



DeVilbiss® IntelliPAP™ PAP Device
DeVilbiss® SleepCube™ PAP Device

Service Manual

Model DV54

CAUTION– Federal (U.S.A.) law restricts this device to sale by, or on the order of a physician.



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A. SAFEGUARDS

When servicing electrical products, basic safety precautions should always be followed. Important safety information in this manual is highlighted by the following terms.

- DANGER:** Urgent safety information for hazards that will cause serious injury or death.
- WARNING:** Important safety information for hazards that might cause serious injury.
- CAUTION:** Information for preventing damage to the product.
- NOTE:** Information to which you should pay special attention.

PLEASE READ ALL INSTRUCTIONS BEFORE USING THIS DEVICE.

! DANGER!

- **ELECTRIC SHOCK HAZARD** – Do not use while bathing.
- **ELECTRIC SHOCK HAZARD** – Do not immerse this device into water or any other liquid.
- **ELECTRIC SHOCK HAZARD** – Do not attempt to open or remove the enclosure. There are no user-serviceable internal components. If service is required, return the product to your home care provider. Opening or tampering with the product will void the warranty.

! WARNING!

- The DeVilbiss IntelliPAP™ and SleepCube™ should be used only with masks recommended by DeVilbiss, your physician or respiratory therapist.
- To avoid rebreathing of exhaled air, do not use a CPAP mask unless the device is turned on and providing a supply of air. Venting in the mask should never be blocked. When the device is turned on and providing a fresh supply of air, exhaled air is flushed out of the mask vent. However, when the device is not operating, exhaled air may be rebreathed. Rebreathing of exhaled air for longer than several minutes can in some circumstances lead to suffocation. This warning applies to most CPAP devices.

- The DeVilbiss IntelliPAP and SleepCube devices are not life support devices and may stop operating with certain device faults or with a power failure. It is intended to be used on spontaneously breathing individuals weighing 66 lbs/30 Kg or greater.
- To avoid electric shock, always unplug power cord from wall outlet power source when performing cleaning.
- Use only accessories recommended by DeVilbiss.

CAUTION– The circular data port connector located on the back of the is used to attach accessories to the device. The connector must only be used with accessories approved for use by DeVilbiss. Do not attempt to attach any other device to this connector as it may damage the CPAP or the accessory device.

CAUTION– Never rinse or place the device in water. Never allow liquids to get into or around any of the ports, switches or air filter; doing so will result in device damage. If this occurs, discontinue use and remove the power cord from the power source. Allow the device to completely dry before use.

CAUTION– Do not place the IntelliPAP or SleepCube device where it can be bumped onto the floor or where the power cord may create a trip hazard.

CAUTION– Only the DeVilbiss DV5 series Heated Humidifier system is recommended for use with the IntelliPAP and SleepCube devices. Other humidifier systems may prevent the device from detecting snoring and may cause inappropriate pressure levels in the mask.

CAUTION– Oxygen is a prescription gas and should only be administered under the supervision of a physician.

B. INITIAL INSPECTION

DeVilbiss recommends equipment inspection upon delivery

- ❑ Power up the DV54 PAP using AC power.
- ❑ Test pressure accuracy using an outlet cap (DV51D-620), a calibrated pressure gauge and the procedures listed under Pressure Accuracy Test.
- ❑ Test the keys on the keypad using the procedures listed under Keypad Test.

1.

C. TRAVEL

The DeVilbiss DV54 PAP

- Automatically adjusts for altitudes between sea level and 9000 ft (2750 m)
- Automatically accepts line voltages of 100-240 V, 50/60 Hz
- Needs power cord appropriate for area
 - o USA DV51D-606
 - o Europe, except UK DV51D-607
 - o UK DV51D-608
 - o Australia DV51D-609
 - o Set of 3 (UK, Europe, Australia) DV51D-611

D. DC POWER

The DeVilbiss DV54 PAP

- Automatically accepts 12V DC power
- Operates on DC power only if AC power is not present
- Operates on AC power if both DC and AC power are present
- Optional 12V, 60 amp hour, deep cycle marine battery
- Optional DC to AC inverter:
 - minimum 200 watts @ 100/120 VAC
 - minimum 400 watts @ 220 VAC
- Needs appropriate DC power cord
 - o DV51D-619 DC accessory cable for DC plug-in adapters
 - o DV51D-696 DC battery clamp-on adaptor for stand-alone battery

E. SETTING PRESSURES AND FEATURES

Use the following steps to enter Clinical/Setup mode:

1. Apply AC power to the unit
2. Verify that LCD displays OFF
3. Press and hold the Down Arrow key and the Delay key.
4. While holding two keys, press the ON/OFF key.
5. The blower will begin operating and the LCD will display 'Clinical Menu'.
6. Use the Left and Right Arrow keys to scroll through the options
7. Use the Up and Down Arrow keys to select the option's value.
8. Press the ON/OFF key at any time to exit Clinical Mode.

F. IMAGES: DEVILBISS DV54 PAP

Figures A and B:

DV54 Device Back and Bottom Views

1. Air supply port on back of device
2. Air supply port on bottom of device (for optional humidifier)
3. Air supply port plug
4. Heater power connector (for optional humidifier)
5. AC power connector
6. DC power connector
7. Data port
8. Air inlet filter opening

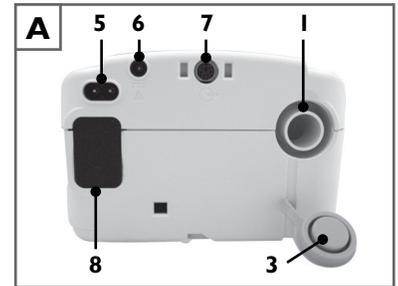
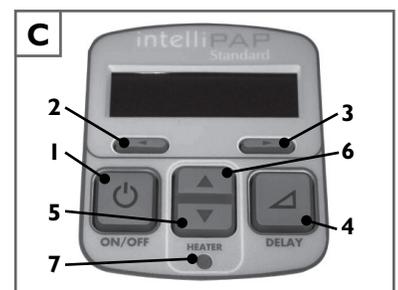


Figure C: Keypad

1. ON/OFF
2. Previous item
3. Next item
4. Delay
5. Decrease value
6. Increase value
7. Heater power LED (for optional humidifier)





2. Description of Normal Operation

An AC line cord (100-240 VAC, 50/60 Hz) or a DC line cord (12 VDC) supplies electrical power to the DV54 PAP. The PAP converts the AC input voltage to DC voltage by means of an internal switch mode power supply and uses the DC voltage to power the internal electronics of the unit, such as microcontroller, motor control circuitry, blower, LCD display, etc. NOTE: The heated humidifier will not operate when the PAP uses external DC power.

The PAP produces positive pressure by spinning a reverse-curved impeller with a brushless DC motor. Room air is drawn through a filter into the blower, pressurized in the blower, optionally passed through a heated humidifier chamber, and then discharged through a 22mm-ID, smooth-bore tube. Pressure regulation is achieved using measured pressure and flow as feedback.

The DV54 PAP senses patient breathing by monitoring the flow transducer signal which detects the fluctuations caused by inhalation and exhalation. The flow transducer signal also triggers mask-OFF alerts and auto-ON / auto-OFF functionality.

In AutoAdjust mode, the DV54 software analyzes the flow transducer signal to detect respiratory events such as apneas, hypopneas, mixed apneas, snoring, and exhale puffing as defined by programmable settings. An onboard algorithm evaluates the detected respiratory events and adjusts the pressure as follows: The DV54 PAP increases output pressure when it detects apneas, hypopneas, and snoring events; it maintains pressure when it detects mixed events; and it decreases pressure on a regular timed interval as the number of recent respiratory events decreases.

A. ROUTINE CLEANING--PATIENT

- Unplug the DV54 PAP and wipe enclosure with a clean, damp cloth every few days to keep dust free. Allow the device to dry completely before returning to power source.
- Check the air-inlet filter every 10 days. Wash the dark outer foam filter in a solution of warm water and mild detergent. Rinse with water. Allow the filter to dry completely before returning to the device.
- Check the optional fine particle filter every 10 days and replace if dirty or damaged.
- Clean the air supply tubing every day. Remove the tubing from the device and mask and wash the inside of the tubing in a solution of warm water and mild detergent. Rinse with water and allow to air dry before replacing device and mask.
- Clean the mask and headgear according to the manufacturer's instructions.

B. DISINFECTING

CAUTION– Always work in an ESD (electro static discharge) safe environment when assembling or disassembling electronic components.

NOTE– DeVilbiss does not require disinfection as part of unit maintenance. If disinfection is desired, the following procedure is recommended.

NOTE– Parts needed to perform the disinfection procedure are NOT covered under the DV54 PAP warranty as listed in this manual.

NOTE– Follow manufacturer's instructions for cleaning and disinfection solutions.

NOTE– Disinfection requires the following parts sold in Disinfection Kit, DV51D-682.

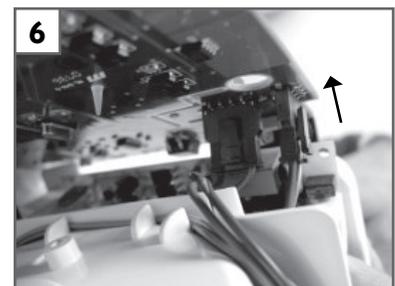
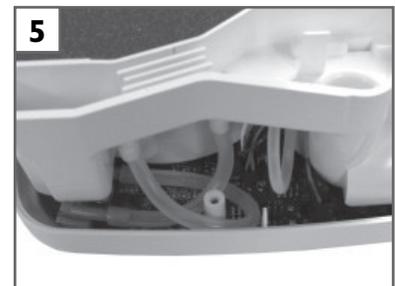
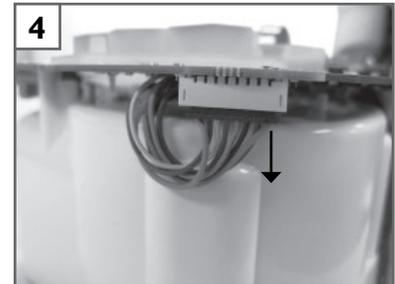
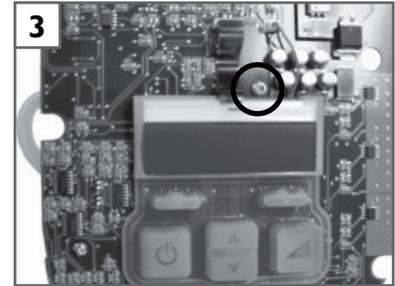
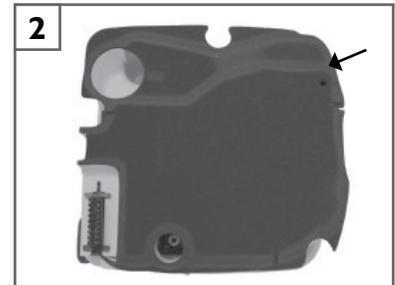
- Blower assembly, balanced
- Blower isolator-silicone
- Grommet-silicone
- 1/4 inch blower wrap foam
- 3 1/2 inch silicone tubing
- Air-inlet filter
- 5 1/2 inch silicone tubing
- Tubing/Humidifier air supply support plug
- 1/2 inch blower mount foam-round
- 1/2 inch top blower foam
- 1/8 inch inside bottom cover foam
- 5 inch silicone tubing
- Fine particle filter (optional)

Disinfection Procedure for the DV Series PAP

1. Make certain that the device is not connected to a power source.
2. Dispose of the mask, headgear, air supply tubing, gray air inlet filter and white fine particle filter, if applicable.
3. Place the unit, top side down, onto a clean work surface. Remove the four (4) screws from the bottom cover and remove the bottom cover from the unit. (Fig. 1)
4. Remove the black 1/8 inch inside bottom cover foam from the bottom cover assembly and discard. This foam may stick to the chassis of the main unit. (Fig. 2)
5. Remove the black 1/2 inch top blower foam from the chassis assembly and discard.
6. Turn the unit top side up and remove the top cover.
7. Using a T-15 driver, remove the screw holding the PC board to the chassis. (Fig. 3)
8. Disconnect the 8-conductor blower wire harness from the underside of the PC board. (Fig. 4)
9. Disconnect the three (3) pieces of tubing and discard. (Fig. 5)

NOTE— Pull the tubing straight off the connectors to prevent damaging the chassis.

10. With the ports side of the chassis toward you, tilt the PC board and its respective wire harnesses upward, and remove the wire connections. Lift the PC board slowly so that you can assist any wires that may become hung up on the chassis or power supply. (Fig. 6)

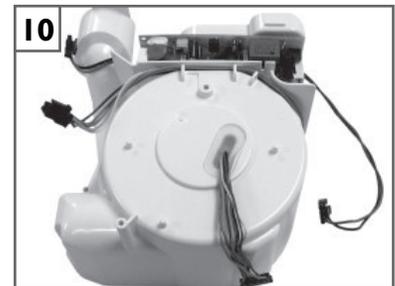
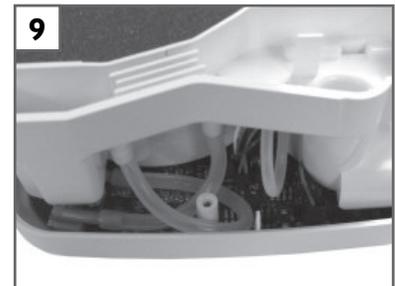
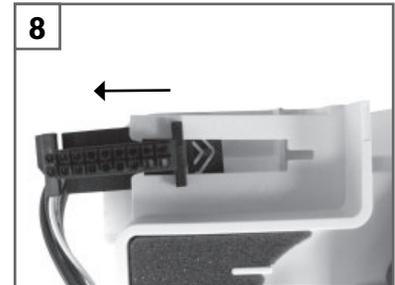
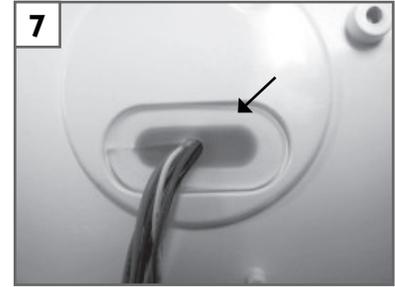


3.

11. Remove the grommet that seals the blower's wire harness. (Fig. 7)
12. Remove the heater wire harness connector from the bottom of the chassis by sliding the connector outward while pulling the top retaining tab upward slightly. (Fig. 8)
13. Remove the 1/4" blower wrap foam, the blower, and the silicone isolator from the underside of the chassis.
14. Carefully spray, wipe or soak the air intake, flow path and blower chassis inside and outside using a 2% glutaraldehyde solution.
15. Wipe the power cord and the outside of both halves of the PAP case with the same solution.
16. Let all components fully dry.
17. Reassemble the unit using parts from the Disinfection Kit—DV51D-682.

NOTES:

- Route the silicone tubing correctly, as shown, and ensure that there are no kinks. (Fig. 9)
- Ensure that the silicone isolator is fully seated in the chassis and the blower.
- Ensure that the grommet is fully seated around the blower wire harness.
- Route the wire harnesses properly, using the provided strain reliefs on the chassis. (Fig. 11)
- Secure the power supply board within the mount clips on the chassis before replacing the unit covers. (Fig. 10)





4. Maintenance

A. INITIAL INSPECTION—EQUIPMENT PROVIDER

DeVilbiss recommends equipment inspection upon delivery

- Power up the DV54 PAP using AC power.
- Test pressure accuracy using an outlet cap (DV51D-620), a calibrated pressure gauge and the procedures listed under Pressure Accuracy Test.
- Test the keys on the keypad using the procedures listed under Keypad Test.

B. ROUTINE MAINTENANCE—PATIENT

- Wipe case with damp cloth every few days
- Check air-inlet filter every 10 days and clean as needed
- Clean air supply tubing daily
- Clean mask and headgear per manufacturer's instructions.

C. REQUIRED 2-YEAR MAINTENANCE—EQUIPMENT PROVIDER

DeVilbiss requires the following maintenance from the equipment provider:

- Test pressure accuracy using procedures listed under Pressure Accuracy Test. If the device is out of calibration, follow corrective procedures as listed.
- Instruct patient on filter maintenance described in Instruction Guide:

<u>Standard Filter</u>	<u>Optional Fine Particle Filter</u>
<input type="checkbox"/> Inspect filter every ten days	<input type="checkbox"/> Inspect filter every ten days
<input type="checkbox"/> Clean as needed	<input type="checkbox"/> Replace if dirty
<input type="checkbox"/> Change every 6 months	<input type="checkbox"/> Change every 30 days
- Optional: Test flow accuracy using procedures listed under Flow Accuracy Test.

The following test procedures verify correct operation of the DV54 PAP and should be performed on all repaired units.

NOTE– Verify that the DV54 PAP contains the latest firmware release before conducting maintenance or repairs. Go to <http://www.devilbisshealthcare.com/Products> to download the latest firmware update. Download and installation instructions are provided on the web site.

A. PRESSURE ACCURACY TEST

Additional equipment required: outlet cap (DV51D-620), a calibrated pressure gauge (0-30 cmH₂O, accuracy ± 0.25 cmH₂O)

1. Connect the pressure gauge to the unit outlet port.
2. Apply AC power to the unit. If the blower is running, press the ON/OFF key on the keypad so that the blower stops and the LCD displays 'OFF'.
3. While pressing both the Down Arrow and Delay keys, press the ON/OFF key to start the blower and enter clinical mode.
4. Press the Next Item (right arrow) key to move to the Operating Mode screen. Use the Up Arrow or Down Arrow keys to place the unit in CPAP mode.
5. Press the Next Item key until Set Pressure is displayed. Use the Up and Down Arrow keys to adjust the pressure to 12 cmH₂O. Wait at least 30 seconds for the pressure to stabilize.
6. Verify that the displayed pressure matches the pressure measured on the gauge (pressure setting ± 0.5 cmH₂O). Accuracy at other pressure settings can be checked if needed.
7. If the pressure is out of calibration, turn the blower OFF for approximately 1 minute to allow auto-calibration to occur. Turn the blower back ON and allow 30 seconds for the pressure to stabilize. If the pressure is still out of calibration, perform a full calibration using the Manual Calibration Procedure.
8. If manual calibration does not improve pressure accuracy, there may be a problem with the flow path or control board. Refer to Troubleshooting.

B. FLOW ACCURACY TEST

Additional equipment required: PAP to PC cable (DV51D-615), a calibrated volumetric mass flow meter (range 0 to 150 L/Min, accuracy ± 3 L/Min), a flow control valve #DV51D-621 (or equivalent) to adjust flow, and a terminal program (Microsoft Windows HyperTerminal or equivalent).

1. Perform pressure accuracy test first to ensure that pressure is correct.
2. Connect the volumetric mass flow meter and flow control valve to the unit outlet port and close the valve.
3. Apply AC power to the unit and connect the unit to the terminal program via the PAP to PC cable.
4. If the blower is running, press the ON/OFF key on the keypad so that the blower stops and the LCD displays 'OFF'.
5. While pressing both the Down Arrow and Delay keys, press the ON/OFF key to start the blower and enter clinical mode.
6. Press the Next Item (right arrow) key to move to the Operating Mode screen. Use the Up Arrow or Down Arrow keys to place the unit in CPAP mode.
7. Press the Next Item key until Set Pressure is displayed. Use the Up and Down Arrow keys to adjust the pressure to 12 cmH₂O. Wait at least 30 seconds for the pressure to stabilize.
8. Adjust the flow control valve to achieve 60 lpm on the flow meter. Wait at least 30 seconds for the flow to stabilize.
9. Verify that the leak flow (terminal command: FI) matches the flow meter reading (set value ± 10 lpm). Accuracy at other flow settings can be checked if needed.
10. If the flow is out of calibration, turn the blower OFF for approximately 1 minute to allow auto-calibration to occur. Turn the blower back ON and allow 30 seconds for the pressure and flow to stabilize. If the flow is still out of calibration, perform a full calibration using the Manual Calibration Procedure.
11. If manual calibration does not improve flow accuracy, there may be a problem with the flow path or control board. Refer to Troubleshooting.

C. KEYPAD TEST

No additional equipment required.

1. Apply AC power to the unit. If the blower is running, press the ON/OFF key on the keypad so that the blower stops and the LCD displays 'OFF'.
2. While pressing both the Down Arrow and Delay keys, press the ON/OFF key to start the blower and enter clinical mode.
3. Press the Next Item key until Delay Time is shown on the LCD display.
4. Note the Delay Time; then change it by pressing the Up and Down arrow keys. Use the arrows keys to return the Delay Time back to the original setting.
5. Use the Previous Item key to return to the Set Pressure screen.
6. If any of the keypad keys did not function correctly during this test, replace the PC control board using Service Instructions.

D. AUTO-ON / AUTO-OFF TEST

Additional equipment required: 6 ft x 22 mm smooth bore tubing.

1. Apply AC power to the unit. If the blower is running, press the ON/OFF key on the keypad so that the blower stops and the LCD displays 'OFF'.
2. While pressing both the Down Arrow and Delay keys, press the ON/OFF key to start the blower and enter clinical mode.
3. Press the Next Item key until Enable Menu is displayed, and then press the Down Arrow key to enter the sub-menu.
4. Press the Next Item key until the Auto-ON setting is displayed. Use the Up or Down Arrow keys to set the value to Enabled.
5. Press the Next Item key until the Auto-OFF setting is displayed. Use the Up or Down Arrow keys to set the value to Enabled.
6. Press the ON/OFF key on the keypad so that the blower stops and OFF is displayed on the LCD.
7. Connect the 6 ft x 22 mm smooth bore tubing to the CPAP and block the airflow with your hand or a plug.
8. Turn the blower ON by pressing the ON/OFF key on the keypad.
9. Keep the airflow blocked for two minutes. Verify that the blower continues running and no mask alerts appear.
10. Unblock the smooth bore tubing to open the unit's airflow.
11. Verify that after approximately 10 seconds the LCD

shows 'Mask OFF'. If the mask alert did not appear, go to step 14.

12. After another 20 seconds the blower should turn OFF via the Auto-OFF feature. Wait approximately two minutes after the blower turns OFF. Verify that the blower does not turn back ON without breathing present.
13. Tap the palm of your hand on and off the end of the smooth bore tubing to simulate breathing and verify that the blower turns ON via the Auto-ON feature.
14. If any of the Auto-OFF or Auto-ON features do not work correctly, perform a full calibration using the Manual Calibration Procedure.

E. BACKLIGHT TEST FOR LCD AND KEYPAD

No additional equipment required.

1. Apply AC power to the unit. If the blower is running, press the ON/OFF key on the keypad so that the blower stops and the LCD displays OFF.
2. Press the ON/OFF key and verify that the LCD and keypad backlight are lit.
3. Wait one minute and verify that the LCD and keypad backlights reduce intensity.
4. Press any keypad key, except ON/OFF, and verify that the LCD and keypad backlights return to full intensity.
5. If the LCD or keypad backlights did not function correctly during this test, replace the LCD, keypad and/or PC control board.



6. Alerts and Device Faults

A. ALERTS VISIBLE TO PATIENTS

Alert	Description
Delay running XX minutes left	Comfort Delay is active
Mask leak = XX%. Check fit.	High airflow for at least 10% of previous use time (Poor mask fit) (actual percentage is listed)
Mask off. Please check mask fit.	High airflow during use (Poor mask fit or mask removed)
Device Fault E0X. Call provider.	Device error (See next table.)

B. DEVICE FAULTS VISIBLE TO PATIENTS

Only device faults classified as critical are visible to the patient on the LCD display. These faults can be corrected by a service technician.

Device Fault	Description
E01	Read Setting Error. Stored prescription settings are corrupted. Unit is in fail-safe state (blower off) when this error displays. See Troubleshooting and Service Instructions to correct fault, or return unit for repair.
E03	Motor Error. Unit attempts to drive the motor, but the blower is not spinning (zero motor speed). See Troubleshooting and Service Instructions to correct fault, or return unit for repair.
E04	Locked Rotor Error. Average motor speed is low, while the motor current is high, for several seconds. See Troubleshooting and Service Instructions to correct fault, or return unit for repair.
E06	Motor Runaway Error. Motor speed is high and the pressure and total flow are low (close to zero) for a fixed period of time. See Troubleshooting and Service Instructions to correct fault, or return unit for repair.
E07	Motor Fault Error. The motor control chip fault output goes active low for a fixed period of time. See Troubleshooting and Service Instructions to correct fault, or return unit for repair.

C. READING AND CLEARING THE LAST DEVICE FAULT CODE

NOTE– The last device fault code is stored in EEPROM to assist in field service of the unit.

Additional equipment: IBM or Compatible PC with a free serial port, PAP to PC cable (DV51D-615), a terminal program (Microsoft Windows HyperTerminal or equivalent).

1. Connect the DV54 PAP to the PC serial port with PAP to PC cable.
2. Apply AC power to the unit. If the blower is running, press the ON/OFF key on the keypad so that the blower stops and the LCD displays 'OFF'.
3. Use a terminal program (such as Windows HyperTerminal, or equivalent) with COM settings 9600 baud, no parity, 8 data bits, 1 stop bit, and Flow Control set to none.
4. When connection is established with the PAP, the terminal program will show: 'RH;' every 0.5 seconds. This display indicates that the PAP is waiting for a handshake.
5. Type 'rh' (all commands are case sensitive) and press Enter. The PAP should respond with the firmware version in the form "V0.XX mm/dd/yyyy." Repeat this step if necessary to complete the handshake.
6. Request the last alert code and date by typing 'E1' and pressing Enter. The return value will be in the form 'Exx dd/mm/yyyy'. Exx is the alert code and dd/mm/yyyy is the date the error occurred.
7. Clear the last alert code by typing 'Ec' and pressing Enter. The PAP will respond with 'OK'.

A. MANUAL CALIBRATION

DeVilbiss recommends calibrating the DV54 PAP if replacing the PC control board or when testing or troubleshooting indicate calibration is required. The manual calibration procedure accesses a terminal program via the unit's communication port to calibrate the internal pressure sensor, flow conditioning circuitry, and the motor current circuitry. Progress and confirmation messages display on the terminal screen throughout the procedure. If a failure occurs during calibration, the error displays as well. See Calibration Errors below.

Additional equipment: IBM or Compatible PC with a free serial port, PAP to PC cable (DV51D-615), a terminal program (Microsoft Windows HyperTerminal or equivalent) and a calibrated pressure gauge (0 to 30 cmH₂O), a calibrated volumetric flow meter (0 to 150 lpm) and a ball valve or equivalent to adjust the PAP flow.

Please read all steps before beginning this process.

NOTE– Details on the Tc serial commands used in this procedure are listed in Section D.

1. Use the PAP to PC cable to connect the DV54 PAP to a PC serial port and apply AC power to the PAP.
2. Use a terminal program (such as Windows HyperTerminal, or equivalent) with COM settings 9600 baud, no parity, 8 data bits, 1 stop bit, Flow Control set to none.
3. When connection is established with the PAP, the terminal program will show: 'RH;' every 0.5 seconds. This display indicates that the PAP is waiting for a handshake.
4. Type 'rh' (all DV54 commands are case sensitive) and press ENTER. The PAP will respond with the firmware version in the form 'V0.XX dd/mm/yyyy'. Repeat this step if necessary to complete the handshake.
5. Start the calibration process by typing 'Tc=s' and pressing ENTER. The PAP will respond with 'Calibration Started'. If the unit responds with 'WF', resend the 'Tc=s' command.
6. The PAP will begin sending messages and prompting for responses to complete the calibration. **NOTE:** If a calibration failure is encountered at any stage during the procedure, the PAP will respond with 'Cal failed: EXX', where XX is a two digit error code.
 - a. PAP sends 'Waiting for blower to stop spinning'.

- b. PAP sends 'Cal press offset' when spinning is stopped.
During this stage of the procedure the PAP stops the blower and saves the pressure sensor and motor current offsets and adjusts the flow balance digital potentiometer. After a short delay, the PAP increases the pressure to approximately 20 cmH₂O.
- c. PAP sends 'Set pressure to 20 cmH₂O using Tw+, Tw-, or Tw=' 'Send Tc=y when ready'
- d. Connect the pressure gauge to the PAP outlet (the outlet should be in a deadhead or zero flow condition) and, using the computer keyboard ('Tw+' followed by ENTER increases the pressure and 'Tw-' followed by ENTER decreases the pressure), adjust the PAP pressure to 20 cmH₂O (± 0.1 cmH₂O), then type 'Tc=y' followed by ENTER.
- e. PAP sends 'Reading and saving pressure hi cal' after confirming that the pressure is correct.
During this stage of the procedure, the PAP calibrates the pressure sensor by reading and saving the high pressure calibration value.

NOTE– As an alternative to steps d and e, the current PAP pressure gauge reading can be sent to the PAP from the terminal. Perform the following steps for this option.

Use the 'Tw+', 'Tw-', or 'Tw=X' (where X is a number between 0 and 1023 to adjust the pressure to a value between 15 and 30 cmH₂O. If the pressure is already within this range no adjustment is needed. **NOTE:** A more accurate calibration will be obtained, if the value is close to 20 cmH₂O.

7. Send the pressure to the PAP in the format 'Tc=yxxxxx', where xxxxx is the gauge pressure in cmH₂O multiplied by 1000 (Example: 20 cmH₂O is sent as 'Tc=y20000').
8. Connect a calibrated flow meter to the PAP and use a ball valve (or equivalent) to adjust the volumetric flow to 110 lpm (+/- 1 lpm),.
9. After a short delay, the PAP will respond with 'Set flow to 110 lpm' and 'type Tc=y when ready'. Press Enter after receiving those messages.
10. After a short delay the PAP will respond with 'cal successful'. Calibration is now complete. Please check PAP pressure and flow for accuracy.

B. CALIBRATION ERRORS

Code	Description
E95	Calibrate Motor Stop Error. The blower did not stop during device calibration. This error only occurs during the calibration procedure.
E96	Calibrate Flow Balance Error. The flow balance digital potentiometer did not adjust during device calibration. This error only occurs during the calibration procedure.
E97	Calibrate Flow Gain Error. The flow gain digital potentiometer did not adjust during device calibration. This error only occurs during the calibration procedure.

C. AUTO-CALIBRATION

The DV54 PAP automatically adjusts calibration to maintain accuracy over time and under varying operating conditions. Each time the blower is turned OFF, the PC control board reads and saves the offset voltages from the pressure transducer and the flow transducer. The PAP uses these voltages to maintain calibration accuracy as the unit is used over time.

D. DETAILS ON TC SERIAL COMMAND

Tc serial commands are used in the manual calibration procedure listed in Section A. The 'Tc' command on the terminal program reads the unit's current calibration values, starts the calibration procedure, and handles user feedback during the calibration process. Refer to the manual calibration procedure for details on the calibration process.

- Sending 'Tc=s' to the PAP starts the calibration process.
- Sending 'Tc' without a modifier requests the current calibration values. A comma-separated list of all cal values is returned.

Comma-separated response to 'Tc' with no modifier:
llll,hhhh,mmmm<cr>

- o llll is the pressure low cal (sensor offset). Convert to voltage by dividing by 1024 and multiplying by 5.
- o hhhh is the pressure high cal (sensor output at 20 cmH₂O). Convert to VDC by dividing by 1024 and multiplying by 5.
- o mmmm is the motor current calibration (adc offset)
- Feedback is provided to the calibration task by sending 'Tc=y' when prompted.

Symptom	Action (for symptoms listed at left, follow the steps listed below)
Blower does not start when powered up E03, E04, or E07 errors display OR display is blank	<ol style="list-style-type: none"> 1. Remove the cover. See Service Instructions. 2. Search for disconnected wire harnesses and reconnect, if needed. 3. Determine if fuses are open. Measures voltages on both sides of the F1 fuse. If 12 +/- .5 VDC is not present on both sides of the fuse, the fuse is open and the power supply board should be replaced. See Service Instructions. Measure resistances, without AC power to unit, on the F2 and F3 fuses with an ohmmeter. If either fuse is open, replace the PC control board. See Service Instructions. 4. If all fuses are closed, install a blower known to operate properly, see Service Instructions, and power up the unit. If the new blower operates properly, replace the old blower. If the new blower does not operate properly, replace the control board. See Service Instructions. 5. Replace the cover. See Service Instructions.
E01 error code displays	Replace the control board
Blower is loud	<ol style="list-style-type: none"> 1. Remove the cover and control board. See Service Instructions. 2. Inspect the assembly of the foam, blower, and silicone isolator. See Blower Replacement instructions for correct placement. 3. Inspect the blower for visible space between the blower halves and press halves back together, if needed. 4. If the assembly is not correct, reassemble the components. 5. If assembly is correct, replace the blower. See Service Instructions. 6. Replace the control board and cover. See Service Instructions.
Blower does not start when powered up and E06 error displays	<ol style="list-style-type: none"> 1. Remove the cover. See Service Instructions. 2. Search for disconnected, occluded, or kinked tubing on the pressure sensor, flow sensor, and chassis. Correct any issues. 3. Search for damage to the chassis, any foam pieces, and/or tubing and replace the component, if damaged. 4. Remove the control board. See Service Instructions. 5. Search for signs of water damage to the blower assembly, pressure sensor, and/or flow sensor and replace, if damaged. 6. Inspect the blower. If a space is visible between the top and bottom sections, re-connect the halves to eliminate the space. 7. Re-calibrate the pressure and flow sensors. 8. If the above steps did not eliminate the error, replace the control board. See Service Instructions. 9. Replace cover. See Service Instructions.

8.

Symptom	Action (for symptoms listed at left, follow the steps listed below)
<p>Pressure or flow out of tolerance (Pressure \pm 0.5 cmH₂O of setting) (Flow \pm 10 L/Min)</p>	<ol style="list-style-type: none"> 1. Remove the cover. See Service Instructions. 2. Search for disconnected, occluded, or kinked tubing on the pressure sensor or chassis. Correct any issues. 3. Search for damage to any foam pieces and/or tubing and replace the component, if damaged. 4. Remove the control board. See Service Instructions. 5. Search for signs of water damage to the blower assembly, pressure sensor, and flow sensor and replace the component, if damaged. 6. Inspect the blower. If a space is visible between the top and bottom sections, press the halves together to eliminate the space. 7. Repeat the pressure and flow accuracy tests. 8. If the pressure or flow remains out of tolerance, re-calibrate the unit. See Service Instructions. 9. If the pressure remains out of tolerance, replace the control board. See Service Instructions. 10. Replace cover. See Service Instructions.
<p>Calibration failure— Error codes E95, E96, E97, E98 Display on terminal program during calibration.</p>	<ol style="list-style-type: none"> 1. Remove the cover. See Service Instructions. 2. Search for damage, and/or loose connections, on the air intake filter, intake foam components, and all internal tubing and replace or reconnect components, if needed. Search for disconnected, occluded, or kinked tubing on the pressure sensor, flow sensor, or chassis and reconnect or replace tubing, if needed. 3. Remove the control board. See Service Instructions. 4. Search for signs of water damage to the blower assembly, pressure sensor, and flow sensor and replace, if damaged. 5. Inspect the blower. If a space is visible between the top and bottom sections, press the halves to eliminate the space. 6. Repeat Manual Calibration Procedure. 7. If the error codes are not resolved, replace the control board. See Service Instructions. 8. Replace the cover. See Service Instructions.

NOTE– After performing any service on the DV54 PAP, please test the unit to ensure proper operation and calibrate, if necessary.

A. COVER REMOVAL

CAUTION– Failure to wear anti-static equipment during service may damage this device.

1. If using a DV5HH, remove the heated humidifier and unplug the tubing/humidifier air supply port plug from the back of the cover and re-plug it in the outlet on the bottom cover.
2. Position the PAP on a clean, flat surface with the keypad facing down.
3. Remove four T-20 screws from the bottom cover.
4. Lift the bottom cover straight up off the top cover.

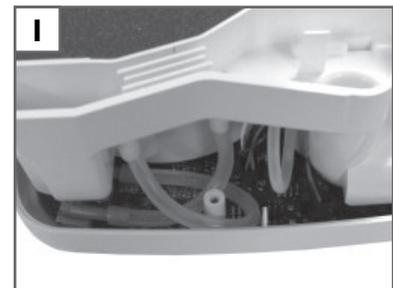
NOTE– Attempting to reorient the PAP in order to lift the top cover, instead of the bottom cover, may damage this device.

5. Wearing an anti-static device, carefully lift the chassis off the top cover.

B. COVER REPLACEMENT

CAUTION– Failure to wear anti-static equipment during service may damage this device.

1. Wearing an anti-static device, search for and connect all loose wire harnesses.
2. Place the chassis into the top cover, with the keyboard facing the cover and fitting the control board around the screw posts in the cover.
3. Connect all tubing, carefully creating the correct loops and eliminating any kinking. (Fig. 1)
4. With the 1/8 inch inside bottom cover foam oriented correctly and lying flat, place the bottom cover over the chassis and onto the top cover, fitting the screw posts into proper alignment with the chassis and moving any protruding wire harnesses and tubing away from the edges of the cover.
5. Replace four T-20 screws.



C. CONTROL PC BOARD REMOVAL

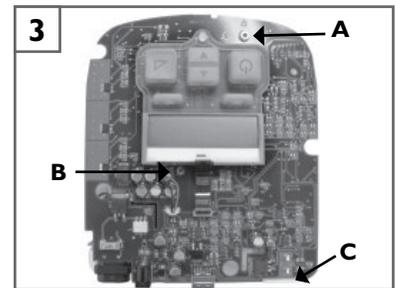
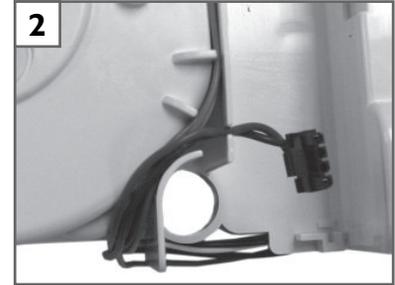
CAUTION– Failure to wear anti-static equipment during service may damage this device.

1. Remove the cover. See instructions above.
2. Wearing an anti-static device, lift the cover off the chassis and place it, with the control board facing up and the blower facing down, onto a clean flat surface.
3. Disconnect the three pieces of tubing from the outlet port side of the chassis.
4. Disconnect accessible wire harnesses: one behind and one to the left of the tubing in step 3, one at the right corner under the keypad, and one on the outside of the power supply board.
5. Remove one T-15 screw, located near the middle of the board beside LCD screen. Lift the board off the chassis slowly and disconnect any remaining wire harnesses from the control board.
6. Place control board keypad facing down onto a clean, flat, static-free surface, if returning to the unit.

D. CONTROL PC BOARD REPLACEMENT

CAUTION– Failure to wear anti-static equipment during service may damage this device.

1. See instructions above to remove the cover and the control PC board.
2. Wearing an anti-static device, verify that the silicone rattails holding the keyboard onto the control board are pulled through the appropriate holes in the board. See Key Pad & LCD Display instructions.
3. Place the chassis on a clean flat surface with the blower facing down. Orient the replacement board so that the keypad is over the rounded end of the chassis.
4. Tilt the board and connect the two wire harnesses near the power supply board and insert the brown and blue wires into the notch on the chassis. Tilt the board and connect the two wire harnesses near the outlet port. Connect the wire harness near the right corner of the keypad. (Fig. 2)
5. Position the board (Fig. 3) so that: the hole on the board (A), located below the ON/OFF key, is over the peg on the chassis; the small hole (B), located near the LCD screen, is over the screw hole on the chassis; and the cut-out (C) on the left rear corner fits around the protrusion above the air outlet port on the chassis. Move any stray tubing from between the board and the chassis, verify that all wire harnesses are properly routed, and replace the T-15 screw on the board.
6. Replace the cover. See instructions above.
7. Connect the CPAP to a PC serial port with cable DV51D-615 and turn the CPAP on.
8. Use a terminal program (such as Windows HyperTerminal, or equivalent) with COM settings 9600 baud, no parity, 8 data bits, 1 stop bit, Flow Control set to none.
9. When connection is established with the CPAP, the terminal program will show: "RH;" every 1/2 seconds. This display indicates that the CPAP is waiting for a handshake.
10. Type 'rh' and press ENTER. The CPAP should respond with the firmware version in the form "V0.XX dd/mm/yyyy." Please note that all commands are case sensitive. Repeat this step if necessary to complete the handshake.
11. Type 'Mn<cr>'. The CPAP will report the model number saved in memory, it should be "000000" if the PC board is new.
12. Read the model number from the CPAP label on the bottom of the unit (EX: DV54SE).
13. Type 'Mn=nnnnnn<cr>' where nnnnnn is the 6 digit model number read in the previous step (use a space for the last digit if necessary to make the string 6 digits). The CPAP should return the new six-digit model number.
14. Type 'Sn<cr>'. The CPAP will report the serial number saved in memory, it should be "00000000" if the PC board is new.
15. Read the serial number from the CPAP label on the bottom of the unit.
16. Type 'Sn=nnnnnnnn<cr>' where nnnnnnnn is the 8 digit serial number read in the previous step. The CPAP should return the new eight-digit serial number.
17. Read the Hour Meter ("Uh<cr>")– a new PC board should have 00000 hours. It is recommended that the original hour meter value be restored if the original blower is used. Set the hour meter by sending 'Uh=nnnn<cr>' where nnnn is the hour meter reading x 10 (Ex: 100.5 hours would be set by typing 'Uh=1005<cr>').



9.

18. Read the Compliance Meter (“Up<cr>”)– a new PC board should have 00000 hours. Clear the Compliance meter if it is not zero by typing ‘Up=c<cr>’. The CPAP will return 000000 . 0 hours.
19. Check the firmware and hardware version information. Read and record the following:
 - BIOS rev “VB<cr>”
 - Firmware rev “VF<cr>”Check the present version of firmware to make sure the board is up to date. Install new firmware if the board has an old version.
20. Check for last saved error, type ‘El<cr>’. The CPAP will respond with “Exx dd/mm/yyyy” where xx is the last saved error code and dd/mm/yyyy is the date that the error was detected. Clear the last error by typing ‘Ec<cr>’, the CPAP will return “OK.” Verify that the error code is “00” by typing ‘El<cr>’.
21. Set all device settings to their default values by typing ‘TD<cr>’. The CPAP should return “OK.”
22. Recalibrate the unit.

E. POWER SUPPLY BOARD REMOVAL

CAUTION– Failure to wear anti-static equipment during service may damage this device.

1. See instructions above to remove the cover and the control PC board.
2. Wearing an anti-static device and with the power supply board facing you, apply thumb pressure to top left corner of the board while pulling the top right corner up and out of the mount clip at its bottom.
3. Pulling the top left corner out of its mount clip, lift the board off the chassis.
4. If returning the power supply board to the unit, place the board onto a clean, flat, static-free surface with its large components facing up OR if discarding the power supply board, remove the two wire harnesses for use with the replacement board or purchase a new wire harness kit.

F. POWER SUPPLY BOARD REPLACEMENT

CAUTION– Failure to wear anti-static equipment during service may damage this device.

1. See instructions above to remove the cover, the control PC board and the power supply board.
2. Wearing an anti-static device, connect the wire harnesses from the old power supply board to the new power supply board.
3. Position the chassis so that the blower faces down and the inlet and outlet ports face you. Position the power supply board so that the components are facing away from you with the large brown component in the bottom left corner and the small blue component in the top right corner.
4. Place the board into the mount clips at the bottom of the power supply board cavity and press down firmly on the top corners until the board is fully mounted.
5. See instructions above to replace the control PC board and the cover.

G. BLOWER REMOVAL

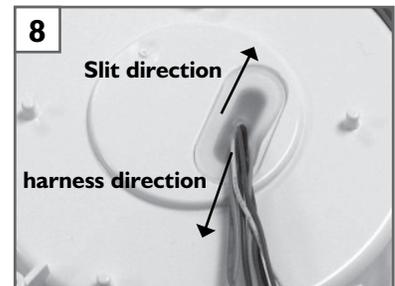
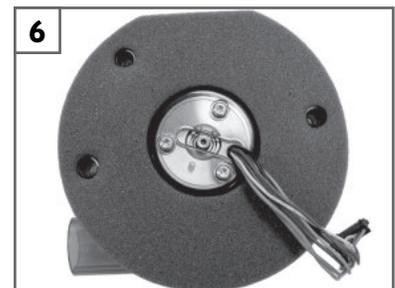
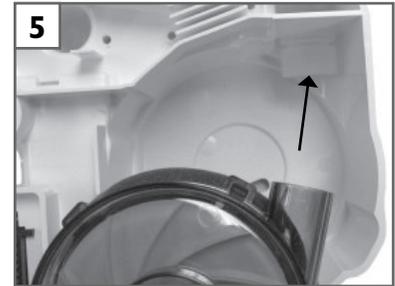
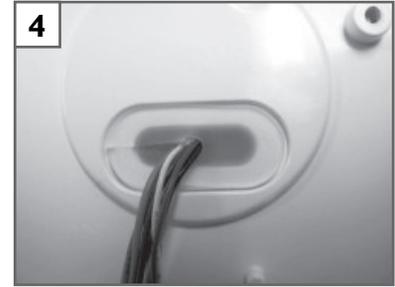
CAUTION– Failure to wear anti-static equipment during service may damage this device.

1. See instructions above to remove the cover and control PC board
2. Carefully remove the silicone grommet holding the blower wire harness. (Fig. 4)
3. Holding the wire harness in your hand, turn the chassis over so that the blower is facing up.
4. Remove the foam covering the blower and the foam around the blower.
5. Reach into the blower cavity and push the silicone isolator off the blower outlet. (Fig. 5)
6. Slowly lift blower out of the chassis and carefully pull the wire harness through the hole in the chassis. If not returning blower to unit, remove foam from bottom of blower and save for new blower. (Fig. 6)

H. BLOWER REPLACEMENT

CAUTION– Failure to wear anti-static equipment during service may damage this device.

1. See instructions above to remove the cover, control PC board and blower.
2. Insert the blower mount foam on the blower base so that the holes in the foam align with the protrusions on the blower and the blower wire harness is through the center hole in the foam. (Fig. 6)
3. Turn the blower over so that the motor is facing down. Guide the wire harness through the hole in the bottom of the blower cavity portion of the chassis.
4. Lower the blower with its outlet port pointing at the silicone isolator. Position the blower's outlet port into the top edge of the silicone isolator then tilt the outlet port into the isolator opening without folding the isolator. Push the outlet port into the isolator until the port is evenly inserted into the isolator. See isolator image in Blower Removal instructions above.
5. Insert the blower wrap foam so that the single-notched end is beside the blower outlet port. Wrap the remaining foam strip clockwise around the blower so that the notched foam corresponds to the latches on the blower body. Wrap the double-notched end around the blower and over the outlet port. The top edge of the foam should be almost flush with the blower. (Fig. 7)
6. Insert the top blower foam so that it conforms to the edges of the blower cavity portion of the chassis.
7. Turn the chassis over so that the blower is facing down. Gently pull any slack from the wire harness. Insert the silicone grommet into the hole in the chassis so that the slit in the grommet is toward the power supply board location, all the wires are in the center hole of the grommet and the grommet flange is fully sealed. Route the wire harness along the top of the chassis and down the front of the blower cavity portion of the chassis. (Fig. 8)
8. See instructions above to replace the control PC board and the cover.



I. KEYPAD & LCD DISPLAY REMOVAL AND REPLACEMENT

CAUTION– Failure to wear anti-static equipment during service may damage this device.

1. See instructions above to remove cover and control PC board.
2. Wearing an anti-static device, disconnect the two LCD display wire harnesses. (Fig. 9)

NOTE– Do not touch the exposed contact area on the end of the ribbon cable. Dirt and oils may damage it.

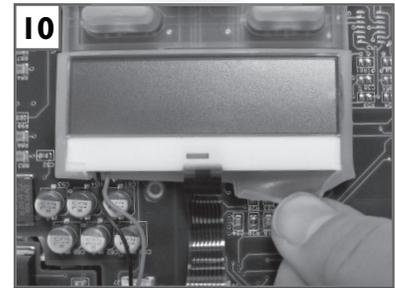
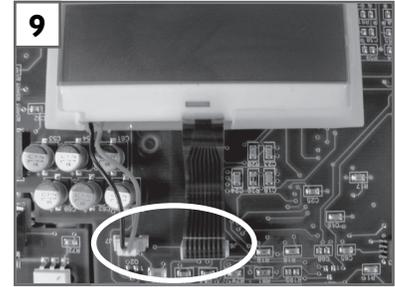
3. Gently roll the silicone frame away from the edges of the LCD display screen (Fig. 10), lift the display off the key pad and place it on a clean, flat, anti-static surface, if returning to the unit.
4. Lift the key pad off the board, gently pulling three silicone rattails through the board.

NOTE– Do not touch the key pad contacts on the PC board. Dirt and oils may damage them.

5. Replace the key pad by inserting the silicone rattails on the replacement key pad through appropriate holes on the control board and gently pulling the rattails through the holes.
6. Insert the LCD display into the silicone frame on the key pad and connect the wire harnesses to the appropriate connectors on the board.
7. See instructions above to replace the control PC board and the cover.

J. FIRMWARE INSTALLATION

Go to <http://www.devilbisshealthcare.com/Products> to download the latest firmware update. Download and installation instructions are provided on the web site, if needed.





10. Unit Specifications

Unit Specifications			
Size	4.2" H x 6.5" W x 6.9" D (10.7 cm x 16.5 cm x 17.5 cm)		
Weight	2.7 lbs. (1.22 kg)		
Electrical Requirements	100-240V~, 50/60 Hz		
DC Operation	12 Volt, 5 Amps		
Maximum Power Consumption	65 watts max from AC power source (PAP device only)		
AutoAdjust CPAP Pressure Range	3-20 cmH ₂ O		
Operating Temperature Range	41°F to 104°F (5°C to 40°C)		
Operating Humidity Range	0% to 95% RH non-condensing		
Operating Atmospheric Conditions	Sea level to 9,000 feet		
Storage & Transportation Temperature Range	-40°F to 158°F (-40°C to +70°C)		
Storage & Transportation Humidity Range	0% to 95% RH non-condensing		
Maximum Limited Pressure	20 cmH ₂ O under normal use		
Sound Level (tested per ISO 17510)	26 dBA		
Filter Specifications			
Standard Filter	> 3.0 micron particles		
Optional Fine Particle Filter	> 0.3 micron particles		
Max Flow Rates			
83 L/m	@ 6.5 cmH ₂ O (1/3 max pressure)		
134 L/m	@ 13 cmH ₂ O (2/3 max pressure)		
163 L/m	@ 20 cmH ₂ O (max pressure)		
Pressure Accuracy	± 1.0 cmH ₂ O		
Pressure Swings (cmH ₂ O peak to peak at 500mL tidal volume, sine wave profile)			
Breaths per minute	10	15	20
@ 6.5 cmH ₂ O	0.5	0.5	0.5
@ 13 cmH ₂ O	1.0	1.0	1.0
@ 20 cmH ₂ O	1.0	1.0	1.0
Other Specifications			
Equipment classification with respect to protection from electric shock	Class II		
Degree of protection from electric shock	Type BF Applied Part		
Degree of protection against ingress of liquids	IPX I Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.		
Mode of operation	Continuous		
Clinical Specifications for Digital Outputs			
Mask pressure	0 to 25.5 cmH ₂ O ± 1.0		
Patient Flow	-127 to +127 L/min ± 10L/min		
Leak Flow	0 to +127 L/min ± 10 L/min		
Estimated Tidal Volume	0 to 1023 mL Note– Tidal Volume is an estimate. It is provided for trending purposes only.		

A. SAFEGUARDS

When servicing electrical products, basic safety precautions should always be followed. Important safety information in this manual is highlighted by the following terms.

- DANGER:** Urgent safety information for hazards that will cause serious injury or death.
- WARNING:** Important safety information for hazards that might cause serious injury.
- CAUTION:** Information for preventing damage to the product.
- NOTE:** Information to which you should pay special attention.

PLEASE READ ALL INSTRUCTIONS BEFORE SERVICING THIS DEVICE.

! DANGER!

- **Electric Shock Hazard** – Do not use while bathing.
- **Electric Shock Hazard** – Do not immerse this device into water or any other liquid.
- **Electric Shock Hazard** – Do not attempt to open or remove the enclosure. There are no user-serviceable internal components. If service is required, return the product to your home care provider. Opening or tampering with the product will void the warranty.

! WARNING!

- Use the Heated Humidifier system only for its intended use as described in this manual.
- Be sure to read and understand all safety instructions supplied with your IntelliPAP or SleepCube flow generator device.
- Use only accessories recommended by DeVilbiss.
- Always remove the water chamber from the humidifier cradle for filling.
- Use only tubing recommended or supplied with the flow generator.
- If water has been spilled onto the cradle or it has been submerged into water, unplug the power cord from the power source immediately. Allow the device to completely dry before use.
- If the device has been dropped, refer to the troubleshooting guide for instructions. Contact your homecare provider for evaluation of the device.
- Never block the air openings of the cradle or chamber. Do not insert any objects into any openings or tubes.

- For proper operation of the humidifier, the device must be placed on a flat, level surface.
- Never place the system on a soft surface such as a bed or couch during operation.
- This heated humidifier is intended for single-patient use only.

B. TRAVEL

The DeVilbiss DV5HH humidifier system

- Automatically accepts line voltages of 100-240 V, 50/60 Hz
- Needs power cord appropriate for area
 - USA DV51D-606
 - Europe, except UK DV51D-607
 - UK DV51D-608
 - Australia DV51D-609
 - Set of 3 (UK, Europe, Australia) DV51D-611

C. DC POWER

The DeVilbiss DV5HH humidifier system

- Will NOT operate, if the DC power is coming directly from a 12V DC power source.
- Will operate, if the DC power coming to the PAP passes through an inverter so that AC power is delivered to the system.
- See DC Power information under the DV54 section of this manual

D. PRODUCT DESCRIPTION

The DV5HH Standard Heated Humidifier System is intended to warm and add moisture to the pressurized air supplied to the patient during the treatment of Obstructive Sleep Apnea (OSA). The addition of heated humidification to the air relieves dryness and irritation to the patient's airway during OSA therapy. The heated humidifier is used in conjunction with the DV5X series PAP devices and consists of a humidifier chamber and humidifier heater.

The humidifier chamber holds enough water for a minimum of 8 hours of operation, with the heating unit at the maximum temperature setting at ambient conditions of 23°C and 25% R.H. with a system flow rate of 60 L/Min. The chamber slides out of the unit for cleaning and filling, without adjusting tubing connections. The chamber's halves separate for easy cleaning but, when assembled, maintain a leak free seal to a maximum operating pressure of 30 cmH₂O.

Heat transferred from the humidifier heater to the humidifier chamber raises the efficiency of the DV5HH system. The patient controls the heater plate temperature using the up/down arrow keypad keys on the attached PAP device to provide the appropriate level of humidification depending upon environmental conditions and individual preference.



12. Description of Normal Operation DV5HH

The heated humidifier connects mechanically and electrically to a DV5X series PAP between the air stream going from the PAP to the patient. The keypad on the PAP controls the heated humidifier's output and ON/OFF functions. Before operation, the humidifier chamber is filled with water to a predefined and visible water-fill level with the patient tubing and patient interface attached to the outlet port on the heated humidifier system.

During operation, the DV5X series PAP device routes AC electrical power (100 – 240 VAC 50/60 Hz) to the heated humidifier's drive circuitry, which is contained within the PAP device. The drive circuitry directs the AC power to the heating element on the heated humidifier's heater plate. A thermistor on the heater plate provides continuous feedback back to the control circuitry so that the temperature of the heater plate is consistent with the setting selected via the PAP's keyboard. The PAP's internal switch-mode power supply routes DC electrical power to the heater's low-voltage circuitry.

The heated humidifier's heater plate transmits heat to the chamber, and then to the water, through a heat transfer plate located on the bottom of the humidifier chamber. As the water is heated, its evaporation efficiency increases. Air flowing into the humidifier chamber from the PAP device is humidified by the evaporation and is then transmitted to the patient through the patient tubing and interface.

A. CLEANING AND DISINFECTION

See the DV5HH Instruction Guide (A-DV5HH) for information on cleaning the humidifier chamber and heater base.

The DV5HH Standard Heated Humidifier is single patient use only and therefore does not require disinfection.

B. MAINTENANCE

The DV5HH Standard Heated Humidifier System does not require regular maintenance.

C. TESTING

Since the DV5HH device is powered and controlled by the PAP, it is important to determine which unit is at fault when there is an issue with humidity/heat. Use the following procedures to determine whether the DV5HH device or the PAP device is faulty.

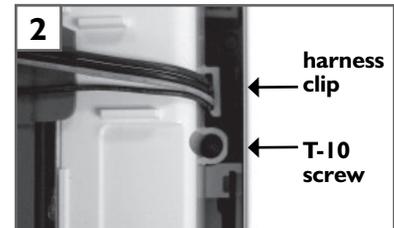
1. Connect the DV5HH device to a known good PAP device.
2. After turning the system on,
 - if the LCD display does NOT show “Heat:XXX” on bottom line, proceed to the troubleshooting section.
 - if the DV5HH device does NOT produce heat, proceed to the troubleshooting section.
3. Connect the PAP to a known good DV5HH device and turn the PAP blower ON, if the LCD display does NOT show ‘Heat : xxx’ on the bottom line, proceed to the troubleshooting section.

If you detect excessive air or water leaks in the DV5HH system, proceed to the troubleshooting section.

HEATER	
Symptom	Action
<p>The PAP does not recognize the heater. (With the PAP blower ON, the PAP display does not indicate Heat:xxx on the bottom line.)</p>	<p>Connect the heater to a known good PAP device, if one is available. If PAP display still does not recognize the heater, replace the heater.</p> <p>If a known good PAP device is not available, remove the PAP from the heater and check the thermistor for resistance. The thermistor pins are located in the connector and are the ones closest to each other. See image below. The resistance should be 10 K ohms +/- 1% at 25° C (77°F). If open or shorted, replace the heater. See Service instructions. Alternatively: Replace the heater plate assembly, DV5H-607. If the resistance is in the correct range, the issue is in the PAP device. Troubleshoot as indicated below.</p>
<p>Heater plate does not respond to the PAP heat setting.</p> <p>(With the PAP blower ON and the heat setting at 1 or above, the heater plate does not get warm.)</p>	<p>Connect the heater to a known good PAP device, if one is available. If the heater still does not respond to the heat setting, replace the heater.</p> <p>If a known good PAP device is not available, connect the PAP, using the serial interface cable DV51D-615, to a PC using a terminal program (such as Windows HyperTerminal, or equivalent) with Com settings 9600 baud, no parity, 8 data stop bits, 1 stop bit, Flow Control set to none. Turn the PAP blower ON and increase the heat setting to 10 using the PAP keypad (UP key). In the terminal program, connect to the PAP device by typing 'rh' followed by ENTER; then type 'Ht' followed by ENTER. Repeat the 'Ht' – ENTER sequence every 2-3 minutes and verify that the returned value increases. If the value increases, the system is operating normally. If the value does not increase, remove the PAP device from heater and measure the heater resistance. The heater terminals are the ones diagonal to each other on the connector.</p> <div style="text-align: center;"> <p>thermistor terminals heater terminals</p> </div> <p>The resistance should be between 180 to 220 ohms; if not replace the heater. See Service instructions. Alternatively: Replace the heater plate assembly, DV5H-607. If the resistance is in the correct range, the issue is in the PAP device. Troubleshoot as indicated below.</p>
PAP	
Symptom	Action
<p>The PAP does not recognize a known good DV5HH heater. (With the PAP blower ON, the PAP display does not indicate Heat:xxx on the bottom line.)</p>	<p>Check the wire harness on the PAP / heater connector; repair or replace, if needed. If the wire harness and connections are correct, replace the control PC board. See Service Instructions.</p>
<p>Heater plate on a known good DV5HH heater does not respond to the PAP heat setting.</p> <p>(With the PAP blower ON and the heat setting at 1 or above, the heater plate does not get warm.)</p>	<p>Check the wire harness on the PAP / heater connector; repair or replace, if needed. If the wire harness and connections are correct, replace the control PC board. See Service Instructions.</p>
MANIFOLD and O-RING	
Symptom	Action
<p>Excessive air leak</p>	<p>Remove the humidifier chamber. Inspect the manifold in the heater base and replace, if torn or worn. Inspect the O-Ring in the humidifier chamber and replace, if worn or missing.</p>
<p>Water leak from the humidifier chamber.</p>	<p>Remove the humidifier chamber. Inspect the chamber for cracks in the plastic or water leaking from the heat transfer plate. If cracks or transfer plate leaks are found, replace the water chamber. Inspect the O-Ring in the humidifier chamber and replace, if worn or missing.</p>

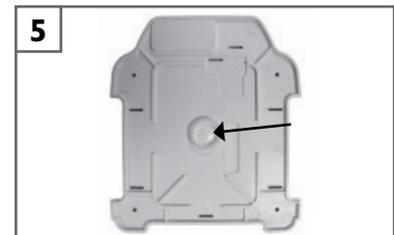
A. REMOVING THE DV5HH BASE COVER

1. Remove the humidifier chamber from the DV5HH base.
2. Push the release button (Fig. 1) on the DV5HH base and lift the PAP device off the heater base and set aside in a safe place.
3. Remove two T-10 screws from the top cover of the heater base.
4. Turn the base over so that the bottom of the unit faces up and remove four T-10 screws.
5. Lift the bottom cover off the unit
6. Remove the final T-10 screw beside the wire harness clip. (Fig. 2)
7. Hold the heater plate onto the base and turn the unit over.
8. Gently pull the top of the unit off the chassis and carefully tilt the top without pulling the wire harness out of the connector.
9. Carefully release the wire harness from the harness clip. Reposition the heater plate so that the orange side is facing the harness clip and carefully push the heater plate through the opening. (Fig. 3)



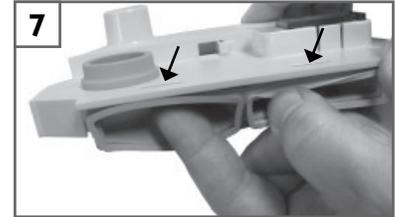
B. REPLACING THE DV5HH BASE COVER

1. Position the heater plate so that the orange side is facing the harness clip and carefully push the heater plate through the opening in the base. See image above.
2. Hold the heater plate onto the base and carefully insert the harness wires, two at a time, into the harness clip. See image above.
3. Install the top of the base onto the heater chassis with the wire harness and manifold clear of all edges and the latch working smooth and free. Fasten top to chassis with two T-10 screws.
4. Holding the heater plate onto the base, turn the unit over and position heater plate into the shallow opening with the metal side facing down and the orange plastic side facing up. Move the harness wires between wire guides. (Fig. 4)
5. Replace the T-10 screw beside the wire harness clip.
6. Verify that the silicone spacer is in place on the inside of the bottom cover. (Fig. 5)
7. Install the cover onto the bottom of the unit matching the edges. Replace the 4 remaining T-10 screws in the bottom cover.
8. With the air supply support plug attached to the back of the PAP device, place the front of the PAP onto the front of the heater base against the brackets and push the back of the PAP down so that the latch closes and the electrical connector is tight.
9. Slide the humidifier chamber into the heater base until it clicks into place.



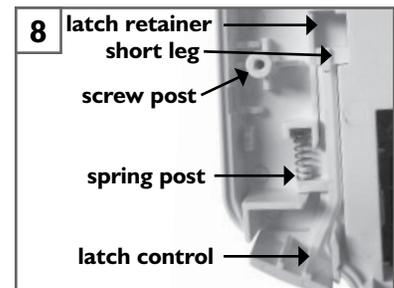
C. REMOVING AND REPLACING SILICONE MANIFOLD

1. Remove the cover as described above.
2. Squeeze the inlet port on the silicone manifold and push the port down into the hole in the top cover, gently releasing the manifold from all other connections. Discard the manifold or set aside in a safe place, if returning to the unit. (Fig. 6)
3. To replace, pinch the inlet port coupler on the replacement silicone manifold and insert it, from the inside of the cover, through the cover hole so that the coupler collar is fully and evenly positioned on the outside of the cover.
4. Press the manifold body into place and insert a finger into each of the rectangular openings, pressing the manifold's rattails through the slots in the top cover until they are fully seated. (Fig. 7)
5. Replace the cover as described above.



D. REMOVING AND REPLACING THE LATCH

1. Remove the cover and silicone manifold as described above.
2. Raise the latch control away from the top cover so that it lifts the attached spring. Remove the spring from the latch and discard or set aside in a safe place, if returning it to the unit. (Fig. 8)
3. Still holding the latch control in a raised position, push it into the latch retainer and rotate the latch so that the spring post faces up. Gently push the short leg of the latch up and through the slot in the cover. Discard faulty latch.
4. Orient the replacement latch over the bottom side of the top cover so that short leg of the latch is over the slot near the screw post and the spring post is facing up.
5. Insert the latch into the slot by rotating the latch stem back toward the screw post and gently applying pressure to the short leg until it fits through the slot.
6. Place one end of the spring over the spring post and insert the other end into the channel on the cover by slightly compressing the spring. Push the latch control several times to ensure that the system is configured properly.
7. Replace the silicone manifold and cover as described above.





Humidity Output (in the operating flow range)	≥ 10 mgH ₂ O/L air
Chamber/Cradle Dimensions	
Size	2.6" H x 6.3" W x 8.4" D (6.6 cm x 16.0 cm x 21.3cm)
Weight	1.75 lbs. (0.794 Kg)
Electrical Rating:	
Electrical Supply Frequency	50/60 Hz
Power Consumption	85 Watts
Voltage and Current:	
DV5HH	100-240VAC, 0.95 A
Heater Plate Cutout	152°C (305°F)
Power/Temperature Control	Setting of 1 (minimum) to 10 (maximum)
Heater Plate Temperature	approx. 29°C to approx. 65°C (84°F to 149°F)
Operating, Transport & Storage	
Operating Temperature Range	41°F to 104°F (5°C to 40°C)
Operating Humidity Range	0 to 95% R.H. non-condensing
Operating Atmospheric Pressure Range	70.0 – 106.0 kPA
Transport & Storage Temperature Range	-40°F to 158°F (-40°C to +70°C)
Transport & Storage Humidity Range	0 to 95% R.H. non-condensing
Transport & Storage Atmospheric Pressure Range	50.0 – 106.0 kPA
Class II Equipment; Type BF Applied Parts; Continuous Operation	
IPX1, Drip-proof vertical	



DV54 AND DV5HH

A. ORDERING NON-WARRANTY REPLACEMENT PARTS

Order non-warranty parts and literature from your distributor or, if you have a DeVilbiss account, from DeVilbiss Customer Service. To expedite the process, be prepared to provide the following information:

- Account and ship-to numbers
- Ship-to address
- Part numbers and/or descriptions
- Quantity required
- Unit catalog number
- Unit serial number

B. ORDERING WARRANTY REPLACEMENT PARTS

Order warranty parts from your distributor or, if you have a DeVilbiss account, from DeVilbiss Customer Service through the Return Material Authorization process. To expedite the process, be prepared to provide the above information, along with the following:

- How and where the product was being used
- A detailed description of the problem associated with warranty replacement item

All warranty replacement orders require the return of the defective part to DeVilbiss.

C. RETURNING WARRANTY DEFECTIVE PARTS

ALL DEFECTIVE PARTS, WHICH ARE STILL UNDER WARRANTY, MUST BE RETURNED TO THE FACTORY IN SOMERSET, PA WITHIN 30 DAYS AFTER SHIPMENT OF THE REPLACEMENT PARTS. AN INVOICE WILL BE ISSUED, IF THE DEFECTIVE PARTS ARE NOT RECEIVED WITHIN THIS PERIOD.

D. PLACING ORDERS

Orders may be placed by calling

- Customer Service 800-338-1988
- Warranty Parts- USA 800-338-1988
- Canada 905-660-2459
- International Department 814-443-4881

Before returning parts or units to the factory, call the DeVilbiss Healthcare Customer Service Department at 800-338-1988 or 814-443-4881 to obtain a return authorization number. Include in the package a note indicating the return authorization number along with your company name, address, phone number, and account number. The return authorization number should also be written on the outside of the package.



18. Parts List

DV54 PAP	
Air-Inlet Filter (4/pk)	DV51D-602
Optional Fine Particle Filter (4/pk)	DV51D-603
Air supply tubing	7351D-616
Air supply support plug	DV51D-604
Disinfection kit	DV51D-682
Blower assembly, balanced	DV51D-672
Blower isolator and grommet-silicone	DV51D-676
Foam Repair Kit	DV51D-678
Tubing Repair Kit	DV51D-681
Wire harness kit	DV51D-675
Outlet cap (mask/leak simulator)	DV51D-620
Pressure gauge with outlet cap	8000D-607
Oxygen adapter	7353D-601
Carrying case	DV51D-610
IntelliPAP case repair kit-DV54D	DV54D-670
SleepCube case repair kit-DV54NE, DV54SE, DV54UK, DV54AU	DV54I-670
Blower chassis	DV51D-680
Keypad	DV51D-671
Control PC board-DV54	DV54D-673
Power supply board-DV5X	DV51D-674
LCD repair kit-DV5X	DV51D-677
Heater connection cover	DV51D-605
Flow control valve	DV51D-621
DV5X series serial cable	DV51D-615
USB to serial adapter	DV51D-691
Power	
AC Power cords	
o USA	DV51D-606
o Europe, except U.K.	DV51D-607
o U.K.	DV51D-608
o Australia	DV51D-609
o International AC power cord set	DV51D-611
DC battery clamp-on adapters	DV51D-696
DC power cord	DV51D-619

DV5HH	
Heated humidifier assembly	DV5HH
Humidifier chamber	DV5C
Sealing gasket for chamber	DV5C-614
Silicone manifold for heater	DV5H-600
Heater latch kit w/spring	DV5H-601
Silicone spacer on bottom cover	DV5H-602
Heater bottom cover	DV5H-603
Heater top cover	DV5H-604
Heater chassis	DV5H-605
Case screws	DV5H-606
Heater assembly	DV5H-607
Chamber latch spring	DV5H-601
Literature	
DV54 Instruction Guide	
North America	A-DV54
Europe / International	SE-DV54
DV54 Set up Card	DV54D-125
DV54 Instructional DVD	
North America	LT-2012
Europe / International	LT-2015
DV54 Service Manual	LT-2027
Disinfection Instruction Guide	A-682
Humidifier/Heater Instruction Guide	A-DV5HH



19. Warranties

DV54

The DeVilbiss IntelliPAP™ and SleepCube™ devices are warranted to be free from defective workmanship and material for a period of three years from date of purchase. Any defective part(s) will be repaired or replaced at DeVilbiss's option if the device has not been tampered with or used improperly during that period. Make certain that any malfunction is not due to inadequate cleaning or failure to follow the instructions. If repair is necessary, contact your DeVilbiss provider or DeVilbiss Customer Service Department for instructions:

U.S.A. 800-338-1988, 814-443-4881

Canada 800-263-3390

Europe 44-138-444-6688

NOTE– This warranty does not cover providing a loaner device, compensating for costs incurred in rental while said device is under repair, or costs for labor incurred in repairing or replacing defective part(s).

THERE IS NO OTHER EXPRESS WARRANTY. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO THE DURATION OF THE EXPRESS LIMITED WARRANTY AND TO THE EXTENT PERMITTED BY LAW ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. THIS IS THE EXCLUSIVE REMEDY AND LIABILITY FOR CONSEQUENTIAL AND INCIDENTAL DAMAGES UNDER ANY AND ALL WARRANTIES ARE EXCLUDED TO THE EXTENT EXCLUSION IS PERMITTED BY LAW. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, OR THE LIMITATION OR EXCLUSION OF CONSEQUENTIAL OR INCIDENTAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Detailed EMC Declaration

Do not place this device near other equipment or devices that create or attract electromagnetic fields. Placing the device in electromagnetic fields greater than 10 V/m can affect its operation. Examples of such equipment are defibrillators, diathermy equipment, cellular telephones, CB radios, radio-controlled toys, microwave ovens, etc.

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DV5HH

The DeVilbiss Heated Humidifier System Model DV5HH is warranted to be free from defective workmanship and materials for a period of two years from date of purchase (except 90 days on chamber). Any defective part(s) will be repaired or replaced at DeVilbiss's option if the unit has not been tampered with or used improperly during that period. Make certain that any malfunction is not due to inadequate cleaning or failure to follow the instructions. This warranty does not cover normal wear and tear on the o-ring seal. If repair is necessary, contact your DeVilbiss provider or DeVilbiss Customer Service Department for instructions:

U.S.A 800-338-1988 (814-443-4881)

Canada 905-660-2459

Europe 44-138-444-6688

NOTE– This warranty does not cover providing a loaner unit, compensating for costs incurred in rental while said unit is under repair, or costs for labor incurred in repairing or replacing defective part(s).

THERE IS NO OTHER EXPRESS WARRANTY. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO THE DURATION OF THE EXPRESS LIMITED WARRANTY AND TO THE EXTENT PERMITTED BY LAW ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. THIS IS THE EXCLUSIVE REMEDY AND LIABILITY FOR CONSEQUENTIAL AND INCIDENTAL DAMAGES UNDER ANY AND ALL WARRANTIES ARE EXCLUDED TO THE EXTENT EXCLUSION IS PERMITTED BY LAW. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, OR THE LIMITATION OR EXCLUSION OF CONSEQUENTIAL OR INCIDENTAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.





Sunrise Medical
Respiratory Products Division
100 DeVilbiss Drive
Somerset, PA 15501-2125
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814-443-4881

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44-138-444-6688

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Division Respiratoire
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Sunrise Medical Canada, Inc.
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CANADA
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800-263-3390

Sunrise Medical Pty. Limited
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Castle Hill NSW 2154
AUSTRALIA
61-2-9899-3144

Sunrise Medical
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GERMANY
49-7253-980-460

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LT-2027 Rev. A

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