SurgiVet™

SAV2500 VENTILATOR
V725000

Operation Manual

en English
Catalog Number V1918
Version 2, June 2007

smiths medical

Table of Contents

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Warranty and Service Information

Proprietary Notice

Information contained in this document is copyrighted by Smiths Medical PM, Inc. and may not be duplicated in full or part by any person without prior written approval of Smiths Medical PM, Inc. Its purpose is to provide the user with adequately detailed documentation to efficiently install, operate, maintain and order spare parts for the device supplied. All information contained in this document is believed to be current and accurate as of the date of publication or revision, but does not constitute a warranty.

Warranty

Limited Warranty

Smiths Medical PM, Inc. ("Seller") warrants to the original purchaser that the Product, not including applicable accessories, shall be free from defects in material and workmanship under normal use, if used in accordance with its labeling, for one year from the date of shipment to the original purchaser.

Disclaimer of Warranties

THE FOREGOING EXPRESS WARRANTY, AS CONDITIONED AND LIMITED, IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES WHETHER EXPRESS OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Seller disclaims responsibility for the suitability of the Product for any particular medical treatment or for any medical complications resulting from the use of the Product. This disclaimer is dictated by the many elements which are beyond Seller's control, such as diagnosis or patient, conditions under which the Product may be used, handling of the Product after it leaves Seller's possession, execution of recommended instructions for use and others.

Conditions of Warranty

This warranty is void if the Product has been altered, misused, damaged by neglect or accident, not properly maintained, or repaired by persons not authorized by Seller. Misuse includes, but is not limited to, use not in compliance with the labeling or use with accessories not manufactured by Seller. This warranty does not cover normal wear and tear and maintenance items.

Limitation of Remedies

The original purchaser's exclusive remedy shall be, at Seller's sole option, the repair or replacement of the Product. **THIS IS THE EXCLUSIVE REMEDY. In no event will Seller's liability arising out of any cause whatsoever (whether such cause is based in contract, negligence, strict liability, tort or otherwise) exceed the price of the Product, and in no event shall Seller be responsible for consequential, incidental, or special damages of any kind or nature whatsoever, including but not limited to, lost business, revenues and profits.**

Warranty Procedure

Should it be necessary to return the Product and/or accessories for evaluation or repair, please contact Clinical Support at 1-888-745-6562 (262-513-8500 for International customers) to obtain a return authorization number. Please provide the serial number of all equipment that will be returned. Any equipment returned for evaluation or repair needs to be cleaned and decontaminated at your facility prior to being handled by our service technicians. For cleaning instructions, please refer to the appropriate section in the operations manual.

If equipment is returned without being cleaned and decontaminated, and in our opinion it represents a potential biological hazard, our service technicians reserve the right to withhold service until proper cleaning and decontamination have been completed by the sender.

Reference the return authorization number when returning your Product, freight and insurance prepaid, to:

Smiths Medical PM, Inc.
Attn: Repairs/Return #
N7W22025 Johnson Drive
Waukesha, WI 53186-1856

Telephone: 262-513-8500
Toll Free: 1-800-745-6562 (U.S.A. only)
Fax: 262-513-9069

Seller will not be responsible for unauthorized returns or for loss or damage to the Product during the return shipment. The repaired or replaced Product will be shipped, freight prepaid, to Purchaser.

To obtain warranty service outside the USA, contact your local distributor.

Keep all original packing material, including foam inserts. If you need to ship the device, use only the original packaging material, including inserts. Box and inserts should be in original condition. If original shipping material in good condition is not available, it should be purchased from Smiths Medical PM, Inc.

Damages occurred in transit in other than original shipping containers are the responsibility of the shipper. All costs incurred returning devices for repair are the responsibility of the shipper.

Chapter 1: Introduction

Intended Use

This ventilator is designed to be easy to use and extremely effective in the area of anesthesia ventilation. The SAV2500 comes standard with a manual breath button, pneumatically controlled for electrical failures or transport. Three simple control knobs set flow rate, breaths-per-minute and length of inspiratory cycle. The ventilator can be made portable by adding an optional five base caster assembly or a universal ventilator mounting assembly (see *Chapter 6: Optional Supplies and Accessories*).

Warnings, Cautions and Notes

Rx ONLY Federal (U.S.A.) law restricts this device to sale by or on the order of a licensed veterinarian.

PLEASE READ AND UNDERSTAND THIS MANUAL BEFORE OPERATING THE ANESTHESIA VENTILATOR.

A TEST LUNG HAS BEEN PROVIDED TO ALLOW THE USER THE OPPORTUNITY TO BECOME FAMILIAR WITH ALL CONTROLS AND FUNCTIONS OF THIS VENTILATOR.

WARNING! Incorrect use of this equipment can cause serious patient injury. It is the responsibility of the user to understand all functions and the need to maintain this equipment to manufacturer's specifications and directions.

WARNING! DO NOT USE THIS UNIT IN THE PRESENCE OF FLAMMABLE ANESTHETICS.

WARNING! ELECTRIC SHOCK HAZARD IF VENTILATOR CASE IS REMOVED.

WARNING! Anesthesia machines used with ventilators must be checked regularly and be LEAK FREE. A leaking machine can cause the ventilator not to perform to specifications and represents possible patient injury.

WARNING! The ventilator is for VETERINARY USE ONLY.

CAUTION! Smiths Medical PM, Inc. shall not be responsible for any unauthorized repair or modifications to the equipment or accessories or damages caused by unauthorized opening of the ventilator.

NOTE! The ventilator is designed to be powered with medical grade oxygen.

Unpacking the Ventilator

Carefully remove the ventilator and accessories from the shipping carton. Save the packing materials in case the monitor or accessories must be shipped or stored. Compare the accessories received with the list of accessories below to make sure the shipment is complete.

PART NUMBER	DESCRIPTION
32359B8	30.5 cm, 22 mm I.D. (12 inch, 0.87 in I.D.) Reusable Cuffed Hose
32359B7	122 cm, 22 mm I.D. (48 inch, 0.87 in I.D.) Reusable Cuffed Hose
32001B1	Adapter, 22 mm x 22 mm (0.87 in x 0.87 in)
32343B20	Silicone Adapter, 22 mm x 17 mm (0.87 in x 0.67 in)
32426B3	DISS Wye Connector (F x M x M Wye)
32391B1	Test Lung
32343B18	Adapter, 30 mm x 19 mm (1.18 in x 0.75 in)
32411B10	Power Pack with Cord
	24 inch O_2 Hose with DISS Female Connectors on Each End
32411B6	1500 ml Bellows Assembly

Chapter 2: Getting Started

The SAV2500 Ventilator is very easy to operate and the unit should be run to become familiar with the controls before the ventilator is connected to a patient. Before starting, decide whether to ventilate to pressure, end tidal CO_2, or volume. Most users ventilate to pressure or end tidal CO_2 instead of volume.

Ventilating to Volume

If ventilating to volume, remember that a certain amount of volume is lost to circuit compliance. If the bellows shows a volume of 400 ml being delivered, be aware that the delivered volume may be only 300 to 320 ml.

Ventilating to Pressure

If ventilating to pressure, most anesthesiologists recommend a pressure of 15 to 18 cm H_2O as read from the patient pressure manometer located on the anesthesia machine. When satisfied with the flow and an increase patient pressure is desired, simply increase the Inspiratory Time. To decrease patient pressure, decrease the Inspiratory Time. This is a unique feature of the SAV2500.

Ventilating to End Tidal CO_2

If ventilating to $ETCO_2$, most anesthesiologists recommend an $ETCO_2$ of 35-45 mmHg. In order to achieve this, the patient's number of breaths per minute must be matched to the desired normal $ETCO_2$ value by increasing or decreasing the number of breaths per minute on the ventilator.

Becoming Familiar with the Ventilator Controls

Front Panel

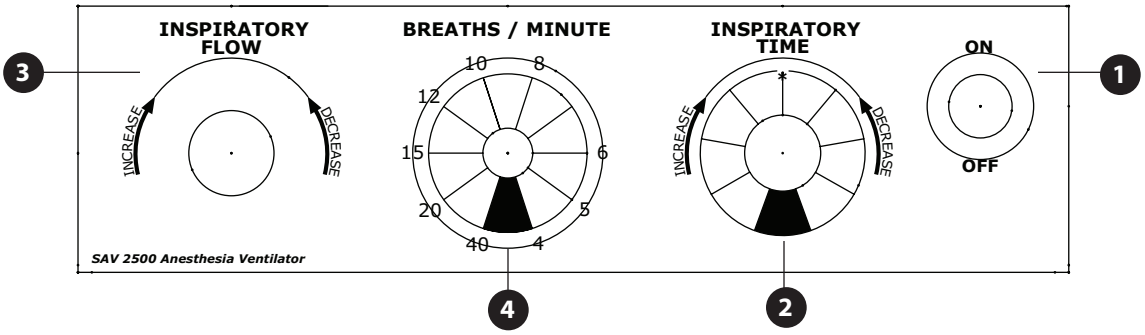

Figure 2.1: Front Panel

1 On/Off Switch

Powers ventilator on or off.

2 Inspiratory Time

Increases or decreases the length of the inspiratory cycle and allows the varying ventilatory demands to be met. Less Time = Less Volume

3 Inspiratory Flow

Controls the delivered volume to the patient.

4 Breaths/Minute

Increases or decreases the number of breaths per minute (4-40 BPM).

Back Panel

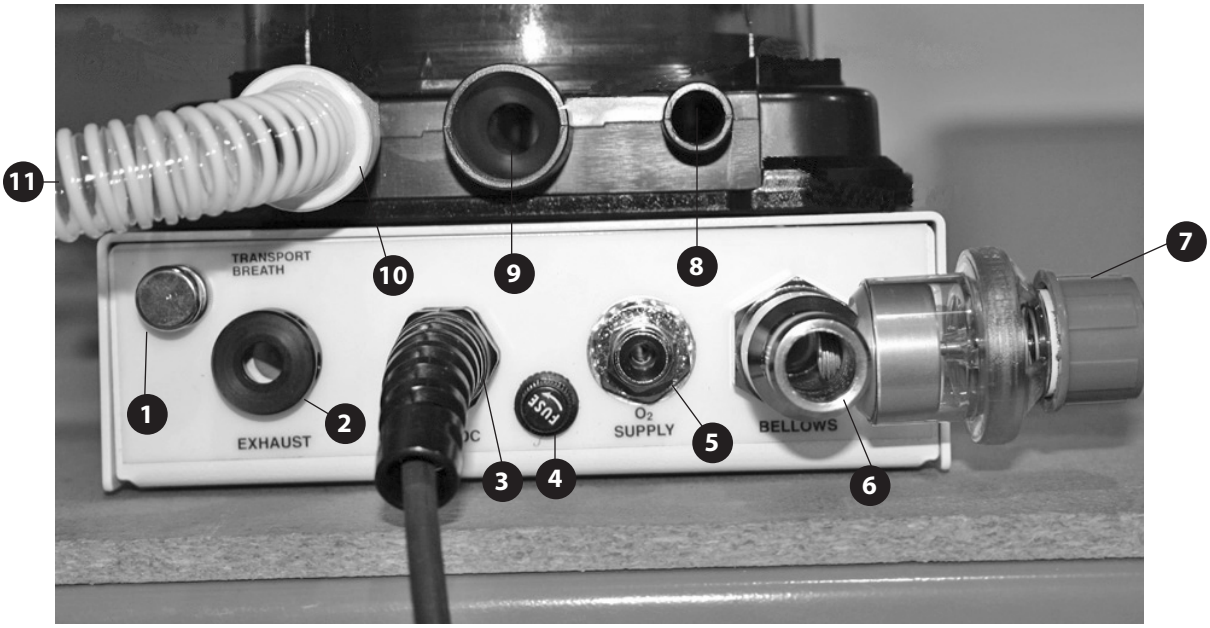

Figure 2.2: Back Panel

1 Transport Breath (pneumatic manual)

Electricity is not needed for this function. This allows the ventilator to deliver a breath if electrical failure occurs or if a manual breath is desired.

CAUTION: This will allow stacked breaths if used when electronic controls are active.

NOTE: The volume or pressure can be changed by adjusting the Inspiratory Time or the Inspiratory Flow. Remember, the two are totally independent of one another. For example, if trying to reach 20 breaths per minute, the Inspiratory Time must decrease in order to obtain those breaths. If there is a long Inspiratory Time, there will not be enough time between the cycles to achieve that rate. At 20 breaths per minute, there are only 3 seconds to get the inspiratory/expiratory breath and refill the bellows for the next breath. Although it is rare to use 20 breaths per minute, it is important to understand that it is necessary to use both controls to achieve the desired number of breaths.

2 Exhaust

Drive gas escapes from here.

3 Power/A.C. Main

For transformer/power supply.

4 Fuse Housing

The fuse is located here (250 volt, ½ Amp).

5 Oxygen Inlet

Connect oxygen hose here.

6 Drive Gas Supply Port

The 32359B8 cuffed hose connects from here to the drive gas inlet. 8

7 Pressure Relief Valve

This feature allows individual pressure limits to be set for each patient. When closed, it is pre-set at 60 cm H_2O (± 5 cm H_2O). It may be opened if very delicate control of pressures is required, such as ventilating an extremely small patient.

NOTE: Normal operational position for this valve is closed.

8 Drive Gas Inlet

The 32359B8 cuffed hose connects from here to drive gas supply port. 6

9 Gas Evacuation Port

Connect the purple 30 mm x 19 mm (1.18 inches x 0.75 in) adapter and waste gas evacuation hose here.

10 Supply Hose Inlet

Connect supply hose 11 for bellows to this inlet.

11 Bellows Supply Hose (part # 32359B7)

Connects the ventilator to the bag port on the anesthesia machine.

Chapter 3: Setting Up the Ventilator

1. Pressure test the anesthesia machine to check for leaks. If leaks are present, this will not allow the ventilator to function properly. If there are any questions about performing a pressure test, please contact Clinical Support at (888)745-6562 or 262-513-8500.

2. Remove the breathing bag from the anesthesia machine bag port, attach a rebreathing circuit to the inhalation/exhalation valves and close the pop-off valve/pressure relief on the anesthesia machine.

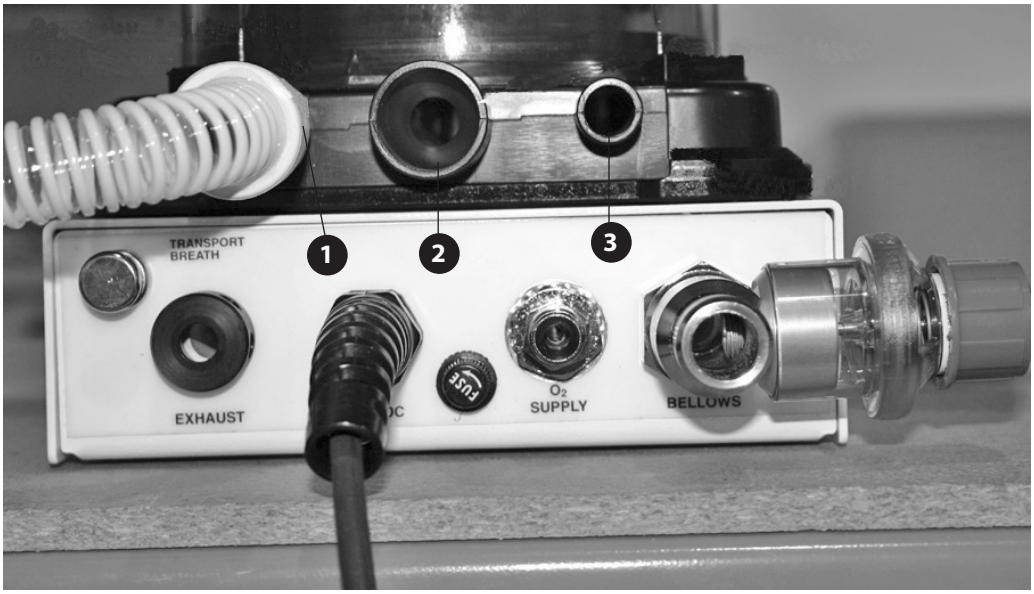

Figure 3.1: Setting Up the Ventilator

1 Supply Hose Inlet

2 Gas Evacuation Port

3 Drive Gas Inlet

3. Connect one end of the 122 cm (48 inch) cuffed hose to the bag port on the anesthesia machine and the other end to the supply hose inlet on the left behind the bellows.

4. Connect one end of the 30.5 cm (12 inch) cuffed hose to the drive gas inlet on the right, behind the bellows, and the other end to the port on the back of the ventilator labeled bellows.

5. Attach the 0.91 m (3 foot) green oxygen hose to the port labeled oxygen supply on the back of the ventilator. When tightening the oxygen hose, it is best to use two wrenches. One wrench should be used to hold the fitting at the back of the ventilator labeled oxygen supply in place. The other wrench should be used to tighten the DISS Female fitting on the end of the oxygen hose. This will prevent inadvertent loosening of the oxygen fitting at the back of the ventilator. Connect the other end of the hose to an oxygen regulator set at 50-55PSI.

If using the Oxygen Wye piece that was provided with the ventilator, configure the machine and ventilator as shown in the following picture.

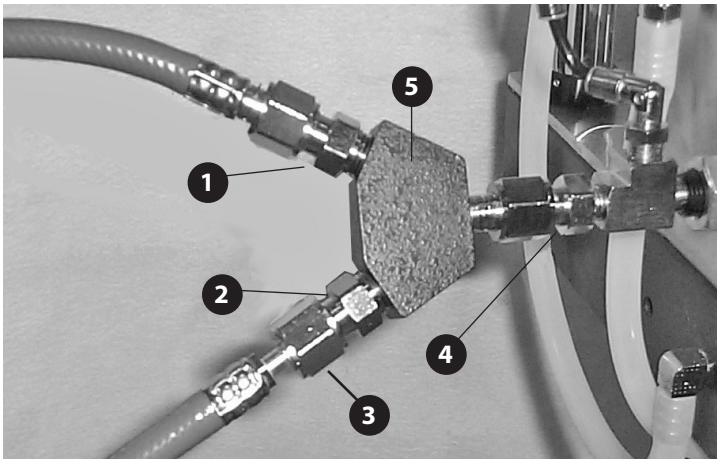

Figure 3.2: Oxygen Wye Connector

1 To Ventilator

2 To Oxygen Source

3 DISS Female Connector

4 Anesthesia Machine Oxygen Connection

5 Oxygen Wye Piece

6. Connect power cord and plug in to an outlet. There should be a green light on the converter of the power cord.
7. Attach Test Lung to the end of the breathing circuit.
8. Attach 19 mm (0.75 in) waste gas evacuation hose to the purple adapter on the back of the bellows.
9. SLOWLY turn on oxygen supply. THE VENTILATOR IS NOW READY FOR TESTING.

Testing the Ventilator

When all hoses are attached, oxygen is on, and test lung connected, start becoming familiar with the ventilator and simulate having a patient attached to the anesthesia machine.

1. Press the flush valve on the anesthesia machine to raise the bellows all the way to the top. Turn flowmeter up to 1.5 to 2LPM. The bellows should stay at the top, but no pressure should build on the manometer.
2. Turn the Inspiratory Flow control knob counter clockwise to the OFF position. DO NOT OVER TIGHTEN.
3. Turn the Inspiratory Time control knob to 12:00 o'clock (center).
4. Set the Breaths Per Minute control knob at 10.
5. Turn the ON/OFF switch ON.
6. The ventilator will start cycling, but will not inflate the test lung. Slowly open the Inspiratory Flow control knob ¼ turn at a time between each breath until the test lung starts to inflate, resembling an actual lung. This flow should resemble a natural inhalation cycle from a healthy patient. The ventilator is now delivering 10 breaths per minute with an adequate flow.

Adjusting the Pressure Relief Valve (optional):

1. Set ventilator controls as stated in the Test Procedure.
2. Turn the ventilator to the OFF position.
3. Keep the flowmeter at 1.5 to 2LPM.
4. Hold the Transport Breath button in and the bellows will descend, delivering 1500ml.
5. While holding the Transport Breath button in, turn the Pressure Relief Valve counterclockwise and watch the bellows start to rise.
6. Watch the manometer. When the unit reaches the desired pressure, release the Transport Breath.
7. Now test to see that the valve will relieve where it was set. It may need a little more adjusting, but should relieve at +/- 5cmH_2O.

Figure 3.3: Pressure Relief Valve

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Chapter 4: Operating the Ventilator

CAUTION! Always make sure the anesthesia machine is pressure tested and leak free. A leaking machine will alter the performance of the ventilator.

NOTE! To become familiar with using the ventilator and to gain confidence in its operation, practice with the ventilator using the test lung.

With the ventilator attached to the patient and the Inspiratory Time and Breaths/Minute at the desired position, start turning the Inspiratory flow until the desired volume is reached. REMEMBER TO TURN THE INSPIRATORY FLOW CONTROL SLOWLY WHILE BECOMING FAMILIAR WITH THE VENTILATOR. The breaths-per-minute can be changed by simply turning the Breaths/Minute control. Either increase or decrease the number of breaths.

WARNING! If the flow rate is too high, or the inspiratory cycle is too long, this may create a high circuit pressure. Watch the Patient Pressure Manometer on the anesthesia machine and be prepared to adjust these controls accordingly so dangerous pressures will not be obtained.

WARNING! The mechanical breath should be as close to the patient's natural breath as possible. This is always the goal of ventilation.

When the ventilator is set and the settings are in the start-up positions, begin adjusting the Inspiratory Time control to the left and then to the right. Notice how the length of the inspiratory cycle is increased or decreased.

WARNING! Always monitor the Patient Pressure Manometer on the anesthesia machine and be prepared to adjust the settings on the ventilator controls.

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Chapter 5: Routine Maintenance and Troubleshooting

Routine Maintenance

The ventilator supply hose, bellows housing and bellows do come in contact with the breathing gases and should be disassembled and cleaned on a regular basis. Use mild soapy water, rinse well, and dry completely before reassembly.

DO NOT USE ALCOHOL.

DO NOT USE STEAM STERILIZATION.

DO NOT USE ETHYLENE OXIDE (ETO).

Bellows Diaphragm

The tear drop-shaped diaphragm located under the bellows should be checked on a routine basis to make sure it seals properly (check for cracks, worn areas, etc).

NOTE: Be sure not to pinch the diaphragm when placing the rim on to the housing.

Bellows Flutter Valve

A 19mm round black rubber flutter valve on the bottom side of the bellows diaphragm should be inspected and replaced if needed (check for tears, curling, worn areas, etc).

Bellows Ring Seal

The black rubber gasket around the bottom of the bellows assembly should be checked on a routine basis to make sure it seals properly (check for cracks, worn areas, etc).

NOTE: All other components of the ventilator, such as the bellows and the amber bellows cover, should be checked on a routine basis as well and replaced as needed.

Troubleshooting

For exploded view of the bellows, see *Appendix A: Bellows Assembly*.

PROBLEM	CORRECTIVE ACTION
The bellows will not stay at the top of the canister; the bellows will not fill.	Pressure test the anesthesia machine to check for leaks Leak test the bellows: remove the bellows, tip upside down, cover hole under base with palm of hand to occlude, then turn bellows right side up (if there are no leaks, the bellows should hold). Check the diaphragm (32102B17), make sure it is in place, and be sure that the flutter valve (32037B5) is present Check the ring seal (3241117) around the bellows assembly Check the oxygen source to the anesthesia machine and to the ventilator. Line pressure should be at 50-55 psi. Check the amber bellows cover (32411B19) to ensure it is locking in place properly.
The ventilator will not cycle. (If cycling, there will be a clicking noise.) No power	Check ON/OFF switch. Check power supply; confirm there is a green light illuminated on the converter. If there is no green light, check connection and try another working outlet. If still no green light, a new power supply (32411B10) must be ordered. If the ventilator is not working, but there is a green light on the power supply, check the fuse (32205B5-250V, ½ AMP) on the back of the ventilator and replace if necessary.
The bellows will not move when the ventilator cycles.	Check the bellows assembly to ensure that all pieces are properly locked in place. If an oxygen leak can be detected around the ventilator head, there may be tubing disconnected on the inside and the ventilator will need to be sent in for service.

Please contact Clinical Support at 1-888-745-6562 (USA Only) or 262-513-8500 for questions and further troubleshooting.

Chapter 6: Supplies and Accessories

CAT. NO	DESCRIPTION	QTY
V1918	Operation Manual	1 each
V7154	Roll Stand	1 each
V7260	Universal Mounting Bracket	1 each
V7310	300 ml Bellows	1 each
V7312	3L Bellows (Foal)	1 each
V725000	SAV2500 Ventilator	1 each
32001B1	Adapter, 22 mm x 22 mm (0.87 in x 0.87 in)	1 each
32343B18	Adapter, 30 mm x 19 mm (1.18 in x 0.75 in)	1 each
32343B20	Silicone Adapter, 22 mm x 17 mm (0.87 in x 0.67 in)	1 each
32359B7	122 cm, 22 mm I.D. (48 inch, 0.87 in I.D.) Reusable Cuffed Hose	1 each
32359B8	30.5 cm, 22 mm I.D. (12 inch, 0.87 in I.D.) Reusable Cuffed Hose	1 each
32391B1	Test Lung	1 each
32411B10	Power Pack with Cord	1 each
32426B3	DISS Wye Connector (F x M x M Wye)	1 each

Ordering Information

For ordering information, contact your local distributor or the Smiths Medical PM, Inc. Veterinary Division Customer Service department.

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N7W22025 Johnson Drive
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Website: www.surgivet.com

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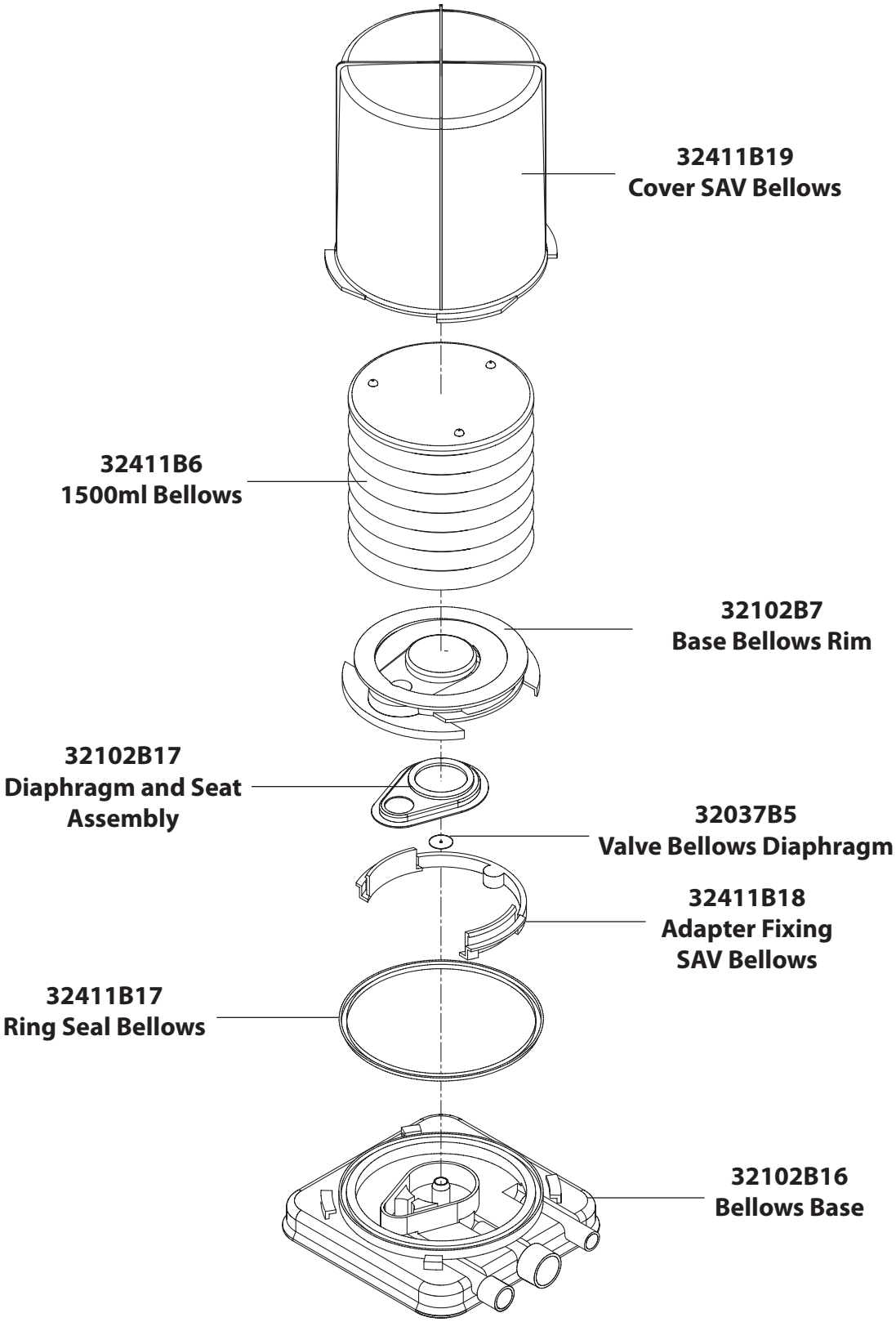
Appendix A: Bellows Assembly

Exploded View of Bellows Assembly



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