

D-Vapor®



Desflurane Vaporiser Instructions for Use

To make it very clear which instructions apply to which D-Vapor, the serial number of the apparatus is specified on the back of the corresponding instructions.

Instructions that do not carry a serial number are for information purposes only and not intended as Instructions for Use.

The serial number is specified on the device's type plate.

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Registered Trademarks

- Vapor®
- D-Vapor®

are registered trademarks of Dräger.

- Suprane®

is a registered trademark of Baxter.

- Selectatec®

is a registered trademark of Datex-Ohmeda.

- Saf-T-Fill™

is a registered trademark of Baxter.

For Your Safety and that of Your Patients

Observe Instructions for Use

Using the apparatus requires the full understanding and strict observation of these instructions. The apparatus is only to be used for the purposes specified herein.

Maintenance

The apparatus must be inspected and serviced by skilled personnel at yearly intervals and a record of the findings kept. Repair and general overhaul of the apparatus may only be carried out by trained service personnel.

We highly recommend DrägerService for all repairs and suggest you sign a maintenance contract with them.

Only authentic Dräger spare parts may be used for maintenance.

Observe the chapter 'Maintenance Intervals'.

Accessories

Do not use accessories other than those in the order list. Reusable accessories (e.g. after they have been prepared) have a limited life span. A number of factors during preparation and operation (e.g. disinfectant residues can damage the material during autoclaving) can increase the wear and decrease the life span considerably. Materials with external signs of wear such as cracks, deformation, discolouration, disbonding or similar must be replaced.

Do not use the apparatus in explosive environments

The apparatus is not approved for use in explosive environments.

Coupling with electrical devices safely

Contact the manufacturer or a technical expert before coupling the apparatus to electrical devices other than those mentioned in these Instructions for Use.

Liability for Function and/or Damage

Liability for the proper functioning of the apparatus is always transferred to the owner or operator to the extent that the apparatus is not serviced or repaired by authorised DrägerService personnel, or when the apparatus is not used in accordance with the intended use.

Dräger is not liable for damage caused by non-compliance with the above-mentioned recommendations. The warranty and liability provisions of Dräger's terms of sale and delivery are not extended by the above-mentioned recommendations.

Dräger Medical AG & Co. KGaA

Recommendations for Safe Use

Use the apparatus under the supervision of qualified medical personnel only to ensure that malfunctions are remedied without delay!

To operate D-Vapor, observe the anaesthesia delivery system's Instructions for Use.

Handle D-Vapor with care! Do not drop!

Do not carry the apparatus by the control dial, control dial cap or locking lever!

Do not use a D-Vapor that has been dropped!

A D-Vapor that toppled over must be tested (see 'Checking the Concentration', page 46). Do not use D-Vapor if the test cannot be performed.

Damage could result in the delivery of incorrect concentrations.

The European Norm EN 740 'Anaesthetic Workplaces and their Modules' requires the use of an anaesthetic gas monitor to monitor the content of anaesthetic vapour in the inspiration gas as protection against dangerous output values when the anaesthetic workplace is operated with a vaporiser.

Dräger strongly recommend using an anaesthetic gas monitoring device when using D-Vapor.

Country-specific standards on the mandatory use of monitors must be observed.

When the D-Vapour is used with an anaesthetic device in A cone operation, an anaesthetic gas monitor must be used.

Do not use D-Vapor during magnetic resonance tomography (MRT)!

The apparatus' function could be disrupted.

Establish the potential equalisation for intracardiac or intracranial operations.

Only fill D-Vapor with Desflurane (Suprane®)! If liquids other than Desflurane get into D-Vapor, the apparatus could get damaged and the patient harmed.

Only use dry, medically pure gases!

To reduce the hazard of fire, do not use flammable substance such as ether or cyclopropane near D-Vapor!

Installation and/or operation with anaesthesia delivery systems in moving vehicles, aeroplanes, helicopters, and ships is only permissible after consultation with Dräger and their approval.

High Desflurane settings reduce the O₂ concentration in the fresh gas.

High Desflurane concentrations can influence the hot-wire volume gauge! The volume displayed is too high.

High-frequency ventilation, the use of anaesthesia delivery systems with non-continuous fresh gas flow, or the repeated activation of the O₂ flush can switch off D-Vapor.

Follow the anaesthesia delivery system's Instructions for Use.

The available RS-232 interface is provided for service purposes only.

General information on electromagnetic compatibility (EMC) according to the international EMC standard IEC 60601-1-2: 2001

Medical electrical equipment needs special precautions regarding electromagnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in the technical documentation available from Dräger Service upon request.

Portable and mobile RF communications equipment can affect medical electrical equipment.



Pins of connectors identified with the ESD warning symbol shall not be touched and not be connected unless ESD precautionary procedures are used. Such precautionary procedures may include antistatic clothing and shoes, the touch of a ground stud before and during connecting the pins or the use of electrically isolating and antistatic gloves. All staff involved in the above shall receive instruction in these procedures.

Intended Use

D-Vapor – heated, calibrated anaesthetic vaporiser for the enrichment of dry, fresh medical gas with vapour of the anaesthetic agent Desflurane (Suprane®) in concentrations of 2 to 18 vol.% in anaesthesia delivery systems.

D-Vapor is inserted in the fresh-gas line of an anaesthesia delivery system. The vaporiser is connected between the fresh-gas flow-control unit and the fresh-gas outlet.

The operation of D-Vapor depends on the direction of flow of the fresh gas. It must be connected and operated in accordance with the direction of flow specified on the apparatus.

The use of D-Vapor with different anaesthesia delivery systems is only permissible and safe when used with the appropriate special adapters.

D-Vapor is not suitable for use in a breathing system.

The simultaneous operation of several vaporisers switched in series is not permissible, particularly when different anaesthetic agents are used.

D-Vapor must not be used in rooms for magnetic resonance tomography!

When D-Vapor is connected to anaesthetic devices by manufacturers other than Dräger, make sure the connection values required for the intended use, e.g. for the geometry, pressure and fresh-gas flow, and the electrical values, including the leakage current, are observed see 'Technical Data'.

Deviating from the required connection values can result in the delivery of incorrect concentrations.

D-Vapor may only be used with anaesthesia delivery systems that correspond to one of the following standards: EN 740, ISO 8835, IEC 60601-2-13, ASTM F 1161, ASTM F 1850, CSA-Z 168.3.

Installation and/or operation with anaesthesia delivery systems in moving vehicles, aeroplanes, helicopters, and ships is only permissible after consultation with Dräger and their approval.

Use the apparatus under the supervision of qualified medical personnel only to ensure that malfunctions are remedied without delay!

Operation Concept

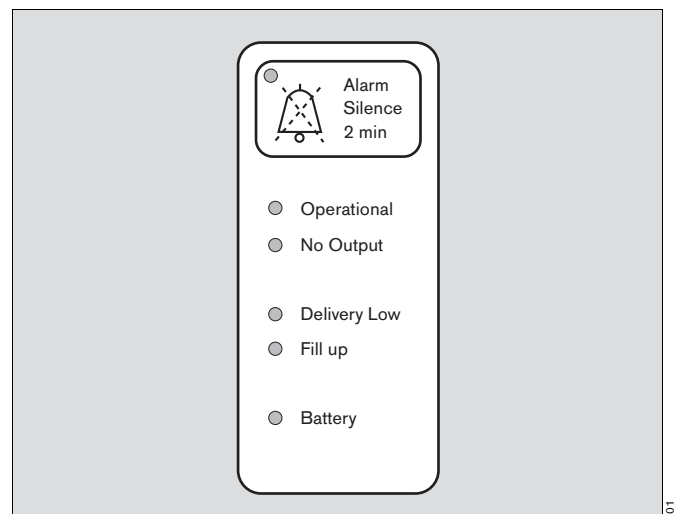
Handle D-Vapor with care! Do not drop it.
 Be careful not to tilt or drop.
 Do not carry by the control dial, control dial caps or locking lever for the plug-in adapter.
 Risk of injury.
 Do not use a D-Vapor that has been dropped!
 Damage could result in the delivery of incorrect concentrations.

Operating Modes of D-Vapor

In normal operation, D-Vapor operates in four modes. Each mode is shown by an LED on the display. Modes that occur outside of normal operation, e.g. alarm modes, are described in the chapter 'Displays and Acoustic Signals'.

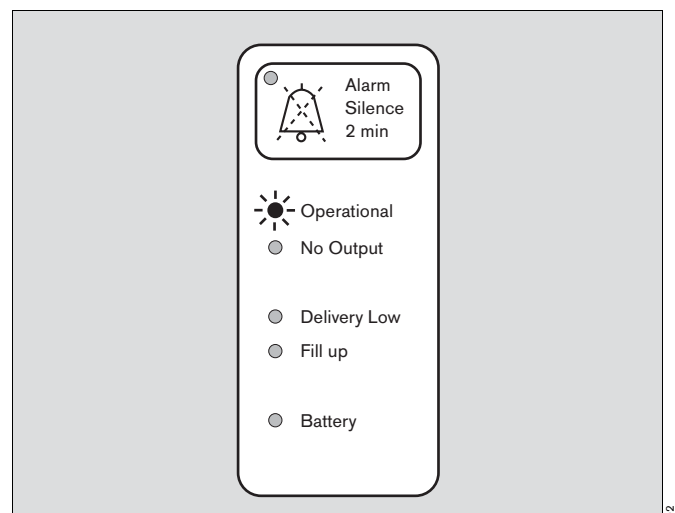
1 – Apparatus is switched off

D-Vapor's power cable is not connected to the power supply. All LEDs are off.



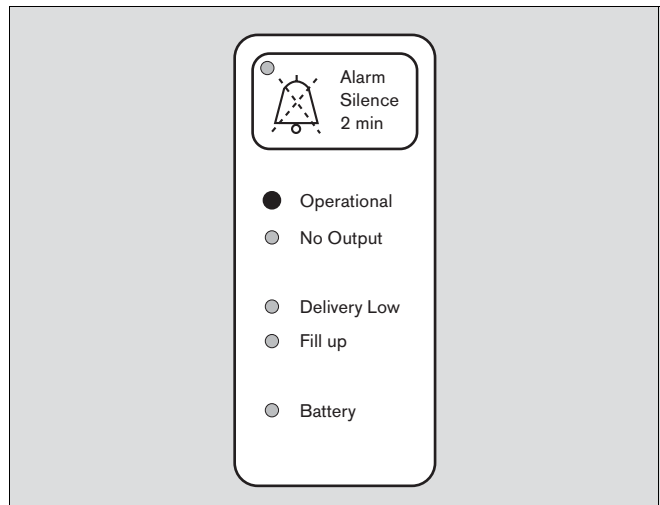
2 – Apparatus is heating up

The power cable is connected to the power supply. The apparatus is heating up. The operating temperature has not yet been reached. The green »Operational« LED is flashing. An acoustic signal is emitted at the end of the heating process.



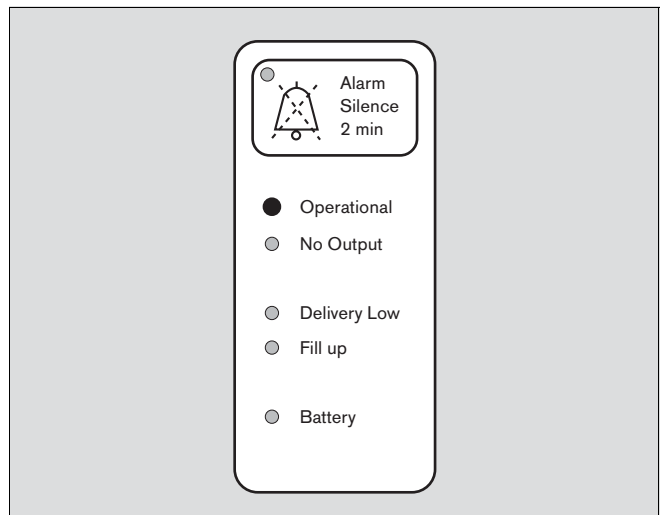
3 – Apparatus is operational

The apparatus has reached its operating temperature. The control dial is switched to »O« or »T«. The green LED »Operational« is glowing.



4 – Apparatus is delivering

The apparatus is ready for use. Control dial ≥ 2 vol.%



Control Dial

Use the control dial to switch the apparatus on and off and adjust the concentration of the anaesthetic agent. The control dial is locked when in zero position »0« and transport setting »T«, and can only be adjusted by pressing the »0« button.

All illustrations of a vaporiser on an anaesthesia delivery system show a stylised anaesthesia delivery system in the background.

All of the illustrations that refer to the transport setting only show the D-Vapor in question.

»ON« – Switch on the apparatus and set the concentration

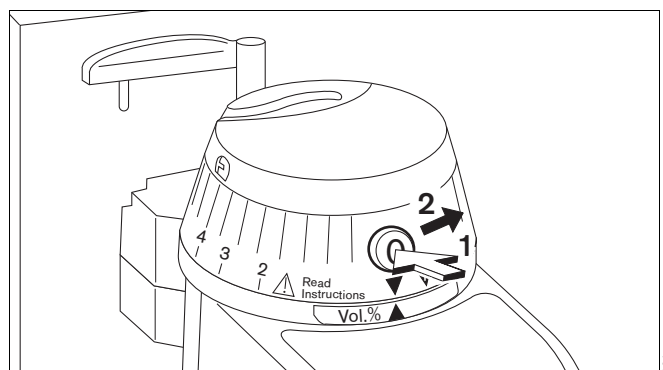
Select this setting only if D-Vapor is connected to an anaesthesia delivery system and is ready for use.

- 1 **Press** the »0« button.
- 2 Turn the control dial anticlockwise to the concentration of anaesthetic agent required.

An acoustic signal is emitted if D-Vapor is not ready for use, see 'Alarms', page 15.

Concentration values above 12 vol.% are shown in reverse order to draw attention to the danger of a high delivery and restricted flow range.

Concentrations above 12 vol.% can only be achieved by pressing the »0« button again.



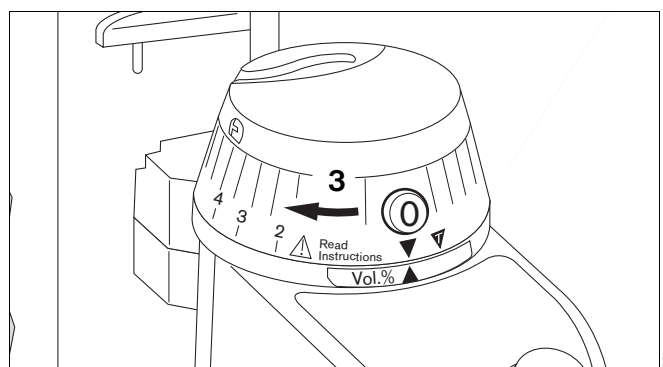
»0« – Switch off the apparatus

Always select this setting if D-Vapor is connected to an anaesthesia delivery system but no anaesthetic agent is to be delivered.

- 3 Turn the control dial clockwise to »0« – the »0« button engages.

If the control dial displays a value higher than »0«, only tilt D-Vapor to an angle of 10°!

Risk of delivering incorrect concentrations.

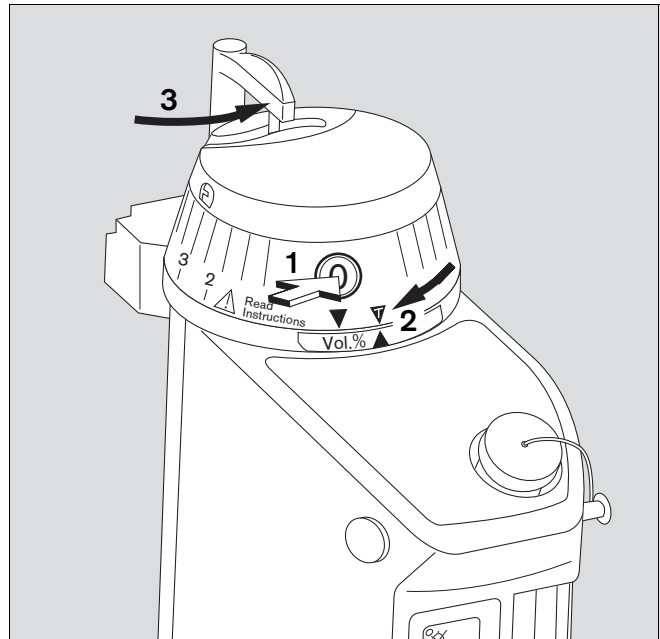


»T« – Transport

Always select this setting if D-Vapor is being removed from the anaesthesia delivery system or is on the parking holder.

- 1 Press the »0« button.
- 2 Turn the control dial clockwise to transport setting »T« – the »0« button engages.
- 3 For plug-in adapters, engage the locking lever in the control dial.

When set to »T«, a full D-Vapor may be transported in any position.



Connecting and Interlock Systems

Using D-Vapor with different anaesthesia delivery systems requires using different connecting systems.

On anaesthesia delivery systems with several vaporiser connections, the different Interlock systems* ensure that only one vaporiser is used at a time and that the others are switched off and locked.

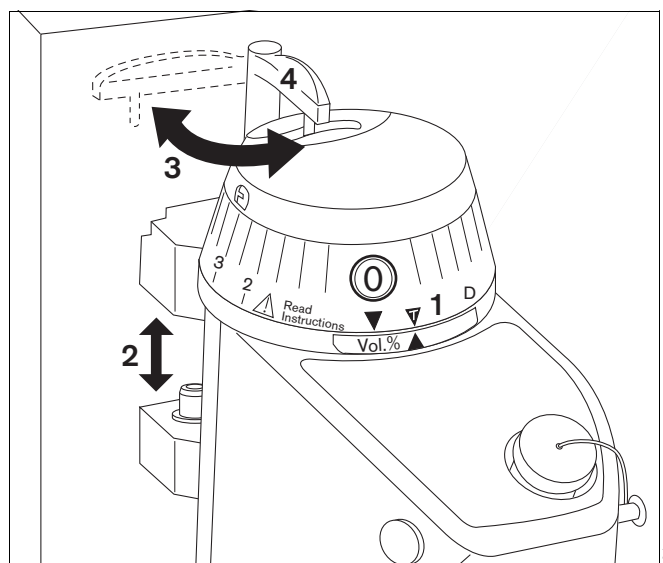
Plug-in Adapter/Plug-in Connector

Enables vaporisers to be safely and quickly connected and changed.

Most plug-in connectors have valves that allow fresh gas to flow through whether a vaporiser is connected or not. These plug-in connectors can be identified by the moveable valve inserts in the inner holes on the connector pins.

Many vaporisers with plug-in adapters carry an anaesthetic agent code on the back which can be read and displayed by anaesthesia delivery systems designed for the purpose.

- 1 To connect/remove, the control dial must be in the »T« position and the locking lever must be engaged in the control dial.
- 2 The holes in the plug-in adapter on D-Vapor fit onto the pins on the plug-in connector on the anaesthesia delivery system.
- 3 To secure/release, swing the locking lever into position and engage/disengage the pin in the cover plate on the vaporiser.
- 4 The locking lever and pin help ensure that D-Vapor is handled correctly and that it can only be fitted and removed when the control dial is in the »T« position.



Plug-in DW-2000 adapter with Interlock 2

To connect to Dräger plug-in connectors.

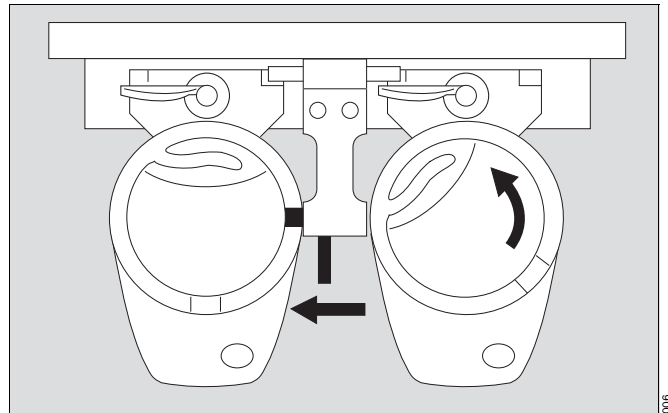


* The different Interlock systems are not compatible with each other. However, D-Vapor can be modified for use with other systems.

For anaesthesia delivery systems with two plug-in connectors combined with **Interlock 2**.

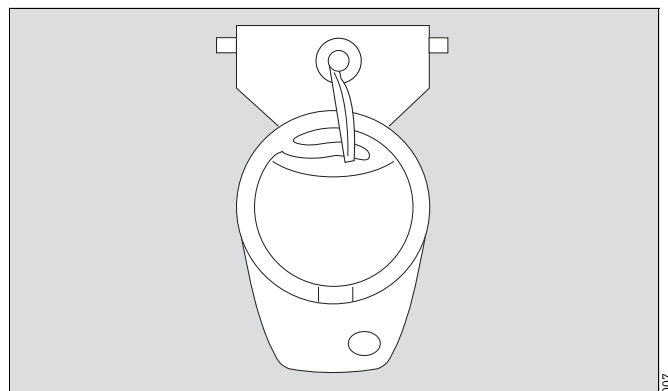
By sliding the locking bar, which can only be engaged in the control dial when set to »0«, only one vaporiser can be used at a time.

Illustration: left D-Vapor locked, right D-Vapor operational.



Plug-in S-2000 adapter with Interlock S

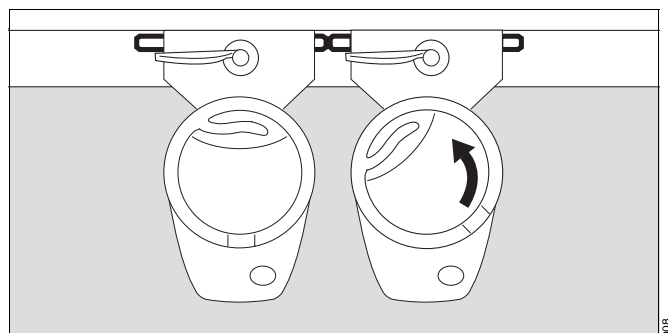
To connect to Selectatec®-compatible plug-in connectors.



For anaesthesia delivery systems with several plug-in connectors in combination with **Interlock S**.

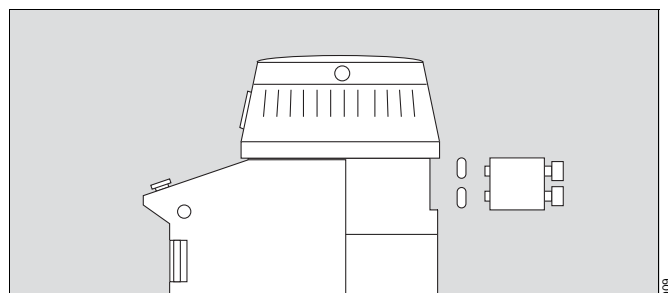
When a vaporiser is switched on, two rods on the side of the plug-in adapter are pushed out. They prevent other vaporisers on adjacent plug-in connectors from being switched on.

Illustration: left D-Vapor locked, right D-Vapor operational.



Permanent Installation

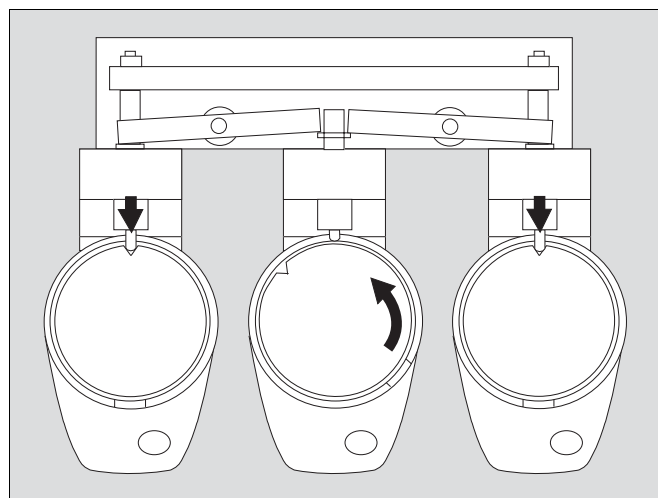
To permanently install in the fresh-gas line of anaesthesia delivery systems with the appropriate connector options.



For anaesthesia delivery systems with several plug-in connectors in combination with **Interlock NMD**. The levers are activated when a vaporiser is switched on. This prevents other vaporisers on adjacent connectors from being switched on.

Illustration: middle D-Vapor in use, right and left D-Vapors locked.

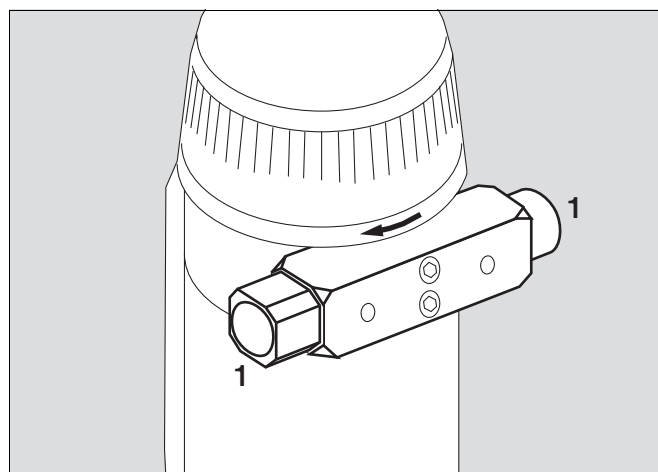
Other Interlock systems are used, such as Interlock 1, which are very similar to Interlock NMD, but on which vaporisers with Interlock NMD do not fit.



Conical connector, 23 mm

For anaesthesia delivery systems with 23 mm conical connectors conform to ISO 5356-1 on the fresh-gas line.

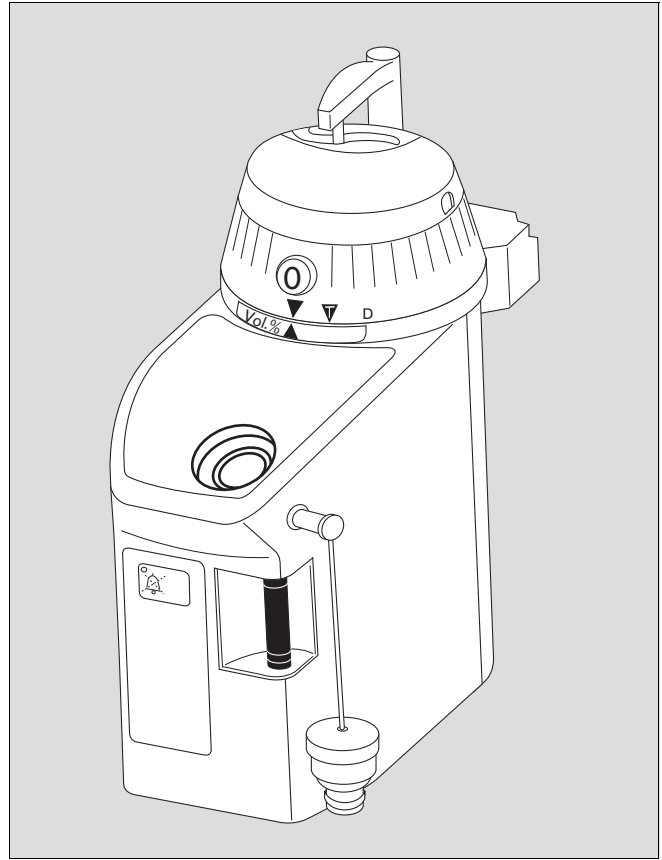
1 Conical connector on D-Vapor.



Desflurane Filling System

For Desflurane (Suprane[®]) bottles with a Saf-T-Fill[™] valve for the safe and distinctive filling with Desflurane, see 'Filling D-Vapor', page 22.

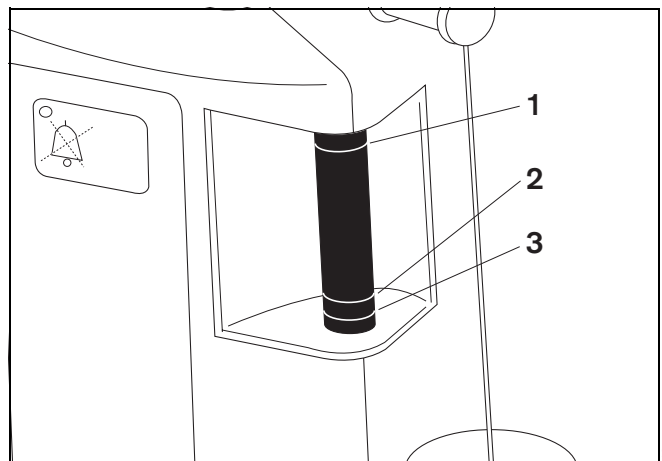
The D-Vapor has a level indicator with minimum and maximum level marks as well as a third (middle) mark that shows when it can be refilled with a whole bottle (240 mL) of Desflurane.



Level Indicator

The level indicator (sight glass) shows the content of the reservoir.

- 1 Upper mark:
D-Vapor is filled to maximum capacity and cannot be filled any further.
- 2 Middle mark:
Refill the apparatus with a full bottle of Desflurane (240 mL).
- 3 Lower mark:
Minimum fill level, the reservoir has a reserve of approximately 40 mL.



Alarms

D-Vapor has an optical and an acoustic alarm system in accordance with EN 475/ISO 9703. In addition, D-Vapor has a secondary acoustic alarm system.

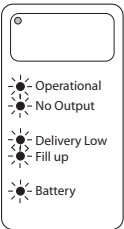
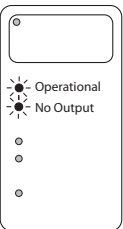
Alarm Priorities

D-Vapor has two alarm priorities and an indication. The priorities have different optical and acoustic signals*:

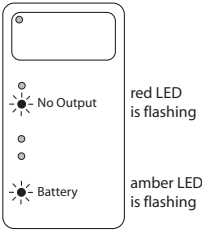
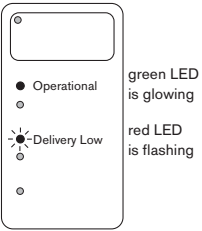
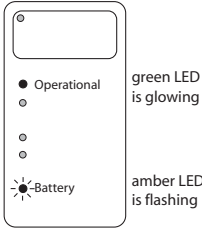
Alarm priority	Optical signal	Acoustic signal
High	Red LED is flashing quickly	Two groups of five tones each are emitted every nine seconds.
Medium	Amber LED is flashing	One group of three tones is emitted every twenty-four seconds.
Indication	Amber LED is glowing permanently	A short indication signal.

Medium priority alarms can be suppressed acoustically for 2 minutes by pressing the »Alarm Silence« button. The yellow LED »Alarm Silence« glows whilst the alarm is suppressed. The alarm is still indicated by the corresponding LED.



Optical and Acoustic Alarm System

Priority	Display	Cause	Remedy
High	 <p>all LEDs are flashing</p>	Apparatus fault	Take the apparatus out of operation. Turn the control dial to »0« and interrupt the power supply. Remove the apparatus from the anaesthetic device. Call DrägerService.
High	 <p>green LED is flashing red LED is flashing</p>	Delivery requirement during the heating phase. Malfunction	Turn the control dial to »0«. Wait until the green LED »Operational« glows permanently.

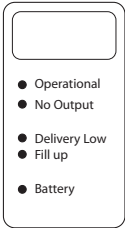
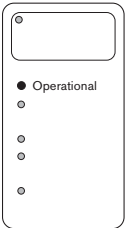

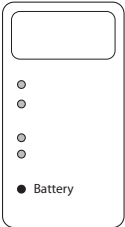
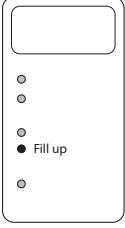
* The green LED »Operational« does not specify an alarm priority, but shows that the apparatus is working properly.

Priority	Display	Cause	Remedy
High	 <p>red LED is flashing</p> <p>amber LED is flashing</p>	End of emergency power operation	Turn the control dial to »0«. Change the anaesthetic agent.
High	 <p>green LED is glowing</p> <p>red LED is flashing</p>	<p>Delivery Low</p> <p>Set concentration and/or fresh gas flow is too high. (only with fresh gas flow >1.5 L/min)</p>	<p>Correct the setting, see 'Flow Dependency', page 59.</p> <p>If the "Delivery low" alarm remains active: Observe the anaesthetic gas parameters on the monitor. Set the control dial to »0«. Interrupt the power supply. Remove D-Vapor from the anaesthetic device if possible. Call DrägerService.</p>
		Apparatus fault	Observe the anaesthetic gas parameters on the monitor.
		The reservoir is empty.	Refill Desflurane, if necessary observe the heating time.
Medium	 <p>green LED is glowing</p> <p>amber LED is flashing</p>	Power failure	<p>Emergency power operation; D-Vapor continues delivering, see 'Emergency Power System during Power Failures (battery operation)', page 36.</p> <p>Prepare to change the anaesthetic agent.</p>

Secondary Acoustic Alarm System

Alarm	Cause	Remedy
 <p>Continuous tone ≥7 s</p>	AC power failure; no further emergency power operation possible.	Turn the control dial to »0«. Change the anaesthetic agent.
 <p>Continuous tone</p>	Delivery requirement if D-Vapor is not connected to the power supply.	Turn the control dial to »0«. Connect D-Vapor to the power supply, wait for the heating phase. Set the selected concentration.

Recommendations

Indication	Cause	Remark
 <p>all LEDs are glowing</p>	<p>Start of self-test</p> <p>End of self-test</p>	<p>The start and the end of the self-test are displayed by an indication signal. All of the LEDs glow during the self-test. Do not put D-Vapor into operation if one or more LEDs do not glow. Call DrägerService.</p>
 <p>green LED is glowing</p>	<p>End of heating phase. D-Vapor is ready for use.</p>	<p>D-Vapor is ready to deliver.</p>
	<p>Control dial switches from »0« to »>2«.</p>	<p>The heated D-Vapor emits an indication signal when the control dial is turned up. If the indication signal is not emitted, the acoustic signal is defective. Call DrägerService.</p>
 <p>amber LED is glowing</p>	<p>The battery is not ready for the specified emergency power operation.</p>	<p>Connect D-Vapor to the power supply without delivery (control dial set to »0« or »T«). If the »Battery« LED is still glowing after one hour, the battery is defective and must be replaced. Call DrägerService.</p>
 <p>LED is glowing</p>	<p>Level has dropped below refill mark.</p>	<p>Refill with a full bottle of Desflurane, see 'Filling D-Vapor', page 22.</p>

Preparation

D-Vapor must not be operated without a battery or with a defective battery.

If the battery is missing or defective (see 'Recommendations', page 17), the secondary alarm system is not available (see 'Secondary Acoustic Alarm System', page 16).

In this case, no (or only a partial) emergency power system is available.

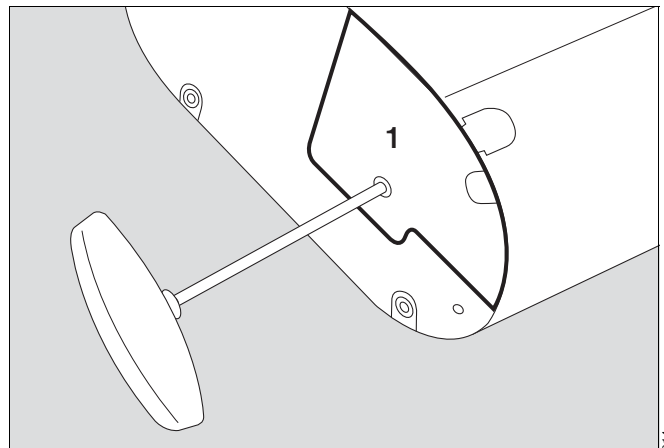
Before Using the Apparatus for the First Time

(Instructions for DrägerService or authorised Dräger service technicians)

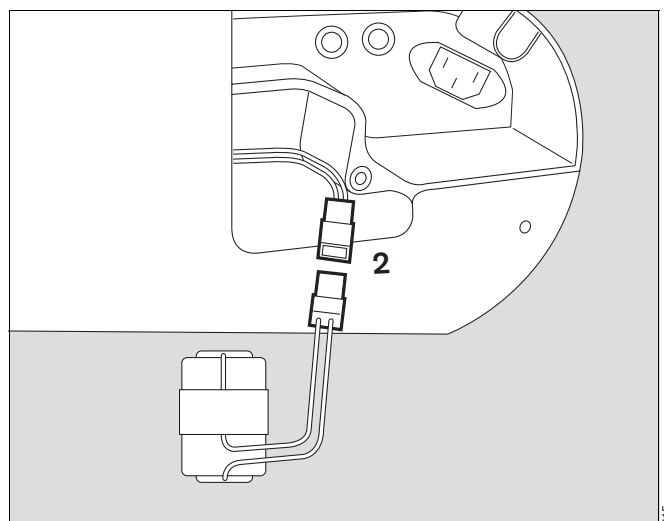
- Check that D-Vapor, its power cable, and its battery are not damaged.

Install the battery and unscrew the base plate.

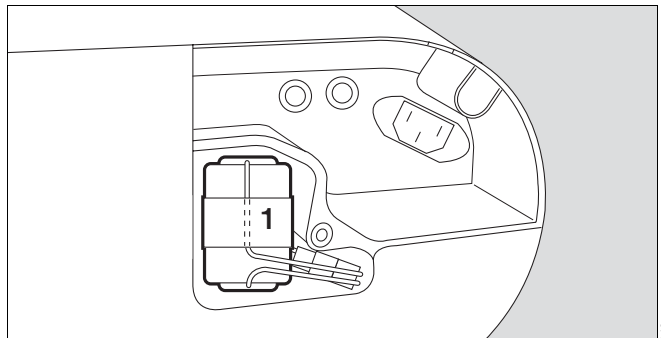
- 1 Unscrew the base plate.



- 2 Connect the battery cable.

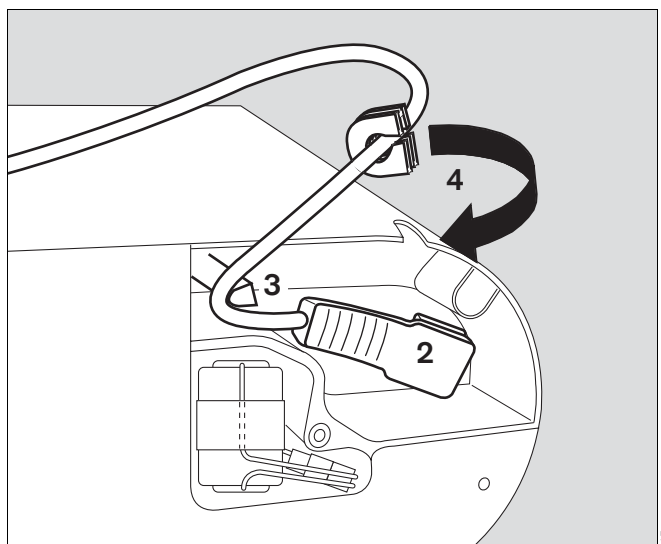


- 1 Place the battery in the battery case.



Connecting the Power Cable

- Use the enclosed original cable.
 - Lay D-Vapor on its side.
- 2 Plug the inlet connector for non-heating apparatus into the slot.
 - 3 Wrap the cable around the pull relief.
 - 4 Plug the grommet and the cable into the casing.
- Screw the base plate back on.



Before Putting the Apparatus into Operation for the First Time and when Detached from the Mains for a Prolonged Period of Time

Connect D-Vapor to the mains for 1 hour.

This charges the battery for the emergency power supply.

- Set the control dial to »T«.
- Remove the cap, if present, from the gas inlet/outlet at the back of the apparatus.
- See 'Checking Readiness for Operation', page 44.

Fitting Connectors

Use only authentic Dräger parts.

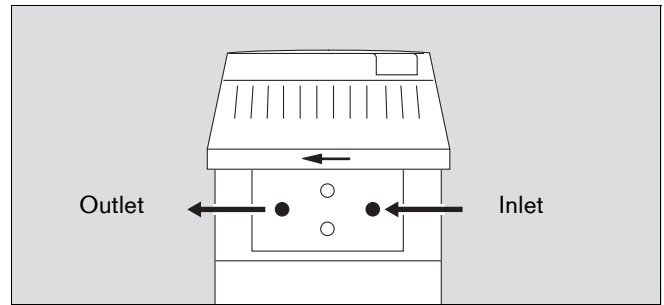
Only selected materials may be used with anaesthetic agents.

Connectors must be fitted by skilled personnel because they have to be dismantled and checked. Risk of delivering incorrect concentrations and/or release of anaesthetic agent.

- Remove the cap, if present, from the gas inlet/outlet at the back of the apparatus.
- Always connect D-Vapor in such a way that the gas flow matches the illustration and the arrow on the back of D-Vapor.

An incorrect direction of flow leads to an incorrect concentration!

- Follow the anaesthesia delivery system's Instructions for Use.
- For conical connectors: the male cone on the connecting piece is the D-Vapor inlet; the female cone on the connecting piece is the D-Vapor outlet.



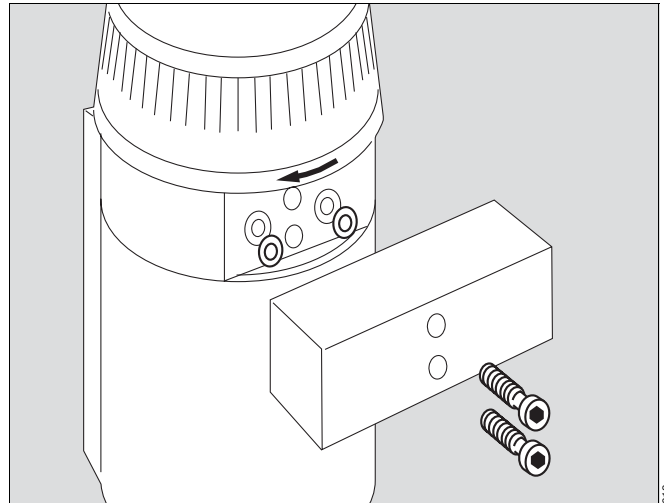
Use two new screws, article no. 13 43 947, – do not re-use old screws:

- Property class 10.9, surface A2R according to DIN ISO 4042, thermally cured
- Dimensions DIN EN ISO 4762-M4 x each connector's length. Screws fitted through the connector must be screwed into place with a thread length of no less than 5 mm and no more than 7 mm. If screws shorter than 25 mm are used, place additional centering pins between the plug-in adapter and D-Vapor.
- Do not use serrated lock washers, flat washers or similar.

If these requirements are not adhered to, D-Vapor could fall off.

Risk of injury. Risk of delivering incorrect concentrations.

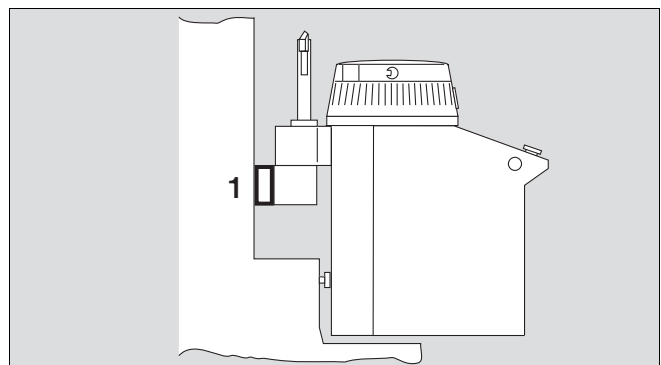
- Before fitting, make sure the sealing surfaces are clean and undamaged.
- Place the sealing washers, article no. M 21929, on the sealing surfaces of the gas bores.
- Fasten the screws to 270 to 300 Ncm, do not tighten.
- Check that the connector is securely in place.



Connect D-Vapor to anaesthetic delivery devices of Type SA2 or Titus

These machines must be modified for operation with D-Vapor (DrägerService) before they are connected.

- 1 SA2: Modification details:
extra plate, 1 cm thick, between plug-in connector and housing of anaesthesia delivery system.



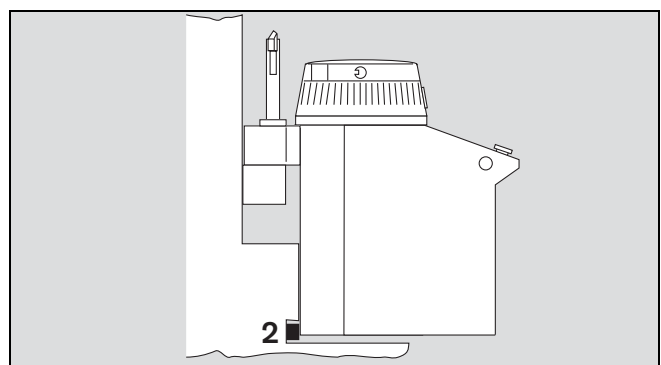
- 2 Titus: Modification details:
rubber buffer (O₂ alarm), fitted at the point where D-Vapor is suspended, fits flush with surface of the housing.

Check that D-Vapor fits flush with the lower installation points and, when viewed from the side, is suspended from the machine in a vertical position.

Risk that fresh gas and anaesthetic agent vapour escape.

- See 'Filling D-Vapor', page 22
- See 'Checking the Concentration', page 46
- When D-Vapor is connected to anaesthetic devices by manufacturers other than Dräger, make sure the connection values for geometry, pressure, flow, and the electrical values, including the leakage current, are checked by skilled personnel on each anaesthetic apparatus type.

The technical data for D-Vapor and the anaesthesia delivery system must be adhered to. Any deviations may result in the delivery of incorrect concentrations.



Filling D-Vapor

Only fill D-Vapor in a well-ventilated environment.

Only fill D-Vapor with Desflurane!

If liquids other than Desflurane get into D-Vapor, the apparatus could get damaged and the patient harmed.

Do not use a D-Vapor that has been filled with other agents. Contact DrägerService immediately!

Use only Desflurane bottles with the Saf-T-Fill™ valve to fill D-Vapor!

Only fill D-Vapor in an upright position!

Do not inhale Desflurane fumes!

Do not fill D-Vapor during emergency power operation (see 'Emergency Power System during Power Failures (battery operation)', page 36)!

Keep filling inlet clean. Dirt, dust or particles must not enter the filling inlet.

Contamination caused by dirt, dust or particles may cause anaesthetic agent to squirt or spray from the filling inlet!

Only fill to the upper mark of the level indicator!

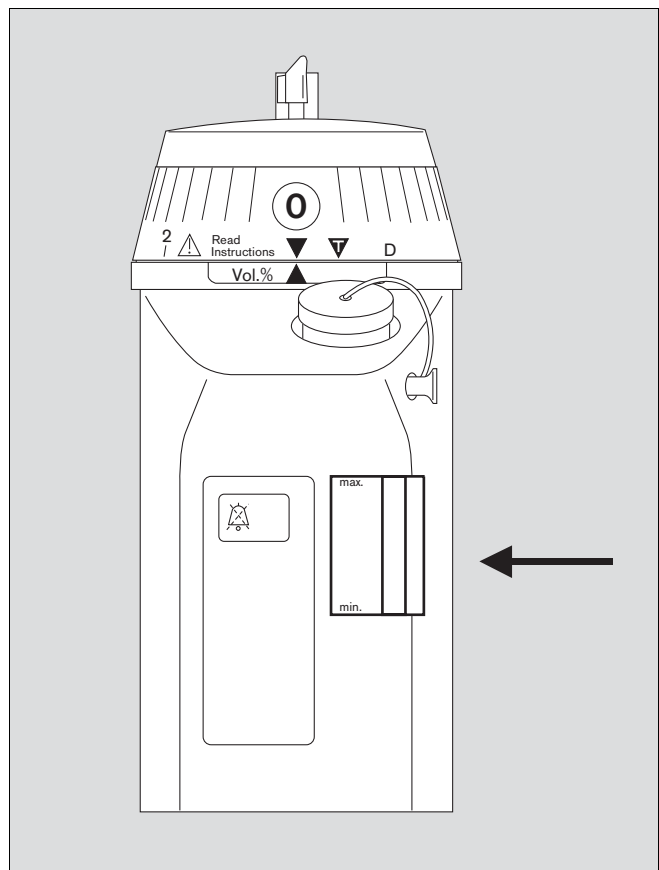
The level indicator only works properly when D-Vapor is in an upright position!

After a longer storage period, heat up D-Vapor until it reaches 'Operational' mode. The green LED »Operational« glows continuously. You can now fill D-Vapor up to the upper filling mark.

If the level indicator falls below the lower level mark, fill D-Vapor again!

If the level indicator is at the middle mark, refill D-Vapor with a whole bottle of Desflurane. This is indicated by the glowing amber LED »Fill up«. An indication signal is emitted.

Observe the usage information enclosed with the Desflurane bottle.



D-Vapor can be filled:

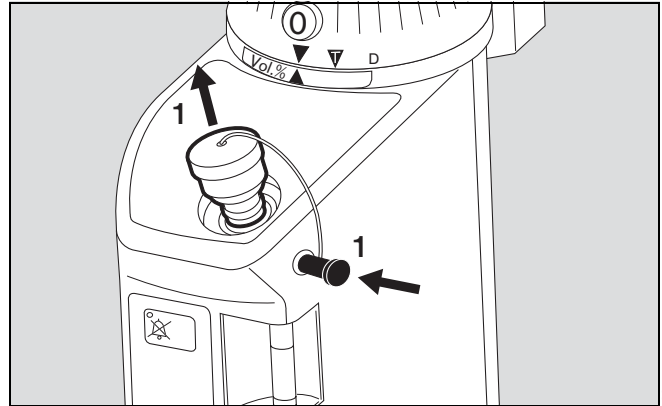
- when the device is switched off
(power cable is not plugged into the power outlet)
- during the heating phase, or
- during operation
(however, the filling process then takes longer).

When filling during operation, use only Desflurane that has an ambient temperature.

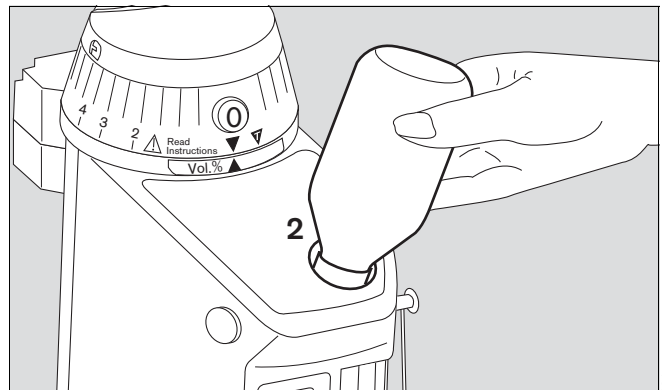
When D-Vapor is not connected to the anaesthesia delivery system, leave the control dial switched to »T«.

To fill:

- Unscrew the cap from the bottle. Make sure the O-ring in the bottle connector is undamaged.
- 1 Press the unlocking button on the D-Vapor and pull out the sealing plug.



- 2 Insert the bottle in the filling inlet. The bottle makes an audible click sound when it locks into the filling inlet.

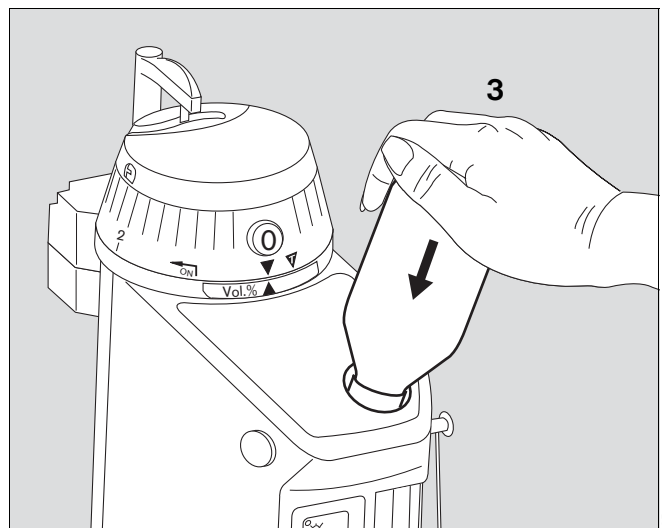


- 3 Press the bottle down to fill. Continue pressing the bottle down during filling and observe the level indicator. Desflurane flows into D-Vapor – the content of the bottle bubbles. Monitor the increasing fill level on the sight glass.

If D-Vapor is filled when it has been heated up, the content of the reservoir also bubbles. Interrupt the filling process to check the filling level. To do so, hold the bottle without pressing it down. Then, if necessary, continue the filling process by pressing the bottle down again.

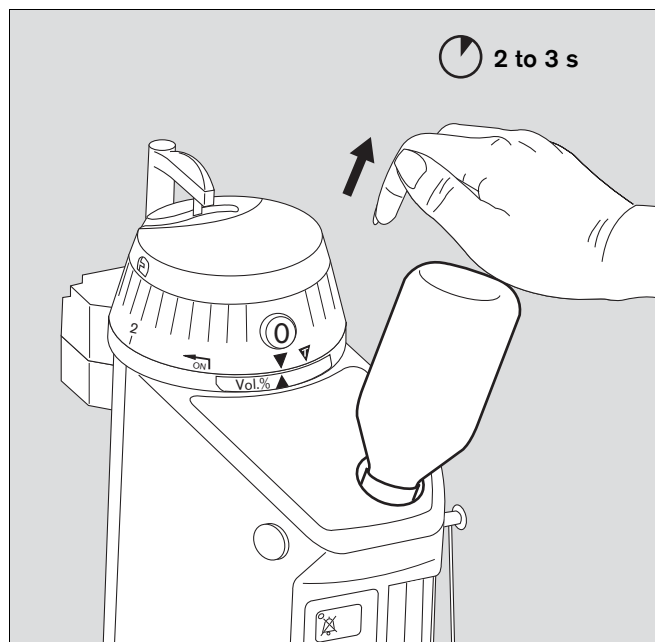
Do not fill D-Vapor beyond the maximum mark!

If the maximum mark is exceeded, excess Desflurane could squirt out of the filling system when removing the bottle, especially when D-Vapor is heated up.



Ending filling:

- Release pressure on the bottle. Filling stops. The bottle's valve closes automatically and prevents Desflurane from escaping.
- Wait 2 to 3 seconds for the anaesthetic agent to flow into the reservoir. Otherwise the anaesthetic agent can squirt or spray from the filling inlet!



- Press the unlocking button.
- Pull the bottle out of the filling inlet.
- Screw the cap back on to the bottle.
- Place the sealing plug in the filling system and press it down. The locking device locks audibly into place.

Connecting D-Vapor to the Connector System

The maximum fresh gas inlet pressure must not exceed 2 bar (29.01 psi).

Observe the anaesthesia delivery system's Instructions for Use.

The control dial must be engaged at »T«.

If D-Vapor is going to be used on SA2 or Titus anaesthesia delivery systems, check that they have been modified for use with D-Vapor (see page 21).

D-Vapor with Plug-in Adapter

- 1 Locking lever must be positioned above the control dial.
- 2 The sealing rings on the plug-in connector's pins must be present and undamaged.
The plug-in connector must be free of foreign bodies.

Anaesthesia delivery systems with several plug-in connectors:
Two plug-in connectors and Interlock 2:

- 3 Before connecting D-Vapor, switch the slide valve of the Interlock 2 to the opposite position.
If a vaporiser has already been connected and is in operation, it must first be set to »0«.

If there are several Selectatec-compatible plug-in connectors:

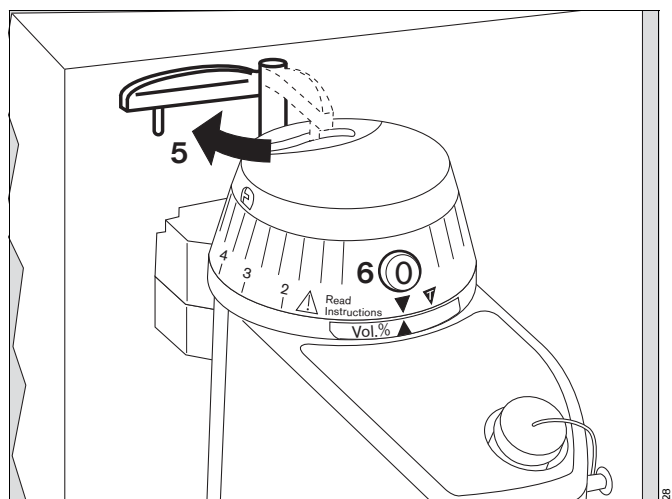
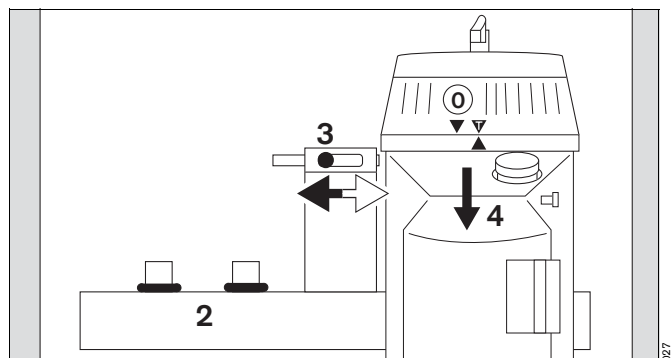
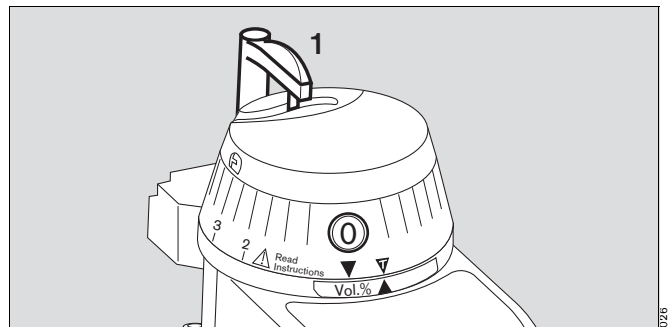
- Switch off vaporisers on other plug-in connectors. Turn the control dial to »0« or »OFF«.
 - When connecting several D-Vapors, always connect them side by side. For Interlock to operate, there must be direct contact with the Interlock pins on the side.
For triple plug-in connectors with built-in locking transmission between the outer plug-in positions, the middle plug-in position may remain unoccupied.
- 4 Hold D-Vapor in a vertical position with both hands and lower gently onto the pins of the plug-in connector.

Risk of injury by trapping finger.

The plug-in adapter must be level and stable on the sealing rings. If this is not the case, there may be a loss of fresh gas, leaks, excessively low concentrations, or the Interlock locking device may jam.

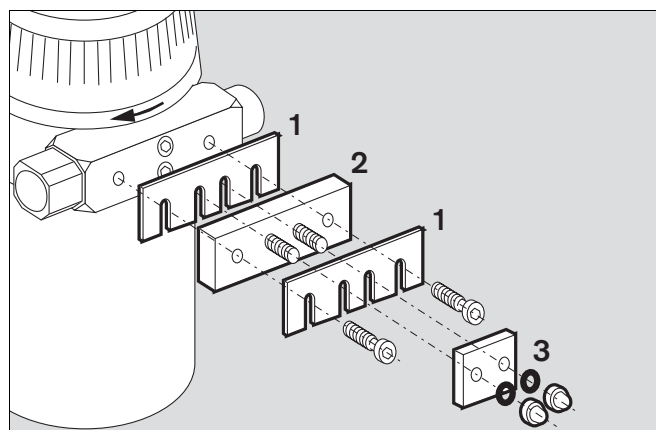
In this case: check the position of the lever and the stop-mechanism, and reconnect D-Vapor, see 'Removing D-Vapor', page 37.

- 5 Swing the locking lever 90° clockwise until it engages. D-Vapor is then secured and cannot be removed.
- 6 Press the »0« button and move the control dial to »0« until it engages.



D-Vapor with Conical Connectors without Interlock System

- Insert D-Vapor in the fresh-gas line.
- 1 For anaesthesia delivery systems with rigid conical connectors, adjustment plates may be used for alignment: between the connecting piece and the connecting plate and/or the connecting plate and the anaesthesia delivery system. Ensure adequate screw length – at least 4 screwable threads. If necessary, use longer screws, strength at least 500 N/mm².
- 2 Fasten connecting plate to connecting piece using M6 DIN 912-A4 cap screws, torque (7±0.5) Nm.
- 3 Tighten D-Vapor with clamping plate and two M6 DIN 1587M-A4 cap screws and two A6,4 DIN 125-A4 washers.



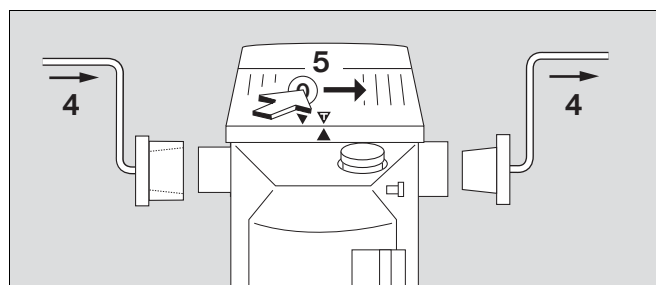
D-Vapor should not be used in a breathing system. High resistance can affect breathing and result in the delivery of incorrect concentrations.

- 4 Connect gas inlet and outlet lines to D-Vapor.

Make sure the direction of flow is correct and corresponds to the arrow on the back of D-Vapor, see page 20.

An incorrect direction of flow leads to an incorrect concentration!

- 5 Press the »0« button and move the control dial to »0« until it engages.

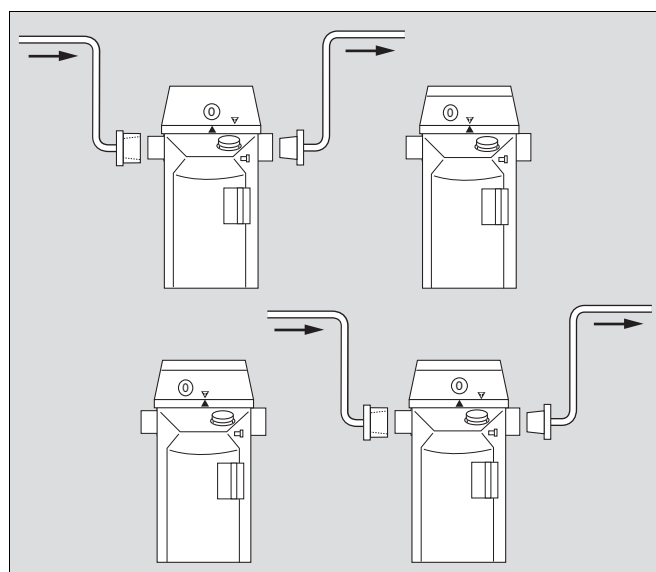


Secure free-standing D-Vapor against tilting and falling. Risk of injury.

Make sure that only one vaporiser is used at any one time, or that only one D-Vapor is connected at any one time. This may otherwise result in the delivery of mixtures or concentrations that may be too high.

On the D-Vapor which is not being used:

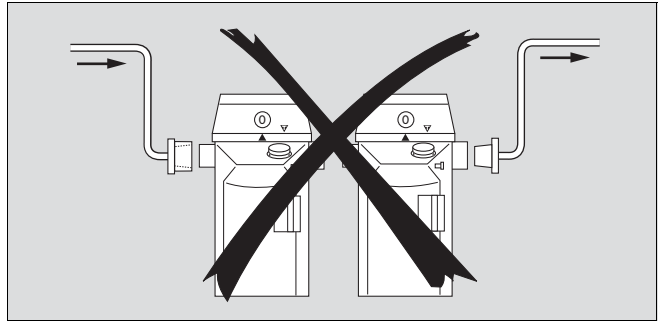
- Press the »0« button and engage the control dial at »T«.



When using several vaporisers with conical connectors:

Never connect vaporisers in series!

If vaporisers are connected in series without an Interlock system there is a risk that several vaporisers will be switched on and in use at the same time. In this case, gas containing anaesthetic agent will flow from one vaporiser to another and result in uncontrollable mixtures or may even damage downstream vaporisers.



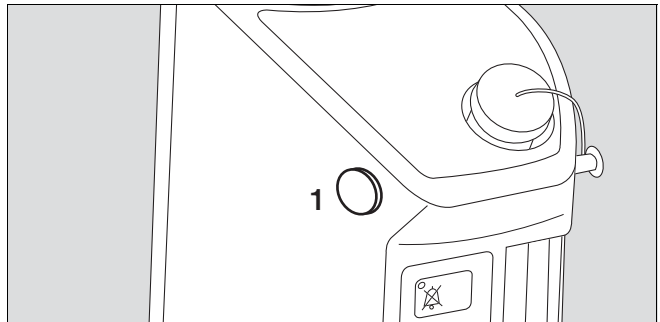
Connecting the Power Cable to the Power Supply

- Connect power cable.

Establishing the Potential Equalisation

e.g. for intracardiac or intracranial operations

- 1 Remove the protective cap.
- Connect one end of the ground wire to the connecting bolt.
 - Connect the other end to a central connecting bolt.



Operation

Checklist

This check must be carried out before every operation.

Prerequisites:

- Operating parameters are in the specified operating range.
- If the temperature of D-Vapor is too low (e.g. after transport), wait until the apparatus has reached ambient temperature.
- May not be used in a magnetic field (e.g. in rooms with magnetic resonance tomographs).

At an angle of more than 10°, an unsecured D-Vapor can topple over.

Operating D-Vapor at an angle of more than 10° can result in uncontrolled concentrations and is therefore not allowed.

Connections and plug-in connectors/plug-in adapters may leak when used at greater angles.

The filling level in the sight glass is incorrect when D-Vapor is used at an angle. This may lead to overfilling.

- The anaesthesia delivery system has been prepared according to the Instructions for Use, and the anaesthetic gas scavenging system has been connected.
- The anaesthetic agent monitor is switched on. Correct anaesthetic agent and alarm thresholds are set.

Dräger recommend continuously monitoring the delivered anaesthetic agent using upper and lower alarm thresholds to detect hazardous values through changes in concentration, leakage, or incorrect filling.

When the D-Vapour is used with an anaesthetic device in A cone operation, an anaesthetic gas monitor must be used.

In low flow and minimum flow mode, the concentration in the breathing system may deviate significantly from the D-Vapor setting. This is why it is essential to measure the concentration of the inspiratory and/or expiratory anaesthetic agent.

- The O₂ monitor is switched on. Alarm thresholds are set.

Dräger recommend continuously monitoring the oxygen concentration with at least one lower alarm threshold to detect an insufficient supply of O₂, e.g. due to leaks.

Checking:

- Check the apparatus for visible damage.
- Check the power cable for visible damage.
- The power cable must not be squeezed between D-Vapor and the anaesthesia delivery system.
- Filling level in sight glass must be high enough above the minimum mark, but must not exceed the maximum mark.
- Filling system:
Sealing plug inserted and engaged.
- Connector system:
 - Plug-in connector: plug-in adapter level on the seals. Locking lever swung to the left. Viewed from the front and side, D-Vapor is hanging vertical on the apparatus and cannot be removed.
 - Other connector: D-Vapor is connected firmly and securely to the anaesthesia delivery system. D-Vapor is suspended or standing upright and is secured against toppling or falling.
- The flow direction corresponds to the arrow on D-Vapor.
- For several connectors:
 - All connectors are occupied, otherwise
 - make sure that any unoccupied permanent and conical connectors or plug-in adapters without valve function are not operated open.

Otherwise, fresh gas and anaesthetic agent vapour will escape and interrupt the patient's supply.

- Connect only one D-Vapor at a time, otherwise
- make sure that the same Interlock system is used on D-Vapor and the anaesthesia delivery system.

A defective Interlock system can harm the patient by delivering an excessive concentration or a mixture of anaesthetic agents.

- The fresh gas flow must be switched off.
- Test each connected D-Vapor as follows:
 - Set D-Vapor to any concentration.
 - All other vaporisers must be switched off, locked, and impossible to switch on.
 - If there is an anaesthetic-agent vaporiser checking system, check that the correct anaesthetic is indicated and that it matches that of the connected D-Vapor.

An incorrect concentration could otherwise be displayed.

- Switch off D-Vapor – Engage control dial at »0«.
- Make sure that D-Vapor, the connector, and the fresh-gas lines are leak-tight (see the anaesthesia delivery system's Instructions for Use):
 - Set the control dial to »0« and »T«
 - Set the control dial to ≥ 2 vol.%.
- Flush the breathing system with fresh gas before connecting a patient.

Do not operate D-Vapor unless all checks have been carried out successfully. Repairs must be carried out by skilled personnel.

Switching on the Apparatus; Self Test

Only use fully functional D-Vapors!

Do not use D-Vapor if one of the six LEDs did not glow during the self-test and/or the acoustic signal was not emitted!

- Plugging the power cable into the power outlet completes the self-test.
 - An indication signal is emitted.
 - All six LEDs glow for several seconds.
 - Then an indication signal is emitted and five LEDs stop glowing.
 - The green LED »Operational« starts flashing to indicate that D-Vapor is heating up.

After the heating phase (up to 5 minutes) an indication signal is emitted and the green LED »Operational« glows continuously.

It takes longer to heat up a cold D-Vapor (e.g. after transport).

D-Vapor is ready for use. The control dial can be disengaged and the desired concentration set.

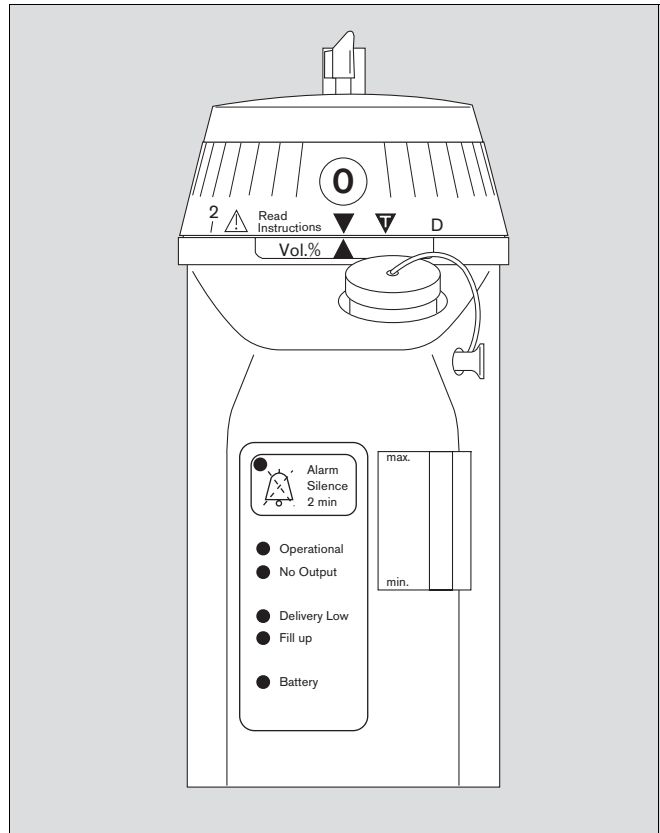
Activating the control dial before the green LED »Operational« starts glowing emits an acoustic signal and the red LED »No Output« starts flashing. No anaesthetic agent is delivered.

If the green LED »Operational« is still flashing after 20 minutes, call DrägerService:

- see 'Fault–Cause–Remedy', page 39

If the amber LED »Fill up« is glowing:

- see 'Filling D-Vapor', page 22



Delivering the Anaesthetic Agent

Set the anaesthetic monitor to Desflurane!

High Desflurane concentrations reduce the O₂ concentration in the fresh gas!

The concentration is not calibrated for the range between 0 and 2 vol.%; do not set to this range!

According to the European Norm EN 740 – 'Anaesthetic Workplaces and their Modules' – the gas monitor, as described in the Instructions for Use in the section 'Recommendations for Safe Use', must be switched on and functional before D-Vapor is put into operation.

On the anaesthetic delivery system:

- Set the fresh gas flow.

To set the concentration on D-Vapor:

- 1 Press the »0« button.
- 2 Turn the control dial anticlockwise to the desired concentration. An indication signal is emitted.

Do not set between »0« and »2 vol.%«!

The concentration is not calibrated for this range.

Do not use D-Vapor if the control dial turns too easily or with difficulty.

The exceedance of 12 vol.% is secured by a lock.

To set the concentration higher than 12 vol.%:

- Press the »0« button and use the control dial to set the concentration.

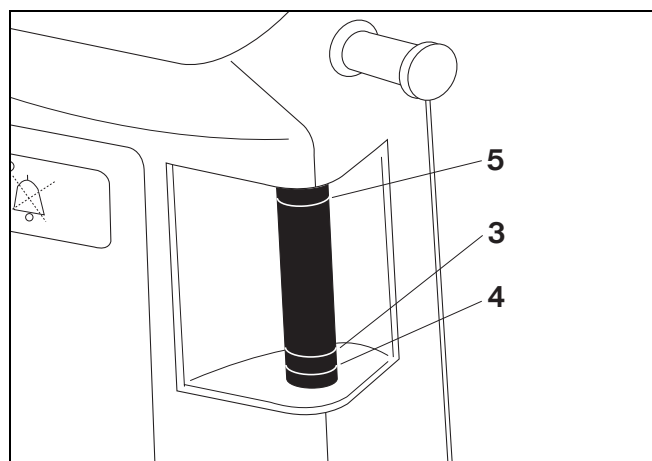
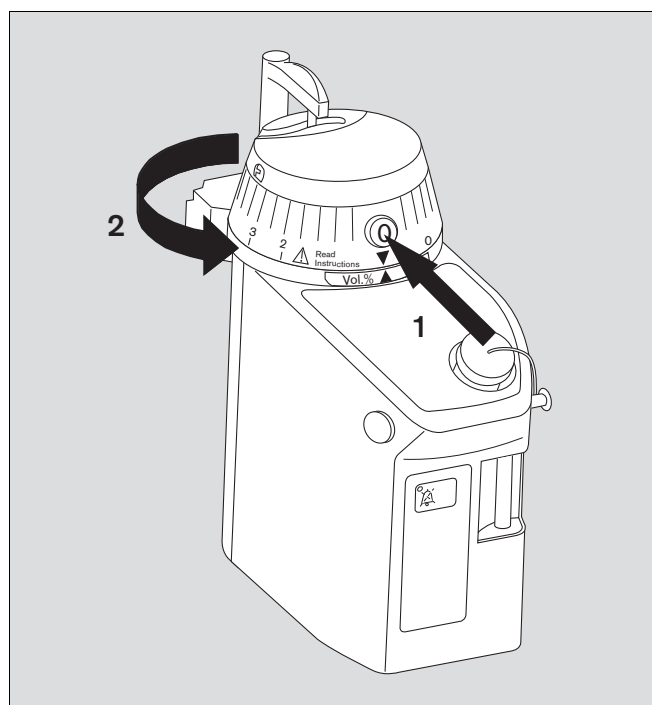
The »0« button does not have to be pressed if the concentration is reduced from a value higher than 12 vol.% to a value lower than 12 vol.%.

- Check the filling level in the sight glass regularly. It must be visible between the minimum (4) and the maximum (5) marks.

If not, do not use D-Vapor. D-Vapor could be empty or overfull and deliver incorrect concentrations.

- 3 When the middle mark is reached, refill D-Vapor with 240 mL of Desflurane (1 bottle).
- 4 At the latest when the minimum mark is reached: see 'Filling D-Vapor', page 22.

When operating with a high fresh gas flow and a high concentration at the same time, the delivered concentration could be lower than the set concentration. Observe the Technical Data, see page 54.



When the alarm “Delivery low” sounds: Adjust the proper setting, see 'Flow Dependency', page 59.

When the alarm “Delivery low” remains active:

Observe the anaesthetic gas parameters on the monitor. Turn the control dial to »0«. Interrupt the power supply. Remove D-Vapor from the anaesthetic device if possible. Call DrägerService.

An anaesthesia delivery system can be moved around the workplace with D-Vapor switched on.

Jerking or tilting at an angle of more than 10° can result in the delivery of incorrect concentrations.

Changing the Anaesthetic Agent

- Set the D-Vapor in use to »0«.
- Switch the anaesthetic agent monitor to the new anaesthetic agent.

If only one Vapor is connected or if one of the connected Vapors is to be replaced:

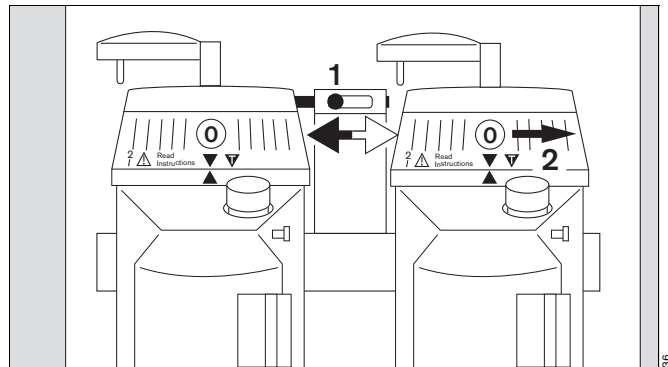
- See 'Removing D-Vapor', page 37.
- Connect the new D-Vapor, see 'Connecting D-Vapor to the Connector System', page 26.

Two Vapors with Interlock 2:

- 1 Lock the slide valve on Interlock 2 into the control dial on the vaporiser that was in use.

On the Vapor to be used:

- 2 Press the »0« button and set the control dial to the desired concentration of anaesthetic agent.



Ending the Delivery of an Anaesthetic Agent

1 Switch off D-Vapor: Engage the control dial at »0« to prevent it from being switched on accidentally.

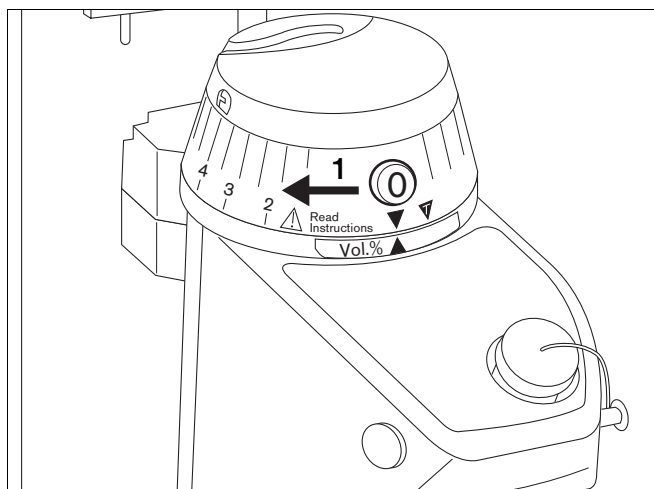
Then, if required:

- Switch off the fresh gas flow on the anaesthesia delivery system.

Always turn the D-Vapor control dial to zero, before turning off the fresh gas flow.

The apparatus is ready for use as long as the power plug is plugged in.

Disconnecting D-Vapor from the mains switches it off completely.



Emergency Power System during Power Failures (battery operation)

Prerequisite:

The battery is present, connected and sufficiently charged, see 'Before Using the Apparatus for the First Time', page 18.

If the battery is defective or not sufficiently charged, the amber LED »Battery« glows, see 'Recommendations', page 17. No or only a partial emergency power system is available.

- A sufficiently charged battery will bridge a power failure for a maximum period of five minutes (for a maximum delivery of 6 vol.%, a fresh gas flow of 4 L/min). The amber LED »Battery« flashes. A suppressible alarm signal is emitted.
- If the power failure is over within five minutes, the apparatus returns to normal operation.
- The apparatus switches itself off after five minutes of emergency power operation. This is indicated by a high-priority acoustic signal; the red LED »No Output« and the amber LED »Battery« flash.
- D-Vapor may not be refilled during battery operation.

Interrupting Operation

D-Vapor does not have to be drained during prolonged periods of inoperation.

If D-Vapor remains on the machine:

- Interrupt D-Vapor's power supply.
- Locking lever on plug-in adapter should remain locked.
- Observe the allowable temperature range, see 'Environment conditions', page 54.
- Observe the anaesthetic agent's expiration date.

If not:

- See 'Removing D-Vapor', page 37 and 'Transporting when full', page 38.

Removing D-Vapor

Do not drop D-Vapor. Do not use a D-Vapor that has been dropped. Damage could result in the delivery of incorrect concentrations.

Do not carry by the control dial, control dial caps or locking lever for the plug-in adapter.

Risk of injury.

Only remove D-Vapor when the control dial is set to »T«!
Pull out the power plug.

Place D-Vapor only on firm even surfaces or hang from sturdy brackets. D-Vapor could be damaged. Risk of injury.

For plug-in connectors

- If necessary: switch the control dials of adjacent anaesthetic vaporisers to »O« or »OFF«.
 - For two plug-in connectors and Interlock 2:
Switch the slide valves into the opposite positions.
- 1 Press the »O« button and turn the control dial clockwise to »T« until it engages.
 - 2 Turn locking lever 90° anticlockwise and engage in control dial.
 - 3 Use both hands to steadily lift D-Vapor off the plug-in connector.

For plug-in connectors without valves, the fresh gas supply is interrupted when in this state. Fresh gas and anaesthetic agent vapour may escape.

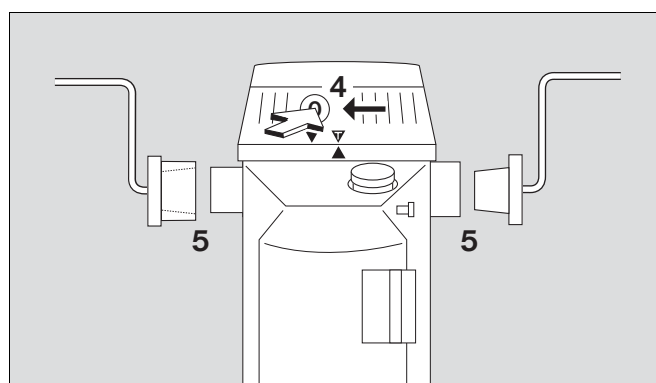
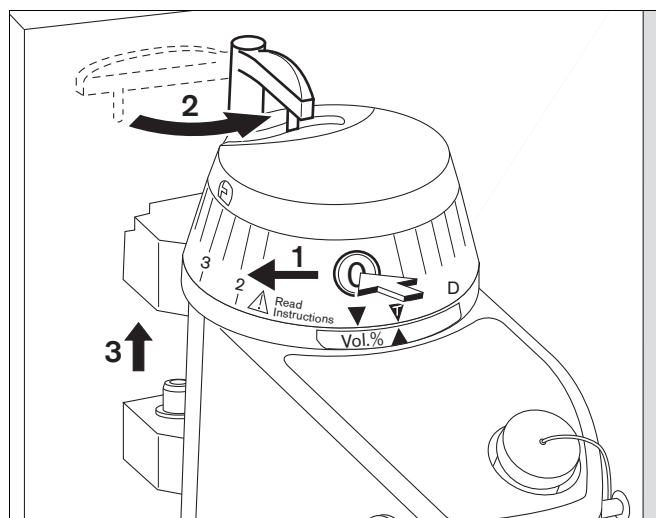
When operating an anaesthesia delivery system with three vaporisers and Interlock S, Interlock S may cease to function effectively when the middle vaporiser is removed.

For conical connectors

- 4 Press the »O« button and turn the control dial clockwise to »T« until it engages.
 - 5 Detach the gas supply and gas delivery lines from D-Vapor.
- D-Vapor can now be removed.

The fresh-gas line is now disconnected. Fresh gas and anaesthetic agent vapour may escape.

- If fresh gas is to flow to the breathing system, the gas supply and delivery lines must be connected to each other leak-tight.



Permanent connection

Only skilled personnel may remove the vaporiser.

Transporting when full

Individually or with a transportable anaesthesia delivery system, for example.

Only to be done as part of normal clinical operation, not for storage and despatching.

See 'Storage', page 50,

see 'Despatching', page 50".

An anaesthesia delivery system can be moved around the workplace with D-Vapor switched on.

Jerking or tilting at an angle of more than 10° can result in the delivery of incorrect concentrations.

For transport, the control dial must always be engaged at »T«. Remove detachable D-Vapors from the anaesthesia delivery system and transport separately.

Anaesthesia delivery systems with a permanently attached D-Vapor can be moved in or between buildings when the control dial is set to »O« or »T«.

Fault–Cause–Remedy

The table shows the link between faults and their possible causes and describes remedies the user may wish to apply.

Fault	Cause	Remedy
Alarm modes:		
All LEDs are flashing.	Apparatus fault	Turn the control dial to »0« and interrupt the power supply. Remove the apparatus from the anaesthetic device. Call DrägerService.
»No Output« Red LED is flashing »Operational« Green LED is flashing	Control dial is open while D-Vapor is heating up. Malfunction	Turn the control dial to »0«. Wait until the green LED »Operational« glows permanently.
»Operational« Green LED is flashing longer than 20 minutes	D-Vapor is heating up. If heating takes longer than 20 minutes and D-Vapor displays 'Operation', there is an internal fault (apparatus fault).	Do not use D-Vapor. Call DrägerService.
»Operational« Green LED is glowing »Delivery Low« Red LED is flashing	Delivery Low Set "Concentration" and/or "Fresh gas flow" too high. (only with fresh gas flow >1.5 L/min)	Correct the setting, see 'Flow Dependency', page 59. When the "Delivery low" alarm remains active: Observe the anaesthetic gas parameters on the monitor. Turn the control dial to »0«. Interrupt the power supply. Remove D-Vapor from the anaesthetic device if possible. Call DrägerService.
	Apparatus fault	Observe the anaesthetic gas parameters on the monitor.
	The reservoir is empty.	Refill Desflurane, if necessary observe the heating time.

Fault	Cause	Remedy
Operation:		
No delivery or insufficient/excessive delivery.	D-Vapor not full, D-Vapor empty.	Fill D-Vapor.
	Control dial set to »O« or »T«	Set the control dial to ≥ 2 vol.%.
	No D-Vapor connected and/or one of several connections is unoccupied and open.	Connect D-Vapor and/or close the open connection to D-Vapor or close direct gas connection.
	Gas is flowing through D-Vapor in the wrong direction.	Check the connector system, see page 20.
	Leakage, e.g. plug-in adapter does not fit flush on the seals.	Disconnect D-Vapor; check the plug-in adapter locking device and sealing rings; replace. Perform the leak test on D-Vapor with the control dial set to »O« and ≥ 2 vol.%.
	Leakage on connector, e.g. D-Vapor connected to an SA2 or Titus that has not been modified for D-Vapor, see page 21.	Have modifications carried out by DrägerService.
	The valves in the plug-in connector are damaged.	Repair*
	D-Vapor is operated with carrier gas other than air.	Change in concentration through carrier gas, see page 47 and 59.
	D-Vapor or anaesthetic monitor is faulty.	Test another D-Vapor to establish whether the D-Vapor or the anaesthetic agent monitor is defective. Repair*.
There is air in the reservoir, e.g. after a (prolonged) storage period at a temperature below 22 °C (72 °F).	In the heated D-Vapor, refill Desflurane up to the upper filling mark.	
The vaporiser detection system on the anaesthesia delivery system displays a different anaesthetic agent than the vaporiser.	The coding of the plug-in adapter or D-Vapor is damaged, faulty, or incorrectly fitted.	Check the coding, if necessary refit. Repair*.
The monitor indicates an anaesthetic agent different to that on the vaporiser. (Only applies to anaesthetic agent monitors with anaesthetic-agent detection system.)	A different anaesthetic agent was previously used and high concentrations of it are still present in the breathing system.	Flush the breathing system or wait for gas to be changed.
	Monitor has not switched over yet (after the anaesthetic agent was changed).	Wait until the monitor switches over.
	Instrument is defective.	Replace instrument.
Control dial cannot be set to the concentration.	The »O« button is not pressed.	Press the »O« button.
	Interlock did not switch over. Interlock is either jamming or another vaporiser is still switched on.	Switch off the other vaporiser and switch over Interlock. See 'Connecting D-Vapor to the Connector System', page 26. Repair*

* to be carried out by skilled personnel only

Fault	Cause	Remedy
The control dial can be moved from »O« to »T« without pressing the button. (The 12 % mark can be exceeded without pressing the button.)	The »O« button is defective.	Repair*
Smell of anaesthetic agent. Anaesthetic agent vapour is leaking, leakage too high during leak test.	Plug-in adapter does not fit flush.	Check plug-in connector and sealing surface and/or if the locking lever was twisted before connection.
	Leakage at connector, e.g. D-Vapor connected to an SA2 or Titus that has not been modified for D-Vapor, see page 21.	Have modifications carried out by DrägerService.
	Seal on filling system is defective.	Disconnect D-Vapor from the power supply; repair*.
	The bottle was pulled out of the supply connection too quickly after the filling process.	Wait for the anaesthetic agent to flow into the reservoir before removing the bottle from the supply connection. See 'Ending filling:', page 25.
The filling level cannot be read in the sight glass.	D-Vapor is completely empty.	Refill D-Vapor.
	D-Vapor is overfull.	Drain D-Vapor to the maximum mark. Check the concentration.
	Sight glass display faulty.	Repair*
Plug-in adapter:		
The locking lever does not engage in the control dial when disconnected.	The control dial is still set to »O«.	Set the control dial to »T« and engage.
The locking lever cannot be swung out of the control dial.	Turn the control dial to »O« or ≥ 2 vol.%. During a previous transport, the control dial may have been set to »O« or ≥ 2 vol.%.	Set the control dial to »T« and engage.
D-Vapor cannot be disconnected.	Control dial not set to »T«.	Set the control dial to »T« and engage.
	Interlock still engaged.	Disengage Interlock.
	Locking lever cannot be swung back into control dial; locking device between the plug-in adapter and the plug-in connector is jammed.	Remove the cap at the top of the locking lever shaft using a 3 mm hexagon socket spanner and remove D-Vapor; repair*.

* to be carried out by skilled personnel only

Fault	Cause	Remedy
The plug-in adapter does not fit flush on the plug-in connector seals. The apparatus is leaking.	The locking lever is not engaged in the control dial because the control dial is set to »O« or ≥ 2 vol.%.	Set the control dial to »T« and engage; insert the pin on the locking lever into the socket on the control dial and engage.
	The locking mechanism of the plug-in adapter and/or plug-in connector is damaged.	Using excessive force can lead to jamming or problems when removing the vaporiser; repair *.
	The locking lever was turned to the left before connection.	Disconnect D-Vapor (control dial at »T«), engage the locking lever in the control dial; reconnect D-Vapor.
	The O-rings on the plug-in adapter are missing.	Fit O-rings.
	There is a spare O-ring on one of the plug-in connector's rods or a foreign body between the plug-in connector and the plug-in adapter.	Remove the O-ring and/or foreign body.
For the S-2000 plug-in adapter only: the control dial cannot be turned.	Interlock pins are not in their original position.	Check whether the control dial can be turned after the adjacent vaporisers have been removed. Squeeze both interlock pins inwards by hand, one after the other, and release. If this does not correct the problem, repair *.
Filling and draining D-Vapor:		
Anaesthetic agent is leaking from the filling system.	The seal on the Desflurane bottle is damaged or missing.	Use another bottle.

* to be carried out by skilled personnel only

If D-Vapor still does not function properly, call DrägerService!

Processing

Disinfecting/Cleaning

Do not immerse D-Vapor in detergents!

Detergents must not be allowed to get under the control dial.

Do not allow detergents to get into the gas inlet or outlet, or the filling system.

If liquids other than Desflurane get into D-Vapor, the apparatus could get damaged and the patient harmed.

Do not sterilise D-Vapor! Internal damage could result in the delivery of incorrect concentrations!

Do not use solvents on D-Vapor.

Cleaning

Wipe off heavy grime with a disposable cloth.

Disinfecting

Use surface disinfectants. For reasons of material compatibility use disinfectants based on:

- aldehydes,
- alcohols,
- quaternary ammonium compounds.

Follow the manufacturer's instructions for use.

Do not use preparations which are based on

- halogen-releasing compounds,
- strong organic acids,
- oxygen-releasing compounds.

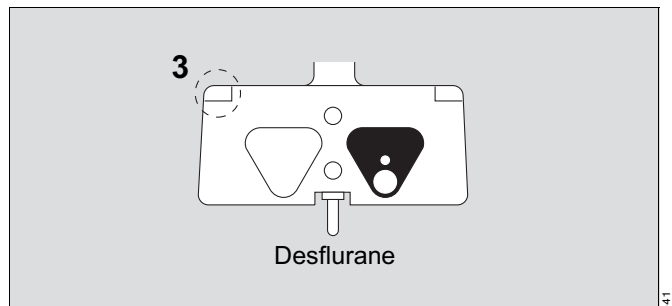
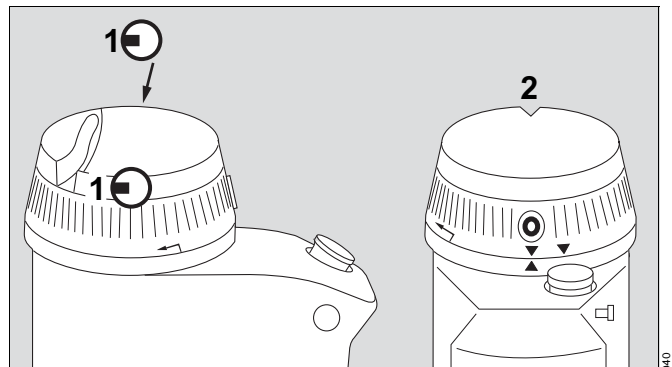
We recommend consulting the current list of the DGHM (German Society for Hygiene and Microbiology) (mhp-Verlag GmbH, Wiesbaden, Germany). This publication specifies the composition of each disinfectant.

Do not disinfect D-Vapor in the Aseptor.

Checking Readiness for Operation

After maintaining and servicing the anaesthesia delivery system and/or D-Vapor, or after prolonged inoperation and at least every six months.

- The previous inspection was less than 12 months ago.
 - Accompanying documents/Instructions for Use are present.
 - No damage to or loose parts on D-Vapor.
 - The anaesthetic agent display on D-Vapor, the colour code on the cover plate, and other anaesthetic agent-specific codes, in so far present (e.g. identification letters or codes on the plug-in adapter), all match.
 - Gas inlet and outlet are not soiled.
 - The control dial engages at »0« as well as at »T« and cannot be turned without pressing the »0« button.
 - The control dial can be turned to the stop near the 12 % mark after pressing the »0« button. Pressing the »0« button again enables the control dial to be turned to the stop near the highest concentration mark.
 - Interlock disc rests firmly on the control dial.
- 1 Interlock 2:
nibs are present in both openings and are undamaged.
 - 2 Interlock NMD:
the notch faces the back when the control dial is set to »0«.
 - 3 Plug-in adapters may not be installed on D-Vapors with an Interlock NMD control dial cap.



Plug-in adapter DW-2000 and S-2000

D-Vapor is not connected to the plug-in connector:

- turn the locking lever to the locking position – it must turn back automatically.

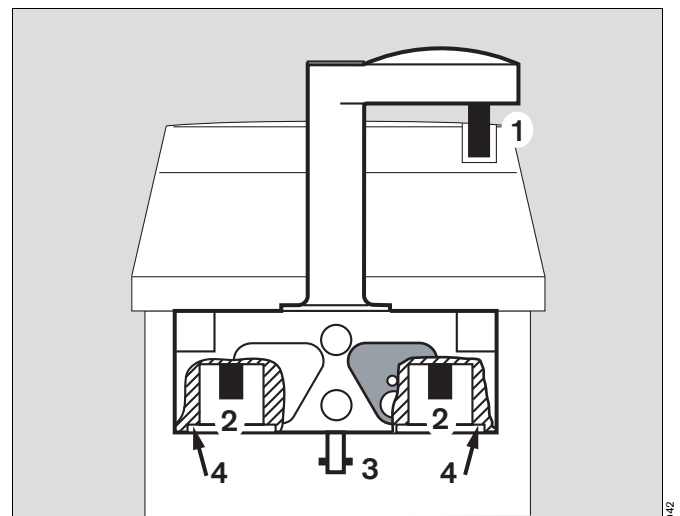
Re-engage the locking lever in the control dial.

Plug-in adapter DW-2000

Only use white plug-in adapters for D-Vapor.

Vapor 19.n plug-in adapter, colour: silver, may not be fitted on D-Vapor.

- 1 Drop-in pin on the locking lever is tight and straight.
- 2 Both valve control pins are present.
- 3 Transverse pin at the bottom of the locking lever is tight, in the centre and not bent.
- 4 Sealing surfaces are undamaged.

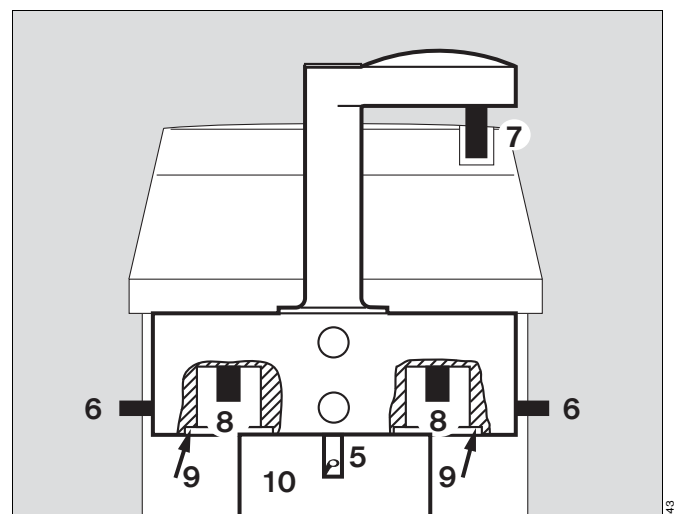


Plug-in adapter S-2000

Only use white plug-in adapters for D-Vapor.

Vapor 19.n plug-in adapter, colour: grey, may not be fitted on D-Vapor.

- 5 Stop mechanism is undamaged, not bent.
- 6 Interlock pins are undamaged, easy to move, and cannot be removed.
- 7 Drop-in pin on the locking lever is tight and straight.
- 8 Both valve control pins are present.
- 9 Sealing surfaces are undamaged.
- 10 The manufacturer's plate on the back of D-Vapor is present and securely fastened.



Conical connector

- The male cone is connected to the D-Vapor inlet.
- The female cone is connected to the D-Vapor outlet.
- The cones and sealing surfaces are undamaged.

Keyed filling system

- Anaesthetic agent in sight glass without impurities. If there are impurities, D-Vapor must be repaired by skilled personnel.
- Use the checklist to check D-Vapor, see page 29.

Checking the Concentration

The operational D-Vapor is connected to the anaesthetic delivery system.

The delivered concentration must be checked once a week if an anaesthetic gas monitor is not continuously used during operation.

The weekly check must be documented.

Preparation

- Fill D-Vapor at least to the middle level indicator.
- Heat up the filled D-Vapor and let it rest for half an hour in 'Operational' mode.
- Check the anaesthetic agent monitor. Carry out zero calibration with the desired gas (air or O₂).
- Connect the monitor to the fresh-gas outlet or Y-piece. Make sure the connections are leak-tight.
- Connect scavenging line and start operation.

Setting

- Switch off the ventilator or set it so that the ventilation pressure is less than 5 mbar.
- Set the monitor to Desflurane and to continuous measurement.
- Set the flow to 2.5 ± 0.5 L/min air.
Use O₂ if air is not available.

Measuring

- Test the marks »O« and »T«, and 2 and 8 vol.%. At the 8 vol.% mark, check in two ways: once by approaching the concentration mark from the top, and once by approaching the concentration mark from the bottom. Wait each time until a stable value has been reached and check if it is within the tolerance zone.

Correcting the Measured Values

Depending on the carrier gas used

- Check using air: No correction.
- Check using O₂: Correct the measured values by the following amounts.

Measured value vol.%	Correction
2.0	–0.2
8.0	–0.8

If the values displayed on the monitor are

- in vol.%: No correction.
- in % partial pressure: Convert to vol.%:

$$\text{Concentration [Vol.\%]} = \frac{\text{Measured value [\% partial pressure]} \times 1013 \text{ hPa}}{\text{Air pressure [hPa]}}$$

Determining the allowable range

Select the allowable concentration range from the accuracy data (see 'Technical Data', page 54).

Determine the monitor's allowable deviation.

The sum of both data is the allowable range for the delivered concentration.

Test result

If the corrected measured value is within the allowable range, D-Vapor may be put into operation.

If the corrected measured value is not within the allowable range:

Do not use D-Vapor; the patient may be harmed.

Have D-Vapor checked by skilled personnel.

Check the monitor.

Document and save the measured values as well as the date, name of the person performing the service, and the serial number of the checked unit.

After the check

- Switch off D-Vapor: set the control dial to »0« and engage.
- If D-Vapor is not on the anaesthesia delivery system:
- Press the »0« button and engage the control dial at »T«.
For the plug-in adapter, engage the locking lever in the control dial.
 - Switch off the air or O₂ flow.

Example for a concentration test:

A Desflurane vaporiser is tested at a setting of 8 %.
The measured value is 8.58.

The measurement was performed with O₂.
This is why the measured value of 8.58 must be corrected by $-0.3 = 8.28$.

The value displayed on the monitor is in vol.% pressure, which is why a correction is not required.
The allowable range is ± 15 % rel. of the set value, i.e. 6.8 to 9.2 vol.%.

The monitor's technical data indicates an accuracy of ± 5 % rel.
For the corrected measured value of 8.28 vol.%, this results in a tolerance of ± 0.41 vol.%.

The allowable range is increased by this amount to 6.39 to 9.61 vol.%.

The corrected measured value of 8.28 is within the allowable range.

Shut-down

Draining D-Vapor

Only by trained personnel.

Do not inhale anaesthetic agent vapour!

Health hazard!

Recommendation: Drain D-Vapor under an extraction system because small amounts of anaesthetic agent vapour will always escape.

Whilst draining, avoid contamination.

Handle, store and dispose of the drained anaesthetic agent as you would medicaments, as you otherwise risk delivering incorrect concentrations of anaesthetic agents or mixtures.

- D-Vapor is not connected to the anaesthetic delivery system or the power supply. The control dial is engaged at »T«.
- Press the unlocking button and pull the sealing plug out of the filling system. Insert the empty Desflurane bottle. The bottle makes an audible click sound when it locks into the filling inlet.
- Turn D-Vapor. The Desflurane bottle is in an upright position underneath the D-Vapor.
- Press the Desflurane bottle into the apparatus' filling system from the bottom. Desflurane flows from the reservoir into the bottle.
- When either the reservoir is empty or the bottle is full, release the pressure on the bottle in the D-Vapor. Place D-Vapor in an upright position, press the unlocking button, remove the bottle.
- Repeat the procedure if necessary.
- Replace the sealing plug. The sealing plug makes an audible click sound when it locks into place.
- A residue of 30 mL of Desflurane remains in D-Vapor, see 'Blowing out D-Vapor'.
- Mark the bottle: 'Used anaesthetic agent'.
Recommendation: **Do not reuse.**

Blowing out D-Vapor

If the remaining anaesthetic agent has to be removed from the reservoir after draining:

- Put D-Vapor into operation.
- Set the control dial to 8 vol.% and cleanse with 10 L/min air until the »**Delivery Low**« alarm is displayed, see 'Alarms', page 15.
- Conduct the gas into the scavenging line.
- Press the »O« button, engage the control dial at »T«. For plug-in adapters, engage the locking lever in the control dial.
- Disconnect D-Vapor from the power supply.

Disposal

This device is subject to EU Directive 2002/96/EC (WEEE). It is not registered for use in private households, and may not be disposed of at municipal collection points for waste electrical and electronic equipment.

Dräger Medical has authorized a firm to dispose of this device in the proper manner: for more detailed information, please contact your local Dräger Medical organization.

Storage

Storage for longer than 6 months:

- See 'Draining D-Vapor', page 49.
- See 'Blowing out D-Vapor', page 49.
- Press the »0« button and engage the control dial at »T«.
- For plug-in adapters, engage the locking lever in the control dial.
- D-Vapor can be stored in any position.
- Package if necessary, see 'Despatching'.

Observe the storage temperature, see 'Technical Data', page 54.

If the storage temperature range is exceeded, inner damage could occur and result in the delivery of incorrect concentrations.

The instructions for storing the anaesthetic agent (temperatures, best before date) must also be observed when storing D-Vapor.

Before putting the apparatus back into operation, inspect it, service it, and test it for operational readiness.

Despatching

- **Completely drain D-Vapor and blow it out** (see page 49), clean and disinfect (see page 43) it as best possible.
- Disconnect D-Vapors from anaesthesia delivery systems for despatching – unless they are permanently connected.
- Set the control dial to »T« and engage.
- Carefully pack each D-Vapor **individually!**

Use original packaging, including the plastic bag, when possible.

Otherwise pack D-Vapor in sealed packaging, e.g. plastic bag and with at least 5 cm of impact-resistant material around each D-Vapor. Fasten the package securely.

Liquid anaesthetic agent and/or full vaporisers are subject to the IATA/ICAO Dangerous Goods Regulations (UN 3334 Class 9 "excepted quantities" if drained but not blown off).

Maintenance Intervals

Clean and disinfect D-Vapor prior to each service* and before despatch! (See page 43)

Inspection and Service

Yearly, together with an anaesthetic delivery system, by skilled personnel. A record of the findings must be kept.

Recommendation: Call DrägerService for inspection and service.

The following wear parts must be replaced by DrägerService or Dräger-authorized technicians if the user detects deviations from the specified values during maintenance, service, or routine checks.

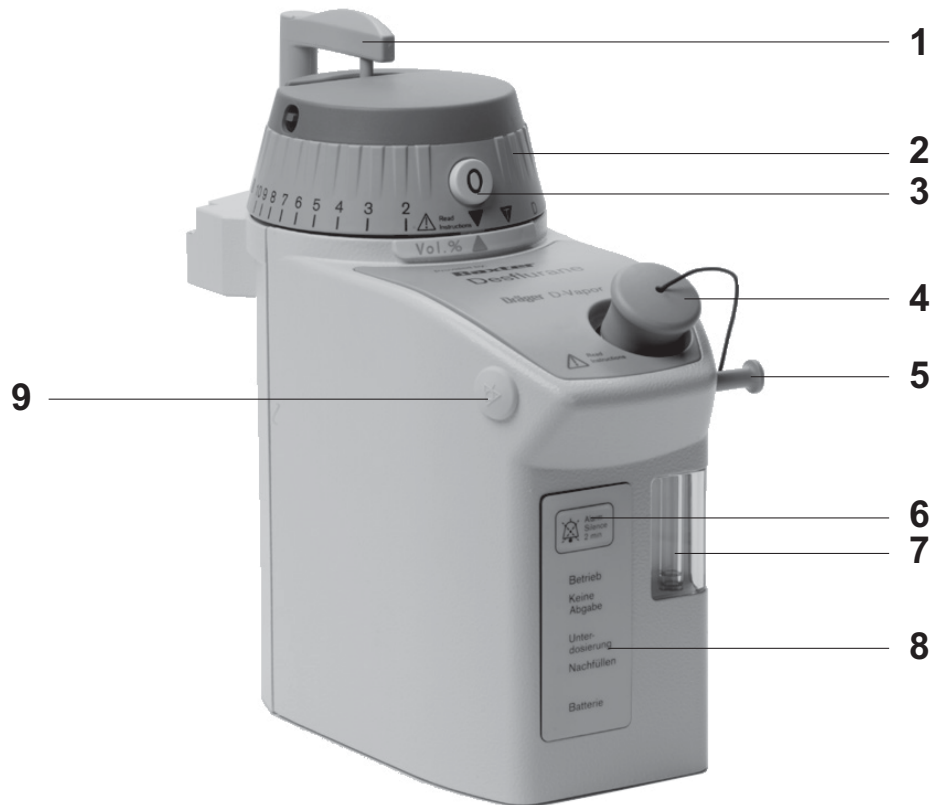
Wear Parts

- Battery
- O-ring for the sealing plug

* Definitions:
 Inspection = Determine the actual condition.
 Service = Measures to maintain the required condition.
 Maintenance = Measures to re-establish the required condition.
 Maintenance = Inspection, service, repair

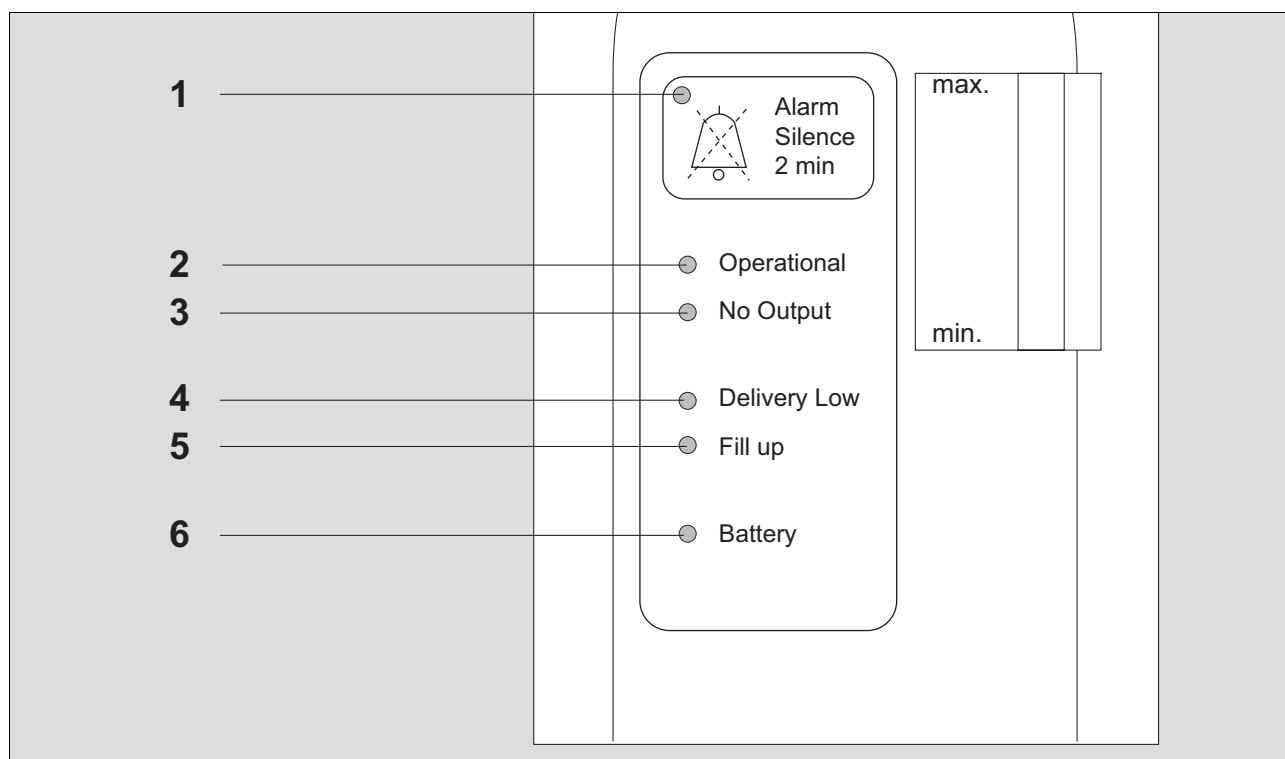
What's What

D-Vapor



- 1 Unlocking lever for the connector system
- 2 Control dial
- 3 »0« button for the control dial
- 4 Sealing plug
- 5 Unlocking lever for the sealing plug
- 6 Button to suppress the acoustic alarm for 2 minutes
- 7 Level indicator
- 8 Display panel
- 9 Protective cap for equipotential bonding pin

Display panel



- 1 Amber LED »Alarm Silence«
- 2 Green LED »Operational«
- 3 Red LED »No Output«
- 4 Red LED »Delivery Low«
- 5 Amber LED »Fill up«
- 6 Amber LED »Battery«

Technical Data

Classification According to EC guideline 93/42/EWG Appendix IX	Class IIb
UMDNS Code Universal Medical Device Nomenclature System	10-144
Protection class According to EN 60601-1	Class I
Environment conditions	
Operation	
Temperature	18 to 30 °C (64 to 86 °F)
Atmospheric pressure	700 to 1100 hPa (10.15 to 15.95 psi)
Relative humidity	30 to 75 %, non condensation
Storage and transport	
Temperature	-20 to 60 °C (-4 to 140 °F)
Atmospheric pressure	115 to 1100 hPa (1.67 to 15.95 psi)
Relative humidity	30 to 75 %, non condensation
Performance values	
D-Vapor is calibrated at a temperature of 22 °C (72 °F) and an atmospheric pressure of 1013 mbar (14.69 psi) (Carrier gas = air, flow 2.5 L/min)	
Concentration range	2 to 18 vol.%
Scaling	1 vol.% division from 2 to 10 vol.% 2 vol.% division from 10 to 18 vol.% 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18 vol.% (mark on the control dial)
Flow range	0.2 to 15 L/min
Direction of flow	According to the arrow on the back of D-Vapor
Required quality of gases	Clean, medically pure mixtures of: O ₂ and air or O ₂ and N ₂ O
Oil content	<0.1 mg/m ³
Particle	dust free air (filtered with a pore size of <1 µm)
Dew point	5 °C (9 °F) below ambient temperature
Dynamic pressure versus ambient pressure of D-Vapor outlet (e.g. through apparatus components or O ₂ flush)	-10 kPa to 20 kPa (-100 mbar to 200 mbar or -1.45 to 2.90 psi)

Alternating pressure through ventilation on the D-Vapor outlet, relative to the pressure on the D-Vapor outlet without ventilation	-1 kPa to 8 kPa (-10 mbar to 80 mbar or -0.15 to 1.16 psi)
The maximum fresh gas inlet pressure may not exceed 200 kPa (2 bar or 29.01 psi).	
Concentration accuracy	±0.5 vol.% or ±15 % rel. (the higher value applies) in calibration conditions (22 °C at 1013 mbar or 72 °F at 14.69 psi, flow 2.5 L/min air) (The requirements according to EN 740 apply outside of the calibration conditions) When D-Vapor is used in range 2 (see diagram 'Flow Dependency', page 59), D-Vapor delivers at least 1.2 L/min saturated steam.
Liquid capacity	300 mL (total), of which 40 mL are reserve capacity
Anaesthetic agent loss (not in operation)	0.5 mL liquid anaesthetic agent (within 24 hours at 22 °C or 72 °F)
Anaesthetic agent loss (in operation)	2.5 mL liquid anaesthetic agent (within 24 hours at 22 °C or 72 °F)
Fill time	1 minute for a bottle of Desflurane (240 mL) at 22 °C (72 °F) for unheated D-Vapor
Flow resistance	<100 mbar (<1.45 psi) at a gas flow of 10 L/min
Max. tilt angle during operation	10°
Max. tilt angle during storage and transport	no limitation
Heating time	approx. 5 minutes at 22 °C (72 °F)
Battery bridge during power failures	For a maximum period of 5 minutes (for a maximum delivery of 6 vol.%, a fresh gas flow of 4 L/min and a full battery)
Noise emission during operation	<45 dB (A)
Pneumatic interfaces	
Filling system	For Saf-T-Fill™ Desflurane bottles
Possible connectors	Dräger plug-in adapter DW-2000 Selectatec plug-in adapter S-2000 Permanent connection Conical connector
Alternating fresh gas flow	<30/min
Maximum static pressure (above ambient pressure) at the interface	<2000 hPa (<29.1 psi)

Electrical values

Operation

Nominal voltage	100 V to 240 V
Power frequency	50 Hz to 60 Hz
Power consumption	30 watts (typical), max. 530 watts during heating up
Earth leakage current	50 μ A

Weight and dimensions

Net weight	<7 kg (<15.5 lbs)
Depth	235 mm
Width	110 mm
Height	250 mm

Electromagnetic Interference Resistance

Safety distances (examples) to portable and mobile radio communication equipment (according to IEC 60601-1-2, revised 2001)

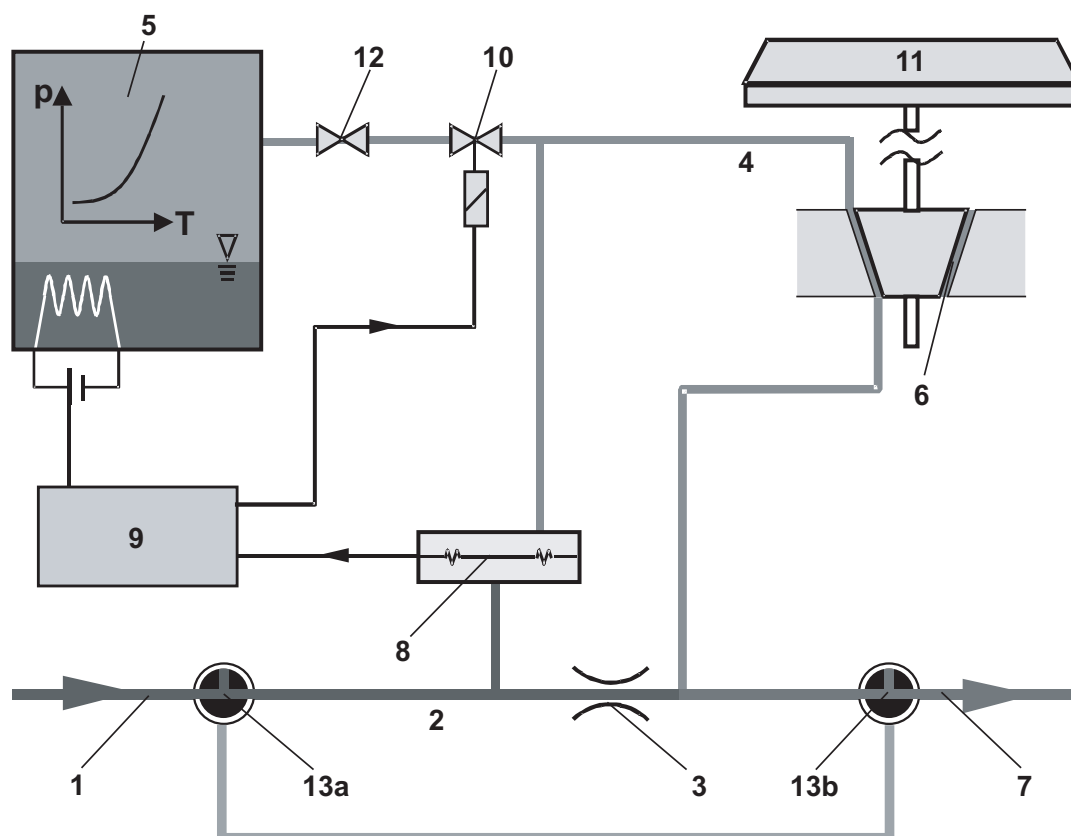
Max. PEIRP* (W)	3 V/m Distance** (m)	1 V/m Distance* (m)	Indication
0.001	0.06	0.17	
0.003	0.10	0.30	
0.010	0.18	0.55	
0.030	0.32	0.95	e.g. WLAN 5250 / 5775 (Europe)
0.100	0.58	1.73	e.g. WLAN 2440 (Europe), Bluetooth
0.200	0.82	2.46	e.g. WLAN 5250 (outside Europe)
0.250	0.91	2.75	e.g. DECT devices
1.000	1.83	5.48	e.g. E-Netz (German digital mobile telephone network), UMTS, GSM 1900 mobile telephone, WLAN 5600 (outside Europe)
2.000	2.60	7.78	e.g. D-Netz (German digital mobile telephone network used by two companies) mobile telephones
3.000	3.16	9.49	

* PEIRP is the 'equivalent isotropic radiated power' of the adjacent RF transmitter

** 3 V/m distance to transmitters with frequencies ranging from 150 kHz to 2.5 GHz, otherwise 1 V/m distance.

Description

Functional Description



Mixed gas 1 (carrier gas 2) is conducted through the permanent flow resistance of the bypass control 3.

Desflurane vapour (saturated vapour 4) flows from the heated reservoir 5 through the flow control 6.

Carrier gas and saturated vapour unite and mix just before reaching the fresh gas outlet 7.

Using the differential pressure sensor (regulating sensor 8), the control 9 meters so much saturated vapour via the proportional valve 10 that the pressure drop over both control cones (bypass and flow control cones) is always the same.

The Desflurane concentration is determined by the relationship between the resistances of the permanent bypass control and the flow control cone. This relationship is set with the control dial 11.

The regulated reservoir heating guarantees a constant temperature (40 °C or 104 °F) and hence a constant and sufficient pressure (2 bar or 29.01 psi) in the Desflurane reservoir.

The shut-off valve 12 blocks the Desflurane reservoir during the heating phase when the control dial is in zero position or when there is a failure (»No Output«).

Control dial set to »0« or »T« (switched off)

The mixed gas flows directly from the D-Vapor inlet to the D-Vapor outlet.

The interior of D-Vapor (bypass and flow control cones) is completely separated from the gas flow by a valve 13a, 13b. The anaesthetic agent cannot get into the fresh gas.

A small hole in the valve 13a bleeds air from the interior of D-Vapor so that there is no pressure build-up. Small amounts of anaesthetic agent vapour can escape when there are temperature and pressure fluctuations.

Control dial set to equal to or greater than »2 vol.%« (switched on)

The fresh gas is conducted through the bypass control cone by means of the valve 13a, 13b connected to the control dial 11.

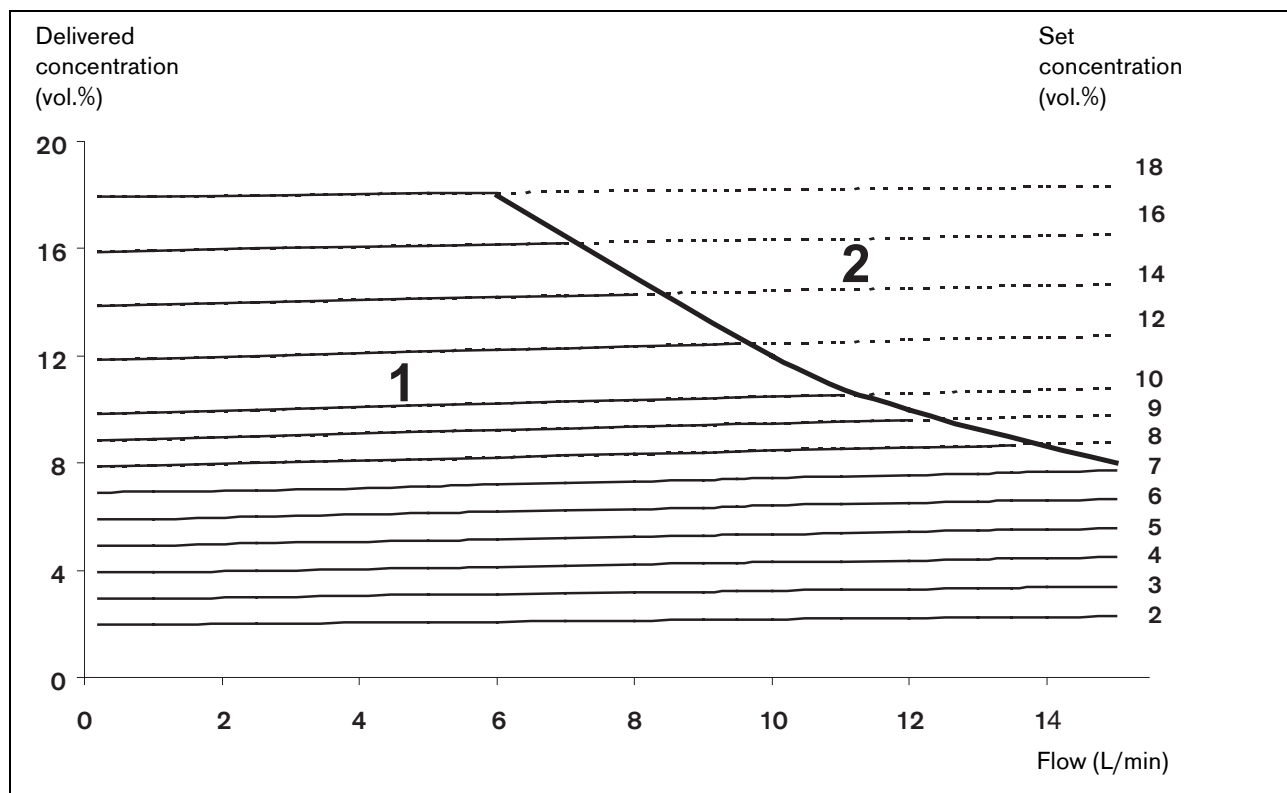
Calibration

Every vaporiser is individually set at 22 °C (72 °F) and at a continuous air flow of 2.5 L/min without ventilation pressure, and tested using different flows at 22 °C (72 °F). Calibration is in vol.%. The scale values on the control dial specify the concentrations for 22 °C (72 °F) and 1013 hPa (14.69 psi) at 2.5 L/min dry air.

Ambient Temperature Dependency

D-Vapor's performance characteristics are not substantially influenced by temperature fluctuations within the specified range (see 'Technical Data', page 54).

Flow Dependency



The concentration delivered by D-Vapor is slightly dependent on the flow (fresh gas flow).

In range 1 (range with mit continuous lines), D-Vapor delivers concentrations with at least the accuracy required in accordance with EN 740.

In range 2 (range with dotted lines), with both a high flow and high concentration, D-Vapor delivers less than set at the control dial, see 'Concentration accuracy', page 55.

The diagram shows the typical dependency of the delivered concentrations at 22 °C , 1013 hPa (72 °F, 14.69 psi), when using air.

Carrier Gas Dependency

The concentration delivered by D-Vapor is dependent on the composition of the fresh gas, as the viscosity and density of the gas changes with the quality and composition. D-Vapor is calibrated with air because the concentration delivered is then exactly in the middle of the range for the anaesthetic gas mixtures which are available.

During operation using 100 % O₂, the delivered concentration increases by up to 15 % relative compared to air.

During operation using 30 % O₂ and 70 % N₂O, it drops by up to 10 % relative.

When changing gas mixtures, a dynamic effect can also occur, which causes an additional concentration variance until the previous fresh gas is flushed out of D-Vapor.

Ambient Pressure and Altitude Dependency

D-Vapor is calibrated in vol.%. The calibration in vol.% depends on the ambient pressure. The partial pressure of the delivered Desflurane vapour (which is physiologically active) depends on the ambient pressure*.

The required setting is calculated according to the formula:

$$\text{Required setting} = \frac{\text{Desired partial pressure at 1013 hPa}}{1013 \text{ hPa}} \times \frac{1013 \text{ hPa}}{\text{Ambient pressure hPa}}$$

The table displays how D-Vapor's control dial is to be set at an altitude of 1000 m and 2000 m above sea level.

Normal control dial vol.% settings	Required vol.% control dial settings	
	at an altitude of 1000 m	at an altitude of 2000 m
5	5.5	6.5
10	11	12.5
14	16	18

* Other anaesthetic agent vaporisers, e.g. Vapor 19 and Vapor 2000, deliver ambient pressure independently of the partial pressure.

Correcting the Flow Measurement under the Influence of Desflurane

Hot-wire volume gauges that are not compensated for Desflurane measure volumes that are too high when the concentration of Desflurane is high.
(See the monitor's Instructions for Use.)

Use this formula to correct the values:
For minute volumes MV

$$\text{Corrected MV} = \text{Displayed MV} \times \frac{100 - 2 \times \text{Desflurane Concentration}}{100}$$

and/or for tidal volumes VT

$$\text{Corrected VT} = \text{Displayed VT} \times \frac{100 - 2 \times \text{Desflurane Concentration}}{100}$$

Example:

Desflurane concentration 8 vol.%
displayed minute volume MV = 10 L/min

$$\begin{aligned} \text{Corrected MV} &= 10 \times \frac{100 - 2 \times 8}{100} \\ &= 10 \times 0.84 \\ &= 8.4 \text{ L/min} \end{aligned}$$





Order List

Name	Article code
D-Vapor Power Cable EU	18 56 553
US	18 56 626
GB	18 56 596
CH	18 56 561
DK	18 56 588
Australia	18 51 810
Italy	18 56 618
ISR	18 51 829
D-Vapor power cable (IEC-IEC, 0.75 m)	18 60 925
Extension	18 56 928
Ground wire (3.2 m)	83 01 349
O-ring for the connector system (2 pieces required)	U 04 314
O-ring for the sealing plug	MK 03 818
Battery	M 35 526
Instructions for Use German	90 37 889
English UK	90 37 890
English USA	90 37 891
French	90 37 892
Spanish	90 37 894
Italian	90 37 895
Norwegian	90 37 896
Russian	90 37 897
Portuguese	90 37 898
Chinese	90 37 899
Hungarian	90 37 900
Dutch	90 37 901
Polish	90 37 902
Swedish	90 37 903
Czech	90 37 904
Danish	90 38 258
Slovakian	90 38 517
Turkish	90 38 531

Abbreviations

Abbreviation	Description
N ₂ O	Medical Nitrous Oxide
O ₂	Medical Oxygen
CE0123	European Community. D-Vapor is conform with the 93/42/EEC Medical Device Directive
% rel.	Relative deviation as % of value
2; 3; 4;.....	Concentration scaling on D-Vapor Control dial can be set to values up to and including 10 vol.%.
vol.%	Volume percentage of anaesthetic agent in fresh gas at D-Vapor outlet. Unit of concentration.
0	On the push-button to stop the control dial. »0« setting on the control dial.
T	Transport setting (»T« setting) on the control dial.
D	On the control dial or on DW-2000 plug-in adapter. First letter of the name of the anaesthetic agent for which D-Vapor is calibrated, or for which the plug-in adapter is coded.
min.	Minimum permissible filling level on sight glass.
max.	Maximum permissible filling level on sight glass.
ASTM	American Society for Testing and Materials
CSA	Canadian Standards Organisation
DGHM	German Society for Hygiene and Microbiology
EN	European standard
IEC	International standard of the International Electrotechnical Commission
ISO	International Organization for Standardization
PEIRP	'Equivalent isotropic radiated power' of the adjacent RF transmitter
Air	Medical Air

Symbols

Symbol	Description
% rel.	Relative deviation as % of value
 Read Instructions	Observe Instructions for Use
	Concentration values on the D-Vapor control dial that draw attention to the danger of a high delivery and restricted flow range.
	The direction of flow of D-Vapor is indicated on the back of D-Vapor or on the connector.
	»Alarm Silence« button Suppresses the alarm for 2 minutes

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These instructions are only valid for
D-Vapor
with the serial number:

If no serial number has been filled in by
Dräger these instructions are provided for
general information only!



Directive 93/42/EEC
concerning medical devices

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