



High Pressure Adsorber

18/25-550/50

Operating Instructions

Revision 00 — 06/2006

CE 0525

Machine passport

Type designation	HDA
Order no.	
Project no.	
Build no.	
Vessel no.	
Year of manufacture	2012
Issue date of these operating instructions	2012-03 DE

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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CERTIFICATE

*in accordance with the requirements of the
Pressure Equipment Directive 97/23/EC.
Annex. III, Module B, EC Type-Examination*

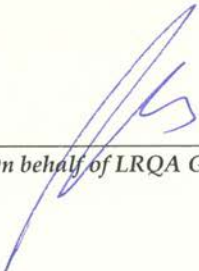
This is to certify that the sample is in conformance with the Essential Safety Requirements of Annex I of the Directive with respect to the global conformity of assemblies and representative for the range of approval.

Name / address of manufacturer /applicant:	ZANDER Aufbereitungstechnik GmbH & Co KG Im Teelbruch 118 D-45 219 ESSEN
Type of pressure equipment:	Assembly acc. Art. 3 Para. 2.2.
Description of product:	HIGH PRESSURE ADSORPTION DRYER
Sample:	HDK 250/250
Range of approval:	HDK / HDAK / HDA 18/25 - 600/500
Appraisal no.:	SIG 074-04 / JK

The Certificate is valid on the assumption that the product fulfils the specified requirements and conditions for use. Any modifications to the approved pressure equipment have to be reported to the notified body. The Certificate is valid for ten years and can be renewed upon request.

Certificate-No.: SIG 0301923/2	Date of Type-Examination:	02 nd February 2004
	Certificate Expiry Date:	02 nd February 2014

LRQA GmbH
Identifikation-No. 0525



On behalf of LRQA GmbH

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ZE-1113 eng. Rev. 1, 01/02

General information

Manufacturer's details

Name and address



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Details on the high pressure adsorber

Standard equipment

High pressure adsorber (hereinafter referred to as the *adsorber*), comprising

- 1 vessel, filled with drying agent and activated carbon
- oil indicator
- pressure gauge
- 1 pre-filter (option)
- 1 after-filter (option)

Associated documents

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

Warranty notes

In the following cases, the warranty shall be void:

- If aggressive media in the compressed air and in the environment cause corrosion damage and functional faults on the adsorber.

- If the adsorber 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 the adsorber is transported or stored incorrectly.
- If the adsorber is sited and installed incorrectly.
- If the adsorber is repaired or maintained incorrectly.
- If the adsorber is operated by personnel that does not have the requisite qualifications.
- If modifications are carried out on the adsorber, 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 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, instruction plates and danger zones at the dryer

Signs and instructions

Please note the plates and instructions attached to the adsorber. Ensure that they are not removed and are always readable.

Hazard areas on the high pressure adsorber

Hazard area	Symbol in operating instructions
<p>Warning against overpressure</p> <p>The entire dryer is under pressure. Before commencing any work, the plant must be depressurised.</p>	
<p>Risk of damage to eyes</p> <p>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.</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.

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.

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!

Safety notes on specific operating phases

Transportation and siting

- During transportation all applicable national regulations for accident prevention must be complied with.

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.

- 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.

Emergency shutdown

- In the event of an emergency, immediately close and depressurise the respective system section. (see also chapter *Depressurising and shutting down the adsorber*, page 20).

Monitor 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 20). The unit may only be restarted after all defects have been eliminated.

Maintenance of the adsorber and fault removal



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.

- Carry out maintenance work only when the plant has been depressurised!
- Bolt connections must be undone with care! Note ram pressure values! Otherwise emerging media may cause personal injury.
- Never use pipes and fittings as steps or holding points! The components might fracture, or the distortions which occur may cause internal damage on the 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.
- Following maintenance work always test all flange and bolt connections for leak tightness and secure seating.
- Only use replacement parts that are suitable for the relevant function and meet the technical requirements stipulated by the manufacturer. This is always the case, if you use original replacement parts only.

Disassembly and disposal



Hazard due to a sudden release of pressure!

Never remove any parts of the 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. The waste code numbers of the purifying agents can be obtained from the manufacturer (for manufacturer's address see page 7).

Technical product description

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.

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.

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 15.

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.
- The ambient temperature must not drop below +1 °C.
- The installation area must be level and firm. It must have the necessary carrying capacity for the weight of the adsorber.
- The adsorber should be installed with sufficient spacing (minimum 1 meter) at the top, sides and rear, in order to be able to carry out maintenance work and change the purifying 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 7).

Transporting adsorber



Warning against damage to property!

The adsorber is delivered in an upright position on a transport pallet. Top and sides have not been designed for mechanical loads.

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

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

- ▶ Secure the pallet on the lifting or forklift truck against sliding movements.
- ▶ Transport the adsorber to its installation site.
- ▶ Remove the packaging of the adsorber.
- ▶ Screw the enclosed ring bolts into the drilled holes on the upper block.
- ▶ Attach suitable lifting gear to the ring bolts.
- ▶ Carefully place the adsorber in an upright position.
- ▶ Place the adsorber at its installation site.

Installing adsorber

The upright stand profiles of the adsorber are provided with pre-drilled anchorage bores. It can thus be anchored to the floor.

Anchor adsorber to the floor

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

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 20.
- ▶ 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.

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 natural gas 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 the 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. 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.
- 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 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.



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 feeding connection lines are to be installed at a slight incline in the direction of the adsorber.
- ▶ One shutdown valve each is to be installed at the compressed air inlet and outlet ends of the adsorber.
- ▶ A relief valve is to be installed after the adsorber.

Start-up

- Carry out all prescribed tests and checks.
- Before start-up, ensure that no tools or other foreign parts have been left lying in a part of the 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
 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.

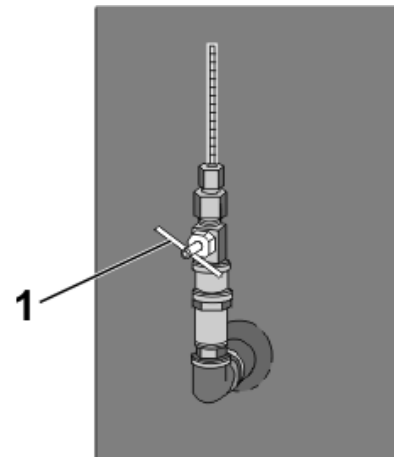
Overview of operating and control elements

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 23.



Oil indicator

Up- and downstream filters (option) with differential pressure gauge

On each of the upstream and downstream filters (option), a differential pressure gauge is installed. The differential pressure between the filter inlet and outlet ends is used as an indicator for the degree of filter element contamination. The indication should be within the green range up to 0.6 – 0.8 bar maximum, otherwise read the instructions on page 28.

Pressure reducer

Upstream of the oil indicator there is a pressure reducer installed. By default, it is set to 7 bar, because the oil indicator is constructed for 9 bar.

Emergency shutdown

In the event of an emergency, shut down the adsorber as described in section *Depressurising and shutting down the adsorber*, on page 20.

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.
- 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.
- ▶ 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:

Remedy fault

- ▶ Look up possible cause of the fault, and how to remedy the same, in the table on page 29.
- ▶ Remedy fault.
- ▶ Repeat the start-up procedure.

Monitoring adsorber operation

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.

Depressurise adsorber

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

Restart

- ▶ Commission adsorber as described in the section *Open compressed air supply* on page 19.

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 any manipulations on a hollow profile vessel or modify the same in any way!
- Following maintenance work, always check all flange and bolt connections for leakage and secure seating.
- Never use pipes and fittings as steps or holding points! The components might fracture, or the distortions which occur may cause internal damage on the 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 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 individual tasks are described in the following pages.

Component	Maintenance task to be carried out	Maintenance interval				
		daily	monthly	6 months	12 months	see page
Complete adsorber	Carry out visual and function checks.	●				23
Oil indicator	Measure the residual oil content and the residual capacity of the purifying agent.		▲			23
Pressure reducer	Check pressure settings (7 bar); adjust , if necessary.		▲			27
Purifying agent, solids filters in the vessels, seals,	Replace after maximum 12 months. If the fed compressed air is humid, the maintenance interval is reduced to 6 months.			(●)	●	28
Upstream and downstream filter (option)	Replace all filter elements after 1 year of operation.				●	28

Codes: ▲ check ● replace

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.

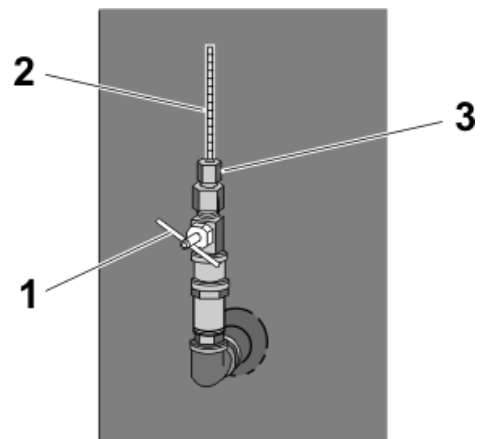
Measuring of residual oil content

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).

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.



Ölprüfindikator

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
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.

<i>Example</i>	
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/m^3], 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/m^3] 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 25 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.

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.

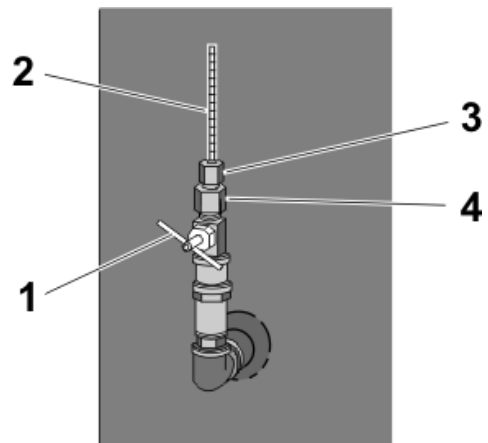
When working at the oil indicator, always wear protective goggles.

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.



Oil indicator

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.

Check pressure reducer

The oil indicator is designed for a maximum pressure of 9 bar, therefore the pressure reducer upstream the oil indicator is set to 7 bar.

- ▶ Check pressure settings monthly.
- ▶ If necessary, adjust the setting of the pressure reducer to 7 bar.

Renew filter elements on the filters (option)

The filter elements must be replaced every 12 months.

- ▶ Depressurise adsorber and take out of service (see page 20).
- ▶ 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.
- ▶ Restart adsorber (see page 21). Check the all filters for leaks.



Filter öffnen

Replace purifying agent (activated carbon) and seals

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).

We recommend, that the replacement is carried out by service engineers of the manufacturer.

The seals should also be replaced together with the purifying agent.

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
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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Technical data

Dimensions see attached dimensional drawing.

Fluid group (acc. to 97/23/EC)	2
max. operating overpressure	25/50 bar
operating overpressure	25/50 bar
min. ambient temperature	$\geq +1$ °C
max. ambient temperature	$\leq +50$ °C
Rel. humidity	100 %

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

Dauer/[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

