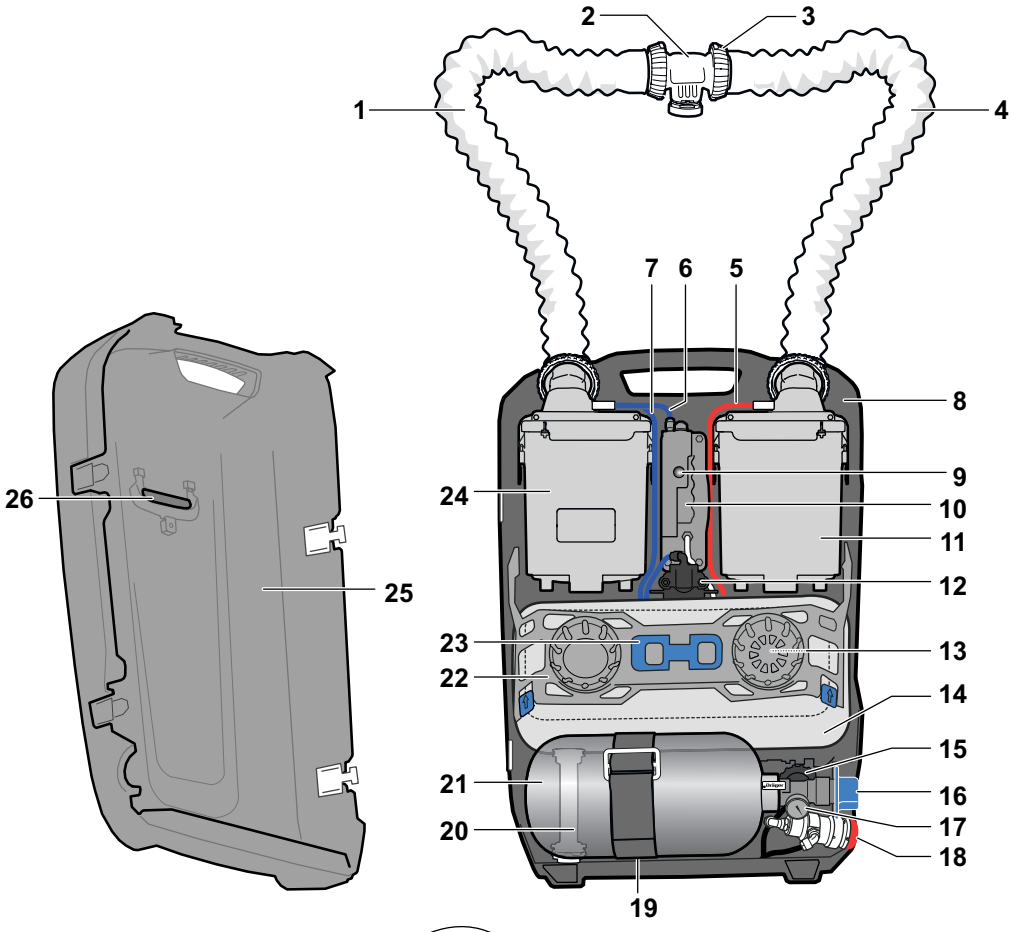
Instructions for use

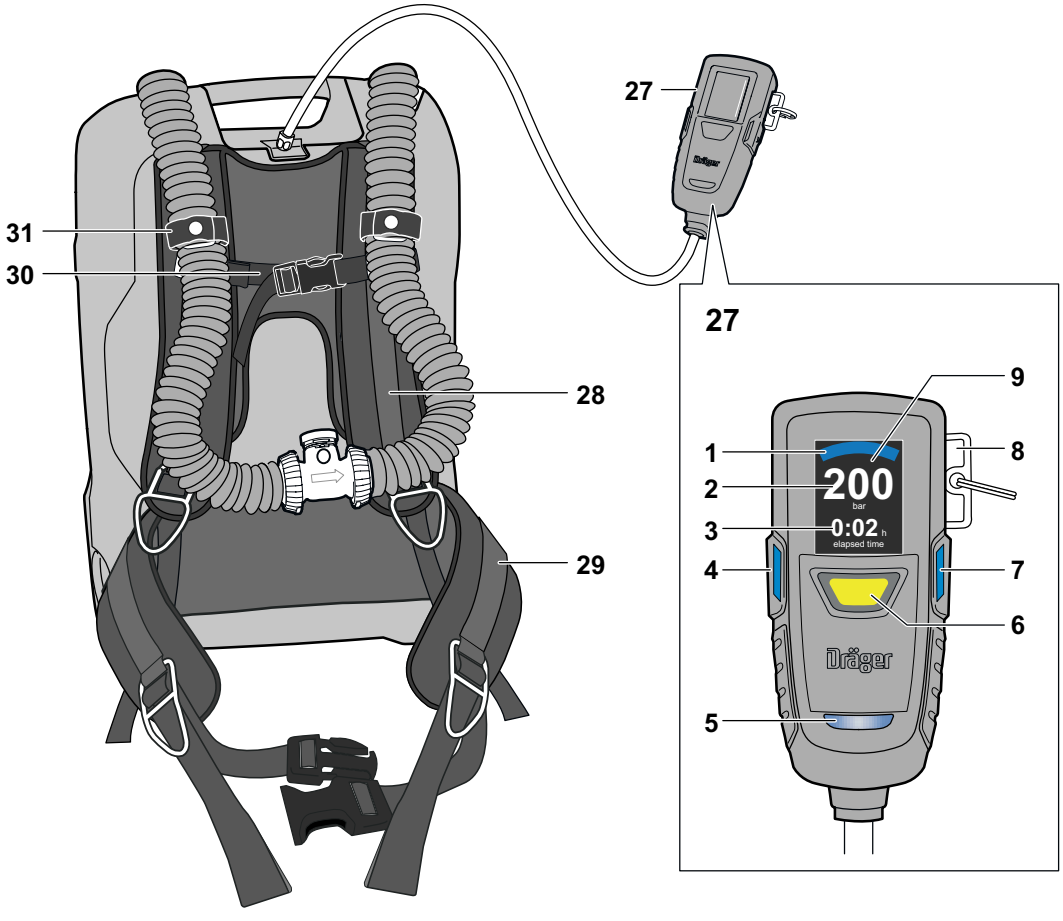
Dräger BG ProAir

More languages available
for download at draeger.com/ifu

⚠ WARNING
To properly use this product, read and comply with these instructions for use.

Dräger. Technology for Life®





ENus	Both the latest edition and other languages of these instructions for use can be downloaded in the Technical Documentation database (www.draeger.com/ifu). ENus = 9300898
FR	La notice d’utilisation peut être téléchargée dans sa présente version et dans d’autres langues sous forme électronique à partir de la base de données de documentation technique (www.draeger.com/ifu). FR = 9300899
ES	La edición actual y otros idiomas de estas instrucciones de uso pueden descargarse en formato electrónico en la base de datos de documentación técnica (www.draeger.com/ifu). ES = 9300900

Contents

1 Safety-related information

1.1 General

- 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.
- Failure to use the product as described in these instructions for use can lead to reduced protection.
- Do not dispose of the instructions for use. Ensure that they are stored and used appropriately by the 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.
- Only trained and qualified personnel are permitted to inspect, repair and service the product as detailed in these instructions for use (see "Maintenance", page 16). 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.
- Use only genuine Dräger spare parts and accessories. Otherwise, the proper functioning of the product may be impaired.
- Notify Dräger in the event of any component fault or failure.
- Do not use a faulty or incomplete product. Do not modify the product.

1.2 NIOSH 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 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.

The cautions and limitations are also listed on the approval label, please refer to supplement 9300897.

1.3 Special ’S’ or critical user’s instructions

- Approved for use at temperatures above 21 °F (-6 °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 CO_2 absorber must never be used after its indicated expiration date.
- Never re-use disposable CO_2 absorber cartridges.
- Only fill the refill absorber with Drägersorb 400. Pay attention to the safety data sheet for Drägersorb 400 when handling the CO_2 absorber!
- After each use of the closed-circuit breathing apparatus, a fully charged cylinder and a recharged/new CO_2 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 Conventions in this document

2.1 Meaning of the warning notices

The following warning notices are used in this document to alert the user to potential hazards. The meanings of the warning notices are defined as follows:

Warning sign	Signal word	Classification of the warning notice
⚠	WARNING	Indicates a potentially hazardous situation. If not avoided, it could result in death or serious injury.
⚠	CAUTION	Indicates a potentially hazardous situation. If not avoided, it could result in physical injury. It may also be used to alert against unsafe practices.
	NOTICE	Indicates a potentially hazardous situation. If not avoided, it could result in damage to the product or environment.

2.2 Trademarks

Trademark	Trademark owner
Bluetooth®	Bluetooth SIG, Inc.

The following website lists the countries in which the trademarks from Dräger are registered: www.draeger.com/trademarks.

The trademarks listed are only registered in certain countries and not necessarily in the country in which this document is published.

3 Description

3.1 Product overview

See overview graphic at the start of the instructions:

1 Exhalation hose
2 Connecting piece with protective cap
3 Bayonet ring
4 Inhalation hose
5 Bypass hose (red)
6 Medium-pressure hose to sensor unit (blue)
7 Medium-pressure hose for the oxygen supply (blue)
8 Carrying frame
9 Buddy-light
10 Onboard electronics (sensor unit)
11 Breathing air cooler
12 Minimum valve
13 Relief valve (under the spring bridge)
14 Breathing bag
15 Pressure reducer incl. hand wheel
16 Hand wheel of cylinder valve
17 Pressure indicator on cylinder valve
18 Bypass button
19 Cylinder strap
20 Drain valve (between carrying frame and compressed oxygen cylinder)
21 Compressed oxygen cylinder
22 Spring bridge
23 Locking lever
24 CO_2 absorber
25 Lid
26 Window for buddy-light
27 Connect ECU ("Electronic Control Unit")
27-1 Graphical pressure display
27-2 Cylinder pressure
27-3 Time (expired or remaining)
27-4 Left button
27-5 LED panel
27-6 Manual alarm button
27-7 Right button
27-8 Function key
27-9 Display
28 Shoulder strap
29 Waist belt
30 Chest strap (optional)
31 Hose strap

3.2 Functional description

3.2.1 Closed-circuit breathing apparatus

The closed-circuit breathing apparatus is a positive-pressure-operated self-contained closed-circuit breathing apparatus. 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 CO_2 absorber. The following absorber types are available:

– Disposable absorber
– Refill absorber
– Training absorber

Every CO_2 absorber has an RFID tag. An RFID reader in the onboard electronics detects the type of absorber installed in the closed-circuit breathing apparatus and how long the CO_2 absorber has already been installed in the closed-circuit breathing apparatus. This RFID feature is optional and can be activated in the Connect ECU.

The breathing air streams from the CO_2 absorber into the breathing bag.

The breathing air is enriched with oxygen from the compressed oxygen cylinder. The following apparatus versions are available:

– Apparatus with constant oxygen dosage
– Apparatus with on-demand oxygen dosage

Apparatuses with constant oxygen dosage use the constant dosage device to continuously supply a constant volume of oxygen to the breathing circuit. In the event of greater breathing intensity, the additional oxygen required is supplied in the breathing circuit via the minimum valve.

Apparatuses with on-demand oxygen dosage have an automatic pre-flush unit. The pre-flush unit ensures that adequate oxygen is supplied in the breathing circuit when the compressed oxygen cylinder is opened at the start of an incident. During the incident, additional oxygen is supplied in the breathing circuit via the minimum valve in accordance with breathing intensity.

The bypass button lets the user add oxygen to the breathing circuit at any time.

Before the regenerated air is inhaled again, it flows through the air cooler. The following cooler options are available:

– Ice cooler
  The ice cooler contains ice packs that can be refrozen after use.
– Regeneration cooler
  The regeneration cooler (PCM [phase chage material] cooler) contains a latent heat storage medium which extracts some of the thermal energy from the alveolar air. This melts the latent heat storage medium. After use, the latent heat storage medium resolidifies when it is stored in a cool place. This phase transition occurs at a temperature of around 80 °F (+27 °C). Afterwards, the regeneration cooler is once again ready for use. The maximum storage temperature must not be exceeded in order to ensure the regeneration cooler retains its full cooling capacity.

The closed-circuit breathing apparatus is connected to a facepiece via a connecting piece.

3.2.2 Electronic monitoring system

The electronic monitoring system contains the onboard electronics, the Connect ECU and the buddy-light.

The onboard electronics check various parameters of the closed-circuit breathing apparatus. The results are visually displayed on the Connect ECU and/or acoustically emitted. In addition, the Connect ECU can be used as an automatic distress signal unit.

The Connect ECU displays the cylinder pressure and remaining period of use, among other things. The system statuses are signalled by LEDs. Alarms and status messages are also emitted acoustically.

The functions and times can be configured with the Dräger PC Link software. The following describes the standard configuration of the apparatuses upon delivery. The latest firmware updates can be downloaded at www.draeger.com/software.

Alarms

No-oxygen alarm	The alarm is issued when the user is breathing from the apparatus and the compressed oxygen cylinder is closed or empty.
Low-pressure alarm 1	The alarm is issued when the cylinder pressure is 650 psi (45 bar)[1)].
Low-pressure alarm 2	The alarm is issued when the cylinder pressure is 150 psi (10 bar).
Pre-alarm (motion sensor)	The alarm is triggered when the motion detection is active (function key removed) and the Connect ECU does not detect any significant movement for 30 seconds.
Main alarm (motion sensor)	The alarm is triggered 15 seconds after the pre-alarm (motion sensor), once the pre-alarm (motion sensor) is not acknowledged.
Main alarm (manual)	The alarm is triggered when the manual alarm button is pressed.
Battery alarm	The alarm is triggered when the charge status of the battery reaches a critical level during operation.

1) The value is configurable

Status messages

Time remaining until low-pressure alarm 1	The electronic monitoring system uses the cylinder pressure and the respiration to compute the time until the warning whistle sounds. A respiration of 30 L/min is initially assumed. The computation of the remaining time is then updated once per second with the specific respiration (but at least 30 L/min).
Elapsed time	The elapsed time indicates how long the Connect ECU has been switched on.
Temperature	The temperature shows the ambient temperature of the Connect ECU.

Statuses of the Connect ECU

– On mode
  The Connect ECU switches from On mode to Standby mode in the following cases:
  – If the apparatus has not been moved for an extended period of time and the system pressure is 0 psi (0 bar).
  – If both buttons on the Connect ECU are pressed for at least 2 seconds and the system pressure is below 90 psi (6 bar).
– Standby mode
  When the apparatus is not being moved, the Connect ECU switches from Standby mode to Eco mode after 60 minutes.

The Connect ECU switches from Standby mode to On mode in the following cases:

- When the compressed oxygen cylinder is opened.
- When a button is pushed on the Connect ECU for at least 2 seconds.
- When the function key is removed.
- When the user breathes from the apparatus. When the user is no longer breathing from the apparatus, the Connect ECU returns to Standby mode after approx. 10 seconds.

ℹ Even when the Connect ECU is in Standby mode, it recognises when the user is breathing from the apparatus. If the compressed oxygen cylinder is closed or empty, the no-oxygen alarm will be triggered.

- Eco mode
  As soon as the closed-circuit breathing apparatus is moved, the Connect ECU switches back from Eco mode to Standby mode.
  The Connect ECU switches from Eco mode to On mode in the following cases:
  - When a button is pushed on the Connect ECU
  - When the function key is removed
- Off
  When the batteries are empty, the Connect ECU is switched off. When new batteries are inserted, the Connect ECU automatically switches to On mode. An acoustic signal sounds. Various information and queries are shown on the display.

ℹ In Eco mode, opening the cylinder will not be recognised and the no-oxygen alarm is deactivated.

ℹ The various states of the Connect ECU allow for maximum operational readiness with minimum power consumption.

Details on the display when turning the apparatus on

ℹ The information and queries shown when the Connect ECU switches to On mode depend on how the Connect ECU is turned on (cylinder valve is opened, a button on the Connect ECU is pushed, batteries are inserted, function key is removed) and on the individual configuration.

The following information and queries are displayed when the cylinder valve is opened and the Connect ECU switches to On mode (procedure with default software settings):

- Displays the battery charge status
- Queries whether the high-pressure leak test is to be carried out
- Display of filling pressure for the compressed oxygen cylinder and the "Remaining time until low-pressure alarm 1"

Alternatively, pushing the button on the left or right displays either the "Elapsed time" or the "Temperature".

Use as distress signal unit

The user can trigger a distress signal using the manual alarm button if the user cannot retreat from the hazard area.

The Connect ECU can automatically issue an alarm if the user is no longer moving. To do so, the function key must be removed from the Connect ECU. If no further motion is detected, a pre-alarm sounds after a defined time (default setting: 30 seconds). If any movement is detected within the following approx. 15 seconds, the pre-alarm is cancelled. If no motion is detected, the main alarm sounds.

ℹ The motion sensor only detects movements or vibrations. The motion sensor does not detect whether the user is moving independently. If the user is not moving independently, but is located on a moving surface, the distress signal unit may not issue an alarm.

Buddy-light

The buddy-light in the lid ensures that the closed-circuit breathing apparatus and the user remain visible even in poor visibility. Team colleagues are notified of warnings and alarms on this closed-circuit breathing apparatus.

3.2.3 Status indicators

The status of the closed-circuit breathing apparatus is signalled with LEDs and sounds. The blue and red LEDs of the Connect ECU and the buddy-light show the same thing. The states of the closed-circuit breathing apparatus are signalled as follows:

LEDs	Sound	Meaning
Pulsing blue	-	The apparatus is functioning correctly.
Pulsing red	Intermittent sound	Cylinder pressure below 1450 psi (100 bar)
Flashing red	Intermittent sound	Low-pressure warning 1 Low-pressure warning 2
Flashing red	2 sounds, descending	The charge state of the battery is critical.
Flashing red/blue alternately	3 sounds, ascending	Pre-alarm for distress signal unit
Flashing blue three times, then red three times	Piercing, repetitive alarm sound	Main alarm of distress signal unit
Flashing green (only on Connect ECU)	-	The function key has been removed from the Connect ECU.
Flashing blue three times, then red three times	Intermittent sound	No-oxygen alarm

3.2.4 Accessories

Dräger provides the following accessories for the closed-circuit breathing apparatus:

– Grip clamp
  The handle can be additionally secured with the grip clamp in particularly tough operating conditions or high temperatures.
– Skids
  Skids can be attached to the lid. The skids serve as spacers when the closed-circuit breathing apparatus needs to be pushed along a surface, and reduce any wear to the lid.
– Training absorber
  The training absorber can be used to reduce soda lime consumption during training missions.When inserted into the closed-circuit breathing apparatus, the training absorber is detected automatically by the Connect ECU. The Connect ECU enters a training mode with reduced mission time. In addition to other messages, a note about the training mode is indicated on the display. Even if the cylinder pressure is higher, only 1450 psi (100 bar) are indicated. The Connect ECU indicates both mission time and alarms accordingly.

⚠ CAUTION
Reduced mission time!
The training absorber does not have the same capacity as a disposable absorber or refill absorber.

► Only use the training absorber in supervised training missions. Do not store or transport the training absorber.

3.3 Intended use

The closed-circuit breathing apparatus supplies the user with breathing air for approx. 4 hours, thus making it independent from the oxygen-deficient and polluted ambient air.

3.4 Limitations on use

3.4.1 General information

The closed-circuit breathing apparatus is not intended for use as a diving apparatus. Brief and/or complete immersion of the apparatus in water (e.g. when navigating a waterhole in a mine) will not impair the function of the closed-circuit breathing apparatus.

ℹ If the closed-circuit breathing apparatus has been completely immersed or the pressure reducer highly contaminated, the pressure reducer must be thoroughly cleaned in order to prevent any contamination from reaching the inside of the pressure reducer.

3.4.2 Measures with temperatures below 32 °F (0 °C)

ℹ The closed-circuit breathing apparatus has been approved by NIOSH for use above 21 °F (-6 °C) only. Nevertheless, the device might be used at lower temperatures when the measures given below are taken.

The use of cooling media is not mandatory. If the closed-circuit breathing apparatus is to be used at temperatures below 32 °F (0 °C), the use of a cooling medium is not recommended. The following measures must be taken, however:

Ambient temperatures	Measure	
	A	**B**
32 °F to 21 °F (0 °C to -6 °C)	x	
21 °F to 5 °F (-6 °C to -15 °C)	x	x
5 °F to -40 °F (-15 °C to -40 °C)	x	x

– Measure A:
  The full face mask visor can fog up from the inside and freeze, restricting vision. To prevent freezing, treat the visor with the anti-fog solution given in the instructions for use for the full face mask. Do not use any other agent.
– Measure B:
  Store the closed-circuit breathing apparatus at temperatures of 50 °F to 77 °F (+10 °C to +25 °C) to ensure that all parts are functioning correctly.

If the closed-circuit breathing apparatus is used at temperatures below 21 °F (-6 °C), this may lead to shorter life cycles (see "Technically possible period of use", page 29).

3.4.3 Restrictions to the usage period

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

– The user is of average size and in good physical health.
– The working conditions are moderate, with the respiratory volume at approx. 30 L/min per minute.
– The filling pressure of the compressed oxygen cylinder is at least 2600 psi (180 bar).
– The apparatus has been adequately maintained and tested.
– The full face mask is fitted correctly on the face and creates a tight seal.

The period of use can be reduced considerably by the following factors:

- Physical condition of the user
- The degree of exertion (the harder the user works, the higher the oxygen consumption)
- The emotional condition of the user (the more anxious or excited the user, the greater the oxygen consumption)
- The condition of the apparatus (e.g. poorly maintained or poorly adjusted apparatus may leak and should therefore always be maintained according to the respective instructions for use)
- Filling pressure of the compressed oxygen cylinder before use less than 2600 psi (180 bar)
- Ambient temperature (see "Ambient conditions", page 29).

3.5 Approvals

For information on approvals see supplement 9300897.

3.6 Explanation of symbols

3.6.1 Symbols on the labels

The apparatus is approved for use in explosion-hazard areas. Observe the specification.

Observe the disposal information.

Please note! Observe the instructions for use.

3.6.2 Symbols on the Connect ECU display

Menu

Confirm, successful, complete

Turn off

Cancel, not successful, cancelled

Try again

Next menu item

Automatic distress signal is enabled

Automatic distress signal is disabled

Alarm: Motion sensor has triggered

Alarm: Manual alarm triggered

Warning: Motion sensor has triggered

No-oxygen alarm

Menu: No CO_2 absorber present

Menu: Expiration date of CO_2 absorber not yet reached

Menu: CO_2 absorber has reached the expiration date

Menu: Query whether the CO_2 absorber has been re-filled

Menu: Charge status of battery unknown

Menu: Charge status of battery 100 %

Menu: Charge status of battery 75 %

Menu: Charge status of battery 50 %

Menu: Charge status of battery 25 %

Menu: Warning for the charge status of the battery. However, there is enough charge for at least four more hours.

Menu: Charge status of battery is critical. There is no charge left in the battery and the Connect ECU switches off.

Charge status of the battery has become critical during operation

Menu: Incorrect type of battery inserted

Menu: Open cylinder valve

Menu: Close cylinder valve

Menu: Query whether a high-pressure leak test is to be carried out

Menu: High-pressure leak test or low-pressure leak test running

Menu: High-pressure leak test or low-pressure leak test successful

Menu: Test of no-oxygen alarm during high-pressure leak test successful
(oxygen supply ok/sensor cable connected)

Menu: Test of no-oxygen alarm during high-pressure leak test failed
(no oxygen supply/no sensor cable connected)

Menu: High-pressure leak test or low-pressure leak test not carried out

Menu: High pressure for the high-pressure leak test too low

High-pressure leak test failed due to low dosage

Menu: High-pressure leak test or low-pressure leak test interrupted

Menu: Error during high-pressure leak test or low-pressure leak test

Menu: High-pressure leak test or low-pressure leak test not OK; the apparatus has a leak.

Menu: Query whether a low-pressure leak test is to be carried out

Menu: Low-pressure leak test: Pressure in breathing bag insufficient

	Menu: Low-pressure leak test: Fill breathing bag
	Menu: Query whether to lower the volume of the acoustic signals (Quiet mode)
	Menu: Reading UserID card
	Menu: UserID card was not found
	Menu: Invalid data on the UserID card
	Menu: Query: Is a Bluetooth® connection required?
	Menu: Preparing Bluetooth® connection
	Menu: Searching for Bluetooth® connection
	Menu: Bluetooth® connection interrupted
	Menu: Bluetooth® connection established
	Menu: Time-out when creating a Bluetooth® connection
	shown instead of the link status if the Connect ECU lost connection with the telemetry radio

4 Use

4.1 Prerequisites for use

4.1.1 General information

- 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 protective clothing and head protection that also needs to be worn during the incident has been clarified. Dissipative protective clothing should be worn for use in explosion-hazard areas.
- The leak and functional test on the closed-circuit breathing apparatus showed no faults (see "Testing the closed-circuit breathing apparatus", page 24).
- The requirements, as described in chapter 4.1.2 and 4.1.3, have been met.

4.1.2 Compressed oxygen cylinder

⚠ WARNING
Risk of fire!
Contact between high-pressure oxygen and oils, greases, organic materials or similar contamination may cause a fire. This can lead to serious physical injuries or death.
► Make sure connections are kept clean and free of dirt.

- The filling pressure of the compressed oxygen cylinder should be no less than 2600 psi (180 bar) in order to be able to achieve the maximum period of use possible.
- The compressed oxygen cylinder may only be filled with oxygen that meets the following quality requirements:
  - Purity: ≥ 99.5 Vol% oxygen
  - Water content: ≤ 0.05 mg/L oxygen
  - Tasteless and odorless
  - National regulations apply for the maximum permissible contaminants, in USA for example:
    Carbon monoxide (CO): 0.001 Vol.-%
    Carbon dioxide (CO_2): 0.03 Vol.-%

4.1.3 CO_2 absorber

Refill absorber

- The refill absorber was filled before use and within the last 6 months. The soda lime used must meet the requirements specified in chapter 5.2.7.3.
- The expiration date of the CO_2 absorber has not yet expired when scheduled to be used.
- As soon as the refill absorber is installed in the closed-circuit breathing apparatus, the CO_2 absorber can be stored for 6 months. The apparatus must have successfully passed the leak test and be sealed with the protective cap.
- The air-tight shrink-wrapped or installed CO_2 absorber was not transported on a vehicle further than 750 km.

Disposable absorber

- The barrier bag is completely sealed and intact until the disposable absorber is installed.
- The expiration date of the CO_2 absorber has not yet expired when scheduled to be used.
- Once the disposable absorber is installed in the closed-circuit breathing apparatus, the storage time of the CO_2 absorber is 6 months, even if the soda lime could be used for a longer period, the breathing bag, breathing hose and medium-pressure hose are connected and the connecting piece is sealed with a protective cap.
- The air-tight shrink-wrapped or installed CO_2 absorber was not transported on a vehicle further than 1500 km.

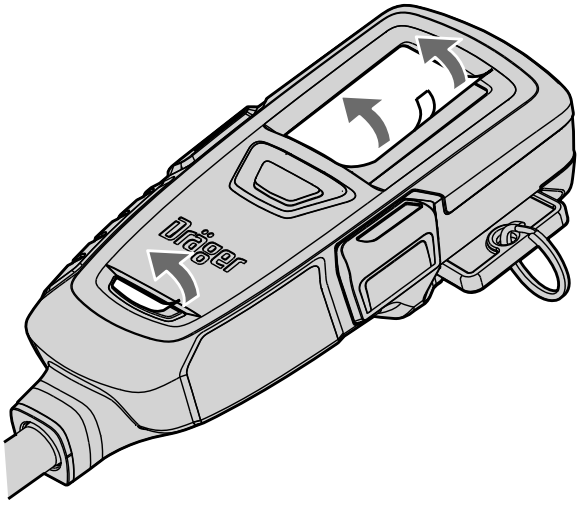
4.1.4 Reuse

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 whether the remaining oxygen supply is adequate before each further use.
– The cylinder valve is fully closed after every use. The connecting piece is sealed with the protective cap.
– The compressed oxygen cylinder and CO_2 absorber are not replaced.
– The ambient temperature is no less than 50 °F (+10 °C) when the closed-circuit breathing apparatus is not being used.
– The closed-circuit breathing apparatus is kept in an upright position.

4.2 Prior to first use

1. Perform a visual inspection. The closed-circuit breathing apparatus must be intact and complete.
2. Insert batteries into the closed-circuit breathing apparatus (see "Replacing the batteries", page 28).
3. Remove the thin, flexible protective foil from the LC display and the LED panel on the Connect ECU. The LC display and LED panel also have a clear, protective cover that must not be removed.



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4. Carry out a leak and functional test (see "Testing the closed-circuit breathing apparatus", page 24).

4.3 Preparations for use

4.3.1 Freezing the ice packs (for apparatuses with ice cooler)

1. Stack the ice packs flat on top of each other.
2. Freeze the ice packs at 3 °F (-16 °C) for 24 hours.

If significant deformations are apparent on the ice pack, allow the ice pack to thaw and then freeze again. Dräger recommends using the respective freezing aid to prevent the ice packs from deforming.
Make sure that no ice is deposited on the ice packs. If necessary, place ice packs in a bag, seal the bag and freeze the ice packs whilst they remain in the bag.
Dräger recommends storing completely frozen ice packs in a sealed bag in the freezer.

4.3.2 Inserting ice packs (for apparatuses with ice cooler)

The breathing circuit will not be opened when the ice packs are inserted into the ice cooler. A leak test is not required.

1. Open the closed-circuit breathing apparatus (see "Opening the closed-circuit breathing apparatus", page 18).
2. Open the ice cooler.
3. Insert the ice packs.

Only use ice packs that are not deformed. Do not press the ice packs into the ice cooler to ensure they do not become damaged and leak.

4. Close the ice cooler.
5. Close the closed-circuit breathing apparatus (see "Closing the closed-circuit breathing apparatus", page 24).

4.3.3 Donning the closed-circuit breathing apparatus

1. Open the quick-release buckles of the waist belt and chest strap.
2. Unfasten both shoulder straps. To do so, push the adjusting clamp upwards with your thumb and pull on the adjusting clamp.
3. Hang the breathing hoses over the lid.
4. Reach your arms through the shoulder straps and lift up the closed-circuit breathing apparatus.
5. Position the closed-circuit breathing apparatus.
6. Make sure that the shoulder straps are tensioned so that the padding on the waist belt rests on your hips.
7. Close the waist belt and adjust the width. To do so, pull the ends of the belt taut until the closed-circuit breathing apparatus rests firmly on your hips.
8. Place the breathing hose in front of your body.
9. Evenly pull the shoulder straps taut and adjust them so that the apparatus is comfortable to wear.
10. If necessary, close the chest strap and pull taut.
11. Don the full face mask.
12. Slowly open the cylinder valve at least two turns.
    The Connect ECU automatically switches to On mode.
    An acoustic signal sounds.
    The battery status is shown on the display.
    The Connect ECU queries whether to carry out the high-pressure leak test. If the test is to be carried out, the symbol and the current pressure are displayed.

A high-pressure leak test can only be carried out if the cylinder pressure is at least 2175 psi (150 bar).

13. Close the cylinder valve.
    Use the Connect ECU to confirm that the cylinder valve has been closed.
    The test is carried out.
    The result of the test is shown after approx. 15 seconds.
    The following results may occur:
    – The closed-circuit breathing apparatus is OK. and are shown on the Connect ECU display.
    – An error has occurred. Either and or and are shown on the Connect ECU display.
      Repeat the test or have the apparatus serviced.
    If the test was successful, the display switches to pressure readings.
14. Completely open the cylinder valve.
15. Use the display on the Connect ECU to check that there is adequate oxygen in the cylinder for the period of use.
16. Remove the protective cap from the connecting piece on the closed-circuit breathing apparatus.
17. Inhale, hold your breath and insert the connecting piece on the closed-circuit breathing apparatus into the connecting piece on the full face mask. A click can be heard when the connecting piece engages.
18. Continue breathing as normal.
19. Firmly squeeze the inhalation hose and breathe in until there is negative pressure in the mask. Do not breathe in for approx. 10 seconds. The negative pressure must remain unchanged, otherwise tighten the harness of the full face mask.
20. Continue as follows:

    If the closed-circuit breathing apparatus is OK:

    - The blue LEDs of the Connect ECU and the buddy-light pulse blue. The cylinder pressure is displayed on the Connect ECU. Additional information is displayed depending on the setting. The apparatus can now be used.

    If an error was detected:

    - An acoustic and optical warning is emitted on the Connect ECU. The closed-circuit breathing apparatus must not be used.

4.3.4 Activating the automatic distress signal function

- Remove the function key from the Connect ECU.
  This activates the motion sensor.
  The symbol is displayed.

4.4 During use

4.4.1 General information

– The chemical process during CO_2 absorption creates heat and moisture. This is a normal process that does not impair the functional integrity of the closed-circuit breathing apparatus.
– The closed-circuit breathing apparatus continues to supply breathing air even if the electronics fail. In this case, the user should retreat immediately.

4.4.2 In an emergency

– To request help, press the alarm button on the Connect ECU. The main alarm sounds, the symbol is displayed and the red and blue LEDs flash.

⚠ WARNING
Danger to life!
If there are any faults on the closed-circuit breathing apparatus, the protection provided by the apparatus may be reduced.
► In the event of faults on the closed-circuit breathing apparatus, retreat immediately!

– In the event of a malfunction of the automatic oxygen supply (failure of minimum valve and/or constant dosage), briefly press the red bypass button. Additional oxygen is supplied to the breathing circuit.

4.4.3 Acknowledging the alarm

- To acknowledge the main alarm, either insert the function key into the Connect ECU or press and hold the right and left button on the Connect ECU for approx. 3 seconds.

4.5 After use

1. Unplug the connecting piece from the full face mask: Press the button on the full face mask and simultaneously remove the connecting piece from the full face mask.
2. Close the cylinder valve immediately after pulling out the connecting piece. The air is automatically released from the breathing circuit.
3. Place the protective cap on the connecting piece of the closed-circuit breathing apparatus.
4. Remove the full face mask.
5. Turn off the Connect ECU: If the pressure in the closed-circuit breathing apparatus is 0 psi (0 bar), press and hold the right and left button for 3 seconds. The display first shows 3 - 2 - 1, then the battery status.
6. Take off the closed-circuit breathing apparatus:
   a. Open the quick-release buckles of the waist belt and chest strap.
   b. Loosen the shoulder straps.
   c. Lift the closed-circuit breathing apparatus over your head and away from your body. Place the closed-circuit breathing apparatus upright on the ground. Do not drop the apparatus!
7. Have the closed-circuit breathing apparatus serviced.

5 Maintenance

5.1 Maintenance intervals

Dräger recommends the following maintenance intervals. Observe any national guidelines that may stipulate different intervals.

	After use	Every 6 months	Annually	Every 5 years	Every 10 years
Visual inspection of all parts, Testing the functional integrity and tightness of the closed-circuit breathing apparatus	X		X[1)]		
Cleaning and disinfecting the closed-circuit breathing apparatus	X		X[1)]		
Replacing the CO_2 absorber	X	X[2)]			
Hydrostatic testing of the compressed oxygen cylinder[3)]				X	
Pneumatic overhaul[4)]					X

1) Applies for stored apparatuses.
2) Applies for CO_2 absorbers that are installed in a closed-circuit breathing apparatus and whose functional integrity and tightness were tested with the apparatus. The protective cap must be attached to the connecting piece of the closed-circuit breathing apparatus.
3) by a certified service provider
4) only performed by service personnel certified either by Dräger or by an organization authorized by Dräger

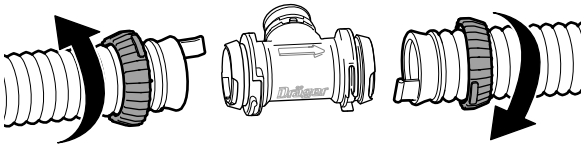
5.2 Maintenance work

5.2.1 General notes on handling

Breathing hoses

The breathing hoses are secured on the connecting piece, on the CO_2 absorber and on the breathing air cooler with bayonet rings.

– To remove, rotate the bayonet rings counterclockwise and use the flap to pull the breathing hoses off the relevant component.



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– Every breathing hose has one thick, narrow flap and one thin, wide flap. The flaps, connecting piece, CO_2 absorber and breathing air cooler are each marked with a triangle or a circle. The end with the thin flap (marked with a triangle) is fastened on the connecting piece on the side with the exhalation valve (marked with a triangle) and to the breathing air cooler (marked with a triangle). The end with the wide flap (marked with a circle) is fastened on the connecting piece on the side with the inhalation valve (marked with a circle) and on the CO_2 absorber (marked with a circle). When fitting the items, make sure that the width of the flap corresponds to the width of the recess and that the markings match.
– Push the end of the breathing hose onto the connection. The flap must be positioned in the recess when tightening the bayonet ring.
– Rotate the bayonet ring clockwise onto the connection to fasten the breathing hose. The breathing hose is correctly fitted when a clicking sound is heard while tightening and the bayonet ring has some play. The bayonet ring (1) must sit flush with the edge of the relevant connection.

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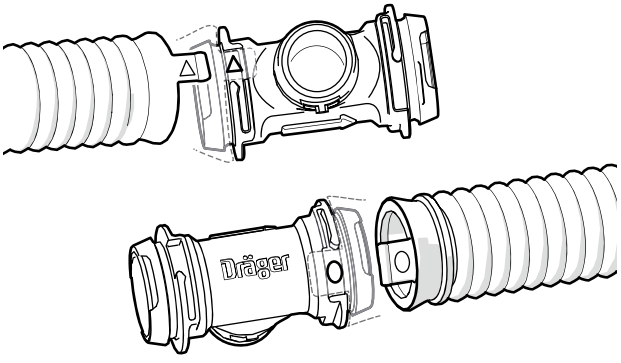
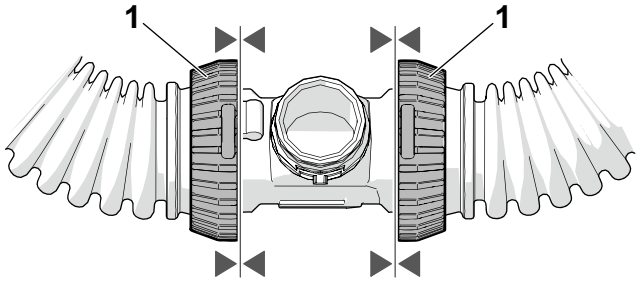




Medium-pressure hoses

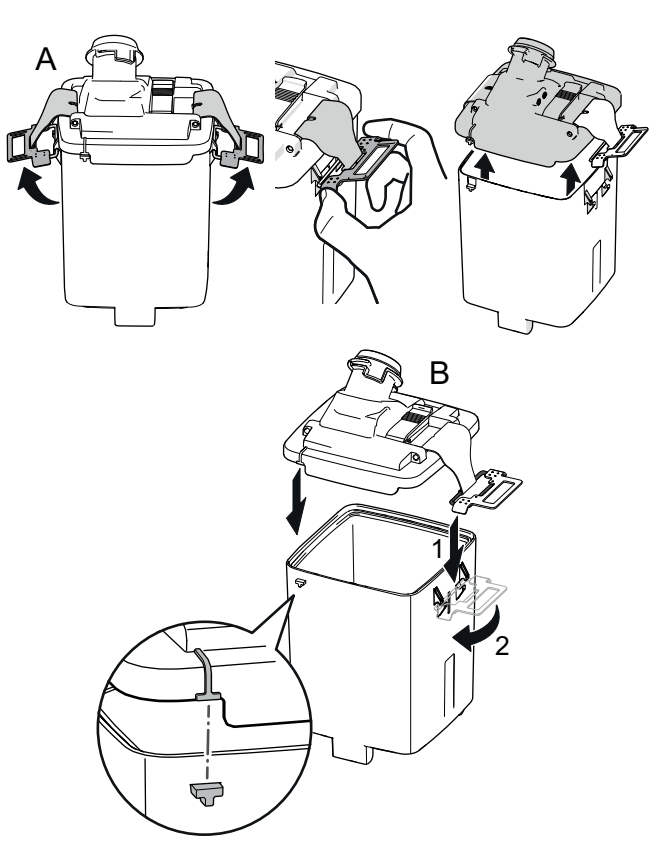
The medium-pressure hoses are connected to the quick connect couplings on the CO_2 absorber and the breathing air cooler (see overview diagram at the start of the instructions, items 5, 6, 7). The quick connect couplings can be released from the CO_2 absorber and breathing air cooler as often as necessary without using tools and are self-locking.

If a pneumatic hose is inserted into a connector multiple times, you will need to check whether the pneumatic hose can still be used.

Lids of the regeneration cooler and CO_2 absorber

The lids of the regeneration cooler and CO_2 absorber have an identical design, but must not be confused with each other.

– Release the fasteners to open (see Figure A). Push the catches on the fasteners evenly onto the tabs on the lower part to lever the lid off the lower part.
– When closing, pay attention to the recess in the lid and the tab on the lower part (see Figure B). This prevents any mix-ups between the lids on the breathing air cooler and the CO_2 absorber. Push the lid onto the lower part when closing. Grease the sealing slightly with Molykote 111 if necessary. Hook the catches on the fasteners under the tabs (see Figure B-1). Push the fasteners closed (see Figure B-2).



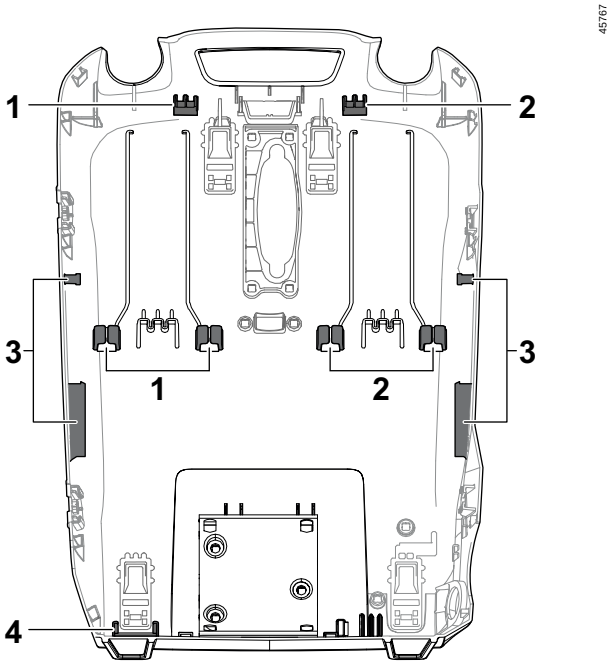
Connecting piece

The direction of flow is marked with an arrow on the connecting piece. The directional valves and connecting piece are designed to prevent confusion during assembly so that the flow is ensured.

Mounting points in the carrying frame

The carrying frame has various holders into which the following components are hooked:

– CO_2 absorber (1)
– Breathing air cooler (2)
– Spring bridge (3)
– Drain valve (4)



5.2.2 Sequence of the maintenance work

1. Disassemble the closed-circuit breathing apparatus and replace defective parts (see "Disassembling the closed-circuit breathing apparatus", page 18).
2. Clean, disinfect, and dry the closed-circuit breathing apparatus (see "Cleaning and disinfecting", page 20).
3. Assemble the closed-circuit breathing apparatus (see "Assembling the closed-circuit breathing apparatus", page 21).
4. Check the closed-circuit breathing apparatus (see "Testing the closed-circuit breathing apparatus", page 24).

5.2.3 Disassembling the closed-circuit breathing apparatus

5.2.3.1 Overview

1. If necessary, remove the waist belt and shoulder straps (see "Removing the waist belt and shoulder straps", page 18).
2. Open the closed-circuit breathing apparatus (see "Opening the closed-circuit breathing apparatus", page 18).
3. Remove the compressed oxygen cylinder (see "Removing the compressed oxygen cylinder", page 18).
4. Remove the breathing bag (see "Removing the breathing bag and disassembling the valves", page 19).
5. Remove the breathing air cooler (see "Removing the breathing air cooler", page 20).
6. Remove the CO_2 absorber (see "Removing the CO_2 absorber", page 20).
7. Remove the connecting piece (see "Removing the connecting piece", page 20).

⚠ WARNING

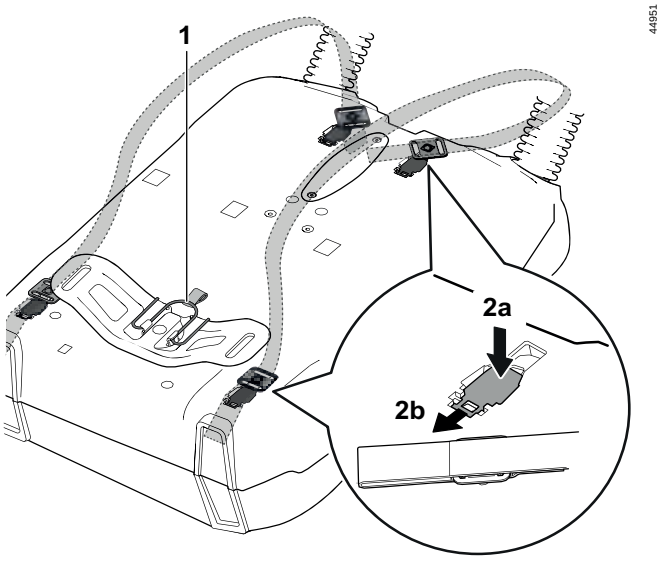
Risk of chemical burns!

The breathing circuit may contain soda base liquid which may leak when disassembling the closed-circuit breathing apparatus and lead to chemical burns!

► Avoid skin contact. Wear protective gloves and goggles. In case of eye contact, immediately rinse with plenty of water and seek medical attention.

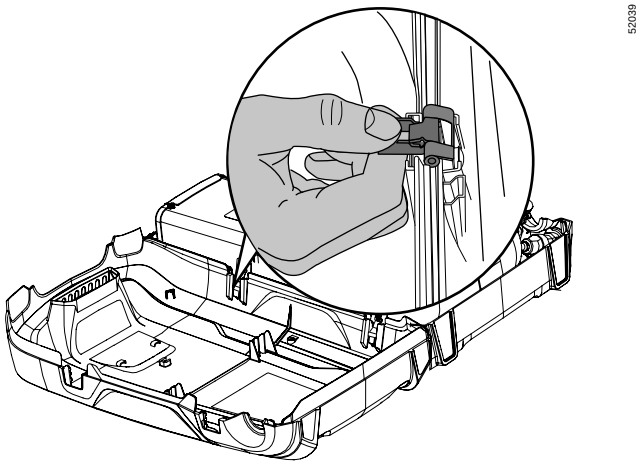
5.2.3.2 Removing the waist belt and shoulder straps

1. Open the loops and release the Connect ECU and breathing hoses from the shoulder straps.
2. Remove the waist belt. To do so, grab hold of the split pin on the flap (1) and pull it out of the waist belt plate. Remove the waist belt from the carrying frame.
3. Remove the shoulder straps. To do so, push on the locking mechanism (2a) and pull the connecting element out of the carrying frame (2b).



5.2.3.3 Opening the closed-circuit breathing apparatus

1. Press the blue locking mechanisms in the direction of the arrow and open the lid.
2. To remove the lid from the apparatus, push the locking mechanisms on the hinges towards the centre of the cover and remove the lid.



5.2.3.4 Removing the compressed oxygen cylinder

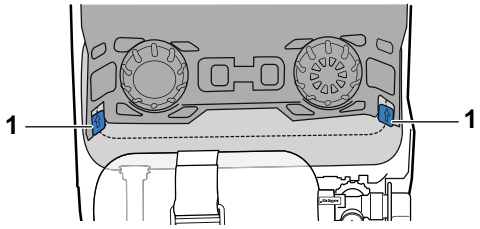
1. Make sure that the cylinder valve is closed and the closed-circuit breathing apparatus is completely purged.
2. Open the hook-and-loop fastener and pull the cylinder strap out of the buckle.
3. Loosen the hand wheel of the pressure reducer. Do not use any tools for this.

⚠ WARNING
Risk of fire!
Contact between high-pressure oxygen and oils, greases, organic materials or similar contamination may cause a fire. This can lead to serious physical injuries or death.
► Make sure connections are kept clean and free of dirt.

4. Pull the compressed oxygen cylinder off the connecting pieces on the pressure reducer and remove it from the closed-circuit breathing apparatus.
5. Seal the compressed oxygen cylinder with the lock nut.

5.2.3.5 Removing the breathing bag and disassembling the valves

1. Push both release levers (1). Swivel the spring bridge 90° and remove it from the closed-circuit breathing apparatus.



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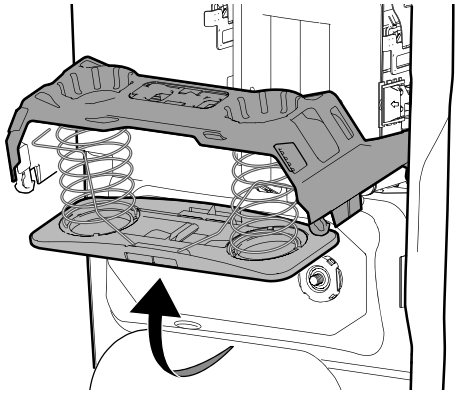
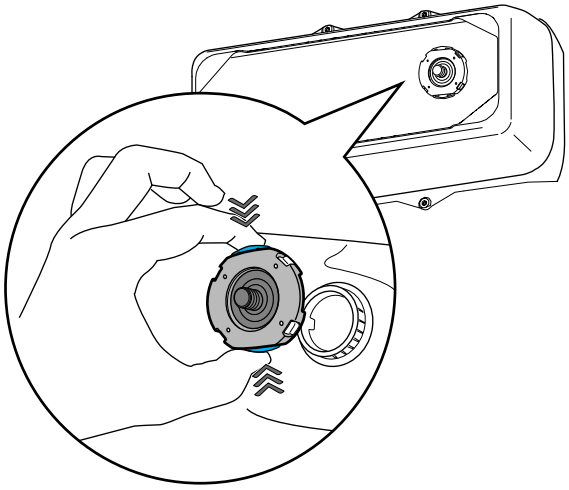


2. Release the locking mechanisms between the CO_2 absorber and breathing bag, as well as between the breathing air cooler and breathing bag:
Push the lock buttons and remove the breathing bag from the CO_2 absorber and breathing air cooler.
3. Release the drain valve from the carrying frame.
4. Pull the breathing bag out of the closed-circuit breathing apparatus. The breathing bag automatically slides off the minimum valve lever.
5. Disassemble the relief valve:
   a. Push the lock buttons and pull the relief valve out of the breathing bag.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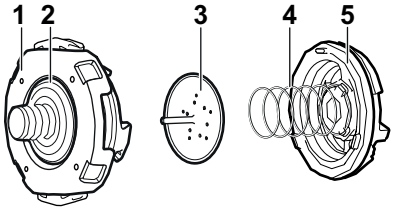
   b. Keep hold of the relief valve and rotate the housing parts (1, 5) against each other to open the valve.
   c. Remove the valve disc (3) from the valve seat.
   d. Check the valve disc (3) and stepped valve disc (2). They must be clean and intact and be in contact with the entire circumference of the valve seat. Replace faulty valve discs.
   e. Check the spring (4). It must not be bent and must be connected to the lid (5) by a single coil.



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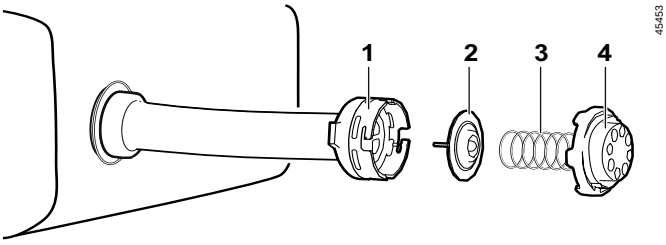
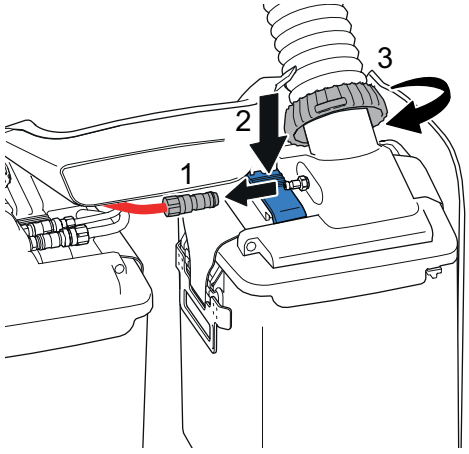
6. Open the drain valve:
   a. Rotate the lid (4) counterclockwise to remove it from the drain valve.



   b. Remove the valve disc (2) from the valve seat (1) and check. It must be clean and intact and be in contact with the entire circumference of the valve seat. Replace faulty valve disc.
   c. Check the spring (3). It must not be bent and must be connected to the lid (4) by a single coil.

5.2.3.6 Removing the breathing air cooler

1. Release the quick connect coupling (1) on the red medium-pressure hose from the breathing air cooler.
2. Press the blue lock button (2) and remove the breathing air cooler with breathing hose from the closed-circuit breathing apparatus.



3. Rotate the bayonet ring counterclockwise (3) and use the flap to pull the breathing hose off the breathing air cooler.
4. For the ice cooler, remove and re-freeze the ice packs. For the regeneration cooler, the cooling elements can be removed so that they dry faster after cleaning.

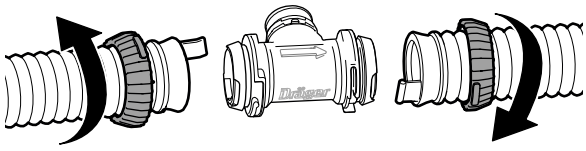
ℹ Replace faulty ice packs or cooling elements.

5.2.3.7 Removing the CO_2 absorber

1. Release the two quick connect couplings on the medium-pressure hoses from the CO_2 absorber.
2. Press the blue lock button and remove the CO_2 absorber with breathing hose from the closed-circuit breathing apparatus.
3. Rotate the bayonet ring counterclockwise and use the flap to pull the breathing hose from the CO_2 absorber.
4. Prepare the CO_2 absorber:
   - Dispose of the disposable absorber.
   - For the refill absorber, remove the soda lime and the two non-woven mats and discard them. The sieve can be reused after disinfection.

5.2.3.8 Removing the connecting piece

1. If necessary, drain off the condensate that has accumulated in the breathing hoses.
2. Remove the protective cap from the connecting piece.
3. Rotate the bayonet rings counterclockwise and use the flaps to pull the breathing hoses off the connecting piece.



4. Remove the directional valves from the connecting piece.
5. Check the valve discs. They must be clean and intact and be in contact with the entire circumference of the valve seat. Replace faulty valve discs.

5.2.4 Cleaning and disinfecting

5.2.4.1 General information

All parts coming into contact with the alveolar air must be thoroughly cleaned and disinfected after use. All other parts should only be cleaned if required. Wear appropriate personal protective equipment during cleaning and disinfection. Dispose of waste water and cloths in accordance with the applicable waste disposal regulations.

NOTICE

Risk of damaging the material!

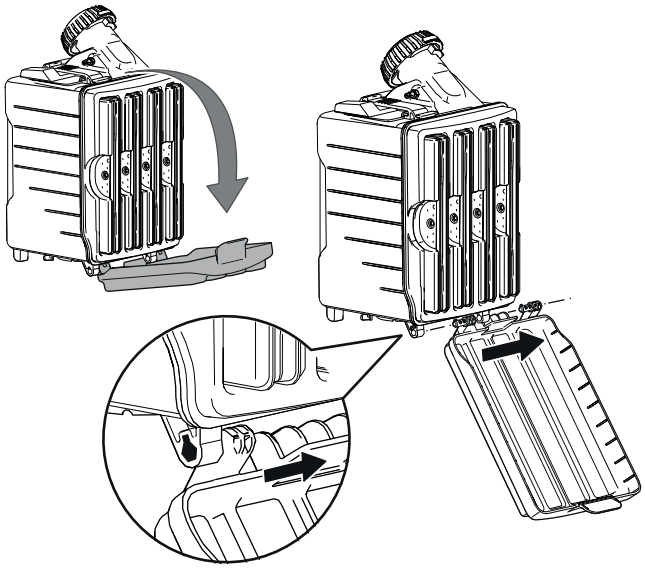
For cleaning and disinfecting, do not use any solvents (e.g. acetone or alcohol) or cleaning agents with scouring particles.

► Only follow the specified procedure and use the specified cleaning and disinfecting agents. Other agents, dosages and application times may cause damage to the product.

For information on suitable cleaning agents and disinfectants and their specifications, see document 9100081 at www.draeger.com/IFU.

5.2.4.2 Ice cooler cover

The ice cooler cover is hooked into the lower part. The cover can be unhooked for cleaning and disinfection. To do so, open the cover wide until the locking device on the pin can slide through the groove in the hole.



5.2.4.3 Cleaning the closed-circuit breathing apparatus

1. Prepare a cleaning solution comprised of water and a cleaning agent.
2. Clean all parts that conduct the breathing air, the waist belt and the harness with a soft cloth and a cleaning solution. The carrying frame and lid can be brushed off with a soft brush and cleaning solution if necessary.
   Wipe down the Connect ECU with a soft cloth. The rubber protection and the protective covers can be removed for cleaning if necessary.
3. Rinse all parts thoroughly under running water.
4. Prepare a disinfection bath comprised of water and a disinfectant.
5. Place all parts that conduct breathing air into the disinfection bath. Only disinfect the waist belt and harness if necessary.
6. Rinse all parts thoroughly under running water.
7. Allow all parts to dry (max. temperature: 140 °F/60 °C). Keep away from direct sunlight.
   Dräger recommends using both a drying cabinet and a hose drying unit for drying.
   If hot air is conducted through the regeneration cooler, it is dry after approx. 4 hours and can subsequently be regenerated. If the regeneration cooler is dried in room air without air circulation, drying takes longer.
8. Store regeneration coolers at temperatures below 77 °F (25 °C) to allow the latent heat storage medium to regenerate.

ℹ All components of the closed-circuit breathing apparatus must be completely dry before storage to prevent mould formation.

5.2.5 Assembling the closed-circuit breathing apparatus

5.2.5.1 Overview

1. Install the CO_2 absorber (see "Installing the CO_2 absorber", page 21).
2. Install the breathing air cooler (see "Installing the breathing air cooler", page 22).
3. Fit the connecting piece (see "Fitting the connecting piece", page 22).
4. Fit the valves to the breathing bag (see "Fitting the drain valve and relief valve", page 23).
5. Install the breathing bag (see "Fitting the drain valve and relief valve", page 23).
6. Install the compressed oxygen cylinder (see "Fitting the compressed oxygen cylinder", page 23).
7. Close the closed-circuit breathing apparatus (see "Closing the closed-circuit breathing apparatus", page 24).
8. Fit the waist belt and shoulder straps (see "Fitting the waist belt and shoulder straps", page 24).

5.2.5.2 Prerequisites for assembly

The following components must be prepared for assembly:

– If a regeneration cooler is to be used: The regenerated cooling elements are available.
– The compressed oxygen cylinder is full.
– The refill absorber is full or a new disposable absorber is present.

ℹ For hygiene reasons, the apparatus should be fitted in a clean work environment and with clean hands. Wear gloves if necessary so that the cleaned and disinfected components are not re-contaminated.
Only use grease to lubricate components where recommended in these instructions for use.

5.2.5.3 Installing the CO_2 absorber

⚠ WARNING
Reduced period of use possible!
If the soda lime comes into contact with ambient air or is too old, the period of use intended for the apparatus may not be possible.

► Only install a CO_2 absorber that meets the criteria described in chapter 4.1.3.

1. Unpack the CO_2 absorber if necessary. Fit the lid on a disposable absorber.
2. Fasten the breathing hose on the CO_2 absorber (see "Breathing hoses", page 16).
3. Place the CO_2 absorber in the mounts on the carrying frame. A clicking sound can be heard when the CO_2 absorber engages in the locking mechanism.
4. Connect the blue medium-pressure hoses to the CO_2 absorber.

ℹ The quick connect coupling must engage. When connecting, make sure that a click is heard. If necessary, pull on the hose and check whether the connection is tight.

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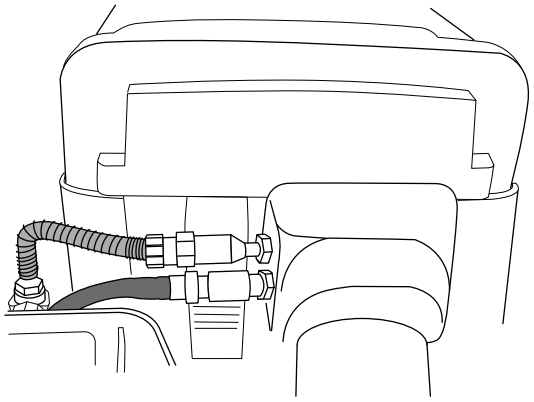

5. Note the assembly date or expiration date on the housing of the CO_2 absorber where applicable.

5.2.5.4 Installing the breathing air cooler

1. If an ice cooler is used, only insert the ice packs in the ice cooler just before use. (The breathing circuit does not open again when the ice packs are inserted.)
   If a regeneration cooler is used, insert the block of 14 cooling elements, which are held together by a sealing cuff, in the breathing air cooler. The filler pipes of the cooling elements and the handle of the sealing cuff must point towards the open side of the breathing air cooler. Wet the sealing cuff if necessary to ensure it slides into the housing easily and correctly.

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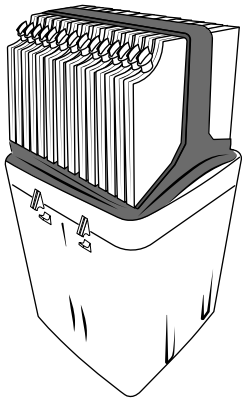

2. Close the breathing air cooler (see "Lids of the regeneration cooler and CO_2 absorber", page 17).
3. Fasten the breathing hose on the breathing air cooler (see "Breathing hoses", page 16).
4. Place the breathing air cooler in the mounts on the carrying frame. A clicking sound can be heard when the breathing air cooler engages in the locking mechanism.
5. Connect the red medium-pressure hose to the breathing air cooler.

ℹ The quick connect coupling must engage. When connecting, make sure that a click is heard. If necessary, pull on the hose and check whether the connection is tight.

5.2.5.5 Fitting the connecting piece

ℹ The valve discs must be clean and intact and be in contact with the entire circumference of the valve seat. Replace faulty valve discs!

1. Place valve discs on the valve seats if necessary.
2. Insert the directional valves into the connecting piece and rotate slightly so that they slide into the openings of the connecting piece. The directional valves must finish flush with the edge of the connecting piece.

ℹ The directional valves are identical. The direction of installation is coded with 3 recesses on one side and 4 recesses on the other side. The recesses fit into the corresponding contours in the connecting piece.
The direction arrow on the connecting piece indicates the direction in which the valve discs must open.

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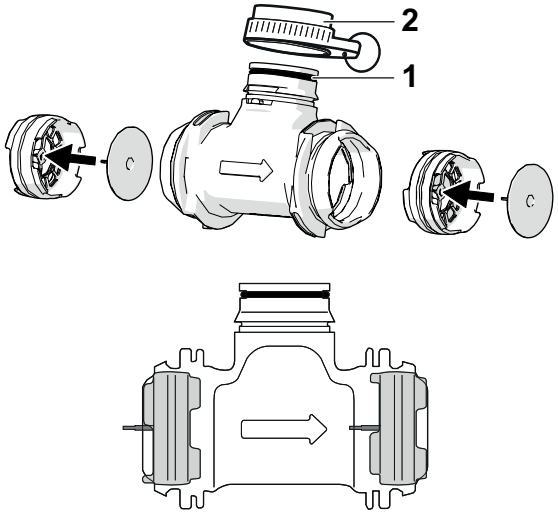
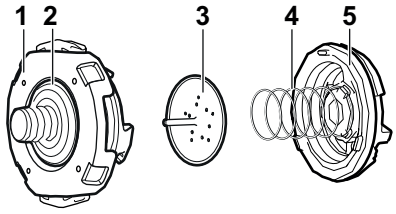


3. Visually inspect the O-ring (1). It must be clean and intact. Replace the O-ring if faulty.
4. Grease the O-ring with Molykote 111 if necessary so that the connecting piece can easily be inserted in the full face mask when donning the closed-circuit breathing apparatus.
5. Fit the protective cap (2) to the connecting piece.
6. Fit the breathing hoses to the connecting piece (see "Breathing hoses", page 16).
7. Fasten the breathing hoses on the shoulder straps with the safety loops.

5.2.5.6 Fitting the drain valve and relief valve

ℹ The valve discs must be clean and intact and be in contact with the entire circumference of the valve seat. Replace faulty valve discs!

1. Fit the relief valve:
   a. Fit the stepped valve disc (2) to the valve seat (1).
   b. Insert the shaft of the valve disc (3) in the hole of the valve seat (1).
   c. Make sure the spring (4) is secured with a coil under the hook in the lid (5). Position the spring (4) centrally on the valve disc (3).
   d. Fit the lid (5) and screw clockwise until it locks into place.



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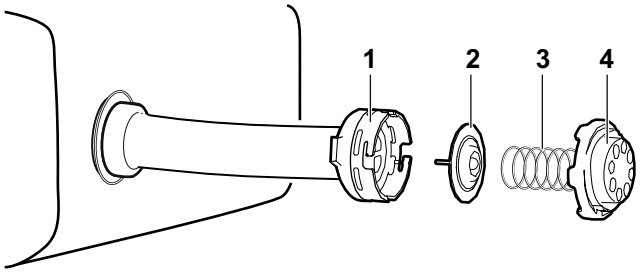
2. Insert the relief valve in the breathing bag.

   ℹ Both engagement hooks must be correctly engaged. When inserting, make sure that a click is heard.

3. Assemble the drain valve:
   a. Insert the shaft of the valve disc (2) in the hole of the valve seat (1).
   b. Make sure the spring (3) is secured with a coil under the hook in the lid (4). Position the lid (4) with the spring (3) centred on the valve disc (2).
   c. Fit the lid (4) and screw clockwise until it locks into place.



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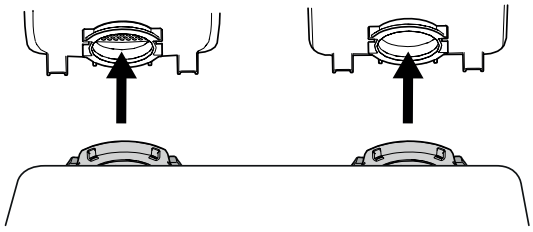
5.2.5.7 Installing the breathing bag

1. Slide the pouch of the breathing bag onto the minimum valve lever and place the breathing bag entirely in the carrying frame.

   ℹ Make sure that the breathing bag is not positioned on the lever, but that the minimum valve lever is correctly inserted in the pouch of the breathing bag and the breathing bag is not lying on the bracing rail of the carrying frame.

2. Fasten the breathing bag with the locking mechanisms to the CO_2 absorber and breathing air cooler. Every locking mechanism has two lock buttons with engagement hooks. Ensure the locking mechanisms on the CO_2 absorber and breathing air cooler fully engage: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   a. Push the locking mechanism on the underside onto the connection of the CO_2 absorber or breathing air cooler until the lower engagement hook clicks into place. Make sure that a click is heard when doing so.
   b. Push the locking mechanism on the upper side onto the connection of the CO_2 absorber or breathing air cooler until the upper engagement hook clicks into place. Make sure that a click is heard when doing so.

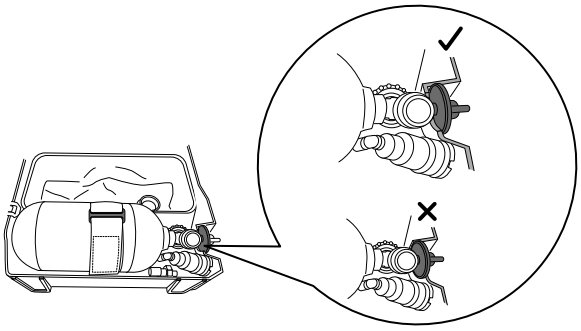
      ℹ The locking mechanisms must engage. When connecting, make sure that a click is heard.

   c. Gently pull the breathing bag and check whether the locking mechanisms are secure.
3. Position the spring bridge on the mounts in the closed-circuit breathing apparatus and swivel by 90°. Make sure the breathing bag does not get stuck between the spring bridge and carrying frame and that the relief valve is positioned in the recess for the pressure plate.
4. Click the spring bridge on each side into the carrying frame. Make sure that a clicking sound can be heard on both sides.
5. Insert the drain valve in the mount of the carrying frame.

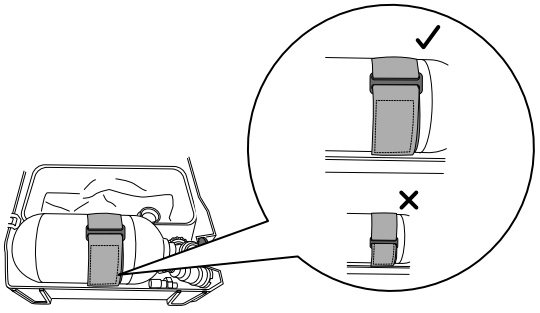
5.2.5.8 Fitting the compressed oxygen cylinder

1. Check the high pressure sealing ring on the pressure reducer connecting piece for damage and contamination. It must be clean, free of grease and intact. Replace if necessary.
2. Remove the lock nut from the compressed oxygen cylinder.
3. Place the compressed oxygen cylinder in the cylinder mount.

The hand wheel for the compressed oxygen cylinder must be positioned in the depression on the outside of the carrying frame.



4. Tighten the hand wheel of the pressure reducer to the compressed oxygen cylinder. Do not use any tools to tighten.
5. Thread the cylinder strap into the buckle and close the hook-and-loop fastener. Slide the buckle onto the edge of the breathing bag so that the lid of the closed-circuit breathing apparatus can be closed.

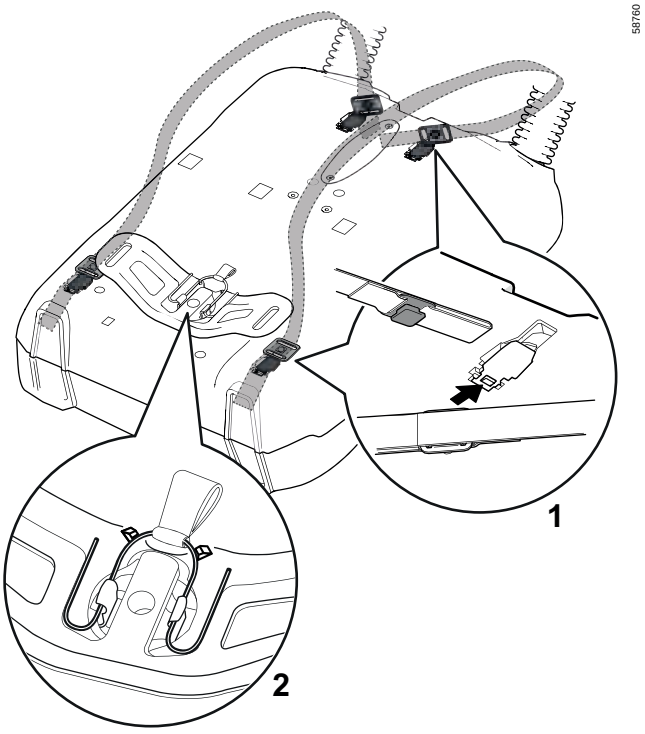


5.2.5.9 Closing the closed-circuit breathing apparatus

1. Interlink the hinges and lock them in place.
2. Close the lid and engage the locking mechanisms. A click can be heard.

5.2.5.10 Fitting the waist belt and shoulder straps

1. Fit the top ends of the shoulder straps. To do so, insert the connecting elements in the mounts on the carrying frame and engage. The loops should point towards one another.
2. Fit the bottom ends of the shoulder straps. To do so, insert the connecting elements in the mounts on the carrying frame and engage (1).
3. Fit the waist belt. To do so, position the waist belt plate with the recess facing upwards on the carrying frame's waist belt support and secure with the split pin. Make sure that the split pin snaps into the right position (2).



4. Fasten the Connect ECU on the shoulder strap.

5.2.6 Testing the closed-circuit breathing apparatus

5.2.6.1 Notes for testing

The following test sequence applies for apparatuses with a constant oxygen dosage, as well as those with on-demand oxygen dosage. In the case of apparatuses with a constant oxygen dosage, there is no need to test the pre-flush unit. This test is marked accordingly.

Carry out a visual inspection, as well as a leak and functional test, after every service. If an error is detected during the leak and functional test, the closed-circuit breathing apparatus must not be used. Appoint qualified personnel to service the apparatus or send it to Dräger.

If the CO_2 absorber is installed in the closed-circuit breathing apparatus, the leak and functional test can be performed a total of six times, whereby each test should not take longer than 15 minutes. After 6 tests, the CO_2 absorber must be replaced and must no longer be used.

If a test failed, replace the faulty part and repeat the test.

The tests are described using the Dräger RZ 7000 by way of example. The sequence of the tests described in these instructions for use is the optimum sequence with this test unit. The closed-circuit breathing apparatus can also be tested with other suitable test units in other sequences. The tests should not be performed in direct sunlight or in a cold room as the air pressure in the apparatus will then change quickly and can lead to incorrect test results.

5.2.6.2 Overview of the functional and leak test

1. Preparing the test (see "Preparing the test", page 25).
2. Checking the exhalation valve (see "Checking the exhalation valve", page 25).
3. Checking the inhalation valve (see "Checking the inhalation valve", page 25).
4. Checking the drain valve (see "Checking the drain valve", page 25).
5. Leak-tightness test with positive pressure (see "Leak-tightness test with positive pressure", page 25).
6. Checking the relief valve (see "Checking the relief valve", page 25).
7. Checking the pre-flush unit (see "Checking the pre-flush unit", page 25).
8. Carrying out the high-pressure leak test (see "Performing the high-pressure leak test (incl. constant dosage device)", page 26).
9. Checking the bypass (see "Checking the bypass", page 26).
10. Checking the minimum valve (see "Checking the minimum valve", page 26).
11. Checking low-pressure alarm 1 (see "Checking low-pressure alarm 1", page 26).
12. Close the closed-circuit breathing apparatus (see "Closing the closed-circuit breathing apparatus", page 24)

5.2.6.3 Preparing the test

1. Switch on the test unit: Press the (OK) button.
2. Set the selector switch on the test unit to −.
3. Position the closed-circuit breathing apparatus and test unit next to each other so that both devices are easily accessible and the test unit can be operated easily.
4. Open the lid or remove it (see "Opening the closed-circuit breathing apparatus", page 18).
5. Remove the protective cap from the connecting piece and insert the connecting piece into the test unit.
6. Perform tests.

5.2.6.4 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 BG ProAir Test Set if necessary.
3. Pump once.
   ⇒ The test unit must display at least -10 mbar or “Sensor out of range”.

5.2.6.5 Checking the inhalation valve

1. Set the selector switch on the test unit to +.
2. Tightly pinch the exhalation hose with your hand. Use the face spanner from the BG ProAir Test Set if necessary.
3. Pump once.
   ⇒ The test unit must display at least +10 mbar or “Sensor out of range”.

5.2.6.6 Checking the drain valve

1. Set the selector switch on the test unit to +.
2. Flip the locking lever in the spring bridge and position it so that the pressure plate is blocked by the locking lever.
3. Pump until the pressure plate on the spring bridge pushes against the locking lever.
4. Continue pumping until flow noises can be heard at the drain valve. Read-off the value on the display.
   ⇒ The drain valve must open between +10 mbar and +25 mbar.

5.2.6.7 Leak-tightness test with positive pressure

1. Set the selector switch on the test unit to .
2. Use the button to reduce the pressure on the test unit to 7+0.5 mbar and wait until the pressure has stabilised.
3. Press (OK) to start the timer.
   The test time must be 1 minute. When the test time has elapsed, the pressure difference is displayed.
   ⇒ The pressure difference must not be greater than 1 mbar.

5.2.6.8 Checking the relief valve

1. Set the selector switch on the test unit to until the locking lever can once again be moved.
2. Turn the locking lever into the spring bridge and make sure that it is latched in position.
3. Set the selector switch on the test unit to +.
4. Pump until flow noises can be heard at the relief valve. Read-off the value on the display.
   ⇒ The relief valve must open between +4 mbar and +8 mbar.

5.2.6.9 Checking the pre-flush unit

(only for apparatuses with on-demand oxygen dosage)

The pre-flush unit only needs to be checked for apparatuses with on-demand oxygen dosage. This chapter does not apply for apparatuses with constant oxygen dosage.

1. Set the selector switch on the test unit to .
2. Slowly fully open the cylinder valve.
   ⇒ Oxygen must be heard to flow into the circuit. The pre-flush unit must automatically shut-down after max. 10 seconds.

5.2.6.10 Performing the high-pressure leak test (incl. constant dosage device)

ℹ For apparatuses with constant oxygen dosage, the constant dosage device is also automatically checked during the high-pressure leak test.

1. Set the selector switch on the test unit to .
2. Slowly open the cylinder valve by at least two turns.
   The Connect ECU automatically switches to On mode.
   An acoustic signal sounds.
   The battery status is shown on the display.
   The Connect ECU queries whether to carry out the high-pressure leak test ( ). If the query is confirmed, the symbol and the current pressure are displayed.

   ℹ A high-pressure leak test can only be carried out if the cylinder pressure is at least 2175 psi (150 bar) and the Connect ECU is in On or Standby mode.

3. Close the cylinder valve.
   For apparatuses with on-demand oxygen dosage, use the Connect ECU to confirm that the cylinder valve has been closed.
   The test starts automatically for apparatuses with constant oxygen dosage.
   ⇒ The test is carried out.

✓ The result of the test is shown after approx. 15 seconds.
The following results may occur:
- The closed-circuit breathing apparatus is OK. and are shown on the Connect ECU display.
- An error has occurred. Either and or and are shown on the Connect ECU display.
  Repeat the test or have the apparatus serviced.

5.2.6.11 Checking the bypass

1. Set the selector switch on the test unit to .
2. Slowly open the cylinder valve by at least two turns.
   The Connect ECU automatically turns on and runs a self-test.
3. Briefly press the bypass button.
   ⇒ Oxygen must be heard to flow into the circuit (flow noise).

5.2.6.12 Checking the minimum valve

1. Set the selector switch on the test unit to .
2. Turn the locking lever into the spring bridge and make sure that it is latched in position.
3. Monitor the display on the test unit and wait until the pressure stops falling.
4. Read off the pressure on the display.
   ⇒ The valve must be between +0.5 mbar and +3.0 mbar.

5.2.6.13 Checking low-pressure alarm 1

1. Set the selector switch on the test unit to .
2. Close the cylinder valve.
3. In apparatuses with on-demand oxygen dosage, gently press the bypass button so that the high pressure drops.
   In apparatuses with constant oxygen dosage, the pressure drops automatically.
4. Monitor the Connect ECU:
   ⇒ At approx. 650 psi (45 bar), the color on the display switches to red and low-pressure alarm 1 should be triggered.
5. Remove the connecting piece from the test unit.
   The apparatus is completely vented.
6. Fit the protective cap onto the connecting piece.
7. Turn off the Connect ECU. To do so, simultaneously press the right and left button until 3-2-1 is shown on the display.
   The Connect ECU switches to Standby mode.
8. Turn off the test unit.

5.2.7 Maintenance work on components

5.2.7.1 Checking the constant dosage device

(only for apparatuses with constant oxygen dosage)

Work equipment

– RZ 7000 (R62500)
– The following parts from the BG ProAir Test Set (3722266):
  (1) Quick connect coupling (3722211)
  (2) Test hose (E02120)
  (3) Adaptor RZ 7000 (R62599)

ℹ The constant dosage device only needs to be checked for apparatuses with constant oxygen dosage. This chapter does not apply for apparatuses with on-demand oxygen dosage. The constant dosage device is automatically checked during the high-pressure leak test. If necessary, it can also be checked separately at the Dräger RZ 7000.

1. Creating the test setup:
   a. Switch on the test unit.
   b. Connect the test hose (2) to the test unit using the adaptor RZ 7000 (3).
   c. Connect the test hose with the quick connect coupling (1) to the medium-pressure hose for the oxygen supply at the CO_2 absorber (see overview graphic at start of instructions, item 7).
2. Swivel the spring bridge upwards in order to disable the function of the minimum valve.
3. Slowly open the cylinder valve by at least two turns.
   The Connect ECU automatically turns on and runs a self-test.

   ℹ The Connect ECU must not be in Eco mode. If the self-test is not being carried out, place the closed-circuit breathing apparatus in an upright position and then lay it down again. The Connect ECU is then in Standby mode and the test can be repeated.

4. Set the selector switch on the test unit to **L/min**.
   ⇒ After a short settling time, the flow must be between 1.5 L/min and 1.9 L/min[1)].
5. Close the cylinder valve.
6. Click the spring bridge on each side into the carrying frame. Make sure that a clicking sound can be heard on both sides.

1) Only applies at a cylinder pressure of >2175 psi (>150 bar).

7. Remove the medium-pressure hose from the quick connect coupling and attach to the CO_2 absorber.

   The quick connect coupling must engage. When connecting, make sure that a click is heard. If necessary, pull on the hose and check whether the connection is tight.

8. Carry out the closed-circuit breathing apparatus leak test.

5.2.7.2 Emptying the refill absorber

Pay attention to the safety data sheet for Drägersorb 400 when handling the CO_2 absorber!

⚠ WARNING
Risk of chemical burns!
The CO_2 absorber may contain alkaline liquid which may leak out during disassembly and cause chemical burns!
► Avoid skin contact. Use protective gloves and goggles. In case of eye contact, rinse straight away with plenty of water and seek medical attention immediately.

The following procedure also applies for training absorbers.

1. Open the lid of the refill absorber (see "Lids of the regeneration cooler and CO_2 absorber", page 17).
2. Check the sealing in the lid. If the sealing is excessively contaminated or faulty, pull the sealing frame out of the lid and remove the sealing from the sealing frame.
3. Remove the sieve with marking II.
4. Remove and dispose of the soda lime and filter mats.
5. Remove the sieve with marking I.
6. Clean and disinfect all parts of the refill absorber.

5.2.7.3 Filling the refill absorber

Only fill the refill absorber with Drägersorb 400. Pay attention to the safety data sheet for Drägersorb 400 when handling the CO_2 absorber!

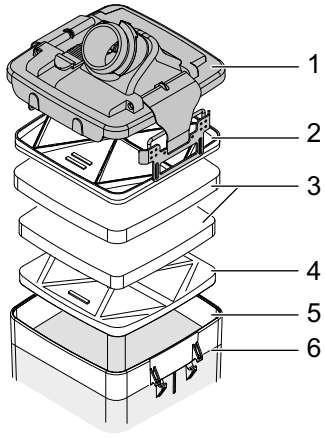
⚠ WARNING
Reduced period of use possible!
If the expiration date of the soda lime is exceeded, the intended period of use for the apparatus may not be reached.
► Note the expiration date on the storage container. Only use soda lime that has an adequate life span for the planned use and any storage period!

⚠ CAUTION
Health risk!
Direct contact with soda lime irritates eyes, mucous membranes, and skin!
► Avoid skin contact. Use protective gloves and goggles. Do not inhale released soda lime dust. Use dust mask with P2 or R95 filter. In case of skin or eye contact, wash off soda lime dust immediately.

⚠ WARNING
Higher CO_2 content possible in the inhaled air!
If the soda lime is only used as a loose fill, the capacity may not be enough for the planned period of use.
► Fill refill absorbers so that no rattling noises are heard.

The following procedure also applies for training absorbers.

1. Open the lid (1) of the refill absorber (see "Lids of the regeneration cooler and CO_2 absorber", page 17).
2. Insert the sieve with the marking I (4) into the refill absorber (5) as shown below.
3. Insert a filter mat (3) in the refill absorber. (There is no preferred orientation for the filter mat.)
4. Half fill the refill absorber with Drägersorb 400. Compact the soda lime by using your hand to gently strike the side of the housing. Evenly fill the refill absorber up to the filling mark (6, transition between the transparent and opaque part of the container) and compact the soda lime. Alternately fill and compact until the soda lime does not settle any further. The surface of the soda lime must be smooth.
5. Insert a filter mat (3) in the refill absorber. (There is no preferred orientation for the filter mat.)
6. Insert the sieve with the marking II (2) into the refill absorber as shown below.
7. Only if the sealing has been removed:
   a. Place the sealing in the lid.
   b. Fasten the sealing with the sealing frame.
8. Close the lid (1) (see "Lids of the regeneration cooler and CO_2 absorber", page 17).



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9. Check whether rattling noises are heard when shaking the refill absorber. If rattling noises are heard, the refill absorber needs to be topped up again.
10. Install the refill absorber in the closed-circuit breathing apparatus within 8 hours or ensure that it is sealed air-tight and protected against drying. The refill absorber can then be stored for up to 6 months.

    Dräger recommends using an aluminium barrier bag if the refill absorber is to be stored.

5.2.7.4 Replacing the batteries

5.2.7.4.1 General information

The service life of the batteries depends on the following factors:

– Operating time of the apparatus
– Alarm frequency
– Ambient temperature
– Frequency of use of backlight

Even when the Connect ECU is switched off, a small amount of energy is consumed. Dräger therefore recommends removing the batteries from the apparatus if it will not be in use for an extended period of time.

Only use types of batteries which are listed in supplement 9300897. Do not mix old and new batteries or different types of batteries when replacing the batteries.

5.2.7.4.2 Replacing the batteries

⚠ WARNING
Explosion hazard!
► Only replace the batteries in non-explosion-hazard areas!

1. Unscrew the 2 screws (TX10) from the battery compartment.
2. Pull the battery carrier out of the closed-circuit breathing apparatus.
3. Replace old batteries with new, approved batteries. Ensure that the plus pole is positioned correctly.
4. Check the sealing. Remove the defective sealing using a sealing ring lifter and replace the sealing.
5. Insert the battery carrier in the battery compartment. If the battery carrier is stiff, apply a thin layer of Molykote 111 to the sealings.
6. Tighten the 2 screws with a Torx screwdriver (TX10) (torque: 1.0±0.2 Nm). The Connect ECU automatically switches to On mode. An acoustic signal sounds. Various information and queries are shown on the display.
7. Confirm the battery type.
8. Turn off the Connect ECU.

6 Transport

Condensate forms in the breathing circuit during use. After use, transport the closed-circuit breathing apparatus in an upright position so that the condensate can gather in the drain valve and breathing bag.

7 Storage

Store the closed-circuit breathing apparatus ready for use in a dark, cool, dry, dirt-free and dust-free place. Avoid exposure to UV radiation and ozone.

When the closed-circuit breathing apparatus with CO_2 absorber installed is placed into storage, the breathing circuit must be closed. Make sure that the protective cap is positioned on the connecting piece. The compressed oxygen cylinder must not be installed. The expiration date of the CO_2 absorber must not be exceeded during the next use.

8 Disposal

8.1 General

This product must not be disposed of as household waste. This is indicated by the adjacent symbol.
You can return this product to Dräger free of charge. For information please contact the national marketing organizations or Dräger.

Batteries must not be disposed of as household waste. They are therefore marked with the adjacent symbol. Dispose of batteries at battery collection centres as specified by the applicable regulations.

8.2 Disposing of the disposable CO_2 absorber

Pay attention to the safety data sheet on Drägersorb 400 during disposal!

⚠ WARNING
Risk of chemical burns!
The CO_2 absorber may contain alkaline liquid which may leak out during disassembly and cause chemical burns!
► Avoid skin contact. Use protective gloves and goggles. In case of eye contact, rinse straight away with plenty of water and seek medical attention immediately.

1. Pack the CO_2 absorber in a bag and seal air-tight.
2. Dispose of the CO_2 absorber in accordance with the relevant regulations.

9 Technical data

Closed-circuit breathing apparatus

Breathing bag volume[1)]	6 L
Weight	
Apparatus ready for operation with full compressed oxygen cylinder and Dräger FPS 7000 RP, without cooling elements	33.5 lbs (15.2 kg)
Apparatus ready for operation with full compressed oxygen cylinder and Dräger FPS 7000 RP, with ice packs	37.3 lbs (16.9 kg)
Dimensions without harness and breathing hoses (L x B x H)	23.3 x 15.8 x 6.9 in. (590 x 400 x 175 mm)
Operating time[2)]	240 minutes
Breathing resistance[3)]	
Inhalation	>0 mbar
Exhalation	<7 mbar
Average constant dosage	1.7 L/min
Bypass	>80 L/min
Minimum valve	>80 L/min
Filling quantity of the refill absorber	5.51 lbs (2.5 kg)
Compressed oxygen cylinders	2 L , 3000 psi (2 L, 207 bar)

1) according to EN 145
2) With a respiration of 30 L/min
3) With a respiration of 50 L/min

Ambient conditions

When in use

Temperature during continuous use	21 °F to 86 °F (-6 °C to +30 °C)
Air pressure	900 hPa to 1200 hPa
Relative humidity	0 % ... 100 %

When in storage

Storage temperature	21 °F to 77 °F (-6 °C to +25 °C)
Air pressure	900 hPa to 1200 hPa
Relative humidity	30 % ... 95 %

Technically possible period of use

The following table shows the times until an inhalation temperature of 113 °F (45 °C) is reached. The tests were carried out by Dräger based on EN 145 inhalation temperature specifications. They are not part of the NIOSH approval specifications.

Consider general conditions for human exposure in hot and cold environments and general conditions for intrinsically safe operation of electronic equipment when using the closed-circuit breathing apparatus.

At an ambient temperature of	Respiratory volume per minute	With ice cooler	With regeneration cooler
21 °F to 5 °F (-6 °C to -15 °C)	30 L/min	240 min	240 min
21 °F to 104 °F (-6 °C to +40 °C)	30 L/min	240 min	240 min
21 °F to 104 °F (-6 °C to +40 °C)	50 L/min	120 min	100 min
Up to 194 °F (90 °C)	30 L/min	100 min	60 min
5 °F to -40 °F (-15 °C to -40 °C)	30 L/min	72 min	72 min

See also (see "Measures with temperatures below 32 °F (0 °C)", page 11)

Regeneration cooler

Max. storage temperature	77 °F (25 °C)		
Regeneration time:	at 70 °F (+21 °C):	at 41 °F (+5 °C):	at 5 °F (-15 °C):
Cooling element assembly	6 h	2 h	1.5 h
Cooling elements in the housing	-	6 h	5 h

Harness

Carrying capacity of belt straps	22 lbs respectively (10 kg)

Electronics

The following table shows the factory settings of the Connect ECU.

End of service time indicators	
Low-pressure alarm 1	650 psi (45 bar)
Low-pressure alarm 2	150 psi (10 bar)
Display accuracy	
At 3000 psi (207 bar)	±150 psi (±10 bar)
At 580 psi (40 bar)	+0 psi/-72 psi (0 bar/-5 bar)

Distress signal unit	
Activation of the pre-alarm after	30 seconds
Activation of the main alarm	15 seconds after the pre-alarm
Restrictions in	AZE, BLR, GEO, RUS, SMR and UKR
RFID	
Transmission power	42 dBµA/m at 10 m
Operating frequency	13.56 MHz
Restrictions in	GEO and UKR

10 Order list

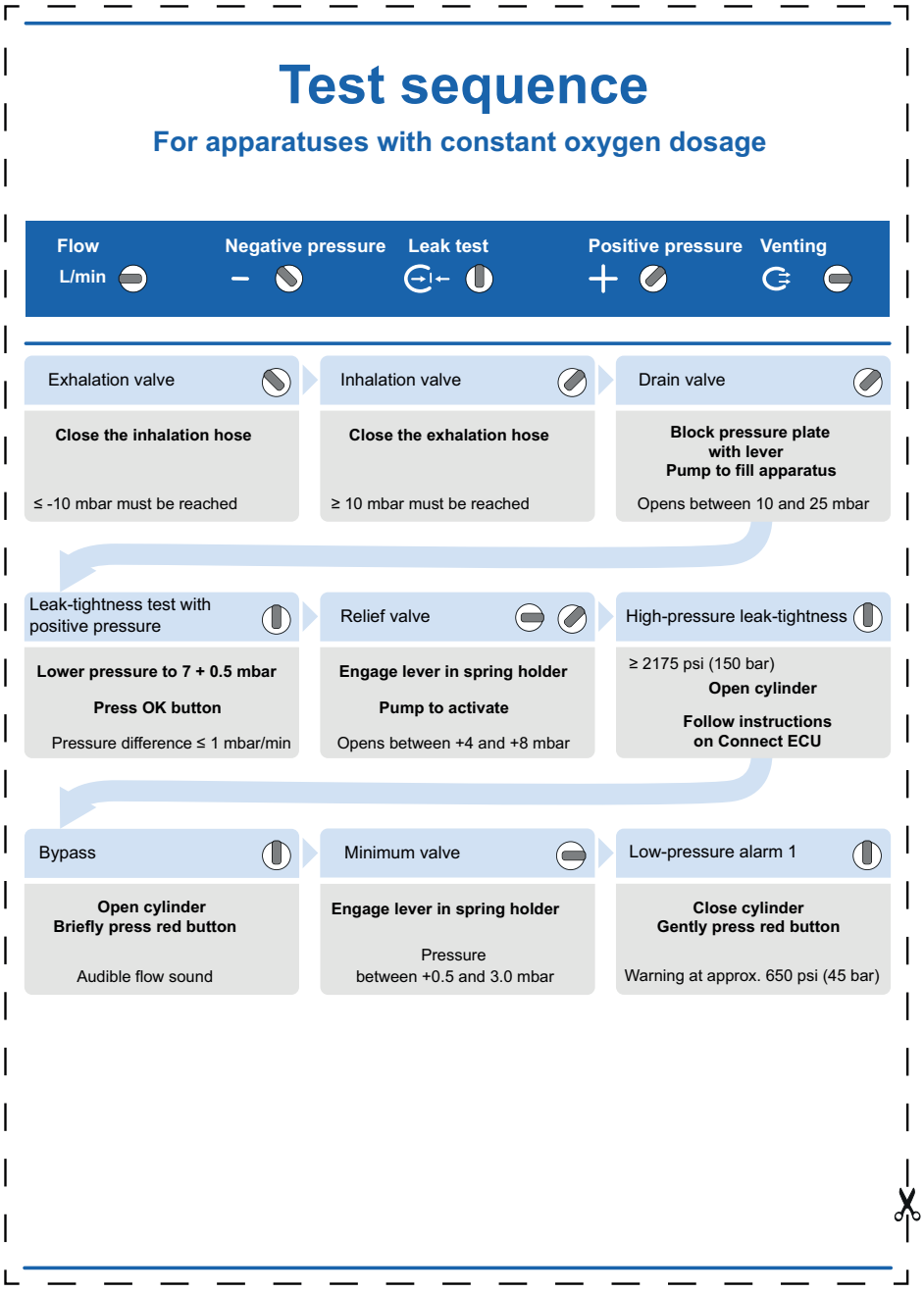
Designation	Order number
Closed-circuit breathing apparatus	
BG ProAir W21.8-C-ICE-CH-CA	R360518
BG ProAir W21.8-C-PCM-CH-CA	R360519
BG ProAir W21.8-LDV-ICE-CH-CA	R360520
BG ProAir W21.8-LDV-PCM-CH-CA	R360521
BG ProAir CGA-C-ICE-CH	R360530
BG ProAir CGA-C-PCM-CH	R360531
BG ProAir CGA-LDV-ICE-CH	R360532
BG ProAir CGA-LDV-PCM-CH	R360533
Compressed oxygen cylinders	
BG ProAir Cylinder 2/200 O_2 W21.8 Canada	R360557
BG ProAir Cylinder 2/200 O_2 CGA USA	R360395
Accessories	
Dräger FPS 7000 RP	R56326
Dräger FPS-COM 5000	R62700
"klar-pilot" anti-fogging spray	R56542
BG ProAir disposable absorber	3702050
BG ProAir refill absorber	R360060
Freezing aid	3723001
BG ProAir ice cooler cartridge, complete	3701814
BG ProAir PCM cooler, complete	R360280
BG ProAir training adapter set	3722874
BG ProAir transport case	3722275
Transport case for compressed gas cylinder	3718247
Grip clamp	3724657
Consumables for refillable absorbers	
BG ProAir filter mat, 50 units	R360356
BG ProAir refill absorber sieve, top	R360067
BG ProAir refill absorber sieve, bottom	R360066
Drägersorb 400, 4.5 kg	6738950
Drägersorb 400, 8.0 kg	6737965
Drägersorb 400, 18 kg	6737985
Spare parts[1)]	
Valve disc for connecting piece	R33934
O-ring for connecting piece	R18352
Protective cap for connecting piece	3713554
Valve disc for relief and drain valve	R33833
Battery for Connect ECU (5 pieces)	R360474
Test accessories	
Dräger RZ 7000	R62500
RZ 7000 test head	R62581
BG ProAir Test Set	3722266
Accessories for Connect ECU	
Bluetooth® Dongle	3721359

1) All spare parts can be found in the spare parts list 1114.800.

11 Annex

11.1 Apparatus with on-demand oxygen dosage: Optimal test sequence with the Dräger RZ 7000

11.2 Apparatus with constant oxygen dosage: Optimal test sequence with the Dräger RZ 7000



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