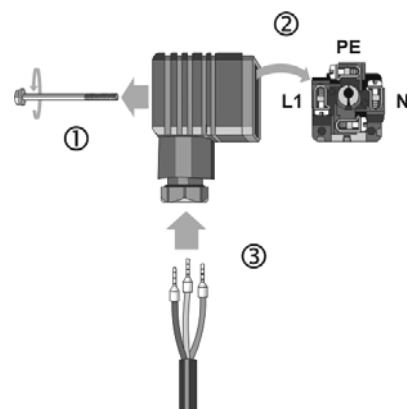
Warning against electrical voltage
Only qualified specialist personnel may carry out work on the electrical system!

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



Connect electrical cable to device adapter

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.

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

- 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.

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

Phase duration	Fixed cycle
Adsorption	6 min
Regeneration, total	4 min
Pressure build-up	2 min

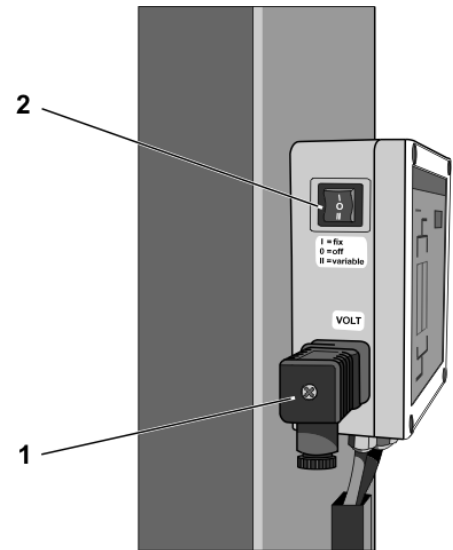
Overview of operating and control elements

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).

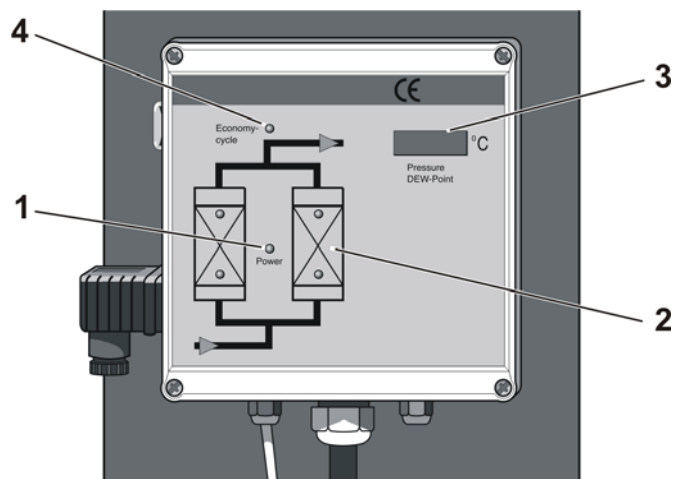
Position **II** is not relevant



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:



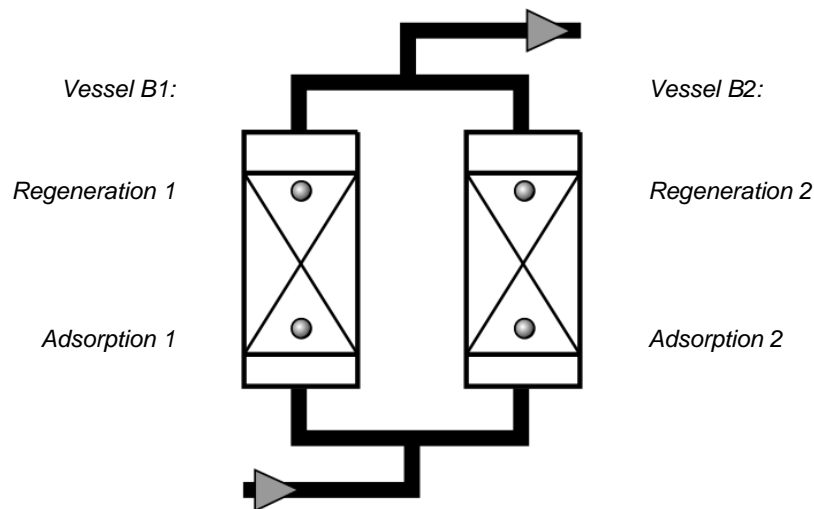
Display panel at the switchbox

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 49.

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.

LED Economy cycle (4)

out of order

Pressure reducer with pressure gauge

The pressure reducer is used to adjust the regeneration air. It is normally set to 5 bar. A pressure gauge which is attached to the pressure reducer helps to check the set pressure.

Emergency shutdown

In the event of an emergency, shut down the dryer as described on page 30.

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), immediately close the compressed air supply line and set the ON/OFF switch of the dryer to **0** in order to disconnect it from the power supply. Afterwards depressurise the dryer (see also chapter , page 30). The unit may only be restarted after all defects have been eliminated.

Open compressed air supply and switch on dryer

For start-up, please proceed in the sequence shown here.

- ▶ Ensure that the compressed air inlet and outlet valves installed by the owner are closed.
- ▶ Ensure that the compressed air system upstream of the dryer is pressurised. If necessary, pressurise (switch on compressor).



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 chambers 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 chamber to be regenerated repeatedly and thus to be prepared optimally for the take-up of humidity.

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.



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 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), immediately close the compressed air supply line and set the ON/OFF switch of the dryer to 0 in order to disconnect it from the power supply. Afterwards depressurise the dryer.

Then proceed as follows:

Remedy fault

- ▶ Look up possible cause of the fault, and how to remedy the same, in the table on page 42.
- ▶ Remedy fault.
- ▶ Repeat the start-up procedure.

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!

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 chamber 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 chamber. 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 chambers 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

In any emergency proceed as described in the next section.

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.



ON/OFF switch

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 or at depressurised condition. When switched off, the dryer is open in main flow direction.

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 27.

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

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 7).

- 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 any manipulations on a hollow profile 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 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(s)
- contamination of the perforated plates
- spent drying 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 individual tasks are described in the following pages.

Component	Maintenance task to be carried	Maintenance interval				
		daily	monthly	12 months	24 months	see page
Complete dryer	Carry out visual and function checks.	●				35
Pressure reducer	Check set pressure, adjust if necessary.		●			36
Muffler	K-MT 1-LAB: Clean muffler, replace if necessary.			●		36
	K-MT 3-6-LAB: Mufflers must be replaced annually and after each desiccant change.			●		36
Solenoid and check valves	Replace.				●	37
Seals, perforated plates, drying agent	Replace.				●	37
Upstream filter	Check function of condensate drain. Clean if necessary.	See filter manual				
Upstream and downstream filter	Replace all filter elements after 1 year of operation.	See filter manual				

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 30, !



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.

Monthly maintenance tasks

Check set pressure at pressure reducer

- ▶ Look at the pressure gauge at the pressure reducer to check the pressure setting.

The set pressure should be adjusted to 5 bars.

- ▶ In case that the set pressure is above or less 5 bars, use the knurled screw at the pressure reducer to adjust the pressure setting to the correct value.

Maintenance work to be completed every 12 months

Check mufflers

The dryer is either equipped with a standard muffler or a fine filter muffler. If the respective 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, mufflers must be checked at least once a year and cleaned (K-MT 1 LAB) or renewed (K-MT 3 LAB + K-MT 6 LAB) if they are contaminated.



Warning against sudden air ejection!

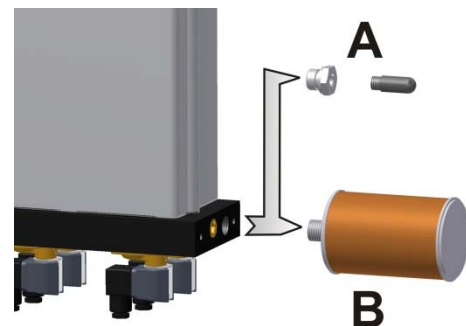
During expansion the pressure is released suddenly through the muffler:

- 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!

The correct procedures for all muffler versions are described below.

- ▶ Depressurise the dryer and shut it down (see page 30).
- ▶ Unscrew muffler as shown in the opposite figures:
 - **K-MT 1-LAB** = Pos. A,
 - **K-MT 3-LAB + K-MT 6 LAB** = Pos. B
- ▶ **K-MT 1-LAB:**
 - Blow out with compressed air for cleaning
 - or renew muffler, if necessary.



Undo muffler

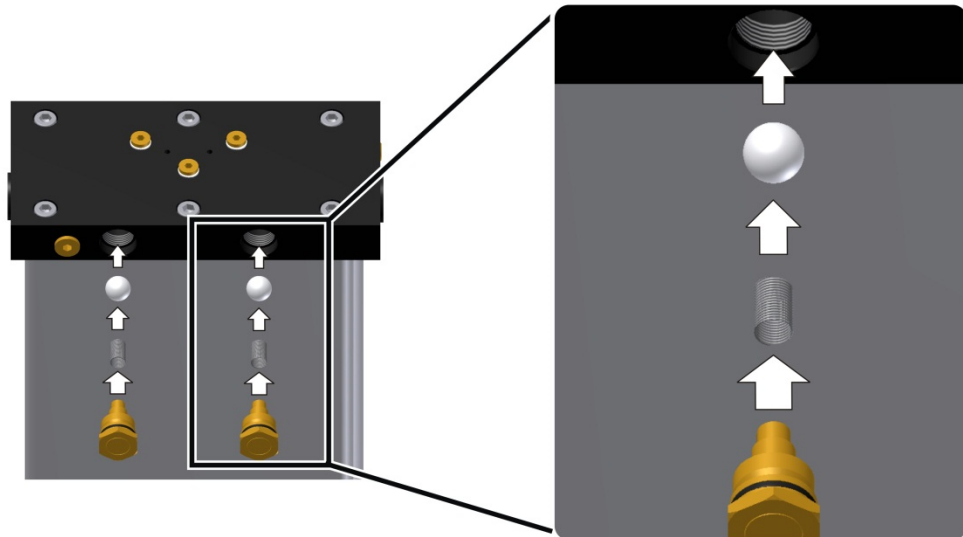
- ▶ **K-MT 3 LAB + K-MT 6 LAB:**
Mufflers must be replaced annually and after each desiccant change.
- ▶ Screw sound absorber tight again.
- ▶ Restart dryer (see page 32).

Maintenance work to be completed every 24 months

Replace check valves

Check valves are wear parts and must thus be replaced every 48 months, even if no damage is visible.

- ▶ Release pressure from dryer and shut down the unit (see page 30).
- ▶ Remove the securing screws at the rear of the check valve plate.
- ▶ Insert new balls and new springs and ensure that they are not jammed.
- ▶ Replace the seals at the securing screws and tighten the screws.



Check valves

- ▶ With regeneration gas return (optional):
Also replace the two additional check valves, following the above instructions.
- ▶ If no other maintenance work is to be carried out: Restart the dryer (see page 32).

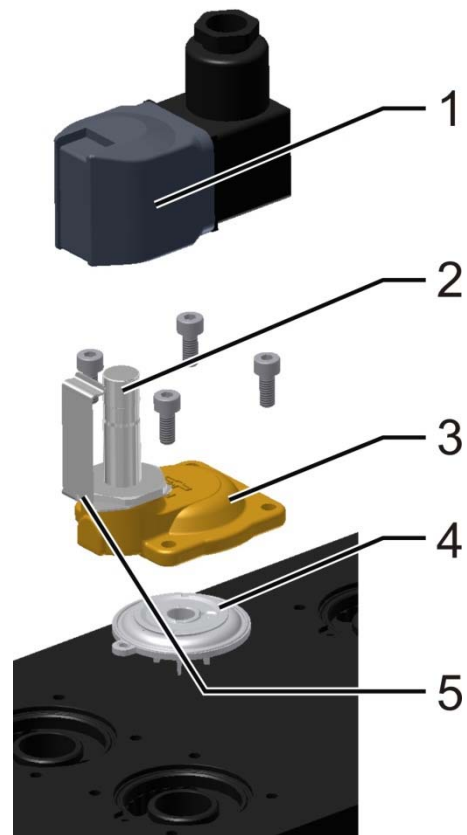
Replace solenoid valves

Solenoid valves are wear parts and must thus be replaced every 48 months, even if no damage is visible.

- ▶ Release pressure from dryer and shut down the unit (see page 30).

Preparation for the replacement of all four solenoid valves:

- ▶ Check the specifications of the valves:
 - The rated voltage of the solenoids (1) must correspond to that indicated on the type plate of the dryer.
 - Solenoid valves Y1/Y2 at the dryer rear must be open when not energised (valve piston without notch, 2).
 - Solenoid valves Y3/Y4 at the dryer front must be closed when not energised (valve piston with notch, 2).
- ▶ Position the new solenoid valves at the points at which they are to be mounted in order to prevent any confusion at a later stage.



Solenoid valve

For each solenoid valve, proceed as follows:

- ▶ Remove solenoid valve from the holder (3). Remove the valve together with the solenoid and the diaphragm (4).
- ▶ Insert new diaphragm with guide (4) and secure it to the holder (3).
- ▶ Position new solenoid (1) onto the armature and secure it to the spring bracket (5).
- ▶ If no other maintenance work is to be carried out: Restart the dryer (see page 32).

Replace perforated plates, seals and drying agent

To complete the following maintenance tasks, you must dismantle the plates and the vessels. We therefore recommend that you carry out these tasks together.

Replace upper perforated plates and seal

Perforated plates are fitted under the check valve plate and over the solenoid valve plate; these retain the drying agent. If these perforated plates become blocked, a dam pressure is generated which can cause compressed air fluctuations in the compressed air system.

In order to remove the upper perforated plates, the check valve plate must be removed.

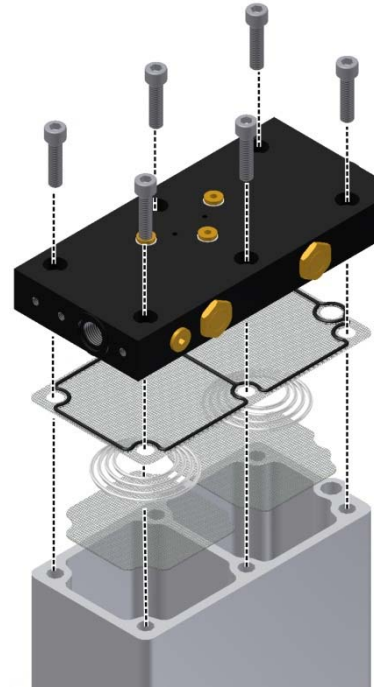


Risk of falls!

The dryer must not be misused as a climbing aid! The components have not been designed for such loads and could fracture.

Only use approved climbing aids when disassembling the check valve plate.

- ▶ Depressurise the dryer and shut it down (see page 30).
- ▶ Loosen the screws at the check valve plate and lift off the plate.
- ▶ Removing and replacing seals, perforated plates, pressure springs and demisters.



Removing the check valve plate

Before reassembling the check valve plate, you should replace the drying agent.

Replace drying agent

The service life of the drying agent is usually approx. 3 to 5 years. However, in favourable installation conditions, the change of drying agent may be carried out at a substantially later date (for notes on the installation site, see also page 18). The change interval is determined by the degree of contamination of the compressed air (which can be minimised by regularly replacing upstream filter elements). Oil, dust, and dirt particles cover the drying agent surface and reduce its effective surface, in part quite irreversibly. If in doubt, have a sample of your drying agent assessed by specialists.

Comply with the following safety notes when changing the drying agent:



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

When emptying the drying agent, increased dust generation may occur.

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

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



Risk of skidding!

If drying agent has been spilt on the floor, there is a risk of skidding caused by the drying agent beads. Therefore, spilt drying agent must always be taken up immediately.

Remove used drying agent

- ▶ Use an industrial vacuum cleaner to Hoover up carefully the drying agent out of the chambers.



Warning!

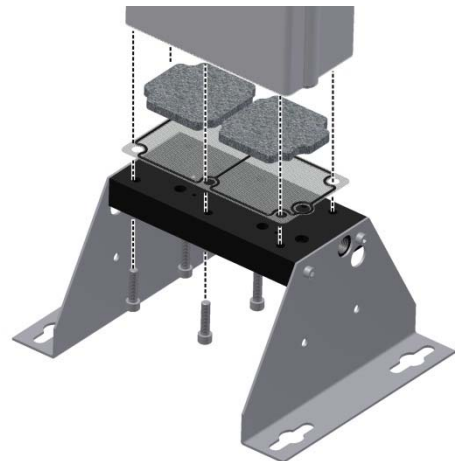
If the dryer is not used within specifications, the drying agent can be contaminated with pollutants. Always take this into account for the environmentally safe disposal of the drying agent. The waste code numbers of the drying agent can be obtained from the manufacturer.

- ▶ Dispose of the used drying agent in accordance with all applicable regulations.

Before filling in new drying agent, we recommend that you replace the demister and the seal.

Replacing the lower perforated plates and seals

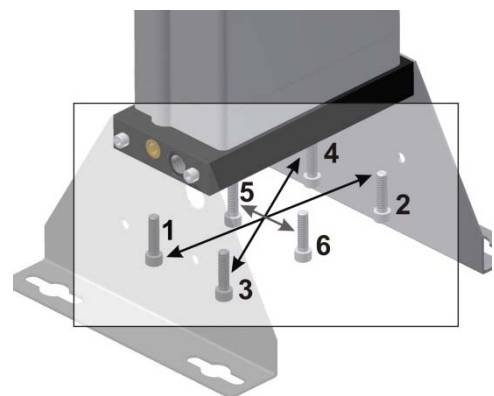
- ▶ Loosen the screws on the solenoid valve plate.
- ▶ Remove and replace all seals with perforated plates.



Loosen the solenoid valve plate

Reaffix the solenoid valve plate:

- ▶ Use a dynamometric key to tighten the screws, and take care to observe the following torques:
 - 25 Nm in the case of K-MT 1 LAB + K-MT 3 LAB
 - 50 Nm in the case of K-MT 6 LAB
- ▶ Tighten the screws crosswise in accordance with the sequence shown on the right.
- ▶ Repeat the process once.



Correctly affixing the solenoid valve plate

Next the new drying agent should fill up.

Fill with new drying agent and remount check valve plate



Risk of falls!

The dryer must not be misused as a climbing aid. The components have not been designed for such loads and could fracture.

Only use approved climbing aids when filling the chambers.

- ▶ Slowly fill up with new drying agent in the chamber. If necessary, use a funnel. Take special note of the next step.
- ▶ Ensure that the drying agent is filled into the chambers with a high bulk density.

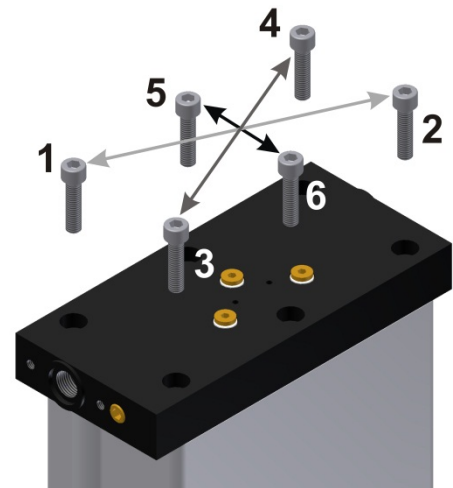
Note:

To achieve an optimum bulk density, we recommend using a "snowstorm" filling pipe available from the manufacturer.

- ▶ Subsequently, position the seal onto the check valve plate, align them properly and secure them.

Reaffix the check valve plate:

- ▶ Use a dynamometric key to tighten the screws, and take care to observe the following torques:
 - 25 Nm in the case of K-MT 1–4
 - 50 Nm in the case of K-MT 6–8
- ▶ Tighten the screws crosswise in accordance with the sequence shown on the right.
- ▶ Repeat the process once.



Correctly affixing the check valve plate

- ▶ Restart the dryer (see page 32). Check that the connection is leak tight.
- ▶ Operate the dryer for two cycles, then shut it down again.
- ▶ Replace sound absorber as described on page 36.
- ▶ Operate the dryer for two cycles, then shut it down again.
- ▶ Replace sound absorber as described on page 36.

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
V1–V2 (Y2–Y1)	Main valves (solenoid valves)
V3–V4 (Y3–Y4)	Expansion valves (solenoid valves)
RV1–RV2	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	Specialised personnel	Service technician
No pressure build-up	The compressed pressure system upstream from the dryer is not pressurised.	Check whether the compressed pressure system upstream from the dryer is pressurised. Eliminate any faults in the compressed air system.	●	
Excessive compressed air consumption	Leakage	Check condensate trap at the upstream filter; clean, if necessary.	●	●
Dryer cannot be switched over	Solenoid valve Y1/Y2 cannot be opened.	Check supply voltage, cable, contacts and solenoid; replace, if necessary.	●	●
	Solenoid valve Y1/Y2 cannot be opened properly (audible humming sound or valve flapping).	Check supply voltage. Check spring and solenoid; 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.	●	●

Fault	Possible cause	Remedy	Specialised personnel	Service technician
	Solenoid valve Y3/Y4 cannot be opened properly (audible humming sound or valve flapping).	Check supply voltage. Check spring and solenoid; replace, if necessary. Check solenoid valve 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 spring and solenoid; replace, if necessary. Check diaphragm; replace, if necessary.	●	●
Dryer is excessively bled	Solenoid valve Y1/Y2 cannot be closed.	Check solenoid and diaphragm; replace, if necessary.	●	●

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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

Technical data

Type	Capacity*	Length	Height	Width	Weight	Drying agent per vessel
	m ³ /h	mm	mm	mm	kg	kg
K-MT 1 LAB	~1,1	210	400	430		0.9
K-MT 3 LAB	~3,8	210	827	430		2.8
K-MT 6 LAB	~10	244	1185	580		6.4

*Volume flow rate at the inlet relative to 1 bar (abs.) and 20 °C (68 °F) at 7 bar operating pressure and a feed temperature of 35 °C (95 °F).

Typ K-MT 1,3,6-LAB	
Fluid group (acc. to 97/23/EC)	2
max. operating overpressure	16 bar
min. operating overpressure	5 bar
min. ambient temperature	≥+1 °C (33,8 °F)
max. ambient temperature	≤+50 °C (122 °F)
Rel. humidity	100 %
Noise level : +3 dB (A) relative to free field measurement, 1 m surr. field	65 – 86 dB(A)
Mains voltage	(see type plate)
Protection class	IP 65

Replacement and wear parts list

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.

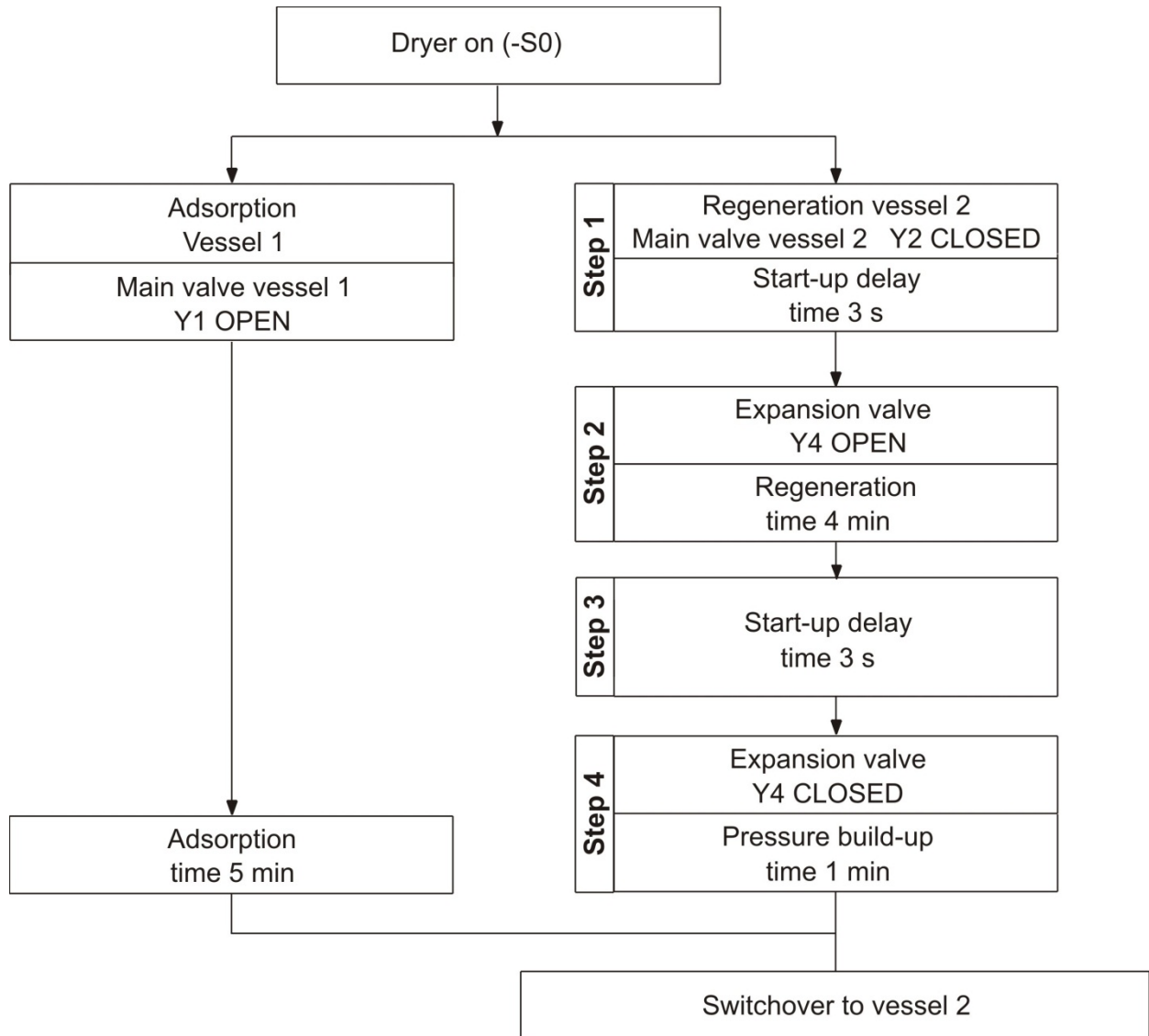
Service kits		
Type	Maintenance interval	Order ID.
K-MT 1-LAB	12 months	SKK1-K3/L1/12
K-MT 3-LAB	24 months	SKK1-K3/L1/24
K-MT 6-LAB	12 months	SKK6/L1/12
	24 months	SKK6/L1/24

Desiccant packs

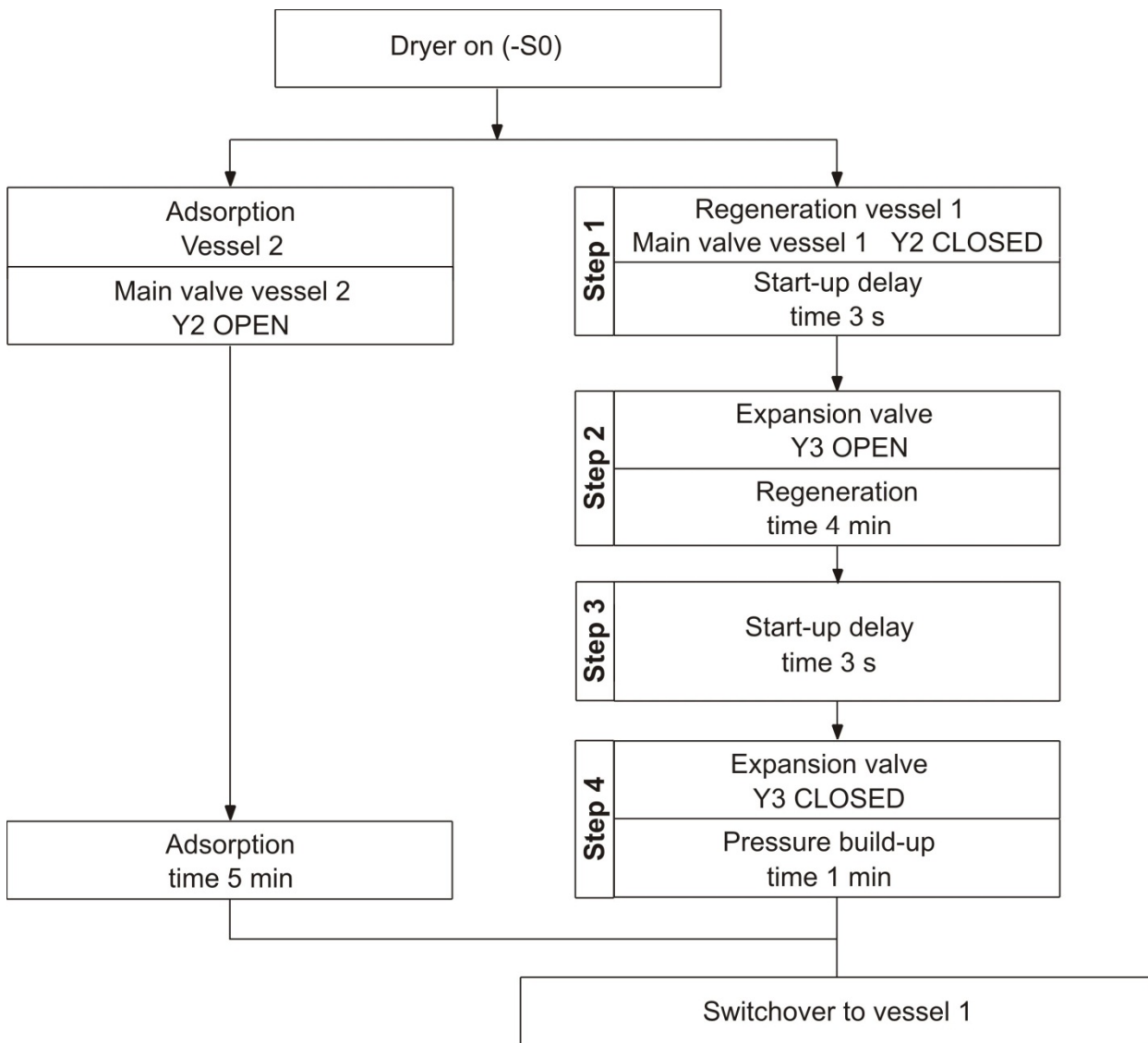
Order-ID..	K-MT 1	K-MT 3	K-MT 6
DESPAC2LAB	1	3	7

Logic control diagram

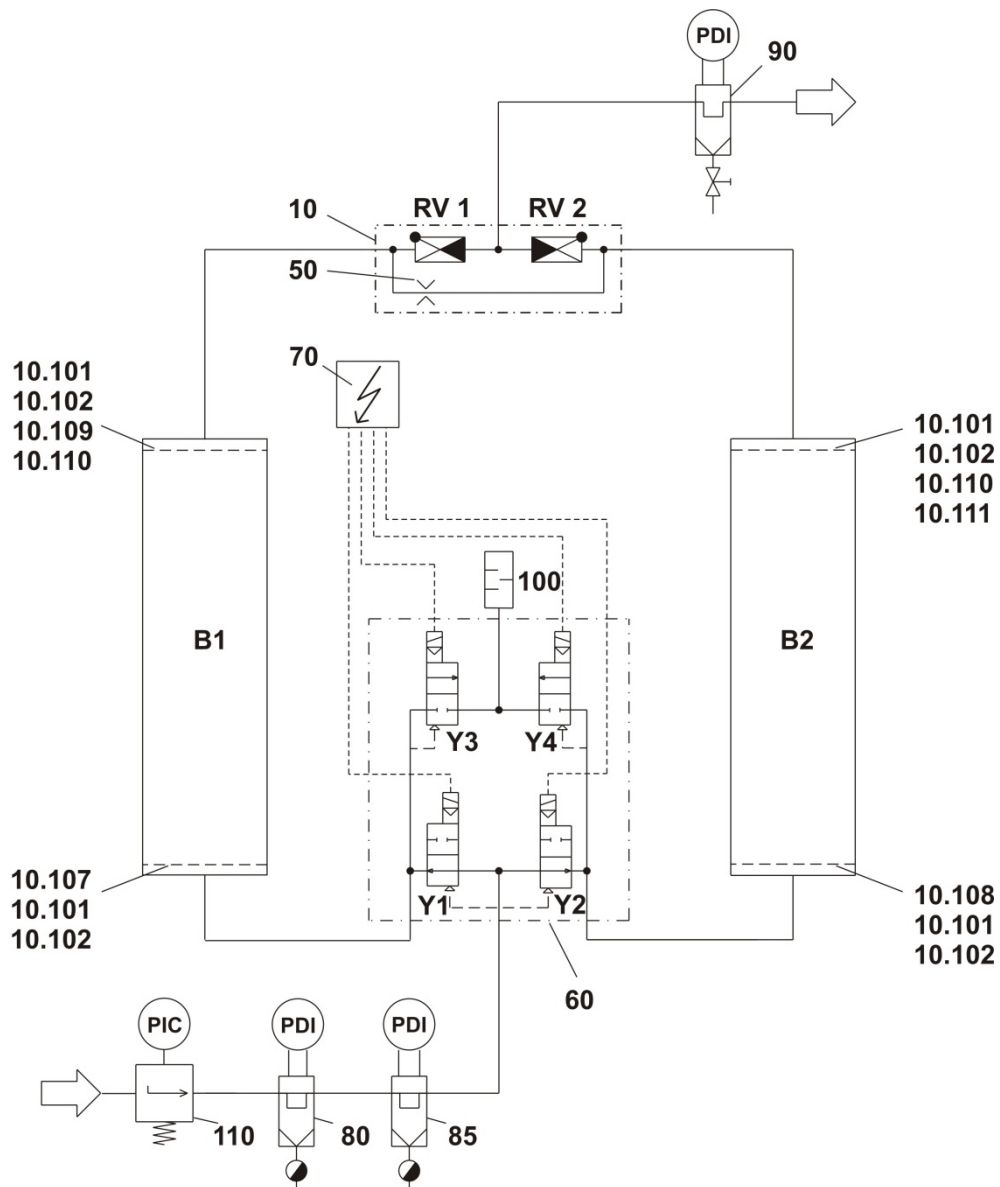
Adsorption in B1 and regeneration in B2



Regeneration in B1 and adsorption in B2



Flow diagram



Pos.	Designation
10	Check valve plate
10.101	Seal
10.102	Perforated plate
10.107	Demister, left
10.108	Demister, right
10.109	Left perforated plate
10.110	Conical pressure spring
10.111	Right perforated plate
50	Regeneration gas orifice plate

Pos.	Designation
60	Control unit
70	Control system
80	1.Upstream filter
85	2.Upstream filter
90	Downstream filter
100	Muffler
110	Pressure reducer