



Dräger PSS BG 4 plus

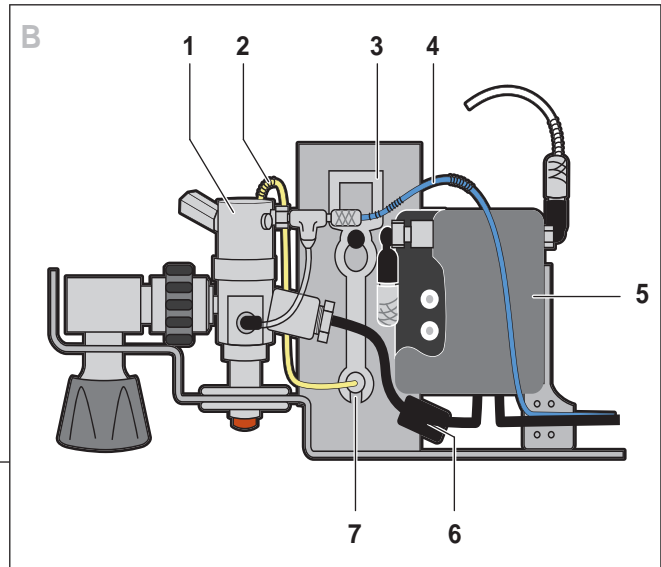
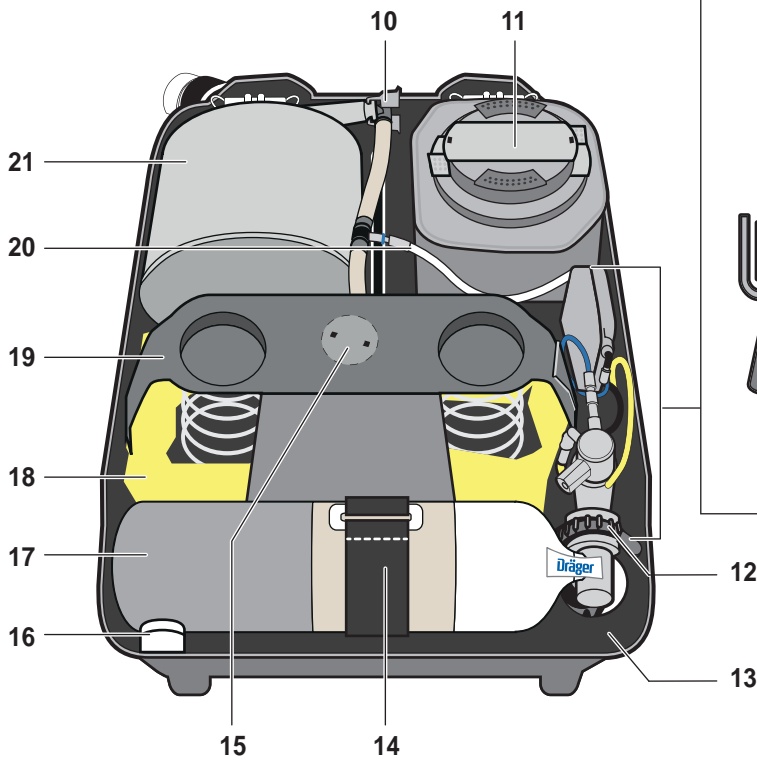
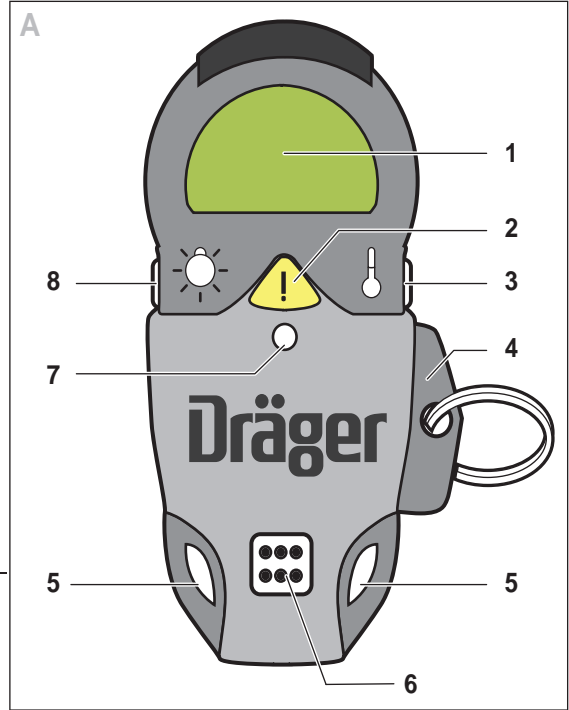
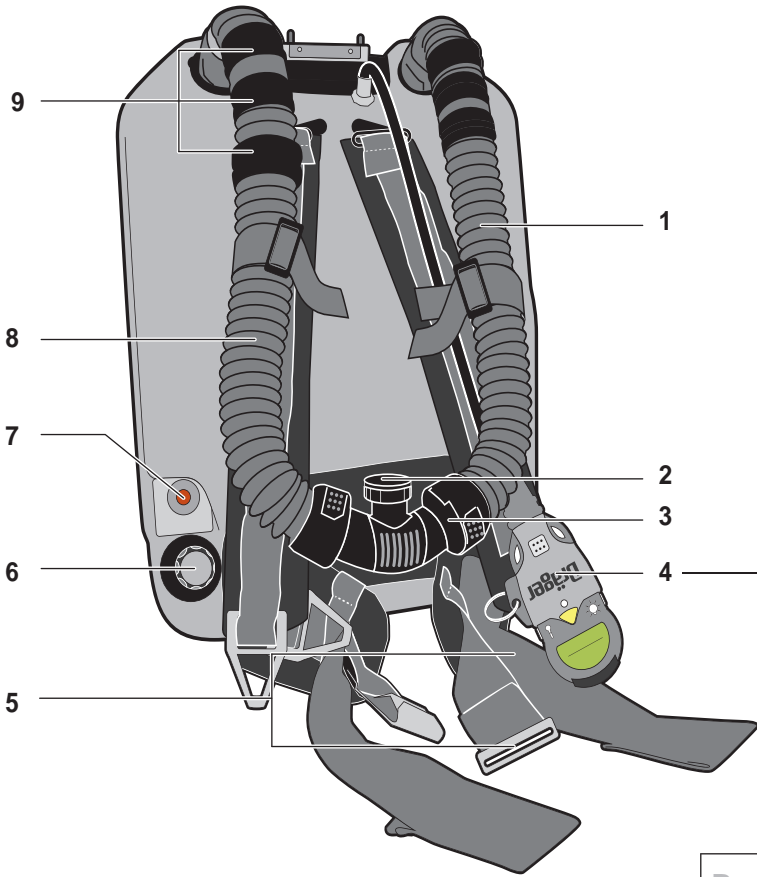


WARNING

Strictly follow the Instructions for Use.
The user must fully understand and strictly observe the instructions. Use the product only for the purposes specified in the Intended use section of this document.







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1 For your safety

1.1 General safety statements

- Before using this product, carefully read these instructions for use and those of the associated products.
- Strictly follow the instructions for use. The user must fully understand and strictly observe the instructions. Use the product only for the purposes specified in the Intended use section of this document.
- It is extremely important that you read and understand every aspect of these Instructions for Use, in addition to receiving proper training, before attempting to use the facepiece. Should you not thoroughly understand any aspect of the Instructions for Use, call Dräger at 1-800-922-1737.
- Do not dispose of the instructions for use. Ensure that they are retained and appropriately used by the product user.
- Only trained and competent users are permitted to use this product.
- Comply with all local and national rules and regulations associated with this product.
- Devices or components for use in explosion-hazard areas which have been tested and approved according to national, European or international Explosion Protection Regulations may only be used under the conditions specified in the approval and with consideration of the relevant legal regulations. The devices or components may not be modified in any manner. The use of faulty or incomplete parts is forbidden. The appropriate regulations must be observed at all times when carrying out repairs on these devices or components.
- Only trained and competent personnel are permitted to inspect, repair and service the product as detailed in these instructions for use. Further maintenance work that is not detailed in these instructions for use must only be carried out by Dräger or personnel qualified by Dräger. Dräger recommend a Dräger service contract for all maintenance activities.
- Only authentic Dräger spare parts and accessories may be used for maintenance. Otherwise the proper functioning of the product may be impaired.
- Do not use a faulty or incomplete product. Do not modify the product.
- Notify Dräger in the event of any product or component fault or failure.

1.2 Meaning of the alert icons

The following alert icons are used in this document to identify and highlight areas of text that require greater awareness by the user. A definition of the meaning of each icon is as follows:



DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

Indicates a potentially hazardous situation. If not avoided, this situation could result in death or serious injury.



CAUTION

Indicates a potentially hazardous situation. If not avoided, this situation could result in physical injury or damage to the product or environment. It may also be used to alert against unsafe practices.



NOTICE

Indicates additional information on how to use the product.

2 Description

2.1 Product overview

2.1.1 Closed-circuit breathing apparatus

► Illustration on the fold-out page

- 1 Exhalation breathing hose
- 2 Connecting piece with sealing cap
- 3 Bayonet ring
- 4 Sentinel
- 5 Waist belt
- 6 Cylinder valve
- 7 Bypass valve
- 8 Inhalation breathing hose
- 9 Reinforcing rings
- 10 Safety catch on the pressure relief valve
- 11 Breathing air cooler
- 12 Hand wheel with anti-vibration strap
- 13 Carrying frame
- 14 Belt
- 15 Pressure relief valve
- 16 Drain valve
- 17 Compressed oxygen cylinder
- 18 Breathing bag
- 19 Spring holder
- 20 Control line
- 21 CO₂ absorber

► Illustration on the fold-out page (figure B)

- 1 Pressure reducer
- 2 Yellow medium pressure hose to minimum valve
- 3 Safety catch
- 4 Blue medium pressure hose of constant metering valve
- 5 Sensor unit/switch box
- 6 Line to sensor unit
- 7 Minimum valve

2.1.2 Sentinel

► Illustration on the fold-out page (Figure A)

- 1 Display
- 2 Panic button
- 3 Right button
- 4 Function key for motion sensor
- 5 Red LEDs
- 6 Alarm device
- 7 Green LED
- 8 Left button

2.2 Functional description

2.2.1 Closed-circuit breathing apparatus

The PSS BG 4 plus closed-circuit breathing apparatus is a regeneration unit with pure oxygen supply in excess pressure version. A positive pressure in the breathing circuit prevents ambient air from entering the system.

The breathing air is circulated in a closed breathing circuit. The carbon dioxide contained in the exhaled air is absorbed in a CO₂ absorber. Either a disposable cartridge or a refillable cartridge can be used.

The breathing air is enriched with oxygen from the compressed oxygen cylinder:

- via constant metering valve in the case of low breathing rates
- in the case of higher breathing rates additionally via the minimum valve or the bypass valve which is then manually operated.

Before the regenerated air is inhaled again, it flows through the air cooler. To reduce the temperature of the inhaled air further, and thus minimize the physical discomfort of the wearer, the air cooler can be filled with ice. The use of ice in the cooling system is only required at ambient temperatures above 32 °F (0 °C). At temperatures below 32 °F (0 °C), ice must never be used.

The closed-circuit breathing apparatus is connected to a full facepiece by means of the connecting piece. One version of the connecting piece has a condensate trap where the condensate from the breathing air collects during use.

A water absorber is available as an option. It is connected to the drain valve on the breathing bag and absorbs the water that is delivered via the valve.

To be able to use the closed-circuit breathing apparatus in particularly low or high temperatures, the following accessories are available:

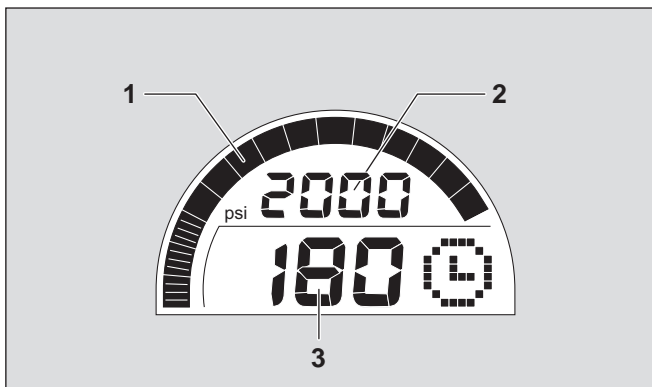
- Radiant heat protection for the breathing hose and the protective cover:
Protects against radiant heat and prevents foreign bodies penetrating through the openings into the carrying frame of the closed-circuit breathing apparatus.

2.2.2 Electronic monitoring system

The electronic monitoring system comprises a sensor unit, switch box and Sentinel. The electronic monitoring system is connected to the breathing circuit via the control line.

The sensor unit measures the available oxygen pressure in the compressed oxygen cylinder and the pressure in the breathing circuit. The values are compared in the switch box. Alarms are triggered at specific values.

The following information is displayed on the Sentinel in normal mode (operating mode display):



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- 1 Oxygen pressure, analog
- 2 Oxygen pressure, digital
- 3 Remaining period of use up to the beginning of the first residual pressure warning in minutes

The Sentinel issues the following warnings:

- first residual pressure warning
The warning sounds at 700 psi to 870 psi/50 bar to 60 bar according to the relevant country-specific settings. When this warning sounds, approx. 75 % of the oxygen has been used up. The Sentinel issues an intermittent tone for 30 seconds and the red LEDs flash continuously.
- second residual pressure warning
When this warning sounds, approx. 95 % of the oxygen has been used up. The Sentinel issues an intermittent tone continuously and the red LEDs flash continuously.
- low pressure warning
When the device is put into operation and the cylinder is closed, the Sentinel issues an intermittent tone and the "Open cylinder valve" symbol appears on the display.

The Sentinel can function as an automatic distress signal unit and issue an alarm when the wearer is no longer moving: When the wearer starts operation and the function key is removed from the Sentinel, the motion sensor is activated. The "Motion sensor activated" symbol is displayed briefly (see chapter 2.6 on page 9). If no further motion is detected, a pre-alarm sounds after approx. 25 seconds. If any movement is detected within the following approx. 10 seconds, the pre-alarm is cancelled. If no motion is detected, the main alarm sounds. The main alarm can be acknowledged as follows:

- The function key is re-inserted.
- Both buttons on the Sentinel are pressed.

The apparatus wearer can trigger an emergency signal using the yellow panic button if the wearer cannot retreat from the hazard area.

The left button can be used to switch on the backlight for 5 seconds.

The ambient temperature can be displayed using the right button.

The Sentinel has an infrared PC interface. Optional Windows software is available to use the infrared interface for the following functions:

- Custom configuration of the Sentinel
- Export of all parameters from the Sentinel

2.3 Intended use

The closed-circuit breathing apparatus supplies breathing air for approx. 4 hours, thus making it unnecessary for the wearer to breathe polluted ambient air lacking in oxygen. It is used by the fire services and for appropriate missions in underground and open-cast mines, as well as in industry.

2.4 Limitations on use

2.4.1 General cautions and limitations

The closed-circuit breathing apparatus must never be used for diving.



NOTICE

Short-term full submersion of the apparatus under water (e.g. when crossing a water hole in a mine) does not result in impairing the correct functioning of the closed-circuit breathing apparatus.

2.4.2 NIOSH cautions and limitations

The cautions and limitations are also listed on the approval label, please refer to chapter 10 on page 34.

- J - Failure to properly use and maintain this product could result in injury or death.
- M - All approved respirators shall be selected, fitted, used, and maintained in accordance with MSHA, OSHA, and other applicable regulations.
- N - Never substitute, modify, add, or omit parts. Use only exact replacement parts in the configuration as specified by the manufacturer.
- O - Refer to User's Instructions, and/or maintenance manuals for information on use and maintenance of these respirators.
- S - Special or critical user's instructions and/or specific use limitations apply. Refer to User's Instructions before donning.

2.4.3 Special or critical user's instructions

- Approved for use at temperatures above 23 °F (-5 °C).
- Ice in the cooling system may only be used at ambient temperatures above 32 °F (0 °C). At temperatures below 32 °F (0 °C), ice must never be used.
- The cylinder is to be charged with compressed oxygen meeting U.S.P. specifications.
- Anti-fog solution must be applied to the full facepiece before each use.
- The CO₂ absorber must never be used after its indicated expiration date. See instructions for use of refillable cartridge 90 21 360.
- Never re-use disposable CO₂ absorber cartridges.
- After each use of the closed-circuit breathing apparatus, a fully charged cylinder and a recharged/new CO₂ absorber must be installed.
- All parts which get into contact with the exhaled air must be thoroughly cleaned and disinfected after use.
- Do not use this apparatus where there is direct exposure of open flames or in high radiant heat.
- Keep exposed hair to a minimum when using the apparatus near open flames or in high radiant heat.
- A good facepiece seal is crucial since facepiece leakage will seriously reduce service time.
- Use of pure oxygen or oxygen enriched air increases flammability and lowers the ignition temperature of most materials.

2.4.4 Restrictions to the usage period

The estimated usage period amounts to approximately 4 hours if the following requirements are met:

- The user is an average-sized man in good physical health.
- The working conditions are moderate.
- The compressed oxygen cylinder is completely full.
- The apparatus has been adequately maintained and tested.

The usage period can be reduced considerably depending on the following factors:

- the physical condition of the user (the worse physical shape the user is in, the more oxygen he will consume)
- the degree of exertion (the harder the user works, the more oxygen he will consume)
- the emotional condition of the user (the more anxious or excited the user is, the more oxygen he will consume)
- the condition of the device (Poorly maintained or poorly adjusted devices may leak. They should therefore always be maintained according to the respective instructions for use.)
- the cylinder pressure before use (If the cylinder is not filled to capacity, usage time is reduced proportionately. The cylinder pressure should amount to at least 2600 psi / 180 bar.)



WARNING

For many users, actual air supply times will be far less than 4 hours! For example, users who are out of shape, stressed, larger than average, working in difficult conditions, inexperienced, or who have not maintained the device properly will drastically lessen their actual air-supply times.

2.5 Approvals

The closed-circuit breathing apparatus is approved in accordance with DIN EN 145 with the following facepieces:

- Dräger FPS 7000 RP Series
- Panorama Nova RP Series

It conforms to the following regulations:

- PPE Directive 89/686/EEC
- vfdb Regulations 0802:2006

The closed-circuit breathing apparatus is also approved by NIOSH according to the NIOSH guidelines 42 CFR, part 84, subpart H. Only combinations that are approved by NIOSH may be used (see approval label on page 34). Otherwise the correct functioning of the device may be compromised.

The Sentinel meets the explosion protection requirements of the following standards:

UL913	Class I Division 1, Group A, B, C, D Class II Group E, F, G Ex ia T4 (T _a : -22 °F to +140 °F T _a : -30 °C to +60 °C)
CAN/CSA-C22.2, No. 157	Class I Division 1, Group A, B, C, D Class II Group E, F, G Ex ia T4 (T _a : -22 °F to +140 °F T _a : -30 °C to +60 °C)

It was tested in methane-air mixtures by the Mine Safety and Health Administration (MSHA) and is registered with approval number 18-A080008-0 for the use in gaseous mines.

2.6 Explanation of symbols and type-identifying marks

USA use the PSS BG 4 AP or PSS BG 4 APK.

Canada use the PSS BG 4 CP or PSS BG 4 CPK.













Units with a "K" in the designation are equipped with a connector with a condensate trap.



NOTICE

Sentinels for the USA indicate the pressure in psi, whereas the Sentinel for Canada indicates the pressure in bar.

The following information can be shown on the Sentinel display:

Symbol	Meaning
	Test completed successfully.
	An error has occurred. The error is indicated by the letter in front of the X. Further information can be obtained from Dräger.
	The numbers to the left of this symbol give the remaining period of use in minutes.
	The leak test is currently running.
	Infrared connection between Sentinel and IR interface.
	The function key has been inserted. The motion sensor is disabled.
	The function key has been removed. The motion sensor is activated.
	Battery symbol
	First battery warning
	Second battery warning
	Open cylinder valve!
	Close cylinder valve!
900 (CP) 902 (AP)	Country code (information on which cylinder threaded connection is programmed in the Sentinel): 900: W21.8x1/14" 902: AP 902

The LEDs have the following meanings:

LED	Meaning
Green LED flashing	The Sentinel is in normal operating mode.
Red LEDs flashing	The Sentinel is issuing an alarm or an error has occurred during the self-test.

3 Use

3.1 Prerequisites

- Check which protective clothing and which head protection also needs to be worn during usage.
- Follow local and national regulations on the use of respiratory protective devices. Before occupational use of this respirator a written respiratory protection program must be implemented meeting all the local government requirements. In the United States employers must comply with OSHA 29 CFR 1910.134 which includes medical evaluation, training, and fit testing.
- The following requirements must be met so that the closed-circuit breathing apparatus can be used:
 - The CO₂ absorber (refillable cartridge) was filled within the last 6 months.
 - The CO₂ absorber (refillable cartridge or disposable cartridge) was installed into the closed-circuit breathing apparatus and leak-tested within the last 6 months.
 - The CO₂ absorber was transported on a vehicle for no further than 310 miles (500 km).
 - The compressed oxygen cylinder is full.
 - The leak-tightness and functional test on the closed-circuit breathing apparatus showed no faults (see chapter 4.5 on page 25).
- Under the following prerequisites, the closed-circuit breathing apparatus can be used multiple times by the same user within 24 hours:
 - The officer-in-charge decides before each further use whether the remaining oxygen supply is adequate for use.
 - The cylinder valve is fully closed after every use. This means that the breathing circuit is vented automatically. The connecting piece is sealed with the sealing cap.
 - The compressed oxygen cylinder and CO₂ absorber are not replaced.
 - The closed-circuit breathing apparatus is stored upright at a temperature of more than 32 °F (0 °C).

3.2 Prior to first use

1. Perform a visual inspection: Is the closed-circuit breathing apparatus intact and complete?
2. Test the closed-circuit breathing apparatus (see chapter 4.5 on page 25).

3.3 Preparation for use

1. Open the closed-circuit breathing apparatus if necessary (see chapter 3.3.1 on page 10).
2. Fit the CO₂ absorber if necessary (see chapter 4.4.8 on page 22). In this case, test the closed-circuit breathing apparatus (see chapter 4.5 on page 25).
3. Fit the compressed oxygen cylinder if necessary (see chapter 3.3.2 on page 11).
4. Insert the ice if necessary (see chapter 3.3.3 on page 12).
5. Test the correct functioning of the closed-circuit breathing apparatus (see chapter 3.3.4 on page 12).



CAUTION

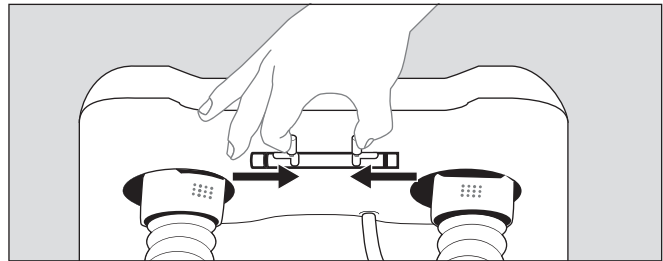
The closed-circuit breathing apparatus may only be used when the functional test has not produced any faults.

6. Close the closed-circuit breathing apparatus if necessary (see chapter 3.3.1 on page 10).
7. Don the closed-circuit breathing apparatus (see chapter 3.3.5 on page 13).

3.3.1 Opening and closing the closed-circuit breathing apparatus

Open the closed-circuit breathing apparatus as follows:

1. Slide the sliding bolts on the handle of the closed-circuit breathing apparatus using your thumb and finger and tip over so that they engage.

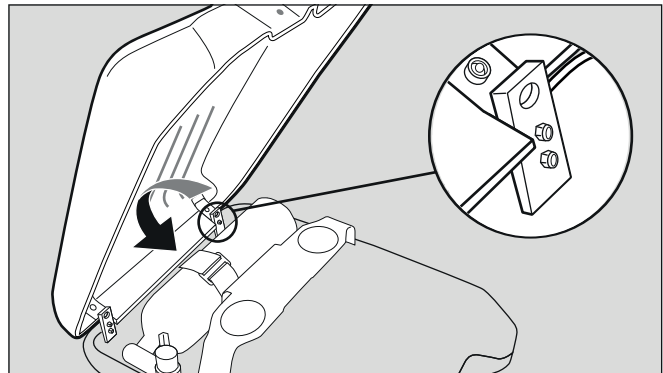


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2. Fold out the protective cover until the guide and the two pins on the lower edge are unlocked.
3. Unhook the pin and remove the protective cover.

Close the closed-circuit breathing apparatus as follows:

1. Attach the guide and the two pins on the lower edge of the cover in the device.



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2. Close the protective cover.
3. Tilt the sliding bolts and slide outwards.

3.3.2 Fitting the compressed oxygen cylinder

Compressed oxygen cylinder may only be filled with oxygen of the following quality characteristics:

- Purity: ≥ 99.5 vol. % O_2
- Water content: ≤ 0.05 mg/L oxygen
- Tasteless and odorless
- For the maximum permissible contaminants national regulations apply, in the USA for example 42 CFR, Part 84 (NIOSH):
carbon monoxide (CO): 0.001 Vol.-%
carbon dioxide (CO_2): 0.03 Vol.-%

The maximum charging pressure is 3000 psi/206 bar.

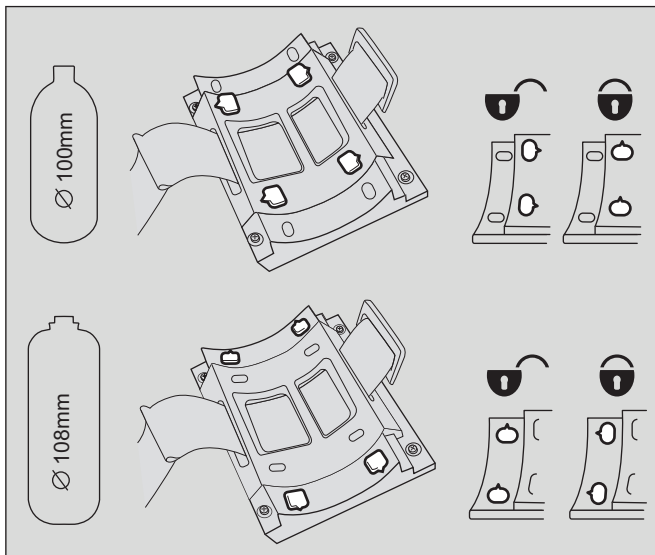


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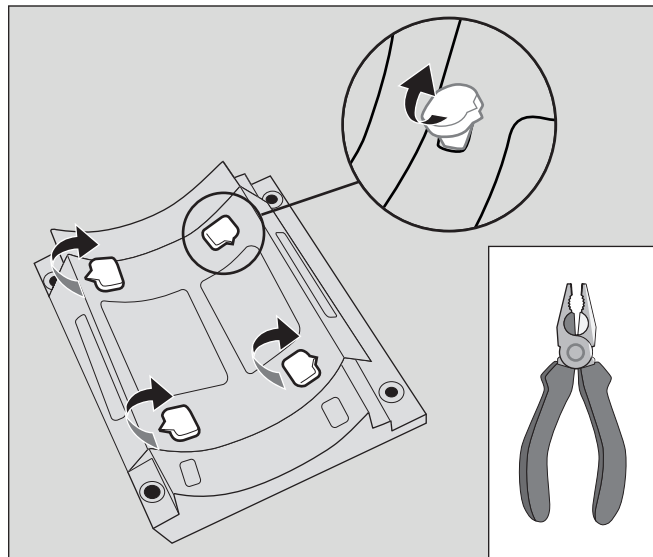
Ensure that the connections are not soiled with oil or grease. To avoid death or serious injury never allow pressurized oxygen to come into contact with oil, grease or similar contaminants. Either a fire, an explosion or both may also be caused.

Fit the compressed oxygen cylinder as follows:

1. Test the high pressure sealing ring on the pressure reducer connecting piece for damage and impurities. It must be clean and undamaged. Replace if necessary.
2. Ensure that the cylinder mount is adjusted to the diameter of the cylinder.

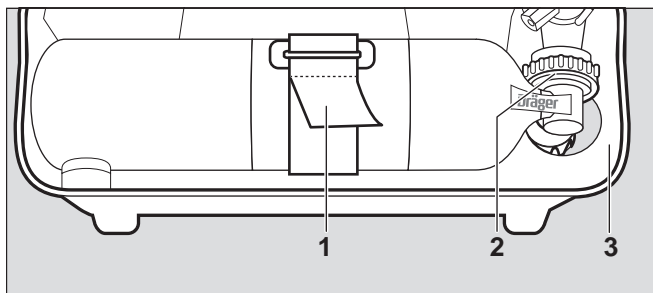


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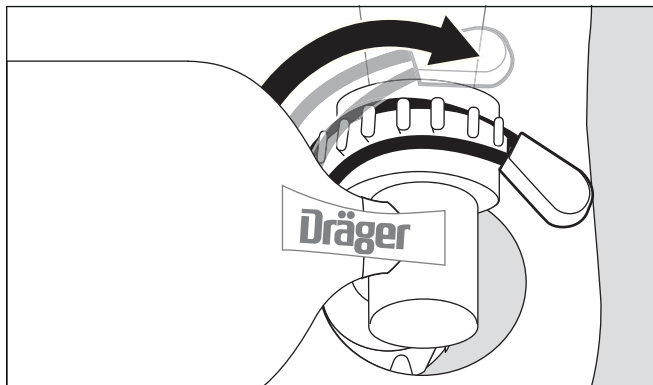
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3. Insert the compressed oxygen cylinder into the carrying frame (3).
4. Screw the hand wheel onto the pressure reducer (2). Do not use any tools to tighten.
5. Thread the belt into the buckle and close the hook-and-loop fastener (1).



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6. Tension the anti-vibration device and hook it into the hand wheel.



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3.3.3 Inserting an ice pack



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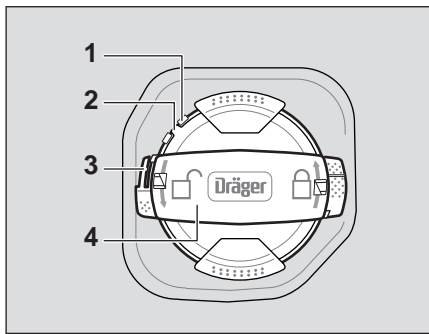
Ice in the cooling system may only be used at ambient temperatures above 32 °F (0 °C). At temperatures below 32 °F (0 °C), ice must never be used.

Prepare the ice pack as follows:

1. Fill the freezer receptacle with water. Leave approx. 2 inches/50 mm free up to the edge.
2. Allow to freeze completely in a deep freezer at approx. 5 °F/-15 °C for at least 16 hours.
3. Fill the ice receptacle up to the rim with water and leave to freeze again for another 8 hours in the deep freezer. Ensure that the ice receptacle is not tilted so that a level surface is obtained.
4. To remove the ice pack, hold the freezer receptacle briefly under running water.

Insert the ice pack into the breathing air cooler as follows:

1. Lift the locking device (3) and release the catch (4) in anti-clockwise direction.
2. Remove the cover from the breathing air cooler.
3. Insert the ice pack into the breathing air cooler.
4. The catch is turned on the cover. Ensure that the catch is fully open to avoid damage to the positioning aids on the breathing air cooler when the breathing air cooler is sealed with the cover.
5. Align the positioning aids on the breathing air cooler (1) and the cover (2).
6. Press the cover into the breathing air cooler.
7. Turn the catch clockwise to lock the cover. The guide slot on the catch must hold the lugs on the breathing air cooler. The catch must engage audibly.



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3.3.4 Testing correct functioning of the closed-circuit breathing apparatus

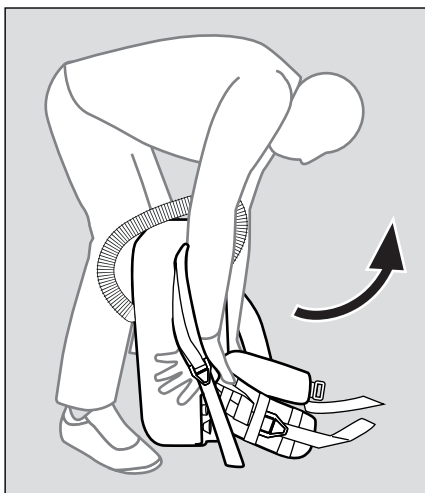
1. Open the cylinder valve.
The Sentinel switches itself on when the pressure in the compressed oxygen cylinder is greater than 145 psi/10 bar and the self-test sequence starts automatically (see chapter 4.8 on page 29).
2. Close the cylinder valve.
The "remaining period of use" symbol appears on the display. A single alarm tone sounds. The bar chart runs once again from left to right.
If the closed-circuit breathing apparatus is OK, the "Open cylinder valve" symbol is displayed and a dual alarm tone sounds.
3. Keep the cylinder valve closed.
4. Remove the sealing cap from the connecting piece and wait until the Sentinel displays a pressure of 0 psi/0 bar.
5. Fit the protective cap back onto the connecting piece.

The Sentinel can display the following results:

Display on the Sentinel	Meaning
<p style="text-align: right; font-size: small;">20021851.eps</p>	The test has been completed successfully.
<p style="text-align: right; font-size: small;">35421728.eps</p>	An error has occurred. Do not use the closed-circuit breathing apparatus. Check once again that the closed-circuit breathing apparatus is functioning correctly or have the device serviced by Dräger or trained experts.
<p style="text-align: right; font-size: small;">20221851.eps</p>	Battery warning 1 A long warning tone sounds at the same time. With normal use of the Sentinel, the closed-circuit breathing apparatus remains fully functional for up to 4 hours. To ensure safe usage, the battery should be replaced, however.
<p style="text-align: right; font-size: small;">20321851.eps</p>	Battery warning 2 At the same time, 5 short alarm tones sound and the red LEDs flash. The Sentinel automatically powers off and any further operation is impossible. The battery must be replaced before before any new operation.

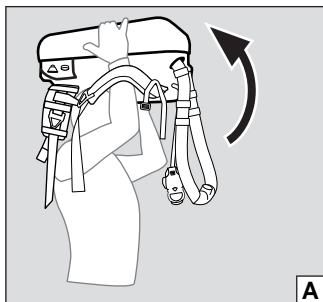
3.3.5 Donning the closed-circuit breathing apparatus

1. Open the waist belt:
Pinch the latch together. Open the hook and eye.
2. Open both shoulder straps:
Press the adjusting clamp upwards with your thumb and simultaneously with the other hand pull the long end.
3. Position the closed-circuit breathing apparatus upright and hang the breathing hoses over the protective cover.
4. Reach your arms through the shoulder straps and lift up the closed-circuit breathing apparatus.

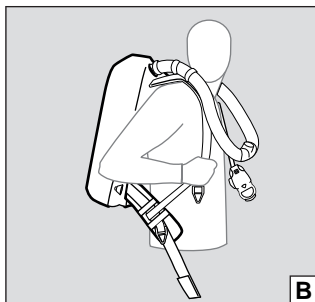


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5. Lift the closed-circuit breathing apparatus over your head, position your head between the breathing hoses (figure A) and allow the closed-circuit breathing apparatus to drop onto your back until the shoulder straps are positioned on the shoulders.
6. Uniformly pull down and tighten the shoulder straps so that the padding on the waist belt rests on your hip (figure B).



A



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7. Close the waist belt and adjust the width.
8. Pull the ends of the waist belt until the closed-circuit breathing apparatus rests firmly on your hips.
9. Insert the ends of the waist belt in the loops on the right and left-hand sides.
10. If required, loosen the shoulder straps slightly until comfortable.

11. Check the position of the three reinforcing rings on the breathing hoses and readjust if necessary: Fix the middle ring with the hose support centrally on the shoulder. The other reinforcing rings should also rest on the shoulder.



CAUTION

When carrying heavy loads on the shoulder, the breathing hoses may be squeezed thus interrupting the breathing circuit.

For this reason, the reinforcing rings must be in the correct position during use as well.

12. If the closed-circuit breathing apparatus has a connecting piece with condensate trap, ensure that the sealing plug is screwed securely into the connecting piece.
13. Fasten the full facepiece.
14. Remove the sealing cap from the connecting piece, breathe in deeply and hold your breath.
15. Press the connecting piece into the connecting piece on the facepiece until it engages.
16. Immediately after the connecting piece engages, open the cylinder valve by at least two rotations and breathe out into the closed-circuit breathing apparatus.
The Sentinel powers on automatically and runs a self-test (see chapter 4.8 on page 29).



WARNING

If a warning signal sounds, the cylinder valve is closed or the compressed oxygen cylinder is empty.

If the warning signal continues to sound after the cylinder valve is opened, the closed-circuit breathing apparatus is not permitted to be used as no oxygen is being supplied to the circuit. In this case, there is a risk of a health hazard due to insufficient oxygen supply.

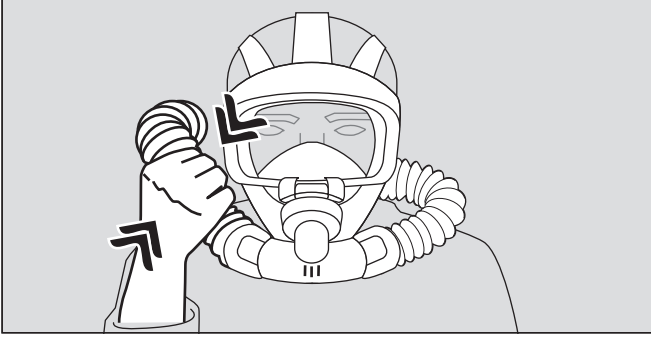
17. Use the display on the Sentinel to check that there is adequate oxygen for the usage period in the cylinder.



NOTICE

To ensure that the maximum usage period can be achieved, the compressed oxygen cylinder must have a charging pressure of at least 2600 psi/180 bar.

18. Tightly squeeze the inhalation hose and breathe in until a vacuum is produced in the full facepiece. Hold your breath for about 10 seconds. The vacuum must be maintained; if it is not, the harness on the full facepiece must be re-tightened.



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19. Press the left button on the Sentinel briefly to check the scale illumination. It goes out automatically after a short time.

When the closed-circuit breathing apparatus is OK, the green LED flashes and the operating mode display is shown. The apparatus can now be used.

In the event of an error, the red LEDs flash and an alarm tone sounds.



WARNING

If an error has occurred, the closed-circuit breathing apparatus must not be used. The closed-circuit breathing apparatus must be returned to Dräger or repaired by trained personnel.

Failure to follow this warning could lead to death or serious injury.

3.4 During use

3.4.1 General instructions for use

The closed-circuit breathing apparatus works fully automatically. Absorption of the CO₂ generates heat which can be felt, particularly when working under aggravated conditions with intense breathing. This is perfectly normal and indicates that the apparatus is functioning correctly.

Always set out in groups with at least two people wearing the apparatus. Check the oxygen supply approx. every 10 to 15 minutes.

The period of service and retreat should be planned independently of the low pressure warnings. When the 700 psi/ 55 bar residual pressure warning sounds, begin retreat. When the low pressure warning sounds, cease usage immediately.

- When the backlight is required, briefly press the left button on the Sentinel.
The backlight is switched on for 5 seconds.
- When the ambient temperature is to be displayed, press the right button on the Sentinel briefly.
Instead of the remaining period of use, the temperature is displayed in °C. The display changes back automatically to the remaining period of use.



CAUTION

If the closed-circuit breathing apparatus needs to be taken off the back in confined spaces, e.g. when entering an emergency shaft, kinks in the corrugated hose may cause increased breathing resistance. Removing the closed-circuit breathing apparatus and pushing it ahead should therefore be practiced thoroughly to avoid problems in the form of interrupted breathing.

3.4.2 In an emergency

- Press the yellow panic button.
The main alarm sounds, the function key symbol is displayed (see chapter 2.6 on page 9) and the red LEDs flash.
- In the event of a functional fault in the oxygen supply press the bypass valve briefly.
Additional oxygen is supplied to the breathing circuit.



WARNING

In the event of faults in the closed-circuit breathing apparatus begin the retreat immediately.

Failure to follow this warning could lead to death or serious injury.

3.4.3 Switching off Sentinel alarms

Switch off all alarms (except the pre-alarm) as follows:

- Press the right and left buttons on the Sentinel simultaneously until the alarm stops. The Sentinel returns to normal operating mode and the operating mode display is shown once again.
- If the Sentinel is used as automatic distress signal unit and the pre-alarm sounds, this pre-alarm can only be acknowledged by moving the Sentinel.

3.5 After use

1. Unplug the connecting piece from the full facepiece:
Press the button on the full facepiece and simultaneously remove the connecting piece from the full facepiece.
2. Close the cylinder valve immediately after pulling out the connecting piece. The air is automatically let out of the breathing circuit.
3. Fit the protective cap onto the connecting piece.
4. Remove the full facepiece.
5. Switch off Sentinel:
Simultaneously hold the right and left hand button pressed down until a short beep sounds.
The charge status of the battery is displayed for approx. 3 seconds. The Sentinel switches off.
6. Take off the closed-circuit breathing apparatus:
 - a. Open the waist belt:
Pinch the latch together. Open the hook and eye.
 - b. Draw the breathing hoses back over your head and lay them over the protective cover behind you.
 - c. Unfasten both shoulder straps:
Push the adjusting clamps upwards with your thumb.
 - d. Slowly allow the closed-circuit breathing apparatus to slide down your back and place it upright on the ground.
Do not drop the apparatus!
7. Have the closed-circuit breathing apparatus serviced (see chapter 4 on page 16).

4 Maintenance

Maintenance is carried out in the following order:

1. Disassemble the closed-circuit breathing apparatus and replace faulty parts (see chapter 4.2 on page 17).
2. Clean, disinfect and dry the closed-circuit breathing apparatus (see chapter 4.3 on page 20).
3. Assemble the closed-circuit breathing apparatus (see chapter 4.4 on page 21).
4. Test the closed-circuit breathing apparatus (see chapter 4.5 on page 25).

4.1 Maintenance intervals

Component	Work to do	Every 6 months	Annually	Every 3 years	Every 6 years
Closed-circuit breathing apparatus	Visual inspection, test function and leak tightness	X ¹	X ²		
	Clean and disinfect		X		
	Major overhaul ³				X
CO ₂ absorber (disposable cartridge)	Replace	X ⁴			
CO ₂ absorber (refillable cartridge)	Refill	X ⁴			
Compressed oxygen cylinder	U.S.DOT ⁵			X ⁶	

1 Applies to closed-circuit breathing apparatus that is constantly in use

2 Applies to reserve stocks

3 Only performed by expert personnel. Send the pressure reducer to Dräger for major overhaul.

4 Applies to CO₂ absorbers in closed-circuit breathing apparatus that are stored on vehicles or in the depot, tested in accordance with chapter 4.5 on page 25 and the connecting piece of which is sealed with the corresponding protective cap.

5 Hydro-testing in accordance with the local requirements.

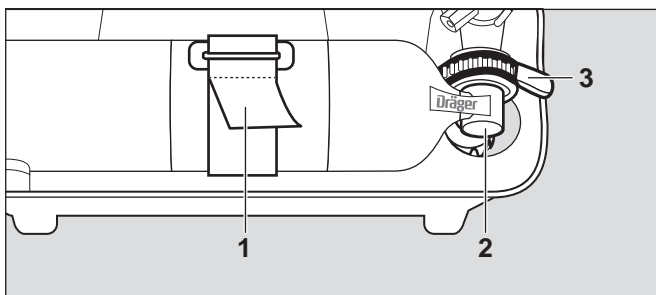
6 Composite cylinder: from date of manufacture.

4.2 Disassembly of the closed-circuit breathing apparatus

1. Open the closed-circuit breathing apparatus (see chapter 3.3.1 on page 10).
2. Remove the compressed oxygen cylinder (see chapter 4.2.1 on page 17).
3. Disconnect the breathing hoses (see chapter 4.2.2 on page 17).
4. Disassemble and test the connecting piece (see chapter 4.2.3 on page 17).
5. Remove the CO₂ absorber (see chapter 4.2.4 on page 17).
6. Remove and test the pressure relief valve (see chapter 4.2.5 on page 18).
7. Remove the breathing air cooler (see chapter 4.2.6 on page 18).
8. Remove the lever (see chapter 4.2.7 on page 18).
9. Remove breathing bag, drain valve, minimum valve and - where applicable - the water absorber (see chapter 4.2.8 on page 19).
10. Remove the switch box (see chapter 4.2.8 on page 19).
11. Remove waist belt and shoulder straps (see chapter 4.2.10 on page 20).

4.2.1 Removing the compressed oxygen cylinder

1. Ensure that the cylinder valve (2) is closed.
2. Release the anti-vibration strap (3).
3. Open the hook-and-loop fastener (1) and pull the strap out of the buckle.



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4. Unfasten the hand wheel from the pressure reducer. Do not use any tools to unfasten.



WARNING

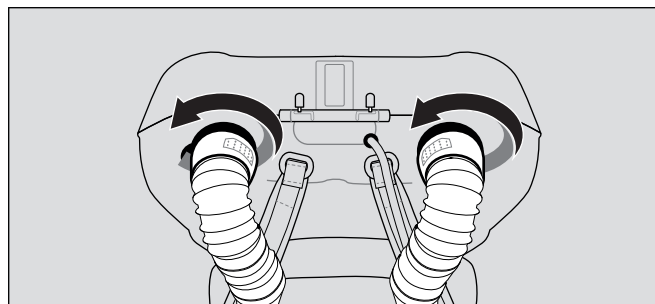
Ensure that the connections are not soiled with oil or grease. To avoid death or serious injury never allow pressurized oxygen to come into contact with oil, grease or similar contaminants. Either a fire, an explosion or both may also be caused.

5. Remove the compressed oxygen cylinder from the closed-circuit breathing apparatus and seal with the lock nut. Re-fill the compressed oxygen cylinder¹.

¹ see the instructions for use for the compressed oxygen cylinder

4.2.2 Removing the breathing hoses

1. Open the safety straps on the shoulder straps.
2. Turn the bayonet rings on the closed-circuit breathing apparatus anti-clockwise until they disengage.



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3. Take the breathing hoses off the closed-circuit breathing apparatus.
4. Drain off the condensate that has accumulated in the breathing hoses.

4.2.3 Disassembling and testing the connecting piece

1. Turn the bayonet rings on the connecting piece anti-clockwise until they disengage.
2. Take the breathing hoses off the connecting piece.
3. Remove the inhalation and exhalation valve seats from the connecting piece.
4. Take the valve disks out of the valve seats and test. Dispose of any damaged valve disks.
5. If the closed-circuit breathing apparatus has a connecting piece with condensate trap, open the sealing plug and drain the condensate.

4.2.4 Removing the CO₂ absorber



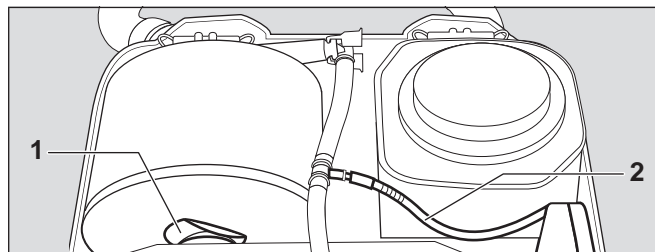
CAUTION

Risk of chemical burns!

The CO₂ absorber may contain alkaline liquid which may leak out during disassembly!

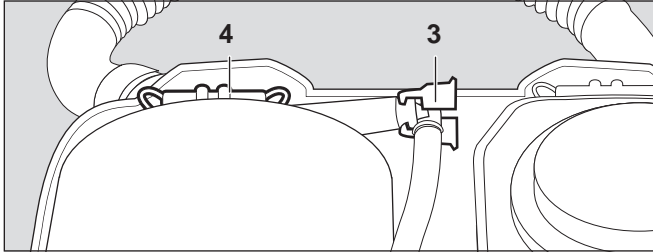
Wear protective clothing, protective gloves and goggles.

1. Disconnect the breathing bag from the CO₂ absorber. To do this, stretch the tab on the sleeve (1) and remove.
2. Unfasten the control line (2) from angled connector and switch box (see chapter 4.2.11 on page 20).



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3. Check that the control line is dry inside.
If necessary, use compressed air acc. to CGA G7.1 Grade D or better to carefully blow-dry.
4. Press the safety catch handles (3) together and remove the angled connector from the CO₂ absorber.
5. Release the tensioning bar (4).



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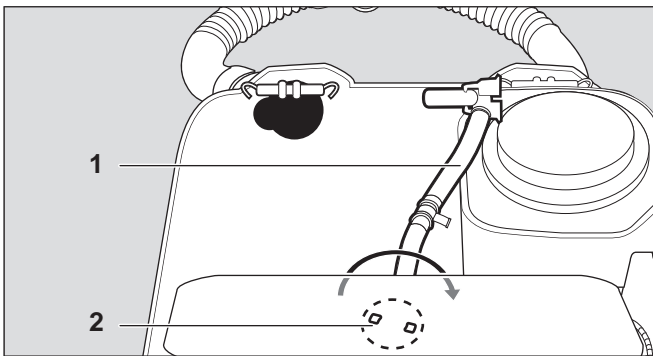
6. Grip the CO₂ absorber on the grommet and tilt upwards.
7. Take the CO₂ absorber out of the lower retaining bracket and remove from the carrying frame.
8. Dispose of the disposable cartridge or re-fill the refillable cartridge.

i NOTICE

Refillable cartridges may only be filled shortly before they are fitted into the closed-circuit breathing apparatus. Take the corresponding instructions for use into account.

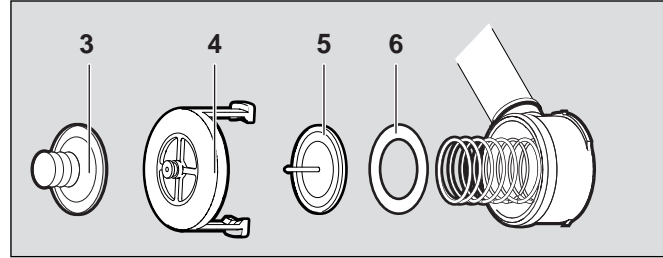
4.2.5 Removing and testing the pressure relief valve

1. Move the pressure relief valve to the right (1) until the clamps (2) can be pressed together.



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2. Take the pressure relief valve off the spring holder.
3. Examine the O-ring of the angled connector; it must be clean and undamaged, otherwise it must be replaced.
4. Take the valve cover (4) off the pressure relief valve.
5. Unhook the stepped valve disk (3) from the valve cover.
6. Take valve disk (5) and O-ring (6) out and check. They must be clean and undamaged.
Replace faulty parts. Apply Molykote 111 thinly to the O-ring.

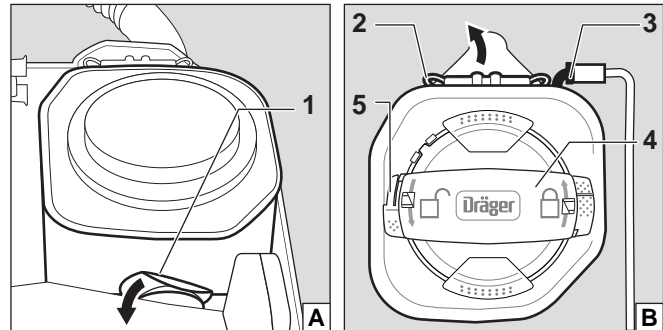


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7. Re-fit the pressure relief valve.

4.2.6 Removing the breathing air cooler

1. Unhook the breathing bag from the breathing air cooler.
To do this, stretch the tab on the sleeve (A-1) and remove.
2. Unfasten the medium-pressure hose of the constant metering valve (B-3) from the breathing air cooler (see chapter 4.2.11 on page 20).
3. Unfasten the tensioning bar (B-2).
4. Remove the breathing air cooler.
5. Remove the cover from the breathing air cooler.
To do this, lift the locking device (B-5) and release the catch (B-4) in an anti-clockwise direction.

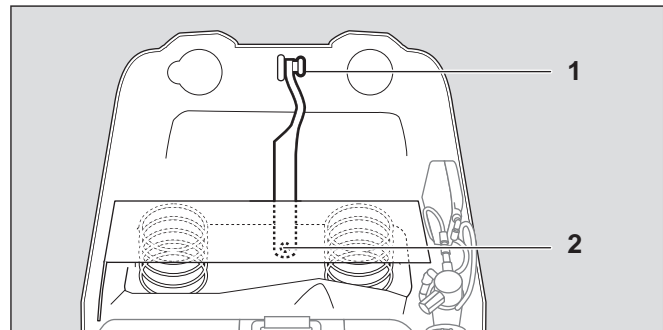


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6. Drain the water of the ice pack.

4.2.7 Removing the lever

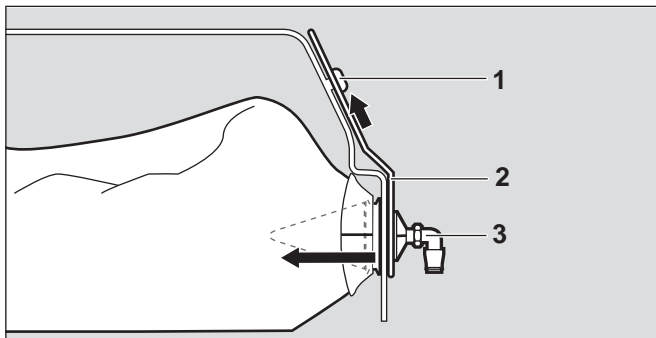
1. Lift the safety knob (1) and pull the lever to the right.
2. Lift the safety knob (2) and remove the lever.



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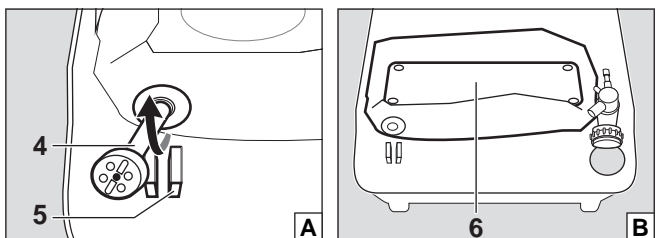
4.2.8 Removing breathing bag, drain valve, minimum valve and where applicable the water absorber

1. Compress the springs underneath the spring holder and remove.
2. Unfasten the medium-pressure hose of the minimum valve from the pressure reducer (see chapter 4.2.11 on page 20).
3. Remove the drain valve (A-4) from the retaining clips (A-5).
4. Release the safety catch (2) from the stop tab (1) on the spring carrier.
5. Remove the breathing bag with minimum valve (3) and drain valve from the spring holder.



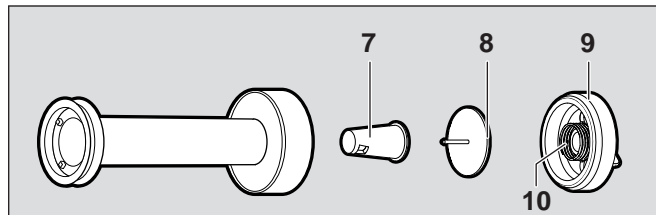
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6. Detach the minimum valve from the breathing bag:
To do this, stretch the tab on the sleeve and remove from the minimum valve.
7. If a water absorber is fitted:
Remove the water absorber from the drain valve and dispose of it.
8. Detach the drain valve from the breathing bag:
To do this, stretch the tab on the sleeve and remove.
9. If the breathing bag needs to be replaced, unhook the pressure plate (B-6) from the breathing bag.



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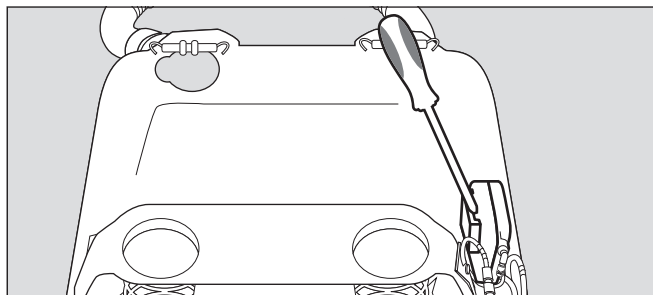
10. Check the drain valve:
 - a. Unscrew the cover (9).
 - b. Remove the valve disk (8), check and replace with a new valve disk if necessary.
 - c. Ensure that the sinter filter (7) is fitted.
 - d. Insert the shaft of the valve disk into the hole.
 - e. Position the springs (10) centrally onto the valve disk.
 - f. Screw the cover on securely.



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4.2.9 Removing the switch box

1. Use a slotted screwdriver to release the switch box from the holder.



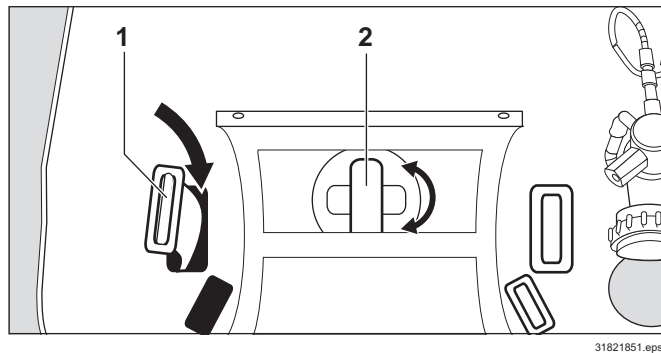
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2. Pull the switch box out of the holder and put it aside. Do not detach the electrical lines.

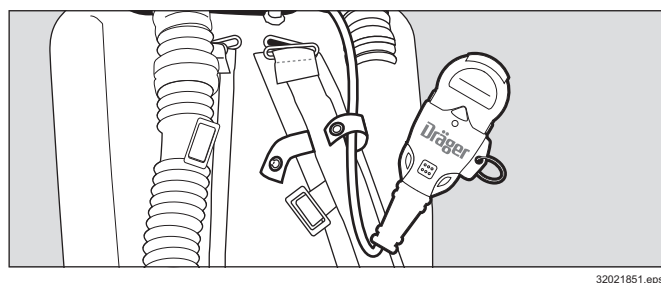
4.2.10 Disassembling waist belt and shoulder straps

NOTICE
Only remove waist belt and shoulder straps if very dirty or if they need to be replaced.

1. Lift the locking clips on the waist belt (1) in the carrying frame and push outwards through the slots.
2. Remove the shoulder straps from the waist belt if necessary.
3. Press the waist belt inwards at the fixing point (2), rotating by 90° and move outwards.



4. Open the press studs on the hoses and remove the Sentinel from the shoulder strap.

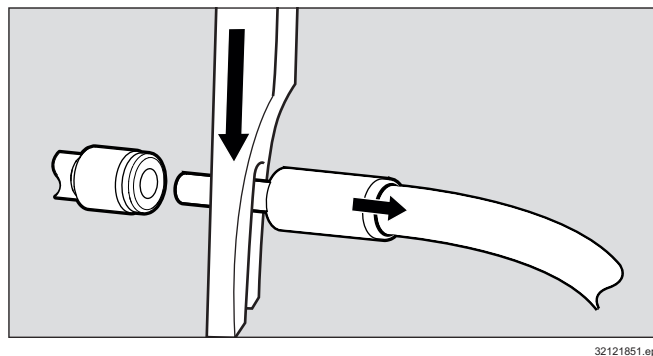


5. Tilt the locking clips on the shoulder straps upwards into the carrying frame and press outwards through the slits.

4.2.11 Unfastening the plug-in connectors on the medium-pressure hoses

The plug-in connectors are secured. They can be unfastened as follows:

- Use removal tool R 34 536¹ to press on the ring and simultaneously remove the plug-in connector from the corresponding component.



4.3 Cleaning and disinfecting

All parts which get into contact with the exhaled air must be thoroughly cleaned and disinfected after use. All other parts should only be cleaned if required.

When contaminated with hazardous substances:

- Wear personal protective clothing.
- Dispose of waste water and cloths in accordance with the applicable waste disposal regulations.



CAUTION

Do not use any solvents (e.g. acetone, alcohol) or cleaning agents containing abrasive particles for cleaning and disinfecting. Only use the prescribed process and use the cleaning and disinfection agents given. Other agents, dosages and contact times may damage the product.

The undiluted agents are damaging to health if they come into direct contact with the eyes or skin. For this reason, wear safety goggles and protective gloves when working with these agents.



NOTICE

Since the use of certain cleaning and disinfecting agents is not allowed among all countries, Dräger tested and recommends several cleaning and disinfecting agents. Make sure to follow the procedure that is suitable for your country.

For further information please contact Dräger or your local dealer.

¹ Part of test set R 33 777

4.3.1 Cleaning and disinfecting procedure for the USA only

1. Wipe both Switch Box and Sentinel with a damp cloth.
2. Loosen the lock screw which is located in the facepiece connector and drain the water from the facepiece connector. Leave the facepiece connector open when cleaning and disinfecting the closed-circuit breathing apparatus.
3. Clean all parts which get in contact with the exhaled air with lukewarm water and 1008 GREEN LIQUID HAND DISH WASH.
4. Thoroughly rinse all parts under running water.
5. Prepare a disinfectant bath containing water and 800 SPUR-TEX Disinfectant (max. temperature: 86 °F/ 30 °C, concentration: 2 fl.oz. per 1 gallon/60 ml per 3.79 l).
6. Place the parts to be disinfected into the disinfectant bath (duration: 15 minutes).
7. Thoroughly rinse all parts under running water.
8. Dry the closed-circuit breathing apparatus as follows (max. drying temperature: 140 °F/60 °C):
Dräger recommends to use both a drying cabinet and a hose drying unit for drying. Adapter set R34098 contains all the adapters required for drying using a hose drying unit. Breathing bag and breathing hoses should be dried using the hose drying unit.



NOTICE

It is important to dry waist belt and shoulder straps before storage to prevent fungus and mold growth.

9. Moisten or grease the O-ring of the lock screw and close the facepiece connector with the lock screw.

4.3.2 Cleaning and disinfecting procedure for other countries

1. Wipe both Switch Box and Sentinel with a damp cloth.
2. Loosen the lock screw which is located in the facepiece connector and drain the water from the facepiece connector. Leave the facepiece connector open when cleaning and disinfecting the closed-circuit breathing apparatus.
3. Prepare a cleaning solution containing water and NEUTRAL DISINFECTANT CLEANER (max. temperature 86 °F/30 °C, concentration: 1 fl. oz. per 2 gallons).
4. Immerse the parts which get in contact with the exhaled air in the cleaning solution (duration: 10 minutes). Make sure that all parts are wetted.
5. Thoroughly rinse all parts under running water.
6. Dry the closed-circuit breathing apparatus as follows (max. drying temperature: 140 °F/60 °C):
Dräger recommends to use both a drying cabinet and a hose drying unit for drying. Adapter set R34098 contains all the adapters required for drying using a hose drying unit. Breathing bag and breathing hoses should be dried using the hose drying unit.



NOTICE

It is important to dry waist belt and shoulder straps before storage to prevent fungus and mold growth.

7. Moisten or grease the O-ring of the lock screw and close the facepiece connector with the lock screw.

4.4 Assembly of the closed-circuit breathing apparatus

Assemble the closed-circuit breathing apparatus as follows:

1. Fit waist belt and shoulder straps (see chapter 4.4.1 on page 21).
2. Fit the drain valve (see chapter 4.4.2 on page 21).
3. Fit the minimum valve (see chapter 4.4.3 on page 22).
4. Fit the breathing bag (see chapter 4.4.4 on page 22).
5. Fit the breathing air cooler (see chapter 4.4.5 on page 22).
6. Connect the hose of the constant metering valve (see chapter 4.4.6 on page 22).
7. Fit the switch box (see chapter 4.4.7 on page 22).
8. Fit the CO₂ absorber (see chapter 4.4.8 on page 22).
9. Fit the connecting piece (see chapter 4.4.9 on page 23).
10. Fit the breathing hoses (see chapter 4.4.10 on page 24).
11. Fit the compressed oxygen cylinder (see chapter 3.3.2 on page 11).
12. Close the closed-circuit breathing apparatus (see chapter 3.3.1 on page 10).

4.4.1 Fitting waist belt and shoulder straps

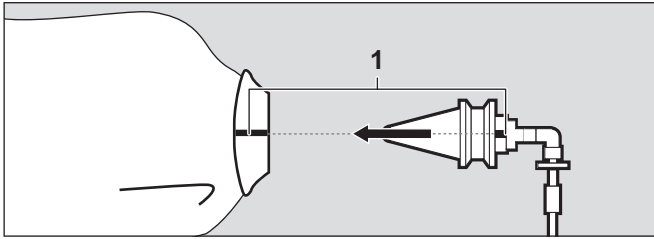
1. Press the locking clips into the carrying frame through the slots.
2. Fasten the Sentinel cables in the loops on the shoulder strap.
3. Press down the waist belt at the fixing point and turn it by 90° at the same time.
4. Thread the waist belt through the shoulder straps.

4.4.2 Fitting the drain valve

1. Attach the drain valve to the sleeve on the breathing bag.
2. If required, fit the water absorber onto the drain valve:
To do this, pull the sleeve on the water absorber over the drain valve housing.

4.4.3 Fitting the minimum valve

1. Open the toggle valve against the spring pressure and check if the minimum valve is dry.
If necessary, use compressed air acc. to CGA G7.1 Grade D or better to carefully blow-dry.
2. Insert the metal plug of the yellow medium-pressure hose into the minimum valve. The plug must engage into place. Pull gently on the plug to check that the medium-pressure hose fits securely.
3. Attach the minimum valve to the breathing bag, so that the pin of the minimum valve and the marking of the breathing bag line up (1).



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4.4.4 Fitting the breathing bag

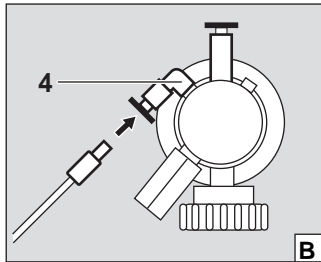
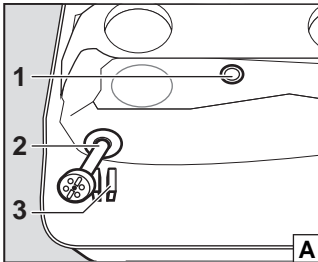
1. Attach the pressure plate to the breathing bag, if necessary. Note the preferred orientation; the button securing the lever (A-1) must point upwards.
2. Slide the breathing bag into the closed-circuit breathing apparatus.



NOTICE

Ensure that the toggle on the minimum valve is positioned underneath the pressure plate. To ensure the functional capability of the apparatus, the pressure plate to be inserted between the toggle and the housing of the minimum valve.

3. Insert medium-pressure hose and minimum valve connector through the hole in the spring holder. Ensure that the pin on the minimum valve slips into the cut-out on the spring holder.
4. Fasten the minimum valve to the spring holder using the locking catch. Carefully pull the breathing bag inwards to check if the minimum valve fits correctly.
5. Insert the medium-pressure hose of the pressure reducer (B-4). It must engage into place. Gently pull the plug to check if the medium-pressure hose fits correctly.
6. Press the drain valve (A-2) into the clamps on the carrying frame (A-3).



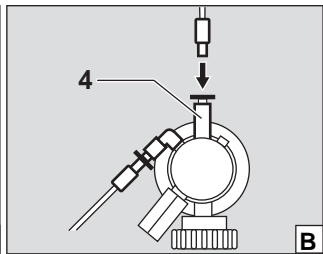
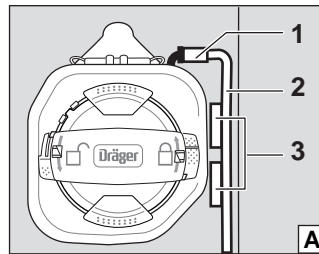
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4.4.5 Fitting the breathing air cooler

1. Position the breathing air cooler onto the two metal pins and fasten with the tensioning bar.
2. Attach the sleeve of the breathing bag onto the breathing air cooler grommet.

4.4.6 Connecting the hose of the constant metering valve

1. Guide one metal plug of the blue medium pressure hose under the stem of the spring carrier.
2. Insert the metal plug into the breathing air cooler (A-1). It must engage into place.
3. Fix the medium-pressure hose (A-2) into the clamps next to the breathing air cooler (A-3).
4. Insert the other plug on the blue medium-pressure hose into the pressure reducer (B-4). It must engage into place. Pull gently on the plugs to check that the medium-pressure hose is sitting securely.



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4.4.7 Fitting the switch box

- Ensure that the cables are not twisted. Slide the switch box into the mount until it engages.

4.4.8 Fitting the CO₂ absorber

- Refillable cartridges may only be filled shortly before they are fitted into the closed-circuit breathing apparatus.. Take the corresponding instructions for use into account.
- Check the following points when using a disposable cartridge:
 - The aluminium bag is completely sealed and undamaged,
 - The use-by date on the label has not yet expired.



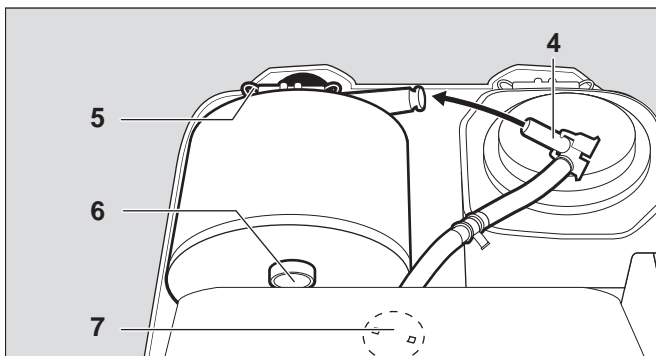
WARNING

Do not use a CO₂ absorber that does not conform to these requirements as the functional capability of the CO₂ absorber would no longer be guaranteed.

Failure to follow this warning could lead to death or serious injury.

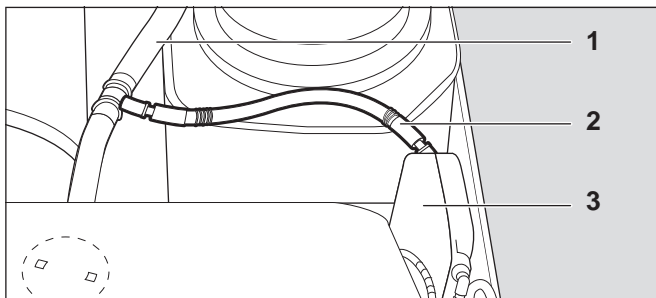
1. Unpack the CO₂ absorber if necessary.
2. Insert the CO₂ absorber into the carrying frame and fasten to the tensioning bar (5).
3. Attach the breathing bag sleeve onto the CO₂ absorber connecting piece (6).

4. Fit the lever:
 - a. Observe preferred position: Insert the lever into the device so that the long end of the lever is pointing upwards.
 - b. Press the lever on both attachment points. Each safety knob must engage.
5. Press the pressure relief valve (7) from behind into the two slots in the spring holder.
6. Apply Molykote 111 thinly onto the O-ring of the angled grommet (4).



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7. Slide the angled grommet into the CO₂ absorber. The clamps must engage.
8. Insert the control line (2) into the silicone hose (1) and the switch box (3). The plugs must engage. Pull gently on the plugs to check that the medium-pressure hose is sitting securely.



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9. Label the CO₂ absorber: Mark installation date permanently and clearly on the housing.
10. Fit the two springs between the pressure plate on the breathing bag and the spring holder.

4.4.9 Assembling the connecting piece

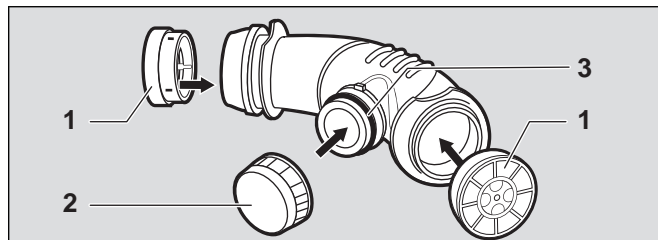
1. Fit valve disks into the inhalation and exhalation valves. Insert the plug on the valve disk into the central hole and pull it until under-cut becomes visible.



NOTICE

The valve disks must have uniform contact on all sides so that it can correctly control the breathing circuit.

2. Insert both valves (1) into the connecting piece. They have different diameters and therefore cannot be confused. The flow direction is marked with an arrow.
3. Examine the O-ring (3). It must be clean and undamaged, otherwise it must be replaced. Apply a thin coating of Molykote 111.
4. Fit the sealing cap (2).
5. If the closed-circuit breathing apparatus has a connecting piece with condensate trap, grease the O-ring on the sealing plug with Molykote 111. Seal the connecting piece with the sealing screw.

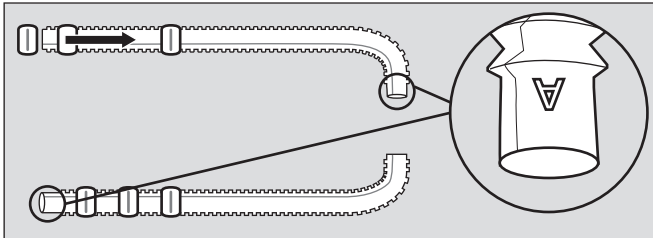


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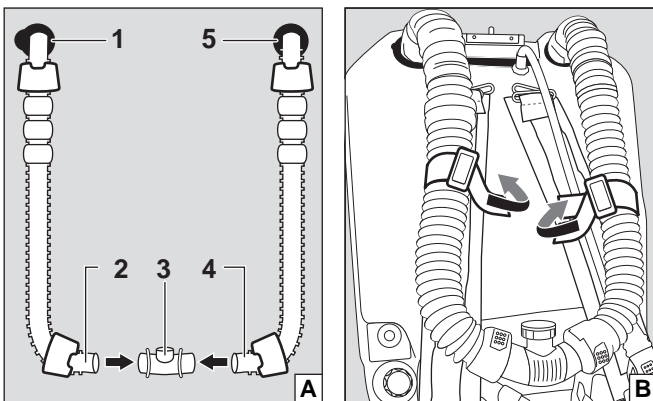
4.4.10 Fitting the breathing hoses

When fitting the breathing hoses, observe the following:

- The breathing hoses should not be twisted.
 - The marks ("A") on the breathing hose and connecting piece are 90° offset. The connector points upwards.
1. Slide three reinforcing rings over each of the two breathing hoses.



2. Slide a bayonet ring over the ends of each of the two breathing hoses.
3. Slide the sealing cuff on one breathing hose, marked "A" (A-1), onto the breathing air cooler connecting piece.
4. Slide the other sealing cuff (A-2) on this breathing hose onto the short connecting piece (A-3).
5. Slide the short sealing cuff on the other breathing hose (A-5) onto the connecting piece on the CO₂ absorber.
6. Slide the sealing cuff on this breathing hose, marked "A" (A-4), onto the connecting piece grommet, marked "A".
7. Secure the ends of the breathing hoses with bayonet rings: Slide bayonet rings over the sleeve and connector and turn until they engage.
8. Fasten both breathing hoses with safety loops onto the shoulder straps (figure B). Do not pull on the safety loops. Push the ends of the loops under the hoses.



NOTICE

After assembly, the storage time of the CO₂ absorber is reduced to 6 months, even if breathing bag, breathing hose and pressure relief valve are connected and the breathing circuit is sealed with the R 33 588 sealing cap.

4.5 Testing of the closed-circuit breathing apparatus

Perform the leak-tightness and functional test before initial commissioning and after every maintenance operation.



WARNING

If a fault is detected during the leak-tightness and functional test, the closed-circuit breathing apparatus must not be used. Send the device in to Dräger or have it serviced by trained personnel.

Failure to follow this warning could lead to death or serious injury.

If the CO₂ absorber is installed in the closed-circuit breathing apparatus, the functional test can be performed a total of six times whereby testing should not take longer than 15 minutes. After these 6 tests, the CO₂ absorber must be replaced and is no longer permitted to be used.

A record of each test should be made on the CO₂ absorber housing, with details of month and year and the tester's initials. If the breathing circuit is opened for more than 5 minutes, the CO₂ absorber apertures should be sealed to be gas-tight.

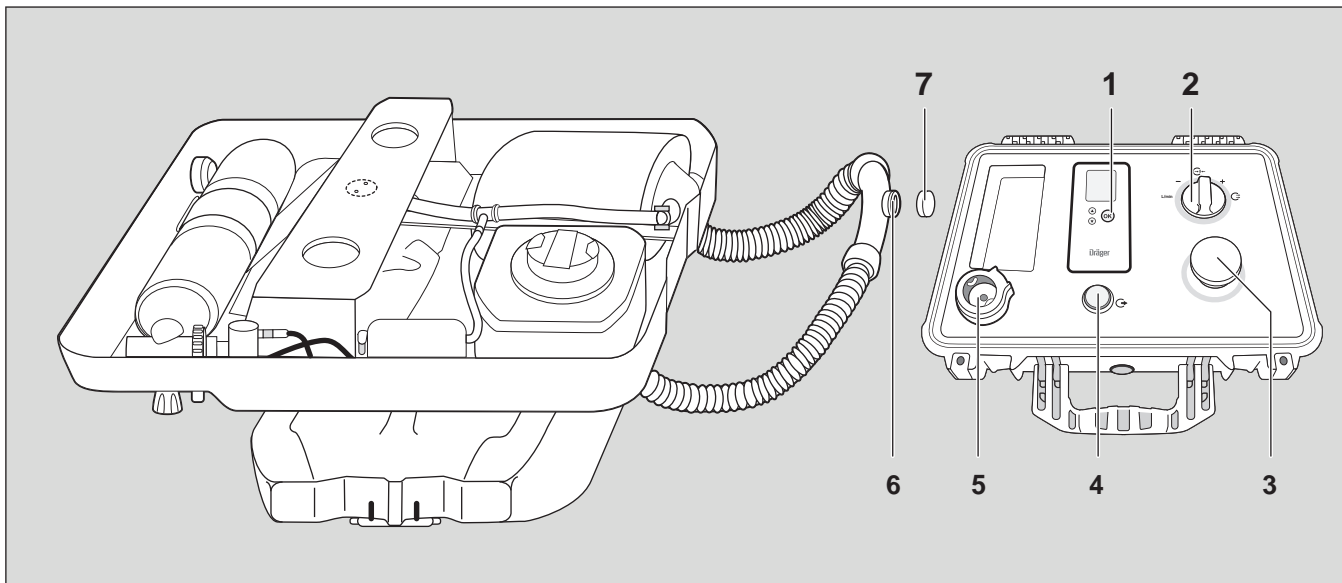


NOTICE

The tests are described using the Dräger RZ 7000 test unit. The specified sequence of the tests is the optimal sequence with this test unit. An overview is given on page 35.

The closed-circuit breathing apparatus can also be tested with other test units (e. g. Dräger Test-it 6100, Dräger Quaestor 5000) in other sequences.


The tests should not be performed with direct sunlight or in a cold room as the air pressure in the device will then change quickly and can result in incorrect test results.




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- 1 Display
- 2 Selector switch
- 3 Pump
- 4 Switch for venting
- 5 Connection for closed-circuit breathing apparatus
- 6 Connecting piece
- 7 Protective cap

4.5.1 Preparation of test

1. Switch on the test unit: Press the  button for 3 seconds.
2. Position the closed-circuit breathing apparatus and test unit so that both devices are easily accessible and the test unit can easily be operated.
3. Remove the protective cover (see chapter 3.3.1 on page 10).

4.5.2 Checking the response threshold of the low pressure warning

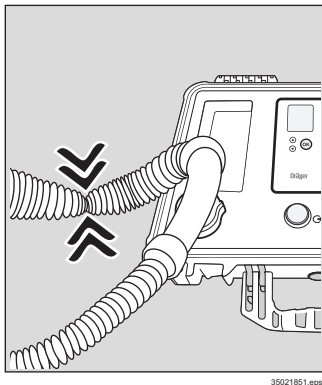
1. Remove the protective cap from the connecting piece and insert the connecting piece into the connection for the closed-circuit breathing apparatus.
2. Set the selector switch on the test unit to .
3. Pump slowly.
4. Watch the test unit display:
The low pressure warning must activate before a pressure of +1.4 mbar is reached.

The low pressure warning is displayed as follows:


- The backlight turns on including red LEDs.
- The "Open cylinder valve" symbol appears on the Sentinel display.
- The alarm tone sounds intermittently.

4.5.3 Checking the inhalation valve


1. Tightly pinch the exhalation hose with your hand. Use the face spanner from the test set if required.

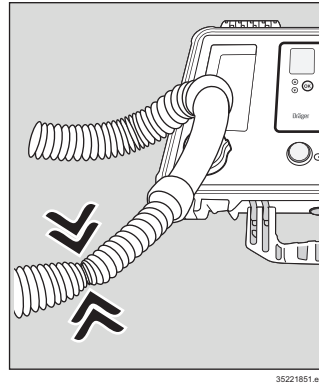


2. Carry out pumping. The test unit must display at least +10 mbar.
3. If +10 mbar is not reached, replace the inhalation valve or inhalation valve disk (see chapter 4.2.3 on page 17).


 **NOTICE**
The low-pressure warning generated by the Sentinel during this test is irrelevant here.

4.5.4 Checking the exhalation valve


1. Set the selector switch on the test unit to .
2. Tightly pinch the inhalation hose with your hand. Use the face spanner from the test set if required.

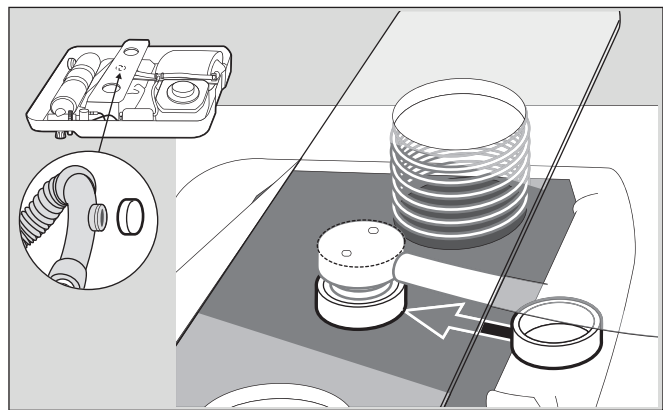


3. Carry out pumping. The test unit must display at least -10 mbar.
4. If -10 mbar is not reached, replace the exhalation valve or exhalation valve disk (see chapter 4.2.3 on page 17).


 **NOTICE**
The low-pressure warning generated by the Sentinel during this test is irrelevant here.

4.5.5 Checking the drain valve



1. Set the selector switch on the test unit to .
2. Pull the open side of the protective cap over the pressure relief valve tappet and hold. Pump until the protective cap is secured by the filled breathing bag.



3. Continue to pump until flow noises can be heard at the drain valve. Read the value on the display.
The drain valve must open between +10 mbar and +25 mbar.

 **NOTICE**
The low-pressure warning generated by the Sentinel during this test is irrelevant here.

4.5.6 Performing the leak test with positive pressure



1. Set the selector switch on the test unit to .
2. Reduce the pressure on the test unit using the venting switch to approx. 7+0.5 mbar and wait until the pressure has quietened.
3. Press the  button briefly to start the timer. If the timer has elapsed, the pressure difference is displayed. This is not permitted to be greater than 1 mbar.



NOTICE

The low-pressure warning generated by the Sentinel during this test is irrelevant here.

4.5.7 Checking the relief valve

1. Set the selector switch on the test unit to  and remove the protective cap.
2. Set the selector switch on the test unit to .
3. Pump until flow noises can be heard at the relief valve, reading the value on the display.


The pressure relief valve must open between +2 mbar and +5 mbar.



NOTICE

The low-pressure warning generated by the Sentinel during this test is irrelevant here.

4.5.8 Performing the high pressure leak test (optional)

1. Set the selector switch on the test unit to .
2. Open cylinder valve.
3. Note the cylinder pressure displayed on the Sentinel.

If the cylinder pressure is less than 2600 psi/180 bar, the high pressure leak test cannot be performed. In this case, the compressed oxygen cylinder must be filled.

If the cylinder pressure is greater than 2600 psi/180 bar, the "Close cylinder valve" symbol appears on the Sentinel display. The alarm tone sounds twice.

4. Close cylinder valve.



On the Sentinel display, the bar chart runs from left to right.

The "Remaining period of use" symbol appears on the Sentinel display. A single alarm tone sounds. The bar chart runs once again from left to right.

The result of the test is output after approx. 15 seconds. The following results may occur:


Result	next steps
An error has occurred. The "X" symbol appears on the Sentinel display. The alarm sounds four times. Do not use the closed-circuit breathing apparatus.	<ul style="list-style-type: none"> • Check once again that the closed-circuit breathing apparatus is functioning correctly or have the device serviced by Dräger or trained experts.
The closed-circuit breathing apparatus is OK. The "Open cylinder valve" symbol appears on the Sentinel display. The alarm tone sounds twice.	<ul style="list-style-type: none"> • Open cylinder valve.

4.5.9 Checking constant metering valve and bypass valve

1. Set the selector switch on the test unit to  until the protective cap fits over the pressure relief valve tappet.
2. Set the selector switch on the test unit to .
3. Pull the open side of the protective cap over the pressure relief valve tappet and hold. Pump until the protective cap is secured by the filled breathing bag.
4. Open cylinder valve.
5. Briefly press the red button for the bypass valve. Oxygen must be heard to flow into the circuit (flow noise).
6. Pump until at least +10 mbar are reached.
7. Set the selector switch on the test unit to **l/min**.


After a short settling time, the flow must be between 1.5 and 1.9 l/min¹.

4.5.10 Checking the minimum valve

1. Set the selector switch on the test unit to  and remove the protective cap.
2. Wait until flow noises can be heard on the minimum valve. The opening pressure must be between +0.1 mbar and +2.5 mbar.

¹ Only applies at a cylinder pressure of 2600 psi to 2900 psi/ 180 bar to 200 bar.

4.5.11 Checking the residual pressure warning

1. Set the selector switch on the test unit to  .
2. Close cylinder valve.
3. Observe the Sentinel.
The first residual pressure warning should be issued at approx. 700 psi/ 55 bar.
The alarm sounds intermittently. The red LEDs flash.
4. Remove the connecting piece from the test unit connector.
The device is vented automatically.
5. Fit the protective cap onto the connecting piece.

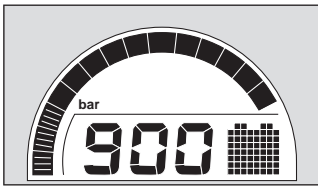
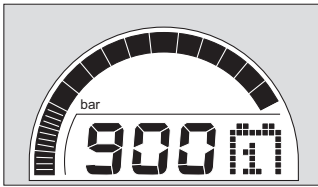
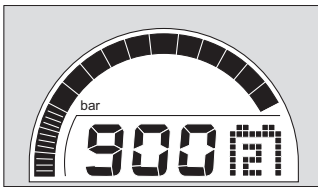
i NOTICE

The second residual pressure warning cannot be tested with this test.

To determine the exact trigger values, a pressure gauge comparative measurement must be carried out. This is described in the apparatus maintenance manual.

4.5.12 Switching off the Sentinel and checking the battery charge status

1. Simultaneously hold the right and left hand buttons on the Sentinel pressed down until a short beep sounds.
2. Release the buttons.
The charge status of the battery is displayed for 3 s. The charge status is displayed as follows:

Display on the Sentinel	Meaning
 <small>33621851.eps</small>	Battery OK: The battery charge is adequate, the battery does not need not be replaced.
 <small>20221851.eps</small>	Battery warning 1: A long warning tone sounds at the same time. With normal use of the Sentinel, the closed-circuit breathing apparatus remains fully functional for up to 4 hours. To ensure safe usage, however, the battery should be replaced when this warning is issued during the self-test before use.
 <small>20321851.eps</small>	Battery warning 2: At the same time, 5 short alarm tones sound and the red LEDs flash. The Sentinel automatically powers off and any further operation is impossible. The battery must be replaced before any new operation.

4.5.13 Closing the protective cover

- When all the tests have been completed successfully, close the protective cover on the closed-circuit breathing apparatus (see chapter 3.3.1 on page 10).

4.6 Inserting or replacing the Sentinel battery

The period of use of the battery depends on the following factors:

- Operating time of the Sentinel
- Frequency of alarms
- Ambient temperature
- Frequency of use of the back lighting

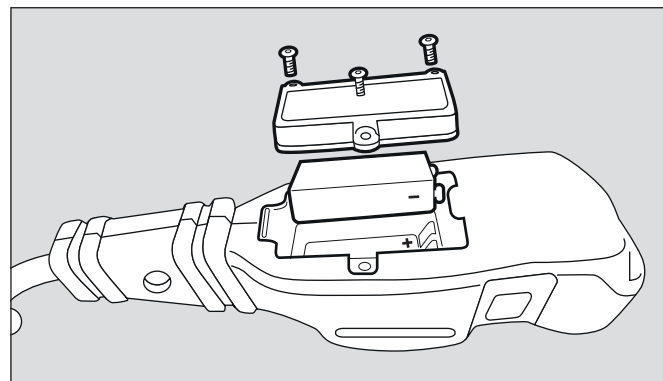
A small amount of energy is consumed even when the Sentinel is switched off. Dräger therefore recommends removing the battery from the Sentinel when the Sentinel is not being used for an extended period.



WARNING

- Only use the approved batteries given on supplement 90 21 716 and on the battery label in the battery compartment.
- 3. Never replace the battery in potentially explosive areas! Otherwise there is a risk of explosion!

1. Use a hexagon key (2 mm) to remove the 3 bolts from the battery compartment cover.
2. Carefully remove the cover.
3. Remove the old battery if necessary.
4. Insert the battery into the Sentinel. Ensure that the positive pole is positioned correctly.



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5. Insert the cover in the battery compartment.
6. Tighten the 3 bolts with a hexagon key (2 mm; torque: 0.4+0.1 Nm).

The Sentinel starts the self-test sequence. The Sentinel returns to operating mode: The operating mode display appears once again. The green LED starts to flash.

7. Simultaneously press the right and left hand button until a short beep sounds.
8. Release the buttons.
The Sentinel switches off.

4.7 Testing the functional capability of the Sentinel

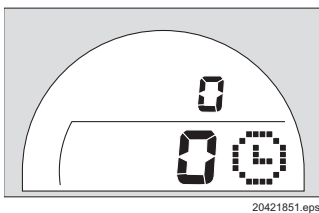
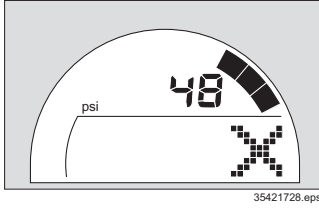
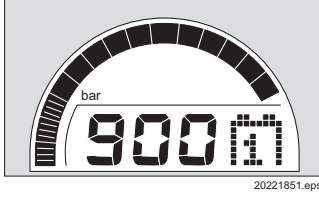
The Sentinel can be tested as follows without the cylinder valve having to be opened:

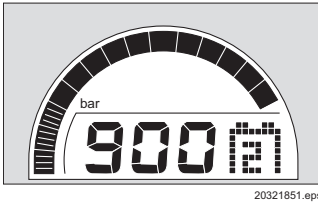
1. Press the left button on the Sentinel briefly.
The Sentinel switches itself on and tests all interfaces and the charge status of the battery.
If the Sentinel is OK, a pressure of 0 psi/0 bar and a remaining period of use of 0 minutes is displayed. The red LEDs flash.
2. Switch off Sentinel.
Simultaneously press the right and left hand button until a short beep sounds. The charge status of the battery is displayed for approx. 3 seconds. The Sentinel switches off.

WARNING

After this functional test, the closed-circuit breathing apparatus must not be used because the cylinder valve is closed and no oxygen is supplied to the circuit. Failure to follow this warning could lead to death or serious injury.

The Sentinel can display the following results:

Display on the Sentinel	Meaning
	The test has been completed successfully. The closed-circuit breathing apparatus cannot be used, however, as the compressed oxygen cylinder is closed.
	An error has occurred. Do not use the closed-circuit breathing apparatus. Check once again if the closed-circuit breathing apparatus functions correctly or have the device serviced by Dräger or trained experts.
	Battery warning 1 A long warning tone sounds at the same time. With normal use of the Sentinel, the closed-circuit breathing apparatus remains fully functional for up to 4 hours. To ensure safe usage, the battery should be replaced, however.

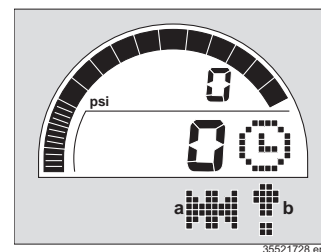
Display on the Sentinel	Meaning
	Battery warning 2 5 short alarm tones sound and the red LEDs flash at the same time. The Sentinel automatically powers off and any further operation is impossible. The battery must be replaced before any new operation.

4.8 Self-test sequence of the Sentinel

A single alarm tone sounds with each new display. The following steps are included in the Sentinel self-test sequence:

- Interface testing
The Sentinel tests all inputs and displays all symbols.
- Battery test
When the battery is tested, the Sentinel displays the battery symbol. On the display, the bar chart runs from left to right and the software version number is displayed.
- High pressure leak test
For the high pressure leak test, the pressure in the compressed oxygen cylinder must be >2600 psi/180 bar. After the test, the "Close cylinder valve" symbol is displayed and a dual alarm tone sounds.

An alarm sounds at the end of the self-test. Either the symbol "a" (function key is removed) or the symbol "b" (function key is inserted) is displayed briefly on the display.



NOTICE

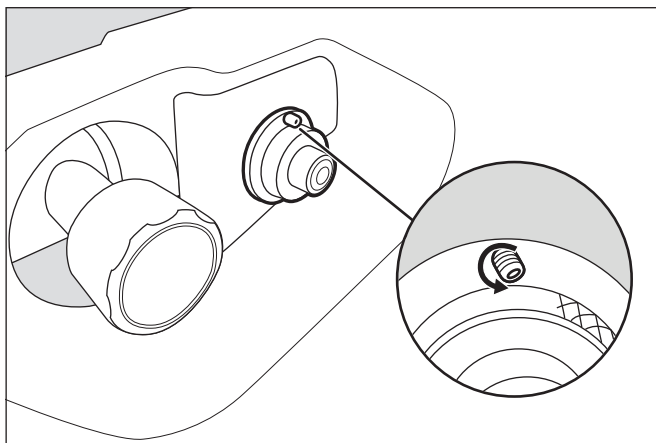
If the pressure in the compressed oxygen cylinder is less than 2600 psi/180 bar, no high pressure leak test is performed.

In this case, the Sentinel cylinder pressure and the remaining period of use are displayed.

4.9 Replacing the pressure reducer

4.9.1 Removing the pressure reducer

1. Remove the compressed oxygen cylinder (see chapter 4.2.1 on page 17).
2. Unfasten the medium-pressure hose from the pressure reducer (see chapter 4.2.11 on page 20).
3. Unfasten the high-pressure sensor using an open-end wrench (SW 17) and remove from the pressure reducer.
4. First unfasten the grub screw, then the crown nut.



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5. Remove the bypass valve switch and spring.
6. Take the pressure reducer out of the closed-circuit breathing apparatus.

4.9.2 Installing the pressure reducer



WARNING

When installing the pressure reducer, ensure that no dust or finger grease reaches the pressure reducer. Contact with oil, grease or similar contaminants can result in serious injuries or death. Either a fire, an explosion or both may also be caused.

Wear suitable protective gloves!

1. Install the pressure reducer into the closed-circuit breathing apparatus.
2. Install the spring and the bypass valve switch.
3. Install the reinforcing plate and the crown nut.
4. Secure the crown nut using the grub screw.
5. Install the high-pressure sensor into the pressure reducer and tighten gently with an open-end spanner (SW 17; torque: 15+5 Nm).
6. Insert the medium-pressure hoses into the pressure reducer. They must engage into place. Pull gently on the plugs to check that the medium-pressure hoses fit correctly.
7. Fit the compressed oxygen cylinder (see chapter 3.3.2 on page 11).

5 Transport

Ensure that the closed-circuit breathing apparatus is transported in an upright position so that the condensate in the breathing hoses can gather in the drain valve and breathing bag.

6 Storage

When the closed-circuit breathing apparatus is stored with fitted CO₂ absorber, the breathing circuit must be closed. The compressed oxygen cylinder does not have to be installed. The expiry date of the CO₂ absorber must not be exceeded during the next use.

Store the closed-circuit breathing apparatus ready for use in a dark, cool, dry, dirt-free and dust-free place. Avoid exposure to UV rays and ozone. The closed-circuit breathing apparatus should be stored upright as far as possible.

7 Disposal

Dispose of the closed-circuit breathing apparatus in accordance with the applicable rules and regulations.

Dräger accepts returned disposable CO₂ absorber cartridges for a charge. A decision on its subsequent use will be made when the product is returned. For information please contact the national sales organisations and Dräger.

Alternatively, the CO₂ absorber can be disposed of as follows:



CAUTION

Risk of chemical burns!

The chemicals in the CO₂ absorber react with the humidity in the atmosphere or water to form a caustic base. The base causes severe eye damage and skin irritation, it can also irritate the respiratory system.

Use protective goggles and base-resistant gloves when working with the CO₂ absorber.

1. Pack the CO₂ absorber in a bag and seal air-tight.
2. Dispose of the CO₂ absorber in accordance with the relevant regulations.

8 Technical data

Device characteristics

Dimensions, excl. harness and breathing hoses (L x W x H)	23.5" x 17.7" x 7.3" (595 x 450 x 185 mm)
Weight	
with filled carbon composite cylinder and Dräger FPS 7000 RP	30.64 lb (13.9 kg)
with filled carbon composite cylinder and Panorama Nova RP	30.42 lb (13.8 kg)
Breathing bag volume	5.5 l
Period of use under moderate service conditions ¹	240 minutes
Breathing resistance (at frequency f = 25/min Breathing cycle volume = 2 l)	
Inhalation	>0 mbar
Exhalation	<7 mbar
Compressed oxygen cylinders	carbon composite/ 2 l / 3000 psi
Oxygen quality	see chapter 3.3.2 on page 11
Accuracy of the Sentinel pressure measurement	±2 % of the final value

Ambient conditions

During operation

Minimum permissible temperature	23 °F (-5 °C) Minimum temperature of 5 °F (-15 °C) is permissible if the closed-circuit breathing apparatus was stored in a temperature range of 59 °F to 77 °F (+15 °C to +25 °C)
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Maximum permissible temperature (when using an ice pack)	when working at moderate ambient conditions: For temperatures of up to 104 °F (+40 °C) the period of use is up to 4 hours ¹ . For temperatures of 105 °F to 140 °F (+41 °C to +60 °C) the period of use is 1 hour ¹ . For temperatures of 141 °F to 194 °F (+61 °C to +90 °C) the period of use is 15 minutes ¹
--	---

Air pressure	900 hPa to 1200 hPa
Relative humidity	0 % to 100 %

During storage

Storage temperature	23 °F to 77 °F (-5 °C to +25 °C)
Air pressure	900 hPa to 1200 hPa
Relative humidity	30 % to 70 %

¹ When consuming 30 L/min.
Even if the recommended period of use is exceeded, the closed-circuit breathing apparatus will operate correctly. Only the temperature of the inhaled air will increase.

9 Order list

Name and description	Order number
Closed-circuit breathing apparatus¹:	
PSS BG 4 AP	R34607
PSS BG 4 APK	R34662
PSS BG 4 CP	R34608
PSS BG 4 CPK	R34663
Oxygen cylinders:	
Oxygen cylinder for PSS BG 4 AP/APK	B30229
Oxygen cylinder for PSS BG 4 CP/CPK	B30230
Full facepieces:	
Panorama Nova EPDM - PC - RP	R 53 306
Panorama Nova SI - PC - RP	R 53 316
Dräger FPS 7000 RP-EPDM-M2-PCas-EPDM	R 56 326
Dräger FPS 7000 RP-EPDM-M2-PCas-EPDM-TR	R 56 670
Dräger FPS 7000 RP-SI-M2-PCas-SI	R 56 672
Dräger FPS 7000 RP-SI-M2-PCas-SI-TR	R 56 673
Dräger FPS 7000 RP-EPDM-S1-PCas-EPDM	R 57 675
Dräger FPS 7000 RP-EPDM-L3-PCas-EPDM	R 57 676
Dräger FPS 7000 RP-SI-S1-PCas-SI	R 57 677
Dräger FPS 7000 RP-SI-L3-PCas-SI	R 57 678
Dräger FPS 7000 RP-EPDM-S1-PCas-EPDM-TR	R 58 135
Dräger FPS 7000 RP-EPDM-L3-PCas-EPDM-TR	R 58 136
Dräger FPS 7000 RP-SI-S1-PCas-SI-TR	R 58 137
Dräger FPS 7000 RP-SI-L3-PCas-SI-TR	R 58 138
CO₂ absorbers:	
CO ₂ absorber (disposable cartridge)	R34360
CO ₂ absorber (refillable cartridge, grey, empty)	R34277
CO ₂ absorber (refillable cartridge, transparent, empty)	R34367

Name and description	Order number
Consumables for refillable cartridges:	
Filter fleece, 200 units	R35754
Filling station	R33752
Support sieve	R34239
DRÄGERSORB 400	
4.5 kg	6738950
8 kg	6737965
18 kg	6737985
Molykote 111	1563572
Spare parts:	
Inhalation valve disk	R33934
Exhalation valve disk	R33934
O-ring for connecting piece	R18352
Medium pressure hose, yellow	R33145
Medium pressure hose, blue	R33144
Control line	R33143
Reinforcing ring for breathing hoses	R34161
Protective cap for connecting piece	R33588
Water absorber for drain valve	R34633
Battery for Sentinel	3355751
Ice receptacle	R33999
Radiant heat protection breathing hose	R34745
Radiant heat protection protective cover	R34646
Cleaning and disinfecting:	
NEUTRAL DISINFECTANT CLEANER	40 58 831
1008 GREEN LIQUID HAND DISH WASH	40 59 491
800 SPUR-TEX Disinfectant	40 59 492
Hose drying unit	On request
Adapter set for hose drying unit	R34098
Drying cabinet	On request
"klar-pilot" anti-fogging fluid	R52550
"klar-pilot" anti-fogging spray	R56542

Name and description	Order number
Test accessories:	
Dräger RZ 7000	R62500
Dräger Quaestor 5000 CCBA	R58317
Test set PSS BG 4 Plus	R33777
Accessories for the Sentinel:	
IR-Link II (IR-Link cable with RS232 plug and IR-Link software)	3351818
Windows-Software	on request

- 1 all apparatus without CO₂ absorber, full facepiece or compressed oxygen cylinder

10 Annex

Approval label



Dräger Safety AG & Co KGaA
D - 23560 Lübeck
Phone: 0111 491 451 8822/0
US Phone: 1-800-952-1131

PSS BG 4 Series



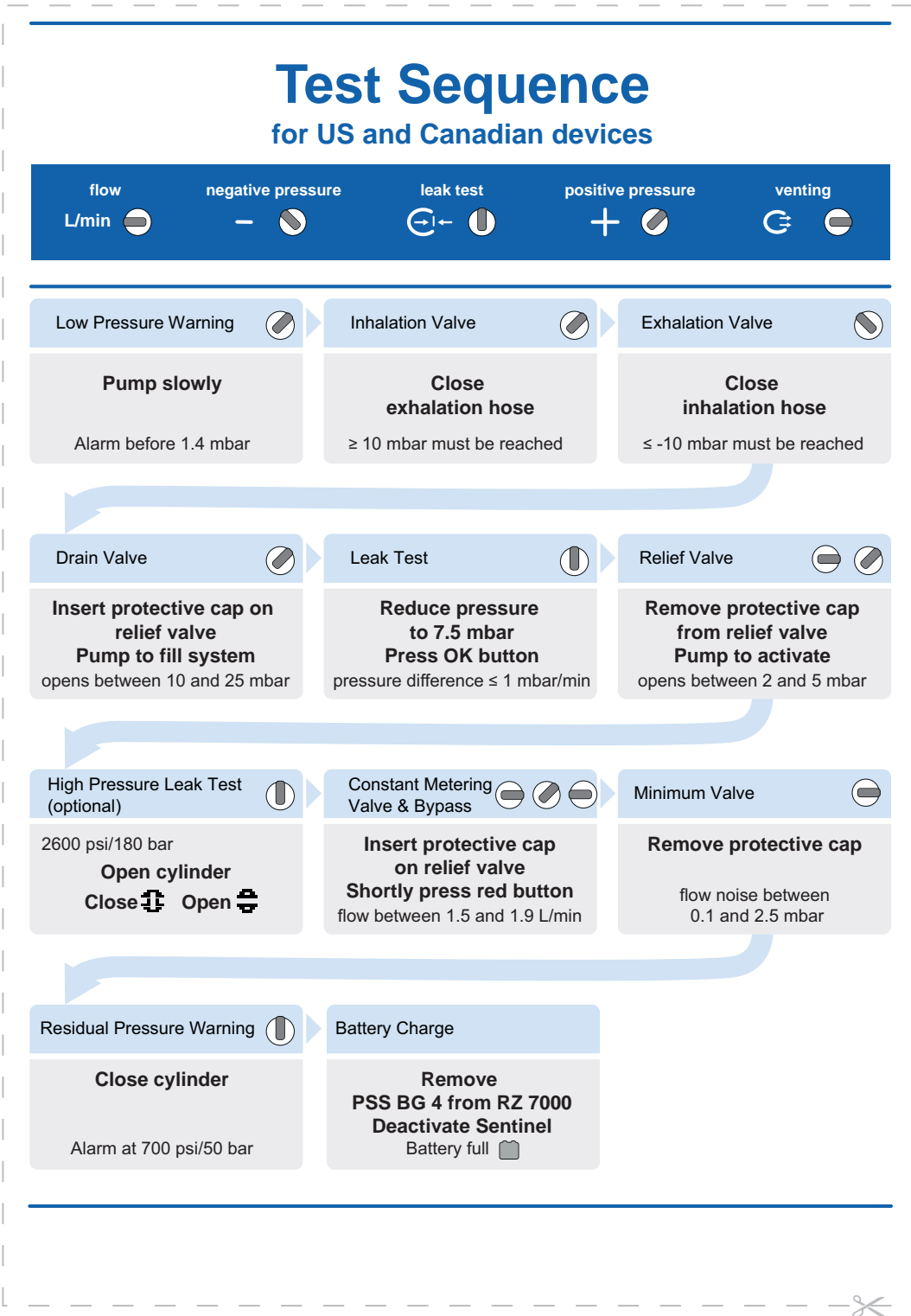
Quick-Circuit Demand, Entry and Escape Self-Contained Breathing Apparatus
or
Closed-Circuit Pressure Demand, Entry and Escape Self-Contained Breathing Apparatus
These respirators are approved only in the following configurations:

TC	Protection ¹	Respirator Components																			Cautions and Limitations ²																											
		Alternate Facepiece Assemblies																																														
13F340	DE/SCG (4 h) 3138 P50	R53306	R53316	R56326	R56672	R57675	R57676	R57677	R57678	R56670	R56673	R58135	R58137	R58136	R58138	R34320	R34680	R33125	R33870	R34140	3350994	R33960	R27082	803390	B30229	B30230	R34360	R34277	R34367	R34295	R34299	R34152	4057102	R56197	R56408	R61072	R56295	R61070	R26279	R50282	R34600	J1NNOS J1NNOS J1NNOS J1NNOS						
13F341	PD/SCG (4 h) 3135 P50	X	X	X											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
13F462	DE/SCG (4 h) 3135 P50	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
13F463	PD/SCG (4 h) 3135 P50	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

¹ **PROTECTION**
SC - Self-Contained
PD - Pressure-Demand
DE - Demand

² **CAUTIONS AND LIMITATIONS**
J - Failure to properly use and maintain this product could result in injury or death.
M - All approved respirators shall be selected, fitted, used, and maintained in accordance with MSHA, OSHA, and other applicable regulations.
N - Never substitute, modify, add, or omit parts. Use only exact replacement parts as the configuration as specified by the manufacturer.
O - Special or critical user's instructions apply. Refer to User's Instructions before donning.
S - Special or critical user's instructions and/or specific user instructions apply. Refer to User's Instructions before donning.

Optimum test sequence using the Dräger RZ 7000



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9021728 - GA 1114.115

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Edition 07 - October 2015 (Edition 01 - June 2007)
Subject to alteration