



## 5.4 Oxygen Outlet / Regulated Pressure Test

### Procedure:

- Step 1** Power up the unit and allow it to run for at least 2 minutes to stabilize.
- Step 2** Set the flow meter to 5 lpm.
- Step 3** Connect the pressure gauge from the tool kit to the DISS outlet fitting. The flow ball should drop to 0.0 lpm.
- Step 4** If the outlet pressure does not fall between 5.0 and 7.0 psig, perform Steps 5 through 10.
- Step 5** Remove the pressure gauge from the DISS outlet fitting.
- Step 6** Remove the front and rear cabinets (see Section 8.4.4 and 8.4.5).
- Step 7** Insert a "T" from the tool kit in between the regulator and the clear oxygen tubing and connect the pressure gauge.
- Step 8** Set the flow meter to 5 lpm.
- Step 9** With the gauge held in a vertical position, verify that the regulated pressure is at  $5.5 \pm 0.25$  psig.

- Step 10** If the regulated pressure needs adjusted, place a 5/32" Allen wrench in the adjusting screw on the end of the regulator.

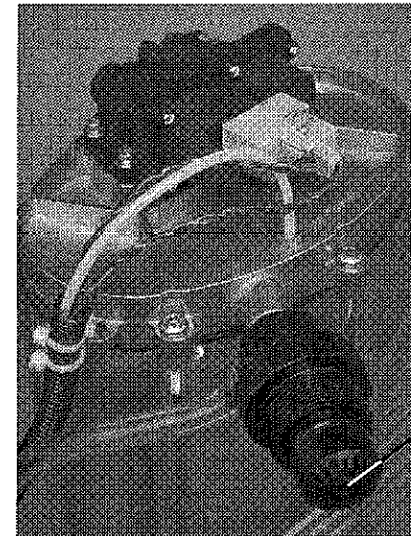


Figure 5-3  
Location of the Pressure Regulator Adjusting Screw

- Step 11** If the regulated pressure is low, turn the wrench clockwise to increase the regulated pressure.
- Step 12** If the regulated pressure is high, turn the wrench counter-clockwise.
- Step 13** Disconnect the pressure gauge and "T" fitting.



*Oxygen Outlet / Regulated Pressure Test (Continued)*

- Step 14**    Reconnect the clear oxygen tubing to the pressure regulator.
  
- Step 15**    Install the front and rear cabinets (see Section 8.4.4 and 8.4.5 for more detailed instructions).



## 5.5 OPI PCB Oxygen Verification

### Procedure:

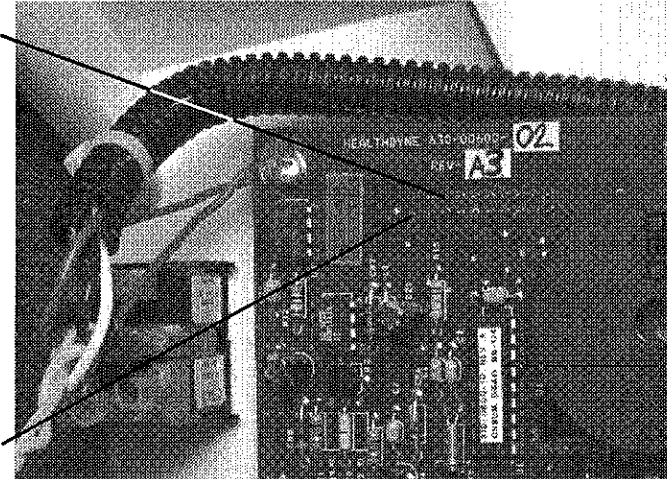
The following steps are to be used as a trouble shooting tool. This will also be used as part of the testing process after a repair has been performed on the unit.

- Step 1** Start the unit and allow it to run for a minimum of one hour.
- Step 2** Remove the rear cabinet (see Section 8.4.4 for more detailed instructions).
- Step 3** Set the flow meter to 5 lpm.

**NOTE:** The oxygen analyzer used in the following steps must be calibrated to meet the manufacturer's specifications.

- Step 4** Connect an Oxygen analyzer to the DISS outlet.
- Step 5** Set the digital multi-meter (DMM) to VDC. Connect the Red test lead to pin 16 and the Black test lead to pin 19 on the power control board (see Figure 5-4).

Pin 16



Pin 19

*Figure 5-4*  
*Location of Pins 16 and 19*

- Step 6** Observe the oxygen analyzer for three cycles and record the oxygen reading for each cycle.
- Step 7** Measure the voltage between pins 16 and 19.
- Step 8** Add the three oxygen readings and then divide by three to find the average oxygen outlet purity.
- Step 9** Locate the average oxygen purity on the Oxygen Percentage Indicator Voltage Verification Chart.



OPI PCB Oxygen Verification (Continued)

- Step 10** Compare the voltage reading from the DMM to the voltage listed on the chart for the oxygen purity average that you calculated.
- Step 11** The voltage reading from the DMM must fall within the values listed on the chart.
- Step 12** If the voltage does not fall within the guidelines, replace the OPI board.

**NOTE:** If the oxygen purity is below 85%. Use the trouble shooting table in Chapter 7 to determine the cause of the low oxygen readings.

- Step 13** Install the front and rear cabinets (see Section 8.4.4 and 8.4.5 for more detailed instructions).

OPI Voltage Verification Chart

Oxygen Concentration Percentage Average	Average Acceptable Voltage Output (VDC)
96 %	3.96 to 3.72 VDC
95 %	3.92 to 3.68 VDC
94 %	3.88 to 3.64 VDC
93 %	3.84 to 3.60 VDC
92 %	3.80 to 3.56 VDC
91 %	3.76 to 3.52 VDC
90 %	3.72 to 3.48 VDC
89 %	3.68 to 3.44 VDC
88 %	3.64 to 3.40 VDC
87 %	3.60 to 3.36 VDC
86 %	3.56 to 3.32 VDC
85 %	3.52 to 3.28 VDC



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## **Chapter 6: Maintenance**

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## Chapter 6: Maintenance

### 6.1 Overview

This chapter describes scheduled and routine maintenance procedures. They must be performed on the Millennium Oxygen Concentrator System (Millennium) as part of the normal care of the unit.

Normal routine maintenance involves periodic checking, cleaning, and/or replacing the following items as necessary:

- air inlet filter
- inlet pre-filter
- inlet filter
- cabinet
- 9-volt battery
- lpm flow setting to the prescribed level
- oxygen concentration level

Preventive maintenance is very important in prolonging dependability and in reducing costly maintenance and repair. Long-term maintenance and regular checking of the filters helps assure the efficient operation of the unit. The user should be instructed on how to clean the accessible filters. An authorized technician should perform all other maintenance.



## 6.2 Maintenance Schedule

### 6.2.1 Weekly User Maintenance

Weekly user maintenance consists of inspecting and cleaning the air inlet filter (see Section 6.3.1 for more detailed instructions).

### 6.2.2 Dealer Routine Maintenance

Routine maintenance shall be performed by the Home Care Dealer, or at a Respironics Customer Satisfaction Center (CSC). Respironics requires that the routine maintenance be performed annually. Routine maintenance includes the following.

- Checking the condition of the air inlet filter, the inlet pre-filter, and the inlet filter (change if necessary).
- Cleaning the cabinet.
- Verifying the oxygen concentration with a calibrated oxygen analyzer. This procedure must be performed once a year.
- Perform a power interrupt alarm test and replace the 9-volt battery if necessary.
- Perform a start-up LED and audible alarm test.

### 6.2.3 Dealer Periodic Maintenance

Periodic maintenance shall be performed by the Home Care Dealer, or at a Respironics CSC. Periodic maintenance includes the following:

- Checking the final patient bacteria filter and replacing if necessary.
- Measuring the product canister pressure.

**NOTE:** If the pressure is lower than normal, as specified in Section 6.4.4.1 of this service manual, but the unit has clean filters and no leaks, then compressor maintenance should be performed.

### 6.2.4 Dealer Compressor Maintenance

Compressor maintenance shall be performed by the Home Care Dealer, or at a Respironics CSC. The maintenance is required by Respironics to prolong dependability and decrease maintenance problems with the compressor. However, the need for this maintenance varies depending on the operating conditions and the environment where the unit is used. Based on low system pressure readings with clean filters and no leaks, compressor maintenance is recommended. This includes the following.

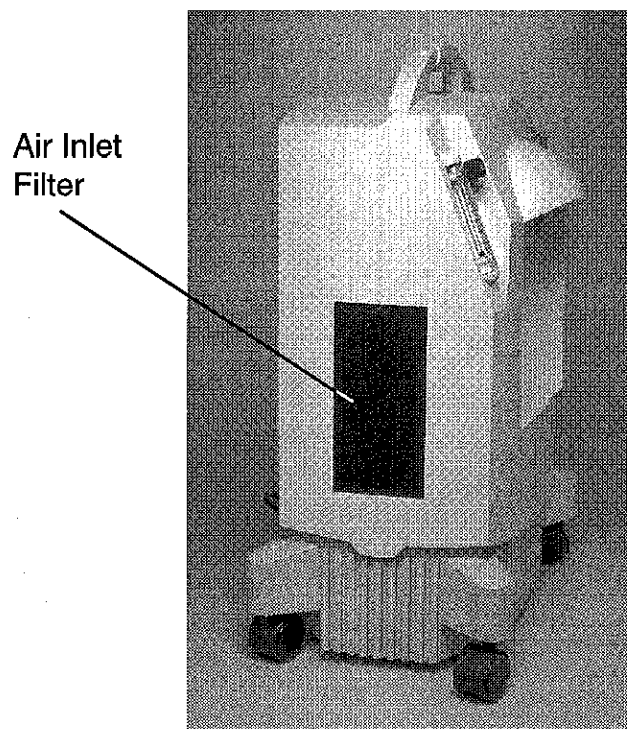
- Installing a compressor maintenance kit in accordance with this service manual; and
- Checking the compressor in-line muffler and replacing if necessary.



## 6.3 Weekly User Maintenance

### 6.3.1 Cleaning the Air Inlet Filter

**Step 1** Remove the air inlet filter from the side of the unit.



*Figure 6-1  
Location of the Pre-Inlet Filter*

**Step 2** Vacuum or wash the air inlet filter with a mild detergent and tap water.

**Step 3** If washed, allow the air inlet filter to air dry before installing it on the unit.



## 6.4 Dealer Routine Maintenance

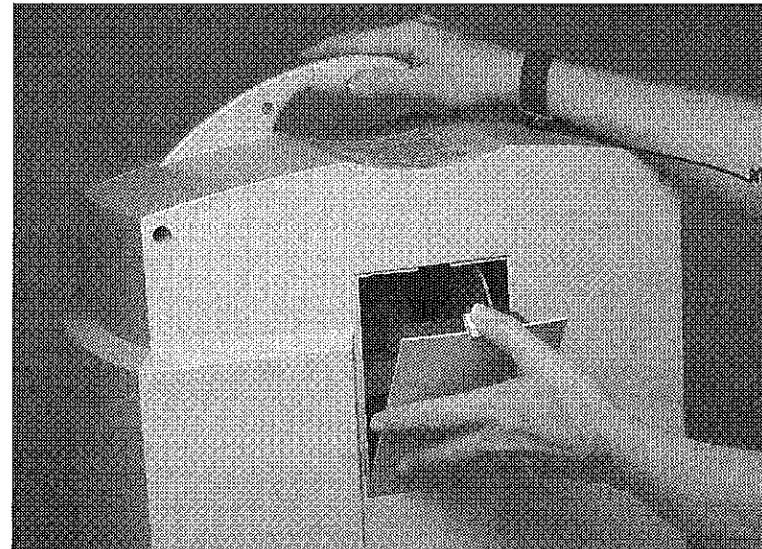
The following sections give the maintenance procedures to perform during the dealers routine visits, as required, by and/or between patients.

### 6.4.1 Air Inlet Filter

Refer to Section 6.3.1 for detailed information.

### 6.4.2 Inlet Pre-Filter and Inlet Filter

**Step 1** Remove the rear access door from the unit.

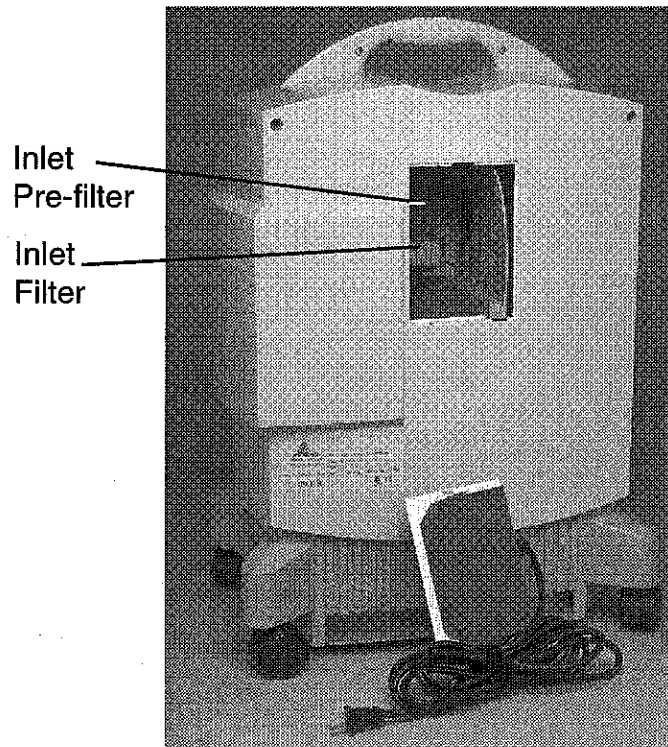


*Figure 6-2  
Removing the Rear Access Door*

**Step 2** Remove the inlet pre-filter and the inlet filter from the unit.

*Inlet Pre-Filter and Inlet Filter (Continued)*

**Step 3** Remove the inlet pre-filter from the inlet filter.



*Figure 6-3  
Location of the Air Inlet and Inlet Filters*

**Step 4** Wash the foam inlet pre-filter with a mild detergent and tap water. Allow it to air dry.

**Step 5** Inspect the inlet filter and replace if necessary.

**Step 6** Place the dry inlet pre-filter on to the inlet filter and reinstall the filter assembly.

**Step 7** Install the rear access door.

### 6.4.3 Cleaning the Cabinet

**Step 1** Disconnect the unit from the power source.

**Step 2** Using a mild detergent and disinfectant, clean all exterior surfaces of the cabinet.

**CAUTION:** Do not allow any liquid to enter the unit.

**Step 3** Ensure that the cabinet is dry before placing in service.

### 6.4.4 OPI PCB Oxygen Verification

#### Procedure:

The following steps are to be used as a trouble shooting tool. This will also be used as part of the testing process after a repair has been performed on the unit.

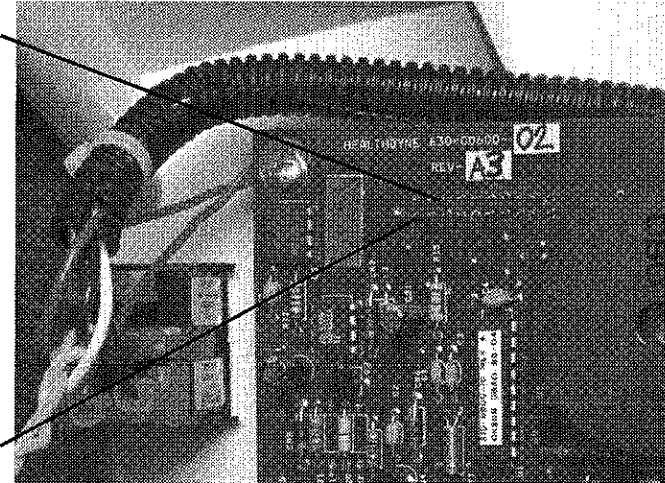
- Step 1** Start the unit and allow it to run for a minimum of one hour.
- Step 2** Remove the rear cabinet (see Section 8.4.4 for more detailed instructions).
- Step 3** Set the flow meter to 5 lpm.

**NOTE:** The oxygen analyzer used in the following steps must be calibrated to meet the manufacturer's specifications.

- Step 4** Connect an Oxygen analyzer to the DISS outlet.
- Step 5** Set the digital multi-meter (DMM) to VDC. Connect the Red test lead to pin 16 and the Black test lead to pin 19 on the power control board (see Figure 6-4).

Pin 16

Pin 19



*Figure 6-4  
Location of Pins 16 and 19*

- Step 6** Observe the oxygen analyzer for three cycles and record the oxygen reading for each cycle.
- Step 7** Measure the voltage between pins 16 and 19.
- Step 8** Add the three oxygen reading and then divide by three to find the average oxygen outlet purity.
- Step 9** Locate the average oxygen purity on the Oxygen Percentage Indicator Voltage Verification Chart (see Page 5-10).



OPI PCB Oxygen Verification (Continued)

- Step 10** Compare the voltage reading from the DMM to the voltage listed on the chart for the oxygen purity average that you calculated.
- Step 11** The voltage reading from the DMM must fall within the values listed on the chart.
- Step 12** If the voltage does not fall within the guidelines, replace the OPI board.

**NOTE:** If the oxygen purity is below 85%. Use the trouble shooting table in Chapter 7 to determine the cause of the low oxygen readings.

- Step 13** Install the front and rear cabinets (see Section 8.4.4 and 8.4.5 for more detailed instructions).

6.4.4.1 System Pressure Test

Refer to Section 5.3 for detailed information.

6.4.5 Battery Test

Procedure

- Step 1** Test the condition of the 9-volt battery as follows.
  - a. With the unit disconnected from the power source, move the power switch to the ON (I) position and verify that the red LED alarm illuminates and the audible alarm sounds.
  - b. If the red LED does not illuminate or the alarm does not sound, install a new 9-volt battery. Be sure to move the power switch to the OFF (O) position and proceed as follows.
- Step 2** Locate the 9-volt battery, inside the rear access door.

Battery Test (Continued)

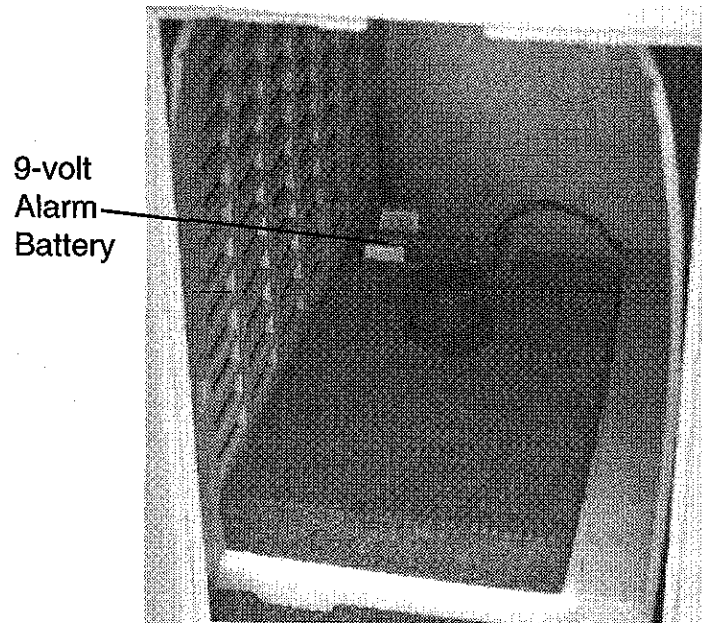


Figure 6-5  
Location of the 9-volt Battery

**Step 3** Remove the battery connector from the battery and check the no-load voltage of the battery with a digital multi-meter. If the voltage is less than 5 volts, install a new 9-volt battery.

6.4.6 Start-up LED and Audible Alarm Test

**Step 1** Before connecting the unit to a power source, perform the following procedures to check the battery condition and alarm function.

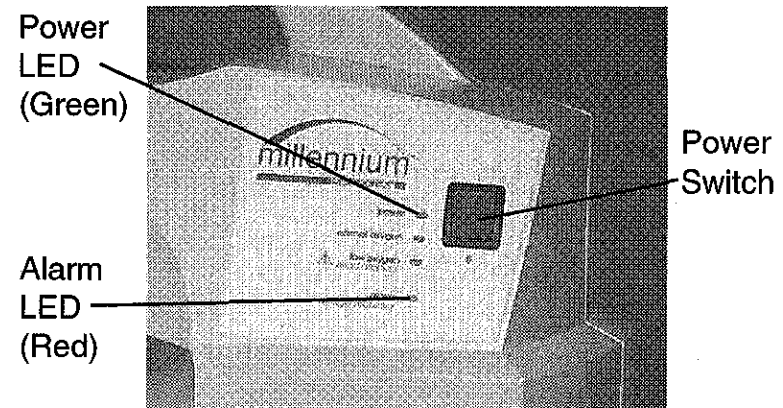


Figure 6-6  
Millennium Control Panel and LEDs

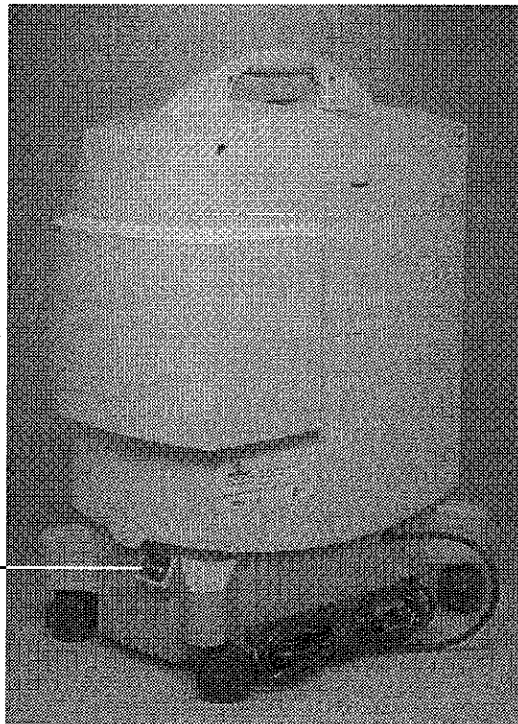
- a. Move the power switch to the ON (I) position. The alarm should sound and the red Light Emitting Diode (LED) light should illuminate.
- b. Move the power switch to the Off (O) position. The alarm and the red LED light should go out.

**Step 2** Connect the power cord to a power source.



Start-up LED and audible Alarm Test (Continued)

**Step 3** Make a note of the hour meter reading.



Hour  
Meter

*Figure 6-7  
Location of the Hour Meter*

**Step 4** Turn on the unit by moving the power switch to the ON (I) position and verify the following:

- the green LED power light illuminates;
- the unit starts running;
- the red LED light goes off and the audible alarm stops after the first cycle; and
- the yellow LED blinks until the specified oxygen level is reached.

## 6.5 Dealer Periodic Maintenance

The following sections detail the maintenance procedures that should be performed by the Dealer on a periodic basis.

### 6.5.1 Bacteria Filter Maintenance

The bacteria filter is the final component in the filtering system before the concentrated oxygen is delivered to the patient. Check and replace as necessary.

**Replacement Part Number H621**

Included in Kit:	Tools Required:
Bacteria Filter (×6) Wire Ties (×2)	Phillips screwdriver (medium w/ long shaft) Diagonals (wire cutters)

#### Procedure

Removed / Installed During Process:

- Rear Cabinet (See Section 8.4.4 for more detailed instructions.)
- Front Cabinet assembly (separate from unit) (See Section 8.4.5 for more detailed instructions.)
- Bacteria Filter

**WARNING:** Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs.

**CAUTION:** Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD protected area.

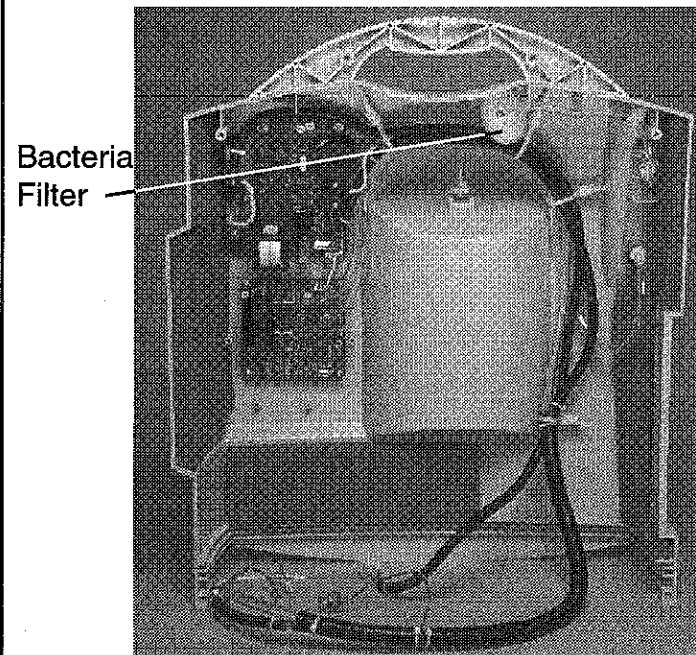


Figure 6-8  
Location of the Bacteria Filter





*Battery Test (Continued)*

- Step 1** Using diagonals, cut the wire ties that secure the pressure tubing to the bacteria filter.
- Step 2** Remove the pressure tubing from the inlet and outlet ports of the bacteria filter.
- Step 3** Slide the pressure tubing onto the inlet and outlet ports of the new bacteria filter.
- Step 4** Using the wire ties provided, secure the pressure tubing to the new bacteria filter.
- Step 5** Use the diagonals to cut off the excess from the wire ties.

**6.5.2 Product Canister Pressure Measurement**

Refer to Section 6.4.4.1 for detailed information.

**6.6 Dealer Compressor Maintenance**

To prolong the dependability and decrease unscheduled maintenance problems, Respironics suggests that the dealer's service technician perform the following two procedures when the unit shows signs of degraded performance:

- Step 1** bacteria filter maintenance (check and replace as needed); and
- Step 2** compressor maintenance (check and perform maintenance or replace as needed based on lower than normal cycle pressure with clean filters and no leaks).

### 6.6.1 Compressor Maintenance

Replacement Part Number H610

Included in Kit:	Tools Required:
Piston cup	Phillips screwdriver (medium with long shaft)
Valve keeper / restraint (exhaust)	Flat blade screwdriver (medium)
Valve keeper (intake)	T-15, T-20, T-25 Torx bits
Cylinder sleeve	C clamp
Valve flapper (exhaust)	Torque wrench (in.-lbs)
Valve flapper (intake)	
O-ring (head & sleeve) (x2)	
O-ring (intake filter cover)	
Gasket (intake)	
Filter (felt)	
screw (valve x2)	
screw (retainer x4)	

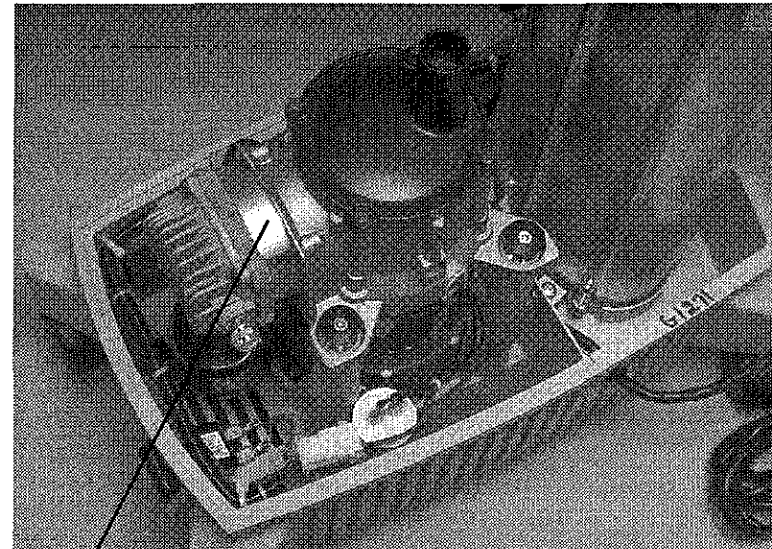
#### Procedure

Removed / Installed during process:

- Rear cabinet (See Section 8.4.4 for more detailed information.)
- Front cabinet (See Section 8.4.5 for more detailed information.)
- Compressor cover / perforated canopy (See Section 8.4.18 for more detailed information.)

**WARNING:** Electrical shock hazard: Disconnect the electrical supply before attempting to make any repairs to the device.

**CAUTION:** Electronic components used in this device are subject to damage from static electricity. Repairs made to this device must be performed only in an antistatic, ESD-protected environment.



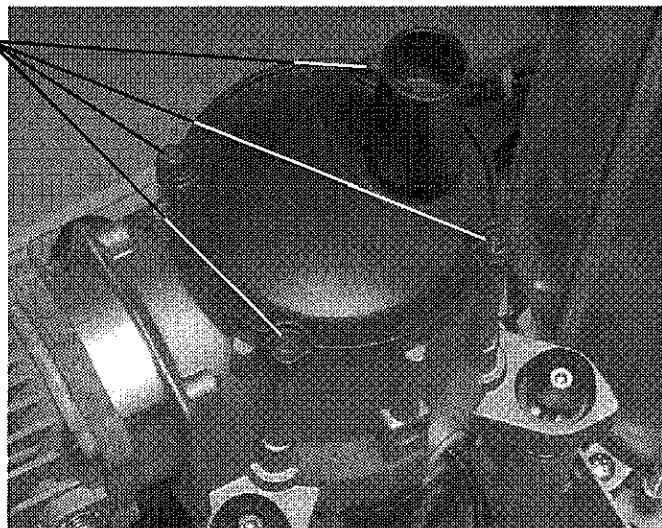
Compressor Assembly

Figure 6-9  
Location of the Compressor Assembly

Compressor Maintenance (Continued)

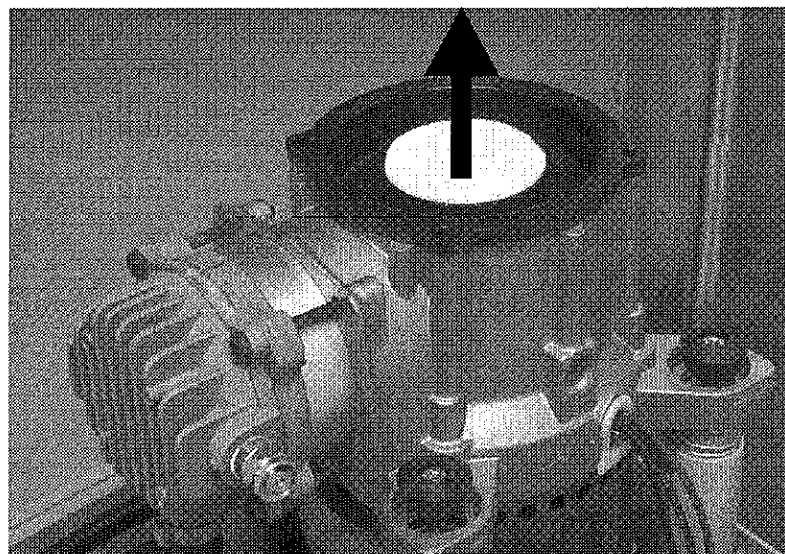
**Step 1** Remove the four screws securing the intake muffler using a T-20 or 7/64 Torx bit.

Screw  
Location



*Figure 6-10*  
*Location of the Intake Muffler Screws*

**Step 2** Remove and replace felt filter inside intake muffler.



*Figure 6-11*  
*Remove and Replace the Felt Filter*

Compressor Maintenance (Continued)

**Step 3** Remove and replace the O-ring on the bottom side of the intake muffler housing.

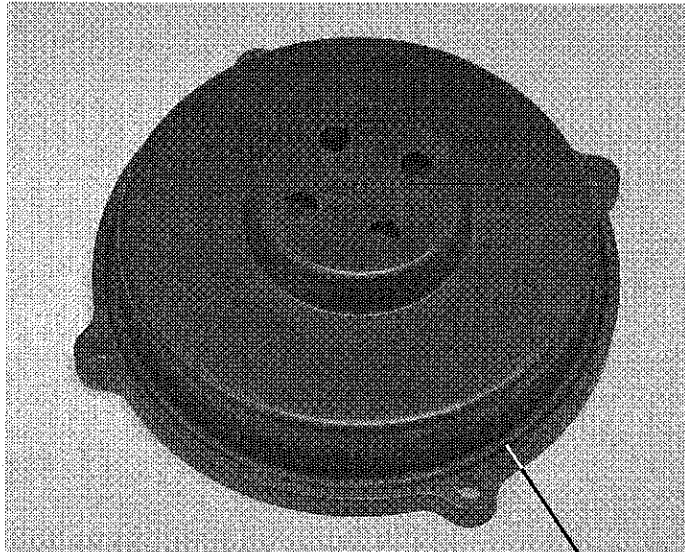


Figure 6-12  
O-ring Location

O-ring

**Step 4** With a marker, mark the top side of the compressor head and valve plate.

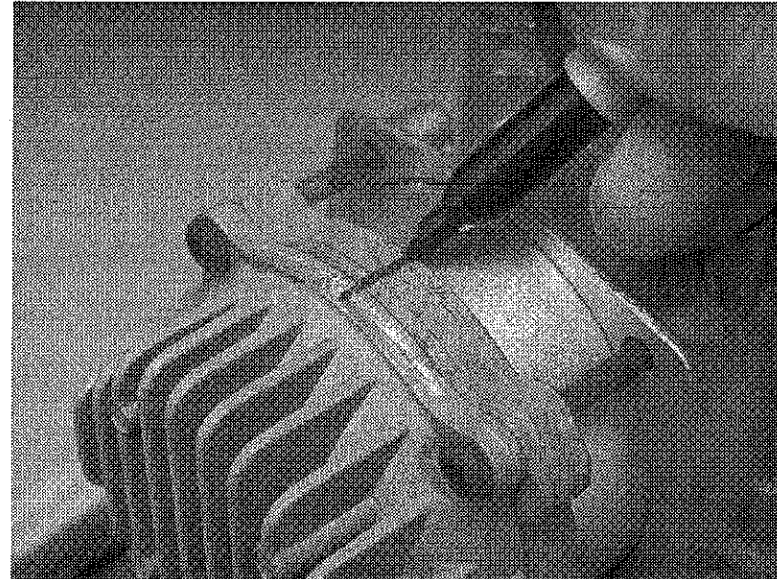
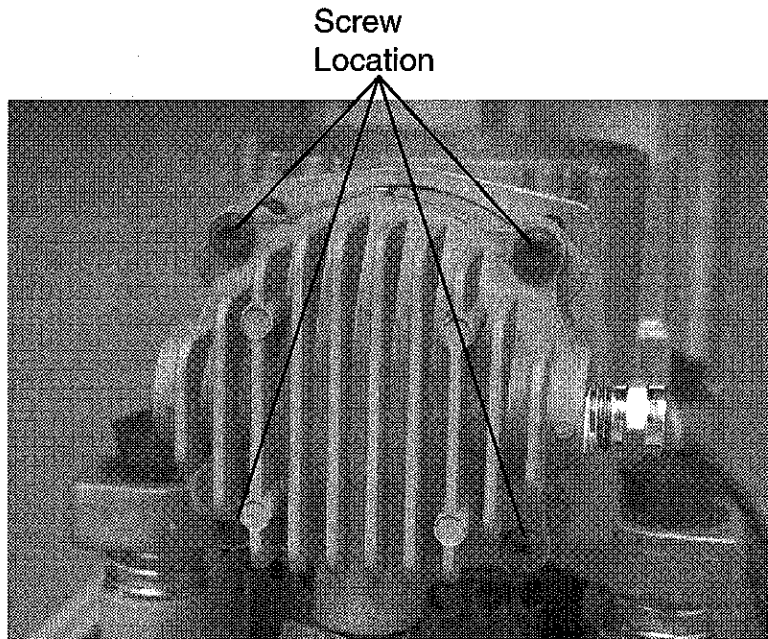


Figure 6-13  
Marking the Compressor Head and Valve Plate

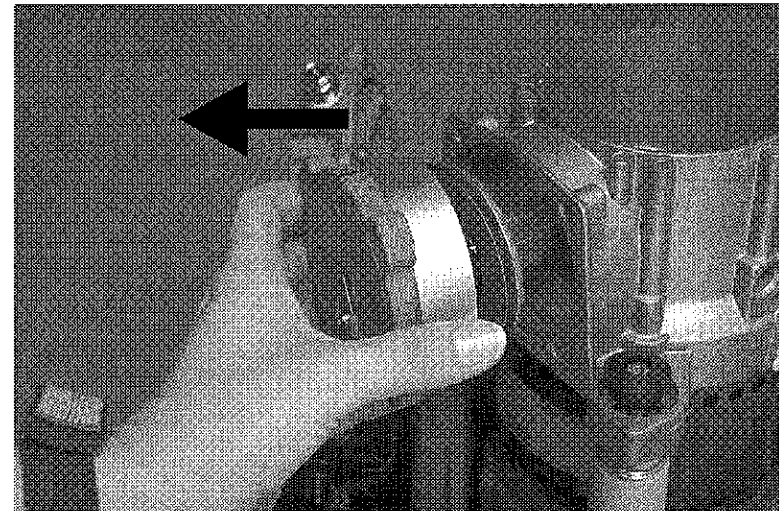
Compressor Maintenance (Continued)

**Step 5** Remove the four screws securing the compressor head using a T-25 or 1/8 Torx bit.



*Figure 6-14*  
*Location of the Compressor Head Screws.*

**Step 6** Remove the valve plate and cylinder sleeve.



*Figure 6-15*  
*Removing the Valve Plate and Cylinder Sleeve*