

Oil vapour adsorber

AK 120-600

Dokument-ID: DMN-AK120-600/Rev02



Operating instructions

CE 0525

Revision 02—2016 /EN

Declaration of Conformity

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

D – 45219 Essen Kettwig

hereby declares with sole responsibility, that the products

oil vapour adsorber
series AK 120 to 600

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 Modules B + D (for assembly assessment).

For the assembly, the EC type approval certificate **DTM 0717129/ZE-1113/1** by Lloyd's Register Quality Assurance GmbH, Hamburg, is available.

The quality assurance system is monitored by the service provider stated below
Lloyd's Register Quality Assurance GmbH (identification number 0525)
Am Sandtorkai 41, D - 20457 Hamburg.

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
AK 120	1	10	204	III	H
AK 150	1	10	252	III	H
AK 200	1	10	400	IV	H 1
AK 250	1	10	470	IV	H 1
AK 300	1	10	571	IV	H 1
AK 380	1	10	735	IV	H 1
AK 500	1	10	980	IV	H 1
AK 600	1	10	1240	IV	H 1

Piping				
Dryer	Allowable pressure (PS)	Dimensions (DN)	Category (PED)	Module
AK 120	10	DN50	Art.4.3	Art.4.3
AK 150	10	DN65	Art.4.3	Art.4.3
AK 200	10	DN65	Art.4.3	Art.4.3
AK 250	10	DN80	Art.4.3	Art.4.3
AK 300	10	DN80	Art.4.3	Art.4.3
AK 380	10	DN100	I	A
AK 500	10	DN100	I	A
AK 600	10	DN125	I	A

Filter						
Dryer	Filter	Quantity	Allowable pressure (PS)	Volume [l]	Category (PED)	Module
AK 120	GL 17	1	16	13,5	I	B+D
AK 150	GL 17	1	16	13,5	I	B+D
AK 200	GL 19	1	16	15,5	I	B+D
AK 250	FL 20	1	16	57	II	H
AK 300	FL 20	1	16	57	II	H
AK 380	FL 20	1	16	57	II	H
AK 500	FL 30	1	16	57	II	H
AK 600	FL 30	1	16	57	II	H

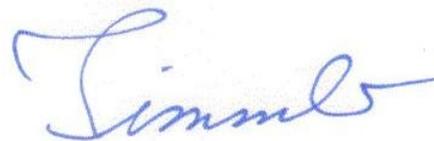
The following standards / technical specifications were used:

- harmonized standards: DIN EN ISO 12100:2011-03

Essen,

19.07.2016

Datum / Date



i. V. Dr. Jürgen Timmler

Leiter Technik und Entwicklung /
Manager Engineering and Development

Machine passport

Type designation	AK
Order no.	
Project no.	
Build no.	
Vessel no.	
Year of manufacture	

It is the responsibility of the owner,

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

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

Further important data on the adsorber such as the details on the permissible operating pressure are found on the type plate (for position of the type plate see page 9).

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General information

Manufacturer's details

Name and address



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Details on the adsorber

Standard equipment

Adsorber, comprising

- 1 vessel, filled with purifying agent

Associated documents

- Operating instructions (present)
- Technical documentation (see annex)

Notes on supplementary documents

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

About these operating instructions

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

Characters and symbols used

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

Note:

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



Warning!

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



Danger!

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

Target group of these operating instructions

These operating instructions are intended for all persons working on and using the adsorber. We assume that all such persons are specialist personnel, e.g. fitters.

Operating instructions: handling

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

For your own safety

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

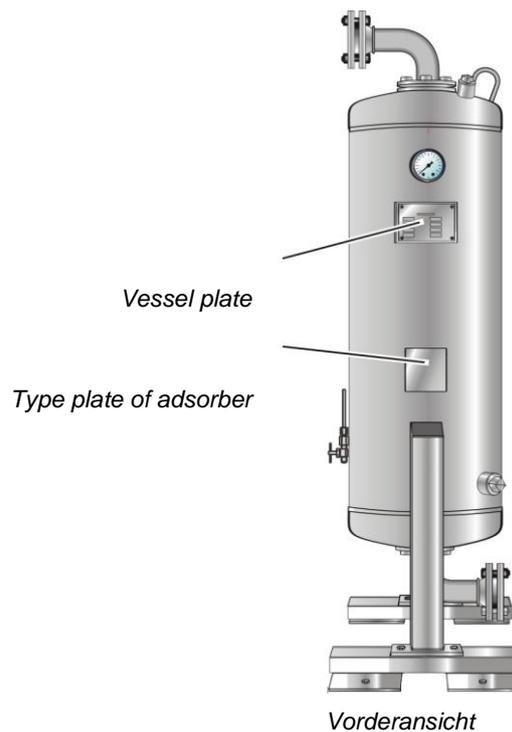
- it is operated by non-qualified personnel,
- not used within its intended design specifications,
- is repaired or maintained incorrectly.

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 adsorber.

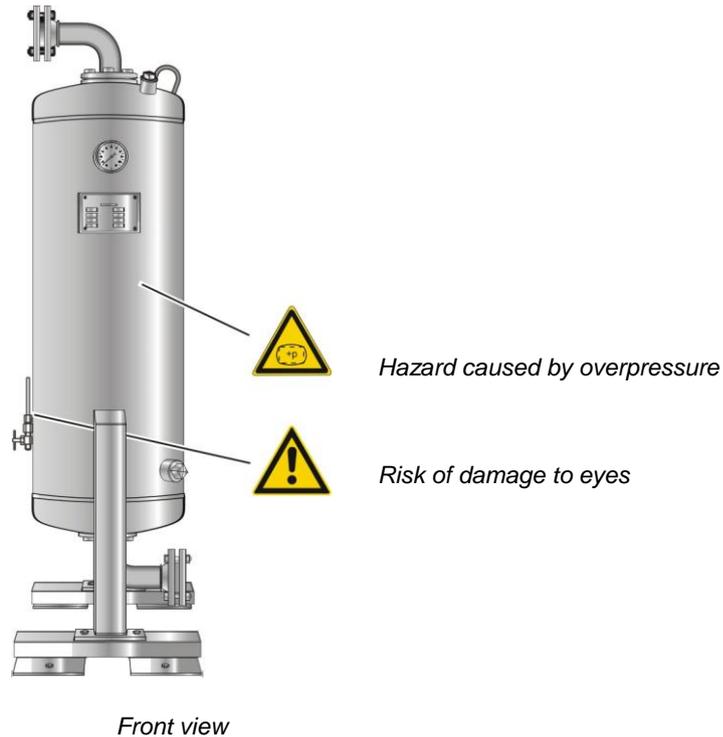
Signs and hazard areas on the adsorber

Signs and labels



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

Hazard areas on the adsorber



Hazard area	Symbol in operating instructions
<p>Warning against overpressure</p> <p>The entire adsorber is under pressure. Before commencing any work, the plant must be depressurised.</p>	
<p>Risk of damage to eyes</p> <p>When the needle valve is opened, the indicator tube is secured by a union nut. If the union nut is not properly tightened, or if the oil indicator has been interfered with, there is a risk that the tube might be propelled by the air flow so that it is shot out of its holder.</p> <p>When working at the oil indicator, always wear protective goggles.</p>	

Intended use of the adsorber

The adsorber is exclusively intended for purifying compressed air. Depending on the defined input conditions, it purifies compressed air for industrial use.

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

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

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

Suspected misuse

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

General safety notes



Hazard due to a sudden release of pressure!

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

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



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

Personnel qualification

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

Conversions and modifications

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

Handling of purifying agents

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

- When handling purifying agents, always wear a dust mask and eye protection!

Disassembly and disposal



Hazard due to a sudden release of pressure!

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

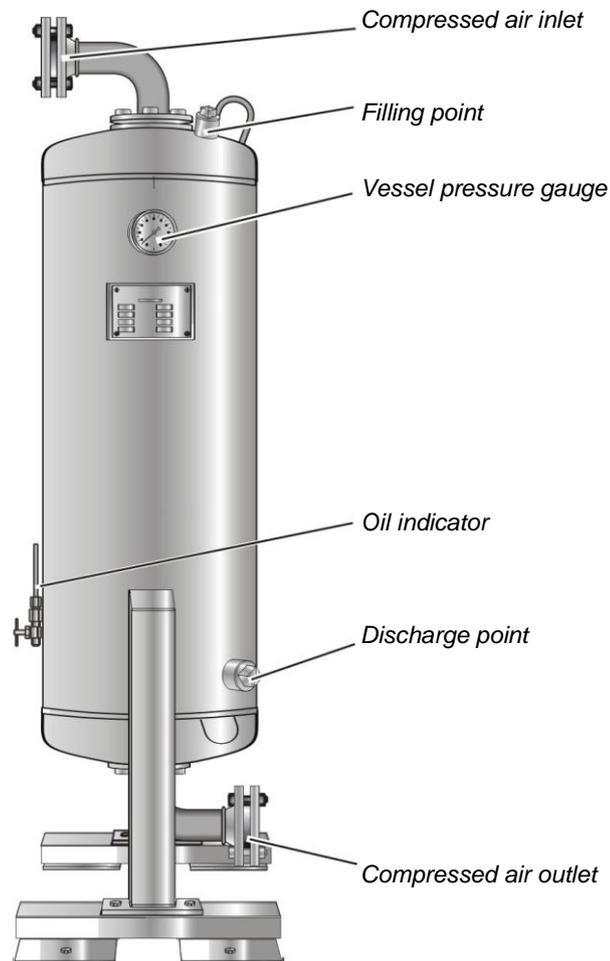
Before carrying out any work on the adsorber, first depressurise the plant.

- Dispose all parts of the adsorber, the purifying agents and all other operating materials in an environmentally safe way and in accordance with all current statutory regulations.

Technical product description

Summary drawing

Front view



Function description

The pre-dried compressed air is fed into the adsorber, where oil vapour and other contaminants are removed from the compressed air, which is then made available for industrial use.

Before the compressed air is fed into the adsorber, it flows through upstream filters where dust and dirt as well as oil and water droplets are removed. The installed upstream filters therefore help extend the service life of the purifying agent.

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

Available options

The following options are available for the adsorber:

- Outside installation
- Auxiliary heater
- Upstream and downstream filters
- Bypass line
- Paint compatible design

Outside installation

As standard, the adsorber is not suitable for outside installation, as its function and service life is influenced by the following factors:

- Environmental humidity due to rain (or other deposit)
- Corrosion caused by environmental humidity or a salt-containing environment
- Freezing of valves, cocks, flaps, and other components at low temperatures

Therefore, a planned outside installation must always be discussed in advance with the manufacturer to allow specific technical design measures to be provided for the installation location.

Auxiliary heater

For installation sites with temperatures under +1 °C, the inlet side of the adsorber must be equipped with an auxiliary heater to prevent components from freezing up.

Upstream and downstream filters

We recommend the installation of suitable upstream filters, as they help protect the purifying agent against contamination by dust particles and oil droplets contained in the fed compressed air. The service life of the purifying agent can thus be extended.

If the supplied compressed air is not or only partially dried before it reaches the adsorber, the upstream filters must be equipped with automatic condensate traps. Large water droplets contained in the supplied compressed air can lead to reduced efficiency or even the destruction of the purifying agent.

Upstream filters should be installed as close to the adsorber as possible. The pipe feeding the air to the upstream filter should be at a slight slope.

It is recommended to install a downstream filter behind the adsorber to prevent contamination of the purified compressed air with adsorbent particles.

Bypass line

The bypass line is a "detour line", which allows the compressed air system to continue operating even whilst maintenance of the adsorber is in progress. However, during this time the air is not purified but flows through the bypass line past the adsorber and through to the actual loads.

Filters in the bypass line are meaningful so that the actual loads are largely protected against dirt, water, and oil droplets even whilst maintenance is in progress.

Paint compatible design

Paint shop plants impose particularly stringent requirements with regard to the cleanliness of the compressed air, as already the minutest contaminations can reduce the quality of the paint finish. Even minute quantities of oil and grease containing foreign materials or solvents — above all silicones — are sufficient to cause pits, discolorations, swellings, and other contaminations in the paint finish. Adsorbers in a paint compatible design comprise gaskets that are absolutely free of grease and silicon and thus ensure a high quality of the compressed air used for painting.

Transportation, installation and storage



Danger due to incorrect transportation!

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

- Only use suitable and technically perfect lifting gear with a sufficient carrying capacity.
- During transportation the adsorber 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 adsorber is delivered in different types of packaging:

- All transportation types: the apertures of the adsorber are closed off by means of plugs.
- In addition, when transportation is effected by air: the adsorber is packaged in a wooden box.
- In addition, when transportation is effected by ship: the adsorber 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 adsorber itself were damaged.
- ▶ Inform the haulier immediately in writing of any damages.
- ▶ Contact the manufacturer urgently in order to report the damage. You will find the telephone number on page 7.



Warning!

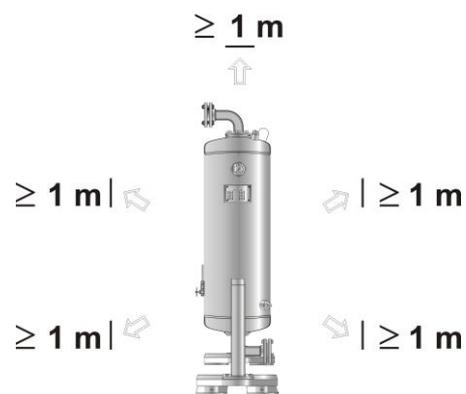
A damaged adsorber must not be taken into operation! Damaged components may lead to functional faults and possibly cause further damage.

Transporting and installing the adsorber

Requirements for the installation site

The conditions at the installation site have a large influence on the functional capacity of the adsorber and the service life of the purifying 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 - protected against the weather. For outside installation (option) the instructions on page 13 must be complied with.
- The ambient temperature must not drop below +1 °C. If necessary, an auxiliary heater is to be provided (for information on the auxiliary heater, see page 13).
- The installation area must be level and firm. It must have the necessary carrying capacity for the weight of the adsorber. The weight of the adsorber is specified in the technical data section of the annex.
- The adsorber should be installed with sufficient spacing at the top, sides and rear, in order to be able to carry out maintenance work and change the purifying agent without any hindrances (see figure).

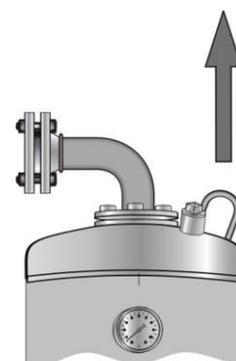


Necessary spacing at the top and sides = min. 1 m

If in doubt, the installation site must be inspected by specialists. If you have any queries in this regard, please contact the manufacturer (for details see page 7).

Transporting the adsorber

- ▶ Remove packaging.
- ▶ Attach suitable lifting gear to the eyebolts on the vessel (see figure).



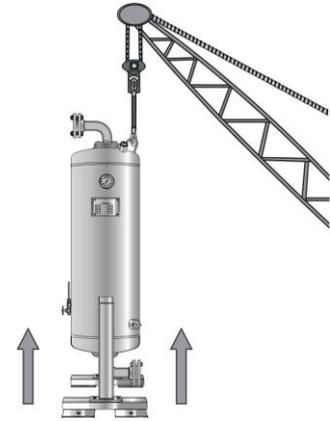
Eyebolt at vessel

**Risk of tilting!**

The adsorber should only be transported in an upright position. However, this means that the centre of gravity of the unit is located in the middle of the adsorber, so that there is a serious risk that the unit might tilt over. Therefore, adhere to the transport instructions outlined as follows.

Transport by crane

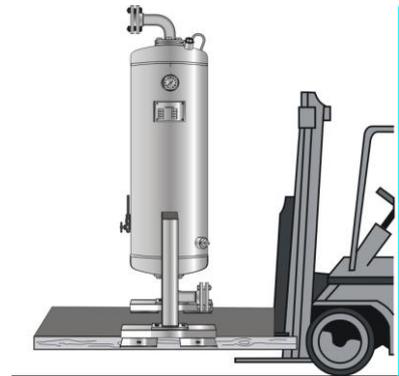
- ▶ Transport the adsorber in an upright position to its location of installation (see figure).



Transport by crane

Transport by forklift

- ▶ When using a forklift, ensure that the adsorber is always in an upright position.
- ▶ Secure the adsorber to ensure that it cannot tilt or fall from the forklift.

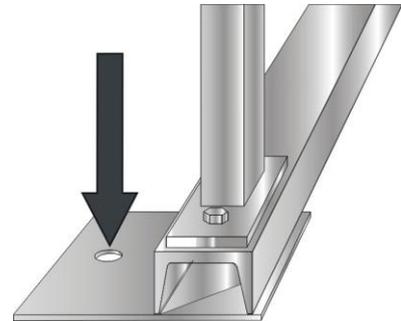


Transport by forklift

Anchoring the adsorber

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

- ▶ Use suitable attachment material to anchor the adsorber to the floor (see figure).
- ▶ In the case of vibrating floors: place the adsorber on suitable vibration dampers.



Bores at the foot of the adsorber

Storing the adsorber

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

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

In order to store the adsorber proceed as follows:

- ▶ Take adsorber out of operation as described on page 25.
- ▶ Ensure that the compressed air inlet valve installed by the owner, and the installed compressed air outlet valve installed by the owner, are both closed, and that the adsorber is depressurised.
- ▶ Disconnect adsorber from the compressed air system.
- ▶ Plug the inlet aperture and the outlet aperture of the adsorber to protect against any possible contamination.
- ▶ If possible cover adsorber with a protective sheet.

The adsorber can now be stored for long periods.

Note:

If you wish to take the adsorber back into service after an extended period of storage, please proceed as described for its first commissioning and start-up (see page 23).

Store purifying agents

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

Installation



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

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

Preconditions for installation

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

- Connections and lines for the infeed and outfeed of compressed air must be provided.
- The compressed air must be pre-dried before it reaches the adsorber. If the input air is not sufficiently dry, a suitable upstream filter equipped with an automatic condensate trap must be installed (minimum option, see also page 13). The upstream filter must have a separation efficiency of $0.01\mu\text{m}$ (according to a residual oil content of 0.01 mg/m^3). Please note that, despite the use of an upstream filter, the service life of the purifying agent is reduced.
- A compressed air inlet valve and a compressed air outlet valve as well as a relief valve must be installed by the owner, so that the adsorber can be installed and maintained in a depressurised condition (see also the installation example on page 20).
- All pipes, couplings, and connections must have the correct diameter and match the operating pressure.



Hazard caused by exceeding the limit values!

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

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

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



Warning!

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

Connect piping

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

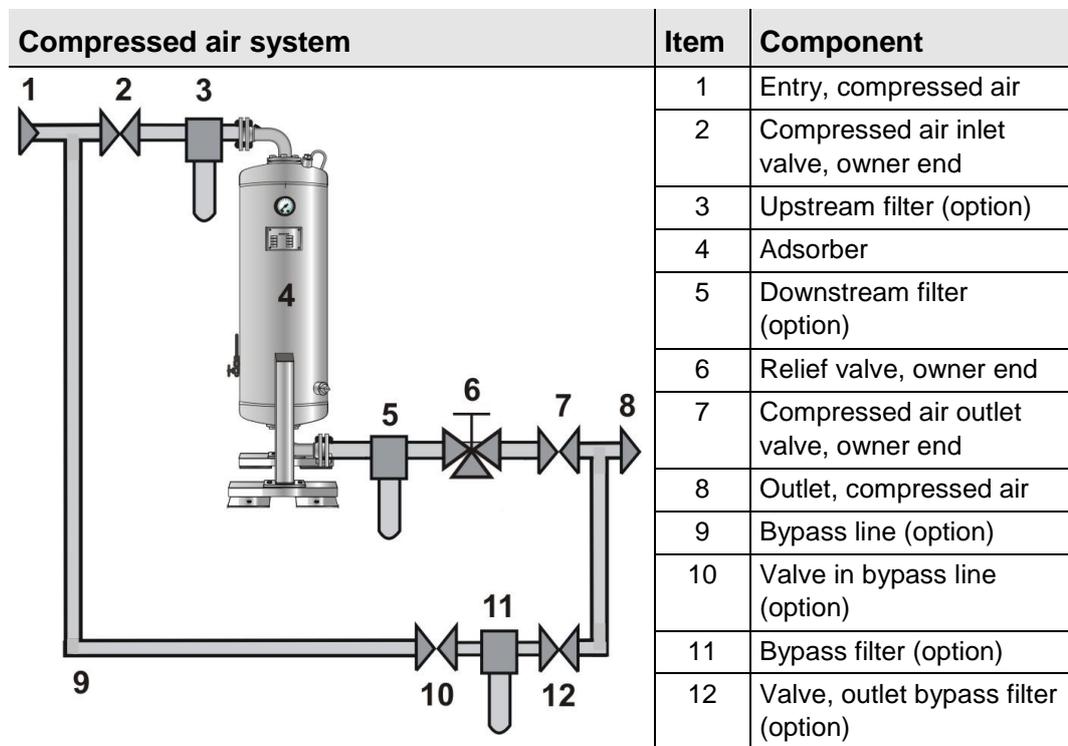
- ▶ Ensure before connection that all infeed and outfeed compressed air lines and valves are clean and undamaged.
- ▶ Check the bolt connections and retighten if necessary, as they could have worked loose during transportation.
- ▶ Remove plugs on the pressure inlet and outlet.



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

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

The following figure shows an installation example.



Example of an installation with bypass line

- ▶ The feeding connection lines are to be installed at a slight incline in the direction of the adsorber.
- ▶ One shutdown valve each (2, 7) is to be installed at the compressed air inlet and outlet ends of the adsorber.
- ▶ A relief valve (6) is to be installed after the adsorber.
- ▶ *If you fit a bypass line (9) with additional shutdown valve:*
Fit the line such that, when carrying out maintenance work on the adsorber, the line system can continue to be supplied with compressed air.

Start-up



Hazard due to a sudden release of pressure!

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

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



Flush adsorber to remove residual moisture!

Prior to startup and after changing the activated charcoal, the adsorber must be flushed with pre-dried compressed air for at least 48 hours.

The flushing process allows any remains of cleaning agents (VOCs - volatile chlorinated hydrocarbons) and residual moisture to vaporise out of the adsorber.

- 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 adsorber where they might pose a hazard to the adsorber being started up.

Requirements for initial start-up

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

- The pipe system is free from
 - scales
 - thread abrasions
 - welding beads and
 - other contaminations.
- All shutdown valves
 - of the compressed air inlet and outlet valves installed by the owner
 - of the relief valve installed by the owner
 - in the bypass line (if available)
 are closed.
- The adsorber is correctly sited and installed.

Checks before start-up

Ensure that

- all pipe and bolt connections on the adsorber have been retightened,
- no pipes chafe against body edges,
- all mountings are perfectly secure,
- the needle valve of the oil indicator is closed,
- owner-end and pressurised parts such as safety valves or other devices are not blocked up by dirt or paint,
- all compressed air system parts which are pressurised (valves, hoses etc.) are free from wear symptoms and defects.

Overview of operating and control elements

Vessel pressure gauge

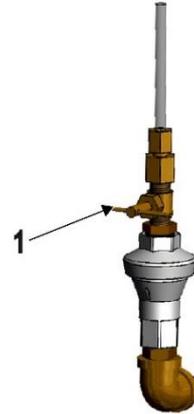
On the vessel, a pressure gauge is fitted which shows the operating overpressure.

Oil indicator

The adsorber is equipped with an oil indicator. The indicator allows for periodic measuring of the residual oil concentration in the purified compressed air.

The residual oil content should only be measured at set intervals, and the needle valve (1) at the indicator should be closed during normal operation.

For detailed instructions on the measuring procedure for residual oil, please refer to the respective section in the maintenance instructions, page 29.



Oil indicator

Emergency shutdown

In the event of an emergency, shut down the adsorber as described in section *Depressurising and shutting down the adsorber*, on page 25.

Start up adsorber



Hazard due to a sudden release of pressure!

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

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

- Only operate the adsorber within the permissible limits. By operating the adsorber in conditions for which it has not been designed, functional faults may be caused.
- Check the adsorber regularly for externally visible damage and defects. Any changes, even in its operating behaviour, must be reported immediately to the competent office or person.
- Depending on the size of the adsorber and the compressed air network and the respective legal requirements in your country, it may be necessary to perform initialisation according to the directive for pressure equipment.
- In the event of an emergency or if a safety-relevant disruption occurs (e.g. escaping compressed air, defective component) immediately close and depressurise the respective system section. The unit may only be restarted after all defects have been eliminated.

Open compressed air supply

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

- ▶ Ensure that the compressed air inlet and outlet valves as also as the relief valve installed by the owner are closed (see installation example on page 20).
- ▶ Ensure that the compressed air system upstream of the adsorber is pressurised. If necessary, pressurise (switch on compressor).



Slowly open compressed air inlet valve!

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

- ▶ Slowly open the compressed air inlet valve, installed by the owner, upstream of the adsorber.

Open compressed air outlet line



Slowly open compressed air outlet valve!

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

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

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

In the event of a fault

In the event of an emergency or if a safety-relevant disruption occurs (e.g. escaping compressed air, defective component), immediately close and depressurise the respective system section. Then proceed as follows:

- ▶ Look up possible cause of the fault, and how to remedy the same, in the table on page 36.
- ▶ Remedy fault.
- ▶ Repeat the start-up procedure

Monitoring adsorber operation



- Only operate the adsorber within the permissible limits (see type plate). By operating the adsorber in conditions that go beyond the defined values, the adsorber is subjected to loads for which it has not been designed. This may cause functional defects.
- Check the adsorber 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, immediately close and depressurise the respective system section. (see also chapter **Depressurising and shutting down the adsorber**, page 25). The unit may only be restarted after all defects have been eliminated.

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

Shutdown and restart adsorber

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

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



Risk of injury from escaping compressed air!

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

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

Emergency shutdown

In any emergency proceed as described in the next section.

Depressurising and shutting down the adsorber

Close compressed air feed line

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

Disconnect adsorber from compressed air system

- ▶ Close the compressed air outlet valve installed by the owner.
- ▶ If available, open bypass line.

Depressurise adsorber

- ▶ Open relief valve installed by the owner.
- ▶ Check the depressurisation: The pressure gauge indicates “0 bar”.

Restart

- ▶ Commission adsorber as described on page 23.

After the purifying agent has been replaced

The newly filled purifying agent contains minute dust particles that can block the downstream filter (option) or other components. We therefore recommend to complete the following steps before you restart the adsorber, in order to protect your equipment:

- ▶ Open relief valve (installed by the owner) downstream of the adsorber, or
- ▶ if available: remove the housing base and the filter element from the downstream filter.
- ▶ Ensure that the compressed air outlet valve (installed by the owner) is closed.



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

Blowing out might lead to increased generation of dust.

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

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

Restart the adsorber:

- ▶ Pressurise the adsorber as described in section *Open compressed air supply*, page 23.

Check that

- compressed air outlet valve (installed by the owner) is closed, and
- relief valve is open, or
- if there is a downstream filter, its housing is open.

Then proceed as follows:

- ▶ Operate the adsorber for approx. thirty minutes, blowing the dust particles off from the relief valve or, if available, from the downstream filter.

Then again depressurise the adsorber:

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

Then close blow-out point and commission the adsorber:

- ▶ Close relief valve installed by the owner, or
- ▶ if available: assemble and mount the downstream filter.
- ▶ Pressurise the adsorber as described in section *Open compressed air supply*, page 23.
- ▶ Check that the vessel and, if available, the downstream filter are leak tight.

Maintenance and repair of the adsorber

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

Notes on maintenance



Warning!

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

Note:

In order to ensure perfect maintenance and reliable operation we recommend that you conclude a maintenance contract (For telephone number, see page 7).

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

- 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.
- 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 adsorber. There is a risk of injury by slipping off the components, components breaking off, and expanding compressed air!
- Never leave tools, loose parts or cloths at or on the adsorber.
- Only use replacement parts that are suitable for the relevant function and meet the technical requirements stipulated by the manufacturer. This is always the case, if you use original replacement parts only.

Regular maintenance intervals

Note:

If a vessel has been depressurised and the pressure remains above 0 bar, the vessel is pressurised by what is known as ram pressure. This might be due to

- contamination of the dust sieve
- spent purifying agent

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. Maintenance work requiring the adsorber to be largely disassembled is not described. We recommend to have this work to be performed by authorised specialists.

Component	Maintenance task to be carried out	Maintenance interval					
		daily	monthly	6 months	12 months	48 months	see page
Complete adsorber	Carry out visual and function checks.	●					29
Oil indicator	Measure the residual oil content and the residual capacity of the purifying agent.		●				29
Purifying agent	Replace after maximum 12 months. If the fed compressed air is humid, the maintenance interval is reduced to 6 months.			(●)	●		34
Seals, dust sieve	Replace.					●	34
Upstream and downstream filter	Please see the enclosed operating instructions for the attached filters. Maintenance work has to be carried out as specified in this document.						

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



Danger!

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

Before commencing any maintenance tasks always shut down the adsorber as described on page 25, *Depressurising and shutting down the adsorber!*

Daily maintenance tasks

Carry out visual and function check on the complete adsorber

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

Clean adsorber

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

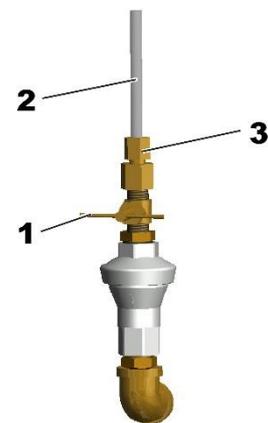
Monthly maintenance tasks

Measuring of residual oil content

The adsorber is equipped with an oil indicator. The indicator allows for periodic measuring of the residual oil concentration in the purified air.

It is recommended to measure the residual oil content every month, using the oil indicator; this allows the operator to determine the absolute residual oil content in the air and the available capacity of the purifying agent.

The measuring principle is as follows: For the duration of the measurement, the needle valve (1) is opened so that a pressure-reduced partial flow of purified compressed air is fed through the indicator tube (2). The indicator tube is secured by means of a union nut (3).



Oil indicator

Any residual oil contained in the air leads to a change of colour of the scale segments of the tube, whereby a higher concentration leads to more segments being coloured.

The change of colour is irreversible; after completion of the measurement, the indicator tube must thus be replaced. It is therefore useful to close the needle valve between measurements.

To measure the residual oil concentration, proceed as described below. A template of the measuring log used for this procedure is included in the appendix.



Risk of damage to eyes! If not properly secured, the indicator tube might be propelled out of its holder!

When the needle valve is opened, the indicator tube is secured by a union nut. If

- the union nut is not properly tightened, or
 - if the oil indicator has been interfered with,
- there is a risk that the tube might be propelled by the air flow so that it is shot out of its holder.

When working at the oil indicator, always wear protective goggles.

Prior to opening the needle valve, check that the union nut at the indicator tube is properly tightened.

Measuring procedure

- ▶ Prepare measuring log and hold it ready.
- ▶ Check union nut holding the indicator tube and retighten, if necessary.
- ▶ At the indicator tube, mark the highest segment with a colour change, using a suitable pen.
- ▶ Open needle valve by turning its handle anticlockwise. Write down start date and time of the measurement.
- ▶ Leave needle valve open for the desired duration of measurement (e.g. 5 hours).
- ▶ Subsequently, close the needle valve. Write down end time of measurement.
- ▶ At the indicator tube, mark the highest segment with a colour change, using a suitable pen. Write down the number of scale segments that have changed colour since the start of the measurement.

Evaluation of measurement: determining the absolute residual oil content

To evaluate the test results, please refer to the table below:

Duration [h]	Number of first-ever coloured scale units							
	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
4	0.58	1.15	1.70	2.25	2.80	3.40	3.95	4.40
4.5	0.55	0.95	1.45	1.90	2.45	2.85	3.55	3.95
5	0.45	0.86	1.35	1.79	2.25	2.70	3.20	3.65
5.5	0.43	0.81	1.17	1.65	2.00	2.40	2.85	3.35
6	0.40	0.78	1.15	1.45	1.79	2.25	2.60	2.85
6.5	0.35	0.72	1.12	1.35	1.70	2.20	2.35	2.75
7	0.32	0.62	0.95	1.17	1.60	1.90	2.25	2.58
8.5	0.27	0.58	0.87	1.15	1.20	1.55	1.85	2.10
10	0.22	0.45	0.65	0.95	1.15	1.35	1.55	1.85
12.5	0.18	0.37	0.57	0.70	0.85	1.08	1.25	1.45

Duration [h]	Number of first-ever coloured scale units							
	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
16.5	0.13	0.27	0.45	0.57	0.65	0.80	0.90	1.08
25	0.09	0.18	0.30	0.38	0.45	0.60	0.65	0.75
33	0.07	0.12	0.19	0.30	0.32	0.42	0.50	0.55
50	0.045	0.090	0.130	0.180	0.225	0.300	0.350	0.400
56	0.040	0.080	0.110	0.155	0.195	0.275	0.300	0.350
63	0.036	0.070	0.105	0.145	0.180	0.225	0.275	0.300
72	0.032	0.062	0.095	0.128	0.155	0.190	0.245	0.275
84	0.025	0.052	0.085	0.105	0.130	0.155	0.180	0.225
100	0.020	0.042	0.068	0.088	0.110	0.135	0.155	0.180
125	0.015	0.035	0.053	0.075	0.088	0.108	0.130	0.145
166	0.008	0.028	0.040	0.055	0.068	0.085	0.095	0.108
250	0.006	0.015	0.025	0.037	0.045	0.055	0.065	0.070
500	0.002	0.007	0.012	0.018	0.02	0.025	0.032	0.035
1000	0.001	0.003	0.005	0.007	0.008	0.012	0.014	0.018

Table for the determination of the residual oil content in [ppm] at 7 bar operating pressure

Note:

The evaluation is based on a pressure-reduced partial flow that is fed into the indicator tube at a pressure of 7 bar operating pressure.

For adsorbers with an operating pressure of less than 7 bar, please refer to the respective table in the appendix (for 4, 5 or 6 bar operating pressure).

- Determine the concentration in the above table, based on the duration of the measurement and the number of scale segments with colour change.

Example

Duration of measurement in [h]	5.0
Number of scale segment with colour change	1.0
Residual oil concentration in [ppm]	2.25

- Write down the residual oil concentration in ppm, parts per million] in the measuring log.
- To determine the residual oil content in [mg/m³], multiply the above value by a factor 1.2. Write down this value in the measuring log.

Determining capacity reduction of purifying agent

To establish the remaining capacity of the purifying agent, you must carry out measurements of the same duration at fixed intervals.

- ▶ Choose a measuring interval (e.g. 4 weeks) and a duration of measurement (e.g. 4 hours).
- ▶ Determine the maximum admissible residual oil concentration in [mg/m³] for your specific application. Divide this value by 1.2 in order to obtain the maximum admissible residual oil concentration in [ppm].
- ▶ Refer to the table on page 31 and determine the corresponding number of scale segments with colour change.

<i>Example</i>	
Maximum admissible residual oil concentration in [mg/m ³]	3.4
Maximum admissible residual oil concentration in [ppm]	2.83
Duration of measurement in [h]	4.0
Maximum admissible number of scale segments with colour change (across entire measuring sequence)	1.0

If there are no additional segments with colour change at the end of the measuring procedure, the purifying agent is working at full capacity.

As its capacity is reduced over time, the number of scale segments with colour change in the tube is increased.

If the established maximum admissible number of segments with colour change is reached, the purifying agent must be replaced (see also page 34).

If all scale segments in the indicator tube show a colour change, the indicator tube is spent and must be replaced as described below.

Replacing indicator tube



Risk of damage to eyes! If not properly secured, the indicator tube might be propelled out of its holder!

When the needle valve is opened, the indicator tube is secured by a union nut. If

- the union nut is not properly tightened, or
- if the oil indicator has been interfered with,

there is a risk that the tube is propelled by the air flow so that it is shot out of its holder.

When working at the oil indicator, always wear protective goggles.

Prior to removing the indicator tube, ensure that the needle valve is closed and that the tube is not under pressure!

The colour change of the tube segments (2) is irreversible. When all segments have changed colour, the indicator tube must be replaced.

Prior to removing the tube:

- ▶ Ensure that the needle valve (1) is closed and that the indicator tube (2) is not under pressure. To close the needle valve, turn its handle clockwise.

To remove the indicator tube:

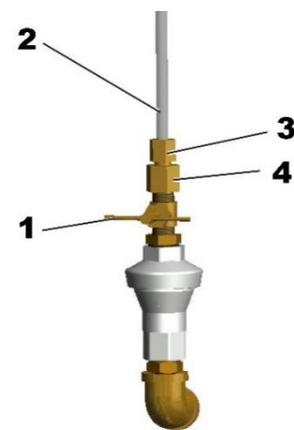
- ▶ Loosen the reducer (4) below the union nut (3), using an appropriate tool.
- ▶ Dispose of spent indicator tube and reducer according to the application regulations.

To install new indicator tube:

- ▶ Screw indicator tube into the reducer, applying a non-locking thread seal.
- ▶ Check the union nut (3) and the reducer (4) to ensure that they are properly tightened.

To check tube:

- ▶ Open the needle valve (1) for a short time and check screw connections for tightness.



Oil indicator

Notes on further maintenance work

Replace purifying agent

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

When replacing the purifying agent, please observe the following safety instructions:



Flush adsorber to remove residual moisture!

Prior to startup and after changing the activated charcoal, the adsorber must be flushed with pre-dried compressed air for at least 48 hours.

The flushing process allows any remains of cleaning agents (VOCs - volatile chlorinated hydrocarbons) and residual moisture to vaporise out of the adsorber.



Wear eye protection and dust mask due to increased dust generation! When emptying/filling purifying agent, increased dust generation might occur.



In order to avoid eye irritations, wear protective goggles!

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



Risk of falls!

The adsorber 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 vessel.

Remove used purifying agent

- ▶ Depressurise adsorber and take out of service (see page 25).
- ▶ Place suitable collection vessel underneath the drain point of the purifying vessel.
- ▶ Use a suitable tool to remove the drain plug.
- ▶ Drain purifying agent into the collection vessel.
- ▶ Use an industrial vacuum cleaner to Hoover up carefully the residues of the purifying agent via the drain plug aperture. In this way, you also clean the sieve bottom at the same time from any possible contamination or deposits.
- ▶ Re-fix drain plug; as well renew the gasket.
- ▶ Dispose of the used purifying agent in accordance with all applicable regulations.

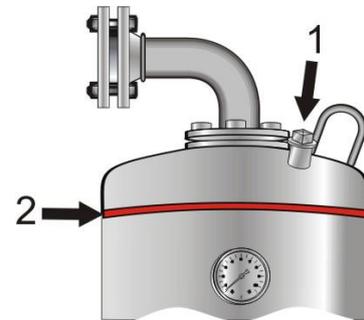
**Caution!**

The spent purifying agent might be contaminated with hazardous substances. Dispose of it in an environmentally safe manner, taking into account possible contamination. The waste code number of the purifying agent can be obtained from the manufacturer (see page 7).

Fill with new purifying agent**Risk of falls!**

The adsorber 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 vessel.

- ▶ Remove used purifying agent (see above section) and ensure that the discharge point is closed.
- ▶ Use a suitable tool to remove the filling plug (see figure) [1]).
- ▶ Refill the vessel with new purifying agent. Use a funnel, if necessary. Ensure that the agent is filled into the vessel with a high bulk density.
- ▶ Fill the tank with purifying agent to just below the weld (see illustration, Item 2).



Fill level of purifying agents

- ▶ Add a layer of desiccant (inert ceramic spheres) onto the purifying agent **Technical data** on Page 41 for the fill level.
- ▶ Re-mount the filling plug, as well renew the gasket.
- ▶ Restart adsorber as described on page 26, *After the purifying agent has been replaced.* Check that the connection is leak tight.

Replacing dust filters

Clogged dust filters result in a back pressure that can cause fluctuations in the compressed air network. You should therefore replace dust filters along with the drying agent. Dust filters come with the “DESPAC” drying agent packs.

Pressure vessel inspection

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

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

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

Identify and eliminate faults

Summary of faults

Faults on the adsorber become noticeable e.g. due to unusual noises and ram pressures.

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

Table of possible faults

Fault	Possible cause	Remedy	Spec. personnel	Service engineer
Excessive dam pressure	Dust sieve is contaminated.	Clean or renew dust sieve.	●	●
Vessel pressure is too low	Excessive differential pressure on the upstream filter (option).	Check differential pressure on the upstream filter, if. nec. renew filter element.	●	
No pressure build up	The compressed air system upstream of the adsorber is not pressurised.	Check whether the compressed air system upstream of the adsorber is pressurised. Remove any faults.	●	
Excessive compressed air consumption	Leakage.	Check screw and flange connections and reseal, if necessary. Check condensate trap at the upstream filter (option); clean, if necessary.	●	●

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Annex with technical documentation

This annex comprises the following information and technical documentation:

- Technical data
- Replacement and wear parts list
- Technical documents of the oil indicator
- Flow diagram
- Dimensional drawing

Technical data

Type	Capacity*	Length	Height	Width	Weight	Duranit-filling level
	m ³ /h	mm	mm	mm	kg	h [cm]
AK 120	1200	500	2070	840	235	9
AK 150	1550	500	2110	900	275	7
AK 200	2000	650	2150	990	340	7
AK 250	2500	650	2210	1040	385	7
AK 300	3000	650	2230	1100	440	7
AK 380	3800	850	2340	1200	520	7
AK 500	4850	850	2640	1250	650	7
AK 600	6100	950	2800	1150	950	7

* relative to 1 bar (abs.) and 20 °C at 7 bar operating pressure and a feed temperature of 35 °C.

Type AK 120–600	
Fluid group (acc. to Pressure Equipment Directive)	2
max. operating overpressure	10 bar
min. ambient temperature	≥ +1 °C
max. ambient temperature	≤ +50 °C
Compressed air input at maximum pressure dewpoint	+3 °C

filling quantities	vessel
upper layer	Duranit (ceramic spheres)
lower layer	Activated carbon

Replacement and wear parts list

Note:

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

Typ	Order No.	AK 120	AK 150	AK 200	AK 250	AK 300	AK 380	AK 500	AK 600
Duranit	DESPAC10FD	3x	3x	4x	5x	6x	7x	8x	10x
Activated carbon	DESPAC3AK	2x							
Activated carbon	DESPAC10AK		4x	-	3x	7x	5x	7x	8x
Activated carbon	DESPAC90AK	1x	1x	2x	2x	2x	3x	4x	5x
Dust sieve DN50	RKSCD-F50/16/VA	◆							
Dust sieve DN65	RKSCD-F65/16/VA		◆	◆					
Dust sieve DN80	RKSCD-F80/16/VA				◆	◆			
Dust sieve DN100	RKSCD-F100/16/VA						◆	◆	
Dust sieve DN 125	RKSCD-F125/16/VA								◆
Oil indicator	P02/ZR	◆	◆	◆	◆	◆	◆	◆	◆

◆ change when necessary

Technical documentation of the oil indicator

Measuring log

Number of measurement _____

Date of measurement _____

Adsorber no. _____

Completed by _____

Measured data

Start of measurement _____

End of measurement _____

Duration of measurement _____ [h]

Number of first-ever coloured scale units _____

Evaluation

Evaluation table according to measuring pressure = _____ [bar]

From table: Residual oil content in
[ppm] = _____

x 1.2

Residual oil content in
[mg/m³] = _____

Evaluation tables for determination of the residual oil content

At 4 bar operating pressure

Duration/[h]	Number of first-ever coloured scale units							
	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
4	1.00	1.95	2.90	3.85	4.90	5.95	6.75	7.50
4.5	0.90	1.75	2.55	3.40	4.35	5.10	6.10	6.80
5	0.80	1.55	2.35	3.10	3.90	4.70	5.50	6.20
5.5	0.75	1.40	2.15	2.80	3.55	4.25	5.00	5.80
6	0.70	1.30	1.95	2.60	3.30	3.85	4.60	5.10
6.5	0.65	1.20	1.80	2.35	3.00	3.60	4.25	4.80
7	0.60	1.10	1.70	2.25	2.75	3.30	3.85	4.50
8.5	0.50	0.95	1.40	1.85	2.30	2.75	3.25	3.65
10	0.40	0.80	1.18	1.55	1.95	2.30	2.70	3.10
12.5	0.31	0.70	1.00	1.30	1.55	1.85	2.20	2.50
16.5	0.24	0.50	0.70	1.00	1.25	1.40	1.65	1.90
25	0.155	0.310	0.500	0.700	0.800	1.000	1.100	1.300
33	0.120	0.240	0.380	0.500	0.620	0.750	0.850	1.000
50	0.075	0.155	0.230	0.310	0.400	0.500	0.600	0.700
56	0.065	0.135	0.210	0.280	0.350	0.420	0.500	0.600
63	0.058	0.125	0.185	0.250	0.305	0.355	0.420	0.500
72	0.050	0.095	0.160	0.195	0.270	0.310	0.380	0.420
84	0.040	0.090	0.140	0.185	0.225	0.280	0.310	0.370
100	0.036	0.075	0.118	0.155	0.195	0.230	0.275	0.310
125	0.030	0.059	0.090	0.125	0.155	0.185	0.230	0.250
166	0.020	0.048	0.064	0.090	0.118	0.135	0.155	0.185
250	0.012	0.030	0.048	0.059	0.075	0.090	0.095	0.125
500	0.005	0.012	0.020	0.030	0.036	0.048	0.055	0.059
1000	0.002	0.005	0.010	0.012	0.015	0.020	0.025	0.030

Table for the determination of the residual oil content in [ppm] at 4 bar operating pressure

At 5 bar operating pressure

Duration/[h]	Number of first-ever coloured scale units							
	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
4	0.80	1.55	2.35	3.15	3.90	4.80	5.55	6.25
4.5	0.72	1.40	2.10	2.75	3.50	4.25	4.90	5.60
5	0.62	1.25	1.85	2.50	3.15	3.75	4.40	5.00
5.5	0.56	1.18	1.72	2.30	2.90	3.45	4.00	4.60
6	0.53	1.05	1.55	2.10	2.60	3.15	3.70	4.25
6.5	0.50	0.95	1.45	1.95	2.45	2.80	3.40	3.90
7	0.48	0.90	1.35	1.80	2.30	2.70	3.15	3.60
8.5	0.40	0.75	1.10	1.50	1.75	2.25	2.55	2.85
10	0.35	0.62	0.95	1.25	1.55	1.85	2.20	2.50
12.5	0.25	0.52	0.76	1.00	1.25	1.52	1.75	2.00
16.5	0.185	0.400	0.560	0.800	0.950	1.180	1.300	1.560
25	0.125	0.250	0.410	0.520	0.620	0.760	0.900	1.000
33	0.090	0.185	0.280	0.400	0.510	0.560	0.650	0.800
50	0.060	0.125	0.180	0.250	0.350	0.410	0.450	0.520
56	0.050	0.110	0.165	0.230	0.280	0.370	0.420	0.440
63	0.047	0.095	0.150	0.195	0.245	0.300	0.390	0.425
72	0.040	0.085	0.130	0.170	0.210	0.260	0.320	0.390
84	0.035	0.075	0.110	0.150	0.175	0.230	0.260	0.300
100	0.030	0.060	0.090	0.125	0.165	0.180	0.225	0.250
125	0.020	0.050	0.076	0.097	0.125	0.155	0.170	0.190
166	0.012	0.037	0.055	0.076	0.090	0.115	0.128	0.155
250	0.008	0.020	0.037	0.050	0.060	0.076	0.085	0.097
500	0.005	0.008	0.012	0.020	0.030	0.037	0.042	0.050
1000	0.002	0.005	0.006	0.008	0.010	0.012	0.015	0.020

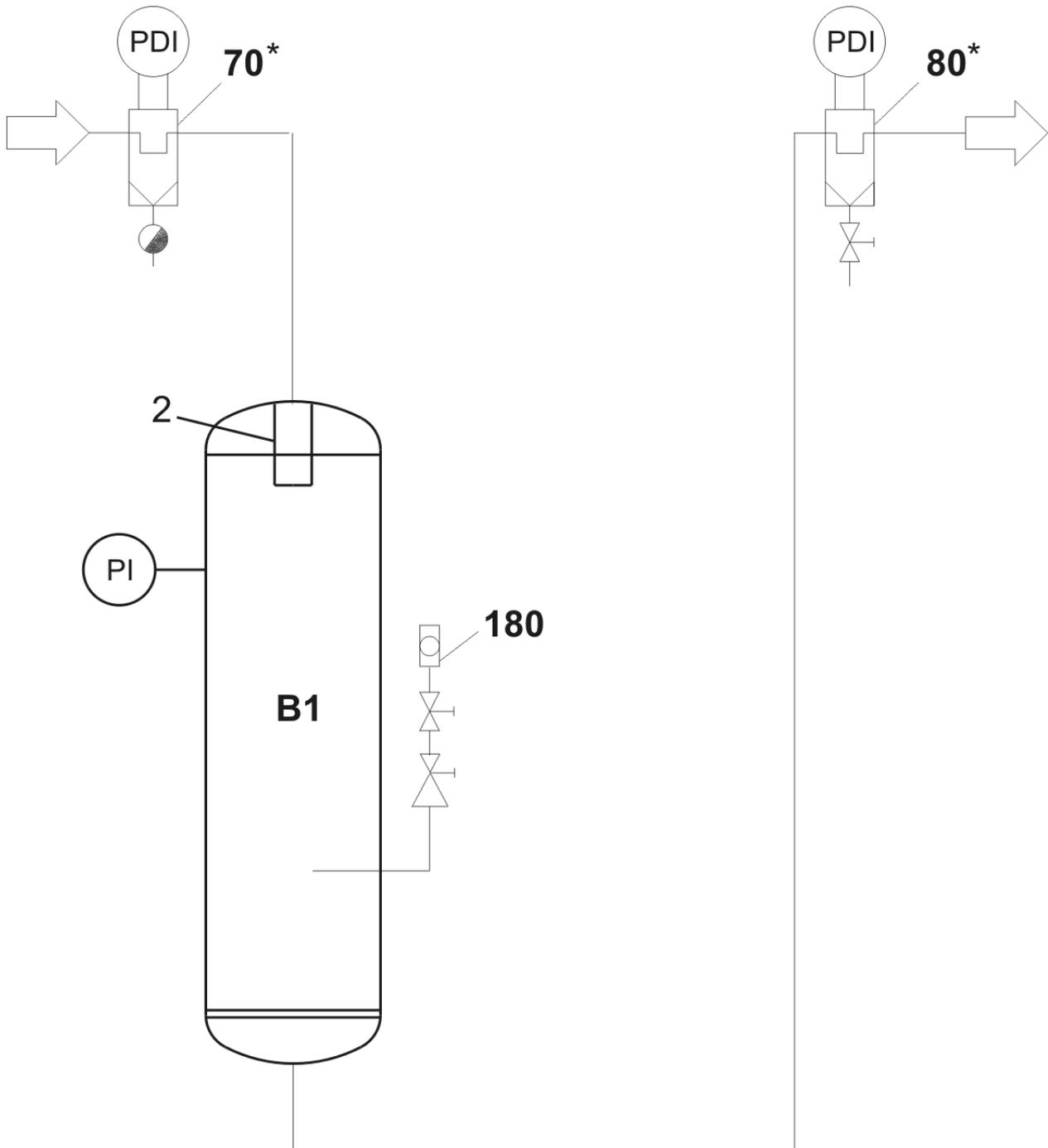
Table for the determination of the residual oil content in [ppm] at 5 bar operating pressure

At 6 bar operating pressure

Duration/[h]	Number of first-ever coloured scale units							
	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
4	0.65	1.30	1.95	2.60	3.25	3.85	4.75	5.40
4.5	0.62	1.20	1.70	2.20	2.80	3.55	4.10	4.75
5	0.52	1.05	1.55	2.10	2.60	3.25	3.70	4.25
5.5	0.48	0.95	1.32	1.90	2.35	2.75	3.50	3.80
6	0.44	0.90	1.30	1.70	2.10	2.60	3.0	3.55
6.5	0.40	0.82	1.25	1.60	2.00	2.40	2.70	3.50
7	0.39	0.70	1.10	1.40	1.85	2.20	2.60	2.90
8.5	0.35	0.62	0.92	1.15	1.45	1.80	2.10	2.45
10	0.27	0.52	0.81	1.05	1.30	1.55	1.80	2.10
12.5	0.21	0.42	0.55	0.85	1.05	1.29	1.48	1.65
16.5	0.16	0.35	0.49	0.55	0.81	0.95	1.08	1.20
25	0.10	0.21	0.35	0.48	0.52	0.55	0.70	0.85
33	0.07	0.16	0.22	0.35	0.40	0.49	0.60	0.66
50	0.05	0.10	0.17	0.21	0.27	0.35	0.38	0.48
56	0.04	0.09	0.16	0.20	0.22	0.27	0.34	0.38
63	0.036	0.082	0.120	0.165	0.210	0.250	0.280	0.355
72	0.035	0.070	0.110	0.160	0.200	0.210	0.270	0.280
84	0.033	0.065	0.090	0.120	0.160	0.200	0.210	0.250
100	0.025	0.050	0.070	0.100	0.120	0.160	0.200	0.210
125	0.018	0.035	0.060	0.075	0.100	0.120	0.150	0.180
166	0.014	0.032	0.038	0.060	0.075	0.090	0.110	0.125
250	0.008	0.020	0.033	0.036	0.050	0.060	0.070	0.075
500	0.002	0.008	0.012	0.018	0.025	0.033	0.034	0.035
1000	0.001	0.002	0.005	0.008	0.010	0.012	0.015	0.018

Table for the determination of the residual oil content in [ppm] at 6 bar operating pressure

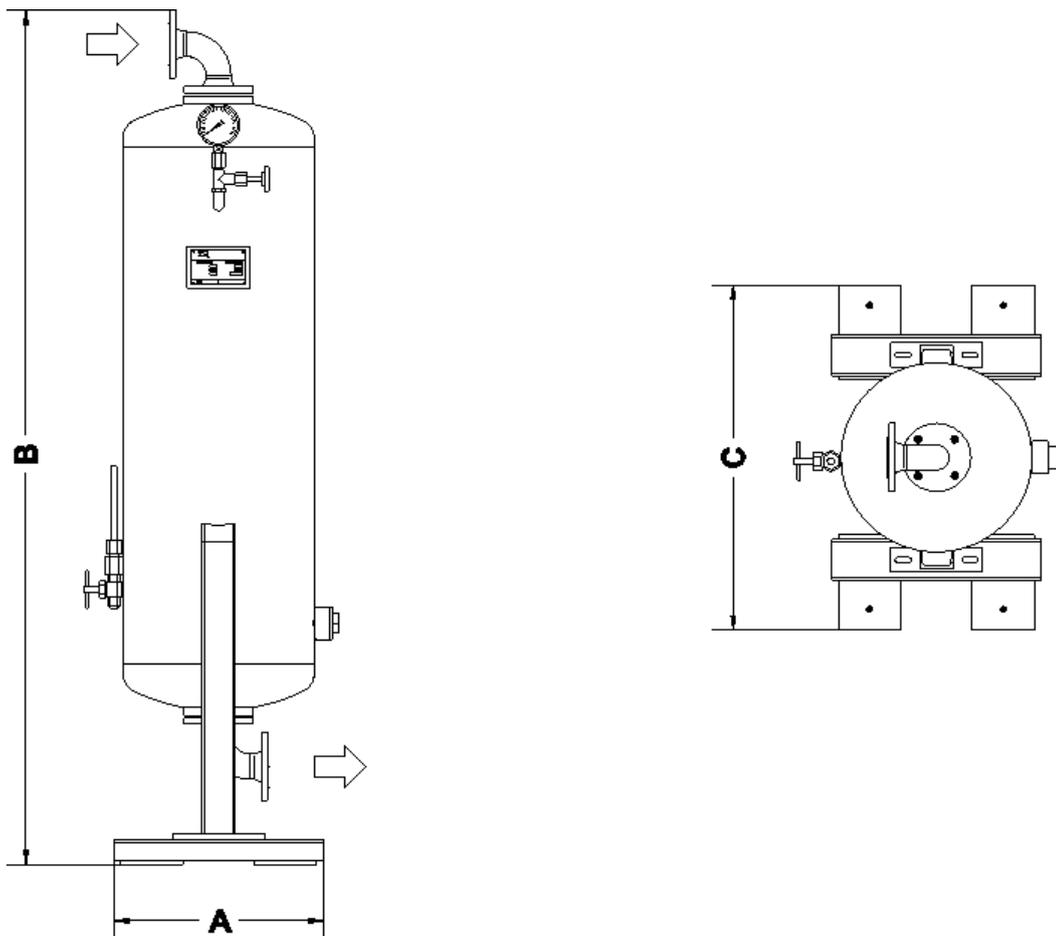
Flow diagram



Pos.	Designation
2	Dust sieve
180	Oil indicator

Pos.	Designation
*	Optional devices:
70	Upstream filter
80	Downstream filter

Dimensional drawing



Dimensions	Type AK							
	120	150	200	250	300	380	500	600
A	500	500	650	650	650	850	850	950
B	2070	2110	2150	2210	2230	2340	2640	2800
C	840	900	990	1040	1100	1200	1250	1150

Connection

Inlet	DN 50	DN 65	DN 80	DN 100	DN 125
Outlet	DN 50	DN 65	DN 80	DN 100	DN 125