IMPORTANT
Includes component upgrade information:
a) Inspiratory/expiratory valves
b) Canister and Release/Lock System;
c) APL Valve

Partnership for Life
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 this A200SP Circle Absorber service manual. 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, servicing and maintenance checks applicable to the A200SP 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 make themselves familiar with the contents of this manual and the machine function before using the apparatus.

IMPORTANT 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.
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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 or, 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 servicing or repairing this Anaesthetic Apparatus.

WARNINGS

General Information

1. Personnel must make themselves familiar with the contents of this manual and the function of the A200SP Absorber before servicing or 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 A200SP 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 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 absorber must comply to ISO 5367 (Hoses) and ISO5362 (Breathing Bags) respectively. The resistance and compliance of these hoses and bags provide essential factors for the satisfactory use of this system.

7. Do not connect a vacuum systems must not directly 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 the canister can lead to inefficient CO2 absorption. Overfilling may result in poor sealing of canister due to caking of granules and abrasion of the canister and seal. See 3.1 and 5.3.

9. Do not use the 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 selector switch before the unit is used clinically.

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

Using the absorber

11. Condensation, which may collect in the bottom of the absorber canister is caustic and care must be taken not to spill it on the skin when draining. See section 7.3.

12. 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.

13. Any breathing system utilising the A200SP absorber must be fitted with:
   a) An oxygen monitor complying with ISO7767.
   b) A breathing system integrity alarm.

14. Refitting the canister - failure to rotate the canister to the fully closed position may cause a system leak and/or a reduction in CO2 absorption (see 5.3).
WARNINGS AND CAUTIONS

CAUTIONS

1. Do not sterilise (autoclave) the manometer.

2. Do not immerse in liquid or autoclave the electrical interface unit, and the heater unit (if fitted) at the rear of the absorber.

3. Remove the absorbent canister before autoclaving.

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 top of the absorber - the manometer, APL valve, breathing circuit connectors, etc.

5. Do not use any ventilator with the A200SP absorber that does not comply with ISO 8835 part 2.
2. PURPOSE

The A200SP Absorber is designed for use as part of a closed breathing system for anaesthesia, providing CO₂ absorption in conjunction with the appropriate ventilator, 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.

The system incorporates a Bag/Ventilator switch to enable:

a) spontaneous breathing or manually assisted ventilation in ‘Bag’ mode.

b) use with an anaesthesia ventilator when ‘Ventilator’ is selected.
A200SP Circle System Absorber

1. Inspiratory hose connector
2. Expiratory hose connector
3. Canister
4. Expiratory non-return valve (NRV)
5. Bag/ventilator switch
6. Reservoir bag connector
7. Electrical interface unit
8. Ventilator bellows housing
9. Manometer
10. Adjustable pressure limiting valve (APL valve)
11. Inspiratory non-return valve (NRV)
3. DESCRIPTION

3.1 Canister

Mounting
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.

Absorbent Capacity
The canister (1) is designed to take a prepacked unit, or hold 1.3 kg (equivalent to 1500 ml) of loose absorbent in its inner container.

NOTE
Remove the inner container from the canister if a pre-pack unit is to be used.

DO NOT OVERFILL the inner container - see section 5.3.

Refill During Use
The canisters seals at the top face.
The canister can be removed and refilled during a clinical procedure.

Gas Flow
The gas flow through the canister is from top to bottom.

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.

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 rubber disc located over a valve seat. The discs operate by gravity and are retained by guides to prevent lateral movement.

The valves are visible through the top cover (2) 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.

3.3 Bag/Ventilator Switch (3)

Ventilator mode
In ‘Ventilator’ mode the reservoir bag is closed off from the breathing system and the ventilator connection port 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.

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.
3.4 Adjustable Pressure Limiting (APL) Valve

The 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 1.0 cmH₂O at 6 L/min. This can be increased by clockwise rotation to 60 cmH₂O.

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

Taper connector (1) at rear of absorber assembly.

3.5 Fresh Gas Inlet and Tubing

The fresh gas inlet (2) is at the rear of the absorber.

The absorber is supplied with a fresh gas hose assembly with attached end fitting. Do not use any other type of hose

**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.*
DESCRIPTION

3.6 Manometer

*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.

Manometer scale: $-10$ to $+100 \text{ cmH}_2\text{O}$

Manometer accuracy: $\pm 5\%$

(within range $+10$ to $80 \text{ cmH}_2\text{O}$)

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

3.7 Heater Unit (option)

The heater unit (1) limits the build up of moisture in the gas paths through the absorber.

**CAUTION**
Do not autoclave the heater unit.

3.8 Bypass System

*It is strongly recommended that a capnometer is used to prevent the risk of hypercapnia.*

When the canister is removed, expiratory gas passes directly to the APL valve and bag, or ventilator, without passing through the absorbent.

This allows the canister to be refilled during a clinical procedure.

3.9 End Tidal Carbon Dioxide Monitoring

The use of end tidal carbon dioxide monitoring is strongly recommended.

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.
3.10 Interface to AV-S Ventilator

The absorber is designed to interface with the AV-S Ventilator and the ventilator bellows unit (1) is built into the absorber.

The interface cable links the connector (2) on the ventilator control panel to the multifunction connector (3) on the interface unit at the rear of the absorber.

a) The A200SP is fitted with a sensor that detects the position of the absorber bag/vent control (4). The sensor signal cabling is routed internally to connector (3).

b) Operation of the Bag/Vent control will trigger automatic Mode switching on the AV-S ventilator, as follows:

i) If the Absorber Bag/Vent control is moved from Vent to Bag, the ventilator will change from Volume Mode, or Pressure Mode, into Spontaneous Mode.

ii) Switching the absorber Bag/Vent control from Bag to Vent: The ventilator will reset from Spontaneous Mode to the previously set active mode.

iii) If the ventilator is in any mode other than those detailed above, operation of the absorber Bag/Vent control will not affect the ventilator.

NOTE This function can be enabled/disabled through the AV-S on-screen menus (refer to the AV-S user manual).
DESCRIPTION

3.11 Gas Flow Schematic

Inspiratory Gas Path

1. Patient Gas from bellows
2. Through the bag/vent switch
3. Down to absorbent canister
4. Through the absorbent
5. Fresh gas flow from anaesthetic machine
6. Into the inspiratory non-return valve
7. Through inspiratory connector to patient breathing circuit
4. SPECIFICATION

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

4.1 General Dimensions
All figures are approximate

- Overall height: 380 mm
- Width: 186 mm
- Depth: 240 mm
- Weight (empty): 5.7 kg
- Mounting system: Polemount assembly

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.

NOTE:
1. The canister must be filled to the correct level with fresh absorbent (follow the instructions in section 5.3).

2. A bacterial filter must be used in the patient breathing system to protect the oxygen sensor.
   Use an appropriate filter that does not raise the resistance values of the whole system to above 0.6 kPa (6 cmH₂O).

3. The APL valve must be 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)

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)
4.3 Internal Compressible Volume
Note that the reservoir bag is not fitted and the bag mount blocked.

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.
Volume required to raise the system pressure to 3 kPa (30 cmH₂O) = 180 ml

(B) Absorber only.
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.

4.4 System Leakage Rate
The patient connection port is sealed and the APL valve fully closed.

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.
Absorber ‘ON’
Leakage rate: less than 50 ml/min at 3 kPa (30 cmH₂O)

(B) Absorber only.
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 correct level (see section 5.3), the canister inner container 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, a pre-pack unit may be used.

Note
i) The absorber canister is 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.

4.7 Heater (option)

Voltage 110 - 240 VAC
Current 1.5 - 0.7 A
Frequency 50/60 Hz
Fuse T2 AH 250 V
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 block at the top of the absorber.

WARNING
The absorber assembly 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.

Polemount bracket assembly (1)
Secure the polemount assembly to the side of the anaesthetic machine.

Mount the absorber on the bracket assembly, and secure by tightening the knob (2)

Height Adjustment
Slacken the knob (2) and position the assembly at the required height.
Tighten the knob.
5.2 System Connection

Hoses and Cables Schematic: AV-S and A200SP Absorber

1. Bellows
2. Ventilator Control Unit
3. Outlets to Anaesthetic Gas Scavenging System (AGSS)
4. Bacterial Filter
5. Absorber valve block
6. Heat and moisture exchanger
7. Patient
8. CGO on anaesthetic machine (Fresh Gas Supply)
9. Auxiliary Outlet on anaesthetic machine (Drive Gas Supply)
10. Flow sensor - expiratory
11. Flow sensor - inspiratory
12. Connectors - sensor - pressure monitor
13. Expiratory Valve - Absorber
14. Inspiratory Valve - Absorber
15. Inlet - from Ventilator Bellows
16. Connector - Reservoir Bag
17. Inlet - Absorber - Fresh Gas Supply
18. Drive Gas Inlet - Ventilator
19. Drive gas Outlet - ventilator control unit to bellows
20. Outlet - Exhaust Valve
21. Inlet - Bellows Drive Gas
22. Outlet - to breathing system
23. Input socket - Oxygen monitor sensor
24. Input socket - Prima SP interface (SP on/off switch)
25. Input socket:
   (i) A200SP Absorber Bag/Vent control position
   (ii) Spirometer sensor signal
26. Interface connections on Prima SP and A200SP
27. APL Valve
28. Outlet from APL Valve to AGSS
29. Oxygen sensor
5.2.1 Breathing System Hose, Reservoir Bag, Ventilator

Inspiratory (1) and expiratory (2) hose connectors and the reservoir bag connector (C) are 22 mm male, complying with ISO 5356/1.

The bag arm (3) is height adjustable, and the bag connector can be rotated to the desired position.

Ventilator connection point (4). Connect a 16 mm diameter corrugated hose between the ventilator control unit drive gas outlet (labelled: DRIVE GAS) and the connector (4) at the rear of the absorber.

5.2.2 Fresh Gas Supply

The fresh gas hose from the common gas outlet of the anaesthetic machine assembly is connected at (5).

5.2.3 Anaesthetic Gas Scavenging (AGS)

The outlet (6) from the APL valve (7) must be connected to a receiver system.

**WARNING**

*Do not connect a vacuum system directly to the APL valve.*

*A receiving system with a positive and negative pressure control function must be interposed.*

*The system must comply with the requirements of ISO 8835 part 2.*

5.2.4 Oxygen Monitor

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

Oxygen Monitor - the sensor (8) is fitted to the right hand side of the absorber.

**Bacterial Filter**

Use a breathing system bacterial filter in the expiratory limb of the breathing circuit to protect the oxygen sensor (see section 5 in the AV-S ventilator user manual).

**CAUTION**

*Replacement/Disposal - always follow the instructions supplied with the filter, and always replace at the recommended interval.*

5.2.5 Pressure Monitor

Pressure monitor self-sealing connector (9). Connect to PATIENT PRESSURE port on the rear panel of the AV-S ventilator control unit.

5.2.6 Bag/Vent Switch and Spirometer

The multifunction connector (10) provides an interface between the AV-S ventilator and

(a) the spirometer flow sensors, and

(b) the sensor that detects the position of the Bag/Ventilator switch (11).
5.3 Changing CO₂ Absorbent

*WARNING*
*If the absorbent is to be changed during clinical use, adequate fresh gas flow must be maintained to prevent excessive build up of CO₂.*

Removing the canister

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

1. Grip the handle (1), turn the canister anti-clockwise, and remove carefully.
2. Check the level of liquid in the canister. Carefully lift out the inner absorbent container (2), or pre-pack unit.
*WARNING*
*Condensate may drip from the container or pre-pack. Use a cloth to prevent spillage.*
3. Dilute the liquid in the canister with water before disposal. Follow your hospital procedure.
4. Dispose of the pre-pack or absorbent from the inner container (2).

Cleaning

Soda lime tends to adhere strongly to surfaces when it has become exhausted.

To maintain good sealing, the canister, absorbent container, seal, and the sealing plate above the canister should be wiped with a damp cloth to remove particles of soda lime, whenever the absorbent is changed.

Refilling with absorbent

Pre-packed soda lime:

1. Check that the three spacers (3) are in place.
2. Check that the carrier (4) is in place.
3. Check the manufacturer’s instructions included with the pre-pack.
4. Remove the packaging and insert the new pre-pack into the carrier in the canister.
Bulk packed (loose) soda lime:

2. **WARNING**
   Underfilling can lead to inefficient CO\textsubscript{2} absorption.
   Overfilling may result in poor sealing of the canister, due to caking of granules and abrasion of the canister seal.

Check that the container (2) is clean and dry and empty of dust or soda lime granules.

Place the container on a horizontal surface and fill it with soda lime up to a level 25 mm (1 inch) below the top.

**Do not fill above this level.**

Check that the three spacers (3) are in place, and place the container in the canister.

**Refitting the canister**

1. Refit the canister.
   Check that the seal and the canister align correctly as the canister is rotated clockwise.
   Grip the canister firmly, using two hands to rotate clockwise until the stop is reached.
   Check that the arrows (1) are aligned.

   **WARNING**
   Failure to rotate the canister to the fully closed position, may cause a system leak and/or a reduction in CO\textsubscript{2} absorption.

2. Leak test the absorber – see section 6.2.

**5.4 Manometer**

The manometer (1) is located on the top of the manifold block, to the rear of the inspiratory valve.
If the manometer has been removed and refitted, Function test the absorber, checking for leaks at the manometer, before clinical use.

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

**5.5 Heater (option)**

Connect the cable (mains electrical supply) to the socket (1) on the back of the heater unit (2).
Secure the cable with the safety clip (3).

The heater operates automatically, with a thermostatic control system.

**CAUTION**
Do not immerse or autoclave the heater assembly. Remove the unit before the absorber assembly is cleaned and sterilised (see section 8.4).
6. PRE-USE CHECKS

6.1 Pre-use Checklist

1. Check the absorbent, replace if necessary.
   Before refitting the canister, check that the sealing surfaces are clean and dust free. Ensure that the canister is fully rotated and seals securely when refitted (see 5.3).

2. Check that the fresh gas hose is connected 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 for correct operation – see section 6.5.

7. Heater (if fitted) - connect to mains supply and check operation.

8. Carry out a leak test with the canister removed - see 6.6.

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.

Check that the manometer is zeroed before use.

6.2 Leak Test

Check that the bag is correctly fitted, and set the switch (1) to 'Bag'.
Connect the fresh gas hose to the anaesthetic machine.
Use a breathing system hose to connect the patient ports (2) to form a closed, leak-free circuit.
Close the APL valve (3).

1. Turn on a flow of 2 L/min of oxygen and pressurise the system.
2. Stop the gas flow when the system pressure reaches 3 kPa (30 cmH\textsubscript{2}O) and check that pressure is maintained, i.e. the pressure must not fall to zero in less than one minute.

6.3 APL Valve Test and Pressure Relief Test

APL Valve Function
1. Open the APL valve (3).
Check that gas escapes freely from the system through the valve outlet.

APL Valve Flow Resistance
2. Set maximum flow and check that the retained pressure is less than 0.5 kPa (5 cmH\textsubscript{2}O).
3. Reduce flow to minimum.

Pressure Relief
4. Close the APL valve fully (clockwise).
5. Remove the reservoir bag and block the bag port (4).
Use the flow controls on the anaesthesia 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 cmH\textsubscript{2}O) ± 10% at 6 L/min.
Refit the reservoir bag.
6.4  Inspiratory and Expiratory Non-return Valve Test

1. Detach the hose connecting the inspiratory (1) and expiratory (2) connectors.
2. Check that the APL valve (3) is closed.
3. Block the inspiratory valve outlet (1) with a suitable bung, and inflate the reservoir bag 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 (2).
5. Remove the bung and attach a spare reservoir bag to the inspiratory valve connector (1).
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 (1).

6.5  Bag/Ventilator Switch

1. Refit the breathing hose between the inspiratory (1) and expiratory (2) connectors.
2. Set a flow of 10 L/min and check that bellows starts to inflate. Ensure that bag is not inflating.
3. Move switch (4) to Bag position and watch bag inflate and bellows stops rising. When the pressure reads 3 kPa (30 cmH2O) turn off the flow of gas.
4. Select ventilator, pressure on gauge should drop, but bag should remain inflated.
5. Squeeze bag, there should be no loss of pressure, and bellows must not rise.
6.6 Leak Test - Absorber Canister Removed

1. Remove absorbent canister (1).
   Set the switch (2) to Bag position and close APL valve (3).

2. Pressurise the system to 3 kPa (30 cmH2O) and turn off the gas flow.

3. Check that pressure does not fall to zero within one minute.

4. Refit absorbent canister.
   Check that the seal and the canister align correctly as the canister is rotated clockwise.
   Grip the canister firmly, using two hands to rotate clockwise until the stop is reached.
   Check that the arrows (4) are aligned.

   **WARNING**
   *Failure to rotate the canister to the fully closed position, may cause a system leak and/or a reduction in CO2 absorption.*

5. A pressure loss will occur as valves operate during refitment.
   Repressurise the system to 3 kPa (30 cmH2O) and turn off gas flow.

6. Check that pressure does not fall to zero within one minute, then open APL valve to release pressure.
7. SERVICE PROCEEDURES

7.1 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 include routine replacement of seals etc., as preventive maintenance.

7.2 Canister and Seals

Cleanliness is the essential requirement for all components in contact with absorbent.

Soda lime tends to adhere strongly to surfaces when it has become exhausted.

To maintain good sealing, the canister, absorbent container, seal, and the sealing plate above the canister should be wiped with a damp cloth to remove particles of soda lime, whenever the absorbent is changed.

These components should be 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 canister is caustic and care must be taken not to spill it on the skin when draining.*

*Wear suitable protective gloves.*

Dilute the liquid with water before disposal.

**Daily Procedure:**

1. Check the level of liquid in the canister (1).
   If necessary, remove the canister by turning anti-clockwise.
   Carefully lift out the inner absorbent container (2), or pre-pack unit.
   **WARNING**
   *Condensate may drip from the container or pre-pack.*
   *Use a cloth to prevent spillage.*

2. Dilute the liquid in the canister with water before disposal. Follow your hospital procedure.

3. Refit the container or pre-pack:
   **Pre-packed soda lime:**
   Check that the three spacers (3) are in place.
   Check that the carrier (4) is in place
   Insert the pre-pack into the carrier in the canister.
   **Bulk packed (loose) soda lime:**
   Check that the three spacers (3) are in place, and place the container in the canister.

4. Refit the canister to the absorber.
   Check that the seal and the canister align correctly as the canister is rotated clockwise.
   Grip the canister firmly, using two hands to rotate clockwise until the stop is reached.
   Check that the arrows (5) are aligned.

**WARNING**

*Failure to rotate the canister to the fully closed position, may cause a system leak and/or a reduction in CO2 absorption.*

Leak test the absorber – see section 6.2.
SERVICE PROCEDURES

7.4  Manometer
Remove the manometer (A) before sterilisation or disinfection.
Grip the manometer and detach from the absorber.

CAUTION  Do not sterilise the manometer.

7.5  APL Valve
Autoclave the valve (B) as part of the absorber assembly - see section 10.
Check that the valve is in the open position before autoclaving.

Do NOT wash in an automatic cleaning/washing machine.
7.6 Main Assembly Components
Tightening Sequence for Fixing Bolts

Note
This procedure is part of the service schedule (see section 8, operation 10).

1. Refit the Base Plate gasket; Centre Plate, and Bellows Plate gasket
   When refitting the Bellows Plate ensure that the Bag/Ventilator knob is aligned with quadrant shaft, and the switch ‘Push-Pin’ is engaged.

2. Secure the Bellows Plate with nine bolts.

3. Apply a small amount of Loctite 243 to the nine fixing bolts.
   Fit the bolts and hand tighten.

4. Starting at the fixing points ‘A’ at the rear of the absorber assembly, tighten the bolts in sequence A to D, to 1.5 Nm.
8. **SERVICE SCHEDULE**

1. **Initial Checks** (every 6 months, plus component replacement at 12 months)
   1.1 Check serial number to determine service required.
   1.2 Check general condition of Absorber and fittings.
   1.3 Remove the absorbent canister.
       Remove the inner canister, or pre-pack.
       Drain any condensate from outer canister. **Caution: Caustic solution**
       Refit if component replacement is not required.
       If a canister lift mechanism is fitted, apply a thin (non-visible) film of oxygen safe
       grease to guide pins.
   1.4 If component replacement is required, disconnect fittings at rear of absorber and
       remove absorber from anaesthesia machine.
       Place absorber on flat work surface.
       Remove the absorbent canister.
       Replace the canister location tubes (x3) - 500396 (every 12 months)
       Remove the heater unit (if fitted).
       Replace fresh gas hose - 462631, and two tie-wraps - 103612 (every 12 months)
       Note: The Preventive Maintenance Kit contains various lengths of hose. **Fit the correct
       length of hose required for your machine.**

2. **Bag arm assembly** (every 6 months, plus component replacement at 12 months)
   2.1 Check the bag arm assembly for movement and security of attachment
   2.2 Unscrew Bag arm connector.
       Replace O-ring - 041217, and internal O-ring - 041207 (every 12 months)

3. **Manometer** (every 6 months, plus component replacement at 12 months)
   3.1 Grip manometer assembly and remove by pulling firmly upwards.
       Remove manometer and ensure it indicates zero. If not adjust using small screw.
   3.2 Using a hand-bulb and test manometer apply increasing pressure, up to 100 cmH2O.
       Ensure manometer reads within +/- 5 cmH2O.
   3.3 Replace manometer O-ring - 5000349 (every 12 months)

4. **Bellows assembly** (every 6 months, plus component replacement at 12 months)
   4.1 Remove bellows canister.
       Examine bellows, diaphragm and canister seal for cleanliness and deterioration
   4.2 Replace canister seal - 5000072 (every 12 months)
   4.3 Replace bellows and diaphragm valve as part of ventilator service procedure

5. **Electrical Interface Box** (every 12 months)
   Disconnect electrical interface connector.
   Undo the four screws securing electrical box to absorber, and remove electrical box
   Replace four O-rings - 0691

6. **Internal component inspection / replacement (upper assembly)** (every 12 months)
   6.1 Inspect APL valve:
       2008 specification (grey label with black text):
       Remove label and use tool 5003177 to unscrew the APL valve from absorber.
       Pre-2008 specification (black label with grey text):
       Do not remove APL valve.
SERVICE SCHEDULE

6.2 Undo the nine bolts and lift up Bellows Plate
6.3 Replace Bellows Plate gasket - 5000080
   Replace Inspiratory and Expiratory Disc valves (x2) - 5000394
   Fit valve disc cages – 5002459 (ensure cage guides do not interfere with dome guides)

7 APL Valve (every 12 months)
7.1 Pre-2008 specification (black label with grey text):
   Replace APL valve seal (white) – 5000364.
7.2 2008 specification:
   Replace O-ring – 0383 and O-ring 5000126

8 Internal component inspection and replacement (Lower) (every 12 months)
8.1 Detach the Centre Plate
8.2 Replace the Base Plate gasket - 5000081
8.3 Replace the Bag/Ventilator switch O-rings (x2) - 5000202, and cap O-ring - 0501

9 By-pass plate removal (every 12 months)
9.1 Remove the two screws from the canister plate that secure the valve seals and supports, and remove
   Remove further two ‘E’ clips from the bypass plate guides.
   Detach the Bypass Plate from the Bellows Plate.
9.2 Replace gasket - 5000092 (absorbent canister)
9.3 Replace large O-ring - 5000754, and small O-ring - 5000755
9.4 Replace valve seals (x3) - 5000097
9.5 Replace seal support internal O-rings (x3) - 5000135
9.6 Apply oxygen-safe grease to the Bypass Plate Guides.
   Reassemble

10 Reassembly (every 12 months)
10.1 Refit Base Plate gasket; Centre Plate; Bellows Plate gasket
10.2 When refitting Bellows Plate ensure that (a) the Bag/Ventilator knob is aligned with the quadrant shaft, and (b) the switch 'Push-Pin' is engaged.
   Secure the assembly with nine bolts, as follows:
   Apply a small amount of Loctite 243 to the threads, fit the bolts and hand tighten.
   Starting at the rear of the absorbers, tighten bolts to 1.5 Nm, in the sequence shown in section 7.6.
10.3 Refit the APL valve (2008 specification valve, removed earlier in operation 6.1).
    Using service tool 5003177, tighten the valve to 15 Nm.
    Note: if a suitable torque wrench is not available, tighten to 8 Nm +20° rotation (or firm hand tight + 20° rotation).
    Recheck when the correct torque wrench is available.
10.4 Refit Bag Arm connector and tighten (hand tight). Do NOT use Loctite.
10.5 Refit manometer ensuring it securely snaps into place
10.6 Refit electrical box and connect the interface cable
10.7 Refit bellows assembly
    Refit absorbent canister assembly, ensure full rotation to locked position
10.8 Refit heater (if fitted)
SERVICE SCHEDULE

10.9 Carry out electrical tests:
   Earth Continuity at 1 amp or less (maximum 0.2 ohms)
   Insulation resistance at 340 - 500 Vdc (not less than 20 Mega Ohms)
   Enclosure leakage (maximum 100 micro amps)

10.10 Connect heater (if fitted) to power supply for the duration of the following tests.
     Check that the centre plate is heated.

11 Set-up (every 6 months)
11.1 Connect absorber to anaesthetic machine that has been checked for leaks.
     Check that manometer reads zero.

12 Leak Test (every 6 months)
12.1 Absorber canister fitted, in locked position
12.2 Ensure that a bag is fitted to the bag port, and Bag/Vent switch is set to 'Bag' position.
12.3 Connect patient ports with hose to form a closed circuit.
12.4 Close APL valve.
12.5 Set a flow of 2 L/min on the anaesthesia machine.
12.6 Reduce the gas flow to minimum when Manometer reads 3 kPa (30 cmH2O).
     Ensure pressure remains stable for at least 10 seconds.

13 APL Valve Test And Pressure Relief Test (every 6 months)
13.1 Fully open APL valve
13.2 Set maximum flow rate.
     Check that manometer indicates less than 5 cmH2O.
13.3 Turn off gas supply
13.4 Close the APL valve fully.
13.5 Use O2 flow and check that the APL valve relieves pressure at 6 kPa (60 cmH2O) +/- 10%, at 6 L/min flow rate.
     If necessary, lift label and adjust setting screw.

14 Inspiratory and Expiratory Non-return Valve Test (every 6 months)
14.1 Remove hose from patient ports.
14.2 Occlude Inspiratory port with suitable bung.
14.3 Fully close APL valve
14.4 Fit re-breathing bag to bag arm and inflate with O2 flush.
     Ensure bag does not deflate within one minute.
14.5 Remove bung from inspiratory port.
     Transfer rebreathing bag, from bag-arm to Inspiratory port.
     Occlude bag-arm with suitable bung.
14.6 Inflate bag with O2 flush.
     Remove occlusion from bag port.
     Ensure rebreathing bag fitted to inspiratory port does not deflate within one minute.
14.7 Remove bag from inspiratory port
     Refit bag to bag-arm.
SERVICE SCHEDULE

15  Bag / Ventilator Switch Test  (every 6 months)
15.1 Ensure ventilator bellows and bag-arm bag are deflated
15.2 Refit hose to patient ports.
15.3 Set bag/vent switch to 'vent' and ensure APL valve is fully closed.
15.4 Set a flow of 10 L/min and check that the bellows starts to inflate.
   Ensure that the bag is not inflating.
15.5 When the bellows has inflated half-way move the Bag/Vent switch to Bag position.
   Observe that the bag inflates, and that the bellows stops rising.
15.6 When the pressure reads 3 kPa (30 cmH2O) turn off the flow of gas.
15.7 Select ventilator.
   Pressure on gauge should drop, but bag should remain inflated.
15.8 Squeeze bag.
   There should be no loss of pressure and bellows must not rise.

16  Absorber Bypass Function  (every 6 months)
16.1 Remove absorbent canister.
   Select Bag position and close APL valve
16.2 Pressurise the system to 3 kPa (30 cmH2O).
   Turn off gas flow.
16.3 Check that the pressure remains stable for at least 10 seconds.
16.4 Refit absorbent canister, ensure full rotation to locked position
   A pressure loss will occur as valves operate.
   Re-pressurise the system to 3 kPa (30 cmH2O).
   Turn off gas flow.
16.5 Check that the pressure remains stable for at least 10 seconds.
   Open APL valve to release pressure.

17  Paperwork  (every 6 months)
17.1 Fill out appropriate service report.
9. PARTS LIST

A200SP Preventive Maintenance Kit
Annual Service Kit - Part No 57294

Kit Contents
Component Description | Part No
--- | ---
Fresh gas hose (1.0 m) | 462631 (not shown)
Fresh gas hose (0.5 m) (SP3 Keomed) | 462631 (not shown)
Fresh gas hose (1.2 m) (Prima SP) | 462631 (not shown)
Tie wrap (x2) | 103612 (not shown)
Seal - Bellows Canister | 5000072 (not shown)
APL valve seal | 5000364 (not shown)
By-pass seal (x3) | 5000097 (not shown)
O-ring - Seal support internal (x3) | 5000135 (not shown)
O-ring - Bag vent switch cap washer | 0501 (not shown)
Seal (small) - Bypass plate | 5000754 (not shown)
Seal (large) - Bypass plate | 5000755 (not shown)
Location Tube (x3) - Absorbent canister | 5000396 (not shown)
Label - APL valve (fit if valve is adjusted) | 5000389 (not shown)

Component Description | Part No
--- | ---
O-ring - Manometer | 5000349
O-ring - Bag arm connector | 041217
O-ring - Bag arm (internal) | 041207
Disc valves (x2) | 5000394
Gasket - Bellows Plate | 5000080
Gasket - Base Plate | 5000081
Gasket - Canister | 5000092
O-ring - Bag vent switch (x2) | 5000202
O-ring (x4) - heater unit | 0691
## A200SP Absorber

### Main Assembly Components

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ADD LOCTITE 242 TO NUT WHEN APL VALVE IS FINALLY SET.
PARTS LIST

Bellows Plate Assembly

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**Base Plate Assembly**

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Installation Components and Heater Unit

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NOTE:
USE EITHER MOUNTING ASSEMBLY (30000876) OR MOUNTING & HEATER ASSEMBLY (30007107) DEPENDING ON ABSORBER VERSION REQUIRED.
Bag Arm Assembly

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* For 2008 specification
valves see Appendix 4
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## Electrical Interface Box Assembly

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<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5000707</td>
<td>Electrical Box</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>5000318</td>
<td>Bracket - microswitch</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>500553</td>
<td>Screw - M2 x 10</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>019170</td>
<td>Screw - M3 x 8</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>025006</td>
<td>Washer - M3</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>01066</td>
<td>Nut - M3</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>019106</td>
<td>Screw - M2.5 x 20</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>5000708</td>
<td>Plate</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>019002</td>
<td>Screw - M3 x 8</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>5000462</td>
<td>Cable assembly (includes 5000496 and 5000462)</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>500963</td>
<td>Label</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>104005</td>
<td>Fixing - Screwlock 4-40</td>
<td>2</td>
</tr>
</tbody>
</table>
Appendix 1

Sterilisation

10.1 Sterilisation Policy
Follow your local hospital guidelines. Autoclavable components are listed in section 8.5.

10.2 Bacterial Filters
The use of respiratory bacterial filters is essential to protect the oxygen sensor mounted at the side of the absorber.

Fit a bacterial filter to the expiratory limb of the breathing circuit.

In addition a heat and moisture exchange (HME) unit should be fitted at the patient Y-piece.

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 the manufacturer.

CAUTION
Replacement/Disposal - always follow the instructions supplied with the filter or HME.
Always renew components at the recommended interval

NOTE
If a bacterial filter has not been used in the expiratory limb of the breathing circuit, the oxygen sensor may be contaminated and must be replaced.

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

For sterilisation, follow the instructions supplied by the manufacturer.
APPENDIX: STERILISATION

10.4 Absorber Assembly
Procedure Before Sterilisation

**CAUTION** Removal and refitting must only be carried out by qualified service personnel. 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 block.

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

Absorber Canister

**WARNING** Condensation, which may collect in the bottom of the absorber canister is caustic and care must be taken not to spill it on the skin when draining.

1. Remove the absorber canister (1), by turning anti-clockwise.

2. Carefully lift out the inner absorbent container (2), or pre-pack unit.
   **WARNING** Condensate may drip from the container or pre-pack. Use a cloth to prevent spillage.

3. Dilute the liquid in the canister with water before disposal. Follow your hospital procedure.

4. Thoroughly scrub off all particles of absorbent from the canister, inner container, seal and underside of the absorber assembly.

Manometer, APL Valve and Oxygen Sensor

5. Remove the manometer (3) Do not autoclave.

6. Remove the oxygen sensor (4) - disconnect the cable and unscrew the sensor from the side of the absorber Do not autoclave.

7. APL Valve (5) - autoclave the valve as part of the absorber assembly - check that the valve is in the open position before autoclaving.

Electrical Interface, Cables and Tubing

8. Disconnect all cable connectors and hoses, then remove the electrical interface unit (6). Disconnect the mains lead from the heater unit (if fitted). (refer to the illustration on next page)

Bellows Assembly - removal

9. Turn the bellows housing (7) anti-clockwise, then lift it from the base. Remove the bellows (8), by carefully pulling it off the base. Do not dismantle.

10. Undo the three retaining screws, then remove the exhalation valve assembly (9). Check that the small O-ring (10) located in the bellows base under the diaphragm valve is in place. The ventilator will not function if the O-ring is missing.
APPENDIX: STERILISATION

Dismantling and Cleaning before sterilisation

Absorber:

**CAUTION** Removal and refitting must only be carried out by qualified service personnel. 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 block.

11. Remove the absorber assembly from the anaesthetic machine:
   a) Loosen the pole-mount knob (11). Carefully lift the absorber assembly from the polemount.
   b) Remove the four screws (12), securing the absorber to the pole-mount bracket assembly (13), (or 14, if heater unit is fitted).

**WARNING:** Do NOT immerse or autoclave the heater unit (15).

12. Wash the absorber assembly internally with warm water and soap solution, then rinse and air dry.

13. Refit the canister, the absorber assembly can now be autoclaved as a single unit.

Ventilator Bellows Assembly:

**Exhalation Diaphragm Valve**

The exhalation diaphragm valve is under the bellows and can be removed by loosening the three thumbscrews.

The valve seat is now visible.

**WARNING**

Great care must be taken. Do not damage the precision surface of the valve seat (14). Never use any hard object or abrasive agent to clean it; use only a soft cloth.

If the valve seat is damaged, the diaphragm valve will leak and may cause serious malfunction.

Clean the seat, and the metal disk (15) attached to the base of the diaphragm valve, thoroughly and remove all contamination from the surfaces of both components.

**NOTE** If excessive contamination is discovered, check that a bacterial filter is used in the expiratory limb of the breathing circuit (and an HME at the patient tee-piece).

After cleaning, check that the small O-ring (10) located in the bellows base under the diaphragm valve is in place. The ventilator will not function if the O-ring is missing.
APPENDIX: STERILISATION

10.5 Sterilisation and Disinfectant Treatment Table

Note:
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.

## 10.5.1 Absorber

<table>
<thead>
<tr>
<th>Component</th>
<th>Soap water</th>
<th>Cidex Sonacid (Note 1)</th>
<th>Steam Autoclave</th>
<th>Maximum Temperature °F °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing hoses</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>(check manufacturer’s instructions)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safelock fittings</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>Reservoir bag</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>(check manufacturer’s instructions)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manifold block</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>(including non-return valves)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame assembly</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>Absorber Canister</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>Absorbent Container</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>Carrier (for pre-pack)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>APL valve</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>Pressure gauge</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>– –</td>
</tr>
<tr>
<td>PEEP valve</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>278 137</td>
</tr>
<tr>
<td>Heater (option)</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>– –</td>
</tr>
</tbody>
</table>

## 10.5.2 Ventilator Bellows

<table>
<thead>
<tr>
<th>Item</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bellows</td>
<td>Gas, liquid, autoclave (20 cycles max.)</td>
</tr>
<tr>
<td>Hoses</td>
<td>Gas, liquid, autoclave</td>
</tr>
<tr>
<td>O rings</td>
<td>Gas, liquid, autoclave</td>
</tr>
<tr>
<td>Bellows base</td>
<td>Gas, liquid, autoclave</td>
</tr>
<tr>
<td>Exhalation valve</td>
<td>Gas, liquid, pasteurise, low temperature autoclave</td>
</tr>
<tr>
<td>assembly</td>
<td></td>
</tr>
<tr>
<td>Bellows canister</td>
<td>Liquid, autoclave</td>
</tr>
</tbody>
</table>
10.6 Absorber Assembly
Reassembly after Cleaning and Sterilisation

**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 block.

**Ventilator Bellows**
Refit the diaphragm valve assembly to the bellows base and refit the bellows assembly and housing.

**CAUTION**
Always check for correct fitment of the bellows (see illustration), and function test the ventilator before clinical use (refer to ventilator user manual).

**Absorber**
Reverse the dismantling procedure given in section 10.4.
See section 5.3 for correct refitment of the absorbent canister.

**Note**
When refitting the absorbent container, or pre-pack to the canister, ensuring that the three spacers (1) are located as illustrated.
If a pre-pack is used, check that the carrier (2) is in place.

**Refitting the canister**
1. Refit the canister.
   Check that the seal and the canister align correctly as the canister is rotated clockwise.
   Grip the canister firmly, using two hands to rotate clockwise until the stop is reached.
   Check that the arrows (3) are aligned.

**WARNING**
Failure to rotate the canister to the fully closed position, may cause a system leak and/or a reduction in CO2 absorption.

Before clinical use, ALWAYS carry out the Pre-use Checks listed in section 6 of this manual.
APPENDIX: Inspiratory and Expiratory Valves

Appendix 2
Inspiratory and Expiratory Valve Discs and Locating Cage
(Introduced late 2007)

Retrofit Kit Fitting Instructions

Purpose
Fitting instructions for Retrofit Kit to update existing units with new components for the Inspiratory and Expiratory Valves.

Kit Parts List

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5001999</td>
<td>Valve disc</td>
<td>2</td>
</tr>
<tr>
<td>5002459</td>
<td>Valve disc cage</td>
<td>2</td>
</tr>
<tr>
<td>5002374</td>
<td>Fitting tool</td>
<td>1</td>
</tr>
</tbody>
</table>

NOTE
If other components require renewal, please order replacements through the normal channels. (e.g. Part No. 5000389: Label for APL valve - fit only if valve is adjusted)
APPENDIX: Inspiratory and Expiratory Valves

Procedure

1. Unscrew the bag arm connector, and remove the bag arm.

2. Undo, and remove the nine bolts (arrowed - 1) securing the bellows plate assembly (2).
   Carefully lift the front of the assembly, then slide back to disengage the switch push-pin.

3. Remove and discard the Inspiratory and Expiratory valve discs (3).

Fitting the valve disc cages

4. Carefully remove the cages (4) from their packaging.
   Use the fitting tool (5) to locate each cage correctly, and to press the cage (5) **carefully** over the valve seats (6).
   **Apply even pressure, taking care not to bend the guides (7) of each cage.**
   **Note correct fitted position of the cage (8) in the photograph.**

Reassembly

5. Fit the new valve discs (3).

6. Refit the bellows plate assembly (2), ensuring that:
   (a) the Bag/Ventilator knob is aligned with the quadrant shaft, and
   (b) the switch 'Push-Pin' is engaged.

7. Secure the assembly with nine bolts (1), as follows:
   Apply a small amount of Loctite 243 to the threads, fit the bolts and hand tighten.
   Starting at the rear of the absorbers, tighten bolts to 1.5 Nm, in the sequence (A - D) shown in the illustration.

8. Refit the bag arm and tighten the connector (hand tight). Do NOT use Loctite.

9. Carry out pre-use checks (refer to service manual).

**NOTE: The negative pressure test is not required.**
Appendix 3
Canister and Release/Lock System (2008 Specification)

Retrofit Kit Fitting Instructions

Purpose
Fitting instructions for Retrofit Kit to update existing A200SP Absorbers with a new canister and release/lock system.

WARNING
Do not use the existing canister with the new release/lock system.

Canister Release/Lock System
The canister release/lock mechanism is operated by a lever at the base of the canister assembly.

Absorbent Refill
The canister can be removed and refilled during a clinical procedure.

WARNING
If the absorbent is to be changed during clinical use, adequate fresh gas flow must be maintained to prevent excessive build up of CO2.

Bypass mode
The absorber reverts to bypass mode when the lever is turned clockwise to release the canister.
Expiratory gas passes directly to the APL valve and bag, or ventilator, without passing through the absorbent.
It is strongly recommended that a capnometer is used to prevent the risk of hypercapnia.

Kit Parts List

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Part No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5002710</td>
<td>Canister Release/Lock Assembly</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>019067</td>
<td>Screw, M4 x 12</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>5003008</td>
<td>Canister</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>5000396</td>
<td>Location tube</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>5000734</td>
<td>Spring clip</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>019122</td>
<td>Screw, M3 x 6</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>01066</td>
<td>Nut, M3</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>5000073</td>
<td>Canister, inner</td>
<td>1</td>
</tr>
</tbody>
</table>
Procedure

1. Switch off the anaesthetic machine, and relieve all gas pressure in the system.
2. Remove the canister by turning anti-clockwise.
   a) Carefully lift out the inner absorbent container, or pre-pack unit.
   WARNING Condensation, which may collect in the bottom of the absorber canister is caustic and care must be taken not to spill it on the skin when draining. Wear suitable protective gloves.
   b) Dilute the liquid with water before disposal.
      Follow your hospital procedure.
   c) Dispose of the canister and contents. Do not use the existing canister with the new lock/release system. Ensure safe disposal - follow your hospital procedure.
3. Carefully remove the pins (1) from the absorber lower moulding mounting points (A, B, C, and D).
4. Fit the new lift assembly:
   Offer up the release/lock assembly and locate each upright (2) and plate (3) at the absorber lower moulding mounting points (B, C, and D) as illustrated (underside of absorber, viewed from front).
   Fit the screws (4) to secure the lift assembly.
   Check the action of the lever (5). Ensure that the mechanism raises and lowers the base plate smoothly and evenly.
5. Rotate the lever (5) clockwise to lower the canister release/lock assembly.
6. Refer to section 5.3 in the User Manual and fill the new inner canister with absorbent (or use a pre-pack).
   Fit the new canister (7).
   WARNING Do not refit the existing canister. Ensure that the top of the canister engages correctly into the seal (8) as you rotate the lever anti-clockwise to the locked-on position.
7. Carry out pre-use checks (refer to service manual), INCLUDING A LEAK TEST.
8. If the absorber fails the leak test:
   a) Rotate the lever (5) clockwise to lower the canister release/lock assembly, and remove the canister (7).
   b) Loosen the locknut (9).
   c) Screw out the adjuster (10), approximately half a turn.
   d) Tighten the locknut (9).
   e) Repeat the leak test.

Ensure that personnel who use the absorber are aware that the unit has been modified.

IMPORTANT: Give them a copy of the revised user instructions included with the retrofit kit.
APPENDIX: Canister (2008 Specification)

Canister and Release/Lock System
Description and Service Information

Purpose
Information for A200SP Absorber with a new canister and release/lock system.

WARNING
Do not use the existing canister with the new release/lock system.

Canister Release/Lock System
The canister release/lock mechanism is operated by a lever at the base of the canister assembly.

Absorbent Refill
The canister can be removed and refilled during a clinical procedure.

WARNING
If the absorbent is to be changed during clinical use, adequate fresh gas flow must be maintained to prevent excessive build up of CO2.

Bypass mode
The absorber reverts to bypass mode when the lever is turned clockwise to release the canister.

Expiratory gas passes directly to the APL valve and bag, or ventilator, without passing through the absorbent. It is strongly recommended that a capnometer is used to prevent the risk of hypercapnia.
Modified canister and new release and lock system

Additional Information

Section 1:
WARNINGS and CAUTIONS

WARNING 15
Refitting the canister:
Ensure that the top of the canister engages correctly into the seal in the absorber as you rotate the lever anti-clockwise to the locked-on position.
Failure to lock the canister in the fully closed position, may cause a system leak and/or a reduction in CO\textsubscript{2} absorption.
Do not use an early type canister with this lock/release system.

Section 3:
DESCRIPTION

3.1 Canister

Canister Release/Lock System
The canister release/lock mechanism is operated by a lever (1) at the base of the canister assembly.
Swivel the front of the absorber assembly away from the side of the anaesthetic machine, and turn the lever clockwise to release the canister.
Note: the illustration shows the canister in the unlocked position.

Absorbent Refill
The canister (2) can be removed and refilled during a clinical procedure.

WARNING
If the absorbent is to be changed during clinical use, adequate fresh gas flow must be maintained to prevent excessive build up of CO\textsubscript{2}.

3.8 Bypass System

The absorber reverts to bypass mode when the lever is turned clockwise to release the canister. Expiratory gas cycles to the patient, without passing through the absorbent.
It is strongly recommended that a capnometer is used to prevent the risk of hypercapnia.
Section 5: 
INSTALLATION and OPERATION

5.3 Changing CO2 Absorbent

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

1. Swivel the front of the absorber assembly away from the side of the anaesthetic machine.

2. Turn the lever (1) clockwise to release the canister (2). Carefully remove the canister from the absorber.

Disposal of condensate, cleaning the canister, and refilling with absorbent:
Please refer to the existing instructions detailed in section 5.3 in the User Manual.

Refitting the canister
1. Fit the canister (2) and check that it is located centrally within the base plate (3). Turn the lever (1) anti-clockwise to lock the canister in place.
Ensure that the top of the canister engages correctly into the seal (4) as you rotate the lever anti-clockwise to the locked-on position.

WARNING
Failure to lock the canister in the fully closed position, may cause a system leak and/or a reduction in CO2 absorption.
Do not use an early type canister with this lock/release system.

2. Leak test the absorber - see section 6.2 in the User Manual.
## APPENDIX: Canister (2008 Specification)

### Parts List

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Part No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5002710</td>
<td>Canister Release/Lock Assembly</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>019067</td>
<td>Screw, M4 x 12</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>5003008</td>
<td>Canister</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>5000396</td>
<td>Location tube</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>5000734</td>
<td>Spring clip</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>019122</td>
<td>Screw, M3 x 6</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>01066</td>
<td>Nut, M3</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>5000073</td>
<td>Canister, inner</td>
<td>1</td>
</tr>
</tbody>
</table>
Additional Service Procedures

Pre-use checks

If the absorber fails the leak test:

1. Check the action of the lever (1). Ensure that the mechanism raises and lowers the base plate (2) smoothly and evenly.
   a) Rotate the canister lever (3) clockwise to lower the canister release/lock assembly, and remove the canister.
   b) Loosen the locknut (4).
   c) Screw out the adjuster (5), approximately half a turn.
   d) Tighten the locknut (4).
   e) Fit the canister

   Check that the canister is located centrally in the base plate (2). Turn the lever (3) anti-clockwise to lock the canister in place.

   **Ensure that the top of the canister engages correctly into the seal (6) as you rotate the lever anti-clockwise to the locked-on position.**

   e) Repeat the leak test.
APPENDIX: APL Valve (2008 Specification)

Appendix 4 : 2008 Specification APL Valve
APL Valve - Retrofit Kit Part No. 5003182

Purpose
Fitting instructions for Retrofit Kit to update existing A200SP Absorbers with latest specification APL Valve (introduced in April 2008).

Identification
1. The new valve has four drillings ‘X’ on the top face.
2. The new valve is secured by screwing directly into the absorber centre plate assembly.

Service Tool
5003177 APL valve fitting adaptor

Kit Parts List

<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5003173</td>
<td>APL valve assembly</td>
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<tr>
<td>2</td>
<td>5003175</td>
<td>Label</td>
</tr>
<tr>
<td>3</td>
<td>0383</td>
<td>O-ring</td>
</tr>
</tbody>
</table>

NOTE
If other components require renewal during the refit procedure, please order replacements through the normal channels.
APPENDIX: APL Valve (2008 Specification)

Procedure
1. Remove the bellows canister (1) and bellows.

2. Unscrew the bag arm connector, and remove the bag arm and post (2).

3. Undo, and remove the nine bolts (arrowed - 3) securing the bellows plate assembly (4). Carefully lift the front of the assembly, then slide back to disengage the switch push-pin from the interface unit (5) at the rear of the absorber.

4. Invert the bellows plate assembly and remove the two screws (6) and washers.

5. Remove the APL valve (7) and seal (8).

6. Remove the APL valve seat (9) from the centre plate assembly.

Reassembly
7. Refit the bellows plate assembly to the centre plate, ensuring that:
   (a) the Bag/Ventilator switch linkage is aligned, and
   (b) the switch 'push-pin' is engaged.

8. Apply a small amount of Molycote BG87 grease to the O-ring (10), and fit the O-ring to the new APL valve.

9. Fit the APL valve to the absorber, and screw in hand-tight only.

10. Refit the bag arm assembly (2) and tighten the connector (hand tight). Do NOT use Loctite.

11. Check that the Bag/Ventilator switch (11) will turn.

12. Secure the assembly with nine bolts as follows:
   Apply a small amount of Loctite 243 to the threads, fit the bolts and hand tighten. Starting at the rear of the absorbers, tighten the bolts to 1.5 Nm, in the sequence (A - D) shown in the illustration.
13. Fit the service tool 5003177 (12) to the APL valve. Set a torque wrench to 15 Nm, and carefully tighten the APL valve.

**CAUTION**
*Do not exceed 15 Nm.*

14. Refit the bellows and canister (1).

**Pre-use checks**

15. **APL Valve Test And Pressure Relief Test**

15.1 Fully open APL valve.

15.2 Set maximum oxygen flow rate. Check that the manometer shows a reading (<5 cmH₂O).

15.3 Turn off gas supply.

15.4 Close the APL valve fully.

15.5 Use O₂ flow and check that the APL valve relieves pressure at 60 cmH₂O (6 kPa) +/- 10%, at 6 L/min flow rate.

15.6 If the APL valve fails the test, reset the valve as follows:
   a) Undo the locknut.
   b) Set a flow of 6 L/min.
   c) Adjust the screw, as illustrated, to achieve 60 cmH₂O on the manometer.
   d) Retighten the locknut and repeat the test procedure.

16. **Leak Test**

16.1 Absorber canister fitted, and in locked position.

16.2 Ensure that a bag is fitted to the bag arm port, and Bag/Ventilator switch is set to 'Bag' position.

16.3 Connect breathing system and occlude the patient Y-piece.

16.4 Close the APL valve.

16.5 Use the O₂ flush to pressurise the system to 30 cmH₂O. Ensure that the pressure remains fixed for at least 10 seconds.

17. Fit the label to the APL valve.
## APPENDIX: APL Valve (2008 Specification)

### APL Valve 2008 Specification

#### Parts List

<table>
<thead>
<tr>
<th>Ref</th>
<th>Part No.</th>
<th>Description</th>
<th>Qty</th>
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<tbody>
<tr>
<td>1</td>
<td>5001016</td>
<td>Valve seat</td>
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<tr>
<td>2</td>
<td>5000106</td>
<td>Valve adjuster</td>
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</tr>
<tr>
<td>3</td>
<td>5000107</td>
<td>Valve body</td>
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<td>4</td>
<td>5001112</td>
<td>Spring</td>
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<td>041245</td>
<td>O-seal</td>
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<td>Valve knob</td>
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<td>5003176</td>
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<td>Dowel pin (dia 3 x 8)</td>
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<td>Location plate - knob</td>
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<td>019117</td>
<td>Screw (M3 x 6)</td>
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