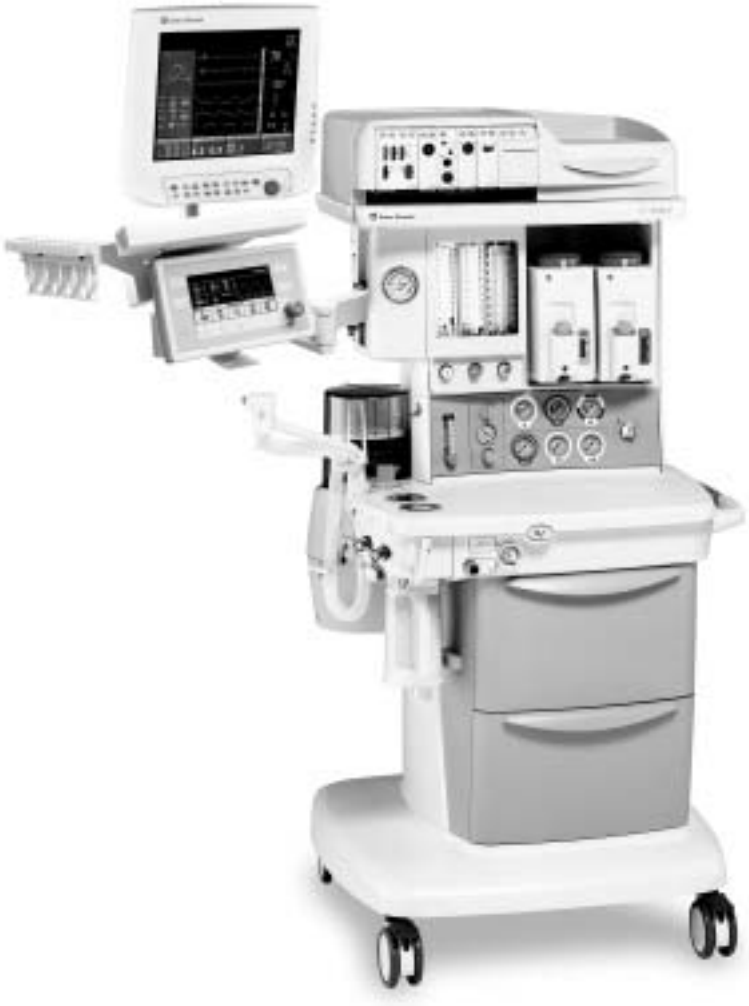
Aespire 7900

User's Reference Manual—Part 2

Setup, Cleaning and Sterilization, Maintenance and Troubleshooting



User Responsibility

This Product will perform in conformity with the description thereof contained in this User's Reference manual and accompanying labels and/or inserts, when assembled, operated, maintained, and repaired in accordance with the instructions provided. This Product must be checked periodically. A defective Product should not be used. Parts that are broken, missing, plainly worn, distorted, or contaminated should be replaced immediately. Should repair or replacement become necessary, Datex-Ohmeda recommends that a telephonic or written request for service advice be made to the nearest Datex-Ohmeda Customer Service Center. This Product or any of its parts should not be repaired other than in accordance with written instructions provided by Datex-Ohmeda and by Datex-Ohmeda trained personnel. The Product must not be altered without the prior written approval of Datex-Ohmeda. The user of this Product shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, improper repair, damage, or alteration by anyone other than Datex-Ohmeda.

⚠ **CAUTION** U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner. Outside the U.S.A., check local laws for any restriction that may apply.

Datex-Ohmeda products have unit serial numbers with coded logic which indicates a product group code, the year of manufacture, and a sequential unit number for identification.

AAA F 12345

This alpha character indicates the year of product manufacture and when the serial number was assigned; "D" = 2000, "E" = 2001, "F" = 2002, etc. "I" and "O" are not used.

CE 0197

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Warranty

Symbols used in the manual or on the equipment

⚠ **WARNINGS** and ⚠ **CAUTIONS** tell you about dangerous conditions that can occur if you do not follow all instructions in this manual. Read and follow all warnings and cautions.

WARNINGS tell about a condition that can cause injury to the operator or the patient.

CAUTIONS tell about a condition that can cause damage to the equipment.

A **Note** provides additional information to clarify a statement in text.

An **Important** statement is similar to a Note, but provides a comment of greater emphasis.

Other symbols replace words on the equipment or in Datex-Ohmeda manuals. No one device or manual uses all of the symbols. These symbols include:

On (power)	Not autoclavable
Off (power)	Type B equipment
Standby	Type BF equipment
Standby or preparatory state for part of the equipment	Type CF equipment
"ON" only for part of the equipment	Caution, ISO 7000-0434
"OFF" only for part of the equipment	Attention, refer to product instructions, IEC 601-1.
Direct current	This way is up.
Alternating current	Dangerous Voltage
Protective earth ground	Input
Earth ground	Output
Frame or chassis ground	**REF** Stock Number
Alarm silence button	**SN** Serial Number
Equipotential	Bag position/ manual ventilation
Variability	Read top of float


Variability in steps


Plus, positive polarity

Minus, negative polarity


Lamp, lighting, illumination


Movement in one direction


Movement in two directions


Lock


Unlock

134°C Autoclavable


Open drain (remove liquid)

Inspiratory flow

O_2% O_2 sensor connection

Volume alarms On/Off touch key


Vacuum inlet


Suction bottle outlet

O_2+ O_2 Flush button


Cylinder


Isolation transformer


Low pressure leak test


Mechanical ventilation


Close drain

Expiratory flow


Alarm silence touch key


Menu touch key


Alarm silence touch key (Tec 6)


End case touch key

CE xxxx

Systems with this mark agree with the European Council Directive (93/42/EEC) for Medical Devices when they are used as specified in their Operation and Maintenance Manuals. The xxxx is the certification number of the Notified Body used by Datex-Ohmeda's Quality Systems.

CE European Union Representative

1 Setup and Connections

In this section

Important Datex-Ohmeda strongly recommends that you use O_2 monitoring with this equipment. Refer to local standards for mandatory monitoring.

Important European Standard EN 740 and International Standard IEC 60601-2-13/ISO 8835-1 require exhaled volume monitoring, O_2 monitoring (in accordance with EN 12342, or ISO 7767) and CO_2 monitoring (in accordance with EN 864 or ISO 9918) be used with this equipment.

Important European Standard EN 740 and International Standard IEC 60601-2-13/ISO 8835-1 also require anesthetic agent monitoring (in accordance with ISO 11196) be used when anesthetic vaporizers are in use.

⚠WARNING Always make sure that the pipeline supply hoses and the breathing circuit components are not toxic and will not:

- Cause an allergic reaction in the patient.
- React with the anesthetic gases or agent to produce dangerous by-products.

⚠ To prevent incorrect values or equipment malfunction, use only Datex-Ohmeda cables, hoses and tubing.

⚠ Desiccated absorbers can be hazardous in the presence of anesthetic agents. Adequate precautions should be taken to ensure that soda lime in absorbers does not become desiccated. Turn off all gases when finished using the system.

⚠ This system operates correctly at the electrical interference levels of IEC 60601-1-2. Higher levels can cause nuisance alarms that may stop mechanical ventilation.

⚠ To help prevent false alarms from devices with high-intensity electrical fields:

- Keep the electrosurgical leads away from the breathing system and the flow and oxygen sensors.
- Do not put the electrosurgical leads on any part of the anesthesia system.

⚠ To protect the patient when electrosurgical equipment is used:

- Monitor the correct operation of all life support and monitoring equipment.
- Keep backup manual ventilation available in case the electrosurgical equipment prevents safe use of the ventilator.
- Do not use conductive masks or hoses.

Canister setup

⚠WARNING Obey applicable safety precautions:

⚠ Do not use the absorber with chloroform or trichloroethylene.

⚠ The Disposable Multi Absorber is a sealed unit which should not be opened or refilled.

⚠ Avoid skin or eye contact with the contents of the absorber. In the event of skin or eye contact, immediately rinse the affected area with water and seek medical assistance.

⚠ Do not change the absorber during ventilation.

⚠ Inspect absorbent color at the end of a case. During non-use, absorbent can go back to the original color. Refer to the absorbent labeling for more information about color changes.

⚠ Desiccated (dehydrated) absorbent material may produce dangerous reactions when exposed to inhalation anesthetics.

⚠ For systems with dual absorbent canisters, the carbon dioxide absorbent material in both canisters shall be changed at least weekly, preferably every Monday morning. For single canister systems the absorbent material shall be changed every day, preferably at the start of the day.

⚠ Carbon dioxide absorbent material shall be changed whenever users cannot assure the degree of hydration of the absorbent. Such conditions may include finding a machine with fresh gas that has been flowing for an unknown period of time, or using a machine that is used infrequently.

⚠ All fresh gas flows shall be terminated when the machine is NOT in use. (User manuals describe how to achieve null flows).

⚠ Users are advised to consider the use of low-flow techniques when the machine is in use and whenever clinically appropriate to maintain hydration of the absorbent material.

⚠ Always perform a breathing system leak test in the Bag Mode after opening the absorber.

The absorber canister is available in two versions: Disposable Multi Absorber and Reusable Multi Absorber. Both are removed and installed on the breathing system in the same way.

Each canister holds 800 g of loose absorbent. Datex-Ohmeda recommends Medisorb absorbent.

Both absorber versions should only be used with air, oxygen, nitrous oxide, halothane, enflurane, isoflurane, desflurane and sevoflurane.

When to change the absorbent

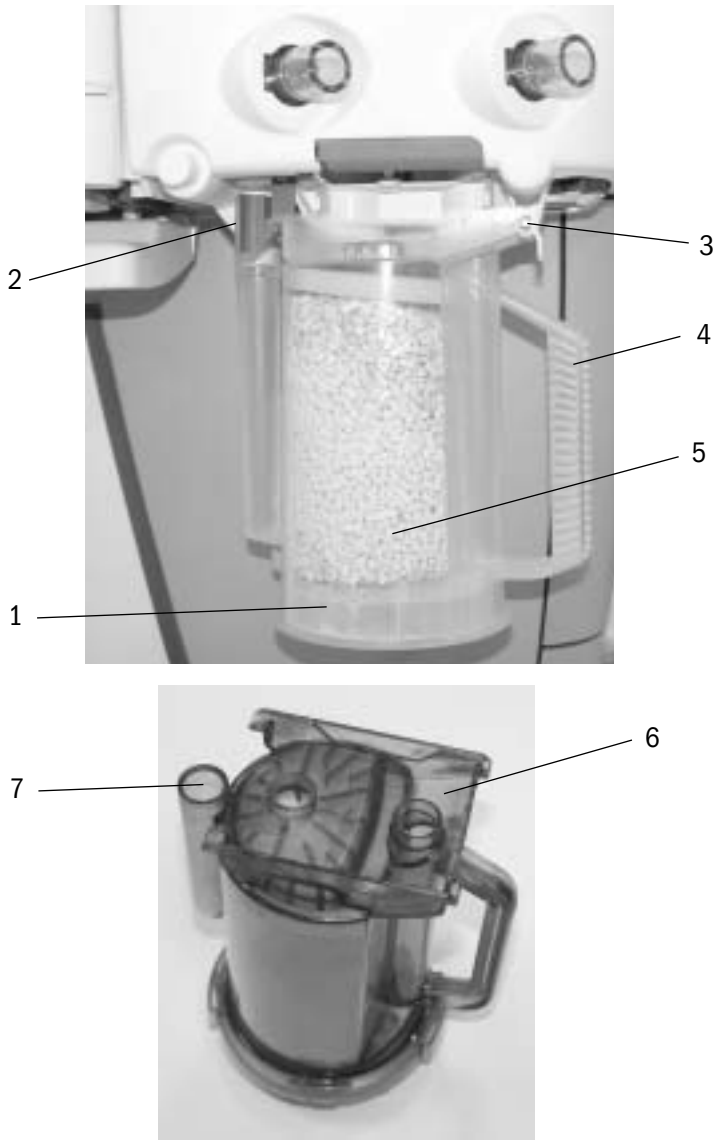
A gradual color change of the soda lime in the canister indicates absorption of carbon dioxide. The color change of the soda lime is only a rough indicator. Use carbon dioxide monitoring to determine when to change the canister.

Discard the absorbent when it has changed color. If left standing for several hours, soda lime may regain its original color giving a misleading indication of activity.

Read the canister instructions completely before using the product.

Removing a canister

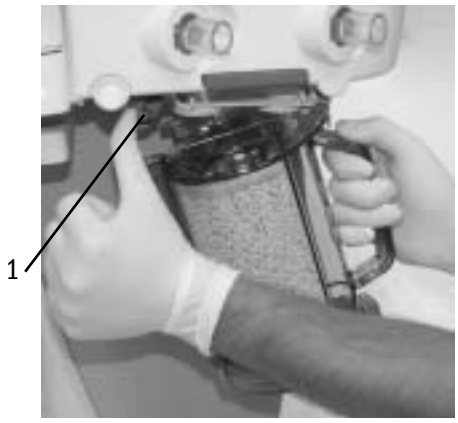
The absorber canister is available in two versions: Reusable Multi Absorber and Disposable Multi Absorber. Both are removed and installed on the breathing system in the same way.



1. Disposable Multi Absorber canister
2. System canister release latch
3. System canister support pin
4. Canister handle
5. Absorbent
6. Reusable Multi Absorber canister
7. Water reservoir

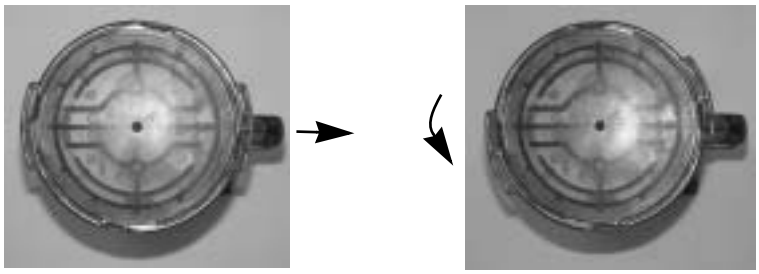
Figure 1-1 • Canister

1. Hold the canister by the handle and push on the release latch (1) to unlock the canister.
2. Remove the canister by tilting it downward and off the two support pins.



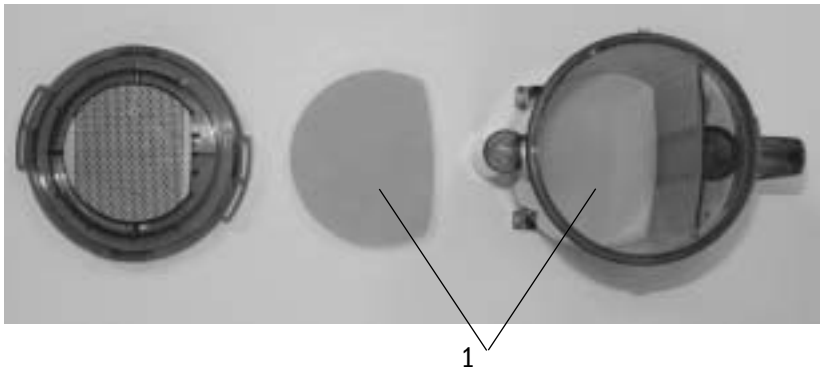
Reusable Multi Absorber canister filling

1. Turn the canister upside down and, using your thumbs, turn the cover locking ring counterclockwise to unlock it.



2. Push up with your thumbs to release the seal.
3. Lift off the cover to remove it.

4. Remove and discard the foam filters (1), the absorbent and any water in the reservoir.



5. To clean and disinfect the canister, see *"Absorber canister"* in section 2 Cleaning and Sterilization."

⚠**WARNING** The filters must be in place to prevent dust and particles from entering the breathing circuit.

6. When dry, place a new filter in the bottom of the canister, pour soda lime into the canister and place a new filter over the soda lime before closing and locking the cover. Wipe off any soda lime dust. Align the cover slots with the canister locking tabs and press the cover down into place. Turn the cover locking ring clockwise to lock the cover in place. Ensure cover is properly sealed to prevent leaks and spillage. Alignment of the arrows helps to indicate correct assembly.
7. When replacing the canister, make sure it is resting on both support pins before latching it into place.

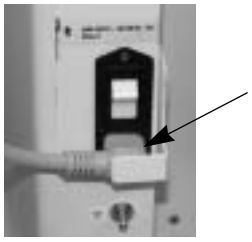
Pneumatic and electrical connections

⚠**WARNING** Equipment connected to the electrical outlets can increase the leakage current. Regularly test the leakage current.

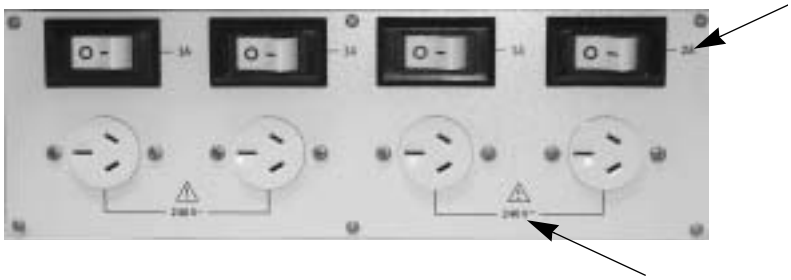
An optional isolation transformer kit is available to reduce total leakage current.

⚠**CAUTION** Use only medical grade gas supplies. Other types of gas supplies may contain water, oil, or other contaminants.

Mains inlet Arrow shows the mains power inlet and cord.



Outlets Labels show outlet voltage ratings and circuit breaker amp ratings.



The gas supplies also supply these devices through internal connections:

- The venturi suction regulator (optional)
- The auxiliary O_2 flowmeter (optional)
- Ventilator drive gas

Pipeline Inlets

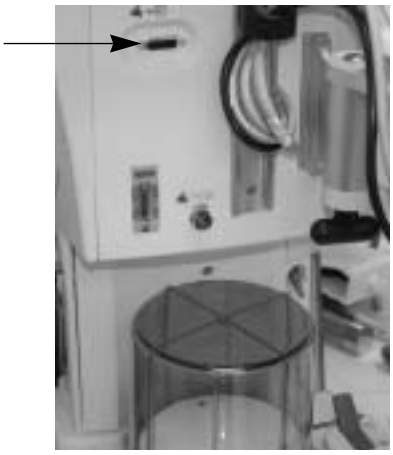
Serial port

The ventilator has an RS-232C electrical interface. The RS-232C connector allows serial input/output of commands and data.

RS-232C signal standards

15-pin Female D connector - Data Communications Equipment configuration (DCE):

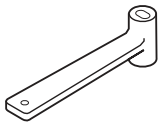
- Pin 1 - Monitor On/Stby
- Pin 5 - Signal ground
- Pin 6 - Receive data
- Pin 9 - Monitor On/Stby Rtn
- Pin 13 - Transmit data



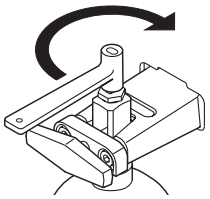
How to install gas cylinders (high pressure leak test)

Pin indexed cylinder yokes

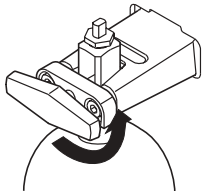
1. Find the cylinder wrench.



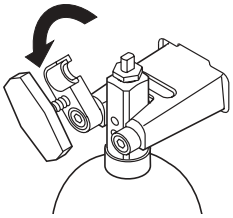
2. Close the cylinder valve on the cylinder to be replaced.



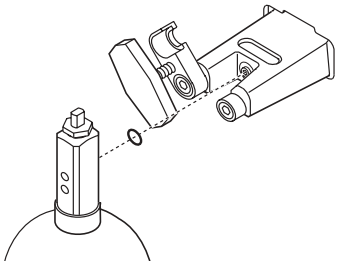
3. Fully loosen the tee handle.



4. Open the cylinder yoke.



5. Remove the used cylinder and the used gasket.



6. Remove the cap from the cylinder valve on the new cylinder.
7. Point the cylinder outlet away from all items that can be damaged by a release of high pressure gas.
8. Quickly open and close the cylinder valve. This removes dirt from the cylinder outlet.

⚠WARNING No gasket or more than one gasket can cause a leak.

9. Install a new gasket.
10. Align the cylinder post with the index pins.
11. Close the yoke gate and tighten the tee handle.
12. Install a cylinder plug and gasket in all empty cylinder yokes.
13. Do a high pressure leak test:
    - Disconnect pipeline supplies.

- Turn off the auxiliary O_2 flowmeter and venturi suction.
- Set the system switch to Standby.
- Open the cylinder.
- Record the cylinder pressure.
- Close the cylinder.
- If the air or oxygen cylinder pressure decreases more than 5000 kPa (100 psi) in one minute, there is a significant leak.
- For N_2O cylinders, a pressure decrease of 690 kPa (100 psi) in one minute represents a significant leak.

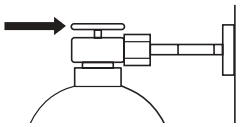
To repair a leak:

- Install a new cylinder gasket and tighten the tee handle.
- Do this step again. If the leak continues, do not use the system.

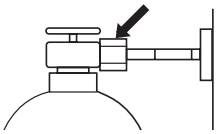
⚠CAUTION Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.

DIN cylinder connections

1. Close the cylinder valve on the cylinder to be replaced.



2. Loosen the adapter and remove the cylinder.



3. Remove the cap from the cylinder valve on the new cylinder.
4. Point the cylinder outlet away from all items that can be damaged by a release of high pressure gas.
5. Quickly open and close the cylinder valve. This removes dirt from the cylinder outlet.
6. Install the cylinder.
7. Do a high pressure leak test:
   - Disconnect pipeline supplies.
   - Turn OFF the auxiliary flowmeter and the venturi suction.
   - Set the system switch to Standby.
   - Open the cylinder.
   - Record the cylinder pressure.
   - Close the cylinder.

- If the cylinder pressure decreases more than 5000 kPa (725 psi) for O_2 and air in one minute, there is a significant leak.
- For N_2O cylinders, a pressure decrease of 690 kPa (100 psi) in one minute represents a significant leak.

To repair a leak:

- Install a new cylinder gasket and tighten the adapter.
- Do this step again. If the leak continues, do not use the system.

⚠**WARNING** Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.

Installation notes

When the system is installed, the Datex-Ohmeda representative will check the following settings and change them if necessary.

⚠**WARNING** These settings can only be changed by qualified personnel.

- Language.
- Automatic calculation of V_E alarm limits during mechanical ventilation.
- Altitude.
- Ventilator drive gas.
- User Select Defaults.

How to attach equipment to the top shelf

⚠**WARNING** The top shelf has a weight limit of 34 kg (75 lb).

Place the equipment between the straps. Fold the straps over each other and fully tighten and fasten them with the hook and loop surfaces.

⚠**WARNING** If you do not fully tighten the strap, equipment can fall off the shelf.

2 Cleaning and Sterilization

In this section

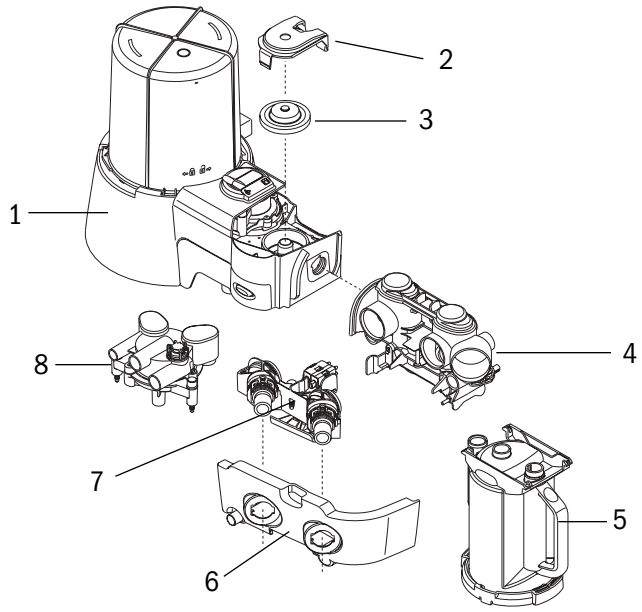
⚠**WARNING** Obey applicable safety precautions:

- Read the material safety data sheet for each cleaning agent.
- Read the operation and maintenance manual for all sterilization equipment.
- Wear gloves and safety glasses. A damaged O_2 sensor can leak and cause burns (contains potassium hydroxide).
- Do not breathe the fumes.

⚠**CAUTION** To help prevent damage:

- Refer to the manufacturer's data if you have questions about a cleaning agent.
- Do not use organic, halogenated, or petroleum based solvents, anesthetic agents, glass cleaners, acetone, or other harsh cleaning agents.
- Do not use abrasive cleaning agents (such as steel wool, silver polish or cleaner).
- Keep all liquids away from electronic parts.
- Do not permit liquid to go into the equipment housings.
- Do not soak synthetic rubber parts for more than 15 minutes. Swelling or faster aging can occur.
- Only autoclave parts marked 134°C.
- Cleaning solutions must have a pH of 7.0 to 10.5.

Breathing system cleanable parts



1. Bellows assembly
2. APL Valve Ramp
3. APL Diaphragm
4. Breathing circuit module (O_2 sensor not autoclavable)
5. Absorber canister (reusable only)
6. Flow sensor cover
7. Flow Sensor Module (plastic flow sensors not autoclavable)
8. Exhalation Valve assembly

Figure 2-1 ▪ Autoclavable assemblies

Parts marked *134°C* are autoclavable or washable by hand or machine (mild detergent pH <10.5). Rinse and dry completely. All parts except the O_2 sensor and disposable flow sensors can be washed.

If the flow sensors are plastic, refer to the *"How to clean and disinfect the flow sensors"* procedure. If metal, they can be autoclaved at 134°C.

Special requirements

- To clean the circuit O_2 sensor, wipe it with a damp cloth. Do not put the sensor in liquid.
- To clean/disinfect metal or plastic flow sensors, use the flow sensor cleaning procedures. Do not get the connectors wet.
- Disassemble the bellows assembly before you wash it. If not, it will take a very long time to dry. Hang the bellows upside down (extended) to dry. If not, the convolutions can stick together.
- Assemble the bellows assembly before you autoclave. Autoclave the bellows assembly upside down.

⚠**WARNING** Do not use talc, zinc stearate, calcium carbonate, corn starch or equivalent materials to prevent tackiness. These materials can go into the patient's lungs and airways and cause irritation or injury.

⚠**CAUTION** Do not put the circuit O_2 sensor or flow sensor connector in liquid.

⚠ Do not autoclave the circuit O_2 sensor or the plastic flow sensors.

⚠ Do not clean the interior surfaces of the flow sensors. Use a damp cloth on external surfaces only.

Inspect all parts for deterioration. Replace them if necessary.

The *"Preoperative Tests" section* in Part 1 of the User Reference Manual tells you how to test the system for correct operation.

How to clean and disinfect the flow sensors

⚠**CAUTION** Do not autoclave plastic flow sensors.

⚠ Do not use high pressure gas or brushes to clean the flow sensors.

⚠ Do not use cleaning solvents that are not approved for use with polycarbonates (e.g. CIDEX Plus).

CIDEX sterilization

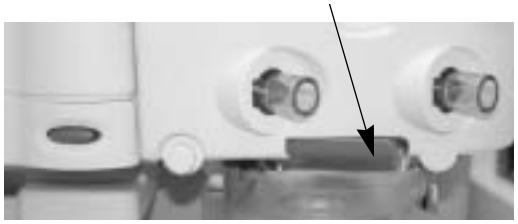
Both Datex-Ohmeda and the manufacturer of CIDEX (Johnson & Johnson) have tested this procedure.

- CIDEX must be 14 day mixture, with activator vial (REF reorder #2245).

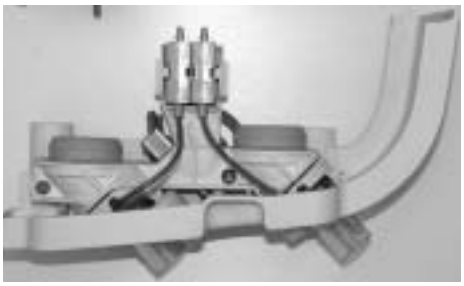
- One liter of this solution cleans four (4) flow sensors.

Procedure

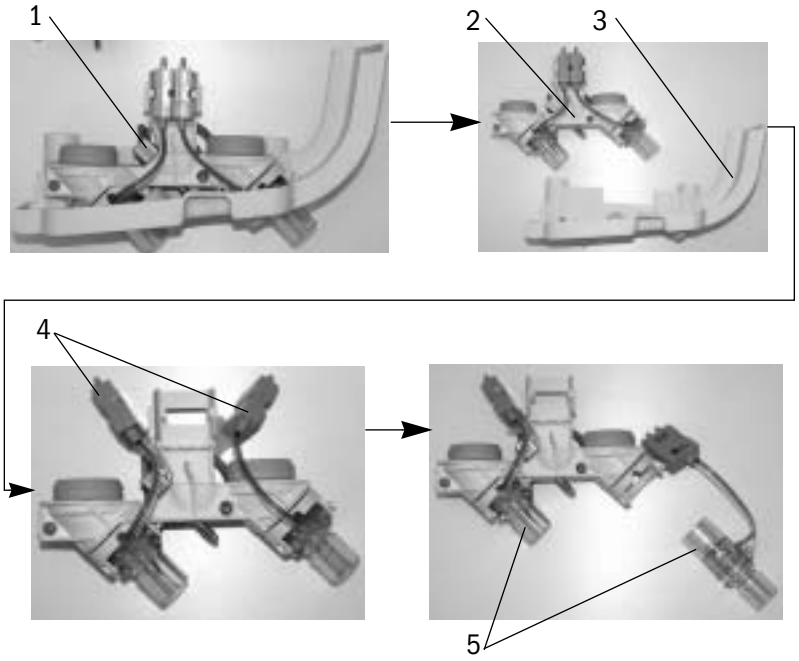
1. Pull the latch to unlock the flow sensor module from the breathing system.



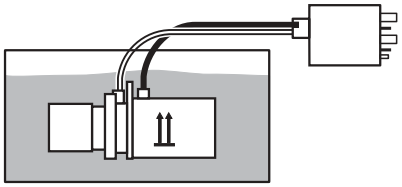
2. Pull the flow sensor module from the breathing system.



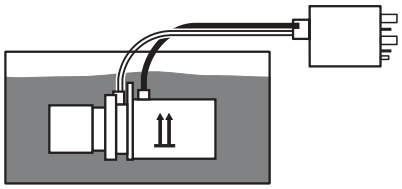
3. Remove the flow sensors from the module.
   - Completely loosen the thumbscrew (1).
   - Pull off the flow sensor cover (3) from the flow sensor holder (2).
   - Remove the flow sensor connectors (4) from the flow sensor holder.
   - Pull the flow sensors (5) from the flow sensor holder.



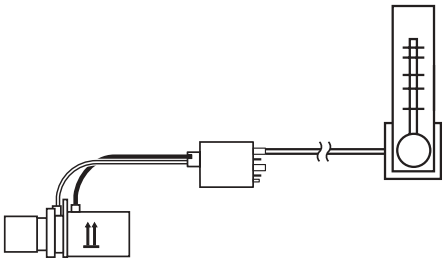
4. Submerge the flow sensor and tubes in activated CIDEX solution. Keep the connector dry.
5. Keep the solution in the tubes for the sterilization period.



6. Submerge the flow sensor and tubes in distilled water. Again, do not get the connector wet.
7. Rinse as indicated in CIDEX instructions.
8. Do steps 6 and 7 again to remove all CIDEX.



9. COMPLETELY dry the flow sensor and the tubes before you use the sensor. Use a dry syringe or connect vacuum or pressure to remove all liquid from the sensor (sensor, tubes, and connector):



⚠**CAUTION** Dry for > 1 min with these precautions:

- Maximum flow 10 L/min
- Maximum pressure ±100 cmH_2O

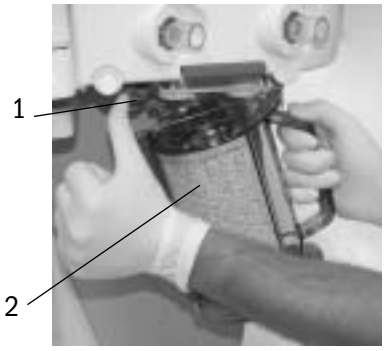
10. Reverse steps 2 and 3 to reassemble the flow sensor module. Be sure to align the flow sensor tubes with the grooves in the flow sensor holder.
11. Before you use the system, complete the "*Preoperative Tests*" in section 4 of the User Reference Manual, Part 1.

Remove the breathing system bag hose

1. Disconnect the bag hose (1) from the bag hose connector (2). Also remove the hose from the clip (3).
2. If bag arm option is present, remove the bag port elbow from the bag arm support. Push down on the release latch and slide the bag port elbow out of the holder.

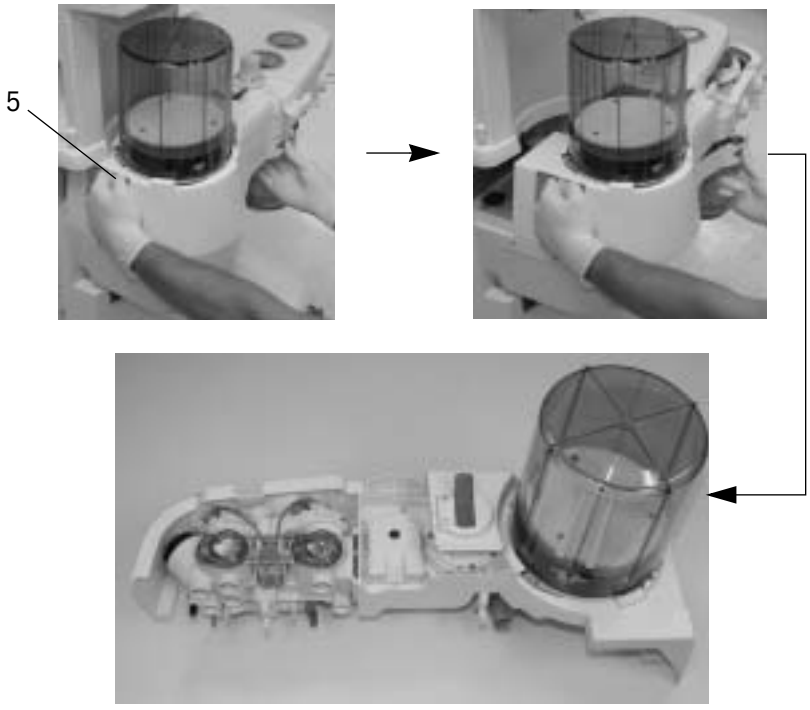
Remove the breathing system

1. Hold the canister (2) by the handle and push on the release latch (1) to unlock the canister.
2. Remove the canister by tilting it downward and off the two support pins.



3. Push the release button (3) and gently pull the latch handle (4) to release the breathing system.

4. Lightly grasp the rear handle (5) to support the breathing system. Slide the breathing system away from the workstation pulling with the latch handle.

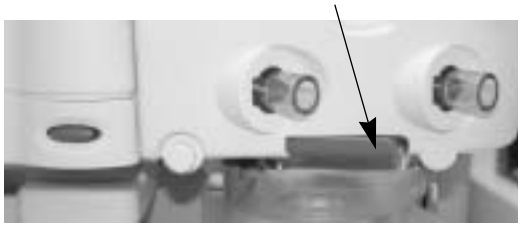


Disassemble the breathing system

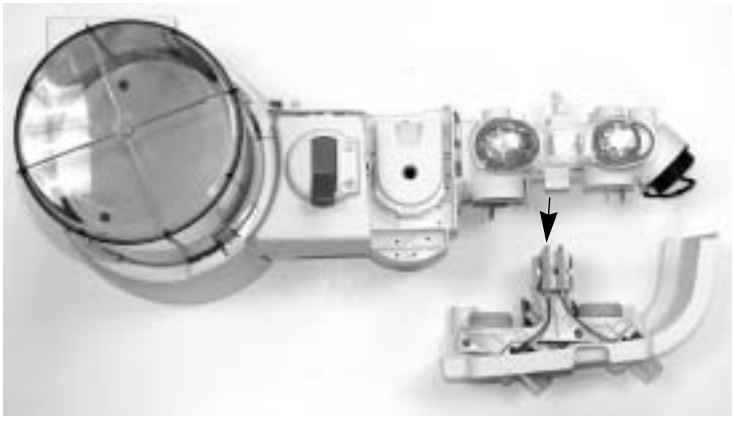
The breathing system assembly can be disassembled for cleaning, sterilization and part replacement.

1. Remove the breathing system and place on a flat surface.

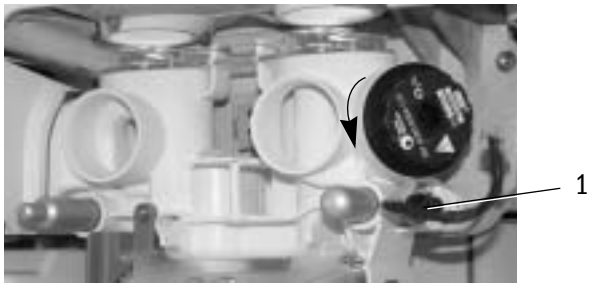
2. Pull the latch to unlock the flow sensor module from the breathing system.



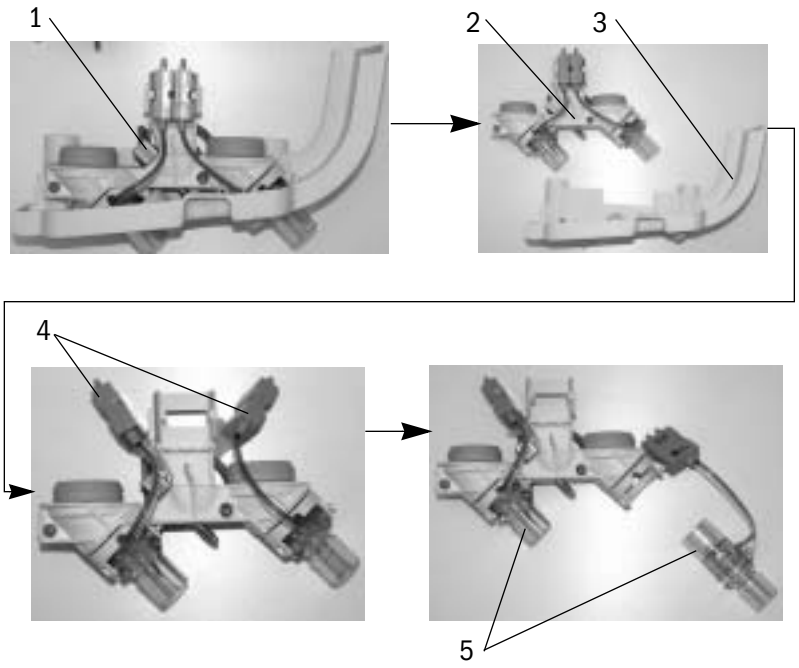
3. Pull the flow sensor module from the breathing system.



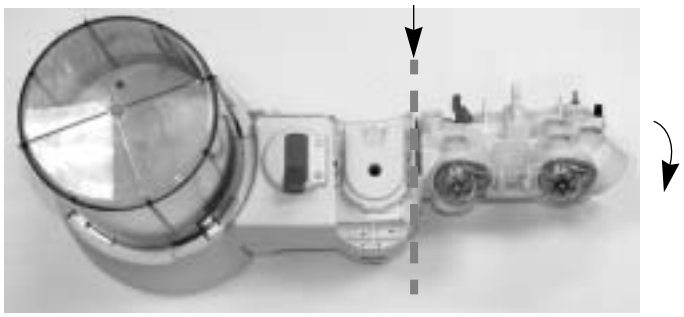
4. Unscrew the sensor counterclockwise and remove it. To remove the sensor cable from the breathing system, press on the connector button (1) while pulling the connector out.



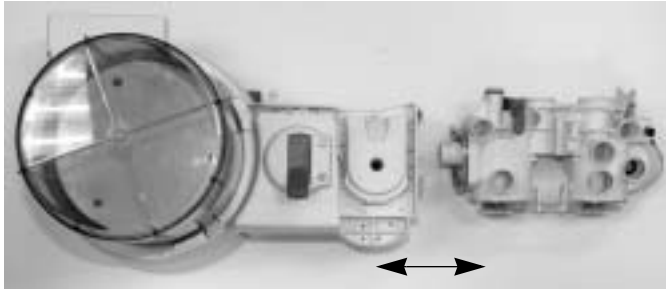
5. Remove the flow sensors from the module:
- Completely loosen the thumbscrew (1).
- Pull off the cover (2) from the Flow Sensor Holder (3).
- Remove the flow sensor connectors (4) from the Flow Sensor Holder.
- Pull the flow sensors (5) from the Flow Sensor Holder.



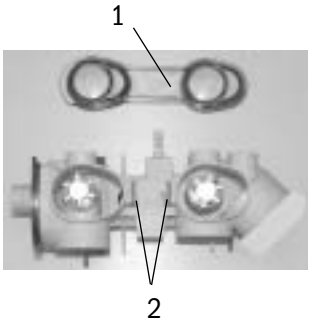
6. Rotate the breathing circuit module at the point shown by the dotted line.



7. After rotating, separate the two sections by pulling them apart.



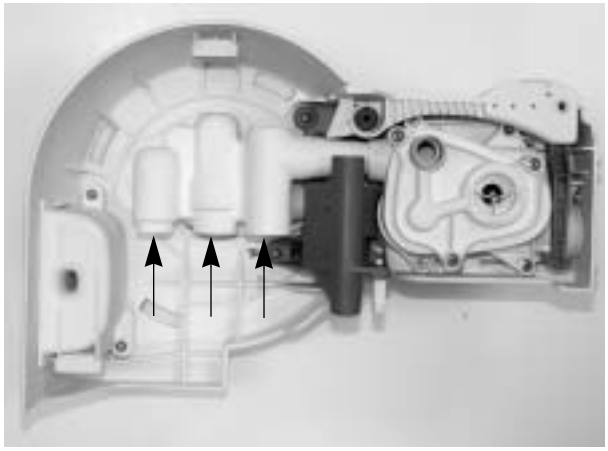
8. On the manifold assembly, remove the check valves circuit lens (1) by squeezing the latches (2) together and pulling up on the lens.

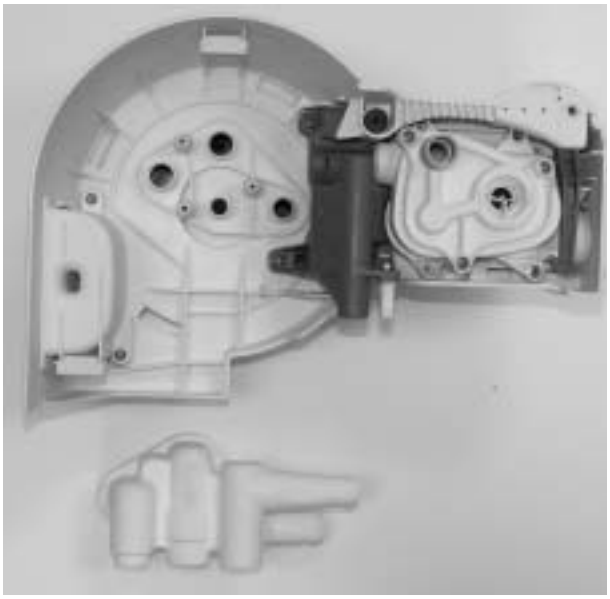


9. Press at (2) to unlock the ramp (1). Rotate the ramp and remove the tabs from the slots (3) to remove the ramp.

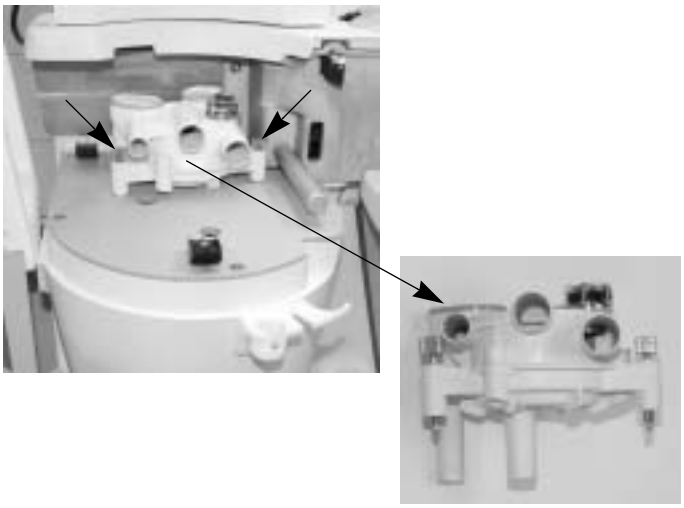
10. Lift the diaphragm to remove it.

11. Turn over the bellows base assembly, grasp the bellows boot with three fingers in the openings at the points shown and pull straight away to remove it.





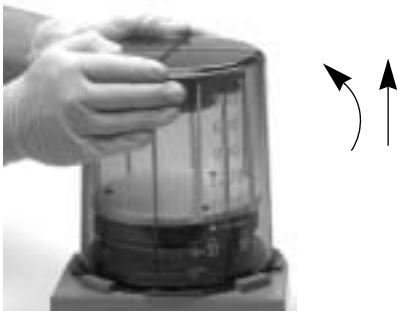
12. With the breathing system removed, the exhalation valve assembly can be removed for cleaning if desired. Loosen the two thumbscrews indicated and lift the assembly off.



Disassemble the Bellows assembly

The bellows assembly can be disassembled for cleaning, sterilization, and part replacement.

1. Turn the housing counter-clockwise and lift.



2. Remove the bottom edge of the bellows from the rim.

3. Push the latch toward the center and remove the rim.

4. Remove the pressure-relief valve.

⚠**WARNING** Do not disassemble the pressure relief valve. This can damage the seat or diaphragm and cause injury to the patient.

5. Push the latch toward the center and remove the locking tabs.

6. Remove the seal.

Assemble the Bellows assembly

1. Install the seal. Verify the arrow on the seal points up.

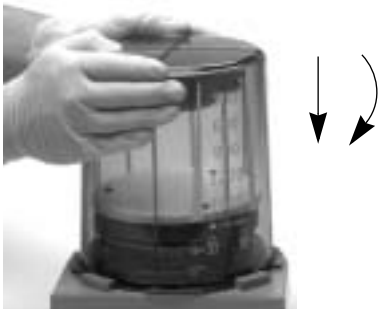
2. Push the latch toward the center and attach the locking tabs.

3. Install the pressure-relief valve.

4. Push the latch toward the center and install the rim. Verify you hear a double-click when you install the rim.

5. Attach the bottom edge of the bellows to the rim. Verify only the bottom ring of the bellows is fitted over the rim.

6. Lower the housing and turn it clockwise to lock. Verify you cannot lift off of the housing.



7. In the above steps, if you see a dust-like powder on the bellows housing or on the bellows, apply a thin layer of KRYTOX lubricant to the ribs of the bellows housing. Make sure the lubricant is applied smoothly and there are no lumps.
8. Perform the Bellows assembly tests before completing the assembly of the breathing system.

Bellows assembly tests

⚠**WARNING** Objects in the breathing system can stop gas flow to the patient. This can cause injury or death:

- Do not use a test plug that is small enough to fall into the breathing system.
- Make sure that there are no test plugs or other objects caught in the breathing system.

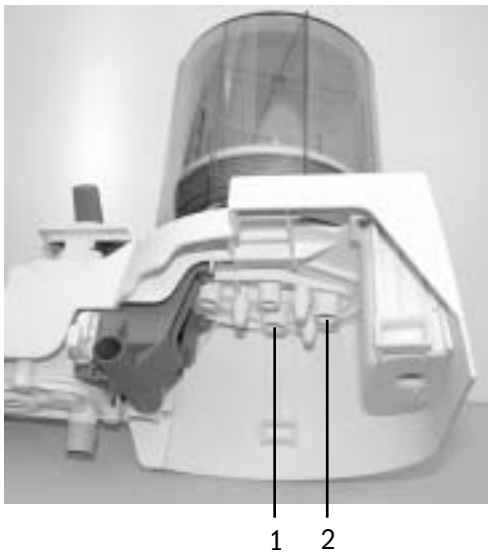
⚠ The bellows assembly test does not replace the preoperative tests. Always complete the tests in the section Preoperative tests before you use the system with a patient.

This test makes sure that all components are correctly assembled. It is not an alternative to a complete system checkout.

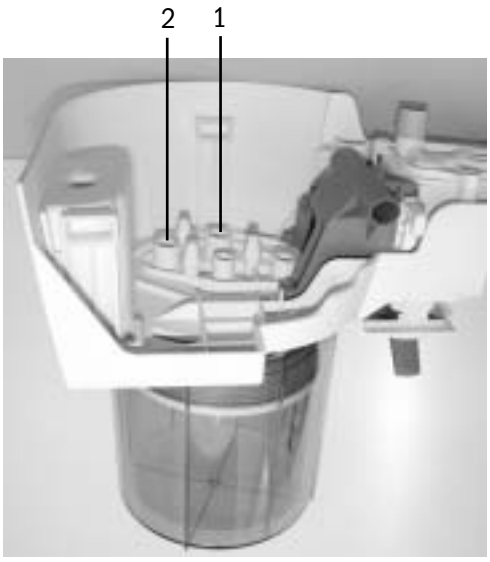
If the bellows assembly operates correctly, complete the assembly of the breathing system.

If there is a problem, disassemble the bellows assembly. Look for and replace damaged parts.

1. Hold the bellows assembly vertical and close the ports (1 and 2).

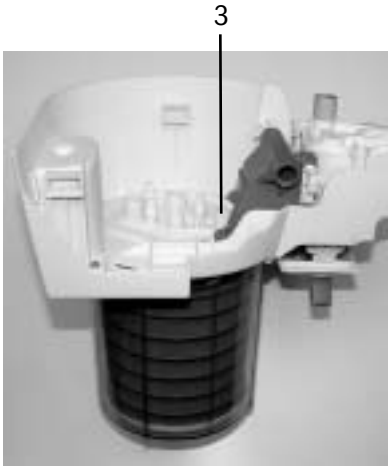


2. Invert the bellows assembly. The bellows must not fall within one minute. If it does:
   - The ports are not tightly sealed.
   - The bellows is incorrectly installed.
   - The seal inside the bellows is not correctly installed (with its groove pointed up).
   - Parts are damaged.



3. Remove the plugs from the ports. Permit the bellows to fully extend.

4. Close port 3.

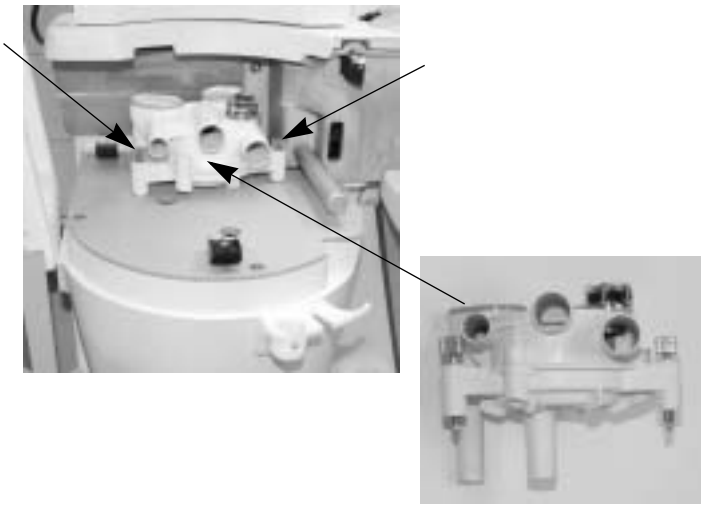


5. Hold the bellows assembly upright. The bellows must not fall past the guide line within one minute. If it does:
   - The port is not tightly sealed.
   - The bellows or the pressure relief valve is not correctly installed.
   - Parts are damaged.

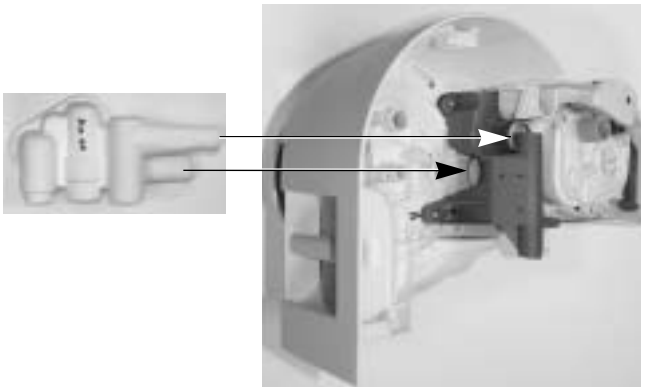
6. If the result for all the bellows assembly tests was “passed,” complete the assembly of the breathing system.

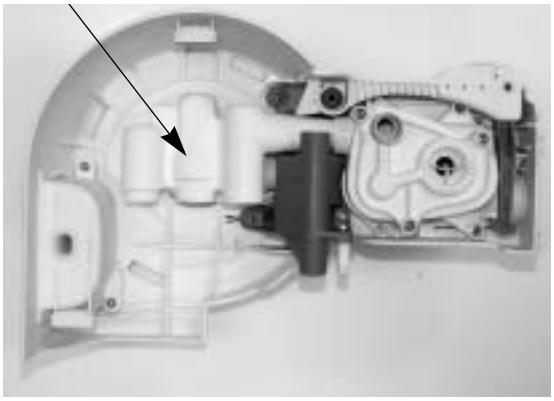
Assemble the breathing system

1. Replace the exhalation valve assembly as shown. Tighten the two thumbscrews.

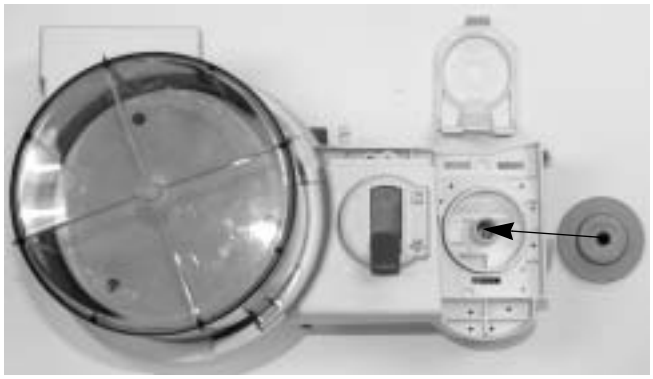


2. Turn over the bellows base assembly. Replace the boot. Be sure to insert it correctly into the ports as shown by the arrows. Then, press on the center of the boot (arrow) to snap it into place on the bellows base assembly.



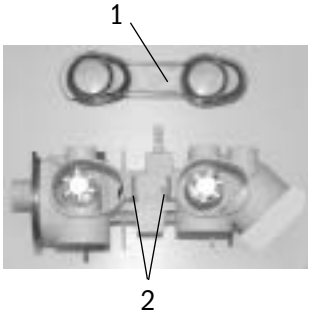


3. Replace the diaphragm.

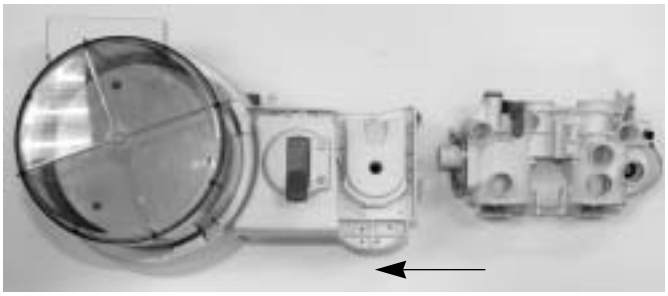


4. Insert the ramp tabs (1) into the slots (2). Rotate the ramp until it locks at (3).

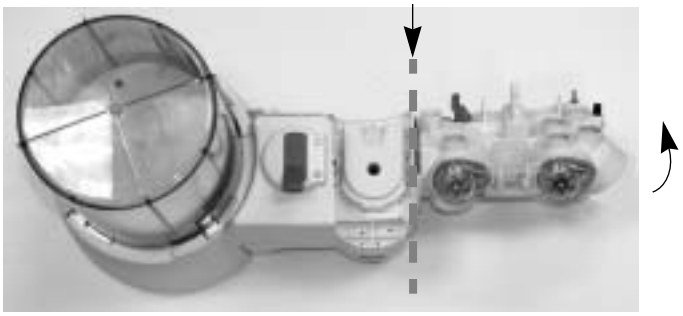
5. On the manifold assembly, press the check valves circuit lens (1) down onto the latches (2) to lock the lens.



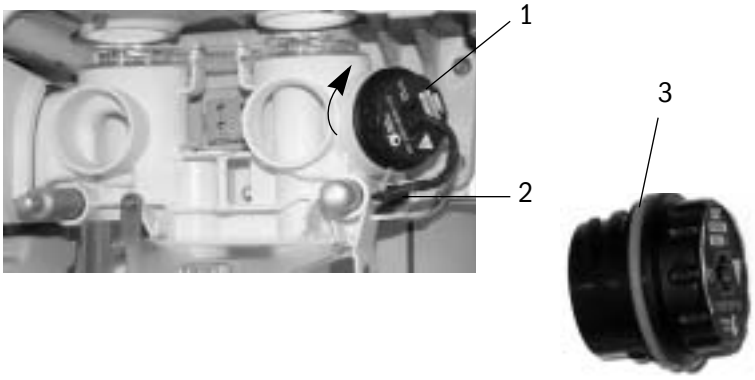
6. Insert the breathing circuit module into the bellows assembly aligned as shown.



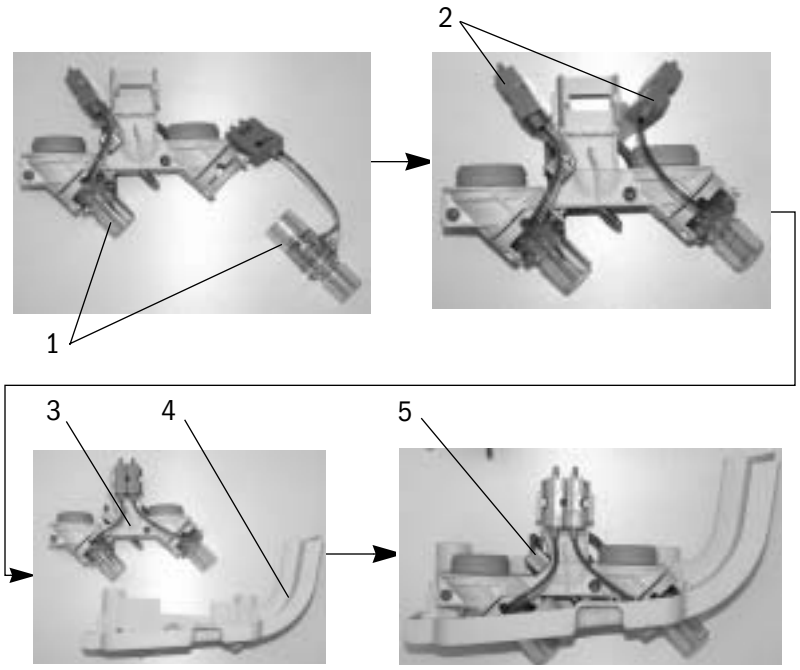
7. Rotate the breathing circuit module at the point shown by the dotted line to attach it to the bellows assembly.



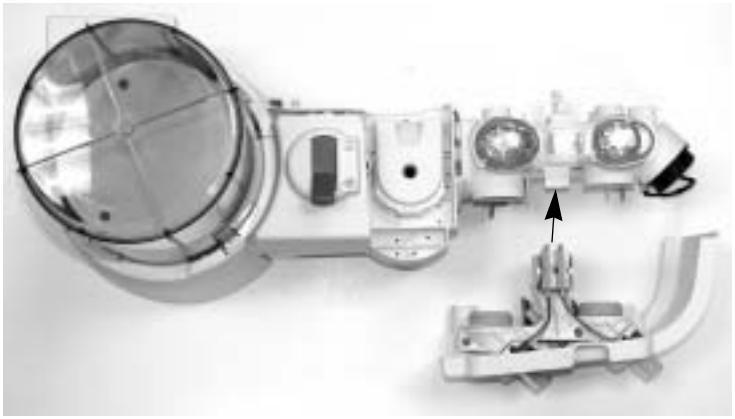
8. Make sure the o-ring (3) is on the O_2 sensor. Replace the sensor (1) by screwing it in clockwise. Replace the O_2 sensor cable connector (2).



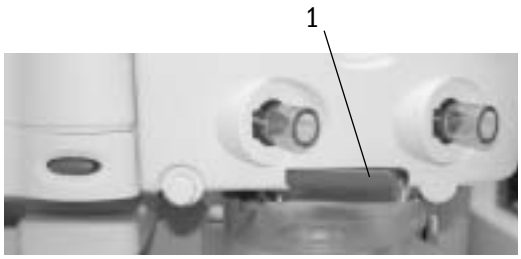
9. Attach the flow sensors to the module:
   - Insert the flow sensors (1) into the flow sensor holder. Note the groove locations.
   - Attach the flow sensor connectors (2) to the flow sensor holder.
   - Attach the cover (4) to the flow sensor holder (3).
   - Tighten the thumbscrew (5) to fasten the cover.



10. Attach the flow sensor module to the breathing system.



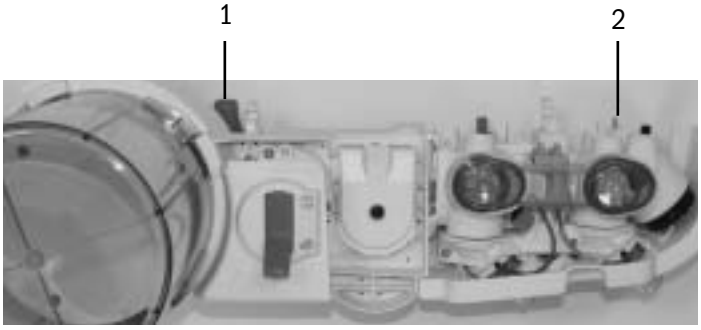
11. Push the latch (1) to lock the flow sensor module onto the breathing system.



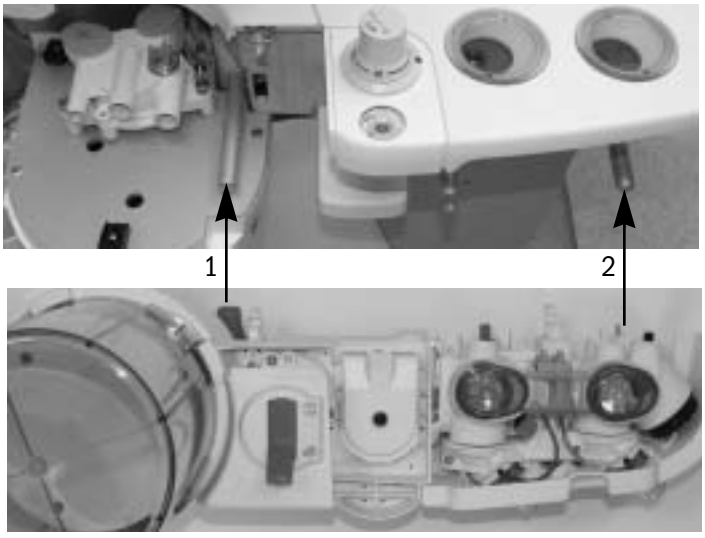
12. This is assembled breathing system.

Install the breathing system

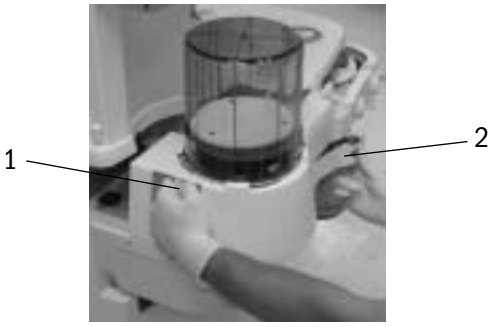
1. Locate guide pin openings 1 and 2.



2. Align opening 1 onto the guide pin 1, then align opening 2 onto guide pin 2.



3. Holding the rear handle (1) and the latch handle (2) as shown, slide the breathing system onto the guide pins.



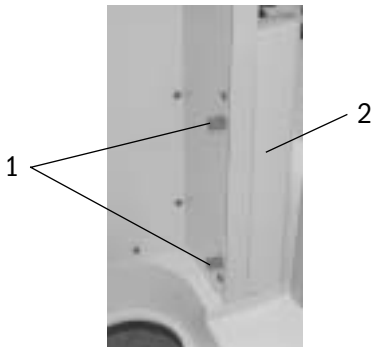
4. Use the grip under the latch handle to push the breathing system in fully until it latches firmly.

5. Install the absorber canister and bag hose.
6. Before you use the system, complete the *"Preoperative Tests"* in section 4 of the User Reference Manual, Part 1.

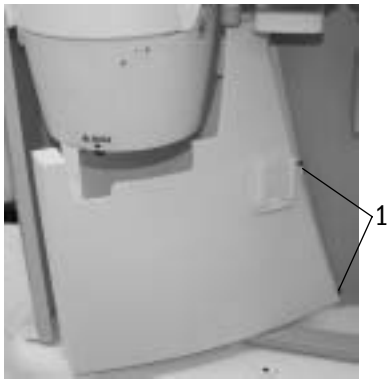
Remove the AGSS receiver

The AGSS receiver may be removed for cleaning and sterilization.

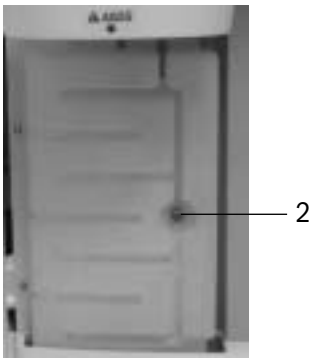
1. On the back of the system, loosen the two thumbscrews (1) to release the system side panel (2).



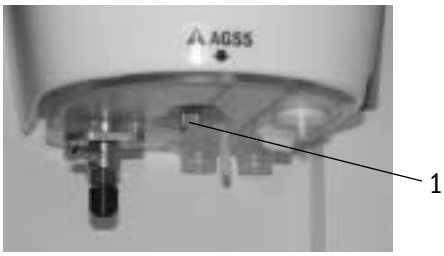
2. Slide the side panel out by removing its tabs from their slots (1).



3. Loosen the thumbscrew and remove the reservoir (2). It is not autoclavable.



4. Loosen the thumbscrew (1) and lower the receiver to remove it.

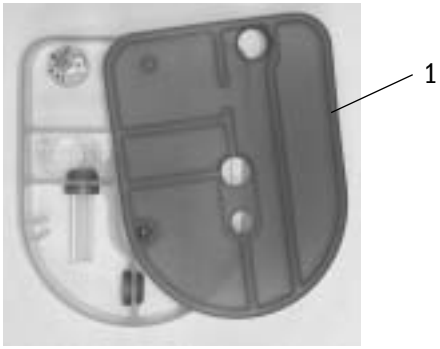


5. Replace the filter as necessary. (See following steps.)
6. Do these steps in the opposite order to replace the receiver and the side panel.
7. Before you use the system, complete the "*Preoperative Tests*" in section 4 of the User Reference Manual, Part 1.

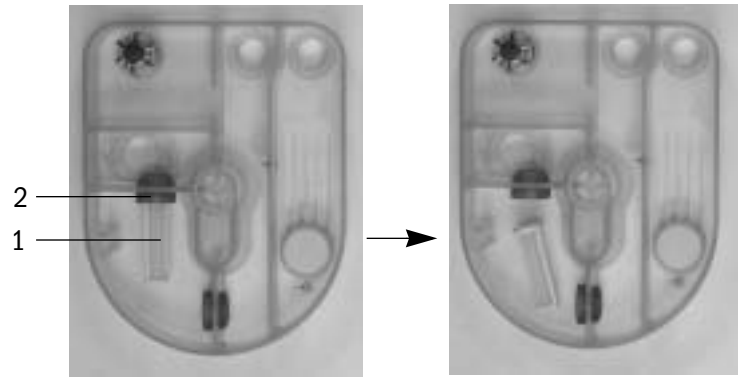
Remove the AGSS receiver filter

The AGSS receiver may be autoclaved. To autoclave AGSS receivers which have a filter, the filter must be removed because it is not autoclavable.

1. Pull the flexible gasket (1) from the receiver.



2. Pull the filter (1) out of its holder (2).



3. Do these steps in the opposite order to replace the filter and gasket after autoclaving the receiver and gasket. Be sure the gasket is firmly pressed into place at all points.
4. Before you use the system, complete the "*Preoperative Tests*" in section 4 of the User Reference Manual, Part 1.

Absorber canister

The absorber canister is available in two versions: Disposable Multi Absorber and Reusable Multi Absorber. Both are removed and installed on the breathing system in the same way.

Refer to *"Removing a canister"* in section 1 *"Setup and Connections"*.

Only the Reusable Multi Absorber canister may be cleaned.

⚠**CAUTION** The filters must be in place to prevent dust and particles from entering the breathing circuit.

Mechanical cleaning in washer or washer-disinfector

1. Place the canister without filters and the lid in the washer or washer-disinfector and clean them with a decontaminating program.
2. Dry the canister and the lid in a warming closet, maximum 80°C (176°F) or at room temperature.
3. If the washer or washer-disinfector is not used for disinfection of equipment, Datex-Ohmeda recommends that a further high level disinfection is conducted.
4. When dry, place a new filter in the bottom of the canister, pour soda lime into the canister and place a new filter over the soda lime before closing and locking the cover. Wipe off any soda lime dust.
5. Align the cover slots with the canister locking tabs, and press the cover down into place. Turn the cover locking ring clockwise to lock the cover in place. Ensure cover is properly sealed to prevent leaks and spillage. Alignment of arrows helps to indicate correct assembly.

Manual cleaning

1. Flush the canister and the lid with fresh running water.
2. Clean the canister and lid under total immersion in a sink with water and cleaning agent for at least 3 minutes. The water temperature should be approximately 40°C (104°F).
3. Flush the canister and lid with fresh running water.
4. When dry, place a new filter in the bottom of the canister, pour soda lime into the canister and place a new filter over the soda lime before closing and locking the cover. Wipe off any soda lime dust.
5. Align the cover slots with the canister locking tabs, and press the cover down into place. Turn the cover locking ring clockwise to lock the cover in place. Ensure cover is properly sealed to prevent leaks and spillage. Alignment of arrows helps to indicate correct assembly.
6. Datex-Ohmeda recommends that manual cleaning is always followed by a high level disinfection.

High level disinfection

1. Always clean the canister before high level disinfection.
2. The canister can be steam autoclaved. Maximum recommended temperature is 134°C (273°F).
3. When dry, place a new filter in the bottom of the canister, pour soda lime into the canister and place a new filter over the soda lime before closing and locking the cover. Wipe off any soda lime dust.
4. Align the cover slots with the canister locking tabs, and press the cover down into place. Turn the cover locking ring clockwise to lock the cover in place. Ensure cover is properly sealed to prevent leaks and spillage. Alignment of arrows helps to indicate correct assembly.

3 User Maintenance

⚠WARNING To help prevent fires:

- Only use lubricants approved for anesthesia or O_2 equipment, such as Krytox.
- Do not use lubricants that contain oil or grease. They burn or explode in high O_2 concentrations.
- All covers used on the system must be made from antistatic (conductive) materials. Static electricity can cause fires.

⚠WARNING Obey infection control and safety procedures. Used equipment may contain blood and body fluids.

⚠WARNING Movable part and removable components may present a pinch or a crush hazard. Use care when moving or replacing system parts and components.

In this section

Repair policy

Do not use malfunctioning equipment. Make all necessary repairs or have the equipment serviced by an authorized Datex-Ohmeda service representative. After repair, test the equipment to ensure that it is functioning properly, in accordance with the manufacturer's published specifications.

To ensure full reliability, have all repairs and service done by an authorized Datex-Ohmeda service representative. If this cannot be done, replacement and maintenance of those parts listed in this manual may be undertaken by a competent, trained individual having experience in the repair of devices of this nature.

⚠CAUTION No repair should ever be attempted by anyone not having experience in the repair of devices of this nature.

Replace damaged parts with components manufactured or sold by Datex-Ohmeda. Then test the unit to ascertain that it complies with the manufacturer's published specifications.

Contact your local Datex-Ohmeda Field Service Representative for service assistance. In all cases, other than where Datex-Ohmeda's warranty is applicable, repairs will be made at Datex-Ohmeda's current list price for the replacement part(s) plus a reasonable labor charge.

Maintenance summary and schedule

These schedules are the minimum frequency based on typical usage of 2000 hours per year. You should service the equipment more frequently if you use it more than the typical yearly usage.

User maintenance

Minimum Frequency	Maintenance
Daily	• Clean the external surfaces. • 21% O_2 calibration (circuit O_2 sensor).
Weekly	• Flow sensor zeroing.
Two weeks	• Drain the vaporizers and discard the agent. This is not necessary for Tec 6 vaporizers.

Minimum Frequency	Maintenance
Monthly	▪ 100% O_2 calibration (circuit O_2 sensor). ▪ Put Krytox (or a lubricant approved for use with 100% O_2) on all tee handle threads.
During cleaning and setup	▪ Inspect the parts for damage. Replace or repair as necessary.
Annually	▪ Replace the external o-rings on the vaporizer ports.
As necessary	▪ Install new cylinder gaskets on cylinder yokes. ▪ Empty the water reservoir and replace the absorbent in the canister. ▪ Empty the overflow trap on the optional suction regulator. ▪ Replace the circuit O_2 sensor. (Under typical use the sensor meets specifications for 1 year.) ▪ Replace the disposable flow sensors (plastic). (Under typical use the sensor meets specifications for a miminum of 3 months.) ▪ Replace the autoclavable flow sensors (metal). (Under typical use the sensor meets specifications for a minimum of 1 year.) ▪ Replace the receiver filter (active gas scavenging only).

Datex-Ohmeda approved service

Minimum Frequency	Planned Maintenance
12 months	Have a qualified service person complete the scheduled service maintenance checks, tests, calibrations and parts replacement as defined in the service manual. **Note:** This is the minimum level of maintenance recommended by Datex-Ohmeda. Local regulations may contain additional maintenance requirements. Datex-Ohmeda advocates compliance with local regulations which meet or exceed this minimum level of maintenance.

Breathing system maintenance

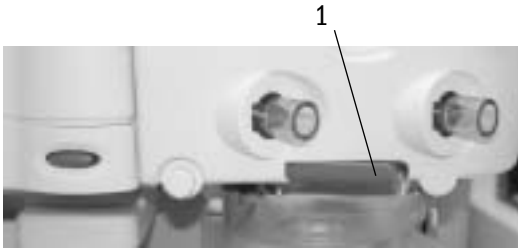
When cleaning the breathing system, replace any parts that are visibly cracked, chipped, distorted or worn.

Refer to the appropriate section for reassembly and tests.

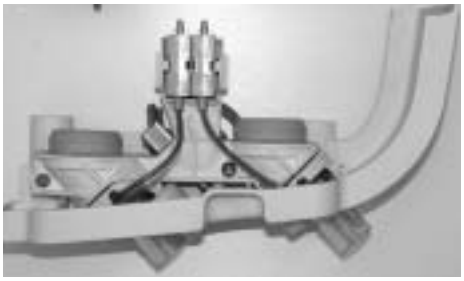
O_2 sensor replacement

⚠**WARNING** Handle and dispose of sensors according to your biohazard policies. Do not incinerate.

1. Pull the latch (1) to unlock the flow sensor module from the breathing system.



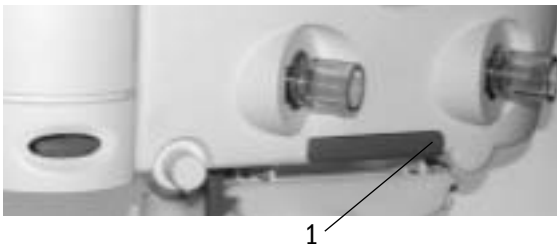
2. Pull the flow sensor module from the breathing system.



3. Remove the O_2 sensor cable connector (2) from the O_2 sensor (1) and unscrew the sensor counterclockwise. Don't lose the sensor o-ring.

4. Make sure the o-ring (1) is on the sensor. Install the replacement O_2 sensor. Reconnect the O_2 sensor cable.

5. Replace the flow sensor module on the system and press the latch (1) in to secure the module.



O_2 sensor calibration

⚠WARNING Do not perform calibration while unit is connected to a patient.

⚠ The O_2 sensor must be calibrated at the same environment pressure at which it will be used to monitor oxygen delivery in the patient circuit.

⚠ Operation at pressures other than the pressures present during calibration may result in readings outside of the stated monitoring accuracy.

21% O_2 sensor calibration

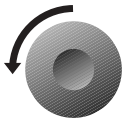
This procedure takes three minutes or less.

You must do the 21% O_2 calibration before the 100% O_2 calibration. During O_2 calibration the screen replaces O_2 data with **- -**.

Step 1
Push the Menu key to see the main menu.

Main Menu
Ventilation Mode
Alarm Settings
Setup/Calibration
Screen and Audio Setup
Cardiac Bypass No
Exit to Normal Screen

Step 2
Turn the knob to select the Calibration screen.



Main Menu
Ventilation Mode
Alarm Settings
Setup/Calibration
Screen and Audio Setup
Cardiac Bypass No
Exit to Normal Screen

Step 3
Push the knob to show the next screen.

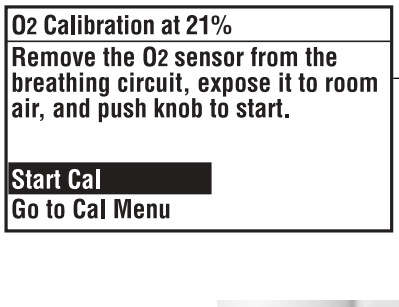
Setup/Calibration
SIMV/PSVPro Setup
O_2 Sensor Cal
Inspiratory Pause No Pause ⚠
Heliox Mode Off
About Ventilator ...
Go to Main Menu

Step 4
Turn and push the knob to select O_2 Sensor Cal.

Setup/Calibration
SIMV/PSVPro Setup
O_2 Sensor Cal
Inspiratory Pause No Pause ⚠
Heliox Mode Off
About Ventilator ...
Go to Main Menu

Step 5
Select 21% then push the knob.

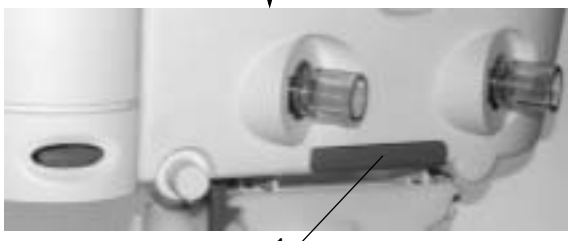
O_2 Calibration
Complete 21% first; 100% cal may be performed only after a 21% cal has been completed.
21%
100% ⚠
Go to Setup/Calibration Menu

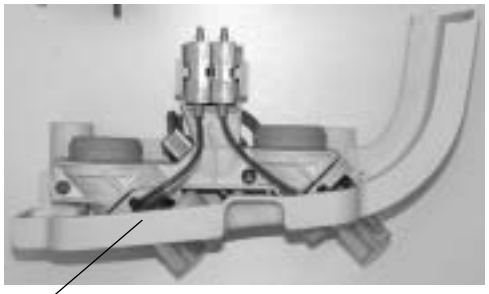


Step 6

Complete the steps shown on the screen.
To remove the O_2 sensor from the circuit:

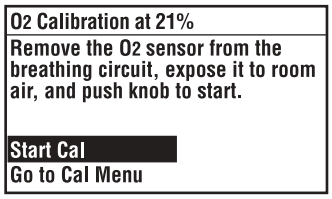
- Pull the latch (1) to unlock the flow sensor module from the breathing system.
- Pull the flow sensor module (2) from the breathing system.
- Remove the O_2 sensor (3) and leave it exposed to room air.





Step 7
Select Start Cal and push the knob to start calibration.

- The screen shows "**Calibrating**" during the procedure.



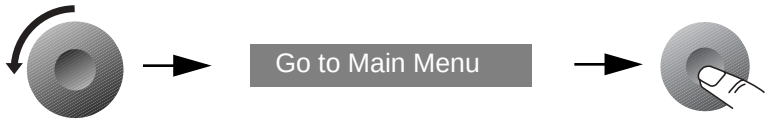
After a successful calibration, the screen shows "Complete" and a flashing "Reinstall Sensor".

After installing the sensor, you can continue to 100% calibration (step 11) or exit to the normal screen (step 7).

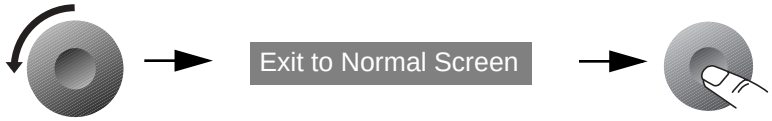
An unsuccessful calibration shows "**Failure**". If the calibration fails:

- Do the calibration again.
- If it still fails, do a 100% O_2 sensor calibration (step 11). If 100% O_2 sensor calibration passes, calibrate at 21% again.
- After repeated failures, replace the O_2 sensor and re-calibrate at 21%.

Step 8
To exit, select "Go to Cal Menu" and push the knob. You can also press the menu key to exit to the normal screen. Select "Go to Main Menu" and push the knob.



Step 9
Select "Exit to Normal Screen" and push the knob.



Step 10
If you are not doing the 100% calibration which follows, do a breathing circuit leak test before using the system.

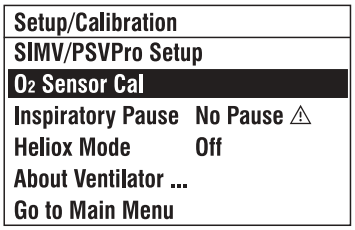
100% O_2 sensor calibration

This procedure takes three minutes or less.

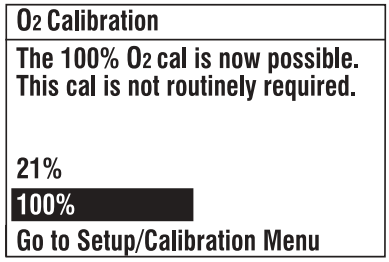
You must complete the 21% calibration before you can select the 100% calibration.

⚠WARNING Do not perform calibration while unit is connected to a patient.

Step 11
Turn then push the knob to select O_2 Sensor Cal.



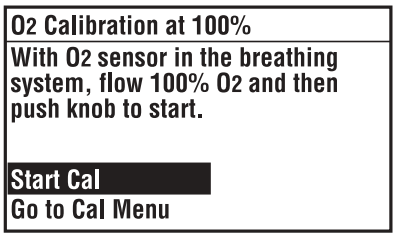
Step 12
Select 100% then push the knob.



Step 13
With the O_2 sensor in the circuit, fill the circuit with 100% O_2:

- Push the flush button.
- Then flow 100% O_2 at 5 L/min. (Circuit should be open.)

Step 14
Select Start Cal. Then push the knob to start calibration.

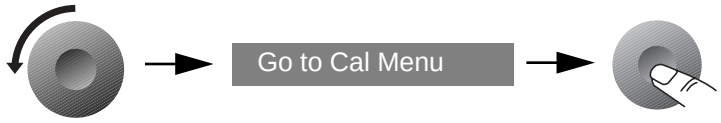


The screen shows 'Calibrating ... ', followed by the result: 'Complete' or 'Failure'.
If the calibration fails,

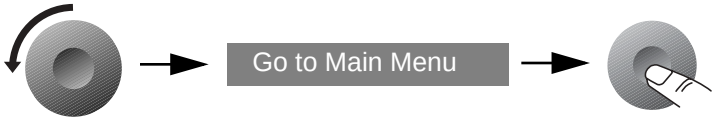
- do it again or
- decrease the airway pressure. Then try again.

After repeated failures replace the O_2 sensor and re-calibrate at 21%.
Continue with steps 14 through 16 to exit to a normal screen.

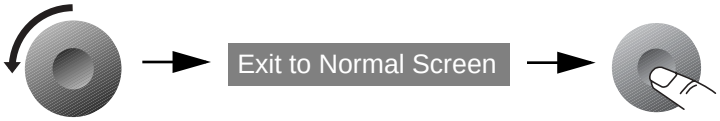
Step 15
To exit, select "Go to Cal Menu" and push the knob. You can also press the menu key to exit to the normal screen



Step 16
Select "Go to Main Menu" and push the knob.



Step 17
Select "Exit to Normal Screen" and push the knob.



Step 18
Do a breathing circuit leak test before using the system.

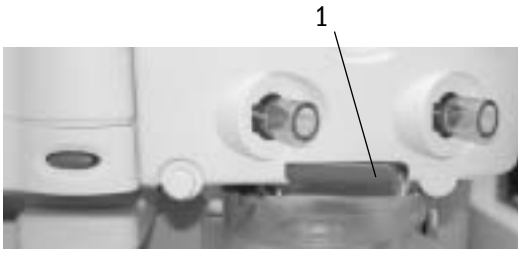
Flow sensor zeroing

⚠WARNING Do not perform calibration while unit is connected to a patient.

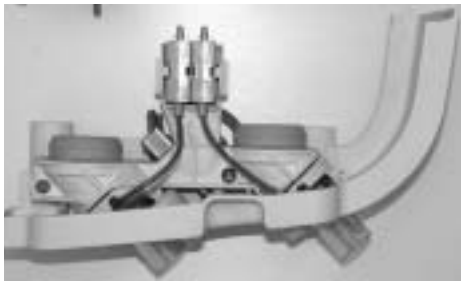
The system automatically corrects for zero offset when you unplug the flow sensor connectors with power on. You must stop mechanical ventilation before you calibrate the flow sensors.

Note: Properly performing the O_2 cell zeroing will also zero the flow sensor.

Step 1
Pull the latch (1) to unlock the flow sensor module from the breathing system.



Step 2
Pull the flow sensor module from the breathing system.



Step 3
When zeroing is complete, the screen shows, “No Insp flow sensor” and “No Exp flow sensor.”

No Insp Flow Sensor
No Exp Flow Sensor

Step 4
Install the flow sensor module.

Step 5
Do a breathing circuit leak test before using the system. Refer to “Breathing system tests” in section 4 *Preoperative Tests* of the User Reference Manual, Part 1.

How to prevent water build-up

Why is water buildup a problem?

Pooled water in the flow sensor or water in the sensing lines causes false alarms.

How much water is acceptable?

Small beads of water or a foggy appearance in the flow sensors is OK.

Where does the water come from?

Water comes from exhaled gas and a chemical reaction between CO_2 and the absorbent in the absorber.

At lower fresh gas flows more water builds up because less gas is scavenged and:

- More CO_2 stays in the absorber to react and produce water,
- More moist, exhaled gas stays in the absorber.

Solutions:

- Empty the water reservoir in the canister when changing the soda lime.
- Ensure that water condensing in the breathing circuit tubes is kept lower than the flow sensors and is not allowed to drain into the flow sensors.
- Water condensation in the breathing circuit tubing can be eased using a Heat & Moisture Exchange (HME) filter at the airway connection.

4 Alarms and Troubleshooting

⚠CAUTION No repair should ever be attempted by anyone not having experience in the repair of devices of this nature.

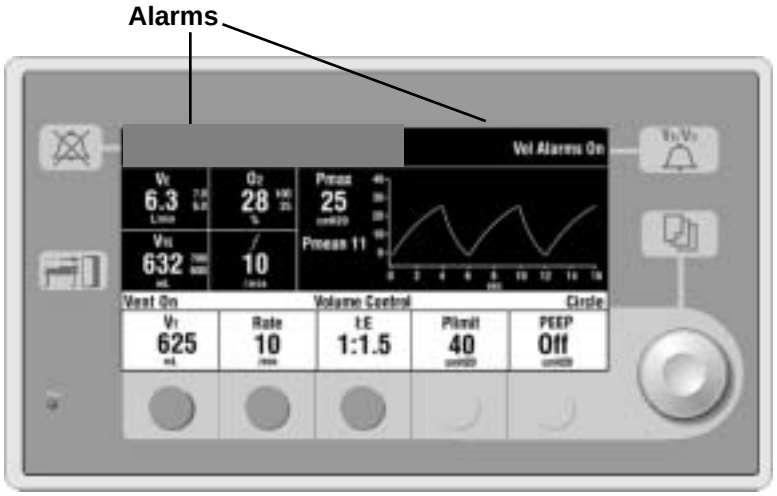
In this section

About alarms

⚠WARNING If an alarm occurs, safeguard the patient first, before troubleshooting or repair procedures.

Two areas on the screen show alarms. The area at the top of the display shows most alarms. If there are more than 4 alarms at the same time, the lower priority alarms cycle every two seconds.

During severe malfunctions that prevent mechanical ventilation and/or monitoring, the area under the waveform shows minimum system messages. During normal operation, this area shows instructions (push the knob, etc.).



Alarm priority depends on the level of danger to the patient. High priority alarms require immediate attention.

Priority	Alarm tone	Alarm silence	Note
High	10 tones, 10 second pause, repeat	120 seconds or cannot be silenced	Reverse video
Medium	3 tones, 25 second pause, repeat	120 seconds	---
Low	Single tone	Tone does not repeat	---

Alarm messages have three general causes.

- Malfunctions: Some malfunctions cause reduced function (for example, no PEEP). Others prevent mechanical ventilation (Minimum shutdown).
- Patient monitoring: These are high and low limit settings that you adjust.
- Informational: Control settings or system conditions can change operation. For example, if the audible circuit leak alarm is Off, the screen shows “Circuit Leak Audio Off” as a low priority alarm.

Alphabetical list

The instructions in this section tell you what you can do:

- During a case to protect the patient
- After the case to repair a problem

This table does not include operator instructions.

There are two special types of alarms:

- Minimum monitoring alarms stop mechanical ventilation.
- Minimum shutdown alarms stop mechanical ventilation and monitoring.

Message	Priority	Cause	Action/Concerns	Repair
+15V Analog Out-of-Range	Min. shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
-15V Analog Out-of-Range	Min. shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
12 Hour Test	Low	System in use for more than 12 hours without a power-up self test.	To do the test, move the system switch from Standby to On.	Not necessary, informational.
A/D Converter Failure	Min. shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Absorber panel open	Medium	The top panel is not completely closed.	Push the breathing system into the frame and ensure it latches.	- - -
Adjust Low Ve Limit	Medium	The audible circuit leak alarm is Off (Alarm menu) but the low VE alarm is not set. VE alarm is Off in SIMV or PSVPro modes.	Increase the low VE alarm limit.	- - -
Apnea Alarm Standby	Low	Normal condition after End Case, power-up, or ACGO change from On to Off	Monitoring resumes after first breath (mechanical) or 2 breaths within 30 seconds (non-mechanical).	- - -
Apnea Alarm Off	Low	The cardiac bypass option is selected (alarm limit menu).	Apnea alarms are normally turned off when this option is selected.	- - -

Message	Priority	Cause	Action/Concerns	Repair
Aux Gas Outlet On	Medium (low after acknowledged)	The outlet selection switch is set to the auxiliary common gas outlet.	Connect the patient circuit to the auxiliary outlet. For mechanical ventilation or manual ventilation with monitoring, select the breathing system.	- - -
Backup Mode Active	Low	SIMV-PC + PSV mode entered.	Spontaneous breath rate fell below the set breath rate	- - -
Battery Charger Fail	Low	The current in the battery charging circuit is too high.	The system is operational, but may fail later depending on what caused this alarm.	Contact a qualified service representative.
Battery Charging	Low	The battery is not fully charged. If power fails, the total backup time will be less than 30 minutes.	Leave the system plugged in to charge the battery.	- - -
Battery Current High	Low	Battery current > 6 amps for 10 seconds.	The system continues to operate, but may fail.	Contact a qualified service representative.
Battery Failure High	Low	Battery voltage > 16 V for 10 seconds.	The system continues to operate, but may fail.	Contact a qualified service representative.
Battery Failure Low	Low	The battery voltage is too low (<7 V) to supply the system if power fails.	The battery does not have enough charge to power the equipment if power fails. Leave the system plugged in to charge the battery.	If the battery does not charge in 24 hours, contact a service representative.
Cal Flow Sensors	Low	The last flow sensor calibration failed.	Calibrate the flow sensors. Look for water in the flow sensor tubes. Dry if necessary.	Contact a qualified service representative.
Calibrate O_2 Sensor	Low	O_2%>110%	Does the sensor measure 21% O_2 in room air?	Calibrate O_2 sensor.
Cannot Drive Bellows	Low	The internal manifold pressure is higher than Paw + tolerance.	Fill the bellows if empty.	- - -
Cardiac Bypass	Low	The alarm limit settings are set for a patient on cardiac bypass. Apnea alarms are off.	Use the alarm limits menu to change this setting.	- - -

Message	Priority	Cause	Action/Concerns	Repair
Check Flow Sensors	Medium (low after acknowledged)	No flow or negative flow on inspiratory sensor during inspiration in a circle system or negative flow on expiratory sensor in expiration (for 6 breaths in a row).	Are the flow sensors correctly installed? Water build-up in the flow sensor tubes? Is a flow sensor tube cracked or broken?	Inspect one way valves (breathing circuit module). Replace flow sensor module. Check the condition of the flow sensor and its tubing.
Circuit Leak Audio Off	Low	Control setting on the Alarm limit menu.	This message tells you that the audio alarm for circuit leaks was turned off.	- - -
Connect O_2 Sensor	Low	The O_2 sensor is not connected to the cable.	Connect the sensor.	Contact a qualified service representative to replace the cable.
CPU Failure	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
CPU Internal Error	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Display Voltage Out-Of-Range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Exp Flow Sensor Fail	Low	The system cannot read the calibration data stored in the sensor.	Operation continues with default values. Replace the flow sensor.	- - -
Exp Reverse Flow	Medium (low after acknowledged)	Flow through the expiratory sensor during inspiration (for 6 breaths in a row).	Look at the check valves. Water build-up in the flow sensor tubes? Is a flow sensor tube cracked or broken?	Replace the expiratory check valve. Check the condition of the flow sensor.
Flow Valve (DAC) Failure Flow Valve (current) Failure	Minimum monitoring (Medium)	Ventilator malfunction.	Ventilate manually. Monitoring is still available.	Contact a qualified service representative.
Gas Inlet Valve Failure	Minimum shutdown (High)[a]	Ventilator malfunction.	Ventilate manually. Monitoring is still available.	Contact a qualified service representative.
Hardware Watchdog Failure	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.

Message	Priority	Cause	Action/Concerns	Repair
High O_2	Medium	O_2% > alarm high limit setting.	Is the limit set correctly? What is the O_2 flow? Did you just push Flush? Does the sensor see 21% O_2in room air?	Calibrate O_2 sensor. Replace O_2 sensor.
High Paw	High	Paw is greater than Plimit. The ventilator cycles to expiration.	Are Plimit and other controls set correctly? Look for blockages. Check the patient connection.	Calibrate the flow sensors. Replace the receiver filter.
High Ve	Medium	The minute volume is greater than the set high limit. This alarm is suspended for 9 breaths or one minute after you change the ventilator settings.	Check patient for spontaneous breathing. Adjust control settings.	- - -
High Vte	Medium	VTE is greater than high alarm limit. This alarm is suspended for 9 breaths after you change the ventilator settings.	Check patient for spontaneous breathing. Check ventilator and alarm settings.	- - -
Insp Flow Sensor Fail	Low	The system cannot read the calibration data stored in the sensor.	Operation continues with default values. Replace the flow sensor.	- - -
Inspiration Stopped	High	Drive gas safety switch activated (high internal pressure)	Adjust controls. Check systems for blockages.	- - -
Insp Reverse Flow	Medium (low after acknowledged)	Flow through the inspiratory sensor during expiration (for 6 breaths in a row).	Look at the check valves. Water build-up in the flow sensor tubes? Is a flow sensor tube cracked or broken?	Replace the inspiratory check valve. Check the condition of the flow sensor.
Internal Ventilator Clock Too Fast	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Internal Ventilator Clock Too Slow	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Invalid Circuit Module	Low	Ventilator malfunction.	Ventilate manually; monitoring is not reliable.	Contact a qualified service representative

Message	Priority	Cause	Action/Concerns	Repair
Limit Task Light Use	Low	The system is running on battery power. Turn off the light to save power.	Turn off the light to extend battery backup.	- - -
Loss of Backup Audio	Medium (low after acknowledged)	The audio alarm will not sound for a CPU failure.	Monitor system operation.	Contact a qualified service representative.
Low Battery Voltage	Medium	Voltage is <11.65V while using battery power.	Manually ventilate the patient to save power.	Make sure power is connected and circuit breakers are closed. Contact a qualified service representative.
Low Drive Gas Pres	Medium	The ventilator did not detect a rise in internal pressure when the flow valve opened.	Manually ventilate the patient.	Make sure that the appropriate gas supplies (O_2 or Air) are connected and pressurized.
Low O_2	High	O_2% < alarm low limit setting	Is the limit set correctly? Is the O_2 flow sufficient? Does the sensor see 21% O_2 in room air?	Calibrate O_2 sensor. Replace O_2 sensor. As sensors wear out, the measured % O_2 decreases.
Low Paw	Medium	Paw does not rise at least 4 cm from the lowest pressure measured during the last 20 seconds.	Are circuit connections OK? Look at the Paw gauge on the absorber.	Look for circuit disconnection.
Low Ve	Medium	Exhaled minute volume <low limit alarm setting. This alarm is suspended for 9 breaths or one minute after you change the ventilator settings.	Check patient condition. Check tubing connections. Check alarm settings.	- - -
Low Vte	Medium	Exhaled tidal volume <low limit alarm setting. This alarm is suspended for 9 breaths after you change the ventilator settings.	Check patient condition. Check tubing connections. Check alarm settings.	- - -
Manifold Pressure Sensor Failure	Minimum monitoring (Medium)	Ventilator malfunction.	Ventilate manually.	Contact a qualified service representative.

Message	Priority	Cause	Action/Concerns	Repair
Memory (EEPROM) Fail		The system cannot access some stored values.	Default settings are used. Ventilation is still possible but service is necessary.	Contact a qualified service representative.
Memory (flash) Failure	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Memory (RAM) Failure	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Memory (Redundant Storage) Fail	Minimum monitoring (Medium)	Ventilator malfunction.	Ventilate manually. Monitoring is still available.	Contact a qualified service representative.
Memory (video) Failure	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Monitoring Only	Medium	A severe malfunction prevents mechanical ventilation. Other alarms may also occur.	Ventilate manually. Cycle system power (On- Standby-On). If the alarm clears, restart mechanical ventilation.	Contact a qualified service representative.
No Circuit Module	Low	Ventilator malfunction.	Ventilate manually.	Optical sensors look for tabs on the back of the module. Is the module assembled? are the sensors dirty?
No CO_2 Absorption	Medium (low after acknowledged)	The absorber canister is open (out of the circuit) but the bypass mechanism prevents a leak (optional feature).	User setting. Reinstall the absorber canister to remove CO_2 from exhaled gas	- - -
No Exp Flow Sensor No Insp Flow Sensor	Medium (low after acknowledged)	Electrical signals show the flow sensor is not connected.	Connect the flow sensors. Make sure the flow sensor module is on all the way.	- - -
No message, only specific shutdown message	High	A severe malfunction prevents mechanical ventilation and monitoring. Other alarms may also occur.	Ventilate manually. Use a stand-alone monitor. Cycle system power (On- Standby-On). If the alarm clears, restart mechanical ventilation.	Contact a qualified service representative
No O_2 Pressure	High (cannot be silenced)	The O_2 supply has failed.	Air flow will continue. Ventilate manually if necessary. Connect a pipeline supply or install an O_2 cylinder.	- - -

Message	Priority	Cause	Action/Concerns	Repair
O_2 Flush Failure	Low	The pressure switch that detects flush flow has seen a very long flush (≥30 seconds).	This alarm occurs if you hold down the Flush button for more than 30 seconds.	If the alarm occurs when flush is not in use, contact a qualified service representative.
O_2 Sensor out of circuit	Low	Ventilator malfunction.	Ventilate manually.	Contact a qualified service representative.
On Battery - Power OK?	Medium (low after acknowledged)	The mains supply is not connected or has failed and the system is using battery power.	Ventilate manually to save power. At full charge, the battery permits approx. 30 minutes of mechanical ventilation.	Make sure power is connected and circuit breakers are closed.
Patient Circuit Leak?	Medium	Exhaled volume <50% of inspired volume for at least 30 seconds (mechanical ventilation).	Check breathing circuit and flow sensor connections.	- - -
Paw < -10 cmH_2O	High	Subatmospheric pressure (<-10 cmH_2O).	Check patient condition, spontaneous activity? Increase fresh gas flow. Look for high flow through gas scavenging.	Calibrate the flow sensors.[b] With active scavenging, check the negative relief valve on the receiver.
PEEP Not Achieved	Low	Pmin does not reach within ±2 cmH_2O of PEEP by the end of mechanical expiration for 6 consecutive breaths.	Check tubing connections. Rate and/or I:E ratio may prevent ventilator from reaching desired PEEP level.	- - -
Positive SIB Vref Out-of- Range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Pres Mode Not Avail	Medium (Pressure, PSVPro and SIMV modes)	Manifold pressure not tracking airway pressure, or manifold pressure ≤ -15 cmH_2O.	Pressure control mode and PEEP are not available. Switch to Volume mode or ventilate manually.	Contact a qualified service representative.
	Low (Volume mode)		Check patient for spontaneous breathing. Check ventilator settings.	
Pres/Vol Mon Inactive	Medium	Outlet selection switch is set to auxiliary gas outlet.	Connect the patient circuit to the auxiliary gas outlet or set the switch to the circle breathing system.	- - -

Message	Priority	Cause	Action/Concerns	Repair
Pressure Limit Switch Failure	Minimum monitoring (Medium)	A pressure safety switch activated at a Paw <90 cmH_2O and Pmanifold <80 cm H_2O.	Ventilate manually. Monitoring is still available. Extreme control combinations may cause this alarm. Check control settings.	Contact a qualified service representative.
Replace O_2 Sensor	Low	O_2% < 5%	Makes sure patient receives O_2. Does the sensor see 21% O_2 in room air? Use different monitor.	Calibrate O_2 sensor. Replace O_2 sensor.
Select Gas Outlet	Medium	Fresh gas may not flow to the patient. Auxiliary gas outlet is On, but flow sensors have seen 3 breaths in patient circuit during the last 30 seconds.	Select the circle breathing system or connect the patient circuit to the auxiliary outlet.	**Note:** the bag arm will not ventilate a patient at the auxiliary outlet.
Service Calibration	Low	Internal calibrations are necessary for maximum accuracy.	The system is operational. Operation continues with default values.	Contact a qualified service representative.
Software Error	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Software Watchdog Failure	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Sustained Airway Pressure	Minimum shutdown (High)	Paw > 100 cmH_2O for 10 seconds.	Check tubing for kinks, blockages, disconnects.	Calibrate the flow sensors.
Sustained Paw	High	Paw > sustained pressure limit for 15 seconds[c].	Check tubing for kinks, blockages, disconnects.	Calibrate the flow sensors.
System Leak?	Medium	Delivered volumes do not match set volumes.	Look for leaks in the breathing system. Compare set to delivered volumes.	Calibrate the flow sensors. Drain water buildup from the breathing system.
Vaux_ref Out-of-Range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.
Vext_ref Out-of-Range	Minimum shutdown (High)	Ventilator malfunction.	Ventilate manually. Monitoring is not reliable.	Contact a qualified service representative.

Message	Priority	Cause	Action/Concerns	Repair
Volume Apnea	Medium	No mechanical breaths or spontaneous breaths >20 mL in last 30 seconds.	Check patient. Bag as needed. Check for disconnects. If the patient is on a heart lung machine, select Cardiac Bypass on the main menu.	- - -
Vol Apnea > 2 min	High	No mechanical breaths or spontaneous breaths >20 mL in last 120 seconds.	See above.	- - -
Vt Not Achieved	Low	Tidal volume measured by inspiratory flow sensor < set value 6 breaths in a row after the first minute of mechanical ventilation.	Adjust controls to supply adequate tidal volumes. Check I:E; Plimit; and volume settings.	Possible leak.
Vte > Insp Vt	Medium	Expired volume > inspired volume for 6 breaths with a circle breathing system.	Check patient condition.	- - -

a. When power is first turned on.

b. Flow sensors are also used to measure pressures.

c. The sustained pressure threshold is calculated from the pressure limit setting. When mechanical ventilation is on, the sustained limit is calculated as follows: for pressure limits < 30 cmH_2O, the sustained pressure limit is 6 cmH_2O; for Plimit between 30 and 60 cmH_2O, the sustained limit is 20% of the pressure limit (Plimit); for pressure limits > 60 cmH_2O, the sustained pressure limit is 12 cmH_2O. If both PEEP and mechanical ventilation are on, the sustained pressure limit increases by PEEP - 2 cmH_2O (the compensated weight of the bellows). When mechanical ventilation is off, the sustained pressure limit is calculated as follows: for pressure limits ≤ 60 cmH_2O, the sustained pressure limit is 50% of the pressure limit (Plimit); for pressure limits > 60 cmH_2O, the sustained pressure limit is 30 cmH_2O.

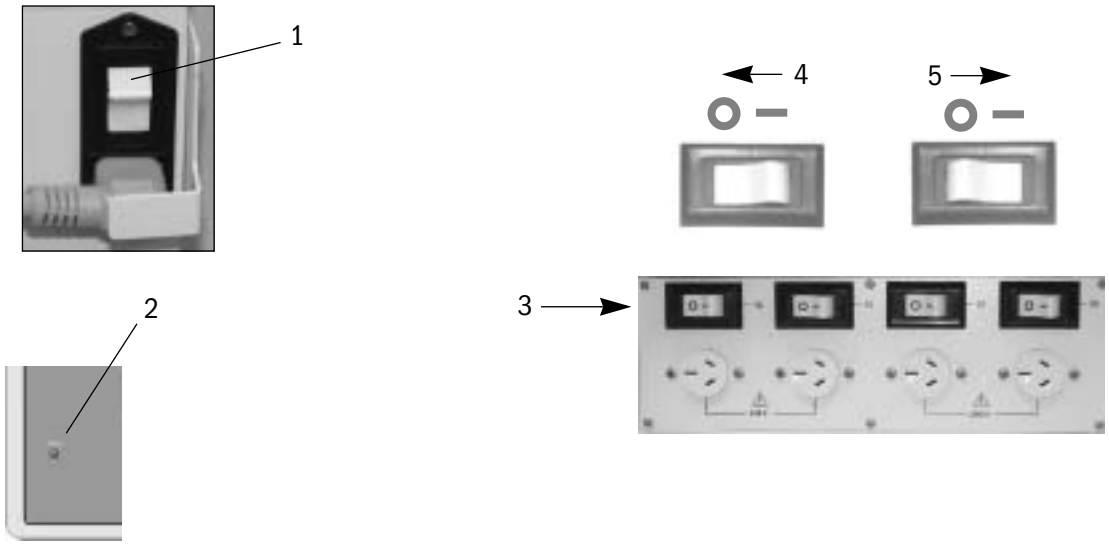
Breathing system problems (no alarm)

Symptom	Problem	Solution(s)
Gas scavenging flow is too low.	Suction supply problem.	Use a different suction supply.
	Filter blockage. Active systems have a flow indicator to show this.	Replace the filter. Refer to "Remove the AGSS receiver filter" in section 2, "*Cleaning and Strerilization"*.
The bellows fills when the Bag/Vent switch is set to Bag or the bag fills when the switch is set to Vent.	Leak through Bag/Vent switch.	Ask a qualified service representative to repair the system.
The ventilator does not read the position of the Bag/Vent switch. Use manual ventilation, if necessary.	Ventilator or absorber malfunction.	Ventilate manually. Ask a qualified service representative to repair the system.
APL valve does not operate correctly.	APL valve problem	Replace APL Valve seal and diaphragm - Refer to User Maintenance

Electrical problems (power failure, etc.)

⚠**WARNING** If a circuit breaker opens frequently, do not use the system. Have a qualified service representative repair the system.

Symptom	Problem	Solution
Mains indicator is not ON.	The electrical power cable is not connected.	Connect the power cable.
	The inlet circuit breaker (toggle switch) is open.	Close the circuit breaker (Figure 4-1).
	The power cable is damaged.	Replace the power cable.
	The electrical socket the power cable connects to has no power.	Use a different electrical socket.
	An internal fuse is open.	Have a qualified service representative repair the system.
One electrical outlet does not have power.	The outlet circuit breaker is open.	Close the circuit breaker.
A circuit breaker opens frequently.	Equipment connected to the outlet(s) (figure 4-1) uses more current than the circuit breaker rating.	Use a different power supply for some of the equipment.
	The equipment connected to the outlet has a short.	Do not use the equipment until it is repaired.
Tec 6 Plus vaporizer has no power.	Not plugged into outlet.	Connect power cable.
The ventilator does not correctly identify the breathing circuit module.	Ventilator malfunction.	Ask a qualified service representative to repair the system.



1. Inlet Circuit Breaker*
2. Mains Indicator
3. Outlet CIrcuit Breakers*
4. Open (No power)
5. Closed (OK)

* Labels show ratings.

Figure 4-1 • Circuit breakers and the mains indicator

Pneumatic problems

Symptom	Problem	Solution
High-pressure leak test fails.	Controls are not set correctly.	Set the system switch to Standby and the auxiliary flowmeter to OFF.
	Incorrect cylinder connection (cylinder yokes).	Make sure that there is only one cylinder gasket, the gasket is in good condition, and the T- handle is tight.
	Incorrect cylinder connection (DIN connection.)	Make sure the nut is tight.
Low-pressure leak test fails with a vaporizer on.	The vaporizer is not correctly installed.	Correctly install the vaporizer.
	The vaporizer filler is loose (fill port type vaporizer).	Tighten the filler.
	Vaporizer port o-rings (external) are damaged or not installed.	Install new o-rings.
	A vaporizer malfunction (the leak stops if you use a different vaporizer in the same position).	Send the vaporizer to a Datex-Ohmeda Service Center for repair.
	A port valve malfunction (the leak continues if you use a different vaporizer in the same manifold position).	Have an qualified service person repair the vaporizer manifold.
Low-pressure leak with a vaporizer OFF.	Anesthesia machine problem.	Contact a qualified service representative.

⚠**CAUTION** No repair should ever be attempted by anyone not having experience in the repair of devices of this nature.

Alarm settings range and default values

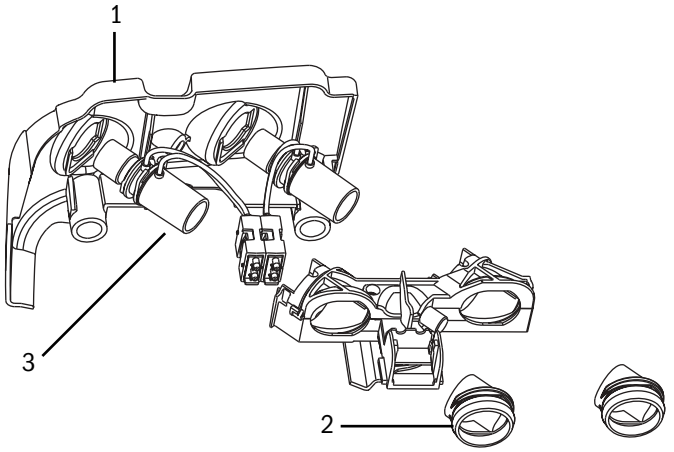
Setting	Range	Increment	Default
Low O_2	18-99%	1%	21%
High O_2)	21-99%, Off	1%	Off
Low VE	Off, 0.1-10 L/min	0.1 L/min	2.0 L
High VE	0.5-30, off L/min	0.5 L/min	10.0 L
Low VTE	Off, 5-1500 mL	5 mL if <20 mL, 20 otherwise	Off
High VTE	20 - 1600 mL, off	20 mL	1000 mL
Circuit leak	Audio on or Audio off	n/a	Audio on
Cardiac bypass	No or In Progress	n/a	No

5 Parts

In this section

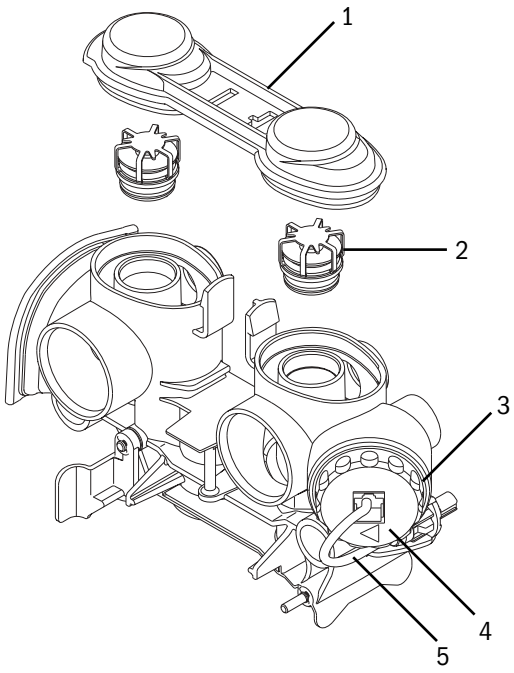
This section lists user-replaceable parts only. For other components, refer to the Technical Reference manual.

Flow sensor module



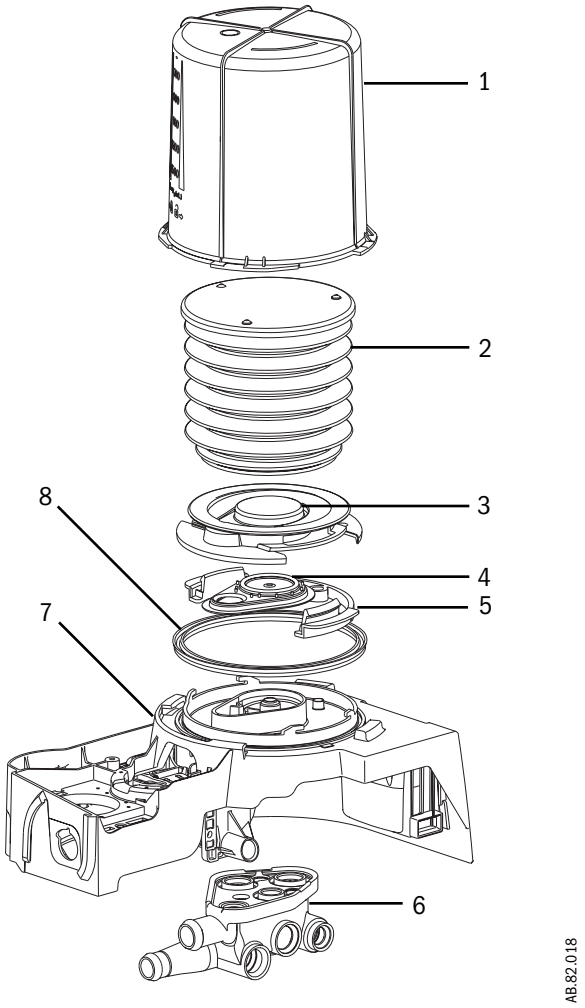
Item	Description	Stock number
	Flow sensor module (does not include flow sensors)	1407-7001-000
1	Flow sensor cover	1407-3000-000
2	Flow sensor cuff	1407-3004-000
3	Flow sensor, disposable (plastic)	1503-3856-000
	Flow sensor, autoclavable (metal)	1503-3244-000

Breathing circuit module



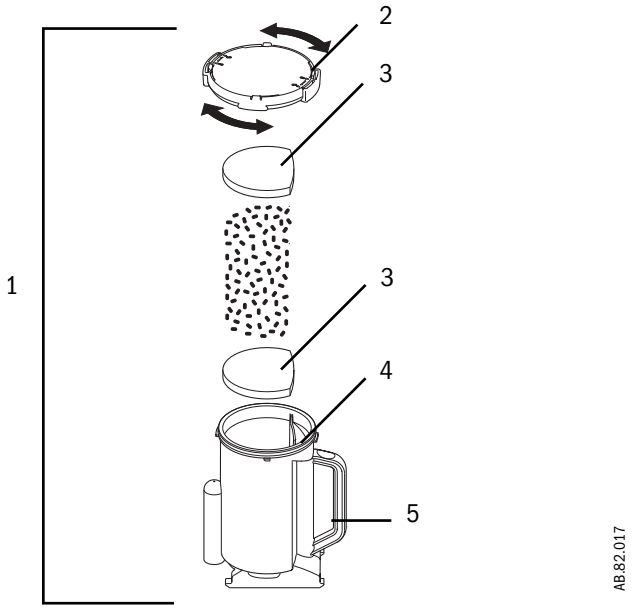
Item	Description	Stock number
	Breathing circuit module (does not include O_2 cell, O-ring, or cable)	1407-7002-000
1	Check valves circuit lens	1407-3101-000
2	Check valve assembly	1406-8219-000
3	O-ring for O_2 cell	1406-3466-000
4	O_2 cell	6050-0004-110
5	Cable, O_2 cell	1009-5570-000
–	Plug (without O_2 sensing)	1407-3111-000
–	O-ring for plug	1407-3112-000

Bellows



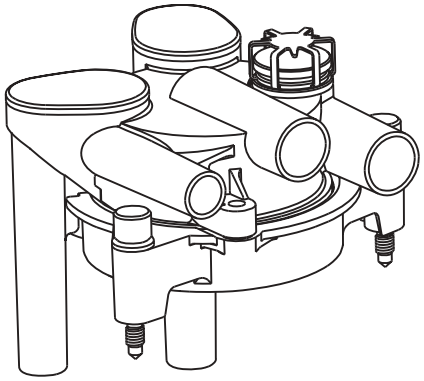
Item	Description	Stock number
1	Bellows housing	1500-3117-000
2	Bellows	1500-3378-000
3	Rim	1500-3351-000
4	Pressure relief valve assembly	1500-3377-000
5	Latch, rim	1500-3352-000
6	Manifold, bellows base	1407-3702-000
7	Bellows base with latch	1407-7006-000
8	Seal, base	1500-3359-000
–	Diaphragm, APL	1406-3331-000
–	Poppet, APL valve	1406-3332-000
–	Cage, APL	1406-3333-000

Absorber canister



Item	Description	Stock number
1	Multi absorber, reusable (includes 40 pack of foam) (does not include absorbent)	1407-7004-000
2	Cover assembly, CO_2 canister	1009-8240-000
3	Foam, CO_2 canister (pack of 40)	1407-3201-000
4	O-ring	1407-3204-000
5	Canister, CO_2, with handle	1407-3200-000
–	Multi absorber, disposable, white to violet, (pack of 6)	8003138
–	Multi absorber, disposable, pink to white, (pack of 6)	8003963

Exhalation valve assembly



AB.82.035

Description	Stock number
Exhalation valve assembly	1407-7005-000

AGSS

Description	Stock number
Common	
Cap 3.18 barb silicone	1406-3524-000
Connector, inlet 30 mm male to 19 mm male	M1003134
Connector, inlet 30 mm male to 30 mm male	M1003947
O-ring for connector, 21.95 ID	1406-3558-000
O-ring for receiver, 22 ID	1407-3104-000
O-ring for thumbscrews, 4.47 ID	1407-3923-000
Reservoir scavenger	1407-3903-000
Seal, down tube scavenger	1407-3904-000
Seal, receiver scavenger	1407-3901-000
Thumbscrew M6 X 28.5	1406-3305-000
Thumbscrew, M6 X 43	1406-3304-000
Valve, unidirectional (complete assembly)	1406-8219-000
Passive AGSS	
Adapter, outlet 30 mm female to 19 mm male (pack of 5)	1500-3376-000
Exhaust hose	8004461
Plug assembly 30 mm ISO	1407-3909-000
Screw, shoulder 4 dia X 4 L M3 X 0.5 sst	1407-3915-000
Active AGSS, adjustable flow	
Bag with 30 mm male connector	8004460
Plug assembly 30 mm ISO	1407-3909-000
Active AGSS, high flow	
Filter, 225 micrometer nylon screen AGSS	1406-3521-000
Seal, filter scavenger	1407-3902-000
Active AGSS, low flow	
Filter, 225 micrometer nylon screen AGSS	1406-3521-000
Seal, filter scavenger	1407-3902-000

Test tools and system parts

Description	Stock number
Cylinder gasket (pin indexed cylinders only)	0210-5022-300
Cylinder wrench (DIN 477 and high-pressure hose)	1202-3651-000
Cylinder wrench for pin-indexed cylinder	0219-3415-800
DIN O_2 plug (cylinder connection)	1202-7146-000
Handle for yoke tee	0219-3372-600
Krytox	1001-3854-000
Negative low pressure leak test device	0309-1319-800
Positive low pressure leak test device (BSI)	1001-8975-000
Positive low pressure leak test device (ISO)	1001-8976-000
Positive pressure leak test adapter	1009-3119-000
Ring, sealing gasket (for DIN 477 and O_2 high-pressure hose)	1001-3812-000
Ring, sealing gasket (for N_2O high-pressure hose)	1202-3641-000
Test lung	0219-7210-300
Test plug	2900-0001-000
Touch-up paint, Neutral Gray N7 (Medium Dark), 18 ml	1006-4198-000
Touch-up paint, Neutral Gray N8 (Medium), 18 ml	1006-4199-000
Touch-up paint, Neutral Gray N9 (Light), 18 ml	1006-4200-000
Vaporizer port o-rings, external (6 pack)	1102-3016-000
Yoke plug	0206-3040-542

6 Specifications and Theory of Operation

Note: All specifications are nominal and subject to change without notice.

In this section

System pneumatic circuits

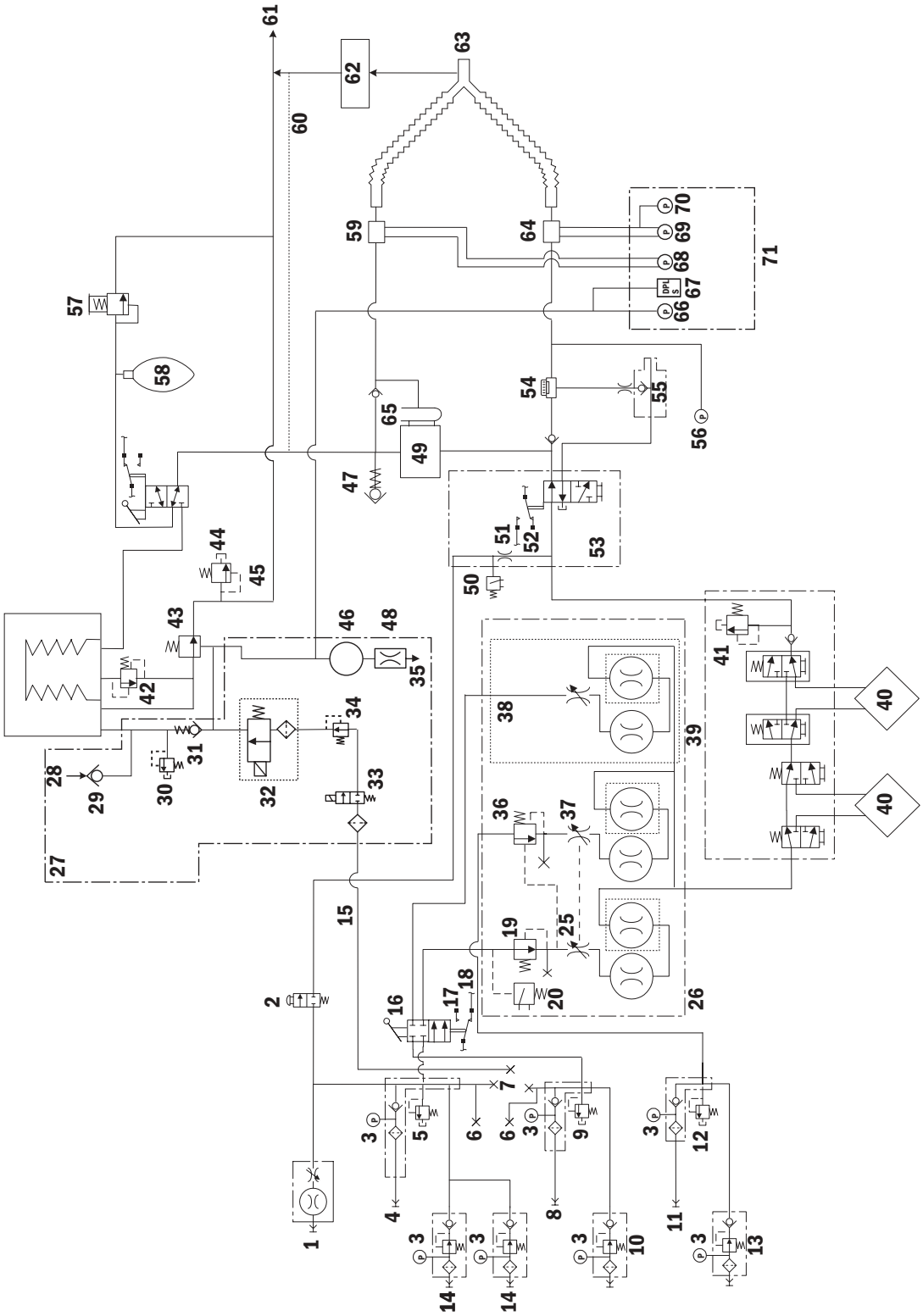


Figure 6-1 ▪ Pneumatic circuit diagram

Figure 6-1 legend

1. Auxiliary O_2, 0-10 LPM (optional)
2. O_2 flush
3. Gauge
4. O_2 P-Line
5. 110 psi relief
6. Venturi
7. Vent drive
8. Air P-line (optional)
9. 110 psi relief
10. Air cylinder (optional)
11. N_2O pipeline (optional)
12. 110 psi relief
13. N_2O cylinder (optional)
14. O_2 cylinder (optional)
15. 0 - 120 L/min flow
16. System switch
17. NC
18. NO
19. 30 psi
20. O_2 supply switch
21. -
22. -
23. -
24. -
25. Link 25
26. Flowmeter module (dual tubes optional)
27. Atmosphere
28. Free breathing check valve
29. Vaporizer
30. Mechanical overpressure valve (110 cm H_2O)
31. Drive gas check valve
32. Inspiratory flow control valve
33. Gas inlet valve
34. 25 psi @15 LPM
35. Vent to ambient
36. Balance regulator
37. Link 25
38. Air (optional)
39. Selectatec manifold
40. Vaporizer
41. 5.5 psi pressure relief valve
42. Popoff valve
43. Exhalation valve (2.0 cm H_2O bias)
44. 10 cm H_2O
45. 0-10 LPM drive gas, 0-10 LPM patient and fresh gas, 0-20 LPM total typical flow
46. 200 mL reservoir
47. Negative pressure relief valve
48. Control bleed to ambient approximately 1.0 L/min at 0.29 kPa (3.0 cm H_2O) if continuous (rate dependent
49. Absorber
50. 5.4 psi O_2 flush switch
51. NO
52. NC
53. ACGO selector valve
54. O_2 sensor
55. ACGO
56. Airway pressure gauge
57. APL valve 0-70 cm H_2O
58. Bag
59. Expiratory flow sensor
60. (Optional)
61. To scavenging
62. Gas monitor
63. Patient
64. Inspiratory flow sensor
65. -
66. Manifold pressure transducer
67. Drive pressure limit switch
68. Expiratory flow transducer
69. Inspiratory flow transducer
70. Paw transducer
71. Enhanced sensor interface board

Gas supplies

Gas goes into the system through a pipeline or cylinder connection. All connections have indexed fittings, filters, and check (one-way) valves. Gauges show the cylinder and pipeline pressures.

A regulator decreases the cylinder pressures to the appropriate system pressure. A pressure relief valve helps protect the system from high pressures.

To help prevent problems with the gas supplies:

- Install yoke plugs on all empty cylinder connections.
- When a pipeline supply is connected, keep the cylinder valve closed.

⚠WARNING Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.

O_2 flow

Pipeline or regulated cylinder pressure supplies O_2 directly to the ventilator (O_2 Ventilator).

The flush valve supplies high flows of O_2 to the fresh gas outlet when you push the flush button. The flush switch uses pressure changes to monitor the position of the flush valve. A message on the ventilator tells you when Flush is ON.

When the system switch is ON, O_2 flows to the rest of the system and there is a minimum flow through the O_2 flowmeter.

A secondary regulator supplies a constant O_2 pressure to the flow control valve.

An electrical switch monitors the O_2 supply pressure. If the pressure is too low, an alarm appears on the ventilator.

Air and N_2O

A balance regulator controls the flow of N_2O to the flow control valve. Oxygen pressure at a control port adjusts the output of the regulator. This stops flow during an O_2 supply failure and ensures that the hypoxic gas pressures decrease with the O_2 supply pressure. Changes in O_2 pressure do not affect Air.

A chain linkage on the N_2O and O_2 flow controls helps keep the O_2 concentration higher than approximately 21% at the fresh gas outlet.

Pipeline or regulated cylinder pressure directly supply Air to the ventilator (Air Ventilators). When the system switch is ON, air flows to the rest of the system. Because there is no balance regulator, air flow continues at the set rate during an O_2 supply failure.

Mixed gas

The mixed gas goes from the flowmeter outlet through the vaporizer that is ON, to the fresh gas outlet, and into the breathing system. A pressure relief valve sets the maximum outlet pressure.

System specifications

Pneumatic

Gas supplies

Pipeline gases	O_2, Air, N_2O
Cylinder gases	O_2, N_2O, Air (maximum: 2 cylinders of each gas); 1 cylinder max. on pendant model; 3rd cylinder is N_2O only
Cylinder connections	Pin indexed (all gases); nut and gland DIN 477 (O_2, N_2O, Air); large cylinder kit available for O_2 and N_2O
Primary regulator output pressure	• Pin indexed: The primary regulator is set to pressure less than 345 kPa (50 psi). • DIN-477: The primary regulator is set to pressure less than 414 kPa (60 psi)
Pressure relief valve	Approximately 758 kPa (110 psi)
Pipeline connections (filtered)	DISS-Male; DISS-Female; AS 4059 (Australian); S90-116 (French Air Liquide); BSPP 3/8 (Scandinavian) or NIST (ISO 5359). All fittings available for O_2, Air, and N_2O
Pressure displays	Color coded gauges
Pipeline inlet pressure	280-600 kPa (41-87 psi)

ACGO Port relief

Valve limits fresh gas pressure to 35 kPa (5.5 psi) at the flush flow.

⚠CAUTION

All gases supplied to the system must be medical grade.

Flow

Flow rates: Minimum O_2 flow: 25 to 75 mL/min.

Gas	Scale (two flow tubes)	
O_2	0.05 -0.95 L/min 1-15 L/min	
N_2O	0.05 -0.95 L/min 1-10 L/min	Note: The link system sets the nominal O_2 flow 25% of the total O_2 and N_2O flow.

Gas	Scale (two flow tubes)
Air	0.05 -0.95 L/min 1-15 L/min

Accuracy: At 20 °C with gas supply pressures at 345 kPa (50 psi) and an outlet pressure of 101.3 kPa (absolute) (14.7 psi) flowmeter accuracy agrees with VDE 3513 Part 3, Accuracy Class 2.5 or better.

Different breathing circuit pressures, barometric pressures or temperatures change the accuracy. With some conditions, these changes can be larger than the tolerances.

Flush flow: 25-75 L/min.

O_2 supply failure alarm and shutoff:

	O_2 Pressure:
O_2 supply failure alarm:	193 to 221 kPa (28 to 32 psi)
N_2O shutoff:	3.5 kPa (0.5 psi)

IEC-60601-1 Clasification

The S/5 Aespire is classified as follows.

- Class I Equipment
- Type B Equipment
- Ordinary Equipment
- Not for use with flammable anesthetics
- Continuous operation
- Steam autoclavable or disinfectable per recommendations (see section 2 *"Cleaning and Sterilization"*.

Electrical power

Supply voltage: 100-120 or 220-240 Vac ± 10% at 50 or 60 Hz.

Inlet Circuit Breakers:

100-120 Vac	220-240 Vac
15A	8A

Outlet Circuit Breakers:

100-120 Vac	220-240 Vac	Japan
(3) 2A (1) 3A	(3) 1A (1) 2A	(2) 2A (1) 4A

System leakage current limit - do not exceed:

- UL and CSA rated systems (USA and Canada): <300 µamps for the system and all systems connected to electrical outlets.
- IEC rated systems (Not USA and Canada): <500 µamps for the system and all systems connected to electrical outlets.

Note Products connected to the electrical outlets may increase the leakage current above these limits.

⚠**WARNING** The connection of equipment to the auxiliary mains electrical outlet(s) may increase the patient leakage currents to values exceeding the allowable limits in the event of a defective earth conductor.

Resistance to ground: <0.2 Ω

Power cord

Length:	5 meters
Voltage rating:	90 to 264 Vac
Current capacity:	10 A for 220-240 Vac 15 A for 100-120 Vac
Type:	Three conductor power supply cord (medical grade where required).

⚠**WARNING** Use the battery if the integrity of the protective earth conductor is in doubt.

Battery information

The system is not a portable unit; a sealed lead acid battery supplies battery backup. Batteries are used as backup power in case of a power failure. Thus, the battery is in a float charge state most of the time. Batteries meet the following:

1. Capacity to operate for 90 minutes under typical operating conditions; 30 minutes under extreme conditions.
2. Unit functions to specifications through the transition to battery power.
3. Long float charge life.
4. Battery pack has an auto-resettable thermal fuse.
5. Battery terminals and connecting wires are protected against short circuits.

Only Datex-Ohmeda service representatives are to replace the battery. Contact a Datex-Ohmeda service representative to disconnect the battery if the equipment is not likely to be used for some time. Batteries must be disposed of in accordance with applicable regulatory requirements in effect at the time and place of disposal.

Electromagnetic compatibility

Changes or modifications to this equipment not expressly approved by Datex-Ohmeda could cause EMC issues with this or other equipment. Contact Datex-Ohmeda for assistance. This device is designed and tested to comply with applicable regulations regarding EMC as follows.

⚠**WARNING** Use of portable phones or other radio frequency (RF) emitting equipment near the system may cause unexpected or adverse operation. Monitor operation when RF emitters are in the vicinity.

- Use of other electrical equipment on or near this system may cause interference. Verify normal operation of equipment in your configuration before use on patients.

The system provides connections for items such as printers, visual displays and hospital information networks. When these items (non-medical equipment) are combined with the S/5 Aespire, these precautions must be followed:

- Don't place items not approved to IEC 60601-1 closer than 1.5 m to the patient.
- All items (medical electrical equipment or non-medical electrical equipment) connected to the S/5 Aespire by a signal input/signal output cable must be supplied from an AC power source which uses a separating transformer (in accordance with IEC 60989) or be provided with an additional protective earth conductor.
- If a portable multiple socket outlet assembly is used as an AC power source, it must comply with IEC 60601-1-1. The assembly must not be placed on the floor. Using more than one portable multiple socket outlet assembly is not recommended.

Do not connect non-medical electrical equipment directly to the AC outlet at the wall instead of an AC power source which uses a separating transformer. Doing so may increase enclosure leakage current above levels allowed by IEC 60601-1 in normal conditions and under single-fault conditions. This may cause an unsafe electrical shock to the patient or operator.

The S/5 Aespire provides multiple AC outlet sockets for connecting only other medical electrical equipment. Do not connect non-medical electrical equipment to these sockets. Doing so may increase enclosure leakage current above levels allowed by IEC 60601-1 in normal conditions and under single-fault conditions. This may cause an unsafe electrical shock to the patient or operator.

After connecting anything to these outlets, conduct a complete system leakage current test (according to IEC 60601-1).

⚠WARNING An operator of the medical electrical system must not touch non-medical electrical equipment and the patient simultaneously. This may cause an unsafe electrical shock to the patient.

Guidance and manufacturer's declaration - electromagnetic emissions

The system is suitable for use in the specified electromagnetic environment. The customer and/or the user of the system should assure that it is used in an electromagnetic environment as described below.

Emissions test	Compliance	Electromagnetic environment guidance
RF emissions CISPR 11	Group 1	The system uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The system is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2 Class A	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines ±1 kV for input/output lines	± 2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial and/or hospital environment.
Surge IEC 61000-4-5	± 1 kV differential mode ±2 kV common mode	± 1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial and/or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	< 5 % UT (> 95% dip in U_T) for 0,5 cycle 40 % U_T (60% dip in U_T) for 5 cycles 70 % U_T (30% dip in U_T) for 25 cycles < 5% U_T (> 95 % dip in U_T) for 5 sec	< 5 % UT (> 95% dip in U_T) for 0,5 cycle 40 % U_T (60% dip in U_T) for 5 cycles 70 % U_T (30% dip in U_T) for 25 cycles < 5 % U_T (> 95% dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial and/or hospital environment. If the user of the system requires continued operation during power mains interruptions, it is recommended that the system be powered from an uninterruptible power supply or a battery.

Immunity test	IEC 60601-1-2 test level	Compliance level	Electromagnetic environment guidance
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8 3 A/m	3 A/m	3 A/m	If display distortion or other abnormalities occur, it may be necessary to position the S/5 Aespire Anaesthetic System further from sources of power frequency magnetic fields or to install magnetic shielding. The power frequency magnetic field should be measured in the intended installation location to assure that it is sufficiently low.
Note: U_T is the AC mains voltage before application of the test level.			

Immunity test	IEC 60601-1-2 Test Level	Compliance level	Electromagnetic environment guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the system, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter.
			Recommended separation distance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz outside ISM bands	3 Vrms (V1)	$D=3.5\sqrt{P}$
	10 Vrms 150 kHz to 80 MHz in ISM bands	10 Vrms (V2)	$D=12\sqrt{P}$
Radiated RF IEC 61000-4-6	10 V/m	10 V/m (E1)	$D=1.2\sqrt{P}$ 80 mHz to 800 mHz
	80 MHz to 2,5 GHz		$D=3.5\sqrt{P}$ 800 mHz to 2.5 GHz Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and D is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range.

The ISM (industrial, scientific and medical) bands between 150 kHz and 80 MHz are 6,765 MHz to 6,795 MHz; 13,553 MHz to 13,567 MHz; 26,957 MHz to 27,283 MHz; and 40,66 MHz to 40,70 MHz.

The compliance levels in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2,5 GHz are intended to decrease the likelihood that a portable communications device could cause interference if it is inadvertently brought into patient areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.

Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the system is used exceeds the applicable RF compliance level above, the system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the system.

Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 1 V/m.

Note: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

Recommended separation distances

Between portable and mobile RF communications equipment and the system

The system is intended for use in the electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the system as recommended below, according to the maximum power of the communications equipment.

Rated maximum output power of transmitter W	Separation distance in meters (m) according to frequency of the transmitter			
	150 kHz to 80 MHz Outside ISM bands	150 kHz to 80 MHz In ISM bands	80 MHz to 800 MHz	800 MHz to 2,5 GHz
	$D = \left[\frac{3,5}{V1}\right]\sqrt{P}$	$D = \left[\frac{12}{V2}\right]\sqrt{P}$	$D = \left[\frac{12}{E1}\right]\sqrt{P}$	$D = \left[\frac{23}{E1}\right]\sqrt{P}$
0,01	0.35	1.2	0.12	0.23
0,1	1.1	3.8	0.38	0.73
1	3.5	12	1.2	2.3
10	11	38	3.8	7.3
100	35	120	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance D in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1: At 80 MHz to 800 MHz the separation distance for the higher frequency range applies.

Note 2: The ISM (Industrial, Scientific and Medical) bands between 150 kHz and 80 MHz are 6,765 MHz to 6,795 MHz; 13,553 MHz to 13,567 MHz; 26,957 MHz to 27,283 MHz; and 40,66 MHz to 40,70 MHz.

Note 3: An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150 kHz and 80 MHz and in the frequency range 80 MHz to 2,5 GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into patient areas.

Note 4: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

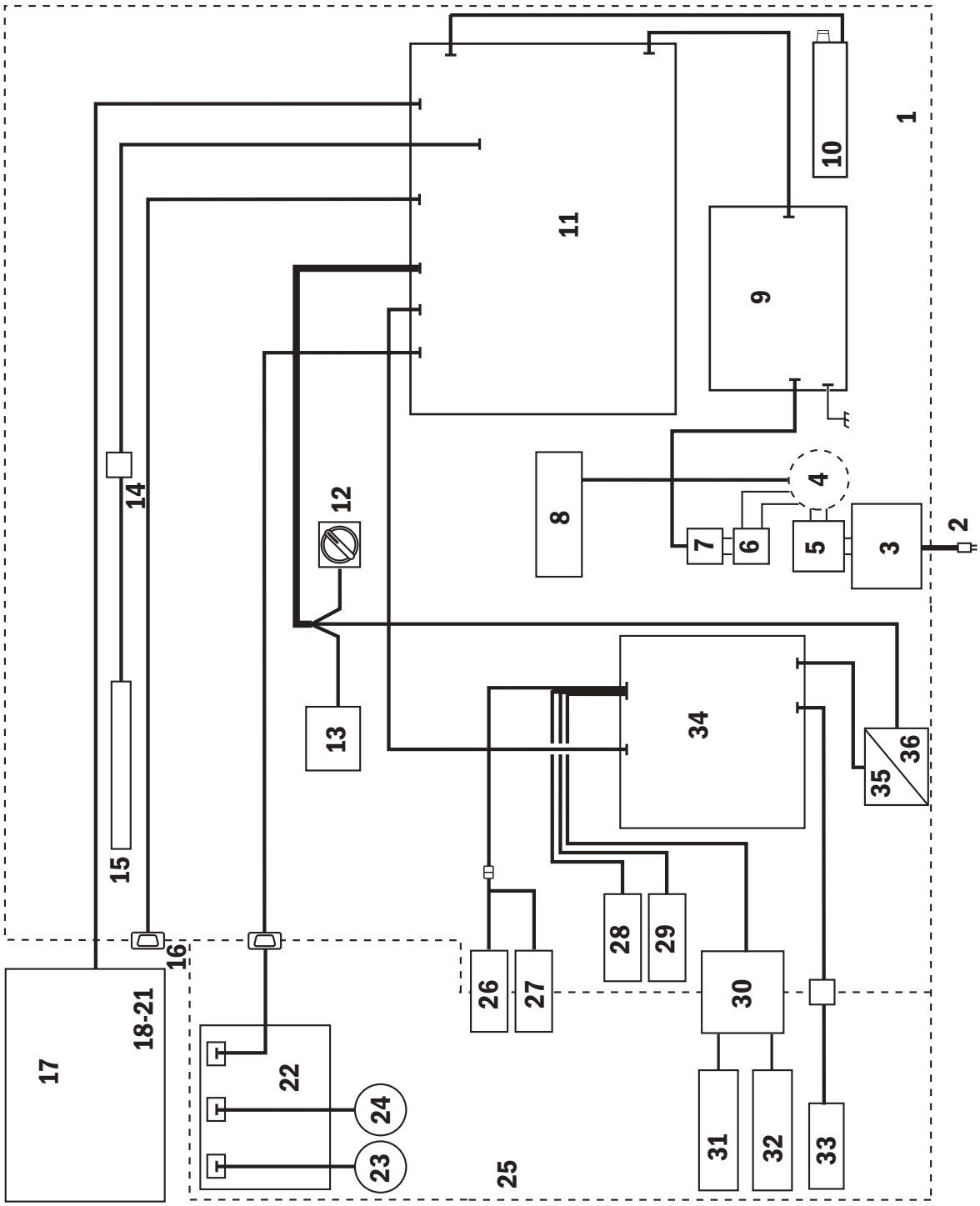


Figure 6-2 ▪ Electrical block diagram

Figure 6-2 legend

1. Inside Anesthesia System
2. Power cord
3. AC inlet with breaker and line filter
4. Isolation transformer
5. Inrush board
6. Fuses
7. Line filter
8. Outlet box
9. Universal power supply
10. Battery, 12 V
11. Integrated CPU board
12. On/Standby switch
13. O_2 supply switch
14. Task light switch
15. Task light
16. RS232 port
17. Ventilator display module
18. Display connector board
19. EL display
20. Keyboard membrane switch
21. ComWheel
22. Ventilator engine board
23. Gas inlet valve
24. Flow control valve
25. Breathing system
26. Bag/Ventilator switch
27. ABS on switch
28. Canister switch (optional)
29. CO_2 bypass switch (optional)
30. Bulkhead connector
31. Expiratory flow sensor
32. Inspiratory flow sensor
33. O_2 sensor
34. Enhanced sensor interface board
35. ACGO select
36. O_2 flush switch

Physical specifications

All specifications are approximate values and can change without notice.

⚠CAUTION Do not subject the S/5 Aespire to excessive shock and vibration.

⚠CAUTION Do not place excessive weight on flat surfaces or drawers.

System

Height	136 cm (53.5 in)
Width	72.5 cm (28.5 in)
Depth	73.5 cm (28.9 in)
Weight	136 kg (300 lb)
Top shelf weight limit	35 kg (75 lb)

Casters 13 cm (5 in) with brakes on the front casters

Drawers 23 cm H x 33 cm W x 27 cm D (9 in H x 13 in W x 10.6 in D)

Ventilator display 146 x 73 mm EL display (480 x 240 pixel)

Environmental requirements

Temperature

Operation: 10 to 40 °C
Oxygen cell operates to specifications at 10 to 40 °C

Storage: -25 to 65 °C
Oxygen cell storage is -5 to 50 °C, 10 to 95% Rh, 500 to 800 mm Hg

Humidity

Operation: 15 to 95% Rh, non-condensing

Storage: 10 to 95% Rh, non-condensing

Altitude

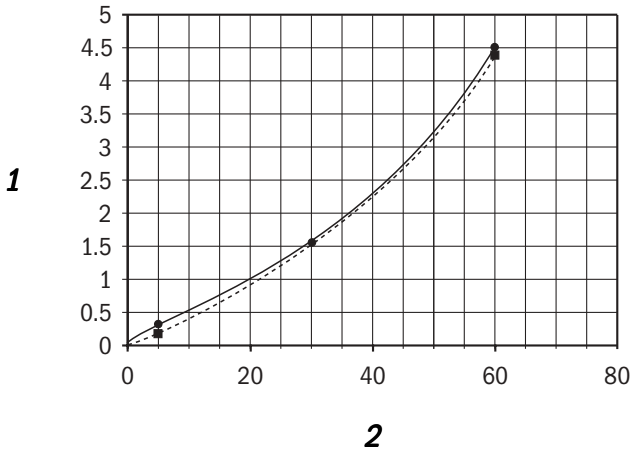
Operation: 500 to 800 mm Hg (3565 to -440 meters)

Storage: 375 to 800 mm Hg (5860 to -440 meters)

Breathing system specifications

General

Volume	4600 mL including bellows
Absorbent	950 mL canister
Connections	Auxiliary Common Gas Outlet: ISO 5356 type connector on the front of the system (Standard 22 mm OD or 15 mm ID conical friction fit connectors)
System leakage	These values are for continuous pressure and are higher than those expected during mechanical ventilation. ≤ 300 mL/min total at 3 kPa (0.4 psi); ≤75 ml/min for all connectors and two part tubes and ≤ 225 mL/min for all other breathing system assemblies
System compliance	Volume of gas lost due to internal compliance (bag mode only) 1.82 mL/cm H_2O
Breathing system resistance (in bag mode)	Y piece or T piece adds ≤0.15 kPa (.02 psi) expiratory resistance at 1 L/sec. To maintain compliance with standards, choose a patient circuit with low resistance to flow.



Inspiratory —●—

Expiratory – ■ –

Figure 6-3 ▪ Breathing System Resistance: 1 = Pressure drop (cm H_2O) vs. 2 = Flowrate (L/min)

Pressure required to open inspiratory or expiratory valves: Dry: 0.49 cm H_2O; Moist: 0.91 cm H_2O

Pressure generated by a wet unidirectional valve: 0.81 cm H_2O

Breathing system leakage (average during use):

Pressure	Bag Mode (mL/min)	Vent Mode (mL/min)
30 cm H_2O	50	50
60 cm H_2O	N/A	106
90 cm H_2O	N/A	163

APL Valve: Approximately 0 to 70 cm H_2O

Pressure Flow Data (APL Valve Completely Open):

Flow (L/min)	Flow (L/sec)	APL Pressure cm H_2O
3	0.05	.78
10	0.17	1.14
20	0.34	-
30	0.51	1.43
40	0.68	-
50	0.83	-
60	1.0	2.61
70	-	3.21

System volume: Vent. side: 2730 mL ; bag side: 1215 mL

Gas scavenging

Passive scavenging:

- Positive pressure relief: 10 cm H_2O
- Negative pressure relief: 0.3 cm H_2O
- Outlet connector: 30 mm male taper ISO

Active scavenging: Particle filter at the outlet has a pore size of 225 microns. All flow data uses a new filter.

Disposal System Type	Outlet Connector *	Flow Range	Pressure
Low flow, high vacuum	DISS EVAC	36 ±4 SLPM @ 300 mmHg (12 inHg)	300 mmHg Minimum vacuum
High flow	BS6834	50 - 80 SLPM	1.6 kPa at 75 SLPM
Venturi/Ejector	½ in. hose barb	30 - 100 SLPM	n/a
Adjustable flow	Needle valve connector	Up to 30 SLPM	n/a

***** Other market-specific connectors may be available.

Ventilator theory

General

The ventilator pneumatics are at the rear of the breathing system.

A precision valve controls gas flow to the patient.

During inspiration, this gas flow closes the exhalation valve and pushes the bellows down.

During expiration, a small flow pressurizes the exhalation diaphragm to supply PEEP pressure.

Volume and pressure measurements come from flow sensors in the flow sensor module. Two tubes from each sensor connect to a transducer that measures the pressure change across the sensor, which changes with the flow. A third transducer measures airway pressures at the inspiratory flow sensor.

Volume monitoring uses the expiratory flow sensor. The ventilator uses the other sensor to adjust its output for changes in fresh gas flow, small leaks, and gas compression upstream of the breathing circuit. There is no adjustment for compression in the patient circuit. If necessary, add the compression loss to the tidal volume setting (volume control mode). The average volume changes from compression in the breathing circuit is small (0.5 to 1.25 mL/cmH_2O).

For better precision:

- When the fresh gas mixture includes Heliox, use the Heliox mode (Ventilation setup menu). Heliox, used on some ANSI Models of the Aestiva, changes the data collected by the flow sensors. When Heliox mode is selected, the ventilator adjusts the flow sensor data to correct for these changes.
- A small quantity of gas bleeds through a resistor to help keep the pressure on the exhalation valve constant. At high airway pressures, this can cause a slight hiss during inspiration.

⚠**WARNING** Do not try to silence the pneumatic resistor. If it is blocked, the ventilator can malfunction and cause patient injury.

⚠ Always connect the expiratory flow sensor. If it is not connected, the patient disconnect alarm cannot operate correctly.

Modes

The system has four modes of mechanical ventilation:

- Volume control mode
- Pressure control mode
- Synchronized intermittent volume (SIMV) mode (optional)
- Pressure support ventilation (PSVPro) mode (optional)

Use the main menu to set the mode.

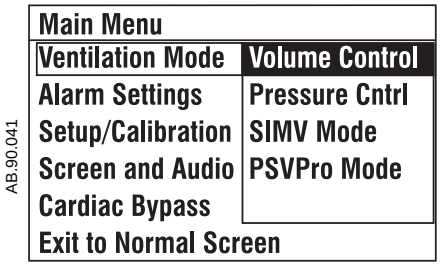


Figure 6-4 • Ventilation Setup Menu

Volume control mode

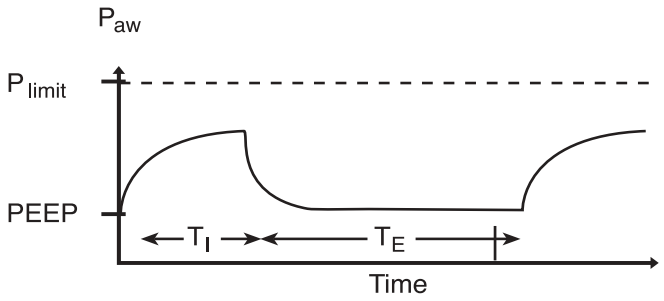


Figure 6-5 • Volume control diagram

Volume Control supplies a set tidal volume. The ventilator calculates a flow based on the set tidal volume and the length of the inspiratory time (T I) to deliver that tidal volume. It then adjusts that output by measuring delivered volumes at the inspiratory flow sensor. Since the ventilator adjusts output, it can compensate for breathing system compliance, fresh gas flow, and moderate breathing system leaks.

A typical volume controlled pressure waveform increases throughout the entire inspiratory period, and rapidly decreases at the start of expiration. An optional inspiratory pause is available to improve gas distribution.

Volume control mode settings

- VT (tidal volume)
- Rate
- I:E
- Plimit
- PEEP

Pressure control mode

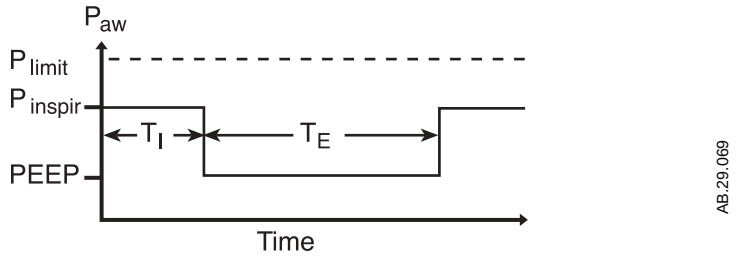


Figure 6-6 • Pressure control diagram

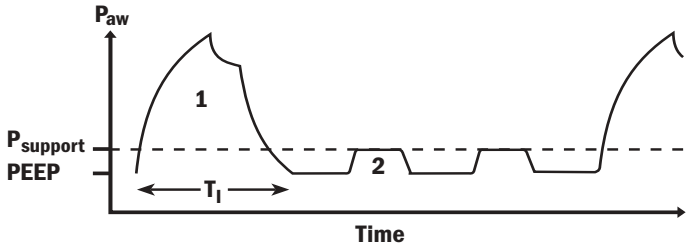
Pressure control supplies a constant set pressure during inspiration. The ventilator calculates the inspiratory time from the frequency and I:E ratio settings. A high initial flow pressurizes the circuit to the set inspiratory pressure. The flow then decreases to maintain the set pressure (Pinspired).

Pressure sensors in the ventilator measure patient airway pressure. The ventilator automatically adjusts the flow to maintain the set inspiratory pressure.

Pressure control mode settings

- Pinspired (control pressure)
- Rate
- I:E
- Plimit (pressure limit)
- PEEP

SIMV mode



1. 1. Mandatory SIMV breath
2. 2. Spontaneous pressure supported breath

Figure 6-7 • SIMV diagram

Synchronized Intermittent Mandatory Ventilation (SIMV) is a mode in which periodic volume breaths are delivered to the patient at preset intervals (time-triggered). Between the machine delivered breaths, the patient can breathe spontaneously at the rate, tidal volume and timing that the patient desires.

At the specified time interval, the ventilator will wait for the next inspiratory effort from the patient. The sensitivity of this effort is adjusted using the flow trigger level. When the ventilator senses the beginning of inspiration it synchronously delivers a volume breath using the set tidal volume, and inspiratory time that is set on the ventilator. If the patient fails to make an inspiratory effort during the trigger window time interval, the ventilator will deliver a machine breath to the patient. The ventilator will always deliver the specific number of breaths per minute that the clinician has set.

In SIMV, the spontaneous breaths can be pressure supported to assist the patient in overcoming the resistance of the patient circuit and the artificial airway. When the Psupport level is set, the ventilator will deliver the pressure support level to the patient during inspiration. PEEP can also be used in combination with this mode.

SIMV mode settings

- VT
- Rate
- Tinspired
- Psupport
- PEEP

PSVPro mode

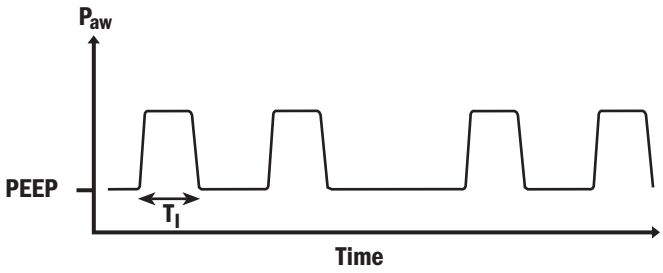


Figure 6-8 • PSVPro diagram

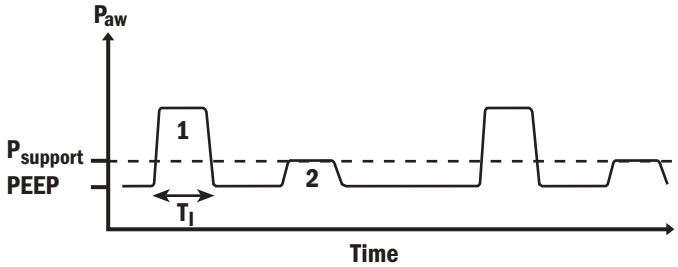
PSVPro is pressure supported ventilation with apnea backup.

PSVPro is a spontaneous mode of ventilation that provides a constant pressure once the ventilator senses that the patient has made an inspiratory effort. The ventilator identifies an inspiratory effort using a flow trigger that is user adjustable. In this mode, the user sets the Pressure Support (Psupport) and PEEP levels. The patient establishes the frequency, inspiratory flow and inspiratory time. The tidal volume is determined by the pressure, lung characteristics and patient effort.

PSVPro uses an inspiration termination level that establishes when the ventilator will stop the pressure supported breath and cycle to the expiratory phase. The inspiration termination level is user adjustable from 5% - 50%. This parameter sets the percent of the peak inspiratory flow that the ventilator uses to end the inspiratory phase of the breath and to cycle into the expiratory phase. If the inspiration termination is set to 30% then the ventilator will stop inspiration when the flow decelerates to a level equal to 30% of the measured peak inspiratory flow. The lower the setting the longer the inspiratory time and conversely, the higher the setting the shorter the inspiratory phase.

An apnea backup mode is provided in the event the patient stops breathing. When setting the backup mode the user adjusts the inspiratory pressure (Pinsp), respiratory rate and the inspiratory time (Tinsp). As long as the patient triggers the ventilator within the set apnea delay time, the patient will get pressure-supported breaths and the ventilator will not deliver machine breaths. The apnea delay time can be set from 10 to 30 seconds with the default set at 30 seconds.

If the patient stops triggering the ventilator for the set apnea delay period, an audible alarm activates and the ventilator automatically switches to the backup mode. The backup mode is an SIMV (Pressure Control) + PSV mode. Once in this mode the ventilator will begin delivering machine Pressure Control breaths at the inspiratory pressure level, inspiratory time and rate that the user has set. If, during this mode, the patient takes spontaneous breaths in between the machine breaths, the patient will receive pressure supported breaths.



1. Mandatory pressure control breath
2. Spontaneous pressure supported breath

Figure 6-9 • SIMV-PC + PSV backup mode

When the ventilator switches to the backup mode the alarm text "Backup Mode Active" will be displayed and will remain in the low priority message site until PSVPro is re-instated or until another mode is selected. To re-activate the PSVPro mode the user must go into the Ventilation Mode menu and re-select PSVPro. Upon selecting PSVPro the ventilator will immediately begin providing pressure supported breaths to the patient using the established settings.

PSVPro mode settings

- Pinspired
- Rate
- Tinspired
- Psupport
- PEEP

Minimum monitoring

- Shows data
- No mechanical ventilation
- “Monitoring Only” alarm message
- “Minimum System Failure” and specific failure message
- The software goes to minimum monitoring when a non-recoverable error occurs in boot-up or normal operations.

Volume control settings

- V_T (tidal volume)
- Rate
- I:E
- P_{limit}
- PEEP

Limited inspired pressure mode

- Selecting Pressure mode generates a pressure plateau linked to the $P_{inspired}$ setting.
- While observing the monitored P_{max} value, the user adjusts $P_{inspired}$ until P_{max} is reached. The ventilator delivers a constant 30 L/m (inspiration) during this mode.
- P_{insp}, Rate and I:E settings are used to create the breathing profile.
- PEEP is available and is additive.

Pressure mode settings

- P_{insp} (control pressure)
- Rate
- I:E
- P_{limit} (pressure limit)
- PEEP

Minimum Monitoring

- Shows data.
- No mechanical ventilation.
- “Monitoring Only” alarm message.
- “Ventilate Manually” and specific failure message.
- The software goes to minimum monitoring when a non-recoverable error occurs in boot-up or normal operations.

Ventilation operating specifications

Pneumatics

Gas source:	Anesthesia system
Gas composition:	Medical Air or O_2
Nominal supply pressure:	350 kPa (51 psi)
Pressure range at inlet:	240 to 700 kPa (35 to 102 psi)
Flow valve range:	1 to 120 L/min at 240 kPa (35 psi)

Fresh gas compensation

Flow compensation range:	200 mL/min to 15 L/min
Gas composition:	O_2, N_2O, Air, Anesthetic Agents

Pressure

Patient airway pressure range:	-20 to +120 cm H_2O
Patient airway display range:	-20 to +120 cm H_2O
High pressure alarm set range:	12 to 100cm H_2O, 1 cm increment
Sustained pressure alarm range:	6 to 30 cm H_2O, 1 cm increment

Volume

Tidal volume display range:	5 to 9999 mL, 1 mL resolution
Setting range:	20 to 1500 mL
Minute volume:	0.0 to 99.9 liters
Breath rate:	4 to 100 bpm (breaths per minute), 1 bpm resolution
Volume sensor type:	Variable flow orifice

Oxygen

Display range:	5 to 110% O_2
Display resolution:	1% increments
Sensor type:	Galvanic fuel cell
Measurement range:	0 to 100% O_2
Measurement accuracy:	± 3% of full scale
Cell response time:	35 seconds, 10 - 90% Response time of cell and adapter as measured using the test method described in ISO 7767 (1988-12-15), clause 50.9
Low O_2 alarm range:	18% to 100%
High O_2 alarm setting:	21% to 100% Note: Low O_2 limit may not be set above the high O_2 limit, nor may the high O_2 limit be set below the low O_2 limit.
Expected cell life:	Four months of shelf life (23 °C room air) and one year of normal operation

O_2 monitor theory of operation

The O_2 monitor measures and displays O_2 concentration in the patient circuit.

The O_2 sensor assembly contains an oxygen sensor that produces a voltage proportional to the oxygen partial pressure (concentration) at its detecting surface.

The O_2 sensor is an electrochemical device (galvanic cell). Oxygen diffuses through a membrane into the device and oxidizes a base metal electrode. This oxidation produces an electrical current proportional to the partial pressure of the oxygen at the electrode's sensing surface. The base metal electrode gradually wears out from the oxidation process.

The voltage from the sensor cartridge is affected by the temperature of the monitored gas mixture. A thermistor in the sensor's housing automatically compensates for temperature changes in the sensor.

The O_2 monitor uses signal processing and analyzing circuitry to convert the sensor signal into a corresponding % oxygen value. The system displays this value and compares it to saved alarm limits. If the value falls outside the limits, the monitor produces the appropriate alarms.

Ventilator accuracy data

The following accuracy data are based on patient conditions and settings described in ASTM F1101. The ventilator is assumed to be operating in volume mode, with 100 percent oxygen in the breathing system; or, it is connected to an anesthesia gas analyzer. If the ventilator is operating without being connected to an anesthesia gas analyzer, additional errors may occur which are described in the “Gas composition related errors (both modes)” chart which is provided on the next page.

The minimum detectable breath size is 5.0 mL.

Delivery accuracy

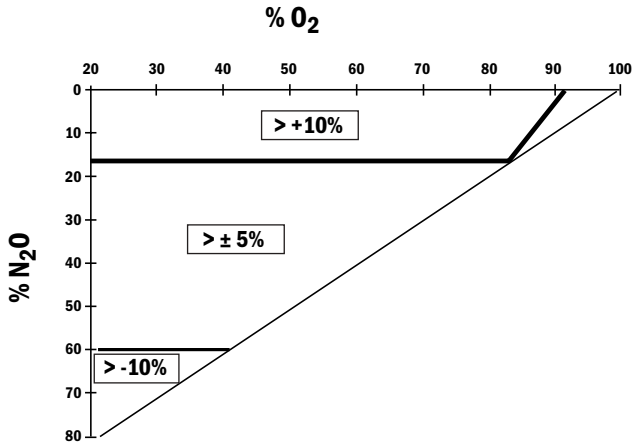
Volume control (100% O_2)	>210 mL tidal volume: Better than ±7% of set V_T 60 to 210 mL tidal volume: Better than ±15 mL <60 mL tidal volume: Better than ±10 mL
Pressure mode (100% O_2)	Inspiratory pressure: ±2.0 cm H_2O (repeatability only) PEEP: ±1.5 cm H_2O: greater of ±10% or ±3 cm H_2O, whichever is greater

Monitoring accuracy

Volume control (100% O_2)	>210 mL tidal volume: Better than ±9% of V_T 60 to 210 mL tidal volume: Better than ±18 mL <60 mL tidal volume: Better than ±10 mL
Pressure mode	Better than: ±2.0 cm H_2O or ±5% of reading whichever is greater

Measured values are taken at ambient temperature and pressure, and are not corrected when displayed.

Gas composition related errors



Note Gas composition errors may be in addition to the above normalized accuracy. When adding errors, positive errors can have the effect of nulling out negative errors.

Note Use of anesthetic agent could affect the errors by approximately -0.95%/% volume agent.

When subjected to gas mixtures containing the following concentrations of gases, the oxygen monitor has been tested to be within ±5% of the actual gas concentration. Gas mixtures other than the ones listed below may result in an accuracy of the oxygen monitor outside of the ±5% V/V.

Gas:	At concentration:
Carbon dioxide	5%
Nitrous oxide	80%
Halothane	4%
Enflurane	5%
Isoflurane	5%
Sevoflurane	5%
Desflurane	15%

Suction regulators (optional)

Venturi suction regulator

Supply: Air or O_2 from system gas supply

Drive gas consumption: 75 L/min

Maximum Vacuum: 57 mm Hg with pipeline drive gas at 345 kPa (50 psi)

Minimum flow: 20 L/min

Accuracy: ±5% of full scale

Continuous suction regulator

Supply: External vacuum

Vacuum levels: 0-200 mm Hg and full line vacuum

Maximum flow: >20 L/min

Accuracy: ±5% of full scale

Auxiliary O_2 flowmeter (optional)

Supply: O_2 from system gas supply

Flow rates: 0-10 L/min

Accuracy: ±5% of full scale; not pressure compensated

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Warranty

This Product is sold by Datex-Ohmeda under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to the purchase of this Product directly from Datex-Ohmeda or Datex-Ohmeda's Authorized Dealers as new merchandise and are extended to the Buyer thereof, other than for the purpose of resale.

For a period of twelve (12) months from the date of original delivery to Buyer or to Buyer's order, but in no event for a period of more than two years from the date of original delivery by Datex-Ohmeda to a Datex-Ohmeda Authorized Dealer, this Product, other than its expendable parts, is warranted against functional defects in materials and workmanship and to conform to the description of the Product contained in this User's Reference manual and accompanying labels and/or inserts, provided that the same is properly operated under the conditions of normal use, that regular periodic maintenance and service is performed and that replacements and repairs are made in accordance with the instructions provided. This same warranty is made for a period of thirty (30) days with respect to expendable parts. The foregoing warranties shall not apply if the Product has been repaired other than by Datex-Ohmeda or in accordance with written instructions provided by Datex-Ohmeda, or altered by anyone other than Datex-Ohmeda, or if the Product has been subject to abuse, misuse, negligence, or accident.

Datex-Ohmeda's sole and exclusive obligation and Buyer's sole and exclusive remedy under the above warranties is limited to repairing or replacing, free of charge, at Datex-Ohmeda's option, a Product, which is telephonically reported to the nearest Datex-Ohmeda Customer Service Center and which, if so advised by Datex-Ohmeda, is thereafter returned with a statement of the observed deficiency, not later than seven (7) days after the expiration date of the applicable warranty, to the Datex-Ohmeda Customer Service and Distribution Center during normal business hours, transportation charges prepaid, and which, upon Datex-Ohmeda's examination, is found not to conform with above warranties. Datex-Ohmeda *shall not be otherwise liable for any damages including but not limited to incidental damages, consequential damages, or special damages.*

There are no express or implied warranties which extend beyond the warranties hereinabove set forth. Datex-Ohmeda makes no warranty of merchantability or fitness for a particular purpose with respect to the product or parts thereof.

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