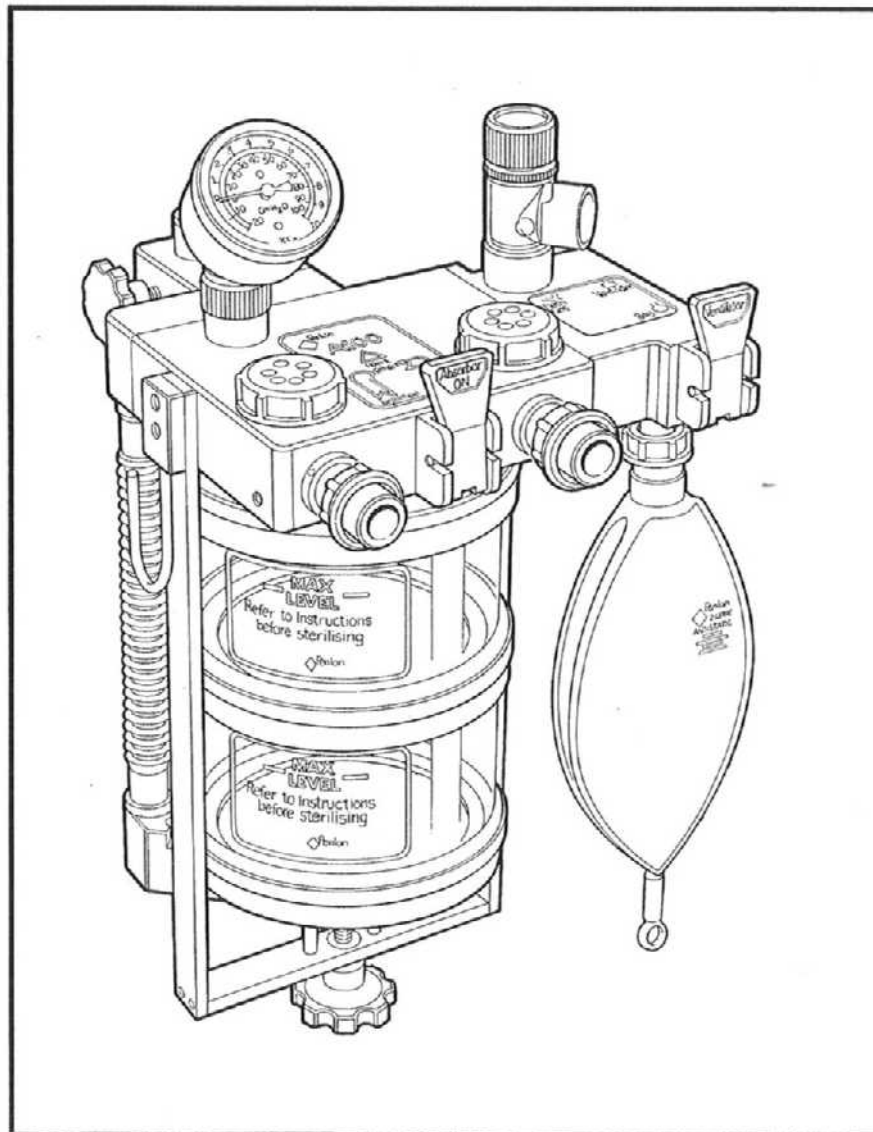


InterMed

Penlon

A100 Circle Absorber User Manual



IMPORTANCE OF PATIENT MONITORING

WARNING

Anaesthesia systems have the capability to deliver mixtures of gases and vapours to the patient which could cause injury or death unless controlled by a qualified anaesthetist.

There can be considerable variation in the effect of anaesthetic drugs on individual patients so that the setting and observation of control levels on the anaesthesia system does not in itself ensure total patient safety. Anaesthesia system monitors and patient

monitors are very desirable aids for the anaesthetist but are not true clinical monitors as the condition of the patient is also dependent on his respiration and the functioning of his cardio-vascular system.

IT IS ESSENTIAL THAT THESE ELEMENTS ARE MONITORED FREQUENTLY AND REGULARLY AND THAT ANY OBSERVATIONS ARE GIVEN PRECEDENCE OVER MACHINE CONTROL PARAMETERS IN JUDGING THE STATE OF A CLINICAL PROCEDURE.

IMPORTANT

Servicing and Repairs

In order to ensure the full operational life of this device, servicing by a Penlon-trained engineer should be undertaken periodically.

We recommend that the absorber should be serviced on the following schedule:

- (a) Six monthly inspection and function testing.
- (b) Annual service which includes routine replacement of seals etc., as preventive maintenance.

Details of these operations are in the A100 Circle Absorber service manual, which contains servicing procedures etc. Servicing should be carried out by Penlon trained engineers.

For any enquiry regarding the servicing or repair of this device, contact the nearest accredited Penlon agent:

or communicate directly with:

Technical Support Department
Penlon Limited
Abingdon
OX14 3PH
UK

Tel: 44 (0) 1235 547076
Fax: 44 (0) 1235 547062
E-mail: technicalsupport@penlon.co.uk

Always give as much of the following information as possible:

1. Type of equipment
2. Product name
3. Serial number
4. Approximate date of purchase
5. Apparent fault

FOREWORD

This manual has been produced to provide authorised personnel with information on the function, routine, performance and maintenance checks applicable to the A100 Absorber.

Information contained in this manual is correct at the date of publication. The policy of Penlon Limited is one of continued improvement to their products. Because of this policy Penlon Limited reserves the right to make any changes which may affect instructions in this manual, without giving prior notice.

Personnel must take themselves familiar with the contents of this manual and the machine function before using the apparatus.

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USER RESPONSIBILITY

This device has been built to conform with the specification and operating procedures stated in this manual and/or accompanying labels and notices when checked, assembled, operated, maintained and serviced in accordance with these instructions.

To ensure the safety of this device it must be checked and serviced to at least the minimum standards laid out in this manual. A defective, or suspected defective, product must not under any circumstances be used.

The user must accept responsibility for any malfunction which results from non-compliance with the servicing requirements detailed in this manual.

Additionally, the user must accept responsibility for any malfunction which may result from misuse of any kind, or non-compliance with other requirements detailed in this manual.

Worn, broken, distorted, contaminated or missing components must be replaced immediately. Should such a repair become necessary it is recommended that a request for service advice be made to the nearest Penlon Service Centre.

This device and any of its constituent parts must be repaired only in accordance with written instructions issued by Penlon Limited and must not be altered or modified in any way without the written approval of Penlon Limited.

The user of this equipment shall have the sole responsibility for any malfunction which results from improper use, maintenance, repair, damage or alteration by anyone other than Penlon or their appointed agents.

USA and Canadian Federal Law restricts the sale and use of this device to, or on the order of, a licensed practitioner.

Statements in this manual preceded by the following words are of special significance:-

WARNING *means there is a possibility of injury to yourself or others.*

CAUTION *means there is a possibility of damage to the apparatus or other property*

NOTE *indicates points of particular interest for more efficient and convenient operation.*

The reader must take particular notice of the warnings, cautions and notes provided throughout this manual

1. WARNINGS AND CAUTIONS

The following **WARNINGS** and **CAUTIONS** must be read and understood before using this Anaesthetic Apparatus

WARNINGS

General Information

1. Personnel must make themselves familiar with the contents of this manual and the function of the A100 Absorber before use.
2. Trichloroethylene must not be used in association with soda lime.
3. This unit is restricted to use with non-flammable anaesthetic agents only.
4. The A100 Circle System Absorber must only be used when securely mounted in an upright position.
 - a) The inspiratory and expiratory non-return valves (NRV) are gravity operated.
 - b) Spillage of absorbent may contaminate the breathing system. See 3.2/5.1

Before using the absorber

5. The use of patient Y-pieces containing non-return valves in connection with the Penlon Circle System Absorber is hazardous, because two sets of non-return valves may easily be connected in opposition, by error.
6. Breathing hoses and bags used with the apparatus must comply to ISO 5367 (Hoses) and ISO 5362 (Breathing Bags) respectively. The resistance and compliance of these hoses and bags provide essential factors for the satisfactory use of this system.

7. Vacuum systems must not be connected direct to the APL valve. A receiving system with positive and negative pressure control functions must be interposed. Systems must comply with ISO 8835 Part 2. See 5.2.3.
8. Underfilling of canisters can lead to inefficient CO₂ absorption. Overfilling may result in poor sealing of canisters due to caking of granules and abrasion of seals and canisters. See 3.1 and 5.3.
9. Do not use the Penlon A100 Absorber without ensuring that it passes all pre-use checks. See Section 6.
10. After servicing and cleaning procedures, verify positive action of the bag/ventilator and absorber On/Off (bypass) selector switches (if fitted) before the unit is used clinically.

Check that at all times the actuator shaft on each switch is free to move from one end of its travel to the other.

Using the absorber

11. Models with a bag/ventilator switch - if no ventilator is connected to the absorber, care must be taken to ensure that the bag/ventilator switch is kept in the 'Bag' position, to avoid loss of gas from the breathing system and to maintain the reservoir bag in the system. However, when no ventilator is connected, the ventilator port must be left uncapped. See 3.4
12. Condensation, which may collect in the bottom of the absorber is caustic and care must be taken not to spill it on the skin when draining the trap provided. After draining ensure that the drain valve is fully closed.

See section 7.3.

WARNINGS AND CAUTIONS

13. *Kinking of the fresh gas tube is a known cause of anaesthetic accident and the use of unsuitable tubing can contribute to this situation. See 3.5.*

14. *The absorber On/Off (bypass) control selector switch isolates the absorber circuit from the breathing system, and its use allows refilling of the absorbent canisters during a clinical operation.*
If the selector switch is left in the 'Absorber OFF' position excessive levels of CO₂ will build up within the breathing circuit.
It is strongly recommend that a capnometer is used in conjunction with this system to prevent the risk of hypercapnia.

15. *Any breathing system utilising the A100 absorber must be fitted with:*
 - a) *An oxygen monitor complying with ISO 7767.*
 - b) *A minute volume monitor.*
 - c) *A breathing system integrity alarm.*

CAUTIONS

1. *On twin canister models, efficient use of soda lime absorbent is only achieved if the newly refilled canister is replaced in the upper position.*

2. *Do not sterilise (autoclave) the manometer (if fitted).*

3. *Do not autoclave the canisters.*
Always remove the canisters if the absorber is to be steam autoclaved (see section 8.5).

4. *If the absorber has to be lifted or carried by hand, always support the weight of the unit under the base. Do not lift the absorber by gripping any of the components attached to the manifold blocks at the top of the absorber - the manometer, APL valve, breathing circuit connectors, etc.*

5. *Do not use any ventilator with the A100 absorber that does not comply with ISO 8835 part 2.*

2. PURPOSE

The A100 Absorber is designed for use as part of a closed breathing system for anaesthesia, providing CO₂ absorption in conjunction with the appropriate breathing hoses, reservoir bags and patient connections.

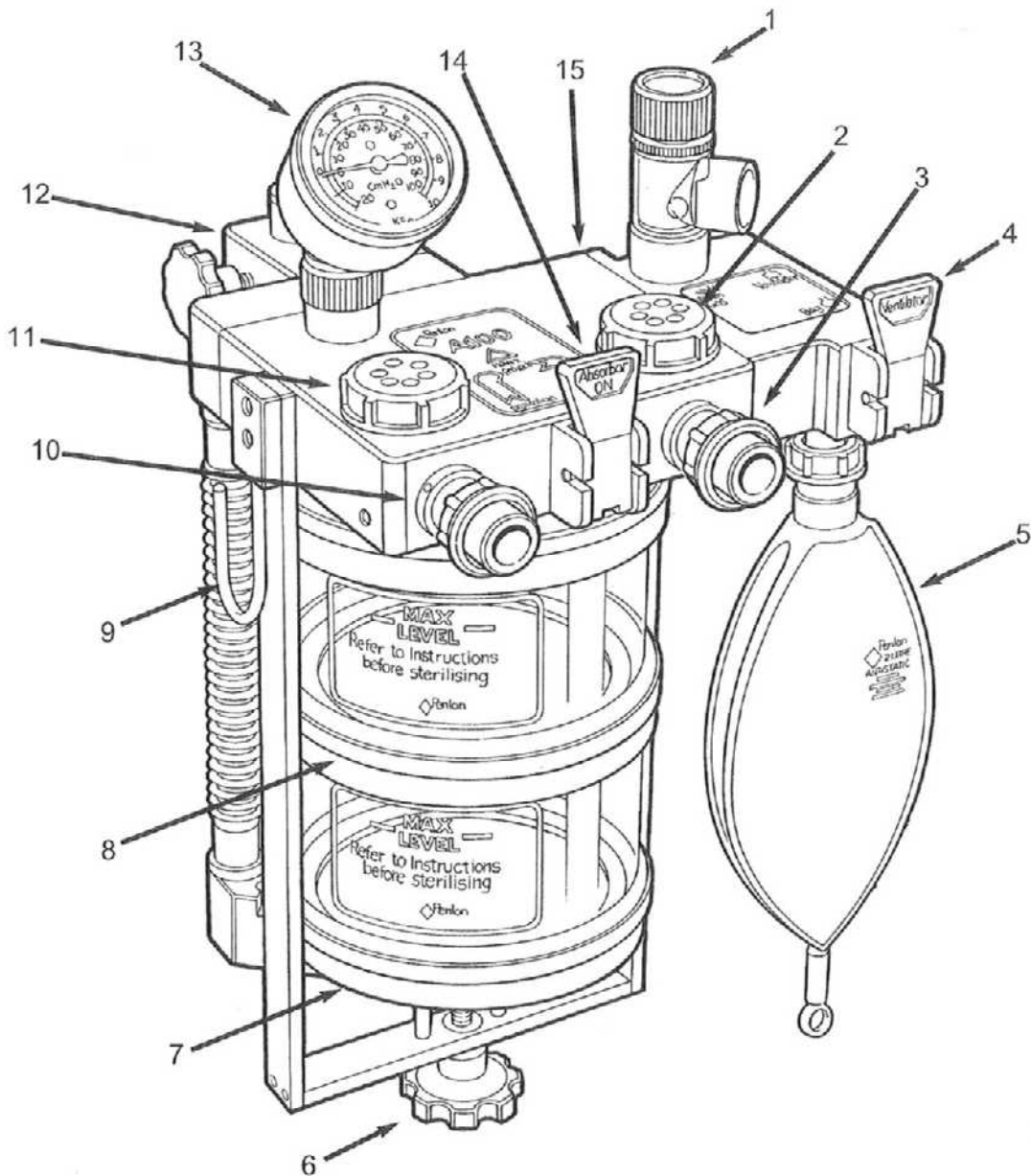
Depending on the flow of fresh gas relative to patient minute volume, the patient may receive fresh gas or partial recirculated gas, as determined by the anaesthetist.

As an option, the absorber can be supplied with an on/off (bypass) control which enables the canister containing the absorbent material to be excluded from the breathing circuit. The purpose of this is to enable CO₂ levels to be increased, or to allow the absorbent to be changed whilst the patient is still ventilated.

The system may also incorporate as an option a Bag/Ventilator switch. This enables the device to be used:

- a) for spontaneous breathing or manually assisted ventilation in the 'Bag' mode,
- b) with an anaesthesia ventilator when 'Ventilator' is selected.

Further options allow for an integral manometer, and an uncalibrated PEEP facility which can be fitted into the expiratory valve.



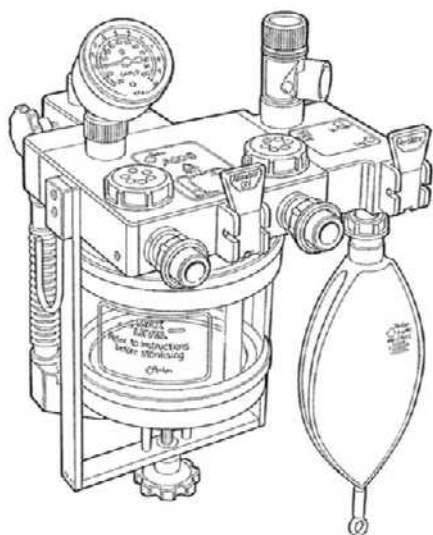
**A100 Circle System Absorber – twin canister model
with optional on/off (bypass) switch, bag/ventilator switch and manometer**

- | | | | |
|----|--|-----|-----------------------------------|
| 1. | Adjustable pressure limiting valve (APL valve) | 8. | Upper canister |
| 2. | Inspiratory non-return valve (NRV) | 9. | Hook – breathing circuit hose |
| 3. | Inspiratory hose connector | 10. | Expiratory hose connector |
| 4. | Bag/ventilator switch (optional) | 11. | Expiratory non-return valve (NRV) |
| 5. | Reservoir bag | 12. | Pole mount block |
| 6. | Canister clamp wheel | 13. | Manometer (optional) |
| 7. | Lower canister | 14. | Absorber on/off (bypass) switch |
| | | 15. | Manifold block |

3. DESCRIPTION

3.1 Canisters

Note – absorbers with single or twin canisters are available (single canister illustrated below).



Capacity

Each canister is designed to hold 1.3 kg of loose absorbent, or to take prepacks.

The maximum fill level is marked on the canister – equivalent to 1500 ml of absorbent.

THIS MUST NOT BE EXCEEDED, but filling should be to a level within 12 mm (0.5 in) of this line.

In addition, the absorber must only be used when securely mounted in an upright position – spillage of absorbent may contaminate the breathing system – see **WARNING**, in section 5.1.

Seals

Canisters each have a rubber seal attached at their lower end. The top seal attached to the metalwork of the frame is identical to the canister seals.

Twin canister models

- Gas flow is upward through the canisters so that the lower unit will be exhausted first.
- The upper and lower canisters are interchangeable.

Further Information

Mounting the absorber – section 5.1

Refilling the absorbent – section 5.3

Cleaning – section 7.2

Draining condensate – section 7.3

Sterilisation and autoclaving – section 8

3.2 Inspiratory and Expiratory Non-return Valves (NRV)

The valves are positioned on the top of the manifold block and control the direction of the gas flow through the system.

Each valve consists of a stainless steel disc located over a valve seat, and operates by gravity. The steel discs are retained by guides on the inside of the valve dome to prevent lateral movement.

The valves are visible through transparent domes and the operation of each valve can be visually checked as the patient breathes in and out.

IT IS IMPORTANT THAT THE ABSORBER IS MOUNTED UPRIGHT SO THAT THESE VALVES MOVE IN A TRULY VERTICAL PLANE, WITH THE VALVE SEATS HORIZONTAL.

The valves are detachable for cleaning, and the attachment of accessories (e.g. a PEEP valve can be fitted at the expiratory valve position).

Further Information

Mounting the absorber – section 5.1

Pre-use check – section 6

Cleaning – section 7.4

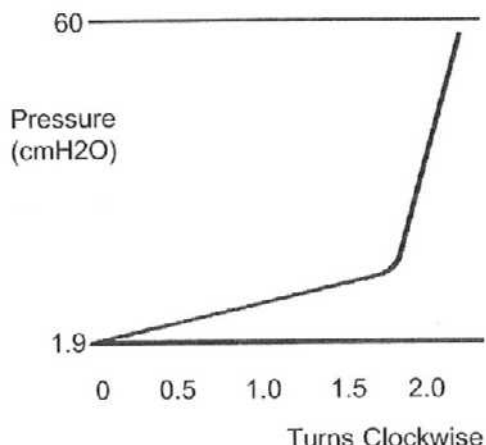
Sterilisation and autoclaving – section 8

DESCRIPTION

3.3 Adjustable Pressure Limiting (APL) Valve

The Penlon APL valve is a spring loaded stainless steel disc valve, providing breathing system pressure control, and excess pressure relief.

The spring pressure can be varied by rotating the control knob on top of the valve. In the fully counterclockwise position the minimum pressure is 1.9 cmH₂O at 30 L/min. This can be increased by clockwise rotation.



As shown in the graph above, further clockwise rotation causes a rapid increase in opening pressure so that in the fully closed position, the valve functions as a 60 cmH₂O excess pressure relief valve.

AGSS connector

On UK specification models, the APL valve is fitted with 30 mm taper connector.

US specification models have a 19 mm taper connector.

Further Information

Pre-use check – section 6.3

Sterilisation – section 8.5

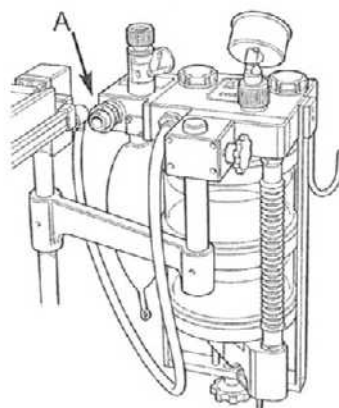
3.4 Bag/Ventilator Switch (Optional)

On the right hand side of the absorber manifold block is a spring loaded lever which in the vertical position shows the word 'Ventilator'. In this position the ventilator is in circuit.

Ventilator mode

In 'Ventilator' mode the reservoir bag is closed off from the breathing system and the ventilator connection port (A) at the rear of the manifold block, is in circuit.

WARNING The APL valve is out of circuit when the system is in 'Ventilator' mode. The ventilator must be equipped with a pressure relief valve.



Moving the lever down against its spring results in a sudden reversal of the spring action, pulling the lever rapidly to the horizontal position where the word 'Bag' is exposed.

There is no intermediate position of the lever.

Bag mode

The breathing bag acts as an additional over-pressure protection device, preventing pressure exceeding 60 cmH₂O.

WARNING If no ventilator is connected to the absorber, care must be taken to ensure that the bag/ventilator switch is kept in the 'Bag' position, to avoid gross loss of gas from the breathing system and to maintain the reservoir bag in the system. The ventilator port must be left uncapped when no ventilator is connected.

Further Information

Gas flow schematic – section 3.10

Pre-use check – section 6

DESCRIPTION

3.5 Fresh Gas Inlet and Supply Tubing

The fresh gas inlet connector is screwed into the rear of the manifold block (labelled 'A' – see illustration at section 3.4).

The absorber is supplied with a fresh gas hose assembly with attached end fitting, and no substitute should be employed.

WARNING *Kinking of the fresh gas tube is a known cause of anaesthetic accident and the use of unsuitable tubing can contribute to this situation.*

3.6 Manometer (optional)

NOTE: *The use of a manometer is strongly recommended at all times.*

The manometer is located on the top of the manifold block to the rear of the expiratory valve and can be swivelled to face in the desired direction.

Manometer scale: -10 to +100 cmH₂O
Manometer accuracy: ±5%
(within range
+10 to 80 cmH₂O)

CAUTION *Remove the manometer before autoclaving the absorber unit.*

Further Information
Installation – section 5.4

3.7 Bypass System (Optional)

It is strongly recommended that a capnometer is used in conjunction with this system to prevent the risk of hypercapnia.

The bypass system opens a valve to allow expiratory gas to pass direct to the APL valve and bag, or ventilator, without passing through the absorbent.

This facilitates:

- canister refill during clinical use of the system.
- CO₂ levels can be increased.

The bypass is operated by a lever at the front of the manifold block, located between the inspiratory and expiratory connectors.

The lever shows 'Absorber ON' in the vertical position and 'Absorber OFF' when the lever is moved down to the horizontal position to open the bypass. The lever has a spring action to prevent it being left in a mid-position.

Note that with the absorber 'ON' all the expiratory gas will pass through the absorbent canisters.

Further Information
CO₂ monitoring – section 3.8

3.8 End Tidal Carbon Dioxide Monitoring

The use of end tidal carbon dioxide monitoring is strongly recommended to support the most effective use of the Penlon Circle A100 Absorber System.

Connection of a suitable analyser must be made between the patient's airway and the patient connection Y-piece.

Detailed instructions are provided by the manufacturers of the analyser.

DESCRIPTION

3.9 PEEP Valve (optional)

The valve is used to generate positive end expiratory pressure (PEEP), which is infinitely variable from zero to 20 cmH₂O.

The valve is fitted into the expiratory valve port on the top of the manifold block, in place of the existing valve components.

It is recommended that a manometer, reading directly from the breathing circuit, is used when a PEEP valve is fitted.

Further Information

CO₂ monitoring – section 3.8

Installation – section 5.4.2

3.10 Gas Flow Schematics

The following pages contain gas flow schematics

1. Absorber – basic model
2. Absorber with bypass and manometer
3. Absorber with bypass, bag/ventilator switch and manometer
4. Absorber with bypass, bag/ventilator switch, manometer, and PEEP valve

Further Information

Gas flow diagrams – section 10

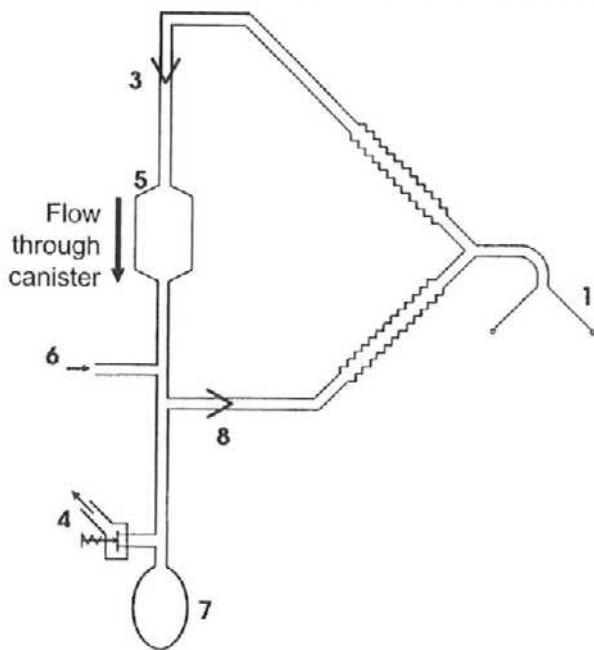
Component layout

In all models the gas flow through the canisters is from bottom to top.

Note that the bag/ventilator connection is between the absorber and the patient. Bag squeezing or the use of mechanical ventilation does not result in the transport of dust toward the patient, but tends to drive dust back into the absorber.

DESCRIPTION

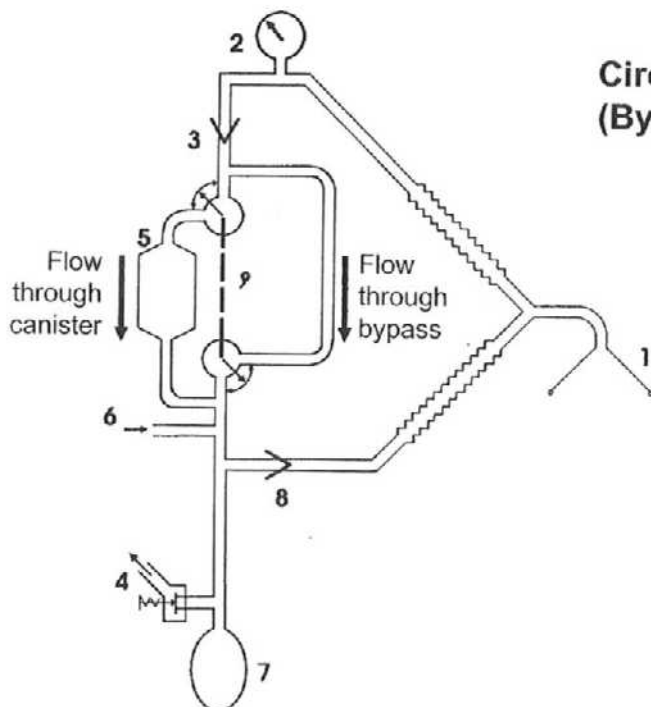
Circle System Absorber – Basic Model



Key to Gas Circuit Schematics

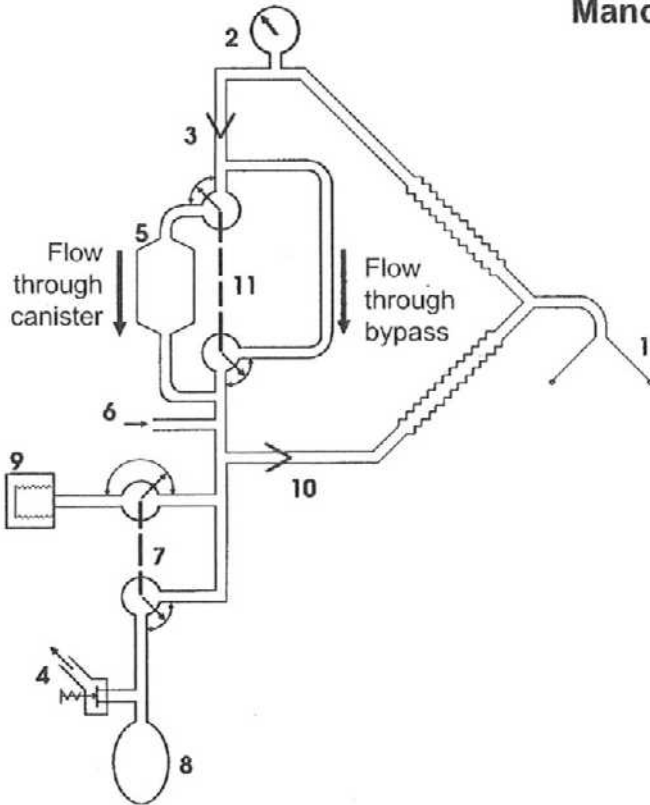
- | | |
|---|--|
| 1. Patient | 7. Breathing bag |
| 2. Manometer (optional) | 8. Inspiratory NRV (Non return valve) |
| 3. Expiratory NRV (non-return valve) | 9. Absorber On/Off (bypass) control / mechanical link (optional) |
| 4. APL (adjustable pressure limiting) valve | |
| 5. Absorber canister | |
| 6. Fresh gas inlet | |

Circle System Absorber with On/Off (Bypass) and Manometer



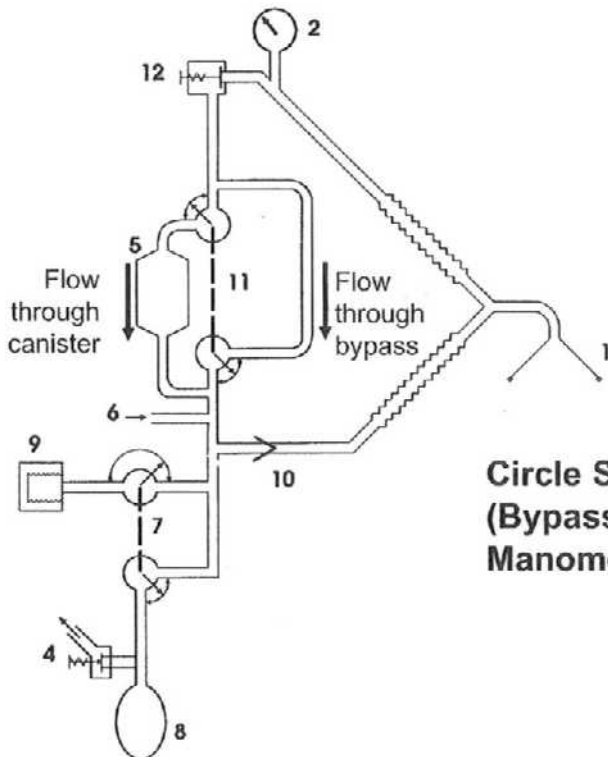
DESCRIPTION

Circle System Absorber with On/Off (Bypass), and Bag/Ventilator Switch, and Manometer



Key to Gas Circuit Schematics

- | | |
|-----|---|
| 1. | Patient |
| 2. | Manometer (optional) |
| 3. | Expiratory NRV (non-return valve)
Note: not fitted if PEEP valve is used |
| 4. | APL (adjustable pressure limiting) valve |
| 5. | Absorber canister |
| 6. | Fresh gas inlet |
| 7. | Bag/ventilator control / mechanical link |
| 8. | Breathing bag |
| 9. | Ventilator |
| 10. | Inspiratory NRV (Non-return valve) |
| 11. | On/Off (bypass) control / mechanical link |
| 12. | PEEP valve (optional)
Note: fitted in place of expiratory NRV |



Circle System Absorber with On/Off (Bypass), and Bag/Ventilator Switch, Manometer, and PEEP Valve

4. SPECIFICATION

NOTE: Information in this section complies with the requirements of ISO 8835-2.

4.1 General Dimensions

Overall height	380 mm (single canister) 470 mm (twin canister)
Width	186 mm
Depth	240 mm
Weight (empty)	5.7 kg (single canister) 6.2 kg (twin canister)
Mounting system	25 mm (1 inch) diameter polemount

4.2 Resistance of Breathing System

Resistances listed in 4.2.1 and 4.2.2 are measured with:

- (A) An absorber fitted with 1060 mm (42 inch) breathing hoses complying with ISO 5367, and a Penlon Safelock Y-piece.
- (B) Absorber only.

Both canisters filled to the MAX level with fresh absorbent, and the APL valve fully open.

4.2.1 Expiratory Resistance

Tested with a flow of 6 L/min of air through the fresh gas inlet and an induced flow of 60 L/min through the breathing system.

- (A) expiratory resistance: less than 0.6 kPa (6 cmH₂O)
- (B) expiratory resistance: less than 0.5 kPa (5 cmH₂O)

By-pass (absorber 'OFF')

Tested with an induced flow of 60 L/min through the breathing system.

- (A) expiratory resistance: less than 0.4 kPa (4 cm H₂O)
- (B) expiratory resistance: less than 0.35 (3.5 cmH₂O)

Bacterial Filter:

Bacterial filters may be used in this breathing system provided they do not raise the resistance values of the whole system to above 0.6 kPa (6 cmH₂O).

SPECIFICATION

4.2.2 Inspiratory Resistance

Tested with a flow of 6 L/min of air through the fresh gas inlet and an induced flow of 60 L/min through the breathing system.

- (A) inspiratory resistance: less than 0.6 kPa (6 cmH₂O)
- (B) inspiratory resistance: less than 0.45 kPa (4.5 cmH₂O)

By-pass (absorber 'OFF')

Tested with a flow of 6 L/min of air through the fresh gas inlet and an induced flow of 60 L/min through the breathing system:

- (A) inspiratory resistance: less than 0.35 kPa (3.5 cmH₂O)
- (B) inspiratory resistance: less than 0.3 kPa (3 cmH₂O)

Bacterial Filter:

Bacterial filters may be used in this breathing system provided they do not raise the resistance values of the whole system to above 0.6 kPa (6 cmH₂O).

4.3 Internal Compressible Volume

These figures are measured with:

- (A) **An absorber fitted with 1060 mm (42 inch) breathing hoses complying with ISO 5367, and a Penlon Safelock Y-piece.**
- (B) **Absorber only.**

Note that the reservoir bag is not fitted and the bag mount blocked.

- (A) Volume required to raise the system pressure to 3 kPa (30 cmH₂O) = 180 ml
- (B) Volume required to raise the system pressure to 3 kPa (30 cmH₂O) = 170 ml

Other disposable breathing hoses may give different figures; the supplier of the hose will provide compressible volume figures.

SPECIFICATION

4.4 System Leakage Rate

These figures are measured with:

- (A) An absorber fitted with 1060 mm (42 inch) breathing hoses complying with ISO 5367, and a Penlon Safelock Y-piece.
- (B) Absorber only.

The patient connection port is sealed and the APL valve fully closed.

- (A) Absorber 'ON' and Absorber 'OFF'
Leakage rate: less than 50 ml/min at 3 kPa (30 cmH₂O)
- (B) Absorber 'OFF', canister removed.
Leakage rate: less than 50 ml/min at 3 kPa (30 cmH₂O)

4.5 Canister Capacity and Resistance

4.5.1 Canister Capacity

When filled to the MAX level mark, each canister holds 1.3 kg (2.87 lb) of absorbent (1500 ml).

Recommended absorbent – Soda lime or barium lime, with a colour indicator, 4-8 mesh, supplied in bulk.

Alternatively, pre-packs may be used.

Note

- i) The absorber canisters are not electrically conductive.
- ii) Cleaning and sterilisation details are given in section 7.

4.5.2 Canister Resistance

The resistance of a freshly filled canister is less than 0.2 kPa (2 cmH₂O) at 60 L/min.

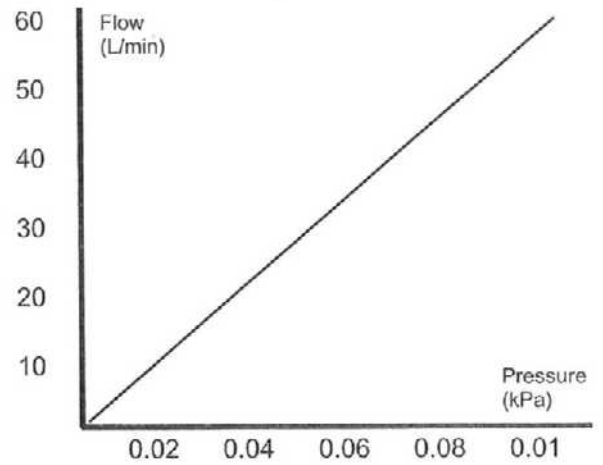
SPECIFICATION

4.6 Non-return Valves

Pressure drop across the inspiratory and expiratory non-return valves at an air flow of 60 L/min: 0.1 kPa (1 cmH₂O).

Note that flow characteristics are identical for valves in a dry or wet condition.

A 'wet' valve is defined as a valve in a flow of humidified gas, such that moisture is visible on the surface of the valve.



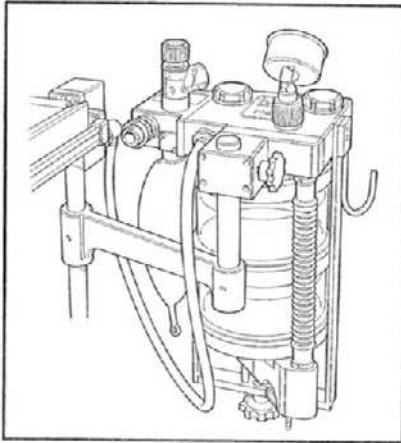
5. INSTALLATION AND OPERATION

5.1 Mounting the Absorber

CAUTION

If the absorber has to be lifted or carried by hand, always support the weight of the unit under the base.

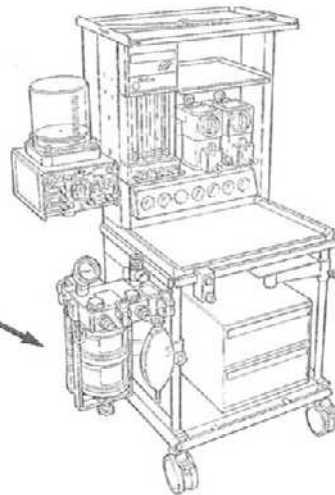
Do not lift the absorber by gripping any of the components attached to the manifold blocks at the top of the absorber – the manometer, APL valve, breathing circuit connectors, etc.



Polemount bracket

A 25 mm (1 inch) diameter pole clamp is provided on the rear of the absorber.

Suitable pole mount brackets are provided on the Penlon Prima anaesthetic machine, as illustrated.



WARNING

The Penlon A100 Circle Absorber System must only be used when securely mounted in an upright position.

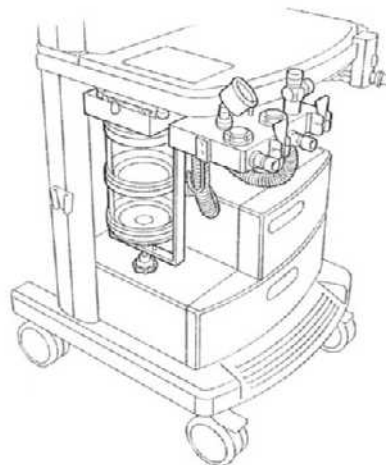
- a) Non-return valves are gravity operated
- b) Spillage of absorbent may contaminate the breathing system.

Inboard Mounting System - Prima SP

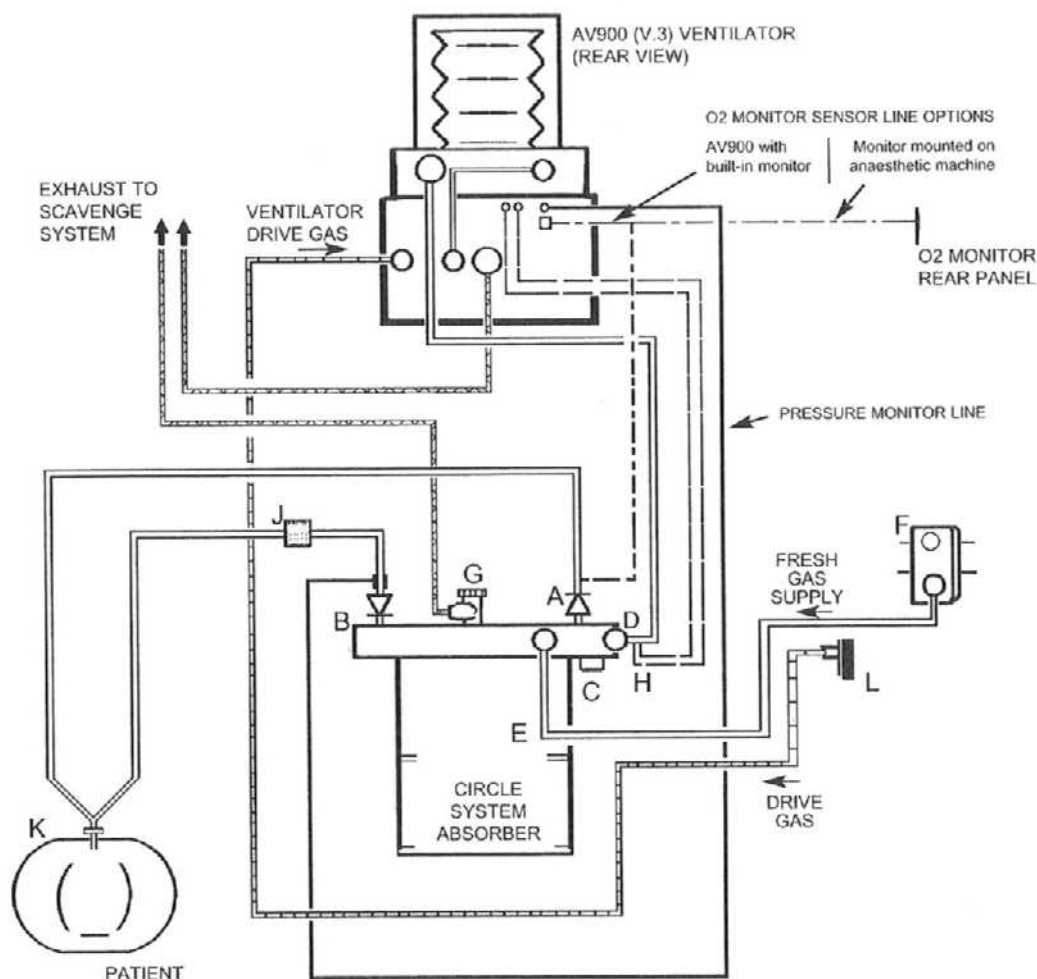
Please refer to the Prima SP user instruction manual for installation and connection details.

Further Information

Condensate Drainage – section 7.3



INSTALLATION AND OPERATION



Breathing Circuit Connections

A	Inspiratory hose connection	E	Fresh gas hose	J	Bacterial filter
B	Expiratory hose connection	F	CGO block	K	Heat and moisture exchanger
C	Reservoir bag connector	G	APL valve	L	Auxiliary gas outlet (anaesthetic machine)
D	Ventilator connection	H	Spirometer		

Note

- 1) To protect the expiratory limb of the breathing circuit, and the spirometer (H), use a breathing circuit bacterial filter (J), or a heat and moisture exchanger (K) at the patient tee-piece.
- 2) Follow the instructions given in the relevant user manuals for connections to analysers and monitors.
- 3) Prima SP Inboard Mounting System:
Refer to the Prima SP user instruction manual for installation and connection details.
- 4) Ventilator connections shown are for AV900 V.3.
For AV900 V.4 and AV800 ventilators, please refer to section 5 in the relevant user manual.

INSTALLATION AND OPERATION

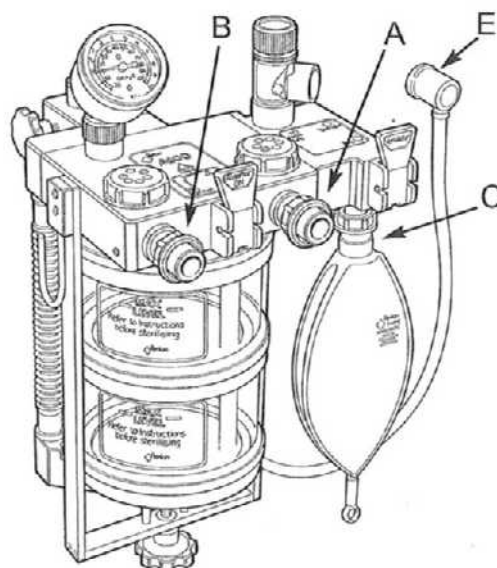
5.2 System Connection

5.2.1 Breathing System Hose, Reservoir Bag, Ventilator

Inspiratory (A) and expiratory (B) hose connectors and the reservoir bag connector (C) are 22 mm male, complying with ISO 5356/1. The ventilator connection point (D) is also 22 mm male.

Hose and bag connections are fitted with Penlon Safelock high security fittings.

See section 9 for ordering information for Penlon breathing system components and accessories.



5.2.2 Fresh Gas Supply

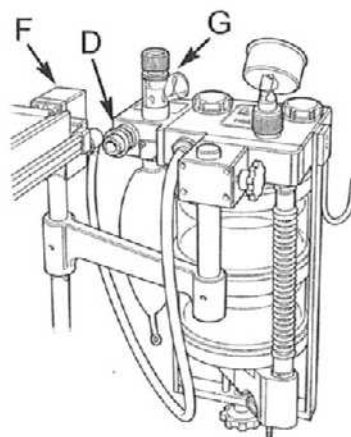
The fresh gas hose assembly (E) supplied with the unit has a Penlon connector at the absorber inlet and a 22 mm Safelock taper at the other end. This should be connected to the common gas outlet (F) of the anaesthetic machine.

5.2.3 Anaesthetic Gas Scavenging (AGS)

The outlet of the APL valve (G) is either a 30 mm or 19 mm taper (US specification), which can be rotated to a convenient position to attach an AGS system hose.

WARNING Vacuum systems must *not* be connected direct to the APL valve. A receiving system with a positive and negative pressure control function must be interposed.

Systems must comply with the requirements of ISO 8835 part 2.



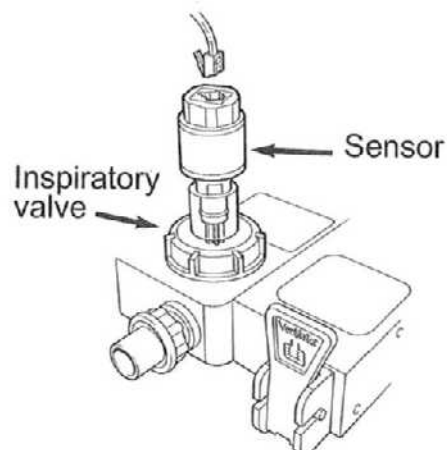
5.2.4 Oxygen Monitor

Penlon Oxygen Monitor - the sensor must be attached:

- at the inspiratory valve, or
- at the CGO block, using a standard 15 mm Tee adaptor.

Refer to the relevant user instruction manual (AV900, Prima, or Prima SP).

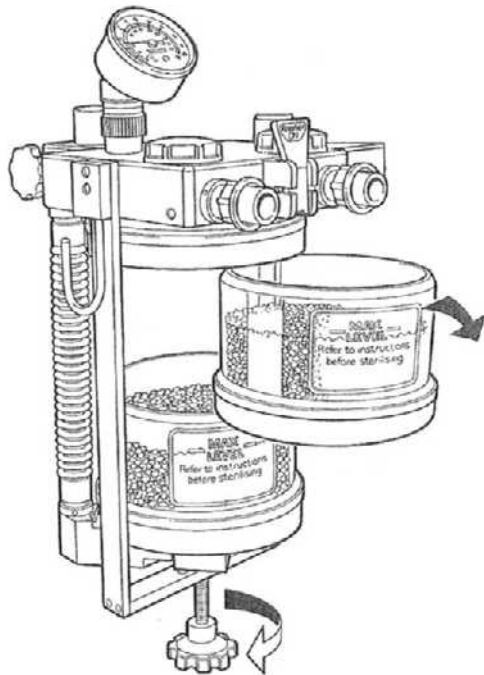
The use of an oxygen monitor (and a carbon dioxide analyser) is highly recommended when using any partial rebreathing anaesthetic system.



INSTALLATION AND OPERATION

5.3 Filling and Changing CO₂ Absorbent

WARNING If the absorbent is to be changed during clinical use, the bypass switch must be in the 'Absorber OFF' position, and adequate fresh gas flow must be maintained to prevent excessive build up of CO₂.



Removing the canisters

1. Turn the clamp wheel at the base of the absorber fully clockwise (8 to 9 turns). This leaves space between the top and bottom of the canister frame for the canisters to be removed sideways after disengaging the rubber seals by vertical movement.
2. On twin canister models, the absorbent in the lower canister is always exhausted first, so the canisters should be rotated as follows:
 - (a) lift the canisters from the frame and place the top canister to one side, for refitment in the lower position,
 - (b) replace the absorbent in the lower canister, and then refit in the top position – see procedure below.

Refilling with absorbent

WARNING Underfilling of canisters can lead to inefficient CO₂ absorption. Overfilling may result in poor sealing of canister due to caking of granules and abrasion of seals and canisters.

WARNING Condensation, which may collect in the bottom of the absorber, is caustic. Avoid skin contact when draining.

After draining, ensure that the drain valve is fully closed (see section 7.3).

1. Using pre-packed soda lime, the packing seals must be removed from the fresh pre-pack following the makers' instructions.
 - (a) Check that the canister is clean and empty of dust or soda lime granules, including the underside of the rubber seal.
 - (b) Insert the pre-pack into the canister. Follow the instructions provided by the pre-pack manufacturer.
2. Using bulk packed soda lime, check the canister in the same manner, then place it on a horizontal surface and fill it with soda lime up to the MAX line, but not above it.

Refitting the canisters

CAUTION Efficient use of soda lime is only achieved if the newly refilled canister is replaced in the upper position.

1. Refit the canisters into the frame, with the newly filled canister in the top position. Make sure that all seals, and the canisters align correctly as you tighten the clamp screw by clockwise rotation.
2. Leak test the absorber – see section 6.2.

INSTALLATION AND OPERATION

5.4 Optional Accessories

5.4.1 Manometer

The manometer is located on the top of the manifold block, to the rear of the expiratory valve. To fit a manometer to an existing absorber, first remove the blanking plug, then carefully screw the adaptor into the manifold block. Fit the manometer to the adaptor.

Function test the absorber, checking for leaks at the manometer, before clinical use.

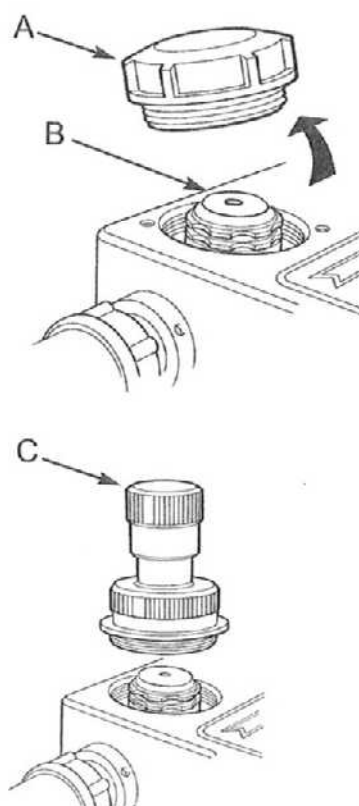
CAUTION *Remove the manometer before autoclaving the absorber unit.*

5.4.2 PEEP Valve

It is recommended that a manometer, reading directly from the breathing circuit, is used when the PEEP valve is fitted.

A positive end expiratory pressure (PEEP) valve can be fitted into the expiratory valve port on the top of the manifold block, in place of the existing valve components

1. Unscrew the expiratory valve plastic dome (A). Check that the steel disc (B) is in place - the face with the white marking must be uppermost.
2. Fit the PEEP valve (C) to the manifold block.
3. Function test the absorber before clinical use.



6. PRE-USE CHECKS

6.1 Pre-use Checklist

1. Check the absorbent, replace if necessary.
Before refitting the canisters, check that the sealing surfaces are clean and dust free before clamping tightly.
2. Connect the fresh gas hose to the anaesthetic machine.
Note that the anaesthetic machine must be leak tested before the absorber pre-use checks are made.
3. Leak test the absorber – see section 6.2
4. Carry out a function check and pressure relief test on the APL valve – see section 6.3.
5. Check the inspiratory and expiratory non-return valves for correct operation – see section 6.4.
6. Check the Bag/Ventilator switch (if fitted) for correct operation – see section 6.5.
7. Check the Absorber On/Off switch (if fitted) for correct operation – see section 6.6.
8. Check the PEEP valve (if fitted) for correct operation – see section 6.7.
9. Repeat the absorber leak test – see section 6.2.

PRE-USE CHECKS

The procedures detailed in sections 6.2 to 6.6 must be carried out in the order listed.

The absorber must be attached to an anaesthetic machine, which must be leak tested before the checks are carried out.

If a manometer is fitted, check that it is zeroed before use.

6.2 Leak Test

On models with a bypass facility, the absorber bypass switch level must be set to its vertical 'Absorber ON' position.

On models with a bag/ventilator option, check that the bag (A) is correctly fitted, and set the switch lever to 'Bag'.

Connect the fresh gas hose to the machine CGO block outlet.

Use a breathing system hose to connect the patient ports (B) to form a closed, leak-free circuit.

Close the APL valve (C).

1. Turn on a flow of 2 L/min of oxygen and pressurise the system.
2. If a manometer is fitted, stop the gas flow when the system pressure reaches 3 kPa (30 cmH₂O) and check that pressure is maintained, i.e. the pressure must not fall to zero in less than one minute.
3. If no manometer is fitted, stop the flow when the bag is fully inflated and check that pressure is maintained by observing the bag, i.e. the bag must not deflate within one minute.

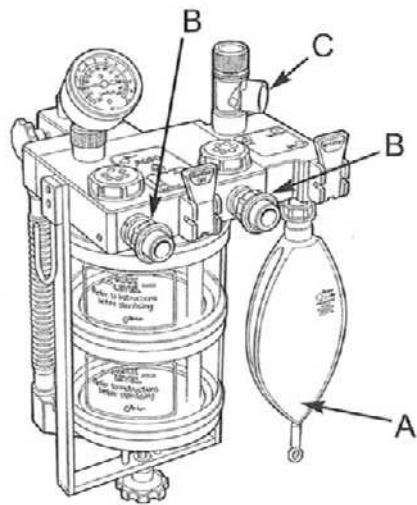
6.3 APL Valve Test and Pressure Relief Test

APL Valve Function

1. Open the APL valve (C).
Check that gas escapes freely from the system through the valve outlet.

APL Valve Flow Resistance

2. If a manometer is fitted, set maximum flow and check that the retained pressure is less than 0.5 kPa (5 cmH₂O).



3. If no manometer is fitted, inflate the bag with a flow of 5 L/min.

Check that the bag can be deflated with gentle squeezing.

Pressure Relief

4. Close the APL valve fully (clockwise).
5. If a manometer is fitted, remove the reservoir bag (A) and block the bag port.

Use the emergency oxygen flush on the machine to produce a high flow of gas into the system and check that the APL valve provides excess pressure relief. The manometer reading must not exceed 6 kPa (60 cmH₂O) \pm 10% at 40 L/min.

Refit the reservoir bag.

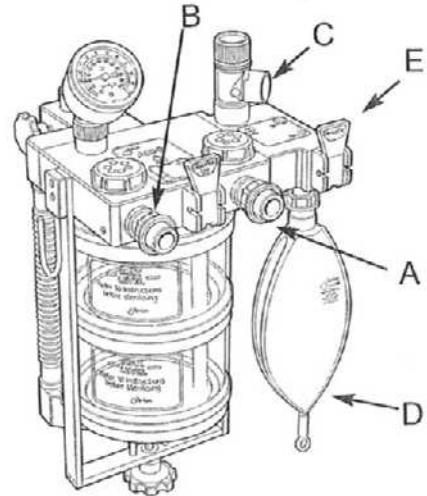
6. If a manometer is not fitted, fully inflate the bag, turn off the gas flow and squeeze the bag.

Check that the APL valve provides excess pressure relief.

PRE-USE CHECKS

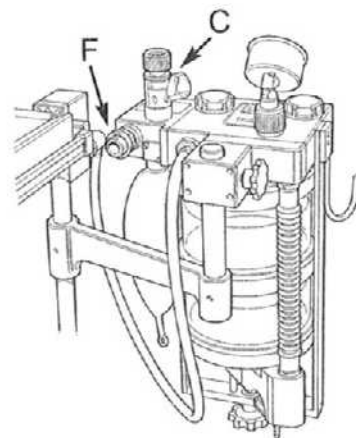
6.4 Inspiratory and Expiratory Non-return Valve Test

1. Detach the hose connecting the inspiratory (A), and expiratory (B) connectors.
2. Check that the APL valve (C) is closed.
3. Block the inspiratory valve outlet (A) with a suitable bung, and inflate the reservoir bag (D) with a 2 L/min oxygen flow.
4. Turn off the gas flow and check that the bag does not empty by reverse flow through the expiratory valve (B).
5. Remove the bung and attach a spare reservoir bag to the inspiratory valve connector (A).
6. Turn on a 2 L/min oxygen flow and fully inflate this bag (and the absorber reservoir bag).
7. Turn off the gas flow. Check that gas cannot be forced through the inspiratory valve by gentle squeezing of the spare bag on the valve outlet.
8. Remove the bag from the inspiratory connector (A).



6.5 Bag/Ventilator Switch (if fitted)

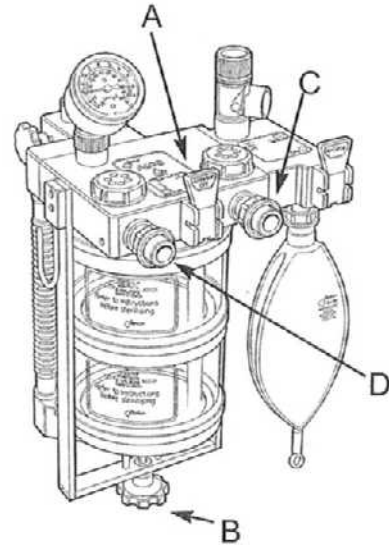
1. Refit the breathing hose between the inspiratory (A) and expiratory (B) connectors.
2. Move the lever (E) to its vertical 'Ventilator' position.
3. Close the APL valve (C).
4. Set a flow of 10 L/min and check that there is a flow out through the ventilator connection port (F).
5. Move the lever to its horizontal 'Bag' position.
6. Check that the flow through (F) ceases, and the bag inflate.
7. When the pressure in the system reaches 3 kPa (30 cmH₂O), turn off the flow of gas.
8. Reselect 'Ventilator' and check that the system momentarily empties through the ventilator connection port (F), but the bag remains inflated.
9. Squeeze the bag, there should be no loss of pressure.



PRE-USE CHECKS

6.6 Absorber On/Off Switch (if fitted)

1. Move the absorber On/Off level (A) to its horizontal 'OFF' position.
2. On models with a Bag/Ventilator option, select 'Bag'.
3. Pressurise the system and when the pressure in the system reaches 3 kPa (30 cmH₂O), turn off the flow of gas.
4. Unscrew the clamp wheel (B) at the base of the absorber, and detach the canisters.
5. Check that pressure is maintained in the system, i.e. the pressure must not fall to zero in less than one minute.
6. Select 'Absorber 'ON'', check that the system exhausts through the canisters.
7. Tighten the canister clamp wheel – check that the canisters and seals align correctly during refitment.



6.7 PEEP Valve (if fitted)

1. Disconnect the fresh gas hose from the anaesthetic machine.
2. Use the hose connecting the inspiratory (C), and expiratory (D) connectors to connect the anaesthetic machine CGO to the expiratory connector.
3. On models with a Bag/Ventilator option, select 'Ventilator'.
4. Set a flow of 10 L/min.
5. Turn the PEEP valve control knob fully clockwise and check that the pressure in the system rises to approximately 20 cmH₂O.
6. Turn the control knob fully anti-clockwise and check that the pressure falls.
7. Carry out an absorber leak test – see section 6.2.

7. MAINTENANCE

7.1 Maintenance and Service Policy

This section of the User Manual describes simple procedures which, if regularly performed, will keep the system in good working order between the servicing procedures laid down in the separate Service Manual.

No tools or special equipment are needed for these user maintenance procedures.

These procedures should be performed daily, or whenever the absorbent is renewed in the canister.

The Pre-use Checks in section 6.1 must then be performed.

Service Frequency

Servicing and repairs must only be carried out by Penlon-trained technicians and engineers.

- (a) Six-monthly inspection and function testing.
- (b) Annual service which includes routine replacement of seals etc., as preventive maintenance.

7.2 Canister and Seals

Cleanliness is the essential requirement for these components. Soda lime tends to adhere strongly to surfaces when it has become exhausted.

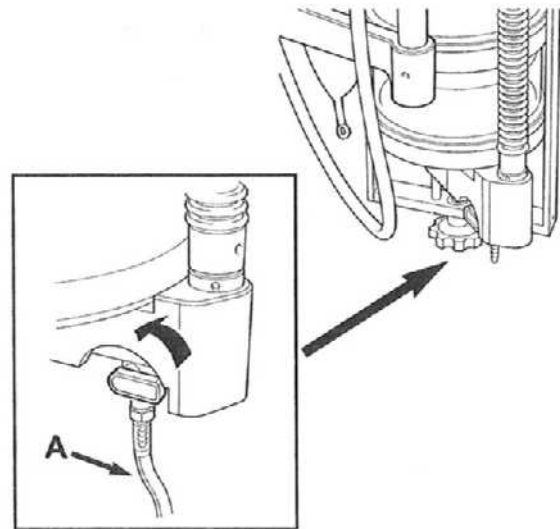
To ensure good sealing, the seals and the canisters should be scrubbed under running water to remove particles of soda lime, whenever these items are removed for recharging.

Attention to the seal and sealing edge on the frame is also important. These can be wiped with a wet cloth, or scrubbed under running water when the complete system is dismantled for sterilisation or disinfection.

See section 8.4.

7.3 Condensate Drainage

WARNING *Condensation, which may collect in the bottom of the absorber is caustic and care must be taken not to spill it on the skin when draining the trap provided. After draining ensure that the drain valve is fully closed.*

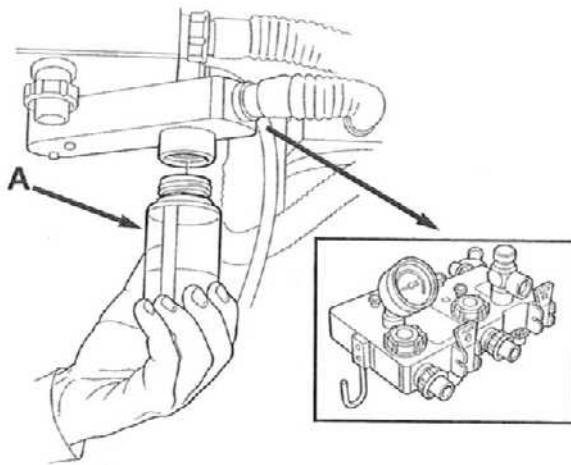


7.3.1 Polemount Models

Weekly:

1. Attach a tube (A) to the drain trap tube and drain the condensate into a suitable container such as a 100 ml beaker.
Open the drain valve by turning the lever.
2. Allow all liquid to drain out, then close the drain valve.
Dilute the liquid with water before disposal.
3. Remove the tube

MAINTENANCE



7.3.2 In-board Mounted Models (Prima SP)

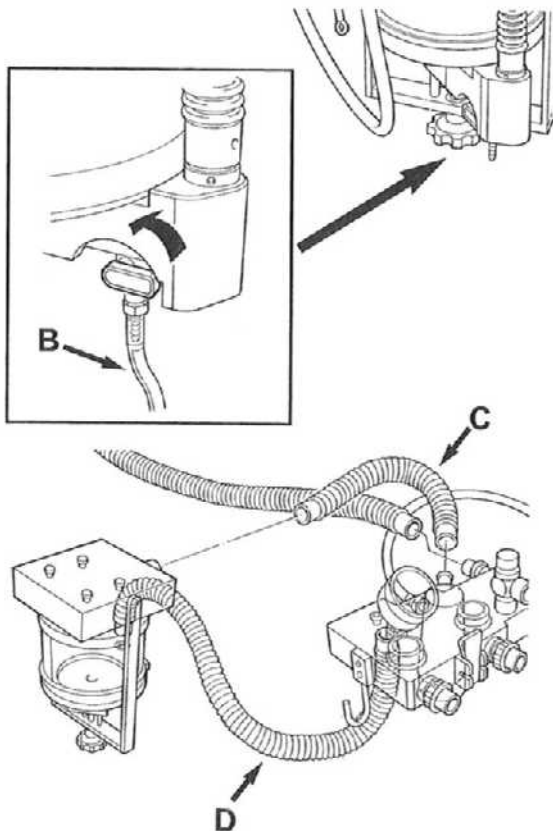
NOTE An additional condensate collection system is fitted under the absorber valve block.

Daily Procedure:

1. Check the level of liquid in the bottle (A). If the bottle is more than half full, unscrew carefully and dispose of the contents - dilute the liquid with water before disposal. **Wear suitable protective gloves if the bottle is full.** Refit the bottle.

Weekly Procedure:

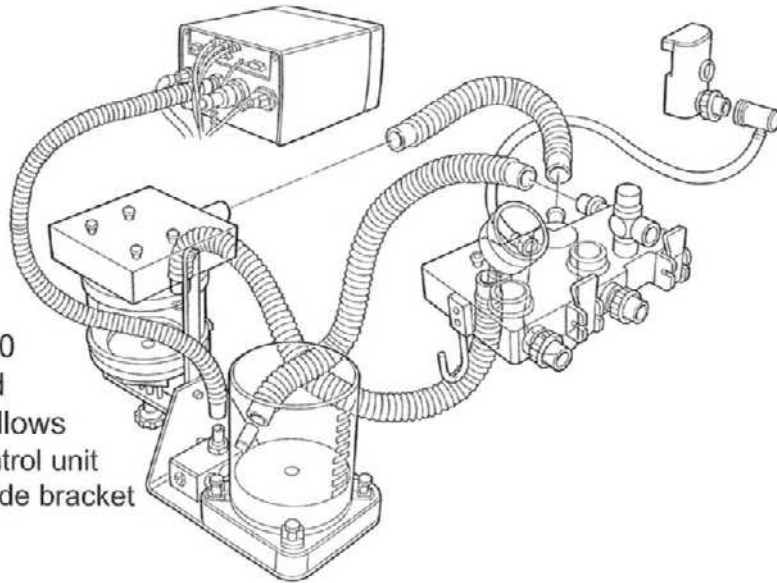
1. Drain the condensate from the base of the absorber canister, as follows:
Attach a tube (B) to the drain trap tube and drain the condensate into a suitable container (such as a 100 ml beaker).
Open the drain valve by turning the lever.
Allow all liquid to drain out, then fully close the drain valve and remove the hose.
Dilute the liquid with water before disposal.



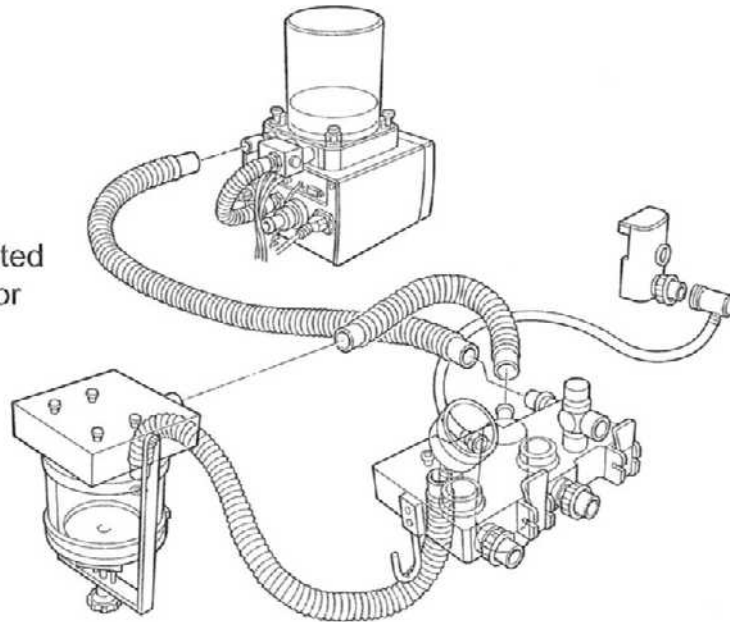
2. Check the hoses (C and D) that connect the valve block and canister assembly.
WARNING
Condensate may have collected inside the hoses.
This condensate may be caustic, and care must be taken to avoid skin contact.
If condensate is visible, wear suitable protective gloves, carefully disconnect each hose, and drain the liquid into a suitable container.
Dilute the liquid with water before disposal.
3. Reconnect the hoses.
4. Check that all the hoses connecting the absorber and ventilator are correctly fitted and secure - refer to the illustrations on the next page.

MAINTENANCE

Prima SP
In-board A100
Absorber and
Ventilator Bellows
(Ventilator control unit
mounted on side bracket
or shelf)



Prima SP
In-board A100
Absorber
(Ventilator mounted
on side bracket or
shelf)



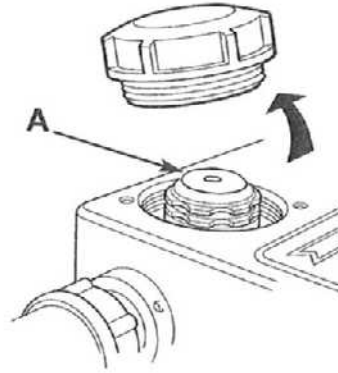
MAINTENANCE

7.4 Inspiratory and Expiratory Non-return Valves

The non-return valves should be opened and the valve discs and domes rinsed under running water, and carefully dried.

It is essential not to bend the disc (A) during this process, otherwise the system will not pass the Pre-use Check in section 6.

Refit the disc - the face with the white marking must be uppermost.

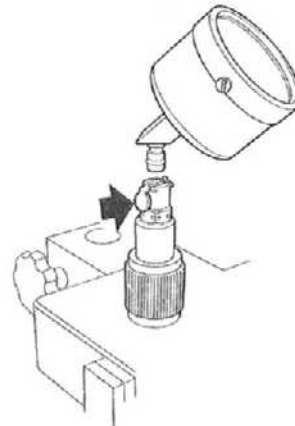


7.5 Manometer (if fitted)

The manometer must be removed from the absorber, before any sterilisation or disinfection process is applied.

Depress the quick release clip to detach the manometer from the adaptor on the absorber.

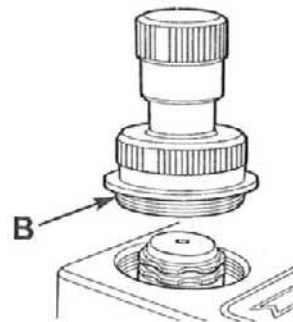
CAUTION Do not sterilise the manometer.



7.6 PEEP Valve (if fitted)

Unscrew the PEEP valve from the absorber. Check that the sealing face of the valve disc is clean.

Check the condition of the seal (B), and replace if worn or damaged. Order Part No. 39883.



7.7 APL Valve

Cleaning - unscrew the valve from the absorber and, with the valve in the open position, wash in a warm water and soap solution, then rinse thoroughly.

Do NOT wash in an automatic cleaning/washing machine.

Sterilisation - see section 8.5. The valve must be in the open position.

8. STERILISATION

8.1 Bacterial Filters

The use of respiratory bacterial filters is highly recommended.

These are normally fitted:

- A) on the expiratory side only, or
- B) at the patient Y-piece if it is an heat and moisture exchange (HME) type.

Refer to the diagram in section 5 – 'Breathing Circuit Connections', and the information on flow resistance in sections 4.2.1, and 4.2.2.

Filters may be sterilisable or single use. Please read the labelling supplied by their manufacturer.

8.2 Sterilisation Policy

When bacterial filters are used, hoses, filters and the patient Y-piece are either treated as single use disposable items or should be disinfected or sterilised between patients (see 8.3).

The remainder of the system should be disinfected or sterilised at regular intervals (see 8.5).

If bacterial filters are not used, the complete system should be disinfected or sterilised either -

- A) every 2 or 3 days, or
- B) following each patient use, or
- C) at an interval set by the hospital infection control committee.

Always follow the guidelines in section 8.5.

8.3 Patient Circuit Components

The components should be separated, washed with warm soap and water solution, rinsed in warm water and air dried.

For suitable treatment, see section 8.5.

STERILISATION

8.4 Absorber Assembly – Cleaning Procedure Before Sterilisation

WARNING Condensation, which may collect in the bottom of the absorber is caustic and care must be taken not to spill it on the skin when draining the trap provided. After draining ensure that the drain valve is fully closed. See section 7.3

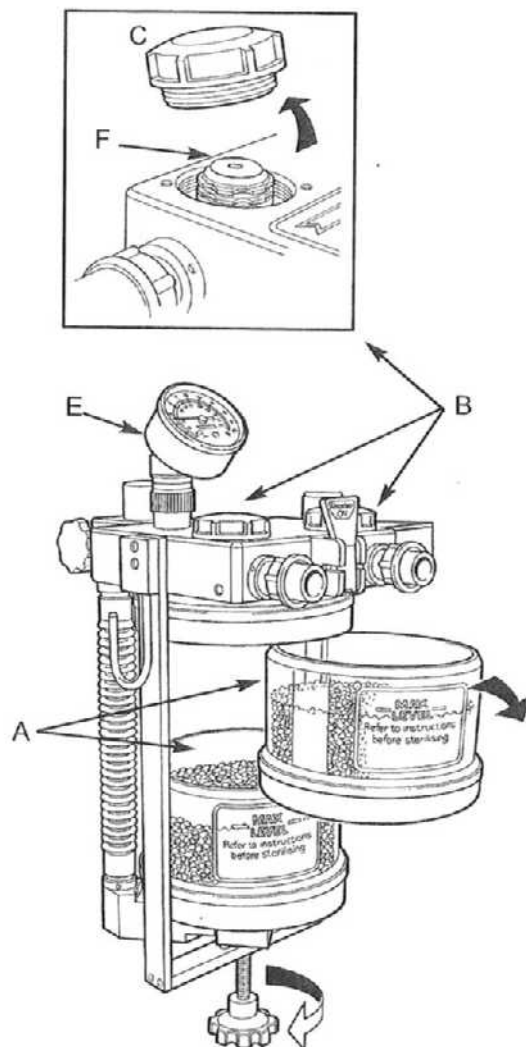
CAUTION When the absorber is lifted or carried by hand, always support the weight of the unit under the base. Do not lift the absorber by gripping any of the components attached to the manifold blocks at the top of the absorber – the manometer, APL valve, breathing circuit connectors, etc.

CAUTION Do NOT clean any component in an automatic cleaning/washing machine.

1. Drain the condensate from the absorber – see section 7.3.
Dilute the liquid with water before disposal.
2. Remove the canisters (A), dispose of soda lime. Thoroughly scrub off all particles of absorbent.
3. Detach the inspiratory and expiratory non-return valve assemblies (B) – unscrew the dome (C) and take out the valve discs (D).
Carefully wash all components in a warm water and soap solution, then rinse and air dry.
Do not bend the discs.
4. Wash the frame internally with warm water.
5. Remove the manometer (E), if fitted. See section 7.5.

Refitting

Note - Refit the discs - the face with the white marking (F) must be uppermost.



STERILISATION

8.5 Sterilisation and Disinfectant Treatment Table

<i>Component</i>	<i>Soap water</i>	<i>Cidex Sonacid (Note 1)</i>	<i>Steam Autoclave</i>	<i>Maximum Temperature</i>	
				<i>°F</i>	<i>°C</i>
Breathing hoses (Penlon)	yes	yes	yes	278	137
Safelock fittings	yes	yes	yes	278	137
Reservoir bag (Penlon)	yes	yes	yes	278	137
Manifold block (including non- return valves)	yes	yes	yes	278	137
Frame assembly	yes	yes	yes	278	137
Canisters	yes	yes	no	–	–
APL valve	yes	yes	yes	278	137
Pressure gauge	no	no	no	–	–
PEEP valve	yes	yes	yes	278	137

General Notes:

1. Thorough rinsing in warm water and drying in air should follow chemical disinfection.
2. Do NOT clean any component in an automatic cleaning/washing machine.
3. Before clinical use, ALWAYS carry out the Pre-use Checks listed in section 6 of this manual.

9. ORDERING INFORMATION

Contact the Sales Department at Penlon Ltd for details.

	UK:	International:
Tel:	01235 547036	+44 1235 547001
Fax:	01235 547023	+44 1235 547021
E-mail:	uksales@penlon.co.uk	export@penlon.co.uk

Fresh gas hose	52590
Manometer	58428
Breathing circuit (black rubber)	58436
PEEP valve	58429
Mounting pole	52584
Absorber detachables	52582

Note:

1. Absorber detachables consists of:
 - 3 litre breathing bag
 - 1.05m (42 inch) breathing tube
 - Female mount
 - Connector mount
 - Facemask elbow
 - Y piece
2. All standard connectors are for use with 30 mm taper anti-pollution systems. Models compatible with 19 mm systems are available on request.

10. APPENDIX

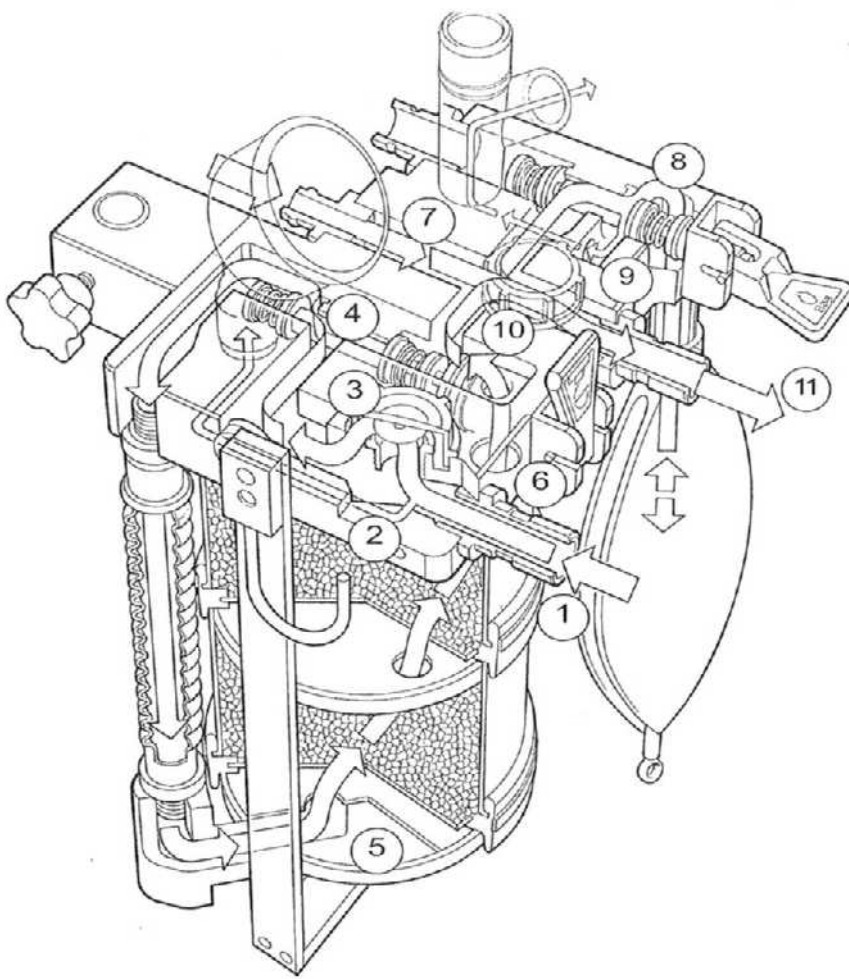
Gas flow diagrams

The following pages contain gas flow diagrams as follows:

- | | |
|--------------------------------------|--|
| 1. Absorber 'ON' / Bag 'ON' | Expired gas flows through the canisters. The reservoir bag and APL valve are in circuit. |
| 2. Absorber 'OFF' / Bag 'ON' | Expired gas bypasses the canisters. The reservoir bag and APL valve are in circuit. |
| 3. Absorber 'ON' / ventilator 'ON' | Expired gas flows through the canisters. The ventilator is in circuit. |
| 4. Absorber 'OFF' / Ventilator 'OFF' | Expired gas bypasses the canisters. The ventilator is in circuit. |

NOTE

1. *The manometer (if fitted) is always in circuit, showing expiratory pressure.*
2. *The APL valve is out of circuit when the system is in 'Ventilator' mode.*
3. *The absorbent canisters are sealed from the breathing circuit when the absorber is in bypass mode (Absorber 'OFF').*

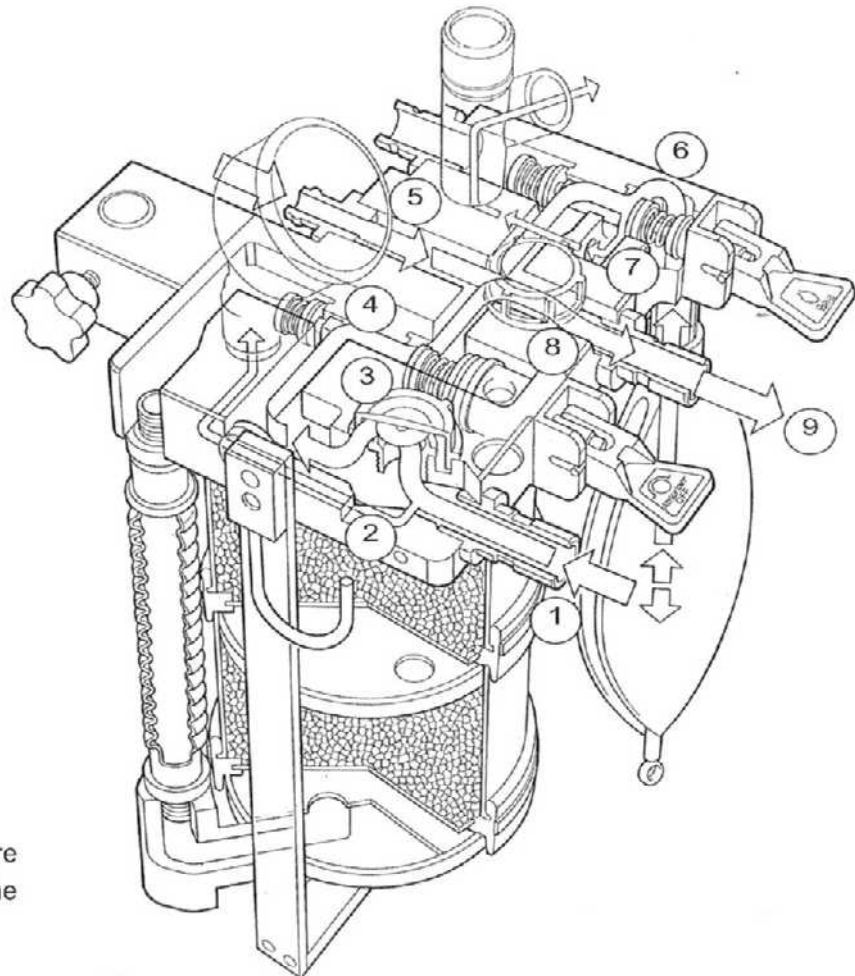


Absorber 'ON' / Bag 'ON'

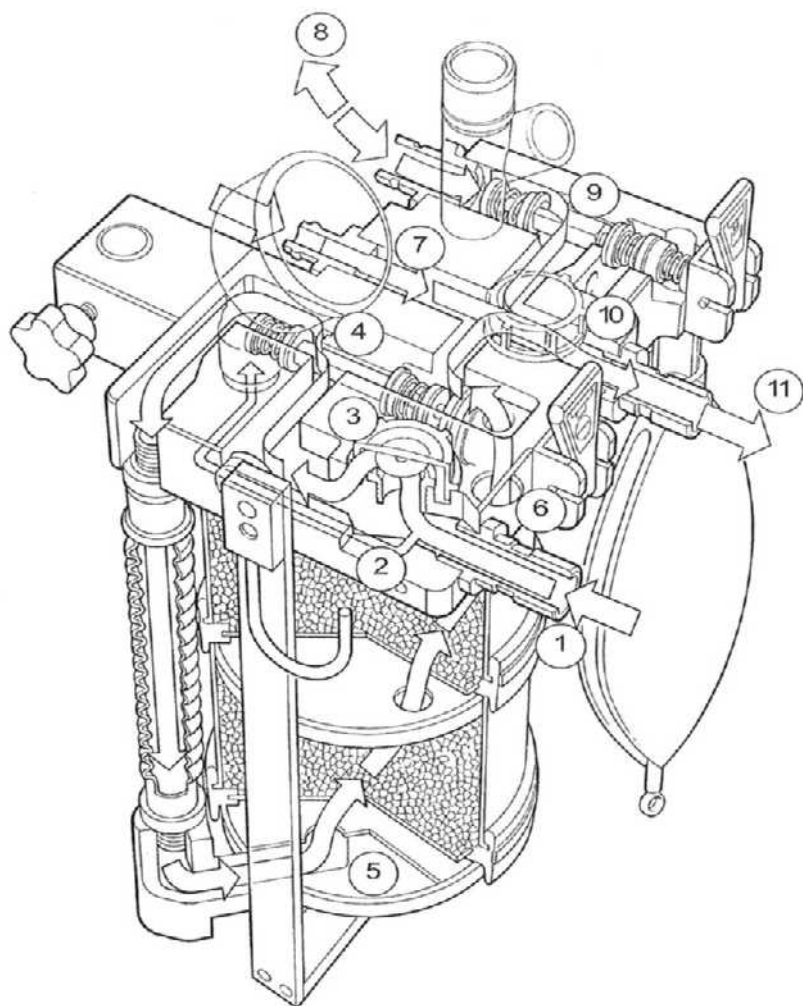
1. From patient, through expiratory connector
2. Gas path to manometer
3. Expiratory non-return valve
4. Through the absorber On/Off (bypass) control – Absorber 'ON'
5. Into absorbent canisters
6. Out of absorbent canisters
7. Fresh gas in
8. Flow from reservoir bag through bag/ventilator control – Bag 'ON'
9. Gas path to APL valve (bag in circuit)
10. Inspiratory non-return valve
11. To patient, through inspiratory connector

Absorber 'OFF' / Bag 'ON'

1. From patient, through expiratory connector
2. Gas path to manometer
3. Expiratory non-return valve
4. Through the absorber On/Off (bypass) control – Absorber 'OFF'
5. Fresh gas in
6. Flow from reservoir bag through bag/ventilator control – Bag 'ON'
7. Gas path to APL valve (bag in circuit)
8. Inspiratory non-return valve
9. To patient, through inspiratory connector



Note that the absorbent canisters are sealed from the breathing circuit when the absorber is 'OFF'.

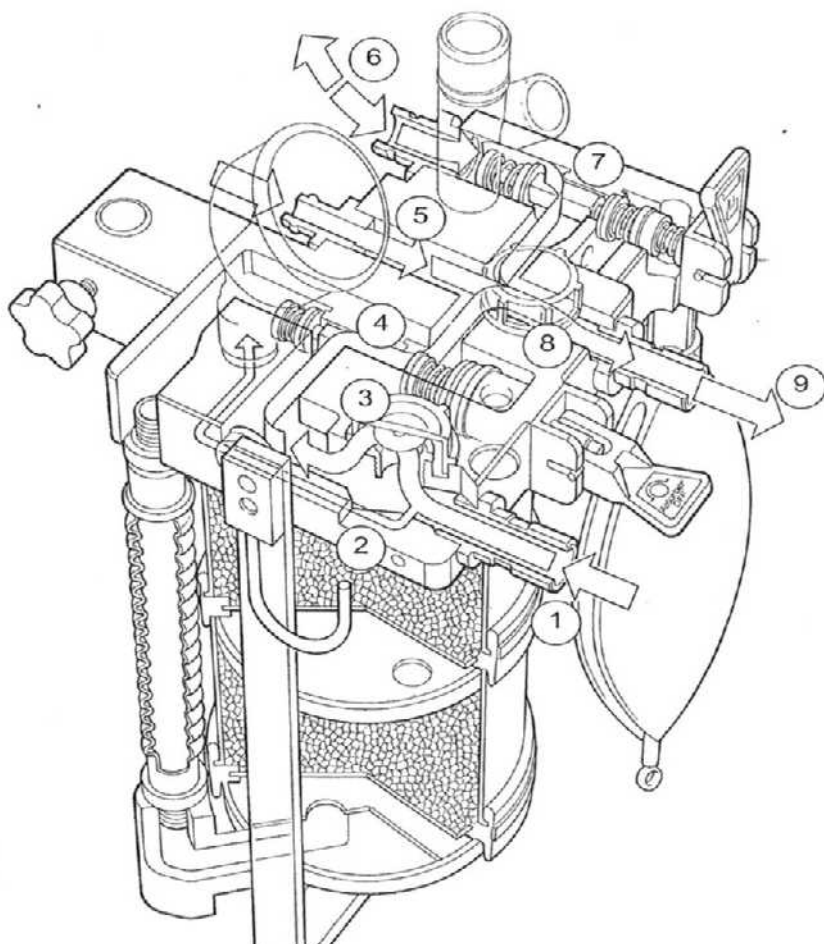


Absorber 'ON' / Ventilator 'ON'

1. From patient, through expiratory connector
2. Gas path to manometer
3. Expiratory non-return valve
4. Through the absorber On/Off (bypass) control – Absorber 'ON'
5. Into absorbent canisters
6. Out of absorbent canisters
7. Fresh gas in
8. Flow from ventilator
9. Through bag/ventilator control – Ventilator 'ON'
10. Inspiratory non-return valve
11. To patient, through inspiratory connector

Absorber 'OFF' / Ventilator 'ON'

1. From patient, through expiratory connector
2. Gas path to manometer
3. Expiratory non-return valve
4. Through the absorber On/Off (bypass) control – Absorber 'OFF'
5. Fresh gas in
6. Flow from ventilator
7. Through bag/ventilator control – Ventilator 'ON'
8. Inspiratory non-return valve
9. To patient, through inspiratory connector



Note that the absorbent canisters are sealed from the breathing circuit when the absorber is 'OFF'

USER NOTES



InterMed

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