High-pressure Dryer

HDK-CNG

250/250 – 2000/250

Dokument-ID: DMN-HDK-CNG250-2000/R03

Operating manual

CE Ex II 2G IIB T1

Revision 03_2016/ EN

Declaration of Conformity

Parker Hannifin Manufacturing Germany GmbH& Co. KG
Gas Separation and Filtration Division EMEA

Im Teelbruch 118

D – 45219 Essen Kettwig

hereby declares with sole responsibility, that the products

High-pressure Dryer

Type HDK-CNG 250/250 – 2000/250

Assembly type: assembly acc. to Art. 4 No. 2b,

which this declaration refers to, conform to Directive **2014/68/EU** and were subjected to a conformity assessment according to Annex III Module H1

The quality control system is monitored by:
Lloyd's Register Quality Assurance GmbH, Hamburg (code no. 0525).
Mönckebergstraße 27, D - 20095 Hamburg.

The products comply with the **94/9/EG (ATEX)** guideline and were subjected to the conformity assessment after having been classified in this group.
The products were classified as follows: **II -/2G IIB T1**

Archiving of documents as per 94/9/EG (ATEX) guideline is done by the named institution *EXAM BBG Prüf- und Zertifizier GmbH, Bochum (ID No. 0158)*.

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

Pressure vessel					
Dryer	**Quantity**	**Allowable pressure (PS)**	**Volume [l]**	**Category (PED)**	**Module**
HDK-CNG 250 / 250	2	250	8,29	IV	H 1
HDK-CNG 750 / 250	2	250	24,03	IV	H 1
HDK-CNG 1200 / 250	2	250	48,36	IV	H 1
HDK-CNG 2000 / 250	2	250	63,96	IV	H 1

Piping				
Dryer	**Allowable pressure (PS)**	**Dimensions (DN)**	**Category (PED)**	**Module**
HDK-CNG 250 / 250	315	DN15	Art.4.3	Art.4.3
HDK-CNG 750 / 250	315	DN25	Art.4.3	Art.4.4
HDK-CNG 1200 / 250	315	DN25	Art.4.3	Art.4.5
HDK-CNG 2000 / 250	315	DN25	Art.4.3	Art.4.6

Filter						
Dryer	**Filter**	**Quantity**	**Allowable pressure (PS)**	**Volume [l]**	**Category (PED)**	**Module**
HDK-CNG 250/ 250	GH9	3	350	1,33	III	H
HDK-CNG 750/ 250	GH11	3	350	2,09	III	H
HDK-CNG1200/ 250	GH11	3	350	2,09	III	H
HDK-CNG2000/ 250	GH11	3	350	2,09	III	H

The following standards / technical specifications were used:

- harmonised standards: DIN EN 12100:2011-3, DIN EN 61000-6-3, DIN EN 61000-6-2, DIN EN 60204-1, DIN EN 13463-1

The following other EC directives were used:

- 2006/42//EG
- 2014/30/EU
- 2014/35/EU

Essen,

19.07.2016

Datum / Date

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

Machine passport

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.

Type designation	**HDK-CNG__**
Order no.	
Project no.	
Build no.	
Vessel no.	
Vessel no.	
Year of manufacture	

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

> **Note:**
>
> **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 15).**

Type plate

Attach type plate here

Note the data on the type plate and keep them complete and always legible.

> **Note:**
> **If an acceptance test of the complete system is required in accordance with ATEX, this is a matter for which the operator is responsible.**

Contents

General Information

Manufacturer's details

Name and address

Parker Hannifin Manufacturing Germany GmbH & Co. KG
Gas Separation and Filtration Division EMEA

Im Teelbruch 118
D-45219 Essen

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

Internet http://www.parker.com

Details on the dryer

Scope of delivery

Dryer, comprising

- 2 vessels, filled with desiccant
- 2 prefilter
- 1 after-filter
- 1 Water separator
- Switch cabinet including control
- 1 Condensate trap
- with the option *pressure dewpoint control*: With pressure dewpoint sensor ZHM100
- with option of regeneration gas cooler

Associated documents

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

Notes on accompanying documentation

Accompanying documents such as operating instructions for options or related components must always be taken into account. These contain additional information such as in respect of maintenance and are therefore essential for safe operation of the system.

Warranty notes

In the following cases, the warranty shall be void:

- If aggressive media in the natural gas and in the environment cause corrosion damage and functional faults on the dryer.
- If the dryer is used without prior approval and confirmation in writing by the manufacturer for purposes other than those specified in these operating instructions or contractually agreed.
- If preset parameters (e. g. on the control system etc.) are changed without prior approval and confirmation in writing by the manufacturer.
- If the dryer is transported or stored incorrectly.
- If the dryer is sited and installed incorrectly.
- If the dryer is repaired or maintained incorrectly.
- If the dryer is operated by personnel that does not have the requisite qualifications.
- If the limits for maximum pressure supply and maximum gas temperature are not complied with.
- If the data indicated on the type plate are not complied with.
- If the environmental conditions defined in the applicable rules for ATEX-compliant dryers are not complied with.
- If modifications are carried out on the dryer, the manufacturer did not approve that.

In the event of non-compliance the manufacturer will not accept any liability for any consequential damage whatsoever.

About these operating instructions

These operating instructions contain basic information on the safe use of the dryer. Read these instructions carefully after receiving the dryer. Keep these instructions at an appropriate location so that they can be referred to at a later date.

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.

This symbol appears beside information relating to explosion protection as defined in ATEX (94/9/EC).

Note:

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

Attention!

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 for the present 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. We presuppose that the personnel has received training in how to work with natural gas.

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.

About your safety

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

Intended use of the dryer

The dryer is intended solely for the drying of natural gas that is free of aggressive water, oil, solids and gas constituents. Depending on defined initial conditions, it dries natural gas for industrial use.

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. Non-observance of the data given there is regarded as improper use.

ATEX-compliant dryers in acc. with designation CE Ex II 2G must only be used in Zone 1 and Zone 2 environments.

ATEX-compliant dryers are designed to be electrically conductive. The operator must ensure that this electrical conductivity is available without restriction. He must also ensure that this electrical conductivity is not disabled by unsuitable attachments. Electrical conductivity must be tested after every service operation, and its full operational capability must be documented.

For filters on ATEX-compliant dryers, only use elements that meet the technical specification of the manufacturer.

Warning against misuse

The dryer described here must not be operated using any other medium than natural gas! The dryer is not designed for other applications.

The dryer must never be used as a climbing aid!

The pipes, valves, etc. have not been designed with this kind of load in mind. They could fracture, tear off, or become damaged in another way. This can cause toxic, explosive natural gas to escape and present substantial hazards to people and the environment.

General safety notes

Working with natural gas

Natural gas is explosive and toxic. Working with natural gas constitutes a substantial source of hazards to people and the environment.

The operator must adopt appropriate safety precautions in respect of these potential hazards. Whenever you are working with the dryer, always follow the safety instructions relating to the handling of natural gas.

Flush the system before commissioning, decommissioning and maintenance!

The operator must consider these risks and take the necessary safety measures. When working with the natural gas system, always adhere to the safety instructions for the handling of natural gas.

In the event of an earthquake

An earthquake can cause pipelines to develop leaks, enabling natural gas to escape. In the event of an earthquake, immediately

- ► cut off the supply of gas,
- ► flush the dryer with inert gas,
- ► ventilate the room thoroughly,
- ► check dryer and pipework for leaks, and repair them all.

In the event of an escape of natural gas

- ► Natural gas is toxic and explosive. In the event of an escape of natural gas, immediately
- ► put on a protective mask,
- ► ventilate the room thoroughly and
- ► stop the gas from escaping immediately.

Personnel qualification

Only authorised and approved specialist personnel (e.g. in acc. with DVGW) may be tasked with the work on the dryer described in these operating instructions.

Notes on critical gases

All explosive, combustible and toxic gases in Fluid Groups 1 as defined in the Pressure Equipment Directive are designated as 'critical gases'.

- The release of a critical gas can lead to substantial hazards for people and the environment and must therefore be avoided at all times.
  - — The operator must install appropriate safety precautions.
  - — Prior to all work that could lead to a release of critical gases, flush the affected section of pipework including the dryer and filter with an inert gas. Then depressurise the dryer and carry out the work.

— *With ATEX-compliant dryers:*
Prior to all work, first cancel the Ex zone (in acc. with the operating instructions of the operator). Then carry out the work.

- When purifying or drying a critical gas, always pay attention to the hazard notices relating to that gas.

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.

Notes about the installation location

The ambient conditions at the installation location must comply with the regulations applicable to ATEX-compliant dryers (94/9/EC) (good ventilation, no naked flame, smoking ban).

Handling of drying and purifying agents

Under certain circumstances, it can be hazardous to work with the drying agent involved. Therefore observe the following instructions:

Avoid the creating of sparks!
An ignition source can arise through the friction caused by emptying and filling drying and purifying agents. That in turn entails the hazard of sparks being caused.

- **For work in Ex-protected rooms, the vessels must all be earthed/grounded while being filled and emptied.**
- **When emptying, only use Ex-protected suction tools.**

- Before changing the drying agent, flush the dryer with inert gas and depressurised it.
- The fresh drying agent can heat up to the evaporation point of water if brought into contact with water.
- When filling and emptying drying agents, wear a dust mask and eye protection!
- The old / used drying agent can still contain residual quantities of the product gas, and may continue to degasify.
- When drying agent gets spilled, there is a risk of slipping on the beads of dessicant.

Notes about safety equipment

The safety equipment used to comply with maximum operating pressure and permitted fluid temperature must be provided by the operator.

The gas escaping from the safety valve must be directed away appropriately by the operator and rendered harmless (e.g. gas flare).

The operator is responsible for the operation and/or maintenance of the safety valve. The nature and scope of maintenance work is determined by local policy and by the type of safety valve installed.

Using the heating element

As a pressure device prone to overheating, the heating element is subject to special requirements. The operating company must therefore ensure that the requirements stipulated in the Pressure Equipment Directive are observed and applied.

- The heating element must only be used for the purpose specified in the data sheet. The heating element must not be placed into operation before the operating medium is flowing under operating conditions.
- If the heating element is to be placed into storage, it must be stored in a dry and heated room. The heaters in particular must be protected from moisture. For this purpose, a drying agent is to be additionally placed in the wiring box that should be replaced or reconditioned at regular intervals.
- The operating company must ensure compliance with the inspection intervals.

Disassembly and disposal

Hazard caused by escaping gas!

Never remove any parts of the dryer, or manipulate the same in any way, for as long as the plant is still pressurised! Sudden escapes of gas can lead to combustible/flammable atmospheres in the area surrounding the dryer!

- The Ex zone must be cancelled prior to disassembly of the dryer.
- Dispose of all parts of the dryer, the drying agent and all other operating in an environmentally responsible manner and in accordance with the current legal regulations.

Signs and hazard areas on the dryer

Hazard areas on the dryer

Hazard area	Symbol in operating instructions
Warning of escaping natural gas The high-pressure dryer is operated by natural gas. During all work on the dryer, note the safety data sheets and safety instructions for working with natural gas.	
Warning against overpressure The entire dryer is under pressure. Before commencing any work, the plant must be depressurised.	
Warning of explosive atmosphere/potentially explosive gas In a potentially explosive environment, and for the purification of explosive gases, only use dryers that comply with the corresponding ATEX code. These dryers must be connected to the customer's own earthing/grounding system (potential compensation on company premises).	

Signs and labels

The type plates are located on the vessel and on the filters. Note these signs on the dryer. Keep them complete and always legible.Keep them complete and always legible.

Information on inerting the dryer

Inerting is an explosion prevention measure. It is essential to comply with the following data and information on inerting. Non-compliance with this information can result in the formation of a potentially explosive atmosphere inside the dryer, thus posing considerable danger.

Only use suitable tools for working on the system.
Ex-zones are to be cancelled prior to maintenance. Strict compliance with the operating instructions and the explosion protection documentation is required for this purpose.

Slowly open the gas inlet valve!

Make sure sudden pressure build-up is avoided! If pressure builds up too fast, this may cause damage to the dryer. Therefore always open the gas inlet valve slowly!

Danger!

The system is pressurised during the inerting procedure.

There is a very considerable risk of personal injury, when carrying out work on the activated and pressurised dryer. Suddenly escaping compressed air might cause serious injuries.

Never remove any parts of the dryer as long as the unit is pressurised!

Inerting for taking out of service

Inert the dryer 2x for taking out of service!

The drying agent can still release natural gas after the initial inerting. This renders a second inerting procedure necessary. The second inerting operation must not be carried out before at least 10 hours have passed since the first inerting procedure. This procedure ensures that gas is no longer bound in the drying agent and cannot be released.

The dryer must be completely purged with inert gas at least for two times before each decommissioning, wherein a time buffer of 10 hours must be maintained between the purge-processes. This buffer is necessary so that the bounded gas constituents in the drying agent can outgas. The individual operations are identical to the inerting activities during the commissioning of the dryer (see section *Immediately operate dryer in natural gas system*).

Transportation, installation and storage

Danger due to incorrect transportation!

The dryer must be transported by authorised 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.

Risk of damage to the dryer when lifting!

The upper pipe bridge is not suitable to safely support the weight of the dryer. The dryer could be damaged.

Always use eyebolts to lift up 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 18.

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.
► When damage occurs, immediately contact the manufacturer to have the problem examined. You will find the telephone number on page 8.

Attention!

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.
- The ambient temperature must not drop below +15 °C.
- Naked flame and smoking are prohibited at the installation location.
- When selecting the installation location, take account of the fact that the noise emissions of the dryer may briefly rise above 95 dB(A) (further information about noise emissions can also be found on page 37).
- 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 (min. 1 m) at the top, sides, and rear, in order to be able to carry out maintenance work and change the drying agent without any hindrances.

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 8).

Transportation using lifting or forklift truck

Warning against damage to property!

The dryer is delivered upright on its side on a transportation pallet.

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

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

Installing and anchoring the dryer

Setup

► Remove the packaging of the dryer.

Danger of tipping over!

The dryer must always be transported upright. However, the center of gravity of the dryer is high on the unit, so there is a danger of it tipping over. When attaching lifting gear to the dryer, pay careful attention to its center of gravity!

► Hammer a suitable lifting bar around the stand profile and the cross strut.
► Position the dryer to it´s installation site.

Anchoring the dryer

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

► 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 39.

► Ensure that the natural gas inlet and outlet valves installed by the operator are closed, and that the dryer is depressurised.

► Disconnect dryer from the natural gas network.

► Disconnect the dryer from the electrical power supply and all external lines.

► Using plastic film or a similar material, seal the natural gas inlet and outlet apertures on the dryer to protect the dryer against the ingress of dirt

► 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.**

Store drying agents

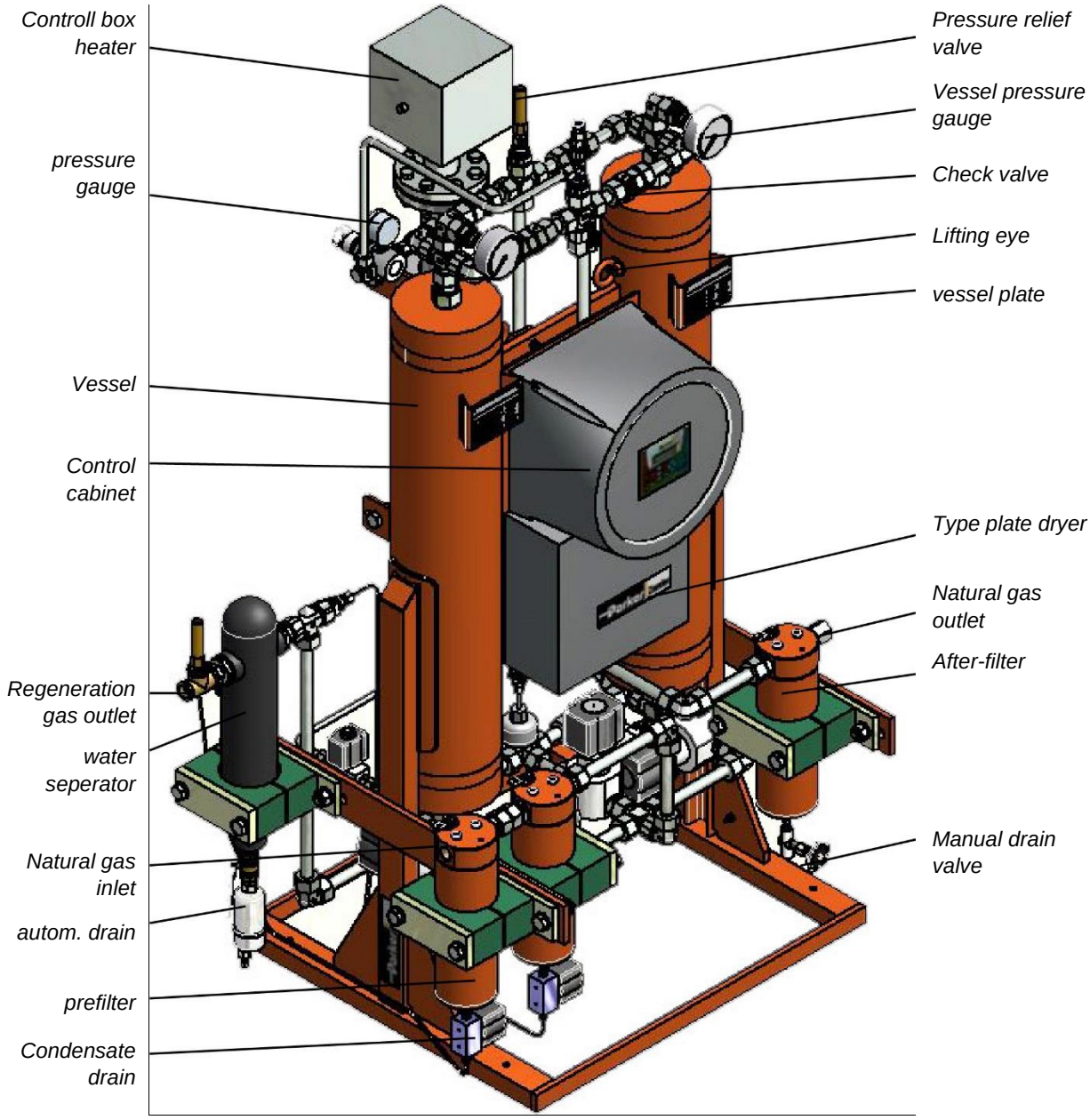
► Do not store drying agents in the open air.

► Protect drying agents against humidity.

Technical Description

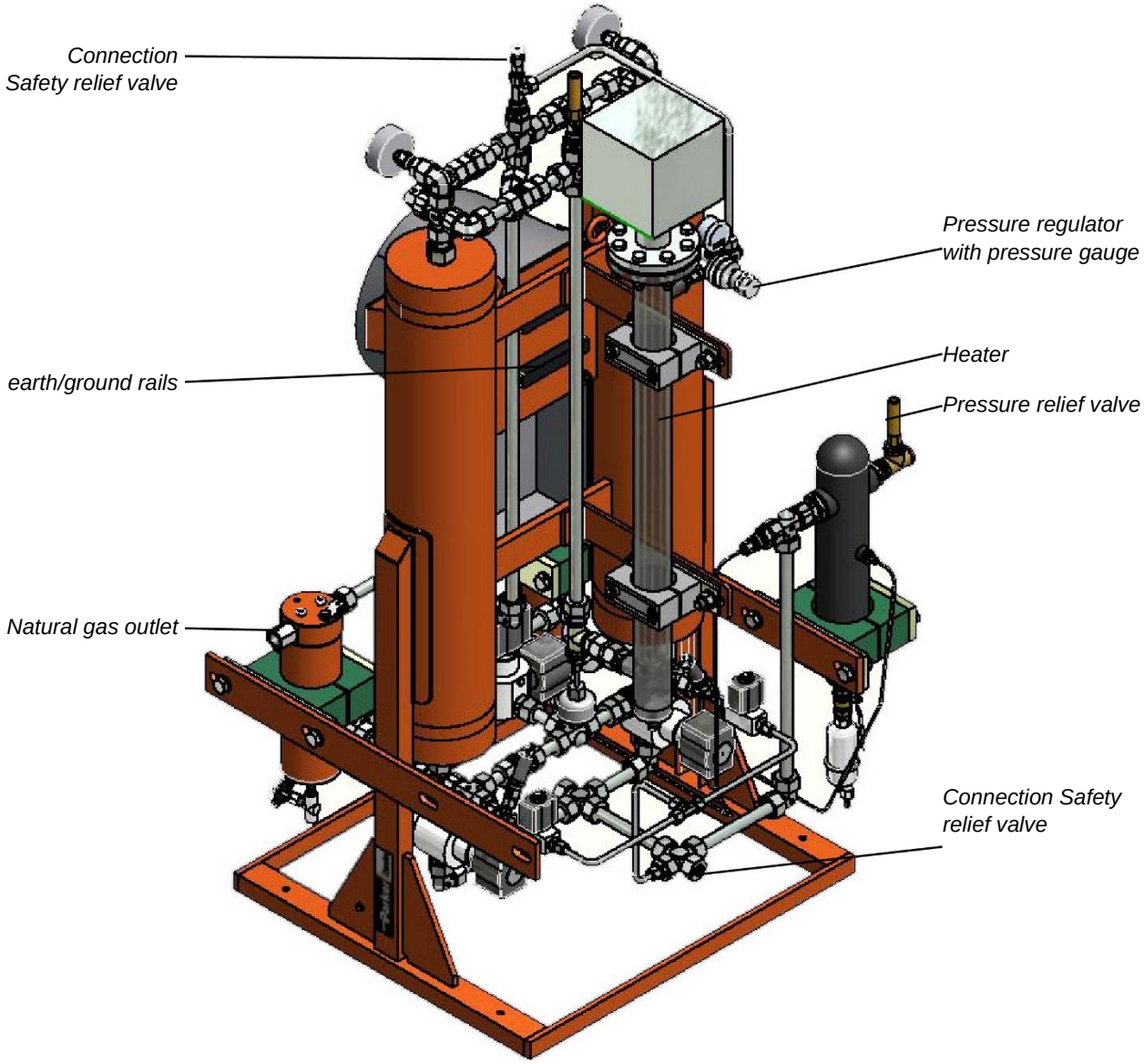
Layout drawing

Front view



Front view

Rear view



Rear view

Function

The dryer dries the natural gas supplied by the compressor and makes it available for industrial use. Because this is a sealed system, a partial flow (regeneration gas) is directed back to the compressor inlet.

Installed upstream and downstream filters purify the natural gas directed into the dryer and/or directed onwards from dryer to consumers.

The two vessels contain an extremely porous drying agent by means of which humidity is removed from the natural gas and stored just as in a sponge.

To this end, the two vessels alternate between different operating modes. Whilst in one vessel, natural gas is de-humidified (adsorption), in the other vessel the humid drying agent is prepared for another charge (regeneration).

These two concurrent states in natural gas treatment are described below.

Adsorption

Humid natural gas is delivered to the dryer from a compressor. From here, the natural gas flows upwards through the absorption vessel, which is pressurised. In so doing, the drying agent dehumidifies the natural gas. The dry natural gas is directed to the pipework network via the natural gas outlet on the dryer.

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 the phases: expansion, dehumidification, and pressure build-up.

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

Expansion phase

Gas pressure in the adsorbing vessel is relieved by an f-stop from compressor outlet pressure to compressor input pressure. This flow rate makes a sudden audible sound.

Dehumidification phase

Before the outlet to the pipework network, dried natural gas is redirected. Via a pressure reducing valve and an f-stop, a partial flow is generated. This partial flow (regeneration gas) is heated by a heating unit. The heated, dried regeneration gas flows through the regenerating vessel from top to bottom. This causes the flow of regeneration gas to absorb the humidity stored in the drying agent.

Then a water separator removes the humidity from the regeneration gas, now cooled, and supplies it to the operator for further use.

Pressure build-up phase

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

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 chamber, as soon as the measured dewpoint at the natural gas 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:

- Dewpoint-sensing control
- Regeneration gas cooler
- Auxiliary heater

Dewpoint-sensing control

With a dewpoint-sensing control system, you can operate the dryer in fixed or variable cycles. In the variable cycle, the switchover is effected in relation to the dew point reached and the charging of the drying agent .

Dryers with the optional *dewpoint-sensing control* are equipped with a further (second) signal contact; it is additionally used for the output of dewpoint alarms.

Regeneration gas cooler

With an air-gas heat exchanger, the regeneration gas can also be cooled, enabling the water to condense out more effectively.

Auxiliary heater

For installation sites with temperatures under +15ºC, the wet side of the dryer must be equipped with an auxiliary heater to prevent valves, cocks, flaps, and other components from freezing up (methane hydrate).

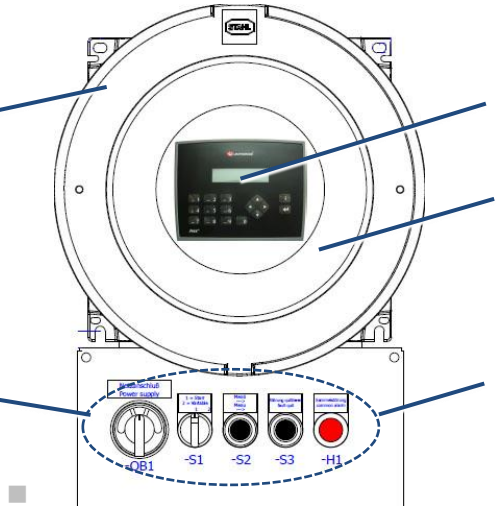
Signalling contacts of the control system

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.

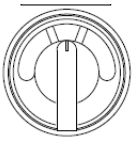
The control system can also be equipped with an optional operation signalling contact with which the dryer operation can be controlled from an external device. This means that dryer operation can be started and stopped externally.

Operating and control elements

Control cabinet

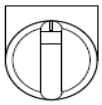


Under the control cabinet is a switch box with controls. Using these controls, the dryer can also be controlled in an Ex zone.



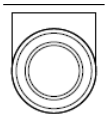
The main switch is the On/Off switch on the dryer.

- In the ON position, the dryer is switched on. The main valves are opened. The drain of the first filter is still in operation. The regeneration piping is drainig small gas flow back to the compressor.
- In the 0ff setting, the power supply is interrupted and the dryer is out of operation. The main valves are closed and de-energised. That means that the dryer is closed in its main direction of flow and no flow through thr dryer no flow to the regeneration piping..



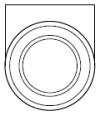
-S1

With switch S1 and with the optional *dewpoint control* it is possible to set the operating method of the dryer using either the *fixed* or the *variable* cycle. When the *variable* cycle is selected, synchronous compressor operation is also selected.



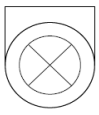
-S2

With the menue button S2, it is possible to page between the individual menus-levels and in different operator levels.
This means that the dryer can also be operated in an Ex zone. Refer to section “*Control* “ for details of how this button functions.



-S3

With the button S3, fault messages are acknowledged. Acknowledging a fault message is not possible until the fault has been remedied. The button continues to be used to confirm actions.



-H1

Whenever there is a fault on the dryer, lamp H1 lights up.

Control unit

The dryer control is visible behind the protective glazing.

If you will use the keypad of the control unit you must be cancelled the ex-zone before. In an explosion-protected zone of the dryer must be controlled using the controls on the control box (see the following section.)

1 Display
2 Arrow keys
3 Info and Enter keys
4 Numerical keypad

	The program can be started by pressing this key.		The program is stopped by pressing this key.
	You can navigate through the menus using this keypad.		With key 0, possible faults are acknowledged.
	Press this key twice to return to the status display.		The *Enter* key is used to enable and/or confirm actions.
	Password-protected sub-menu		Settings cannot be altered without first requesting a password.

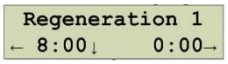
Note:

On the numerical keypad the keys 0, 4 and 5 are for the local dryer control. The Keys 1, 2, 3, 6, 7, 8 and 9 are not assigned.

User interface on control

Danger!

The user interface on the control can only be used when the switch cabinet cover is open. Before disassembly of the cover with protective glazing the Ex zone must be cancelled !

The of each dryer is shown on the status display: 

.
Using the keypad, individual menu levels and/or their corresponding sub-menus will be called up. The menu layout for the control is illustrated on page 61.
Due to different authorisation levels with different numerical codes, the control can be protected against input by unauthorised persons.

Password-protected area

The menu items indicated with a padlock symbol are protected against any attempt at change by unauthorised persons. In the menu level "Dryer Settings" all submenus are protected with a password To enter the password, observe the following steps:

- ► Select the desired menu level.
- ► Select desired menu item using arrow keys.
- ► Enable input using the Enter key.

- ► Enter password with help of numerical keypad.

- ► Confirm input using the *Enter* key.

- ► Press the key to return to the screen status

Start/ stop the dryer

The dryer control has a start/stop function that can be used 'locally' from the control user interface or via the 'remote' function by remote control.

lokale start/stop

- ► To start or stop the program sequence in local mode press the key 4 or key 5.

or

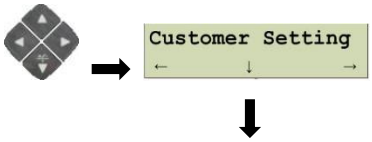

*Remote control **or** in protective area(Ex-zone) start/stop*

- ► pressing the S3 key for longer (>3s)
- ► briefly pressing the S2 key

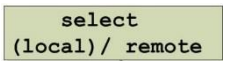
Local- oer remote control

The choice between local and remote control is performed via the *status menu* in the relevant sub-menu (refer to page 61 for details of menu layout).

- ► Select the desired menu level.



► Select the sub-menu item using arrow keys..



► To enable the sub-menue press the *Enter* key.

► Choose the alternative with the arrow keys (the desired alternative must be shown in brackets).

► Confirm input using the Enter key.

► Press the key to return to the status display.

Note:

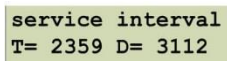
After the change of control mode (local / remote) the dryer must be restarted.

Reset service interval

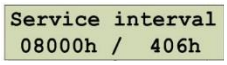
The dryer controller has a service interval counter which reminds you when a maintenance is carried out on the dryer.

All 8000 operating hours should maintenance be performed on the dryer. For maintenance needed wear parts are grouped in a service kit.

► If the maintenance schedule is reached and the counter is set to 0, the status diplay is not shown, but the message *service interval* with *date* and *time* will be shown.



► This message can be acknowledged with the S3 button and will thus be extended to 168 hours. This time should be sufficient to order the appropriate service kit.

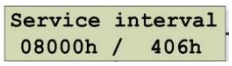


After the maintenance has been performed, the service-counter can be reset. The service counter can be reset only by the keypad of the control unit.

Go therefor proceed as follows:

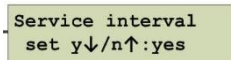
► *With ATEX-compliant dryers:*
Cancel the Ex zone (in acc. with owner's operating instructions).

► Select the desired menu level *Customer Setting* at the submenu item *Service interval* using arrow keys.



► Then select by the arrow keys the desired menue item.

► After maintenance select with the keypad, the option "Y" and set the counter back to 8000 Bh.



► Restart the dryer.

Note:
The service interval can only be changed on the control user interface.

Control elements on the switch cabinet

The dryer can only be controlled in an Ex-protected zone with the controls on the switch cabinet. For this, controls are located under the control switch cabinet. These controls function as follows:

- Menu key S2 runs through the individual menu items.
  - By pressing the S2 key for longer (>2s) it is possible to change between the individual menu levels.
  - By briefly pressing the S2 key, the sub-menus of the selected level are called up.

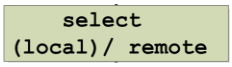
- Faults are acknowledged by pressing key S3 (>3s) for longer.

To start/stop the dryer using the controls on the switch cabinet, use the following keystroke combination:

► Press and hold down key S3, and at the same time press menu key S2.

The choice between local and remote control is performed via the *menu Customer Setting* in the relevant sub-menu (refer to page 61 for details of menu layout).

- To enable the remote function, the desired alternative must be shown in brackets.



- Press the  key to return to the screen status.

Note:
With keys S1 and S2 parameter settings can be made. To change the factory settings, the Ex zone must be cancelled and the cover with protective glazing must be removed.

Other display elements

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
  - During the expansion phase, reduce from positive operating pressure to compressor inlet pressure (CIP)
  - During the dehumidification phase, display the compressor inlet pressure.

During the pressure build-up phase the indication on the pressure gauge should again rise to operating overpressure level.

Installation

All work at the pipelines and on the electrical components must be carried out by authorised and suitably qualified technical personnel.

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

Requirements for installation

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

- Connections and lines for the inlet and outlet as well as disposal of the natural gas must be in place.
- The operator must install a natural gas inlet valve, an outlet valve and a recuperation valve, thereby enabling the dryer to be installed and maintained in a depressurised condition.
- All pipes, couplings, and connections must have the correct diameter and match the operating pressure.
- Connect the outlets from the regeneration gas safety valves to the line used to evacuate escaping gas.
- The disposal line on the regeneration gas safety valves must not include any shutdown valves.

Hazard caused by exceeding the limit values!

The following safety devices must be installed.

- **One safety device to prevent operating pressure from exceeding its maximum permitted limit, and fluid from exceeding its maximum permitted temperature**
- **One safety device to monitor hazardous gas concentrations and to protect against escaping natural gas.**

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

Attention!

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.

Hazard caused by unearthed/ungrounded dryer!

The electrical conductivity of the dryer in the on-site potential compensation system must be assured during installation. Assure the presence of appropriate connection points at the installation location.

Connect piping

In order to ensure that the dryer operates to optimum standards, the dryer must be assembled into the natural gas system free of all stresses.

- ► Ensure before connection that all inlet and outlet natural gas 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 from natural gas inlet and outlet points and from the recuperation line.

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 natural gas system.
- ► Earth/ground building-related pipework.
- ► 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 is to be installed at each of the natural gas inlet and -outlet ends of the dryer.
- ► *If you fit a bypass line* with additional *shutdown valve:*
  Fit the line such that, when carrying out maintenance work on the dryer, the line system can continue to be supplied with natural gas.

Installing the electrical connection

Warning! Risk of injury from electrical voltage

Work on the electrical system must only be carried out by qualified technical personnel!

With ATEX-compliant dryers

- **All work on the electrical system must be carried out with the dryer properly earthed/grounded.**
- **Existing Ex zones near the dryer may need to be cancelled.**
- **The Ex protection of electrical components must not be disabled. Therefore treat these components with the requisite level of care and attention.**

The dryer is operated by 3-phase AC current.

Connection therefore takes the form of a 5-core feed wire (see following section).

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.

- ► 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 (pay attention to the electrical circuit diagram at the same time).
- ► Connect up the cables in accordance with the electrical circuit diagram.
- ► In all phases the dryer must be protected against short circuits by means of fuses.
- ► In order to relieve cable strain, re-tighten the union.

Connecting the external signalling lines

In respect of compressor synchronisation

The controller is fitted as standard with a digital input which makes the dryer regeneration dependent on operation of the compressor.

Following compressor contact, operation of the compressor and dryer regeneration run synchronously: When the compressor is stopped, the dryer regeneration also stops. When the compressor restarts, regeneration also restarts.

To install the external lines, proceed as follows:

- ► Connect the signalling line to the potential-free busbar connection of the compressor in accordance with the electrical circuit diagram).

For operational monitoring

Here there is the option of connecting the dryer to a fault signalling system via a potential-free operation signalling contact. Messages such as:

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

can be displayed centrally, e.g. in a control room.

To install the external lines, proceed as follows:

Connect up the lines in accordance with the electrical circuit diagram.

Remote control of the dryer

The dryer can be monitored externally and the regeneration can be started or stopped. Therefore the dryer must be set to „Remote“.

For installation proceed as follows:

- ► Connect the signal line of the potential-free contact of the compressor according to the wiring diagram.

Check bolt connections

Before the initial start-up:

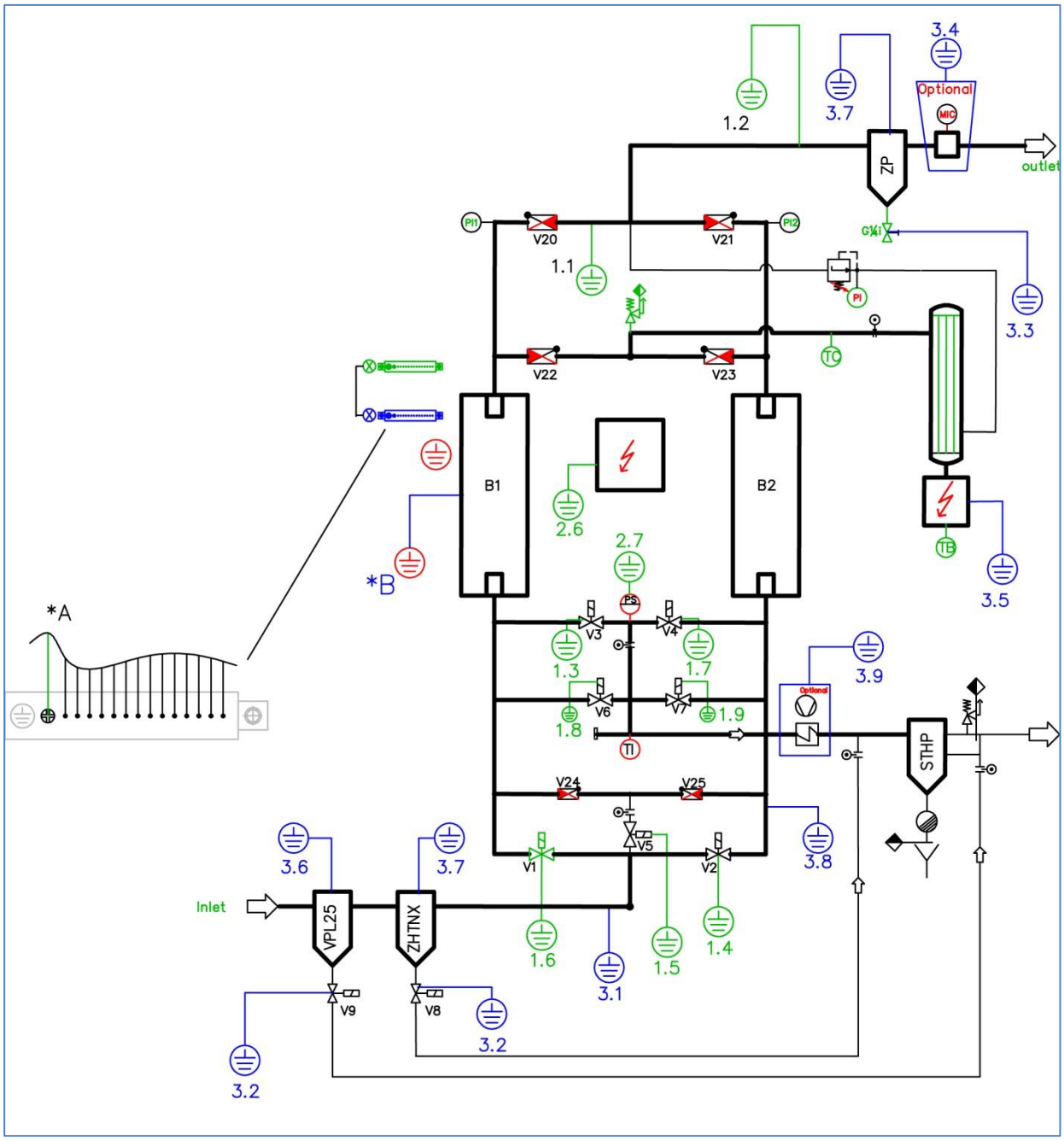
- ► Check all unions and bolt connections as well as the terminals in the control cabinet for secure seating; re-tighten if necessary.

Connect to earth/ground

Earth/ground connection on ATEX-compliant dryers!

- **ATEX-compliant dryers must be earthed/grounded properly.**
- **Existing Ex zones near the dryer may need to be cancelled.**

The earth/ground rails are mounted on the back of the switch cabinet. Here, the dryer is connected to the potential compensation system on the company premises.
The operator must connect earth/ground points ***A** or ***B** to the potential compensation system on the company premises.



Commissioning

On no account place the dryer into service or take the dryer out of service without inerting it beforehand!

Together with air, gaseous natural gas can form an explosive gas mixture and therefore poses a considerable danger. An explosive atmosphere can build up especially during commissioning and when replacing the drying agent. To avoid this, the dryer must be purged with inert gas both before placing into service well as before taking out of service (e.g. before maintenance).

Hazard caused by escaping gas!

Never remove any parts of the dryer, or manipulate the same in any way, for as long as the plant is still running! Any sudden escape of gas can lead to combustible atmospheres in the area surrounding the dryer. Before carrying out any work on the dryer, first depressurise the plant.

Requirements for initial start-up

Attention!

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

- The line network must be kept free of contamination.
- All shutoff valves and customer-installed natural gas inlet and outlet valves are closed.
- 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.
- Do not modify the factory settings of the control system in any way without prior consultation with the manufacturer.
- The dryer is correctly sited and installed.

Checks before start-up

Purge system before start-up!

The dryer was subjected at the plant to a leak test using compressed air and is supplied with a positive pressure of +0.5 bar.

Prior to commissioning, the dryer must be purged using a suitable medium to remove any residual humidity or oxigen!

Warning!

Interrupt the start-up procedure if the controller displays an error message. All displayed faults must be rectified prior to start-up.

Ensure that

- all pipe, cable and bolt connections on the dryer have been retightened,
- no pipes chafe against body edges,

- **All earthing connections have been made correctly**
- all connections on the dryer are sealed.
- 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 natural gas system components which are pressurised (valves, hoses etc.) are free from wear symptoms and defects.

Note:

Run the dryer at least for 24 hours after commissioning so that the dewpoint sensor displays a precise dewpoint.

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	Short cycle	Variable cycle	Fix
Adsorption	60 min	~ 20 min	120 min, max	35 min
Regeneration, total	60 min	~ 20 min	60 min	35 min
– of which: expansion time	~ 3 min		~ 1 min	5 min
– of which heating	~ 50 min	~ 15 min	~ 50 min	20 min
– of which cooling	~ 5 min		~ 7 min	7 min
– of which: pressure build-up	~ 2 min		~ 2 min	2:30 min
Standby	—		~ 60 min, max	

Emergency shutdown

In the event of an emergency, shut down the dryer *Depressurise the dryer and shut it down* as described on page 39.

Startup dryer

On no account place the dryer into service or take the dryer out of service without inerting it beforehand!
Notes for inerting, see page 15.

Risk of pressure blow when starting the dryer!
At the start of the dryer the container in the pressure build-up or expansion phase must have the same pressure level.
If the pressure rises too fast, it can cause damage to the dryer.

Open natural gas supply and switch on dryer

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

- ► Purge system with inert gas.
- ► Ensure that owner-installed natural gas inlet valve and regeneration gas return valve are closed.
- ► Ensure that the natural gas network upstream of the dryer is pressurised.
- ► Switch on dryer: to this end, pressing the key S3 for longer (>3s) and than briefly pressing the key S2.

Open natural gas inlet valve slowly!
Make sure sudden pressure build-up is avoided! If pressure builds up too fast, this may cause damage to the dryer. Therefore always open natural gas inlet valve slowly!

- ► Slowly open owner-installed natural gas inlet valve upstream of the dryer.

No regeneration!
The regeneration gas return valve must always be opened because otherwise the regeneration gas escapes through the safety valves to the disposal line.

- ► Open owner-installed regeneration gas return valve.

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 for 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.

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

► Ensure that the natural gas valve installed by the owner is closed.

► Keep natural gas outlet valve closed for the recommended period of time.

Then the dryer can be taken into service in the natural gas system as described in the following section:

Immediately operate dryer in natural gas system

► Ensure that the natural gas system downstream of the dryer is pressurised or that a start-up device was installed into the natural gas system directly downstream of the dryer.
The importance of this increases with the size of the natural gas system downstream of the dryer. Smaller natural gas systems can also be pressurised by the natural gas directed through the dryer.

Slowly open user-installed natural gas outlet valve!

Avoid a sudden drop in pressure in any circumstance! If pressure drops too fast, this may cause damage to the dryer. For that reason, always open natural gas outlet valve slowly!

► Slowly open user-installed natural gas outlet valve. Observe the vessel pressure gage of the pressurised vessel. The pressure should not drop below the 80% of the operating pressure if possible. If necessary, keep the natural gas outlet valve in a slightly open position until the natural gas system downstream of the dryer has filled up completely. Do not open the valve fully until that time.

The dryer is then in operation in the natural gas system.

In the event of a fault

► *When critical gases flow through:*
First purge the relevant section of pipework, the dryer and the filters with inert gas.

► *With ATEX-compliant dryers:*
Cancel the Ex zone (in acc. with owner's operating instructions).

► *All gases:*

- Block gas supply to the dryer.
- Depressurise the dryer.

► Look up possible cause of the fault, and how to remedy the same, in the table on page 51.

► Rectify fault.

► *With ATEX-compliant dryers:*
Restore operational potential compensation, check electrical conductivity and document the results.

Restart commissioning again.

Changing cycle mode (optional)

Which cycle modes can I choose?

After a successfully concluded initial commissioning process, with the option *dewpoint control* the dryer must be operated in economy mode (*Economy Cycle*).

- Dryers equipped with dewpoint-sensing control operated in variable cycle mode, based on the measured dewpoint of the dried air at the natural gas 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.
- At the same time, at the changeover point to variable cycle, synchronous compressor operation is enabled. Compressor synchronisation helps reduce energy costs, as the dryer can be operated independently of 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.

The compressor synchronization 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.

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.

How do I change cycle mode?

► Wait until the dryer has reached the pressure build-up phase (phase prior to switchover).

► Actuate the S1 switch. The selected driving mode is shown on the control display. The driving mode shown in brackets is enabled.

The programme continues the cycle.

Monitoring of the 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 of sudden gas escape!

During expansion the pressure is relieved suddenly through a restrictor:

- **A loud cracking noise occurs which can injure your hearing.**

Therefore you should always wear ear protection when in the vicinity of the dryer!

At all times, observe the following points when operating 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. The noise emission level can briefly exceed 95 dB(A). Therefore, the owner 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 natural gas, defective components), the dryer must be shut down immediately as described in the section *Depressurise the dryer and shut it down* on page 39. The dryer may only be restarted after all defects have been eliminated.

With dewpoint-sensing control (optional)

Display of dewpoint

If the dryer is equipped with a dewpoint-sensing control system, the digital display on the control shows the currently measured dewpoint.

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.

Shutting down and restarting the dryer

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

- In the event of an emergency or malfunction
- For maintenance
- For disassembly

Formation of an explosive gas mixture!

- **An explosive mixture of gases can form if gas escapes while oxygen enters the dryer.**

Risk of injury from escaping compressed air!

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

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

On no account place the dryer into service or take the dryer out of service without inerting it beforehand!

Together with air, natural gas can form an explosive gas mixture and therefore poses a considerable danger. An explosive atmosphere can build up especially during commissioning and when replacing the drying agent. To avoid this, the dryer must be purged with inert gas both before placing into service well as before taking out of service (e.g. before maintenance). You will find information on inerting on Page 15.

Notes for interrupted mains voltage

Note the following instructions in the event of the power supply to the dryer being cut unexpectedly.

In the event of a power failure or of the dryer being switched off using the On/Off switch, any main valve open then closes, resulting in

- pressure at the delivery side of the dryer rising while the compressor is running (up to the controlled shutdown point of the compressor),
- vessel pressure (without startup fixture) dropping when natural gas outlet valve is opened, if natural gas is being sourced from the grid,
- no further natural gas enters the downstream natural gas system.

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 the event of an emergency, shut down the dryer as described in the next section.

Depressurise the dryer and shut it down

In order to switch the dryer into a safe state, proceed as described in the next three sections:

- ► Close the owner-installed natural gas outlet valve.
- ► Close the owner-installed natural gas inlet valve.
- ► Leave the dryer switched on until each vessel has run through an expansion phase.

The expansion phase causes pressure in the vessels to be relieved successively down to compressor inlet pressure.

- ► Check the pressure relief of the dryer on both pressure gages. It should show '0 bar' above the compressor inlet pressure.

Disconnect voltage supply

- ► Switch on dryer: to this end, pressing the key S3 for longer (>3s) and than briefly pressing the key S2.
- ► Close owner-installed regeneration gas return valve.
- ► Switch OFF of the power supply to the dryer.

key S3 + key S2

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.

Re-start

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 locked in main flow direction.
- The vessel pressure drops (with opened owner-installed natural gas outlet valve) if natural gas is being sourced from the grid.

If natural gas system and dryer have remained below positive operating pressure

- ► Ensure that owner-installed natural gas inlet valve is opened.
- ► Ensure that owner-installed regeneration gas return valve is opened.
- ► Start program (see section on display elements on page 31).
  The program continues the cycle from the point at which it was interrupted..

Slowly open natural gas outlet valve!

Avoid a sudden drop in pressure in any circumstance! If pressure drops too fast, this may cause damage to the dryer. For that reason, always open natural gas outlet valve slowly!

- ► Slowly open owner-installed natural gas outlet valve. Observe the vessel pressure gauge of the pressurised vessel. The pressure should not drop below the operating pressure (if poss.). If necessary, keep the natural gas outlet valve in a slightly open position until the natural gas system downstream of the dryer has filled up completely. Do not open the valve fully until that point.

The dryer is now back in operation and is working fully automatically.

If the natural gas system and dryer have not stayed below positive operating pressure

- ► If disconnected, reconnect the voltage supply of the dryer.
- ► Switch on the dryer and pressurise as described in section *Open natural gas supply and switch on dryer* , page 34.

The dryer is now back in operation and is working 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

Attention!

Maintenance tasks may be carried out only by authorised and qualified specialist and approved personnel (e.g. DVGW), and only with the plant in a switched off and depressurised condition.

Hazard resulting from release of a critical gas!

If the gas system is operated using a critical gas (explosive, combustible, toxic), it can present a hazard to people and the environment if released.

Therefore before working on dryers for critical gases
— purge the relevant pipework section with inert gas
— keep the hazard instructions for the gas in the system in a convenient location
— prepare appropriate protective measures
— *with ATEX-compliant dryers:*
before work, first cancel the Ex zone,
ensure that the individual components of the dryer are also earthed/grounded
during any maintenance work.

Note:

To assure perfect maintenance and reliable operation, we recommend concluding a maintenance contract.

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.

- 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 caused by the components slipping, the components breaking off, and by expanding natural gas!
- 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.
- Only use spare parts approved for the Ex-protected area.

- **When working in an area at risk of explosion, always use suitable tools.**

Regular maintenance intervals

Note:

If pressure is well below the CIP after pressure relief of a vessel, e.g. after the expansion phase, the vessel is pressurised by what is known as dam pressure. This might be due to

- **the regeneration gas return line not being free,**
- **contamination of the dust sieves,**
- **drying agent which is too old.**

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

The table provides an overview of the maintenance work to be carried out. The following pages describe some of these tasks.

Component	Maintenance task to be carried	Maintenance interval				
		daily	weekly	12 months	24 months	see page
Complete dryer	Carry out visual and function checks.	●				44
Vessel pressure gauge	Check dam pressure. With differential pressures of more than 1 bar: – check the regeneration gas line, – Check dust sieve. – Check drying agent.	●				44
Condensate trap on separator and upstream filter	Check function of condensate trap	●				
Pressure reducer	Check pressure setting, and reset if necessary.		●			47
ATEX-compliant dryer	Check earth/ground rail and retighten grounding strap if necessary.			●		
Safety valve	Please note the owner's maintenance specification				●	45

Component	Maintenance task to be carried	Maintenance interval				
		daily	weekly	12 months	24 months	see page
Sensor of optional dewpoint-sensing control system	Replace.			●		
Check valves	Clean, replace if necessary.			●		47
Solenoid valves	Valve bodies and purging - clean and replace if necessary.			●		47
Dust sieves, gaskets, drying agent	Replace.				●	47
Pre- and after-filter	Check differential pressure on the upstream and downstream filters.		●			45
	Change the element.			●		46

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 39, *Depressurise the dryer and shut it down*!

Before working on dryer, first purge the system with inert gas and depressurise it.

On no account place the dryer into service or take the dryer out of service without inerting it beforehand!

Together with air, gaseous methane can form an explosive gas mixture and therefore poses a considerable danger. An explosive atmosphere can build up during maintenance work especially when replacing the drying agent. To avoid this, the dryer must be purged with inert gas both before commissioning well as before taking out of service.

You will find information on inerting on Page 15.

Making preparations

Make the following preparations before starting maintenance work:

► Purge the affected section of pipework and the dryer with inert gas.

► *On ATEX-compliant dryers:*
Cancel the Ex-zone (in acc. with owner's operating instructions).

► Block gas supply to the dryer.

► Depressurise the dryer.

► Allow the dryer to cool down.

Then start work - not before this point!

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.

Clean dryer

ATEX-compliant dryers

A buildup of dust on the dryer can be dangerous. The dryer must therefore be cleaned regularly. The cleaning interval depends on the dust loading of the ambient air. The more dust in the air, the more frequently the dryer needs to be cleaned.

Warning of static charge!

With ATEX-compliant dryers, never use dry textiles for cleaning purposes. The friction they produce can cause static discharge. That in turn could create a combustion source.

Therefore always clean dryers with damp cloths!

- ► Clean the dryer regularly with a damp cloth to prevent any hazardous buildup of dust.
- ► Only dampen the cloth with water, wring it out well, and do not use additives!

Dryers that are not intended for an ATEX environment

- ► Clean the dryer once a week with a damp cloth.
- ► Only dampen the cloth with water, wring it out well, and do not use additives!

Check dam pressure

If, following depressurisation of a vessel, e.g. after the expansion phase, the positive pressure has not decreased to compressor inlet pressure (CIP), 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 gage indicates CIP. Then there is no dam pressure.

If the dam pressure is greater than 1 bar:

- ► Depressurise the dryer and shut it down (see page 39).

Dam pressure can be caused by:

- a regeneration gas return line,
- a blocked dust sieve or
- drying agent which is too old.

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

Check function of all condensate trap

Check the electronic condensate drain in accordance with details in the manual of the condensate drain.

Replace the safety valve

The operator is responsible for the operation and/or maintenance of the safety valve. The nature and scope of maintenance work is determined by local policy and by the type of safety valve installed.

Weekly maintenance tasks

Check differential pressure on the filters

► Check the differential pressure at the pressure gauge for the filter.

The differential pressure should be 0.35 bar max. If the differential pressure exceeds 0.35 bar, we recommend that you replace the filter element (see page 46). The filter elements must be replaced in any case every year.

Checking pressure setting at pressure reducer

Damage to heating!

If regeneration gas pressure is too high, the following components may get damaged and this would impair the function of the dryer. Never set pressure on the pressure regulator to more than 25 bar!

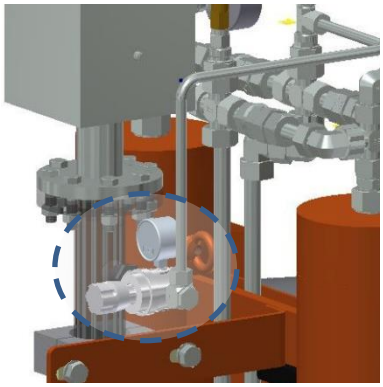
> **Note:**
>
> **The set pressure can only be changed during running regeneration!**

► Check the pressure setting at pressure gauge of the pressure reducer.

For details of the required pressure setting, please refer to *Technical data*

on page 56.

► If the pressure setting is less than or more than the correct level, set the correct pressure at knurled screw of the pressure reducer.



Pressure reducer

Maintenance work to be completed every 12 months

With ATEX-compliant dryers, tighten down the grounding straps

The grounding straps on ATEX-compliant dryers can work loose over time. They may then no longer be electrically conductive.

The grounding strap is located behind the switch cabinet and connects all grounding points on the dryer.

- ► Tighten down these grounding straps regularly and at least once a year.
- ► The location of the grounding points is shown in the grounding diagram on page 31.

Grounding strap

Renew filter elements on the filters

The filter elements must be replaced every 12 months.

- ► Depressurise the dryer and shut it down (see page 39).
- ► Remove the bottom section of the filter housing (see figure).
- ► Replace filter element.
- ► Refit bottom section of the filter housing: first screw on very tightly, and then unscrew by a quarter turn.
- ► Dispose of used filter element in accordance with the applicable regulations.
- ► If no other maintenance work is to be carried out: Restart the dryer (see page 40). Check the all filters for leaks.

Replace 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.

Attention!

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 and order a new dewpoint sensor. After receipt of the new pressure dewpoint sensor, replace the sensor as follows:

- ► Flush the pressure equipment with an inert gas; release all pressure and switch it off.
- ► Remove the sensor from the dewpoint measuring chamber.
- ► Before fitting ZHM 100 TT Eex to a sampling block ensure that the large housing clamp nut is only finger tight against its seal.
- ► Apply the bonded seal supplied over the sensor end.
- ► Screw the ZHM 100 TT-Eex into the block by turning the fitting. **Do not turn the housing!** Fully tighten the fitting using a spanner of the correct size.

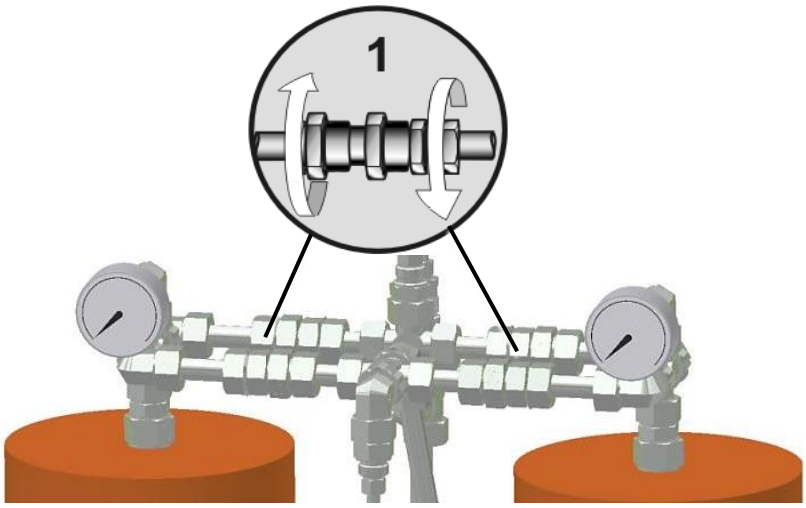
Note:

Installation of ZHM 100 TT-Eex must be as per either system drawings in order to comply with the Intrinsic Safety certification for ZHM 100 TT-Eex.

Clean check valves and replace if necessary

Check valves are wearing parts and must therefore be cleaned every 12 months, and replaced if necessary.

- ► Depressurise the dryer and shut it down (see page 39).
- ► Unscrew and remove check valves from pipe bridge. Pay attention to different direction of rotation on upper (1) and lower pipe bridge (see figures).



Removing the check valves

- ► Dismantling and cleaning the check valves
- ► If necessary, replace the check valves with new ones.
- ► Then reinstall check valves in the pipe bridge.
- ► If no other maintenance work is to be carried out: Restart the dryer (see page 40). Check that the connection is leak tight.

Cleaning solenoid valve bodies and replacing if necessary

Solenoid valve bodies are wearing parts and must therefore be cleaned every 12 months and replaced if necessary.

- ► Depressurise the dryer and shut it down (see page 39).
- ► Unfasten solenoid valves from the pipework.
- ► Remove the coil.
- ► Unfasten screws on housing and remove.
- ► Remove diaphragm and spring from housing.
- ► Clean all components carefully.
- ► After cleaning components, reassemble them. Replace any defective solenoid valve with a new one.
- ► Replace the coil.
- ► Reinstall solenoid valve in the pipework.
- ► If no other maintenance work is to be carried out: Restart the dryer (see page 40). Check that the connection is leak tight.

Maintenance work to be completed every 24 months

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

Note:

For an inspection of the pressure vessels, the drying agent must be removed. For an inspection of the pressure vessels, the drying agent must be removed, as described below.
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 (see page 8).

Replace dust sieve (Flow distributor)

Dust sieves are installed in the vessel that retain the drying agent dust. If these dust sieves block, dam pressure is generated and this can cause natural gas levels in the system to fluctuate.

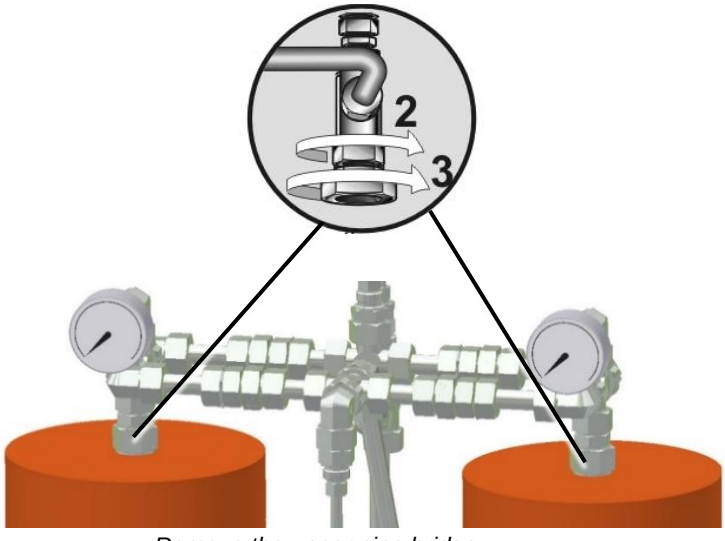
To remove the dust sieves, the check valve block and attached angle pipes also need to be removed.

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.

To remove the pipe bridge, only use approved climbing aids.

- ► Depressurise the dryer and shut it down (see page 39).
- ► Dismantle and remove upper pipe bridge:
  - — Unfasten connections between pipe bridge and downstream filter.
  - — Unfasten cap nuts between pipe bridge and vessels (2, 3).
  - — Remove upper tube bridge.
- ► Unfasten cap nuts on dust sieves, remove Teflon tape and remove dust sieves.
- ► Clean dust sieves with compressed air or a wire brush, or replace if necessary.
- ► Tighten dust sieves back into place and seal with new Teflon tape.



Remove the upper pipe bridge

- ► Reinstall complete pipe bridge, and tighten down cap nuts.
- ► Restart dryer (see page 40). Check that the connection is leak tight.

Replace drying agent

Never take the dryer out of service without inerting it beforehand.

Together with air, natural gas can form an explosive gas mixture and therefore poses a considerable danger. An explosive atmosphere can build up especially when replacing the drying agent. To prevent this, the dryer must therefore be purged with inert gas.

The service life of the drying agent is usually approx. 3 to 5 years. . The drying agent can however, if installation conditions are favorable, take place must later (for notes on installation location, also refer to page 17). 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.

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

Avoid the creating of sparks!

An ignition source can arise through the friction caused by emptying and filling drying and purifying agents. That in turn entails the hazard of sparks being caused.

- **For work in Ex-protected rooms, the vessels must all be earthed/grounded while being filled and emptied.**
- **When emptying, only use Ex-protected suction tools.**

► Depressurise the dryer and shut it down (see page 39).
► Provide a suitable collecting hopper.
► Unfasten connection between lower pipe bridge and upstream filter (1).
► Unfasten cap nuts between lower pipe bridge and vessels (2, 3).
► Drain drying agent into collecting hopper. Carefully remove residues with an industrial vacuum cleaner.
► Then reinstall lower pipe bridge and connection to upstream filter.
► Dispose of the used drying agent in accordance with all applicable regulations.

Add new drying agent.

The filling of drying agent in these vessels comprises 3 different layers of drying and cleaning agent. These different layers assure a constant dewpoint.

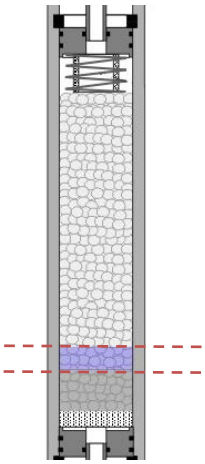
Together with the drying agent, the gaskets and the solids filter in the vessels/hoppers should also be replaced.

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 container.

- ► Dismantle upper pipe bridge and connection to downstream filter (also refer to page 48).
- ► Fill the several drying agents in as separate layers (according to the technical data in the appendix).
- ► If necessary, use a funnel. Take special note of the next step.
- ► Ensure for a high bulk density in the vessel.
- ► Failing that, when filling the drying agent, use a stick to distribute and compact it.
- ► Repeat the process on the second vessel.
- ► Then reinstall the pipe bridge and connection to the downstream filter.



► Restart dryer (see page 40). Check that the connection is leak tight.

Note:

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

Identify and eliminate faults

Stop condition of dryer

In stop condition, the main valves on the dryer are open. When the main valves are open, the dryer is permeated with humid natural gas. This can cause damage to dryer and drying agent.

In stop condition, ensure that gas supply is stopped, or that dryer is turned off at the mains isolator switch.

There are different fault types. With most electrical faults (e.g. short circuit, defective fuse etc.), the main valves close. Faults on the dryer (or 'adsorber') become noticeable e.g., due to unusual noises and dam pressures.

The fault message is shown in the display until the fault has been remedied and then acknowledged. To acknowledge a fault, acknowledge each one individually using the relevant keystrokes.

> **Note:**
>
> **A fault (alarm) is shown on the Alarm menu display with date and time.**

Summary of faults

In the case of some process faults, the dryer will continue to operate for some time.

Table of possible faults

Fault	Possible cause	Remedy	Dryer stops
fault heater	Motors protection switch QA 1 has triggered.	Replace heating.	●
	Temperature limiter A 2 triggers.	Reset temperature limiter by pressing the Acknowledge Fault key	
pre alarm heater	Temperature limiter A 2 triggers.	Heating temperature is higher than planned.	
fault fan (option)	high power consumption on regeneration gas cooler QA3	Check and if necessary replace the regeneration gas cooler	
	Motor temperature of regeneration gas cooler too high	Check and if necessary replace motor function.	
fault valve Y1-Y7	Solenoid coil defective	Replace fuse and solenoid coil and/or valve.	●
fault PT100 sense	Sensor defective	Replace sensor.	●
	Cable defective	Replace cable.	

Fault	Possible cause	Remedy	Dryer stops
dew point	Dewpoint not reached	Check and if necessary adjust settings	
	Insufficient operating pressure.	Increase operating pressure.	
	Differential pressure on the upstream filter is too high.	Check differential pressure on the upstream filter, if nec. renew filter element.	
	Gas inlet temperature too high.	Reduce compressed air inlet temperature or pre-connect a compressed air cooler.	
	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 drying agent for contamination, if nec. renew drying agent.	
	Cable defective	Replace cable.	
	TF1 defective	Replace transmitter	
fault dew point sense	Regeneration gas too low.	Check function of valve V7 / V8 and muffler, if necessary, replace muffler or filter element.	
service interval	Service not carried out	Carry out service and confirm	
fault expansion	Y3 / Y4 fails to open	Check valve and replace if necessary	
	Pressure too low		●
	Nozzle blocked	Check nozzle and replace if necessary	
fault pres. Sens.	Cable defective	Replace cable.	
	Sensor defective	Replace sensor.	
	TF2/ TF3 defective	Replace transmitter	
	Exceeded operating pressure	Reduce inlet pressure	
fault pressuris.	pressure-up valve falls to open	Check valve and replace if necessary	
	expansion valve fall to close	Check valve and replace if necessary	

Index

Annex with technical documentation

This annex comprises the following information and technical documentation:

- Technical data
- Replacement and wear parts list
- Logic control diagram
- Menu diagram of controller
- Flow diagram
- Time diagram of valve setting
- Dimensional Drawing

Technical data

Scope of application

Installation location	Interior installation, above freezing level, in non-aggressive atmosphere
Ambient temperature	25 to 40°C (77 to 104°F)
Natural gas inlet temperature	35 to 50°C (95 to 122°F)
Operating pressure, maximum	250 bar_e
Return pressure, maximum	20 bar_e
Fluid medium	Compressed natural gas (CNG)
Fluid group (acc. to PED)	1

Electrical connection

Mains voltage, standard	400 V, 3Ph, 50-60 Hz
Protection class	IP65
Please note type plate and attached electrical circuit diagram!	

Performance details

Model	Output[1] in m3/h	Nominal width[2]	1. prefilter	2. preflter	afterfilter	Water separator
HDK 250/250	250	G ½ i	GH7/250XP/CNG	GH7/250ZP/CNG	GH7/250ZP/CNG	STH001P
HDK 750/250	750	G 1 i	GH11/250XP/CNG	GH11/250ZP/CNG	GH11/250ZP/CNG	STH003P
HDK 1200/250	1200	G 1 i	GH11/250XP/CNG	GH11/250ZP/CNG	GH11/250ZP/CNG	STH003P
HDK 2000/250	2000	G 1 i	GH11/250XP/CNG	GH11/250ZP/CNG	GH11/250ZP/CNG	STH003P

[1] m³ related to a compressor suction capacity of 1 bar at 15 °C. Subsequently compacted to 250 bar and 35 °C at the dryer inlet at a relative humidity of 100 % – for dewpoints of -25 °C and -40 °C.

[2] related to DIN ISO 228 (BSP-P).

Pressure reducer

Pressure setting	dam pressure + 5 bar

Noise emissions

Noise level: +3 dB (A)[1]	approx. 75 dB(A)

[1] related to free field measurement, 1 m field

Drying agent

Filling quantity	Drying agent per vessel	
Top	Molecular sieve	60 %
Middle	Waterproofed Silica gel	30 %
Bottom	Duranit	10 %

Dimensions

Please observe the dimensional drawing and table with dimensions and weights on page 64.

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.**

First aid kits (for emergency situations)

Model	Scope of supply	Order no.
HDK-CNG 250	Repair kit coils, repair kit valves, service kit 12 month, spare part safety valve, 2 x nozzle screw	FIRST AID KIT HDK/CNG 250
HDK-CNG 750 - 2000		FIRST AID KIT HDK/CNG2000

Service kits (wear part kits)

Model	Scope of supply	Maintenance interval	Order no.
HDK-CNG 250	O-ring, filter element	12 months	SKHDK/CNG250/250-12
HDK-CNG 750 - 2000			SKHDK/CNG2000/250/12
HDK-CNG 250	Service kit 12 month, Repair kit, coils, condensate drain	24 months	SKHDK/CNG250/250-24
HDK-CNG 750 - 2000			SKHDK/CNG2000/250/24

Repair kits

Model	Description	Order no.
HDK-CNG 250 - 2000	Repair kit coils	RK-ESC-HDK-CNG
	Repair kit valves	RK-MV-HDK-CNG
HDK-CNG 250	Repair kit check valve	RK-RV-HDK-CNG250
HDK-CNG 750-2000		RK-RV-HDK-CNG750-2000

Desiccant packs

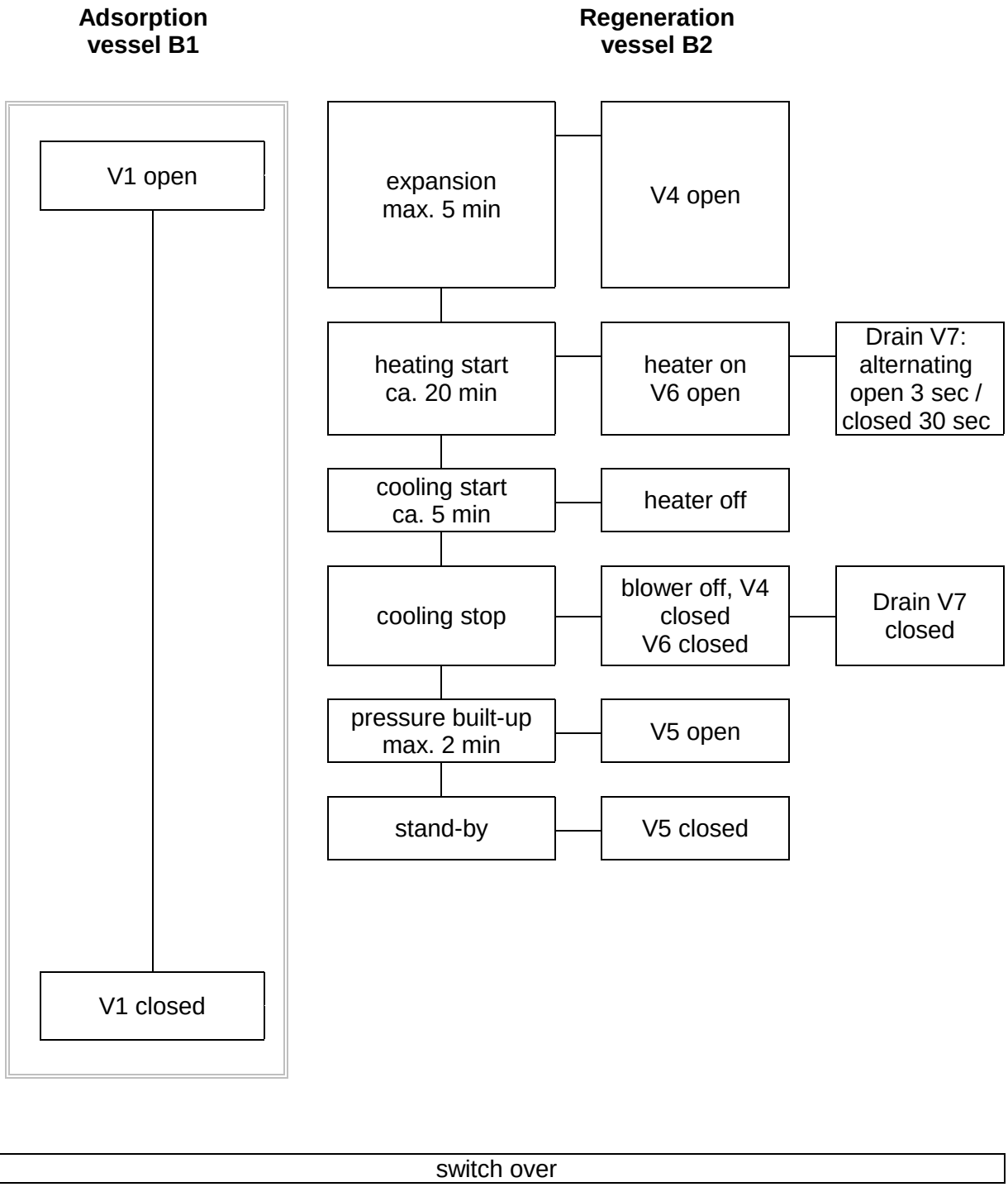
Model	Order no.
HDK-CNG 250	HDK.CNG250DESMIX
HDK-CNG 750	HDK.CNG750DESMIX
HDK-CNG 1200	HDK.CNG1200DESMIX
HDK-CNG 2000	HDK.CNG2000DESMIX

Additional spare parts

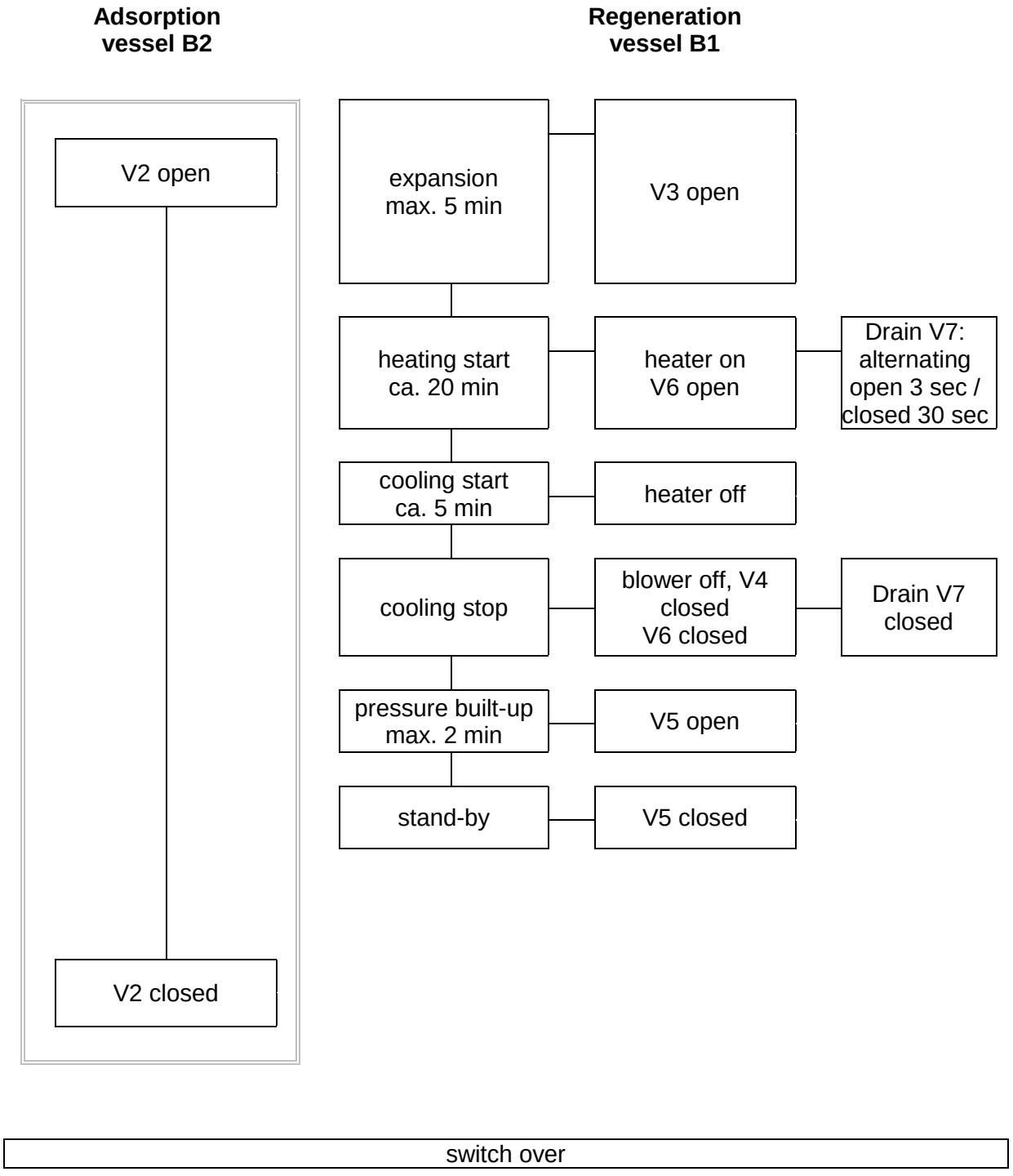
Model	Scope of supply	Amount	Order no.
HDK-CNG 250	Heater	**1**	ET-HEE65/40NGO-F40380/1KW
HDK-CNG 750	Heater	**1**	ET-HEE65/40NGO-F40380/2.5
HDK-CNG 1200	Heater	**1**	ET-HEE65/40NGO-F40380/4KW
HDK-CNG 2000	Heater	**1**	ET-HEE80/40NGO-F40380
HDK-CNG 250 - 2000	Pressure regulator	1	ET-DRM.G10-GHR-J50-C-B9
	Condensate drain	1	11LD/28TG
	Safety valve	2	ET-VG15/25PS/MS/CNG
	Thermometer	1	ET-ITI-MEG/25/VA
	Vessel pressure gauge	2	ET-IPI100/400-28/AK-WI-01
	Pressure gauge	1	ET-MANO.063VWO232-3
	Dewpoint sensor	1	ET-ITT-6X250/PT100/A

Logic control diagram

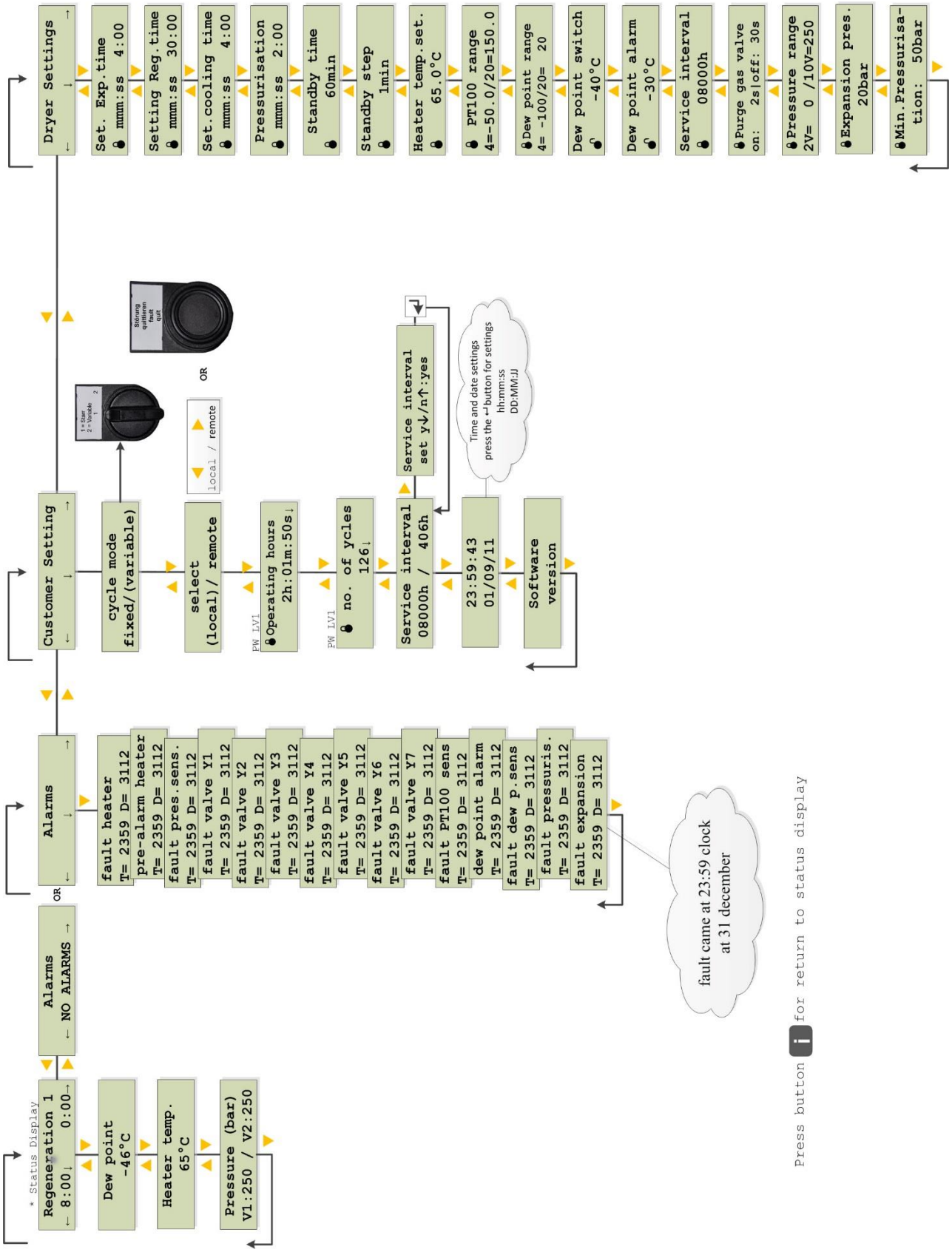
Adsorption in B1 and regeneration in B2



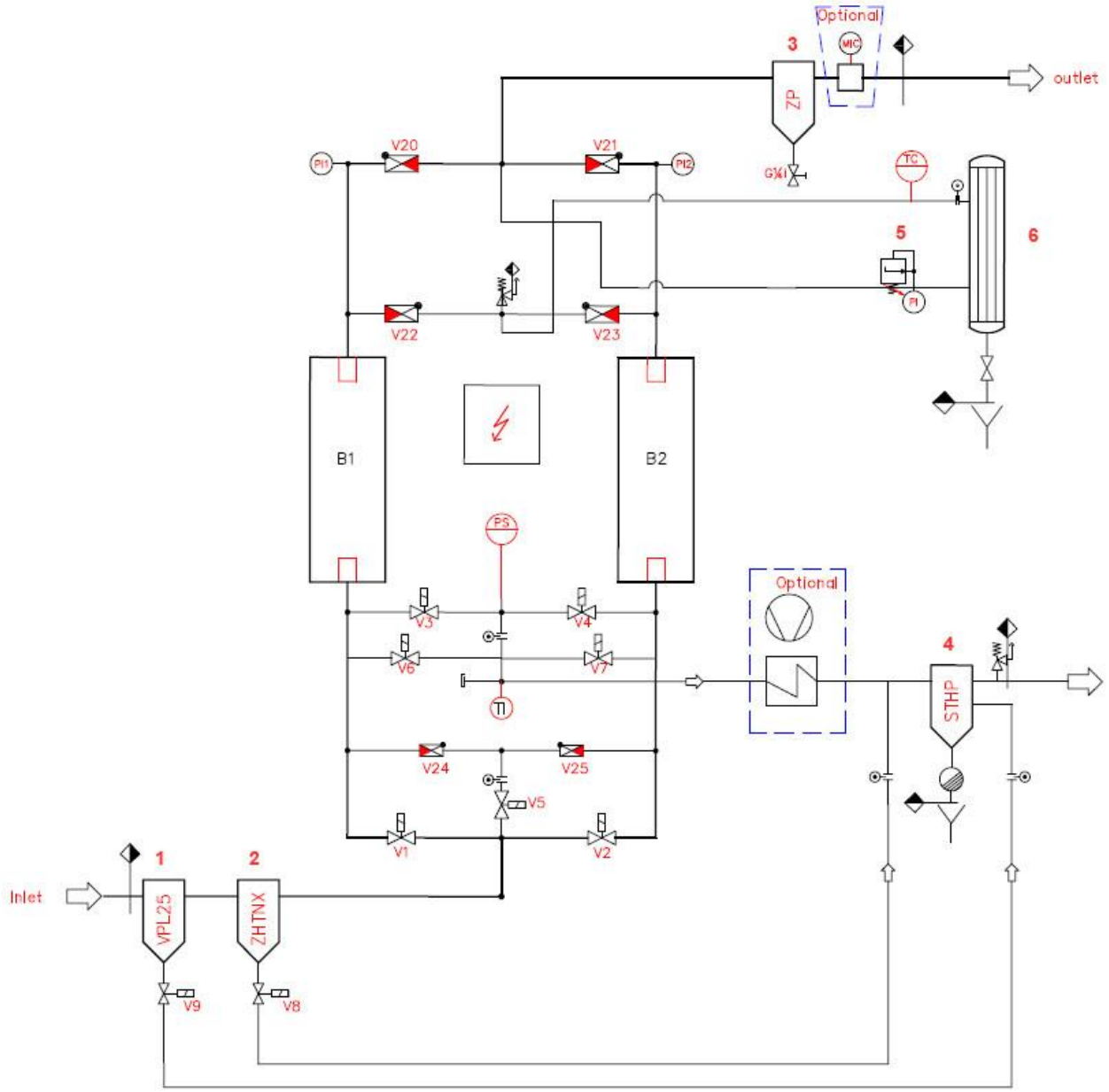
Regeneration in B1 and adsorption in B2



Menu diagram of controller



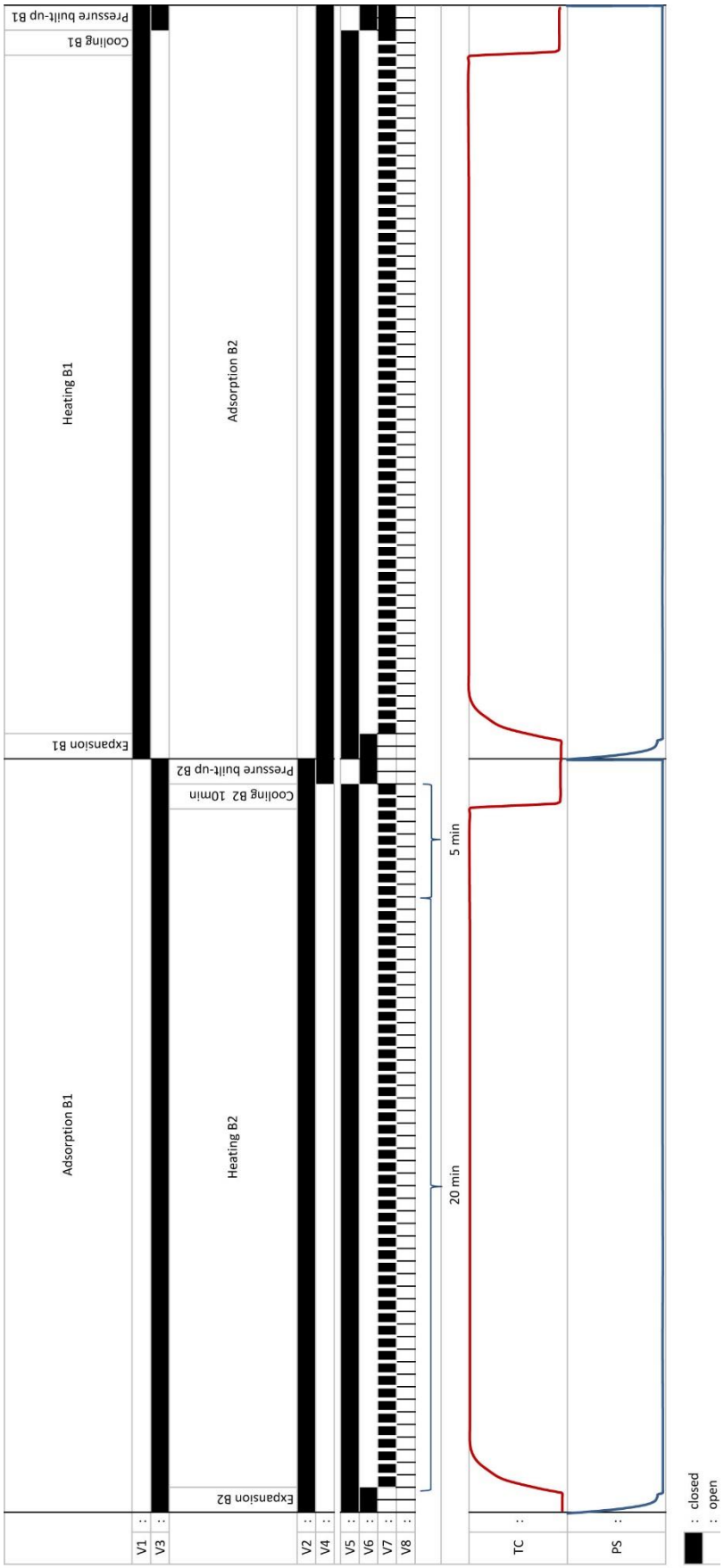
Flow diagram



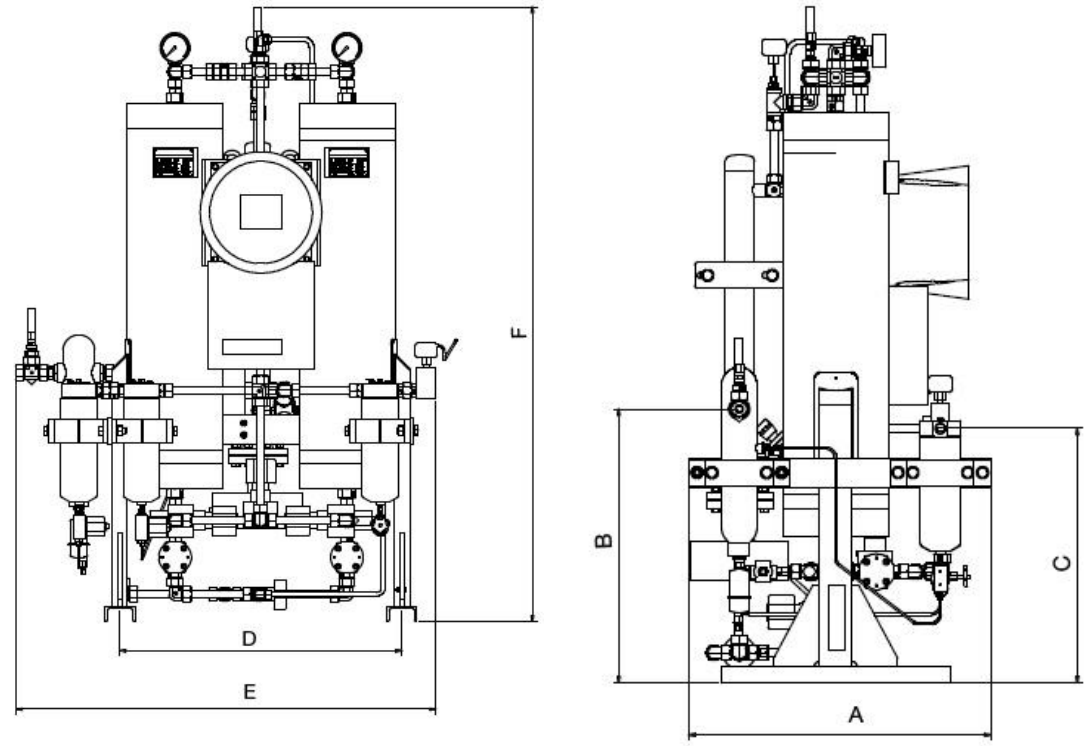
Pos.	Designation
1	prefilter
2	prefilter
3	After-filter
4	Water separator
V1, V2	Inlet valves
V3, V4	Regeneration valves
V6, V7	Regeneration valves
V5	Pressure build-up valve
V20-V25	Check valves

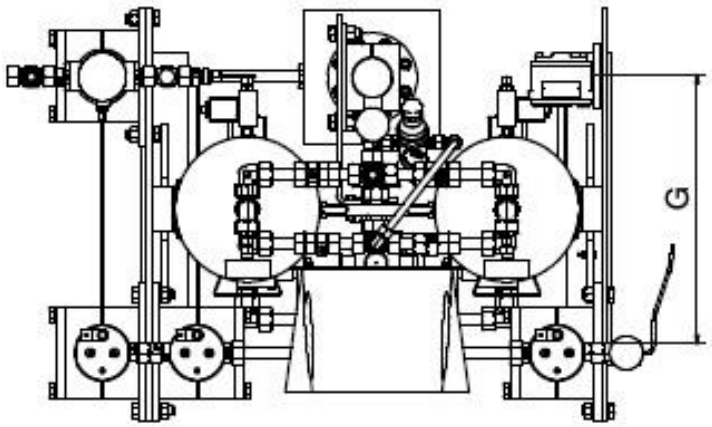
Pos.	Designation
V26	Condensate drain
V8, V9	Condensate valve
B1, B2	Vessel
5	Pressure reducer
6	Heater
Optional:	
	Dewpoint sensor
	Regeneration fan

Time diagram for valve setting



Dimensional Drawing





Type	Connection		Dimensions [mm]			Weight
		A	C	E	F	[kg]
HDK-CNG 250	½	763		990	1771	380
HDK-CNG 750	1	874	592	1139	2110	690
HDK-CNG 1200	1	919	760	1264	2110	990
HDK-CNG 2000	1	919	780	1264	2110	1100