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L909005-224
REV. A

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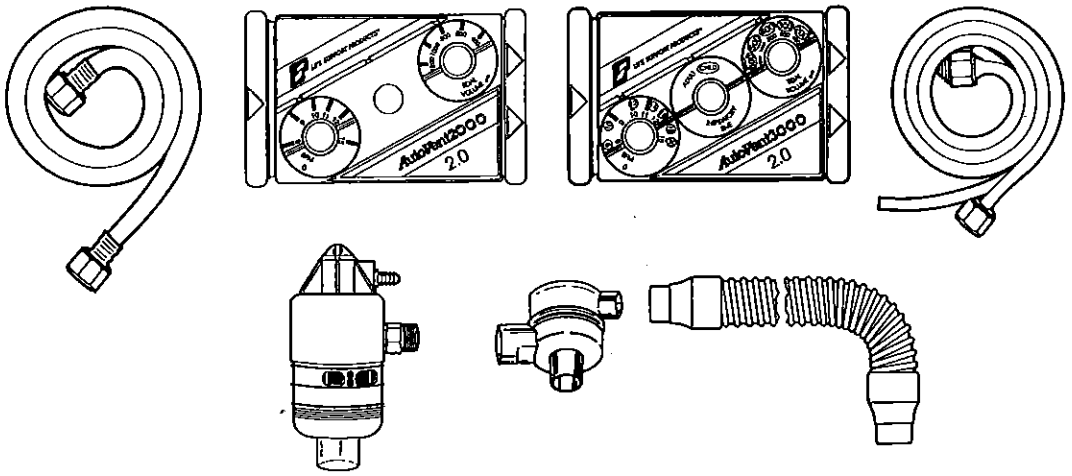
INTRODUCTION

Long an innovator in emergency and trauma medicine, Life Support Products has been a primary manufacturer of oxygen delivery devices for field use in the United States and worldwide since 1979. LSP is also a manufacturer of a wide range of trauma, burn and rescue devices.

Specifications for the LSP AutoVent 2000/3000, including the Patient Valve Assembly, Control Module, and Regulators intended for use with this device, are included in the Appendix of this manual.
The Life Support Products AutoVent 2000/3000 represent a major breakthrough in pneumatic technology. They are intended for the ventilatory assistance of patients following cardiac arrest, near drowning, trauma, paramedical transport, and other circumstances requiring ventilatory assistance.

THE AUTOVENT 2000/3000



GENERAL DESCRIPTION

The LSP Automatic Ventilator (AutoVent 2000/3000) time-cycled, constant-flow, gas-powered ventilators offer controlled ventilation at rates from 8 to 15 breaths per minute (BPM) in the AutoVent 2000 version, and 8 to 20 breaths per minute in the AutoVent 3000 version. The attached Patient Valve Assembly allows a patient to draw supplemental gas flow (up to 36 LPM) with spontaneous effort. Designed for transport and emergency medical use, the AutoVent 2000 delivers from 400 ml to 1200 ml volume. The AutoVent 3000 delivers from 200 to 1200 ml in volume.

Both AutoVents deliver **Peak Pressure up to 60 ±5 cm H_2O at** flow rates from 12 to 36 liters per minute (LPM). They are small, compact units ideally suited for emergency and transport situations at temperature extremes from 0°F to 125°F. Operating power is obtained from standard 50 psi source gas. They are simple to assemble and operate, and their functions are easily understood. The Ventilators meet or exceed the American Heart Association (AHA) guidelines for resuscitation.

An Audible alarm sounds whenever ventilatory pressures approach the preset pressure limit, alerting the operator. This alarm will continue to sound until the airway pressure drops or the system cycles to the expiratory phase.

WARNING: Use only as directed. Improper usage or unauthorized modification of this product may result in user or patient injury.

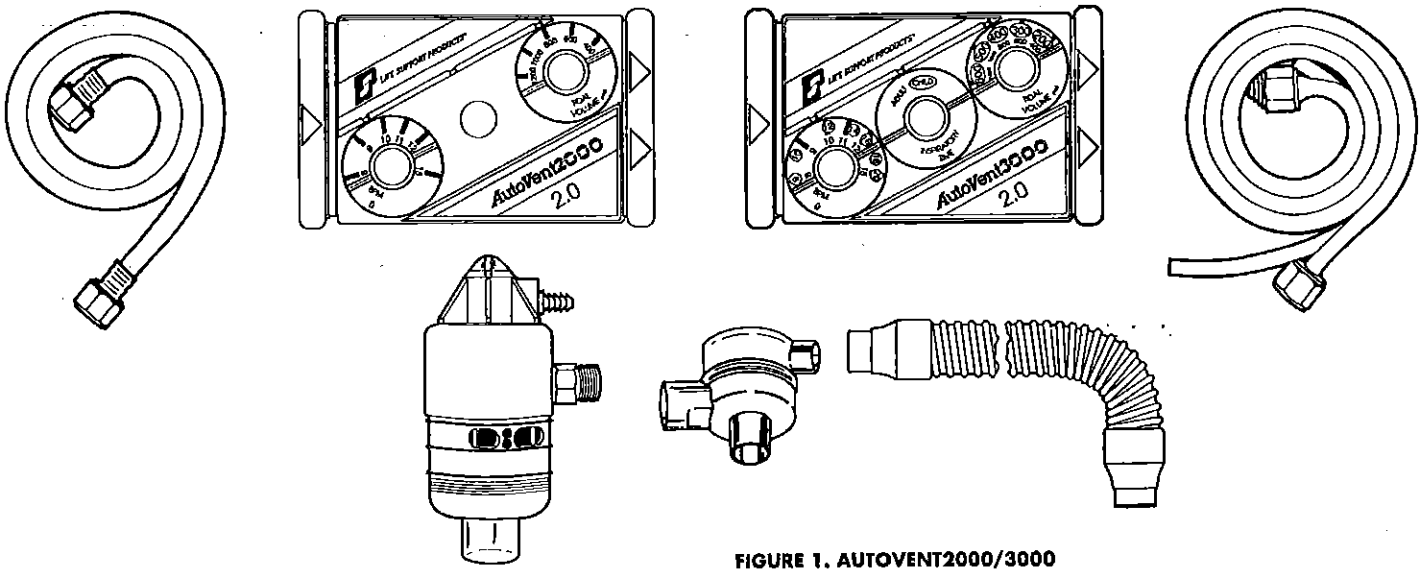


FIGURE 1. AUTOVENT2000/3000

USE OF THE OPERATING MANUAL

Design

This operating manual for the Life Support Products AutoVent 2000/3000 Automatic Ventilators has been designed for ease of use in the paramedical and field transport setting.

Illustrations are provided throughout this manual to provide the user with both a graphic and narrative description of the ventilators' operating features.

Explanation of Warnings/Cautions/ Notes

This operating manual contains three (3) types of statements with which the user should be aware, and are defined as followings:

WARNING: Potential injury to the patient or operator. These are always in boxes throughout the text of the manual.

CAUTION: Potential damage to the ventilator, breathing circuit, and/or other equipment may result. These are always in brackets throughout the text of the manual.

NOTE: An item of special interest concerning the use and operation of the device(s) or feature (s) being discussed is high-lighted to note ease of use or understanding. These are always preceded and followed by asterisks throughout the text of the manual.

WARNINGS AND CAUTIONS SHOULD BE READ PRIOR TO OPERATING THE LSP AUTOVENT 2000/3000.

PERFORMANCE CHARACTERISTICS AND FEATURES

The AutoVent 2000/3000 are time cycled, constant flow, gas powered ventilators. This feature allows the ventilators' automatic rate to be set by the operator from 8 to 15 breaths per minute (BPM), in the AutoVent 2000 version, and 8 to 20 BPM in the AutoVent 3000 version. Should the patient require additional breaths, these can be obtained on demand by making an inspiratory effort on the patient valve.

PATIENT VALVE ASSEMBLY

The patient valve delivers both controlled and spontaneous breaths to the patient. It consists of a demand valve, a visual indicator, pressure limit alarm, and exhalation valve. It has a standard 15mm. inside diameter/22mm. outside diameter adapter, which is compatible with masks and other airway devices. The patient valve allows spontaneous breathing upon demand if the patient makes an inspiratory effort of -2 cm. H_2O. (The BPM control may be turned to the "0" position if desired for this purpose.)

Figure 2 indicates the individual components which make up the Patient Valve Assembly.

NOTE: Since the patient valve and control module are a matched set with identical serial numbers, do not separate. If used with other units, setting may not be accurate.

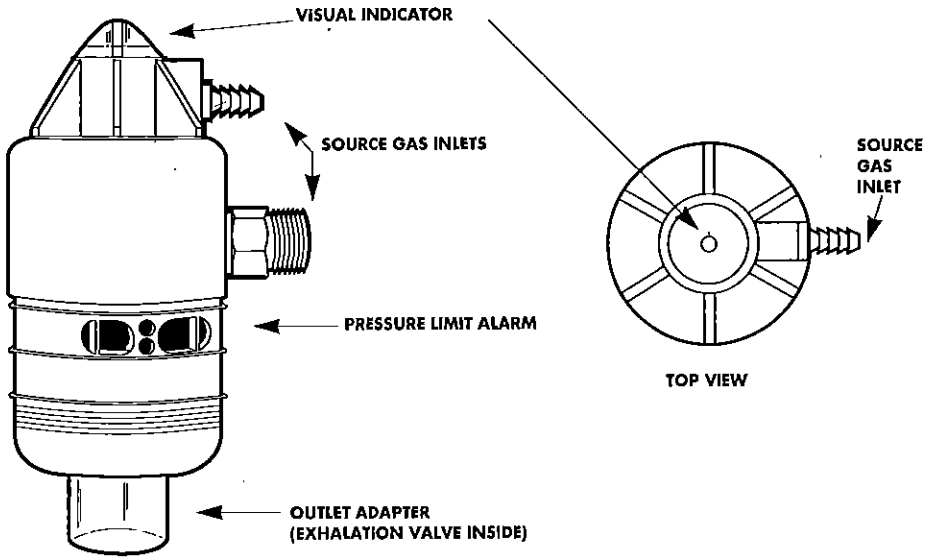


FIGURE 2. PATIENT VALVE ASSEMBLY

Visual Indicator

The visual indicator is located on the top of the Patient Valve Assembly. This indicator displays bright green as gas flows during inspiration. During expiration, the indicator dome is clear. The visual indicator does not indicate on spontaneous breaths.

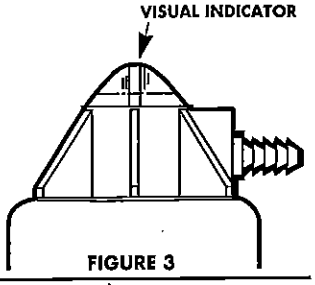


FIGURE 3

Pressure Limit Alarm Module

An audible pressure limit alarm is located in the Patient Valve Assembly. This alarm sounds whenever the patient airway pressure approaches the designed pressure limit. The Pressure Limit Alarm will continue to sound during the inspiratory phase until either the airway pressure decreases or the ventilator cycles off to begin the expiratory phase.

In addition to functioning as a high pressure alarm the alarm module also provides additional air entrainment during the Intermittent Mandatory Ventilation (IMV) mode should the patient's inspiratory flow rate exceed the flow delivery from the control module. The entrainment of ambient air occurs through the blue rubber diaphragm located on the side of the alarm module.

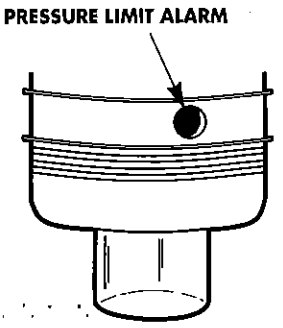


FIGURE 4.

WARNING: If the maximum pressure limit is reached, the pre-set tidal volume may not be delivered to the patient. Inspiratory time will remain constant, however, and an inspiratory hold will be maintained with no additional volume being delivered until the ventilator cycles to the expiratory phase. *This warning also appears under Tidal Volume in the Performance Characteristics.*

WARNING: Should the blue rubber diaphragm blow outward from the alarm module's air entrainment ports, remove the AutoVent immediately from service, and contact your LSP distributor.

Source Gas Inlets

Located on the side of the Patient Valve Assembly, the inlets connect the Patient Valve with the Control Module. The top inlet: (1) Supplies the actuator assembly and is a nippled connector. The bottom inlet: (2) Supplies source gas to the patient and is a diameter index safety system (DISS) oxygen connector.

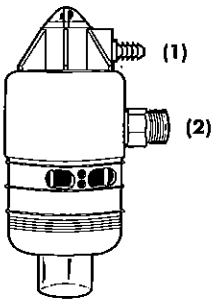


FIGURE 5.

Exhalation Valve

The exhalation valve is an internal diaphragm located on the inside of the Patient Valve Assembly. The exhalation valve allows the patient to exhale through the Patient Valve Assembly once the inspiratory cycle is completed, whether ventilator-controlled, or on demand. This valve can be accessed by removing the outlet adapter on the Patient Valve Assembly.

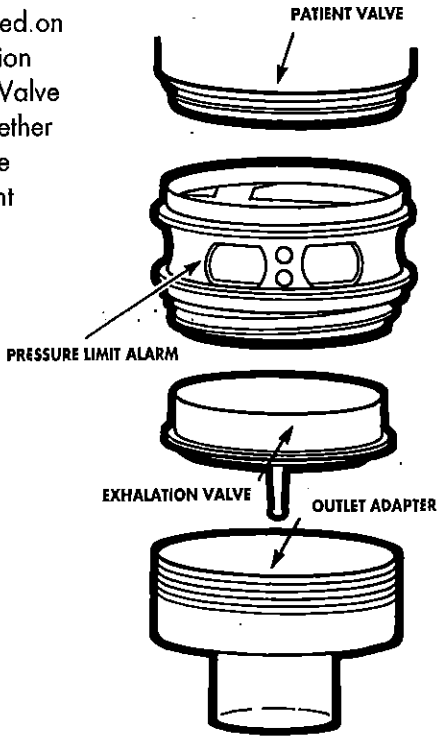


FIGURE 6.

CONTROL MODULE

The Control Modules for the AutoVent 2000/3000 are designed to be compact, durable and easy to use. The units are constructed to perform in the difficult environments of paramedic or transport operations. Their features include an impact-resistant case with shock absorbing bumpers and easy to read controls for independently setting Breaths Per Minute (BPM), Tidal Volume and Inspiratory Time (AutoVent 3000 only). The reverse side of the case also has simplified operating instructions for ease of operation.

Figure 7 indicates the individual components which make up the Control Module.

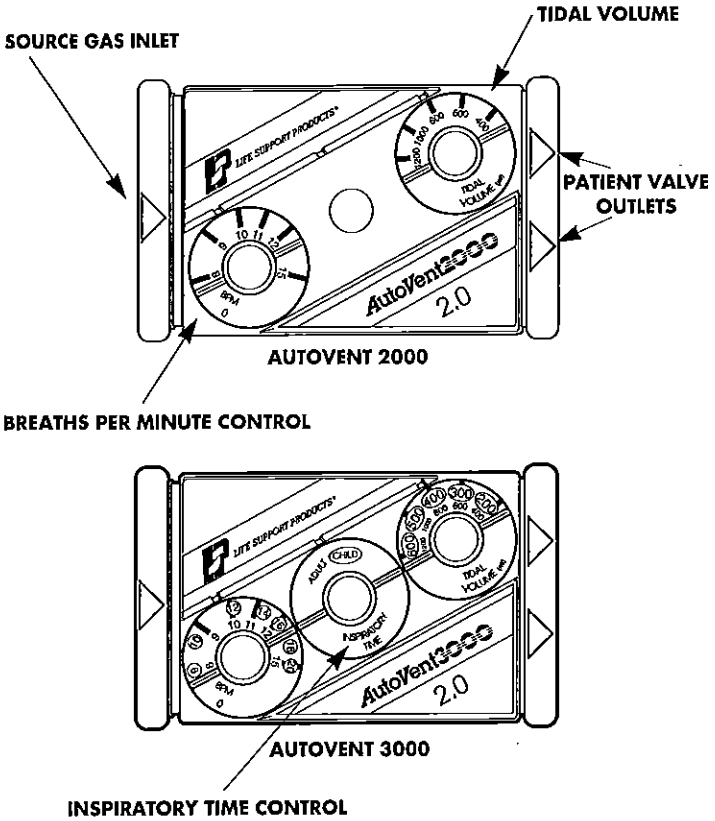


FIGURE 7. CONTROL MODULE

Source Gas Inlet

Located on the left side of the Control Module and marked with an arrow, the source gas inlet is a standard diameter index safety system (DISS) male oxygen connector. When a high pressure line is attached to a 50 psi source gas from a cylinder or bulk oxygen source, this gas is delivered to the Control Module and cycled for delivery to the Patient Valve Assembly.

An Air/Oxygen Blender can also be inserted in line with this system, between the source and the ventilator, to deliver a specified oxygen concentration.

NOTE: Use of an Oxygen Analyzer is recommended prior to patient use in order to accurately measure the desired oxygen concentration to be delivered.

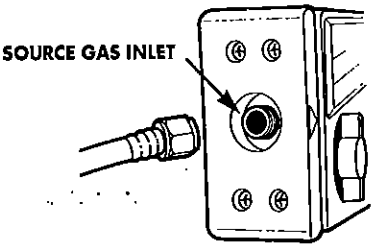


FIGURE 8.

Patient Valve Outlets

Located on the right side of the Control Module body and marked with arrows, the patient valve outlets connect the Control Module with the Patient Valve Assembly. The top outlet (1) Supplies source gas to the Patient Valve Assembly at a constant flow and is a diameter index safety system (DISS) oxygen connector. The bottom outlet: (2) Supplies the Patient Valve Actuator and is a unique 7/16 inch threaded female connector.

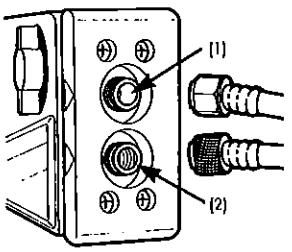


FIGURE 9.

Breaths Per Minute (BPM)

This control sets the ventilator rate from 8 to 15 BPM in the AutoVent 2000 version, and from 8 to 20 BPM in the AutoVent 3000 version. Adjusting the knob clockwise decreases the breathing rate and adjusting counter clockwise increases the rate. Source gas is available on demand, even in the "0" position up to 36 LPM depending on Tidal Volume setting, from the Patient Valve Assembly to allow the patient to breathe spontaneously.

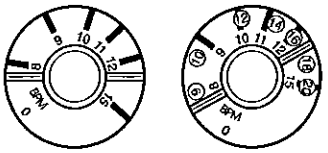


FIGURE 10.

AUTOVENT 2000 AUTOVENT 3000

Tidal Volume (V_t)

This control adjusts the volume available to the patient during a breath and is adjustable from 400 ml to 1200 ml in the AutoVent 2000 version, and from 200 to 1200 mil in the AutoVent 3000 version. Turning the knob clockwise increases tidal volume. Turning the knob counter clockwise decreases tidal volume. Following a volume adjustment change, the tidal volume stabilizes after one breath and remains constant.

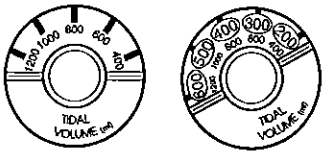


FIGURE 11.

AUTOVENT 2000 AUTOVENT 3000

WARNING: If the maximum pressure limit is reached, the pre-set tidal volume may not be delivered to the patient. Inspiratory time will remain constant, however, and an inspiratory hold will be maintained with no additional volume being delivered until the ventilator cycles to the expiratory phase. *This warning also appears under Pressure Limit Alarm Module in the Performance Characteristics.*

Tidal Volume (V_t) (Continued)

NOTE: It is recommended that you periodically check the performance characteristics of the AutoVent 2000/3000 during maintenance by placing a pressure manometer in line with the patient circuit near the outlet to verify inspiratory pressures and the accuracy of the pressure alarm limit.

Inspiratory Time (Ti)

This control knob in the center position of the AutoVent 3000 allows adjustment of the patient's inspiratory time. The two settings allow selection of Adult and Child inspiratory time respectively. The inspiratory time for the circled orange child setting is approximately 1 second and when selected corresponds to the circled orange settings on the BPM and Tidal Volume control knobs. The inspiratory time for the white Adult setting is approximately 2 seconds and when selected corresponds to the white settings on the BPM and Tidal Volume control knobs. The AutoVent 2000 has a pre-set inspiratory time of approximately 2 seconds.

FIGURE 11A.

CAUTION: When you select either Adult or Child Setting, rotate the center control knob to the appropriate setting and position it against either of the end stops.

WARNING: Should the inspiratory time control knob on the AutoVent 3000 be adjusted after initial setup, it will alter the patient's BPM and Tidal Volume settings.

Patient Valve Supply Tubing and Oxygen Line

The patient valve supply tubing is a specially constructed twin polyurethane hose enclosed in a PVC jacket. It is three feet in length and has one portion with DISS fittings at both ends while the other section is designed for nipple connection at one end and for connection to the unique 7/16 inch female connector (on the Control Module) at the other end. The oxygen line is standard oxygen tubing with DISS fittings at both ends.

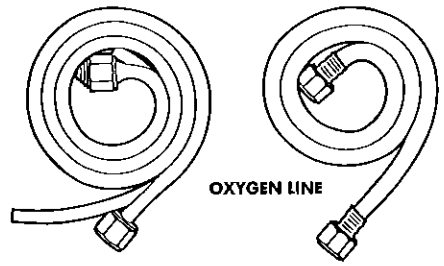
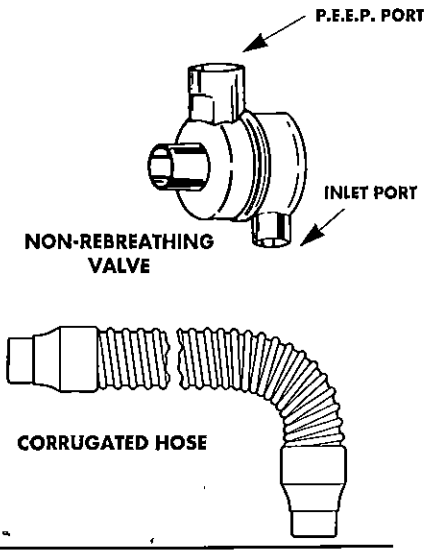


FIGURE 12.

Non-Rebreathing Valve and Corrugated Hose

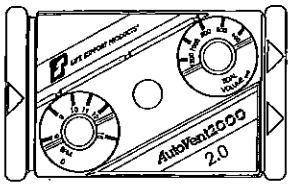
Part number L496 Non-Rebreathing Valve is designed to allow a simple method for providing P.E.E.P. (positive-end-expiratory-pressure) to a patient. Attach one end of the corrugated flex tube to the patient valve assembly. Attach the opposite end to the inlet port on the P/N L496 (see diagram) valve. Both these connections are friction fit, so be sure to slide the flex tube over each connection as far as possible. At this point, you are set to install your P.E.E.P. product in the appropriate port.

WARNING: The P/N L496 Non-rebreathing valve is not for use in toxic atmospheres

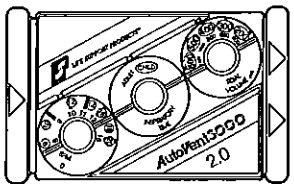


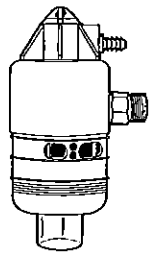
UNPACKING AND INSPECTION OF THE AUTOVENT 2000/3000

After opening your new LSP AutoVent 2000/3000, examine the shipping carton and contents. Lay out contents so that each component is identifiable, as displayed below (Figure 13). If the carton is crushed, previously opened, or shows other signs of damage, notify the carrier immediately to file a claim. Do *not* use the unit on a patient until it has been tested and performs as specified.



CONTROL MODULE



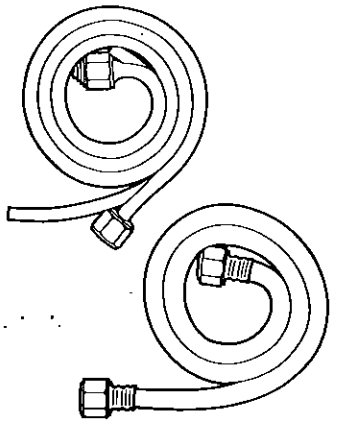


PATIENT VALVE ASSEMBLY

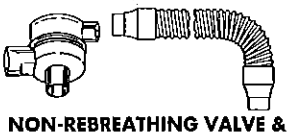
The complete LSP AutoVent 2000/3000, P/N L460, and AutoVent 3000 Automatic Ventilator, P/N L461, consists of the following component parts:

Description	AV 2000 Part No.	AV 3000 Part No.
One Control Module	L462	L463
One Patient Valve Assy.	—	—
One Patient Valve Supply Tubing	L535114	L535114
One Oxygen Line	L535026	L535026
Non-Rebreathing Valve	L496	L496
Corrugated Hose	L535124-010	L535124-010
Operator Manual	L909005-224	L909005-224

PATIENT VALVE SUPPLY TUBING



OXYGEN LINE



NON-REBREATHING VALVE & CORRUGATED HOSE

FIGURE 13

NOTE: Appendix A provides a list of suggested equipment for use in conjunction with or in support of the LSP AutoVent 2000/3000.

OPERATING INSTRUCTIONS

NOTE: Read all instructions carefully prior to set-up and operation of this unit. Particular attention should be paid to all warnings, cautions and notes in order to assure proper performance during use.

WARNING: Should a mechanical problem develop or the patient appears to be experiencing difficulty while connected to this unit, disconnect the unit immediately and ventilate by other means. If unable to determine the cause of the problem, the unit should be returned to an authorized AutoVent repair center.

WARNING: This device operates with medical gases under pressure, including oxygen. Do not use this device while smoking or near open flames. Do not use oil on this device or operate near flammable materials.

WARNING: This device should only be operated by qualified personnel under approved medical direction.

CAUTION: In order to provide optimal performance, check all source gas supplies to assure only clean, dry gas is used, free of contaminants and/or liquids.

Instructions for Use of the AutoVent 2000/3000 with Oxygen Cylinders

Regulator Attachment

Remove plastic wrap from oxygen cylinder valve outlet.

Point the cylinder valve in a safe direction before opening the valve. Remove all dirt and debris from cylinder valve by "cracking" the cylinder prior to attaching the pressure regulator. ("Cracking" consists of slowly opening the cylinder valve and allowing a brief flow of gas to occur prior to attaching the regulator).

When mounting a pin index regulator (LSP P/N L270-020, L270-030, L735-060, or other approved regulator) on a cylinder, make sure the gasket is properly positioned on the inlet stem to prevent oxygen or source gas leakage.

Tighten the regulator yoke by hand using the "T" handle assembly. (The use of tools may result in damage to the regulator).

LSP P/N L280-020, L160-060, or other regulators complying with Compressed Gas Association (CGA) guidelines, mount on cylinders with CGA 540 connections.

Connect the oxygen high pressure line to the 50 psig gas outlet on the regulator.

Control Module Attachment

Connect the other end of the oxygen supply line to the source gas inlet on the Control Module.

Connect the Patient Valve supply tubing to the Patient Valve outlets of the Control Module. Hand tighten the DISS connector and the unique 7/16 inch actuator connector to the Control Module.

Connect the twin hose to the source gas inlets on the Patient Valve Assembly. The fittings allow for proper connection only. Hand tighten the DISS connector to the Patient Valve Assembly.

Examine the cylinder pressure gauge. This can be used to indicate cylinder contents since the pressure is proportional to the amount of remaining oxygen. A portable cylinder is essentially empty when the pressure has fallen to 200 psig.

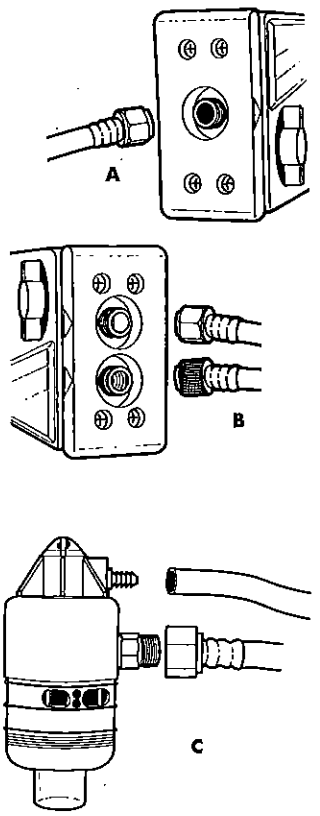


FIGURE 14.

Instructions for Use of the AutoVent 2000/3000 with Oxygen Cylinders (Continued)

NOTE: Check all line and tubing connections for leaks. If a leak occurs, check that the previous fitting instructions have been followed correctly.

CAUTION: Read all instructions thoroughly before opening the cylinder valve. Connect all oxygen/source gas pressure lines to the LSP AutoVent 2000/3000 and Patient Valve Assembly prior to use. Assure all high pressure outlets are plugged and cylinders turned off or closed when not in use.

CAUTION: Always make sure an adequate supply of oxygen or source gas is available for patient use and transport. It is advisable to have a back-up regulator available to facilitate change-over in the event a cylinder transfer needs to be made.

CAUTION: Always verify that the cylinder valve is in the *closed* or *off* position (fully clockwise) prior to disconnecting the tubing assembly or removing the regulator from the oxygen cylinder.

Instructions for Use of the AutoVent 2000/3000 with a Wall Outlet Employing a Quick Connection Adapter

Use standard approved quick release connectors intended for use with cylinder banks or transport gas supplies, attached to 50 psig high pressure lines. Connect the other end of the oxygen supply high pressure line to the source gas inlet port of the Control Module.

Connect the Patient Valve supply tubing to the Patient Valve outlets of the Control Module. Hand-tighten the DISS connector and the unique 7/16 inch actuator connector to the Control Module.

Connect the Patient Valve supply tubing and the actuator supply tubing to the inlet ports on the Patient Valve Assembly. The fittings allow for proper connection only. Hand tighten the DISS connector to the Patient Valve Assembly.

Insert the quick-release adapter into the corresponding wall outlet and assure it is properly in place with an audible snap or click. Pull firmly on the adapter to check its proper insertion.

NOTE: Immediately check all pressure lines and tubing for leaks. If a leak occurs, check that the previous fitting instructions have been followed correctly. Check that all line and tubing connections have been adequately hand tightened.

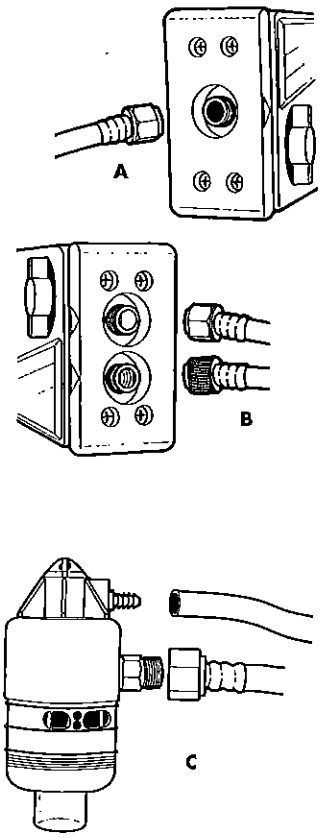


FIGURE 15.

Instructions for Use of the AutoVent 2000/3000 with an Air/Oxygen Blender

Instructions for this application are essentially identical to those for use with either cylinder or wall outlet systems.

The high-flow blender system should be connected to the source gases as per manufacturers instructions. The blender then becomes the attachment site for the source gas supply line to the Control Module.

CAUTION: *Always* follow the blender manufacturer's instructions, contained in the blender product manual, for exact connection of the blender to cylinders or wall sources. Always use a *high-flow* blender (15 LPM to 150 LPM) for ventilatory application.

NOTE: Make sure a compressed air source and oxygen source are available prior to using a blender.

Connect the other end of the oxygen supply high pressure line (source gas supply line) to the source gas inlet port of the Control Module.

Connect the Patient Valve supply tubing to the Patient Valve outlets of the Control Module. Hand-tighten the DISS connector and the unique 7/16 inch actuator connector to the Control Module.

Connect the Patient Valve supply tubing and the actuator supply tubing to the inlet ports on the Patient Valve Assembly. The fittings allow for proper connection only. Hand tighten the DISS connector to the Patient Valve Assembly.

NOTE: Immediately check all pressure lines and tubing for leaks. If a leak occurs, check that the previous fitting instructions have been followed correctly. Check that all line and tubing connections have been adequately hand tightened.

NOTE: Assure the delivery of precise oxygen concentrations when using a blender by inserting an oxygen monitor probe in the gas delivery system at the patient valve outlet prior to patient use.

WARNING: Always check or change the source gases if a low pressure blender alarm sounds, distinguished by a continuous high-pitched hum.

Ventilator Check-Out

1. Check the ventilator system for proper function by performing the following tests:
   - Set the BPM control knob to the setting marked "12". (Adult for AutoVent 3000)
   - Set the Tidal Volume (Vt) control knob to 800 ml.
   - Set the Inspiratory Time control knob to the adult setting on the AutoVent 3000. (Inspiratory time is pre-set on the AutoVent 2000). Rotate the control knob clockwise until it is against the end stop on the adult setting.
   - Count the number of complete ventilator cycles for a full minute. At the checkout setting, there should be 12 BPM delivered, with a 2 second inspiration and 3 second expiration per breath.

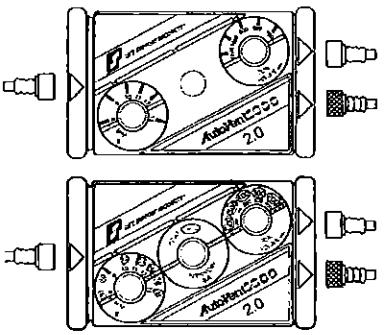


FIGURE 16.

60 SECONDS	
INSPIRATORY TIME 2 SEC.	12 BPM
EXPIRATORY TIME 3 SEC.	

FIGURE 17.

2. Occlude the outlet of the patient Valve Assembly. An audible pressure limit alarm should sound after the ventilator cycles, indicating the designed pressure limit has been reached.

NOTE: The pressure limit alarm should sound throughout the latter portion of the breath after reaching the pressure limit, and stop when the ventilator cycles to expiration.

***NOTE: AutoVents & patient Valves are serialized and calibrated to work together and should remain together for the life of the products*

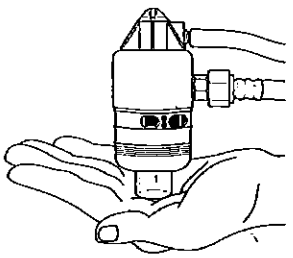


FIGURE 18.

3. Test the unit for proper function prior to each patient use. Refer to Maintenance section for this procedure (page 14).

4. Should the unit fail to operate properly at any time, refer to the Troubleshooting Guide (page 16.) Disconnect the patient from the ventilator any time the unit does not appear to be operating properly. If unable to determine the cause of problem, contact Life Support Products for service.

5. Clean the unit after each use (refer to the Maintenance section for detailed instructions on page 14).

6. Always store the unit in a clean, dry place.

PATIENT USE

NOTE: if the LSP Automatic Ventilator is to be powered by a cylinder, be sure to turn on the cylinder valve slowly.

WARNING: This device should only be operated by qualified personnel under approved medical direction.

Check for obstructions in the patient's throat or mouth (vomitus, foreign bodies, broken dentures, etc.), and remove if present, in accordance with prevailing standards.

Set the volume to equal 8 to 10 ml. for every kg. of body weight; e.g., 70 kg. patient equal 700 ml. volume.

WARNING: The AutoVent 3000 is not recommended for use with patients less than 20 kg. The AutoVent 2000 is not recommended for use with patient less than 40 kg.

PATIENT USE (Continued)

Set the BPM control knob to the desired setting. Refer to the quick set-up instructions on the back of the Control Module for guidelines.

Set the inspiratory time control knob to the desired adult or child position. Rotate the control knob to either position until it is against the end stop. (AutoVent 3000)

Set the Tidal Volume control knob to the desired volume.

Occlude the outlet port of the Patient Valve Assembly. Allow the ventilator to cycle to ensure proper operation of the valve and pressure limit alarm.

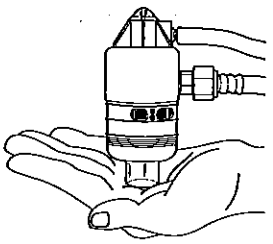


FIGURE 19.

Use with a standard resuscitation mask: *after* initial Control Module settings have been made and a patient airway is established, install the mask on the outlet adapter of the Patient Valve Assembly and place on the patient.

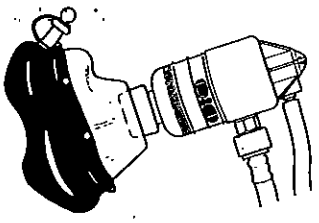


FIGURE 20.

NOTE: Follow established procedural guidelines for opening and maintaining a patient airway.

Use on patients with an endotracheal tube or tracheostomy tube in place: after initial control Module settings have been made, connect the Patient Valve Assembly directly to the endotracheal or tracheostomy tube adapter (15mm. inside diameter/22mm. outside diameter dimensions allow this connection).

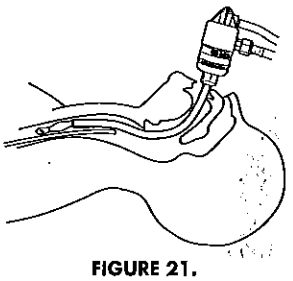
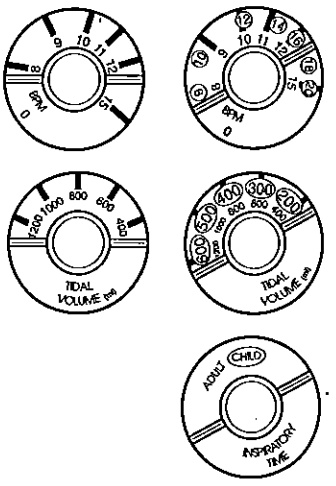


FIGURE 21.

NOTE: A humidification device is recommended if the patient has an endoctracheal tube or tracheostomy tube in place.

AUTOVENT 2000 FIGURE 22.

AUTOVENT 3000 FIGURE 23.



Check the following parameters immediately after connecting the patient to the ventilator.

(1) BPM - Using the second hand on your watch, count the number of breaths delivered to the patient for one full minute. If you need to increase or decrease the rate, adjust the BPM control knob accordingly, checking the rate again once the adjustment has been made.

(2) Tidal Volume - Observe patient for adequate chest rise and fall (chest excursion). Chest excursion should be normal and equal on both sides. If the chest does not rise, check the airway and evaluate for other injuries to the thoracic area. Recheck the tidal volume setting.

(3) Inspiratory Time - With the AutoVent 3000 ensure that the Inspiratory Time control knob is set appropriately and all the way against the appropriate end stop. **(AutoVent 3000 only.)**

***NOTE: If the pressure limit alarm sounds during the inspiratory phase and adequate chest movement does not occur, an increase in airway resistance, a blocked airway and/or a stiff lung is indicated. Increase the volume delivered to the patient, until adequate chest movement occurs, by rotating the Tidal Volume control knob in a clockwise direction. Disconnect the patient from the ventilator and attempt to ventilate via other means if adjustments do not result in satisfactory ventilation of the patient. For additional information, refer to the Troubleshooting Guide.** (page 16)*

PATIENT USE (Continued)

If the patient is being ventilated by mask, check the patient *frequently* for signs of vomiting. Should vomiting occur, remove the mask to prevent aspiration which may cause airway obstruction.

Immediately clear the mask and Patient Valve Assembly of any foreign material, reestablish the patient's airway, and resume ventilation.

If unable to resume ventilation with the Patient Valve Assembly, use a resuscitator bag or perform mouth-to-mask resuscitation.

NOTE: If a compressed gas cylinder is used, check the cylinder contents frequently; should the cylinder require replacement, perform maneuver with minimal interruption to ventilation of the patient.

Should patient begin breathing spontaneously (an effort of -2 cm.H_2O will activate the demand valve) it may be desirable to decrease or turn the ventilator rate (BPM) to the "0" position. This will allow the patient to breathe spontaneously.

The ventilator will deliver **100% source gas** to the patient on demand, up to 36 LPM depending on the tidal volume setting (See Table I.). Any volume required by the patient in excess of the indicated source gas flow rate (see Table I.) will be supplied by ambient air.

WARNING: Monitor the patient *closely* while using the demand mode. Should the patient's respirations slow, become shallow or labored, return to initial automatic ventilator settings *immediately*.

TABLE I.

TV SETTING		FLOW (LPM)
ADULT	CHILD	
400	200	12
600	300	18
800	400	24
1000	500	30
1200	600	36

Source gas flow rates upon patient demand.

MAINTENANCE OF THE LSP AUTOVENT 2000/3000

NOTE: Gloves and protective coverings are recommended when performing maintenance and cleaning of patient care equipment.

NOTE: Clean and disinfect the ventilator after each use. Re-certify calibration of AutoVent once a year.

***Note: AutoVents should be checked for calibration annually.*

WARNING: Cleaning procedures must be performed in an environment free of oil and petroleum-based products.

Cleaning and Disinfecting Equipment

1. Cleaning and Disinfecting the Control Module

NOTE: Water will not affect the operation of the Control Module.

Leave hoses connected so you do not get water inside.

Follow established protocol regarding frequency of cleaning.

Do *not* submerge the Control Module when cleaning. Take a clean cloth soaked in a detergent solution and wipe off any residue from surface.

Wipe thoroughly.

Take a clean cloth soaked in an 80% isopropyl alcohol solution or a cold chemical disinfecting solution, and wipe entire surface of Control Module.

Rinse Thoroughly being careful not to get any liquid inside the control module.

Take a clean cloth and dry surface of Control Module.

Test Control Module before use.

Cleaning and Disinfecting Equipment (Continued)

2. Cleaning and Disinfecting the Patient Valve Assembly

WARNING: Clean and disinfect the Patient Valve Assembly after *every* use.

Remove the outlet adapter and exhalation valve assembly from the Patient Valve Assembly. Leave tubing assembly connected.

Clean all foreign matter from the components with a mild soap solution, being careful not to get any liquid inside the Patient Valve Assembly. Rinse the parts *thoroughly* in clean water.

Immerse the outlet adapter and the exhalation valve assembly from the Patient Valve in a disinfectant or bacteriocidal solution for a *minimum* of 10 minutes.

Remove the outlet adapter and the exhalation valve assembly from the solution and rinse *thoroughly* with water. Rinse repeatedly to assure that all the solution is removed.

Place the Patient Valve, outlet side down, into a shallow container with not more than 1/2 inch of disinfectant or bacteriocidal solution. The Patient Valve should remain in this solution for a minimum of 10 minutes. Leave tubing assembly connected.

Remove the Patient Valve from the solution and rinse thoroughly with water. Dry assembly using approved standard methods such as hot air drying.

After drying, carefully examine the parts of the Patient Valve Assembly. Discard any cracked or damaged parts and replace as necessary.

Prior to reassembling the entire unit, inspect all lines and tubing filters for contaminants, replacing as necessary.

Reconnect the tubing assembly to the fittings.

Check the exhalation valve assembly to assure the flapper valve is not twisted and the locating bosses are properly positioned. (Figure 25)

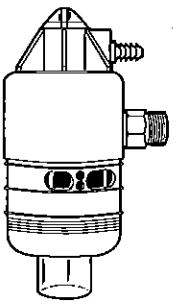


FIGURE 24.

Cleaning and Disinfecting Equipment (Continued)

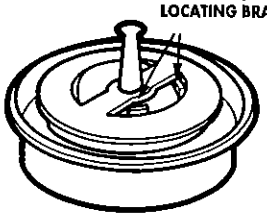


FIGURE 25.

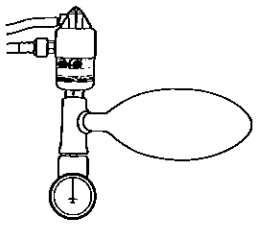


FIGURE 26.

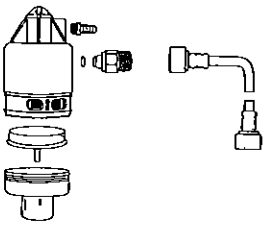


FIGURE 27.

3. Cleaning the Non-Rebreathing Valve

CAUTION: If the flapper valve is twisted or the locating bosses are not properly positioned, the Patient Valve Assembly will not function properly. Always make sure the valve is flat and properly seated.

Immediately after cleaning, reassemble the Patient Valve Assembly and connect to the Control Module. Turn on the oxygen supply and allow the ventilator to cycle several times to blow out any liquid which may have gotten inside during the cleaning process.

Test the unit for proper function prior to each patient use. Attach an inflatable test lung, P/N L109, to the Patient Valve Assembly outlet and complete the test at different rates and tidal volumes.

Clean after each use. All components of the P/N L496 Non-Rebreathing Valve are autoclavable. To disassemble, unscrew the valve inlet from the outlet and remove the duckbill diaphragm. The individual components can now be cleaned. If autoclaving systems are not available, you may also sterilize via cidex or other bacteriocidal solution. Be sure to rinse and dry all parts thoroughly before re-assembling. After cleaning, inspect all parts for damage or breakage. Replace any damaged or broken parts.

STORAGE OF THE LSP AUTOVENT 2000/3000

Store the unit in a clean, dry area within a temperature range of -40°F to 160°F.

After long periods of storage, the unit should be fully tested before use in accordance with the checkout procedures in this manual.

TROUBLESHOOTING GUIDE FOR THE LSP AUTOVENT 2000/3000

INDICATION	PROBABLE CAUSE	SOLUTION
Decreased tidal volume or decreased chest expansion	Leak around mask or Patient Valve tubing	Check all connections for leaks
	Inappropriate volume setting	Check Control Module setting and adjust as required
	Inappropriate inspiratory Time setting (AV 3000)	Check Control Module setting and adjust as required
	Decreased lung compliance and/or increased airway resistance	Evaluate patient and correct as required by adjusting Control Module settings
	Airway secretions	Clear airway of secretions

TROUBLESHOOTING GUIDE (Continued)

Increased tidal volume or increased chest expansion	Volume setting to high	Check Control Module settings and adjust volume as required
	Increased lung compliance	Evaluate patient and correct as required by adjusting Control Module Settings
	Inappropriate inspiratory Time setting (AV 3000)	Check Control Module setting and adjust as required
Pressure limit alarm at beginning of inspiratory phase	Airway blockage, kinked tubing, and/or increased airway resistance	Clear airway of secretions or foreign matter; check endotracheal tube; check ventilator tubing
Pressure limit alarm during inspiratory phase	Increased airway resistance	Evaluate patient and adjust ventilators as required
	Decreased lung compliance	Evaluate patient and correct as required by adjusting Control Module settings
	Coughing	Attempt to alleviate coughing
	Increased airway secretions	Clear airway secretions
Failure of the ventilator to cycle	Gas source failure	Change oxygen cylinder if being used, or evaluate and check gas source outlet.
	Cylinder valve closed	Open cylinder valve fully
	BPM control knob in "0" position	Adjust BPM knob to desired rate
	Loose connections	Tighten connections
	Disconnected actuator tubing	Reconnect tubing
	Kinked oxygen supply line and/or actuator tubing	Straighten tubing
	Regulator failure	Change regulator
	Malfunctioning Control Module	Remove from patient and ventilate by alternate means.
Failure of the pressure limit alarm	Alarm outlet is plugged with debris or has malfunctioned	Remove and clean, or replace

WARRANTY INFORMATION

Warranty Repair Service

Please complete and return the Warranty Registration card inclosed with your AutoVent 2000/3000 as soon as possible.

Please read the following limited warranty carefully:

In the event your LSP AutoVent 2000/3000 Automatic Ventilator needs servicing, the following steps will help to ensure that the repair service is processed promptly.

Contact your authorized Life Support Products distributor, or Life Support Products before returning product for repair/service.

Mailing Address:
Life Support Products
1720 Sublette Avenue
St. Louis, MO 63110
Telephone: (314) 771-2400
(800) 444-3954

Shipping Address:
Life Support Products

Repackage the Control Module and Patient Valve Assembly, providing adequate packaging material to protect the module during shipment.

This warranty is not valid if the Control Module or Patient Valve Assembly show signs of misuse, being opened, altered or modified in any way other than its intended use.

NOTE: Some warnings and cautions appear more than once throughout the manual. They appear in this summary to help direct the user to the proper page and section of this manual.

SUMMARY OF WARNINGS AND CAUTIONS

Page Number	Warnings
4	If the maximum pressure limit is reached, the pre-set tidal volume may not be delivered to the patient. Inspiratory time will remain constant, however, and an inspiratory hold will be maintained with no additional volume being delivered until the Ventilator cycles to the expiratory phase. ***This warning also appears under Tidal Volume in the Performance Characteristics.***
4	Should the blue rubber diaphragm blow outward from the alarm module's air entrainment ports, remove the AutoVent immediately from service. And contact your LSP Distributor.
6	If the maximum pressure limit is reached, the pre-set tidal volume may not be delivered to the patient. Inspiratory time will remain constant, however, and an inspiratory hold will be maintained with no additional volume being delivered until the ventilator cycles to the expiratory phase. ***This warning also appears under the Pressure Limit Alarm Module in the Performance Characteristics.***

SUMMARY OF WARNINGS AND CAUTIONS (Continued)

Page Number	
	Warnings
7	Should the inspiratory time control knob on the AutoVent 3000 be adjusted after initial setup, it will alter the patient's BPM and Tidal Volume.
7	The P/N L496 Non-Rebreathing valve is not for use in toxic atmospheres.
8	Should a mechanical problem develop or the patient appears to be experiencing difficulty while connected to this unit, disconnect the unit immediately and ventilate by other means. If unable to determine the cause of the problem, the unit should be returned to an authorized AutoVent Support Center for service.
8	This device operates with medical gases under pressure, including oxygen. Do not use oil on this device or operate near flammable materials.
8	This device should only be operated by a qualified personnel under approved medical direction.
11	Always check or change the source gases if a low pressure blender alarm sounds distinguished by a continuous high-pitched hum.
12	This device should only be operated by qualified personnel under approved medical direction.
12	The AutoVent 3000 is not recommended for use with patients less than 20kg. The AutoVent 2000 is not recommended for use with patients less than 40kg.
14	Monitor the patients *closely* while using the demand mode. Should the patient's respirations slow, become shallow or labored, return to initial automatic ventilator settings *immediately*.
14	Cleaning procedures must be performed in an environment free of oil and petroleum-based products.
15	Clean and disinfect the patient valve after *every* use.
	Cautions
8	In order to provide optimal performance, check all source gas supplies to assure only clean, dry gas is used, free of contaminations and/or liquids.

SUMMARY OF WARNINGS AND CAUTIONS (Continued)

Page Number	Cautions
10	Read all instructions *thoroughly* before opening the cylinder valve. Connect all oxygen/source gas pressure lines to the LSP AutoVent 2000/3000 and Patient Valve Assembly prior to use. Assure all high pressure outlets are capped and cylinders turned off or closed when not in use.
10	Always make sure an adequate supply of oxygen or source gas is available for patient use and transport. It is advisable to have a back-up regulator available to facilitate change-over in the event a cylinder transfer needs to be made.
10	Always verify that the cylinder valve is in the *closed* or *off* position (fully clockwise) prior to disconnecting the tubing assembly or removing the regulator from the oxygen cylinder.
11	*Always* follow the blender manufacturer's instructions, contained in the blender product manual, for exact connection of the blender to cylinders or wall sources. Always use a *high-flow* blender (15 LPM to 150 LPM) for ventilatory application.
16	If the flapper valve is twisted or the locating bosses are not properly positioned, the Patient Valve Assembly will not function properly. Always make sure the valve is flat and properly seated.

APPENDIX A: Support Equipment

For your ordering convenience, the following is a list of adjunct equipment which may be used in conjunction with or in support of the LSP AutoVent 2000/3000.

Description	Model No.
Patient Valve Actuator	L004006
Pressure Limit Alarm	L535-010
Pressure Limit Alarm	L535-030 Toxic
Oxygen Regulator	L270-020 or L270-030
Non-Rebreathing Valve	L496
Corrugated Hose	L535124-010
Patient Valve Supply Tubing	L535114
Oxygen Supply Hose	L535026

APPENDIX A: (Continued) **Support Equipment**

Description	Model No.
Outlet	L002768-030
Exhalation Valve	L585045-030
Adapter Anti-Inhalation	L003571
Diaphragm Anti-Inhalation	L517043
Operator Manual	L909005-224
Aspirator	L146
Infant Cuffed Mask	L099-000
Child Cuffed Mask	L099-002
Adult Cuffed Mask	L099-005
Child Tru-Fit Mask (10/Box)	L595060-020
Adult Tru-Fit Mask (10/Box)	L595060-050
Airway (Adult)	L002882-050
Airway (Child)	L002882-020

Kit 109 and Kit 002-983 Combined. Test Regulators, Demand Valves and Constant Flow Selector Valves	L010090
Test Equipment for Demand Valve and Constant Flow Selector Valve	L109
Test Kit for Oxygen Regulators (Outlet Pressure and High Flow)	L002983
Orange Molded Case for "D" and Jumbo "D" Size Portables	L040088
Child Bag Mask Kit, Child Tru-Fit Mask, Cardboard Box	L238-210
Adult Bag Mask Kit, Adult Tru-Fit Mask, Cardboard Box	L238-220
Mouth to Mask Resuscitator, Adult Tru-Fit Mask (6/Box)	L483-010

APPENDIX B:

Patient Valve Assembly Specifications (All performance specifications were obtained by testing at normal temperature and pressure.

Flow:	As required in demand valve mode: 0-36 LPM at 50 psig. Depends on volume setting.
Peak Inspiratory Flow:	36 LPM at an airway pressure drop of less than 2.5 cm.H_2O.
Delivery Pressure:	60±5cm.H_2O (44 mm.Hg.)
(Insp.) Crack Pressure:	0- to -2 cm.H_2O
Exhalation Resistance:	LPM: 0-10, 11-70 / cm.H_2O (max): 1.5, 3.8
Gas Consumption Driving Gas:	0.4 LPM Maximum
Dead Space	8 ml. (excluding mask)
Supply Pressure:	40 to 60 psig.
Operating Temperature:	0°F to 125°F
Storage Temperature:	-40°F to 160°F
Inlet Fitting:	Standard male oxygen DISS.
Filter:	25 Micron Stainless Steel Mesh.
Outlet:	22 mm. outside diameter x 15 mm. inside diameter (fits standard medical masks, endotracheal tubes and tracheostomy tubes).
Weight:	16 oz./450 g.
Material	
Body:	Anodized aluminum
Cover:	Polycarbonate
Outlet:	Polysulfone
Inlet Fitting:	Plated brass

APPENDIX C:

Control Module Specifications (All performance specifications were obtained by testing at standard temperature and pressure

Supply Pressure Range:	40 to 60 psig
Storage Temperature:	-40°F to 160°F
Operating Temperature:	0°F to 125°F
Frequency: (AV 2000)	8 to 15 BPM
Frequency: (AV 3000 Only)	8 to 20 BPM
Tidal Volume:	400 to 1200 ml.
Tidal Volume: (AV 3000 Only)	200 to 1200 ml.
Flow Rate:	12 to 36 LPM
Inspiratory Time:	Approx. 2 seconds
Inspiratory Time: (AV 3000 Only)	Approx. 1 second (Child Setting) Approx. 2 seconds (Adult Setting)
Expiratory Time:	2 to 5.0 seconds
I:E Ratio:	1:1 to 1:4
Dead Space in Patient Valve Assembly:	8 ml.
Weight:	24 oz./680g.
Expiratory Resistance:	5 cm.H_2O
Minute Volume:	1.8 to 24 LPM
Case Material:	Polyester
Input Connection:	Plated brass
Output Connectors:	Plated brass
Gas Consumption Driving Gas:	0.4 LPM Maximum

APPENDIX D:

LSP Oxygen Pressure Regulator Specifications

(Model No.'s L270-020, L270-030, L280-020 and L280-030)

Supply Pressure:	500 to 2200 psig
Proof Pressure:	8000 psig
Outlet Pressure:	High Flow Outlets: 50 ± 10 psig at 2200 psig
Flow Capacity:	High Flow Outlets: 100 LPM minimum Constant Flow Outlet: 1,2,4,6,10,15,25, LPM or 0.5,1,2,3,4,8,15,LPM
Outlet Fitting:	Standard Male Oxygen DISS. Constant Flow Outlet: 1/4" barb
Operating Temperature:	-30°F to 124°F
Storage Temperature:	-40°F to 160°F
Outlet Pressure Relief Point:	100 psig Maximum
Filter:	25 Micron Stainless Steel Mesh

APPENDIX D: (Continued)

LSP Oxygen Pressure Regulator Specifications

Material	
Body:	Anodized Aluminum
Knob:	Polycarbonate
Outlets:	Plated Brass

Model No.'s L735-060 and L106-060

Supply Pressure:	500 to 2200 psig
Proof Pressure:	8000 psig
Outlet Pressure:	High Flow Outlets: 40 to 60 psig
Flow Capacity:	High Flow Outlets: 100 LPM
Outlet Fitting:	Standard Male Oxygen DISS
Operating Temperature:	-30°F to 125°F
Storage Temperature:	-40°F to 160°F
Outlet Pressure Relief Point:	100 psig maximum
Filter:	25 Micron Stainless Steel Mesh
Body:	Anodized Aluminum
Outlets:	Plated Brass

APPENDIX E:

The conversion chart values are calculations which approximate actual performance at various altitudes, but do not represent guaranteed performance specifications.

Life Support Products by Allied

AutoVent 2000/3000 Altitude Conversion Chart Tidal Volume Settings (ml.)

Altitude		200	300	400	500	600	700	800	900	1000	1200
(m.)	(ft.)										
1000	3280	226	339	452	565	678	791	904	1017	1130	1356
2000	6560	254	381	508	635	762	889	1016	1143	1270	1524
3000	9840	288	432	576	720	864	1008	1152	1296	1440	1728
4000	13120	328	492	656	820	984	1148	1312	1476	1640	1958
5000	16400	374	561	748	935	1122	1309	1496	1683	1870	2244
6000	19680	460	690	920	1150	1380	1610	1840	2070	2300	2760

APPENDIX F:

The values in this chart are calculations which approximate actual performance at various settings, but do not represent guaranteed performance specifications.

Life Support Products by Allied

AutoVent 2000/3000
Oxygen Cylinder Depletion Times*

Tidal Volume	Breaths per minute 8	9	10	12	14	16	18	20	Cyl.
1200									
	76	68	62	52	45	40	36	32	E
1000	71	64	58	49	42	37	33	30	Jmb. D
	46	41	38	32	28	24	22	20	D
800									
	117	106	97	83	72	64	58	52	E
600	110	99	91	78	68	60	54	49	Jmb. D
	71	65	59	50	44	39	35	32	D
500									
	162	148	136	117	103	92	83	76	E
400	152	138	127	110	96	86	78	71	Jmb.D
	99	90	83	71	63	56	50	46	D
300									
	262	243	227	200	179	162	148	136	E
200	245	227	212	187	168	152	138	127	Jmb. D
	159	148	138	122	109	99	90	82	D

* All times in minutes. Assumes .5 L/m. Module Consumption - .5 L/m. Patient Valve Consumption. Assumes no spontaneous breathing. Row #1=Aluminum 'E' cylinder 682 liters. Row #2=Aluminum Jumbo 'D' cylinder 637 liters. Row #3=Aluminum 'D' cylinder 414.6 liters.

NOTES:

NOTES:

Limited One (1) Year Warranty

LSP warrants this product to be free from defects in material and workmanship for a period of one (1) year from the date of manufacture. This Warranty is expressly conditioned on compliance with all inspection and preventative maintenance requirements as set by applicable government agencies and as specified by LSP.

This Warranty is extended by LSP only to the first purchaser of the product from either LSP or from an authorized distributor.

LSP'S OBLIGATIONS AND PURCHASER'S REMEDIES UNDER THIS WARRANTY ARE LIMITED AS FOLLOWS: In the event of a defect, malfunction or failure to conform to this Warranty, purchaser shall return this product to LSP, with shipping charges prepaid, within a reasonable time after discovery of such defect, malfunction or failure to conform. LSP shall repair or replace (at LSP's option) this product if it is defective, malfunctions or fails to conform to this Warranty, and shall return it to the purchaser with shipping charges prepaid and without any additional charges due to costs of repair or replacement.

In the event the product returned by purchaser is not defective, has not malfunctioned and does conform to this Warranty, LSP shall not be obligated to repair or replace the product and shall not be obligated for shipping charges for return of the product to the purchaser.

LSP shall in no event be liable for any consequential damages, nor for loss, damages or expenses directly or indirectly arising from the use of this product.

Disclaimer of Other Warranties

THIS WARRANTY IS IN PLACE AND IN LIEU OF ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A SPECIFIC PURPOSE, BY OPERATION OF LAW OR OTHERWISE.

This Warranty does not apply to malfunction or damage resulting from accident, alteration, misuse, abuse of the product, improper preventative maintenance, storage at extreme temperatures or extreme environments beyond design limits, or, where appropriate, improper use of the product by untrained persons. This Warranty does not apply to any plastic or rubber components since they can be affected adversely by undue exposures to heat, sun, water, ozone, or to other deteriorative elements.

LSP has not authorized any other firm or person to make any representations concerning this product nor to assume on LSP's behalf any liability in any way connected with the sale or use of this product.

This Warranty becomes void immediately, should any repairs of, or alterations to this warranted product be made without authorization by LSP.

Life Support Products
by Allied
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TEL: 314/771-2400 • FAX: 314/771-0650