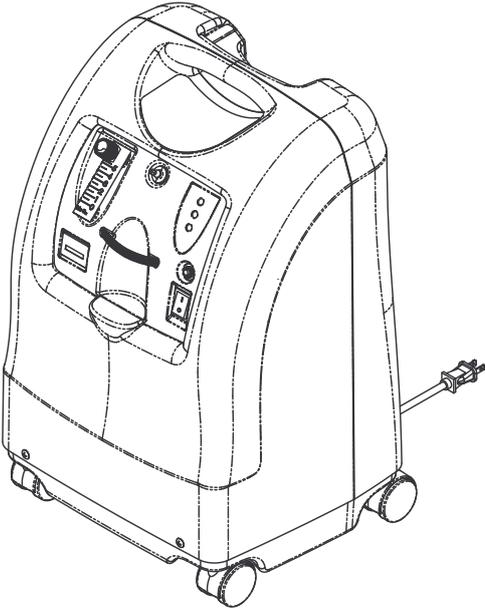


Invacare® Perfecto₂™ Oxygen Concentrator

Models without SensO₂: IRC5P, Models with SensO₂: IRC5PO2

en **Homefill® System Compatible Oxygen Concentrators**
Service Manual



DEALER: Keep this manual.
The procedures in this manual MUST be performed by a qualified technician.



Yes, you can.®

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I General

I.1 Symbols

Signal words are used in this manual and apply to hazards or unsafe practices which could result in personal injury or property damage. See the information below for definitions of the signal words.



DANGER!

– Danger indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING!

– Warning indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION!

– Caution indicates a potentially hazardous situation which, if not avoided, may result in property damage or minor injury or both.



Gives useful tips, recommendations and information for efficient, trouble-free use.

Symbols in Documentation



General Warning Sign



The background color inside the triangle is yellow on product labels.



Read manual



The color of the symbol background is blue on product labels.



No Smoking



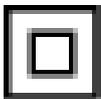
The color of the circle with diagonal bar is red on product labels.



No Open Flame



The color of the circle with diagonal bar is red on product labels.



Class II, Double Insulated

IPX1

Protected against solid foreign objects of 12.5 mm diameter and greater.

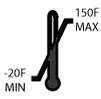
Protected against vertically falling water drops.



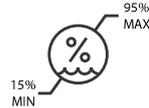
Indoor Use ONLY



Keep Dry



Transport and Storage Temperature



Transport and Storage Humidity



Alternating Current



Type BF equipment



Recycle



DO NOT dispose of in household waste



Electrical Hazard



Manufacturer

Symbols on Product



Unit running



Unit not running

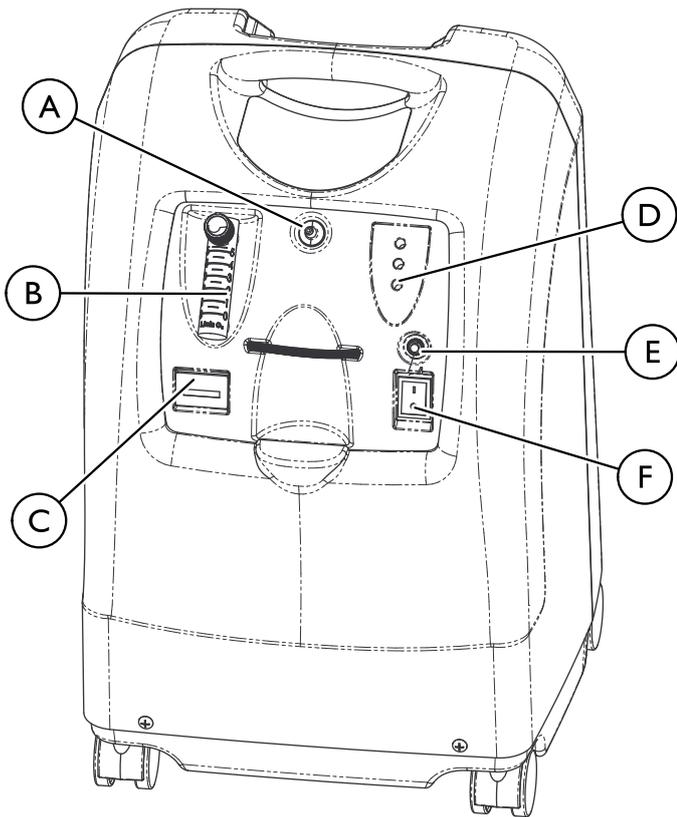
O₂ Indicators

Symbol	O ₂ Purity	Indicator Lights (LED)
O ₂	SYSTEM OKAY O ₂ over 85%	GREEN Indicator Light
	O ₂ between 73% to 85%	YELLOW Indicator Light A. YELLOW Solid B. YELLOW Flashing Sensor Failure. Call a qualified technician
	SYSTEM FAILURE O ₂ Below 73%	RED Indicator Light Refer to Troubleshooting.

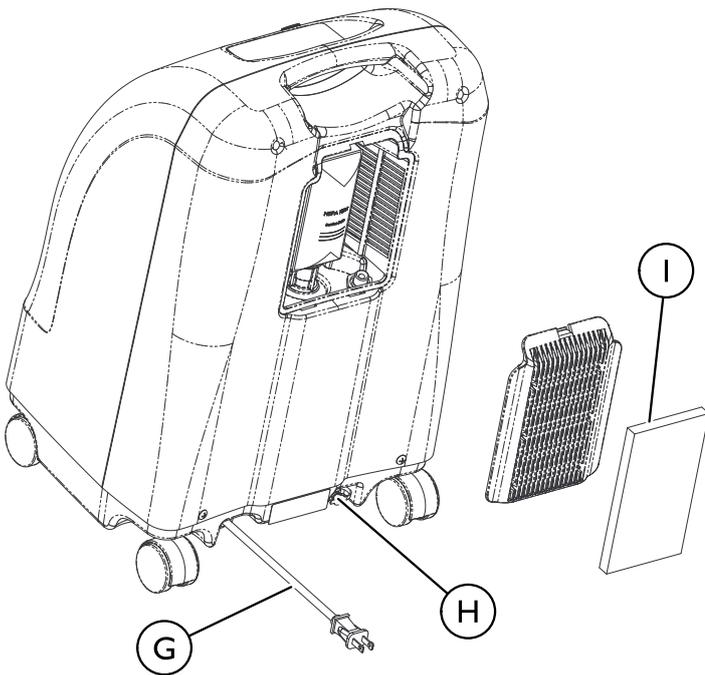
Non-Sensored Indicators

Symbol	O ₂ Purity	Indicator Lights (LED)
I/O	SYSTEM OKAY	GREEN Indicator Light
	SYSTEM FAILURE	RED Indicator Light Continuous Audible Alarm Sieve — GARD™ Compressor Shutdown Call a qualified technician.

1.2 Component Identification



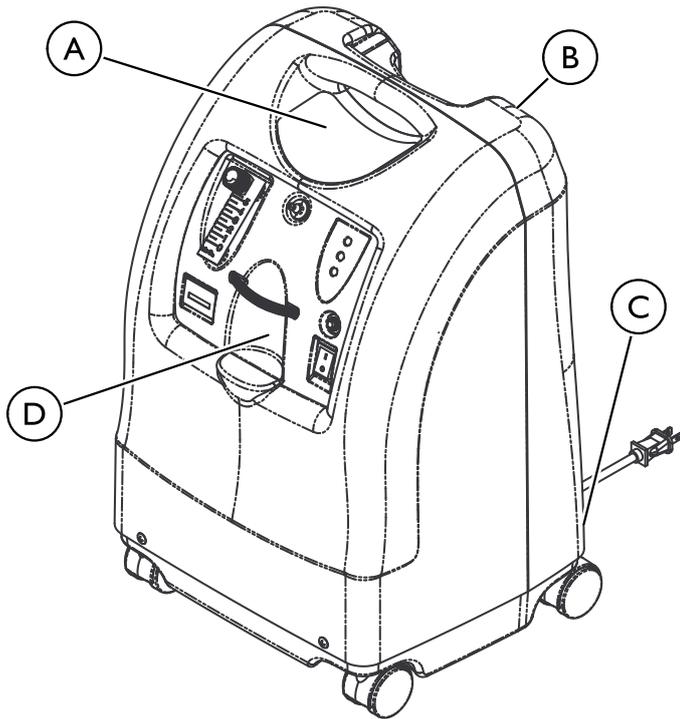
Ⓐ	Oxygen Outlet
Ⓑ	Flowmeter
Ⓒ	Elapsed Time Meter
Ⓓ	Oxygen Purity Indicator Lights/Fault and Power Indicator Lights
Ⓔ	Circuit Breaker
Ⓕ	Power Switch
Ⓖ	Power Cord
Ⓗ	Outlet Fitting
Ⓘ	Cabinet Filter
Not shown	PreciseRx™ Pediatric Humidifier/Flowmeter Accessory - IRCPF16 (Perfecto ₂ 5 Only)
Not shown	HomeFill home oxygen compressor - IOH200



i This outlet fitting is to be used only for filling oxygen cylinders with the HomeFill home oxygen compressor. The outlet fitting does not affect concentrator performance. Refer to the HomeFill user manual, part number 1100873, for connection and operating instructions. When not in use, the plug provided with the concentrator should be inserted into the outlet fitting. For more information about the HomeFill, contact your Invacare dealer.

2 Safety

2.1 Label Locations



A	<p style="text-align: center;">Perfecto₂™</p> <p>SEE USER MANUAL OR CONTACT YOUR HOME EQUIPMENT PROVIDER FOR SAFE OPERATING INSTRUCTIONS, ALARMS, AUDIBLE ALERTS AND USE OF ACCESSORIES.</p> <hr/> <p>⚠ DANGER RISK OF FIRE - NO SMOKING, OPEN FLAME OR IGNITION SOURCES</p> <p>Keep ALL sources of ignition out of the room in which this product is located and away from areas where oxygen is being delivered. Textiles, oil and other combustibles are easily ignited and burn with great intensity in oxygen enriched air.</p> <p>⚠ DANGER RISK OF ELECTRIC SHOCK DO NOT remove cover. Refer servicing to qualified service personnel.</p> <p>⚠ CAUTION Federal (USA) law restricts this device to sale by or on the order of a physician.</p> <p style="text-align: center;">HomeFill® II Compatible</p>
B	Serial number label is located on the resonator intake assembly.
C	Specification label is located on the back of the concentrator at the base.
D	 <p>NO SMOKING NO fumar Escape non fumeur</p> <p style="font-size: small;">PIN 1154274 Rev B</p>

2.2 General Guidelines



DANGER!
Risk Of Death, Injury, Or Damage

Improper use of the product may cause death, injury or damage. This section contains important information for the safe operation and use of this product.

- DO NOT use this product or any available optional equipment without first completely reading and understanding these instructions and any additional instructional material such as user manuals, service manuals or instruction sheets supplied with this product or optional equipment.
- If you are unable to understand the warnings, cautions or instructions, contact a healthcare professional, dealer or technical personnel before attempting to use this equipment.
- Check ALL external components and carton for damage. In case of damage, or if the product is not working correctly, contact a technician or Invacare for repair.
- THE INFORMATION IN THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE.



DANGER!
Risk Of Death, Injury, Or Damage From Fire

Textiles, oil or petroleum substances, grease, greasy substances and other combustibles are easily ignited and burn with great intensity in oxygen enriched air and when in contact with oxygen under pressure. To avoid fire, death, injury or damage:

- DO NOT SMOKE while using this device.
- DO NOT use near OPEN FLAME or IGNITION SOURCES.
- DO NOT use any lubricants on concentrator unless recommended by Invacare.
- NO SMOKING signs should be prominently displayed.
- Avoid creation of any spark near oxygen equipment. This includes sparks from static electricity created by any type of friction.
- Keep all matches, lighted cigarettes, electronic cigarettes or other sources of ignition out of the room in which this concentrator is located and away from where oxygen is being delivered.
- Keep the oxygen tubing, cord, and concentrator out from under such items as blankets, bed coverings, chair cushions, clothing, and away from heated or hot surfaces including space heaters, stoves, and similar electrical appliances.



DANGER!
Risk of Death, Injury, from Electric Shock

To reduce the risk of burns, electrocution, death or injury to persons:

- DO NOT disassemble. Refer servicing to qualified service personnel. There are no user serviceable parts.
- Avoid using while bathing. If continuous usage is required by the physician's prescription, the concentrator must be located in another room at least 7ft (2.1m) from the bath.
- DO NOT come in contact with the concentrator while wet.
- DO NOT place or store concentrator where it can drop into water or other liquid.
- DO NOT reach for concentrator that has fallen into water. Unplug IMMEDIATELY.
- DO NOT use frayed or damaged AC power cords.

**WARNING!****Risk Of Injury Or Damage**

- Invacare products are specifically designed and manufactured for use in conjunction with Invacare accessories. Accessories designed by other manufacturers have not been tested by Invacare and are not recommended for use with Invacare products.
- There are many different types of humidifiers, oxygen tubing, cannulas and masks that can be used with this device. You should contact your local home care supplier for recommendations on which of these devices will be best for you. They should also give you advice on the proper usage, maintenance, and cleaning.

**DANGER!****Risk of Injury or Death**

To avoid choking or ingestion of chemicals from airway contamination:

- DO NOT use the concentrator in the presence of pollutants, smoke, fumes, flammable anesthetics, cleaning agents, or chemical vapors.

**WARNING!****Risk of Injury or Death**

To prevent injury or death from product misuse:

- Closely supervise when this concentrator is used by or near children or impaired individuals.
- Monitor patients using this device who are unable to hear or see alarms or communicate discomfort.

**WARNING!****Risk of Injury or Death**

To avoid choking and/or strangulation from tubing entanglement:

- Keep children and pets away from nasal cannula and tubing.
- Close supervision is necessary when the nasal cannula is used by or near children and/or impaired persons.

**WARNING!****Risk of Injury or Death**

To reduce the risk of injury or death from illness:

- Replace the nasal cannula on a regular basis. Check with your equipment supplier or physician to determine how often the cannula should be replaced.
- DO NOT share cannulas between patients.

**WARNING!****Risk of Injury**

A change in altitude may affect total oxygen available to you. To prevent oxygen deprivation:

- Consult your physician before traveling to higher or lower altitudes to determine if your flow settings should be changed.

**WARNING!****Risk of Injury or Damage**

To prevent injury or damage from cord misuse:

- DO NOT move or relocate concentrator by pulling on the cord.
- DO NOT use extension cords with AC power cords provided.
- Properly store and position electrical cords and/or tubing to prevent a tripping hazard.

**WARNING!****Risk of Injury or Damage**

To prevent injury or damage from misuse:

- NEVER leave concentrator unattended when plugged in.
- Make sure concentrator is off when not in use.

**WARNING!****Risk of Injury or Damage**

Invacare oxygen concentrators are specifically designed to minimize routine preventive maintenance. To prevent injury or damage:

- Only professionals of the healthcare field or persons fully conversant with this process such as factory trained personnel should perform preventive maintenance or performance adjustments on the oxygen concentrator, except for tasks described in this manual.
- Users should contact your dealer or Invacare for service.

**CAUTION!****Risk of Damage**

To prevent damage from liquid ingress:

- If the concentrator is not working properly, if it has been dropped or damaged, or dropped into water, call equipment supplier/qualified technician for examination and repair.
- NEVER drop or insert any object or liquid into any opening.
- For indoor use ONLY.

**WARNING!****Perfecto₂ Parts Compatibility**

- The Platinum concentrator and the Perfecto₂ concentrator share many similar components. However, there are some components that are NOT cross compatible and they are specific to each model.
- Parts that can be used for Perfecto₂ repairs are listed in the Perfecto₂ parts catalog, form number 93_038. Please reference this catalog before replacing any parts. Use of incorrect parts could result in injury or property damage.

**WARNING!****Risk of Injury**

It is very important to select the prescribed level of oxygen flow. To void injury from oxygen deprivation:

- DO NOT increase or decrease the flow unless a change has been prescribed by your physician or therapist.
- ALWAYS confirm prescribed dose before administering to patient and monitor on a frequent basis.

**CAUTION!****Risk of damage**

Shorter periods of operation may reduce maximum product life. For optimum performance:

- The concentrator should be on and running for a minimum of 30 minutes at a time.

2.3 Radio Frequency Interference



WARNING!

Risk of Injury or Damage

To reduce the risk of injury or product damage from interference with wireless equipment:

- Keep concentrator at least 9.8 ft (3.0 m) away from wireless communication equipment such as wireless home network devices, mobile phones, cordless phones and base stations, walkie-talkies, etc.

This equipment has been tested and found to comply with EMC limits specified by IEC/EN 60601-1-2. These limits are designed to provide a reasonable protection against electromagnetic interference in a typical medical installation.

Other devices may experience interference from even the low levels of electromagnetic emissions permitted by the above standards. To determine if the emissions from the concentrator are causing the interference, turn the concentrator Off. If the interference with the other device(s) stops, then the concentrator is causing the interference. In such rare cases, interference may be reduced or corrected by one of the following measures:

- Reposition, relocate, or increase the separation between the equipment.
- Connect the equipment into an outlet on a circuit different from that to which the other device(s) is connected.

3 Installation

3.1 Verification of Battery Free Power Loss Alarm

Check the concentrator for proper operating conditions.

1. If the unit has been in below-freezing temperatures, allow it to warm up to room temperature before operating.
2. The concentrator may need to be turned on for four to five seconds to charge the Battery Free Power Loss Alarm. Connect power cord to outlet and turn the concentrator on. Turn flow control knob counterclockwise and flow will begin IMMEDIATELY. Set flow rate to five L/min. Let the unit run for 30 minutes, then turn unit off.
3. Unplug the power cord and press On/Off (I/O) switch to the On (I) position. An intermittent audible alarm will sound. This confirms proper operation of the Battery Free Power Loss Alarm. Turn On/Off switch Off (O).
4. Connect power cord to outlet and turn on concentrator. Unit will beep on start-up.
5. Check the oxygen concentration per specifications after 30-40 minutes running time.

3.2 Sequence of Operation

Turning On (I) the power switch applies 120 VAC to the compressor motor, hour meter, transformer, cooling fan and the printed circuit (P.C.) board.

Room air enters the compressor via the cabinet filter and the compressor inlet filter. The air is compressed by the wobble pistons in the compressor to a pressure of 21 psi (144.79 kPa).

As increased pressure creates increased temperature, a heat exchanger is used to lower the temperature before the air enters the 4-way valve. It is then channeled to a sieve bed containing the adsorption material. Restriction downstream of the sieve bed causes pressure to build up inside the sieve bed which is necessary for the adsorption process. A small amount of relatively pure oxygen enters the top of the second bed through a restrictive leak in the pressure equalization (PE) valve with the balance entering a storage tank. The nitrogen removed is exhausted back from the bed through the 4-way valve into room air. A muffler is located at the exhaust end of the valve to muffle the sound of the exhaust as it exits the concentrator.

The oxygen not being used to exhaust is channeled into the storage tank. The pressurized oxygen is regulated down to five psi (34.4 kPa), enters an accurate flow-measuring device, flows through Outlet HEPA filter and check valve, then out to the patient.

The electrical activation of the 4-way Valve is accomplished every 8 to 15 seconds by the pressure sensor and P.C. Board electronics when the pressure reaches a set point of 21 psi (144.79 kPa) output flows 4 L/min and above or 16 psi (110.32 kPa) output flows 3 L/min and below. The time between cycles is dependent on altitude, flow rate and internal environmental factors.

A PE valve opens just prior to the shift of the 4-way valve. This allows highly concentrated oxygen to enter the just exhausted bed from the top. This additional pressure allows the bed to start its cycle at a higher pressure. The PE valve will close just after the shift of the 4-way valve.

If main power is lost, the Battery Free Power Loss Alarm will sound a short "BEEP", with a long pause after. All units are equipped with a diagnostic alarm system that signals if the pneumatic pressure or electrical systems malfunction. The troubleshooting guide in this manual explains the alarm system signals and reasons, in detail. Refer to 9.1 Troubleshooting, page 44.

3.3 SensO₂ Oxygen Sensor Technology - Ceramic Zirconia Sensor

3.3.1 Technical Description

The oxygen being produced by the concentrator flows out of the product tank and into the flowmeter. A small flow of oxygen produced by the unit is sent through a precision orifice to the oxygen sensor mounted on the printed circuit board.

As the oxygen enters the sensor, it passes through a screen and contacts the sensing disk.

Electric current flowing through a metal film resistor heats the disk in excess of 300° C.

Oxygen molecules contact the electrode of the disk and pick-up extra electrons to become oxygen ions. These oxygen ions are attracted to the electrode on the bottom of the zirconia sensing disk. Because of the crystal structure of the zirconia, only oxygen ions can pass through. When the oxygen ions reach the bottom electrode, the extra electrons are released from the oxygen ions and oxygen molecules return to the air. The number of electrons is directly related to the oxygen concentration. The electrons travel to the P.C. board where they are counted and the oxygen concentration reading is calculated.

A microprocessor on the P.C. board contains software that interprets the signal being received from the sensor. It compares the signal to clinically acceptable limits. Signals outside of the clinically acceptable limits generate responses in the form of lights, audible indicators, and/or system shut-down.

3.3.2 Operating Sequence

Once the power switch has been turned On (I), the SensO₂ circuit will wait five minutes for the concentrator to begin producing clinically acceptable oxygen and the oxygen sensor to stabilize. The GREEN light will illuminate (indicating normal system operation) while the oxygen sensor is warming up.

After five minutes, if the oxygen purity exceeds 85% ± 2%, the GREEN light will continue to illuminate.

If the oxygen level is not above 85% ± 2% after the first five minutes, the system will continue to monitor the O₂ and wait for a maximum of 30 minutes from start-up to reach 85% ± 2% before activating an alarm. Environmental factors such as low voltage, high altitude, or age of the machine will affect the time required to reach 85% ± 2%.

If the oxygen level is not above 85% ± 2% within the first 30 minutes, the oxygen concentration alarm sequence will activate and the unit will shut down.

When oxygen concentration is above 85% ± 2%, the sensor measures oxygen purity every 10 minutes. If a reading falls below 85% ± 2%, a YELLOW light will illuminate. If the oxygen purity falls below 73% ± 3% the RED light/Alarm/Shut-Down mode will activate.

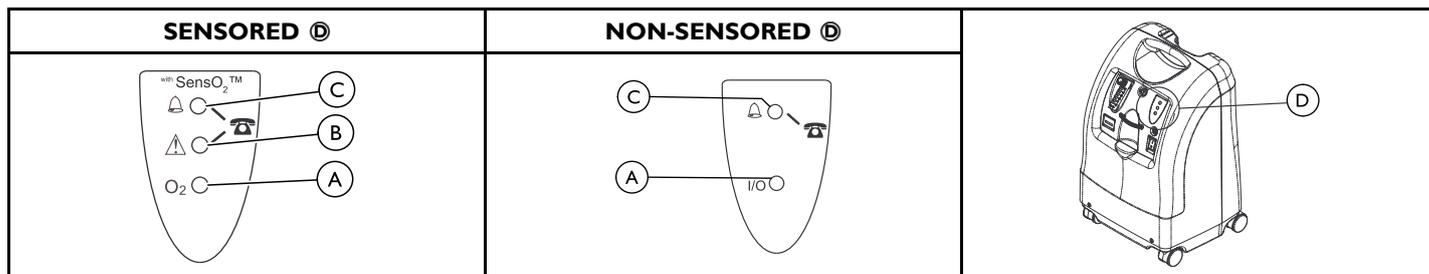
3.4 Alarm Indicators (Sensored and Non-Sensored)



DANGER!

To prevent electrical shock:

– ALWAYS disconnect concentrator from electrical outlet before servicing.



Operation

The Perfecto₂ with SensO₂ Concentrator is equipped with an oxygen purity indicator. This feature monitors the purity level of the oxygen generated by the concentrator. If purity falls below alarm thresholds, indicator lights on the control panel will illuminate.



Concentrator may be used during the initial start warm-up time (approximately 30 minutes) while waiting for the O₂ purity to reach maximum.

When the unit is turned on, the GREEN light will come on (SYSTEM OK/O₂ greater than 85%). After five minutes, the oxygen sensor will be operating normally and will control the indicator lights depending on oxygen concentration values. The explanation of the indicator light functions are as follows:

Indicator Lights



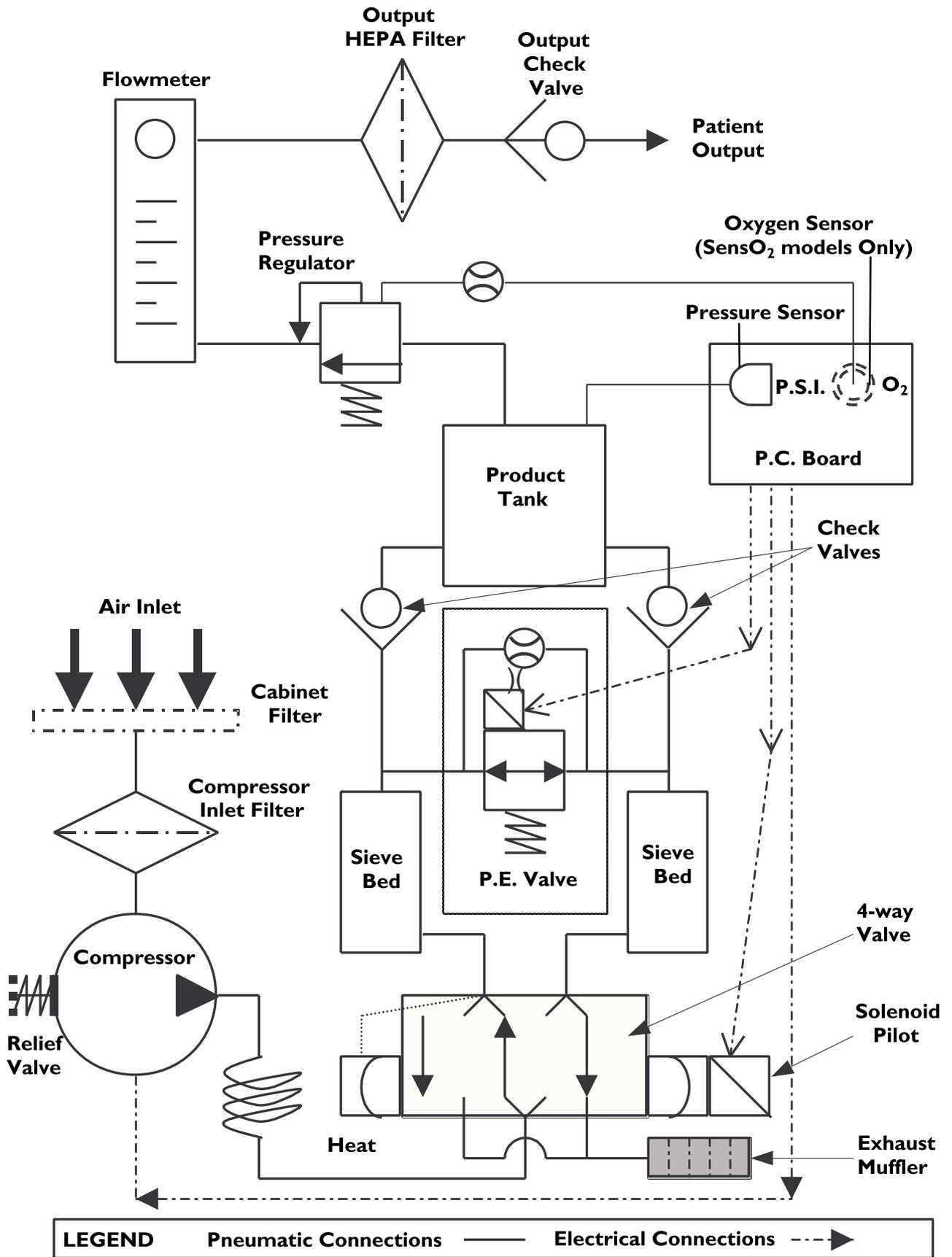
Indicator lights are visible only when lit.

Sensored Version Indicator Light Explanation		
O ₂	GREEN light	(O ₂) - Normal Operation.
	YELLOW light	Call supplier IMMEDIATELY. You may continue to use the concentrator unless instructed otherwise by your supplier. Be certain that backup oxygen is nearby.
	RED light	Total unit shutdown. Switch IMMEDIATELY to backup oxygen supply. Call supplier IMMEDIATELY.
	GREEN light with YELLOW light flashing	Call supplier IMMEDIATELY. Oxygen sensor malfunctioning; you may continue to use the concentrator. Indicators - If your unit does not feature the O ₂ Sensor.

Non-Sensored Version Indicator Light Explanation		
	RED light	Total Unit Shut-Down. Switch IMMEDIATELY to a back-up oxygen supply. Call Supplier IMMEDIATELY.
I/O	GREEN light	On/Off (I/O). System okay.

4 Pneumatic Diagram

4.1 Pneumatic Diagram



5 Maintenance

5.1 Cleaning the Cabinet Filter



DANGER!

– To prevent electrical shock, ALWAYS disconnect concentrator from electrical outlet before servicing.



At a minimum, preventive maintenance MUST be performed according to the maintenance record guidelines. In places with high dust or soot levels, maintenance may need to be performed more often.



CAUTION!

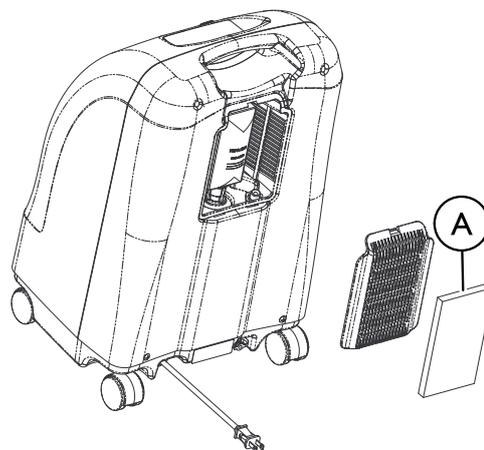
Risk of Damage

To avoid damage to the internal components of the unit:

– DO NOT operate the concentrator without the filter installed or with a dirty filter.



There is one cabinet filter located on the back of the cabinet.



1. Remove the filter **A** and clean as needed.



Environmental conditions that may require more frequent inspection and cleaning of the filters include but are not limited to: high dust, air pollutants, etc.

2. Clean the cabinet filter with a vacuum cleaner or wash with a mild liquid dish detergent and water. Rinse thoroughly.
3. Thoroughly dry the filter and inspect from fraying, crumbling, tears and holes. Replace filter if any damage is found.
4. Reinstall the cabinet filter.

5.2 Checking the Outlet HEPA Filter

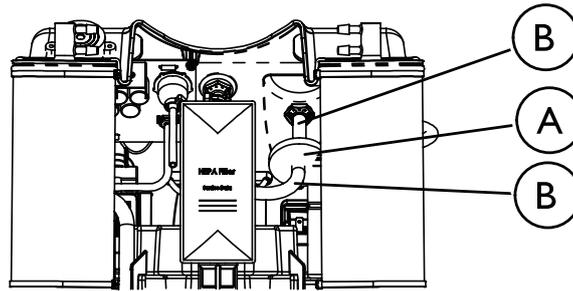


The outlet HEPA filter can be checked during preventive maintenance or between patients by performing the following procedure.

1. Turn the concentrator On (I) and adjust the flowmeter to the maximum flow rate of the unit.
2. Observe the flowmeter's flow indicator while connecting a fifty foot cannula tube to the outlet barb of the concentrator (not shown).
3. If the flow indicator fluctuates, the outlet HEPA filter may need replacement. Refer to 9.1 Troubleshooting, page 44.

5.3 Replacing the Outlet HEPA Filter

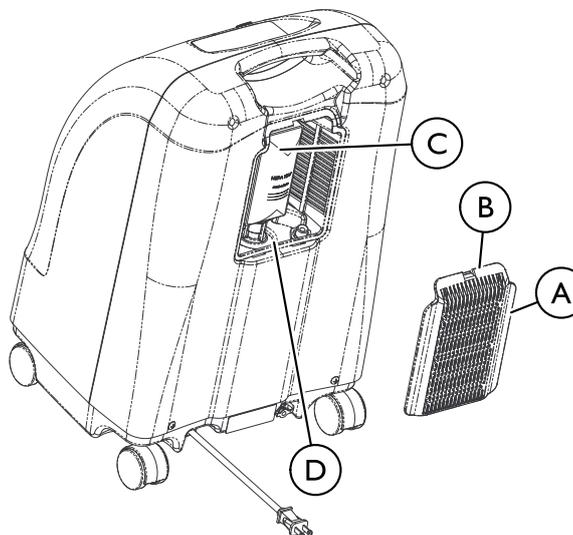
 Perform this procedure during preventive maintenance or between patients depending on the outlet HEPA filter check results.



1. Turn power Off (O) and unplug the unit.
2. Remove the cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. For easier access to the outlet HEPA filter (A), remove the compressor inlet HEPA filter by grasping the compressor inlet filter, pull outward and up until filter is dislodged from rubber base.
4. With a flat head screwdriver, remove the tubing (B) from both sides of the existing outlet HEPA filter by prying the tubing away from the outlet HEPA filter.
5. Discard existing outlet HEPA filter.
6. Connect tubing to both sides of the new outlet HEPA filter as shown.
7. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
8. If no leaks detected, turn power Off (O) and unplug the unit.
9. Install cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse ALL steps.

5.4 Replacing the Compressor Inlet HEPA Filter

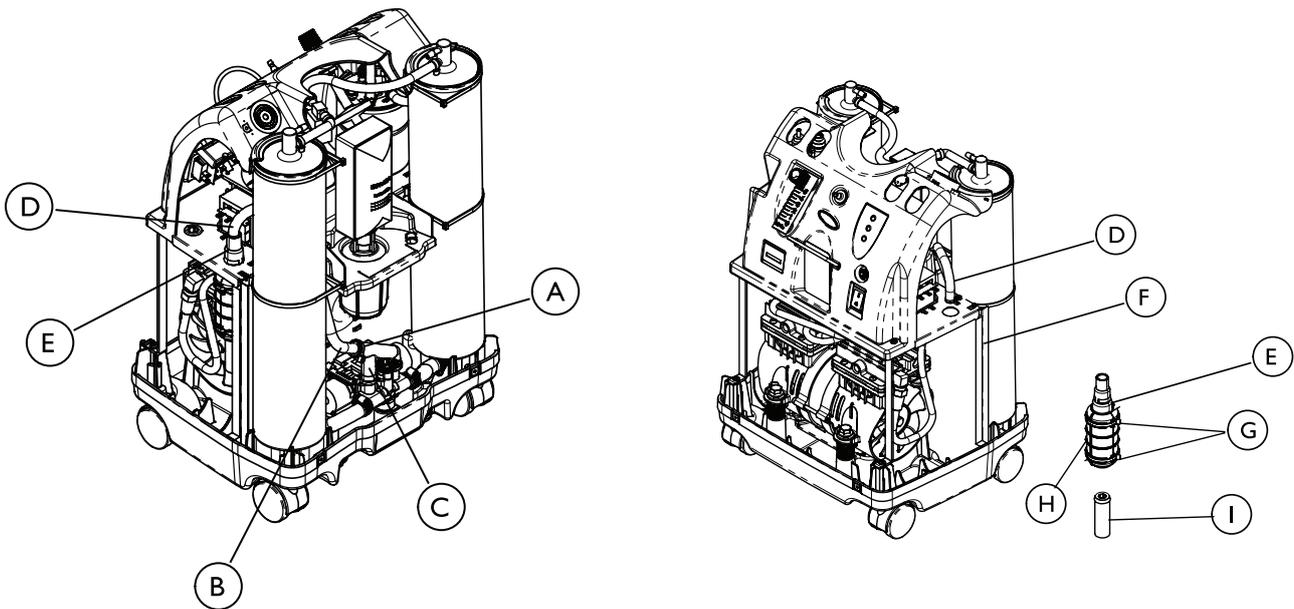
 Perform this procedure during preventive maintenance or between patients depending upon the environment the concentrator is used in.



1. Turn power Off (O) and unplug the unit.
2. Remove the filter access panel (A) by pressing down on center tab (B) and pulling panel out.
3. Grasp the compressor inlet HEPA filter (C), pull outward and up until filter is dislodged from rubber base (D).
4. Discard the existing compressor inlet HEPA filter.
5. Install new compressor inlet filter by inserting the filter into the rubber base.
6. Push the filter down until the rubber base touches the edge of the filter.
7. Reinstall the filter access panel.

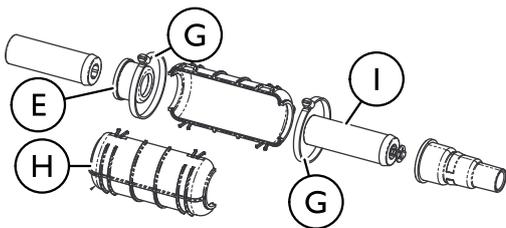
5.5 Replacing the Muffler Assembly

 Perform this procedure during preventive maintenance or between patients depending upon the environment the concentrator is used in.



 Depending on the date of manufacture, the unit will be equipped with one of the two PE valve assemblies, a circular shape or rectangular shape. Only the rectangular PE valve is shown. The muffler replaces in the same manner for units equipped with the circular shape PE valve.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Cut tie wrap **A** that secures the bottom of the manifold exhaust tube **B** to the “F” tube **C**.
4. Remove the bottom of the manifold exhaust tube from the “F” tube.
5. Disconnect and remove the top of the manifold exhaust tube **D** from the grommet **E**.
6. Push the muffler assembly down through the opening in the sound box **F**.
7. Cut the two tie wraps **C** around the muffler assembly.
8. Separate the muffler assembly.
9. Inspect the components to ensure they are clear.



10. Do one of the following:
 - Replace exhaust canister **H** and throttling muffler **I** if plugged or restricted.
 - Install only new throttling muffler if exhaust canister is in good condition.
11. Install new/existing muffler assembly by reversing 3-8.
12. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
13. If no leaks detected, turn power Off (O) and unplug the unit.
14. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

5.6 Cleaning the Heat Exchanger

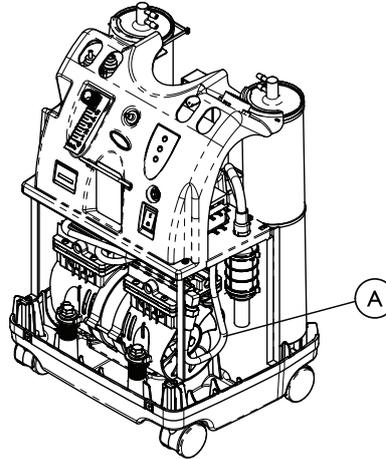
**DANGER!****Risk of Death, Injury, or Damage**

To prevent electrical shock

- ALWAYS disconnect concentrator from electrical outlet before servicing.

**CAUTION!****Risk of Damage**

- Use care not to deform heat exchanger  when installing, removing or cleaning.



 PE valve not shown.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Remove excess dirt using compressed air or vacuum.
4. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse ALL steps.

5.7 Preventative Maintenance Record

On Each Inspection																		
Record Date of Service																		
Record Elapsed Hours On Hour Meter																		
Clean Cabinet Filter(s)																		
Check Prescribed L/min. Flow Rate																		
DURING PREVENTIVE MAINTENANCE SCHEDULE, OR BETWEEN PATIENTS																		
UNITS WITHOUT SensO₂— EVERY 4,380 HOURS																		
Check Oxygen Concentration																		
Clean/Replace Cabinet Filter(s)																		
Check Outlet HEPA Filter*																		
Check Compressor Inlet Filter*																		
Check Power Loss Alarm																		
UNITS WITH SensO₂— EVERY 26,280 HOURS																		
Check Oxygen Concentration																		
Clean/Replace Cabinet Filter(s)																		
Check Outlet HEPA Filter*																		
Check Compressor Inlet Filter*																		
Check Power Loss Alarm																		

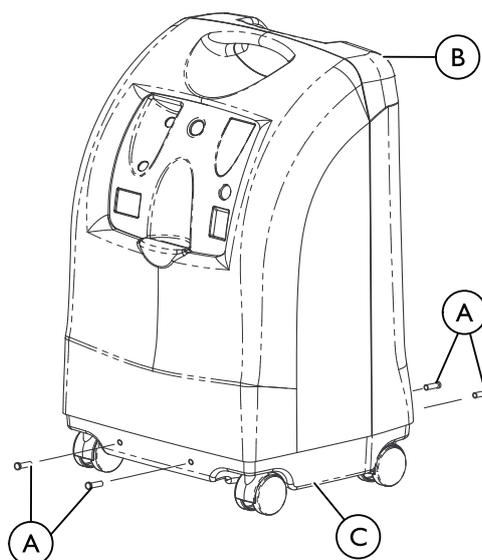
 * Refer to Preventative Maintenance section of Service Manual.

4,380 hours are equivalent to usage 24 hours per day, 7 days per week, for 6 months.

26,280 hours are equivalent to usage 24 hours per day, 7 days per week, for 3 years.

6 Service

6.1 Removing Cabinet

**DANGER!****Risk of Death, Injury, or Damage**

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.

1. Turn power Off (O) and unplug the unit.
2. Remove the four mounting screws (A) that secure cabinet assembly (B) to the base assembly (C).
3. Lift the cabinet straight up.



When required, vacuum inside of the cabinet and exposed foam insulation.

4. To re-install cabinet, reverse STEPS 2-3.

6.2 Replacing Compressor Assembly

6.2.1 Replacing Compressor Assembly Before September 2015

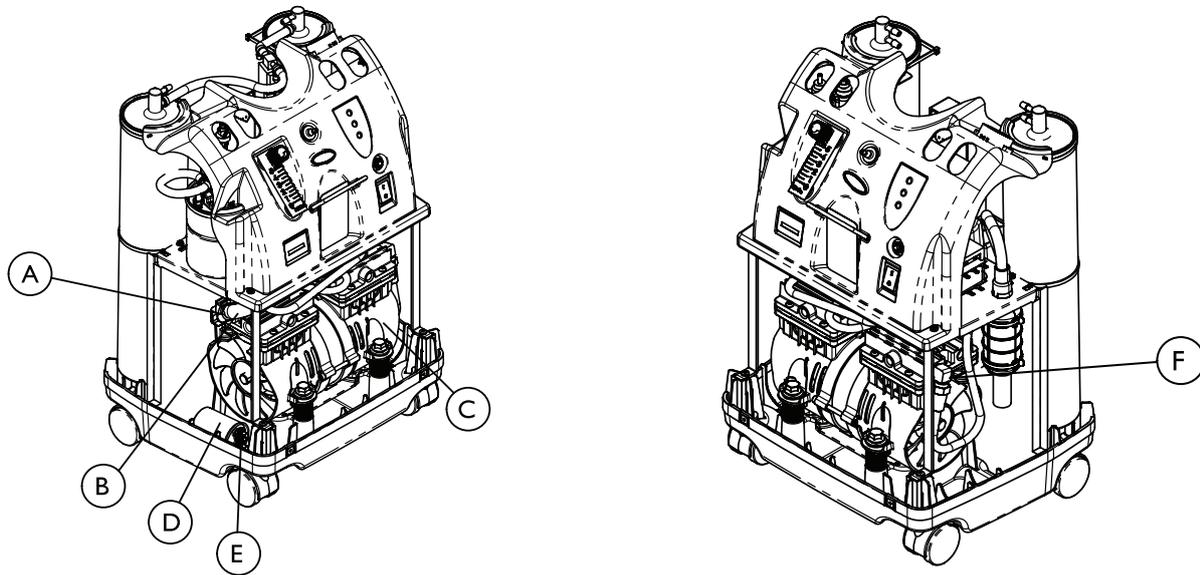


DANGER!

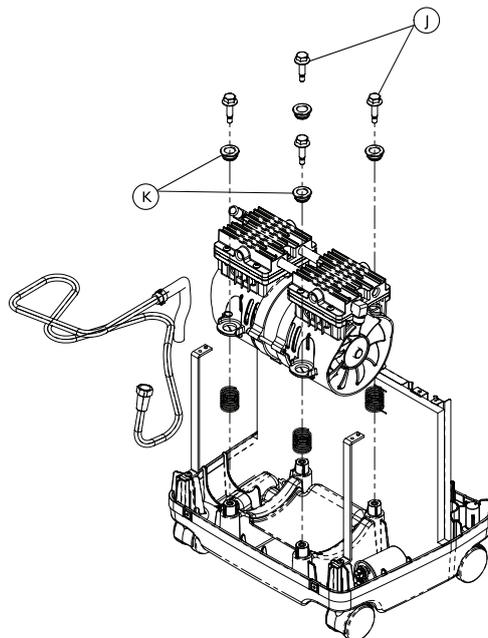
Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.



1. Turn power Off (O) and unplug the unit.
2. Remove the cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Cut the tie wrap (A) that secures the intake hose (B) to the compressor assembly (C).
4. Disconnect intake hose from compressor assembly.
5. Remove compressor wires from wire clamps or tie-wraps (not shown).
6. Disconnect compressor connector from the main harness connector (not shown).
7. Disconnect capacitor wires (D) from the top of the capacitor (E).
8. Disconnect brass nut (F) from compressor.



9. Remove the four mounting screws (I) and grommets (K) that secure the compressor to the base assembly. Leave springs on the post in the base.
10. Tilt compressor assembly forward and lift out.
11. Reverse STEPS 3-10 to install new compressor assembly. Torque screws to 30 +/- 5 in-lbs when assembling the four mounting screws in STEP 9.
12. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.

13. If no leaks detected, turn power Off (O) and unplug the unit.
14. Reinstall the cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.2.2 Replacing Compressor Assembly After September 2015

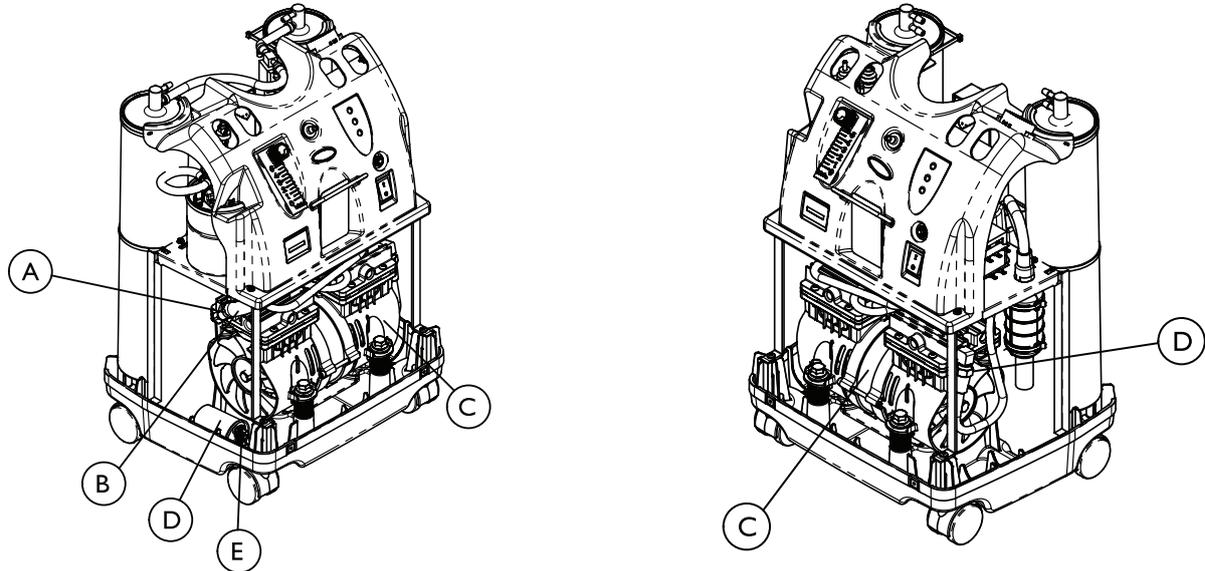


DANGER!

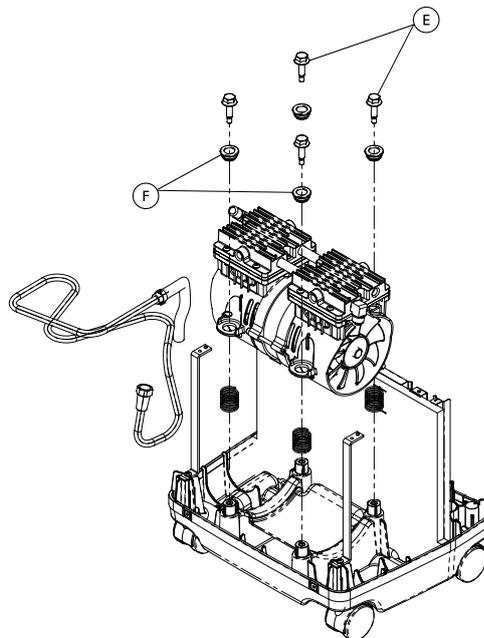
Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.



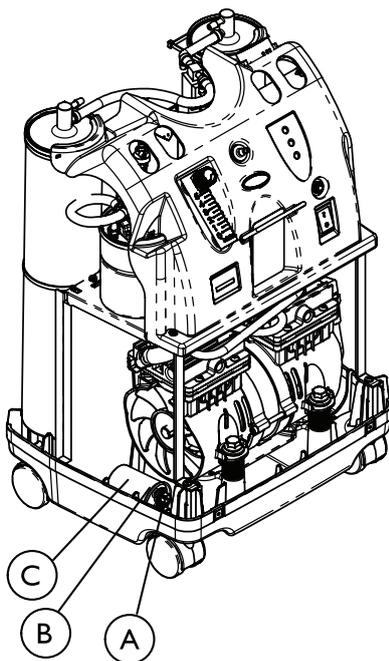
1. Turn power Off (O) and unplug the unit.
2. Remove the cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Cut the tie wrap (A) that secures the intake hose (B) to the compressor assembly (C).
4. Disconnect intake hose from compressor assembly.
5. Cut tie-wraps that secure compressor wires to gusset.
6. Disconnect the compressor wires (not shown) from the jumper wires (not shown).
7. Disconnect brass nut (D) from compressor.



8. Remove the four mounting screws (E) and grommets (F) that secure the compressor to the base assembly. Leave springs on posts in the base.
9. Tilt compressor assembly forward and lift out.
10. Reverse steps 3-9 to install new compressor assembly. Torque screws to 30 +/- 5 in-lbs when assembling the four mounting screws in STEP 8.
11. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
12. If no leaks detected, turn power Off (O) and unplug the unit.
13. Reinstall the cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

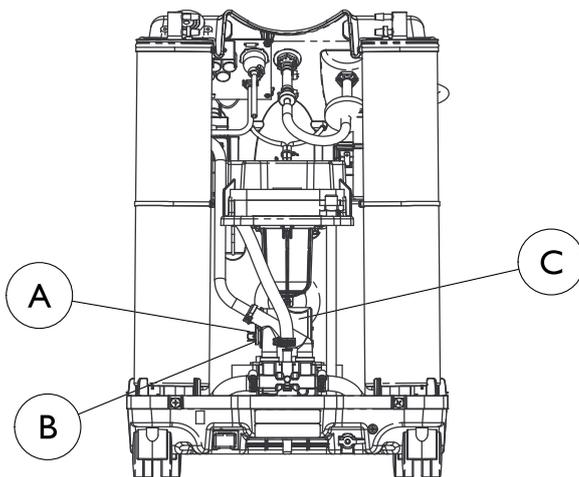
6.3 Replacing Capacitor

6.3.1 Replacing Capacitor Before September 2015



1. Turn power Off (O) and unplug the unit.
2. Remove the cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Using needlenose pliers, disconnect the spade connectors from the capacitor terminals (A).
4. Cut the tie wrap (B) that secures the capacitor (C) to the base of the concentrator.
5. Remove the capacitor from the concentrator base.
6. Install new capacitor by reversing STEPS 3-5.
7. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
8. If no leaks detected, turn power Off (O) and unplug the unit.
9. Re-install the cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.3.2 Replacing Capacitor After September 2015



1. Turn power Off (O) and unplug the unit.
2. Remove the cabinet. Refer to 6.1 Removing Cabinet, page 17 .
3. Using needlenose pliers, disconnect the spade connectors from the capacitor terminals (A).
4. Cut tie wraps (B) that secures the capacitor (C) to the vertical sound box and remove the capacitor.
5. Attach non-skid pad (1072004) to capacitor.
6. Install new capacitor by reversing STEPS 3 and 4.
7. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
8. If no leaks detected, turn power Off (O) and unplug the unit.
9. Re-install the cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.4 Replacing PE Valve

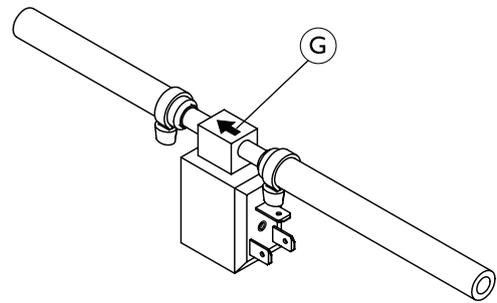
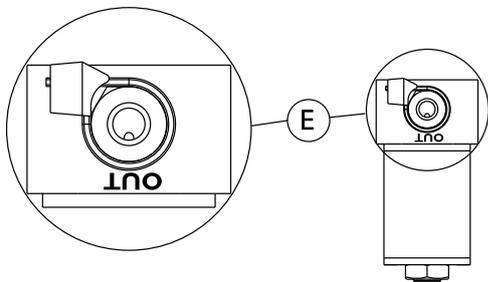
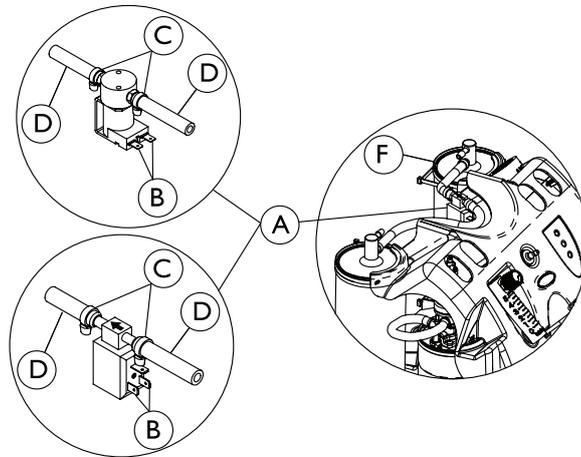


DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.



i Depending on the date of manufacture, the unit will be equipped with one of the two PE valve assemblies **A** shown above, circular shape (top) or rectangular shape (bottom).

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Remove the compressor inlet HEPA filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.
4. Remove spade connectors (not shown) from PE valve terminals **B**.
5. Remove tie-wraps **C** from PE valve tubing **D**.
6. Remove PE valve assembly from tubing.



CAUTION!

– If PE valve is not to be installed IMMEDIATELY, plug the sieve bed fittings to prevent sieve bed contamination.



To ensure proper orientation on the circular shape PE valve, the “OUT” port barb **E** should face to the left side sieve bed **F** when viewing from behind the unit.

To ensure proper orientation on the rectangular shape PE valve, the FLOW arrow **G** should face to the left side sieve bed **F** when viewing from behind the unit.

7. Install new PE Valve or PE valve assembly IMMEDIATELY, by reversing STEPS 4-6.



CAUTION!

– Ensure the restrictor is on the product tank side of the concentrator.

8. Reinstall the compressor inlet HEPA filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.



Autotuning of the concentrator is necessary. Refer to 7.1 Autotuning, page 36 or 7.2 Manual Tuning, page 37.

9. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
10. If no leaks detected autotune the concentrator. Refer to 7.1 Autotuning, page 36.
11. Turn power Off (O) and unplug the unit.
12. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.5 Replacing Sieve Beds

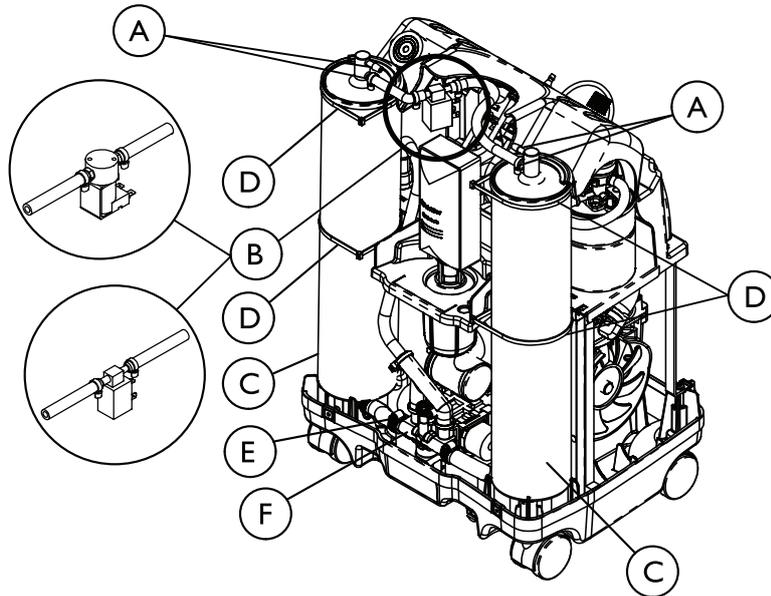


DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.



i ALWAYS replace sieve beds in pairs to ensure that both beds are in optimum condition.

There are two configurations of the PE valve assembly, a circular shape PE valve assembly **B** and a rectangular shape PE valve assembly **B**. Only the rectangular shape PE valve assembly is shown in the unit.

Depending on date of manufacture, the circular shape PE valve assembly will either be located in the middle of the two sieve beds or shifted closer to the left sieve bed as shown.

The rectangular shape of the PE valve assembly will always be located closer to the left sieve bed.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Remove compressor inlet HEPA filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.
4. Remove tie wraps **A** and disconnect PE valve assembly **B** and check valve assembly (not shown) from top of sieve beds **C**.
5. Remove the four large tie-wraps **D** (two on each sieve bed).
6. Tilt sieve beds back and lift up. Rest sieve beds on rear of base.
7. Using a hose clamp tool, remove the clamp **E** and reinforced tubing **F** from bottom of both sieve beds and remove sieve beds.



CAUTION!

– DO NOT remove plastic caps from new sieve bed fittings until ready to install new beds. Severe sieve contamination can occur if uncapped beds are exposed to air.

8. Remove plastic caps from the top and bottom fittings of the new sieve beds.
9. Install new sieve beds reversing STEPS 3-8.



After replacing sieve beds, retiming is necessary. Refer to 7.1 Autotuning, page 36 or 7.2 Manual Tuning, page 37.

10. Run unit and check for leaks. Refer to 8.1 Leak Test, page 38.
11. If no leaks detected, turn power Off (O) and unplug the unit.
12. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.6 Replacing Check Valves



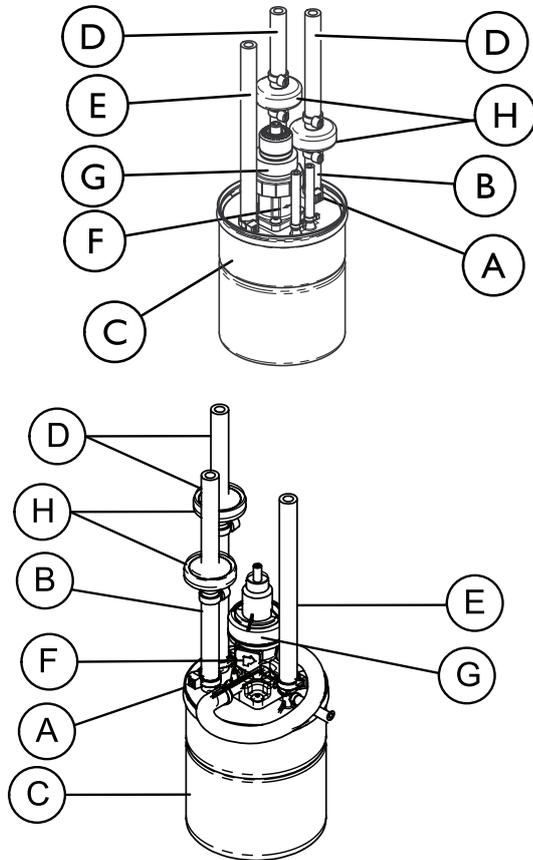
DANGER!

Risk of Death, Injury, or Damage

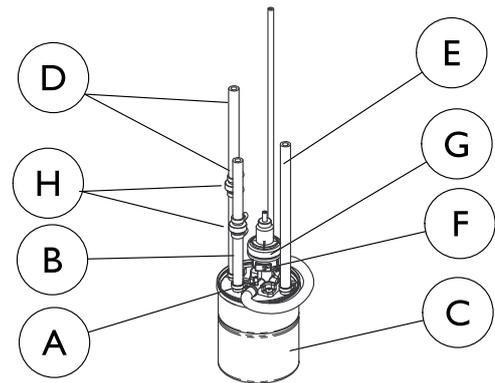
To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.

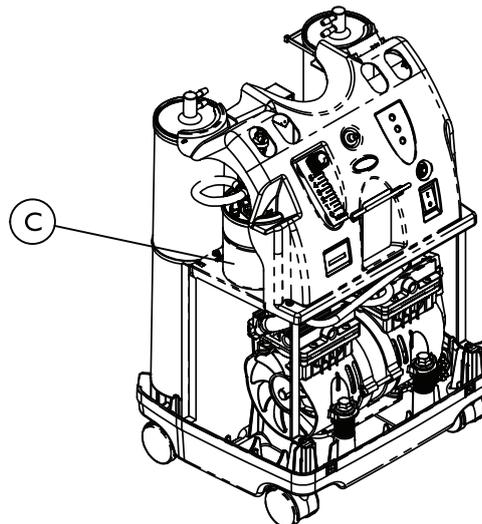
PRODUCT TANKS BEFORE MAY 2016



PRODUCT TANK AFTER MAY 2016



LOCATION OF PRODUCT TANK



PE Valve is not shown.

Replace both check valves when performing this procedure. The check valves are one way directional and can be checked by passing air through them. Air should flow in one direction only.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. It may be necessary to remove the compressor HEPA inlet filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.

4. Remove tie-wrap (A) securing the lower 1/4-inch tubing (B) to the product tank (C).
5. Remove the tie-wrap (not shown) securing the upper 1/4-inch tubing (D) to the barb on the sieve bed (not shown).



WARNING!
Risk of Injury or Damage

Low system pressures and eventual bed contamination will result if check valves are not properly installed.

- The check valves are one-way directional and **MUST** be installed correctly.
- The check valves must be installed with the black end of the valve facing the product tank.



CAUTION!
Risk of Damage

The regulator outlet tubing (E) is identified by the flow arrow (F) on the side of the regulator (G) which points to it.

- **DO NOT** put a check valve on the regulator outlet tubing.

6. Position the check valve assembly (H) so the black side of the valve is facing the underside of the check valve to ensure proper orientation.
7. Use two tie-wraps (not shown) to secure the 1/4-inch tubing to the product tank and to the barb on the sieve bed where previously removed.

 Ensure check valves are not crossed. Left barb product tank check valve goes to left barb on sieve bed. Right barb product tank check valve to right barb on sieve bed.

8. Reinstall compressor inlet HEPA filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.
9. Run units and check for leaks. Refer to 8.1 Leak Test, page 38.
10. If no leaks detected, turn power Off (O) and unplug the unit.
11. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.7 Replacing Regulator

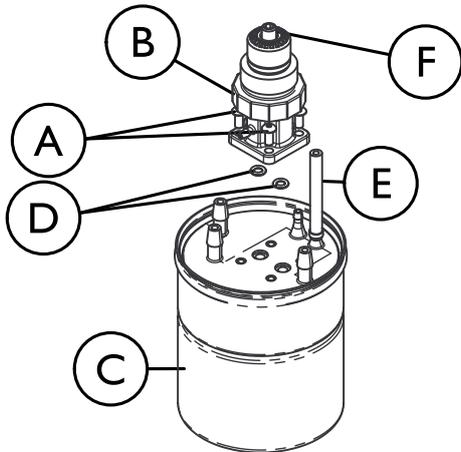


DANGER!
Risk of Death, Injury, or Damage

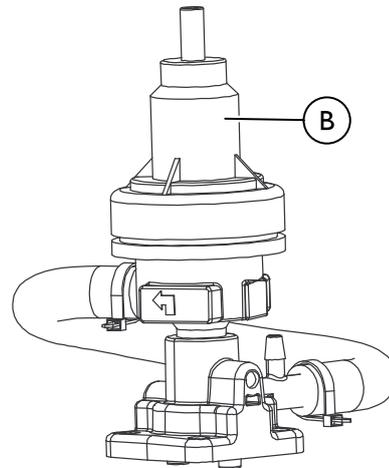
To prevent electrical shock

- **ALWAYS** disconnect concentrator from electrical outlet before servicing.

REGULATORS MANUFACTURED BEFORE 7/1/12



REGULATORS MANUFACTURED AFTER 7/1/12



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. On concentrator models with the SensO₂ unit **ONLY**, remove the 1/8-inch tubing that is connected to the regulator assembly.
4. Remove the four mounting screws (A) that secure regulator (B) to product tank cap (C).
5. Remove regulator from product tank lid ensuring that the O-rings (D) are removed.
6. Clean mounting surface of product tank cap.
7. Install the two "O" rings for the **NEW** regulator onto the ports (underside) of the **NEW** regulator before installation.



WARNING!
Risk of Injury or Damage

Note flow arrow on regulator. This **MUST** face toward the regulator outlet tubing (E) or flow will be interrupted causing system shutdown.

- Ensure proper installation of regulator.

8. Install new regulator onto product tank cap.
9. Use the four mounting screws to secure the new regulator onto the product tank cap.
10. Torque the mounting screws to 5 ± 1 in-lbs.
11. On units with SensO₂, reinstall 1/8-inch tubing to the regulator assembly.
12. Adjust regulator pressure if necessary. Refer to 6.8 Adjusting Regulator, page 25.

13. Run units and check for leaks. Refer to 8.1 Leak Test, page 38.
14. If no leaks detected, turn power Off (O) and unplug the unit.
15. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.8 Adjusting Regulator

 For this procedure, refer to images in 6.7 Replacing Regulator, page 24.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Plug unit in and turn power switch On (I).
4. Adjust the flow meter to approximately 5 L/min as specified by the flow meter.
5. Install pressure gauge onto oxygen outlet.

 Use a 0 - 30 psi pressure gauge.

Check O₂ pressure at oxygen outlet. It should read a steady 5 psi ± 0.5 psi. If pressure is not in specification, proceed to STEP 3. If pressure falls within specification, no adjustment is needed.

6. Using the access hole located on the control panel, locate the pressure adjustment screw (F) in center of pressure regulator top (B).
7. Perform one of the following:
 - a. Regulators before 07/01/12 (Sensored) or 09/01/12 (Non-Sensored) - Insert a 5/32- inch Allen wrench into the pressure adjustment screw.
 - b. Regulators after 06/30/12 (Sensored) or 08/31/12 (Non-Sensored) - Insert a 3/32 (2.5 mm) Allen wrench into the pressure adjustment screw.
8. While reading pressure gauge, do one of the following:
 - Turn pressure adjustment screw clockwise to increase output pressure; or
 - Turn pressure adjustment screw counterclockwise to decrease output pressure.
9. Adjust until pressure reads a steady 5 psi ± 0.5 psi.
10. Allow the concentrator to run for ten minutes.
11. Retest the pressure by performing STEPS 6-9, to ensure proper operation.
12. Once required pressure is achieved, reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.
13. Refer to 9.1 Troubleshooting, page 44 if you are unable to adjust or maintain 5 psi ± 0.5 psi.

6.9 Replacing Heat Exchanger Assembly

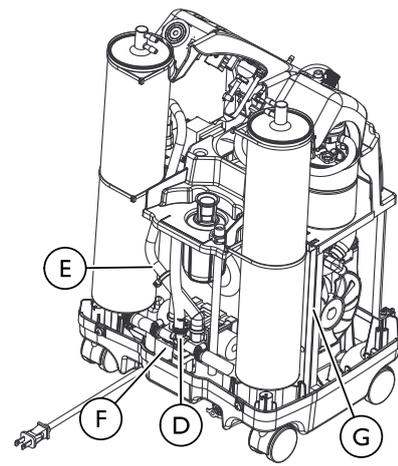
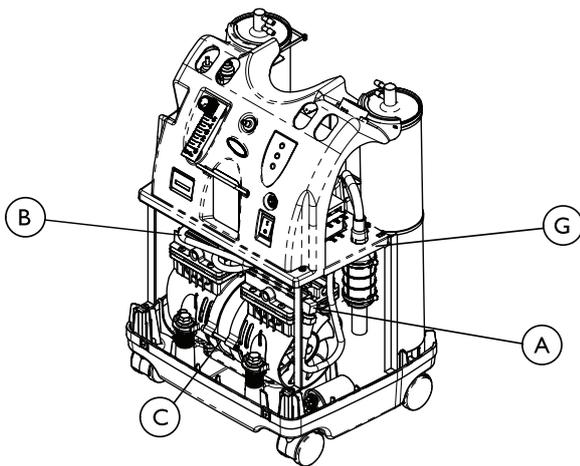


DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.



 PE valve and intake filter not shown.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.



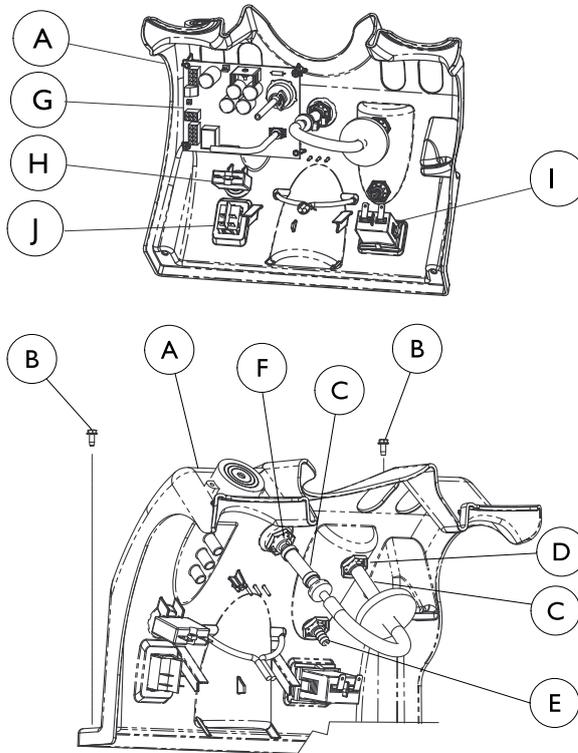
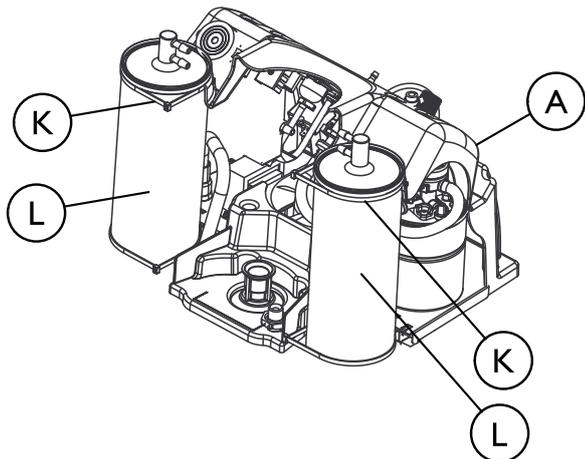
CAUTION!

– Use care not to deform heat exchanger when installing, removing or cleaning.

3. Disconnect brass nut (A) that secures the heat exchanger assembly (B) to the compressor (C).

4. On the backside of the Perfecto₂, loosen the clamp ④ that secures the tube ⑤ to the manifold assembly ⑥ and remove the tube from the manifold assembly.
5. Remove heat exchanger assembly by pulling tube through sound box ③.
6. Reverse STEPS 3-5 to install new heat exchanger.
7. Run unit and check for leaks. Refer to 8.1 Leak Test, page 38.
8. If no leaks detected, turn power Off (O) and unplug the unit.
9. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.10 Removing and/or Replacing Control Panel



ITEM	DESCRIPTION
A	Control Panel
B	Mounting Screws
C	1/4-inch Mounting Screws
D	Top Barbed Fitting For the Flowmeter
E	Bottom Barbed Fitting For the Flowmeter
F	Patient Outlet Barbed Fitting
G	P.C. Board
H	Circuit Breaker
I	Hour Meter
J	On/Off (I/O) Switch

6.10.1 Removing Control Panel



DANGER!
Risk of Death, Injury, or Damage

To prevent electrical shock
 – ALWAYS disconnect concentrator from electrical outlet before servicing.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Cut the two tie wraps ⑧ that secure the control panel ① to the sieve beds ①.
4. Cut the two tie wraps that secure the P. E. valve assembly to the control panel (not shown).
5. Remove the two mounting screws ② that secure the control panel to the sound box.
6. Remove the 1/4-inch I. D. tubing ③ from the top barbed fitting ④ of the flowmeter (not shown).

7. Remove the ¼-inch I. D. tubing © (not shown) from the bottom barbed fitting ⑤ of the flowmeter (not shown).
8. Cut tie wrap and remove ¼-inch I. D. tubing © from the patient outlet barbed fitting ⑥ behind the control panel.
9. Disconnect the wire harness from P.C. board.



Before performing STEP 9, label all wires to ensure correct reinstallation.

10. Remove spade connectors from circuit breaker, hour meter and On/Off (I/O) switch. (Jumper wire harness from On/Off (I/O) switch to circuit breaker does not have to be removed.)
11. Remove the control panel assembly.

6.10.2 Replacing the Control Panel



DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.

1. Remove the control panel. Refer to 6.10.1 Removing Control Panel, page 26.
2. Remove the P.C. Board. Refer to 6.12 Replacing P.C. Board, page 29.
3. Remove the transformer. Refer to 6.13 Replacing the Transformer, page 30.
4. Remove the On/Off switch. Refer to 6.14 Replacing On/Off Switch, page 31.
5. Remove the flow meter. Refer to 6.15 Replacing Flowmeter, page 31.
6. Remove the hour meter. Refer to 6.16 Replacing Hour Meter, page 32.
7. Remove horn and palnuts that hold the barbed outlet fitting.
8. Cut tie wrap on the bungee cord and remove the bungee cord from the control panel.
9. Discard the existing control panel.
10. Install new control panel by reversing STEPS 1-8.
11. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
12. If no leaks detected, turn power Off (O) and unplug the unit.
13. Re-install the cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.11 Replacing Cooling Fan

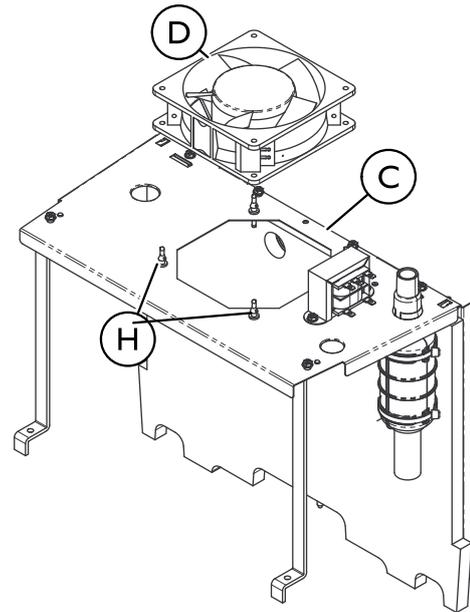
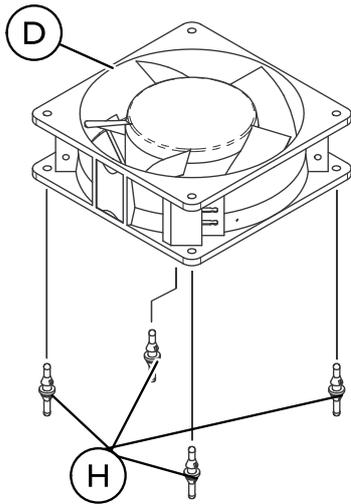
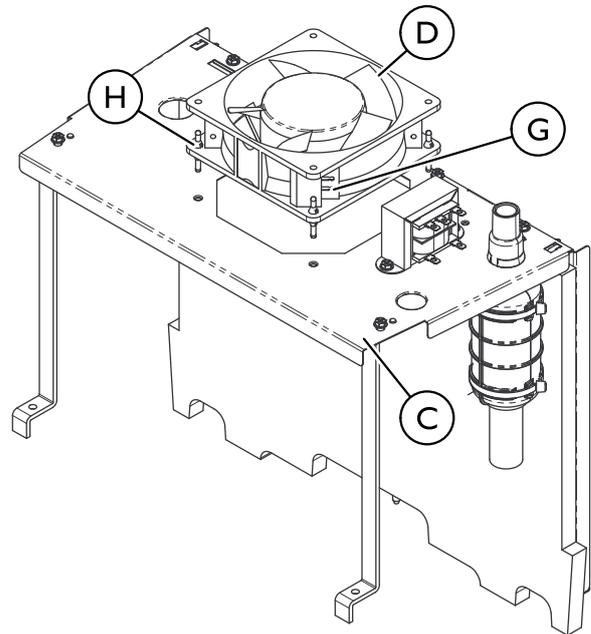
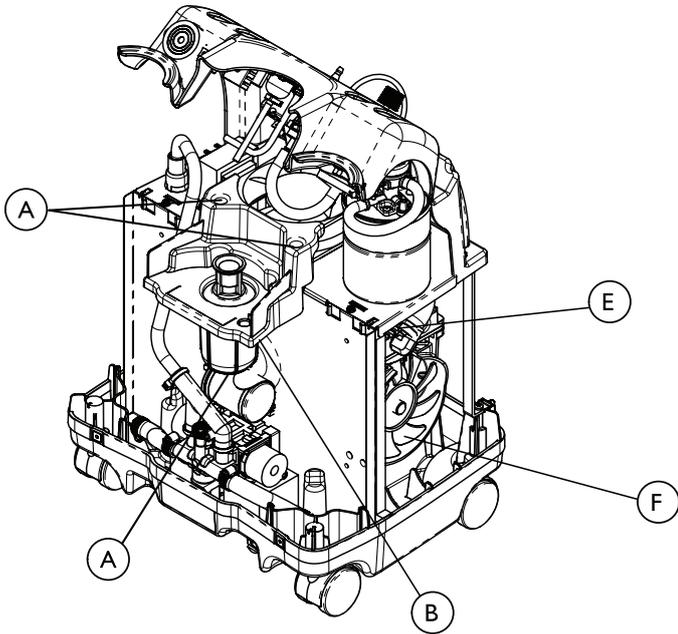


DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Remove control panel. Refer to 6.10.1 Removing Control Panel, page 26.
4. Remove compressor inlet HEPA filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.
5. Remove the three mounting screws (A) that secure the resonator housing (B) to the soundbox (C).

 Two mounting screws are installed in the top. The other mounting screw is located on the backside of the housing near the bottom.

6. Move the resonator housing back slightly for access to the cooling fan (D). Disconnect the intake hose (E) on the compressor assembly (F), if necessary.
7. Disconnect spade connectors from fan terminals (G) on side of cooling fan.

 The cooling fan is fastened to the soundbox with four rubber grommets (H) on each corner.

8. Lift cooling fan up and dislodge the rubber grommets (H) from the soundbox.
9. Remove the rubber grommets from the existing cooling fan.

10. Note the orientation of the installed rubber grommets. There are two recessed areas on the rubber grommet. The larger recessed area of the grommet is installed in the fan. The smaller recessed area is installed in the sound box.
11. Inspect rubber grommets for damage. If damage is found, do not use and replace with new rubber grommets.
12. Install rubber grommets into new cooling fan with larger recessed area installed in the fan.



CAUTION!
Risk of Damage

- Fan **MUST** be oriented properly so air from the fan blows **DOWN** onto the compressor (see air flow arrow on back of fan and make sure the arrow is pointing down).

13. Connect spade connectors to fan terminals on side of cooling fan.
14. Orient cooling fan onto soundbox.
15. Pull rubber grommets down into the sound box until rubber grommet is seated.
16. Move resonator housing back into position.
17. Secure the resonator housing to the soundbox with the three mounting screws.



Two in the top and one on the back near the bottom of the housing.

18. If necessary, reconnect the intake hose on the compressor assembly.
19. Reinstall control panel. Refer to 6.10.1 Removing Control Panel, page 26 and reverse all steps.
20. Reinstall compressor inlet HEPA filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.
21. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
22. If no leaks detected, turn power Off (O) and unplug the unit.
23. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.12 Replacing P.C. Board



DANGER!
Risk of Death, Injury, or Damage

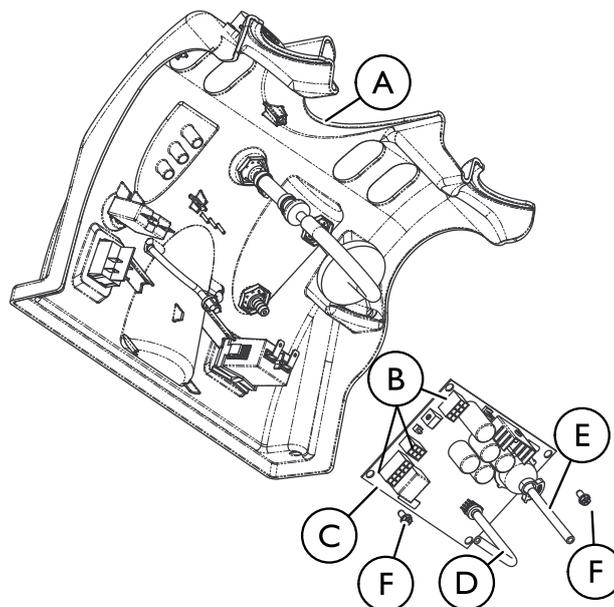
- To prevent electrical shock
- **ALWAYS** disconnect concentrator from electrical outlet before servicing.



CAUTION!
Risk of Damage

Follow these pre-cautions to prevent damage to the P. C. boards:

- Before handling any P. C. boards, you need to be properly grounded to prevent static damage to the components of the board. A Static Cuff **MUST** be worn and properly grounded using an alligator clip. Electrical conduit or a water pipe is normally sufficient when a known good ground is not available. Care should be taken to ensure that the alligator clip contacts with bare metal surface.
- When removing quick disconnects terminals, **DO NOT** pull on wire itself as damage to the connection may occur. Hold down the P. C. board with one hand and use an upward force with a slight rocking motion to remove the terminals.
- Before installing any P. C. boards, ensure that all insulators are in place.



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Remove control panel **A**. Refer to 6.10.1 Removing Control Panel, page 26.

4. Do the following:

- a. Disconnect wiring harnesses ⑥ from PC board ③.



WARNING!

Risk of Injury or Damage

To avoid damage to oxygen sensor assembly or pressure sensor or a faulty sensor resulting in improper oxygen delivery and harm to the user:

- DO NOT remove oxygen sensor tubing from P.C. board. Remove from regulator ONLY.
- DO NOT remove the pressure sensor tubing from P.C. board. Remove from top of product tank only.

- b. Disconnect pressure sensor tubing ④ from product tank, not P. C. Board.
- c. For concentrators that have O₂ sensor, disconnect the oxygen sensor tubing ⑤ from regulator fitting. Refer to 6.7 Replacing Regulator, page 24.

5. Remove the two mounting screws ⑦ from the P. C. board.

6. Position new P. C. board on the control panel.

7. Secure new P. C. board in place with existing mounting screws.

8. Do the following:

- a. Connect wiring harnesses to P. C. board.
- b. Connect pressure sensor tubing to product tank. Secure tubing with tie-wrap.
- c. For concentrators that have O₂ sensor, connect the oxygen sensor tubing to regulator fitting.

9. Reinstall control panel. Refer to 6.10.1 Removing Control Panel, page 26 and reverse all steps.

10. Run concentrator to ensure unit operates to specifications.

11. After replacing P. C. board, retiming may be necessary. Refer to 7.1 Autotuning, page 36 or 7.2 Manual Tuning, page 37.

12. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.

13. If no leaks detected, turn power Off (O) and unplug the unit.

14. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.13 Replacing the Transformer

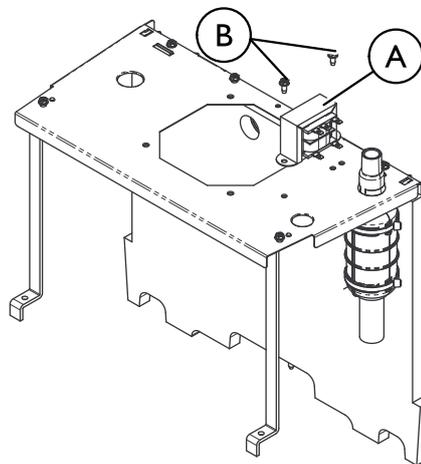
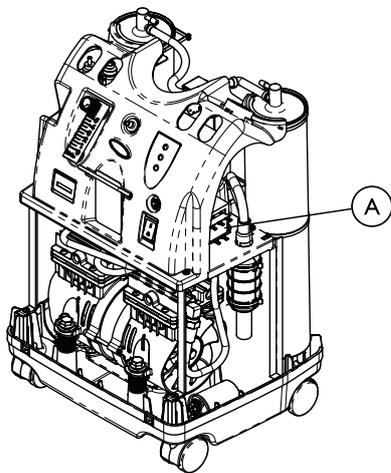


DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

- ALWAYS disconnect concentrator from electrical outlet before servicing.



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Locate the transformer ① located on the sound box.
4. Label all wires before disconnecting for proper re-connections.
5. Remove the two mounting screws ② that secure the transformer to the soundbox.
6. Note orientation of transformer on soundbox before removing for proper reinstallation.
7. Remove the existing transformer and discard.
8. Install new transformer in orientation noted in STEP 6.
9. Connect all wires as noted from STEP 4.
10. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
11. If no leaks detected, turn power Off (O) and unplug the unit.
12. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps

6.14 Replacing On/Off Switch

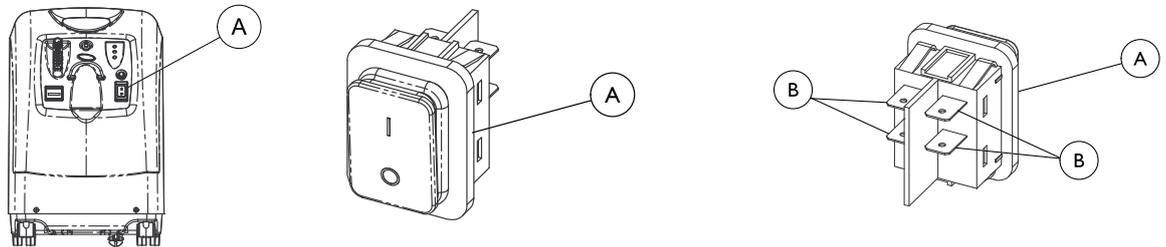


DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Remove control panel. Refer to 6.10.1 Removing Control Panel, page 26.
4. Remove and label the four spade connectors (B) from back of existing On/Off (I/O) switch (A).
5. Compress retaining grips on back of existing On/Off (I/O) switch and push switch out through front of control panel.



Ensure proper orientation of the On/Off (I/O) switch and wiring connections before installation.



CAUTION!

Risk of Damage

Possible damage to the concentrator may result if not properly installed.

– DO NOT install the On/Off (I/O) switch upside down. Universal Off (O) symbol should be at bottom and Universal On (I) symbol should be at the top.

6. Reverse STEP 4 and 5 to secure new On/Off (I/O) switch.
7. Reinstall control panel. Refer to 6.10 Removing and/or Replacing Control Panel, page 26.
8. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
9. If no leaks detected, turn power Off (O) and unplug the unit.
10. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.15 Replacing Flowmeter

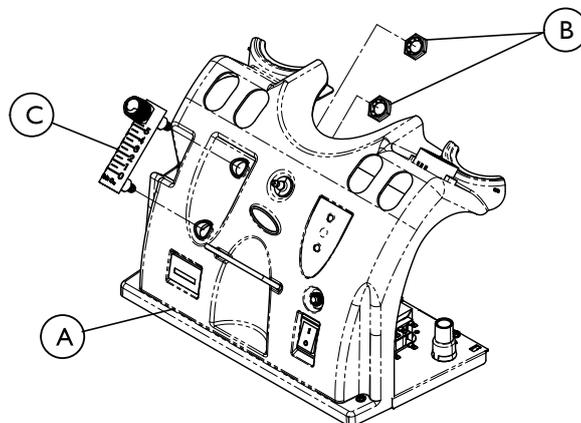


DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Note the location of the tubing for accurate replacement after new flowmeter is installed.
4. Remove control panel (A). Refer to 6.10.1 Removing Control Panel, page 26.

5. Remove palnuts ⑥ that secure flowmeter ③ to the control panel.
6. Remove flowmeter from front of control panel.
7. Install new flowmeter reversing STEPS 5-6.
8. Reinstall control panel. Refer to 6.10.2 Replacing the Control Panel, page 27 and reverse all steps.
9. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
10. If no leaks detected, turn power Off (O) and unplug the unit.
11. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.16 Replacing Hour Meter

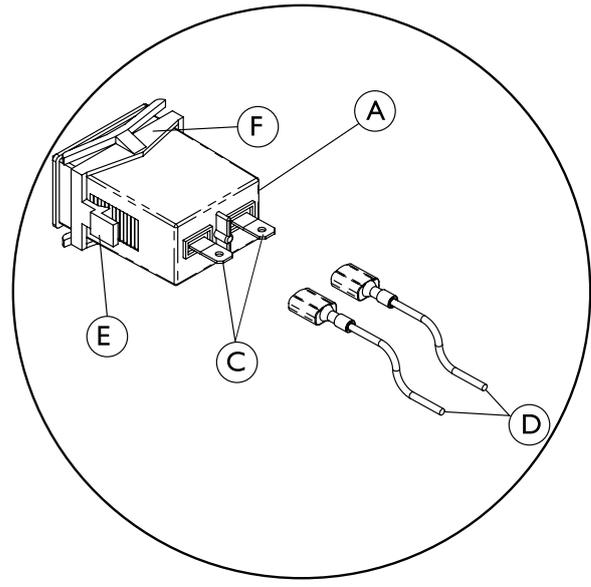
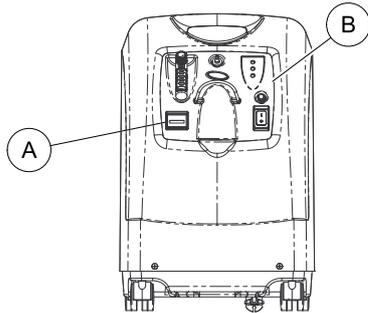


DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

– ALWAYS disconnect concentrator from electrical outlet before servicing.



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Remove control panel ⑥. Refer to 6.10.1 Removing Control Panel, page 26.
4. Remove and label the two hour meter connectors ③ and wires ④ connected to back of hour meter ①.
5. Spread retaining clips ⑤ on hour meter housing ② that secure hour meter to control panel.
6. Remove hour meter by pushing meter through front of control panel.
7. Install new hour meter reversing STEPS 4-6.
8. Reinstall control panel. Refer to 6.10.1 Removing Control Panel, page 26 and reverse all steps.
9. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
10. If no leaks detected, turn power Off (O) and unplug the unit.
11. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.17 Replacing 4-Way Valve and/or Manifold Assembly



DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock

- ALWAYS disconnect concentrator from electrical outlet before servicing.

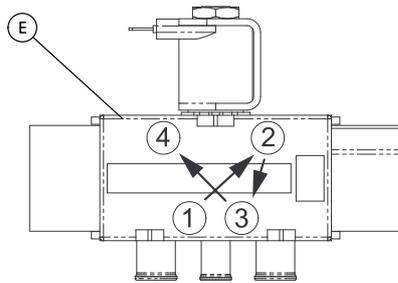


CAUTION!

Risk of Damage

This is a maintenance free valve. Opening the valve will void any and all warranties applicable to the valve.

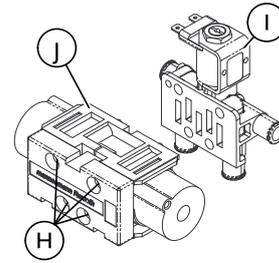
- Do not open or alter valve.



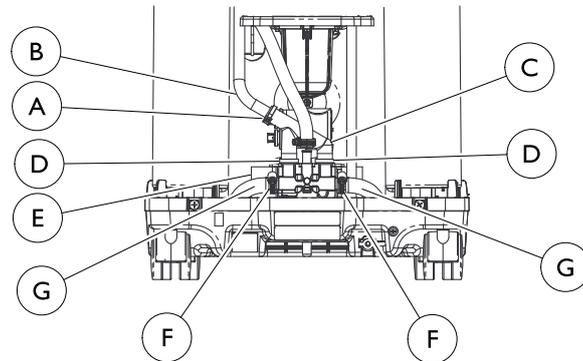
The rectangular pilot valve not shown.



The numbers above indicate the MOUNTING SCREW TORQUE SEQUENCE: pre-torque to 10 + 2 in-lbs., then torque to 22 + 2 in-lbs.



The rectangular pilot valve not shown.



The illustration depicts concentrators manufactured after September 2015. The 4-way valve and/or manifold assembly for concentrators manufactured before September 2015 replace in the same manner.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Cut the one tie wrap (A) that secures the manifold exhaust tube (B) to the "F" tube (C).
4. Remove the manifold exhaust tube from the "F" tube.
5. Cut the two tie wraps (D) that secure the "F" tube to the 4 way valve/manifold assembly (E).
6. Remove the "F" tube from the 4 way valve/manifold assembly.
7. Using a hose clamp tool, remove the clamps (F) that secure the tubes (G) to the 4-way valve/manifold assembly.
8. Remove the tubes from both sides of the 4 way valve/manifold assembly.
9. Note the orientation of the 4-way valve/manifold assembly before removing for correct re-installation.
10. Lift 4-way valve/manifold assembly up and out of the base of the concentrator.
11. Disconnect spade connectors located on the side of the 4 -way valve assembly (Not shown).
12. Remove the four mounting screws (H) that secure the 4-way valve/manifold assembly together.
13. Replace the 4-way valve, manifold or both.

14. Loosely install mounting screws through 4-way valve ①.

 Ensure the manifold gasket is in place on 4-way valve before installing.



CAUTION!
Risk of Damage

To avoid damage to the 4-way valve
– Adhere to Torque sequence and specification.

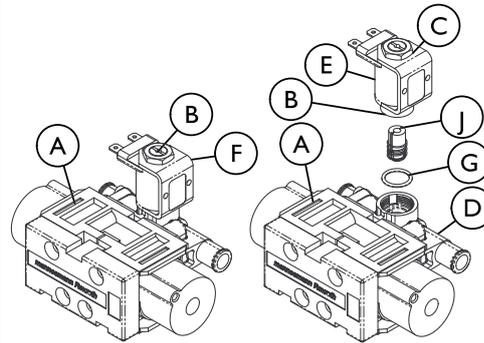
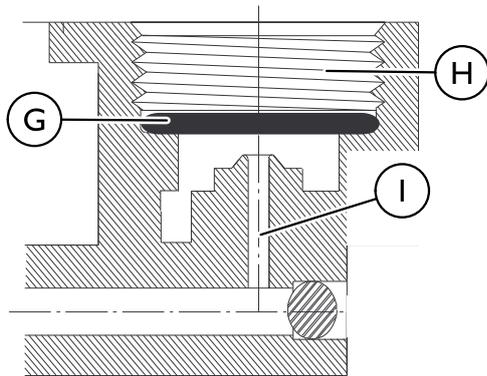
15. Align the 4-way valve with the manifold assembly.
16. Tighten mounting screws in the sequence described above.
17. Pre-torque the mounting screws to 10 ± 2 in-lbs using the torque sequence.
18. The mounting screws can now be torqued to 22 ± 2 in-lbs in the same sequence.
19. Connect spade connectors located on the side of the 4-way valve assembly.
20. Position the 4-way valve/manifold assembly in the base of the concentrator on the foam block in the orientation noted in STEP 9.
21. Slide the tubes onto each side of the manifold/valve assembly.
22. Using a hose clamp tool, secure the tubes to the 4-way valve/manifold assembly with the clamps.
23. Install the “F” tube into the 4-way valve/manifold assembly.
24. Secure the “F” tube to the 4 way valve/manifold assembly with two tie wraps.
25. Install the manifold exhaust tube into the “F” tube.
26. Secure the manifold exhaust tube to the “F” tube with a tie wrap.
27. Run unit and inspect for leaks. Refer to 9.1 Leak Test, page 46.
28. If no leaks detected, turn power Off (O) and unplug the unit.
29. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

6.18 Replacing Pilot Valve Poppets and O-Rings



DANGER!
Risk of Death, Injury, or Damage

To prevent electrical shock:
– ,ALWAYS disconnect concentrator from electrical outlet before servicing.



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Remove the 4-way valve/manifold assembly. Refer to 6.17 Replacing 4-Way Valve and/or Manifold Assembly, page 33.
4. Locate pilot valve on 4-way valve/manifold assembly (A) .
5. Hold pilot valve stem (B) with the flat blade screwdriver and turn the 9/16-inch locknut (C) counterclockwise one complete turn.
6. Unscrew the pilot valve stem assembly from the manifold (D) while leaving the coil (E) with yoke (F) and locknut intact on stem.
7. Remove pilot valve poppet (I) from inside the pilot valve stem.



CAUTION!
Risk of Damage

To avoid damage to components during reassembly:
– DO NOT remove the washer between the bottom of the yoke and the bottom of the coil.
– DO NOT remove the coil yoke from the coil.

8. Set aside the coil with yoke and pilot valve stem assembly with the wires still intact.



WARNING!
Risk of Injury or Damage

Damage to the plastic manifold and/or plastic manifold airflow passage (I) may occur. Damage to airflow may result in improper oxygen delivery and harm to the user. To avoid:
– DO NOT use sharp tools to remove O-ring (G) from plastic manifold opening (H).

9. Remove pilot valve poppet and O-ring (G) from manifold opening.

10. Discard old poppet and O-ring.
11. Install new O-ring into the opening in the plastic manifold housing.



CAUTION!
Risk of Damage

To avoid damage to the rubber O-ring and/or plastic manifold:

- DO NOT overtighten pilot valve stem when installing it into plastic manifold.

12. Install new pilot valve poppet into the bottom of the pilot valve stem with tapered end facing to the bottom.
13. Install pilot valve stem and new pilot valve poppet with coil (with yoke and locknut intact) into manifold opening.
14. Use a flat blade screwdriver, and tighten pilot valve stem clockwise until snug. Torque to 47 in-lbs. \pm 5 in-lbs.
15. Position pilot valve coil with yoke at an approximate 90° angle to the right as viewed from the front of valve.
16. Use the flat blade screwdriver and hold the pilot valve-stem in place.
17. Tighten locknut clockwise with the 9/16-inch wrench until snug to secure the stem and coil with yoke. DO NOT overtighten. Torque to 20 in-lbs \pm 3 in-lbs.



CAUTION!
Risk of Damage

To avoid damage to the plastic manifold:

- DO NOT overtighten locknut when installing it onto pilot valve stem.

18. Reinstall the 4-way valve/manifold assembly. Refer to 6.17 Replacing 4-Way Valve and/or Manifold Assembly, page 33.
19. Plug power cord in and turn concentrator On (I) to ensure proper operation.
20. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
21. If no leaks detected, turn power Off (O) and unplug the unit.
22. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

7 Timing

7.1 Autotuning



DANGER!

Risk of Death, Injury, or Damage

To prevent electrical shock:

- ALWAYS disconnect concentrator from electrical outlet before servicing.
- Turn unit Off (O) and unplug before adjusting timing switch.
- Use extreme care when making adjustments to the timing switch.
- DO NOT allow screwdriver or your hands to contact the P. C. Board when unit is plugged in and/or on.

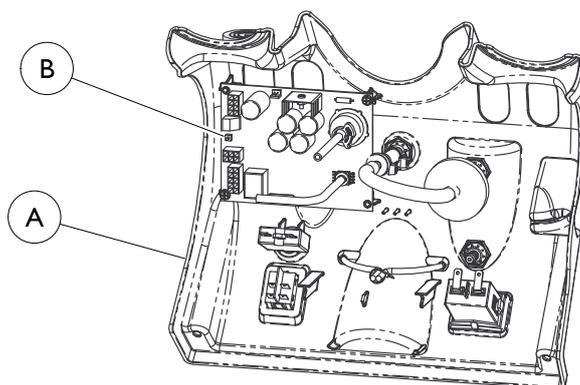


WARNING!

Risk of Injury or Damage

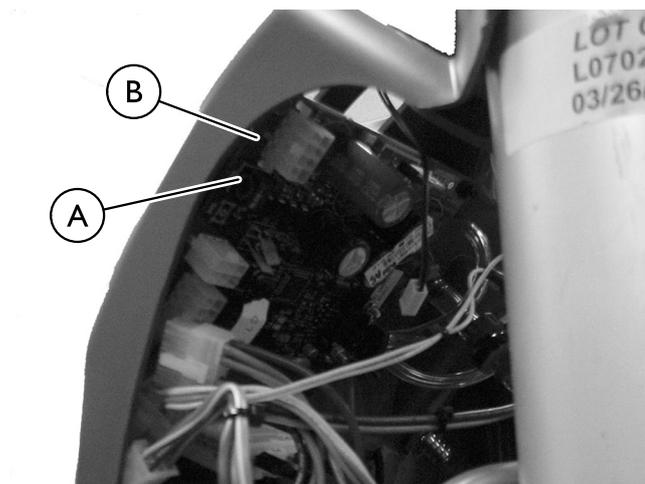
To avoid erasing the factory settings and misusing the concentrator:

- DO NOT push the autotune button while powering up.



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Plug the unit in and turn the power On (I).
4. Locate the P. C. board (A).
5. Set the output flow to 5.0 L/min +0.5 L/min -0.0 L/min.
6. Wait for the main valve shift to indicate one of the following:
 - If the P. C. board is new, the front panel RED indicator light will slowly blink, indicating autotune has initiated.
 - If the P. C. board is used and has performed autotuning before, press and release the small push button (B) on the P. C. board. The front panel RED indicator light will slowly blink, indicating the unit is autotuning and automatically adjusting the PE valve timing.
7. The GREEN (onboard) diagnostic light will flash the current value of the P. E. valve timing number.
8. Place the cover back on the unit but DO NOT install the cover screws. Let the unit run until autotuning is completed.
9. When autotuning is complete, the RED front panel indicator light will change from a slow blinking to a flashing of the final P. E. valve timing number.
10. Turn the unit Off (O) and then back On (I). The timing value is stored in memory for future use.
11. If the unit is turned off before an autotune cycle is completed, the P. E. valve timing will not be stored or updated. If the board is new, autotuning MUST be successfully completed before the unit can be placed into service.
12. After a successful autotune, run the unit for 30 minutes and verify that the oxygen concentration output of the unit is within specification.
13. If the oxygen output concentration is not within specification, rerun the autotune again.
14. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
15. If no leaks detected, turn power Off (O) and unplug the unit.
16. Reinstall the cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

7.2 Manual Tuning



1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Plug the unit in but DO NOT turn the power On (I) until instructed to below.
4. Locate the timing switch (A) on the P.C. board (B).
5. Insert a small common or flathead screwdriver into the adjustment screw of the timing switch.
6. Set the timing switch initially at the number “7” position.
7. Turn unit On (I) and wait 15 minutes for unit to stabilize.
8. If after 15 minutes of run time the concentration is below specification, change setting to a number one position lower than the previous setting.
9. Let unit run ten minutes. If concentration is lower still, change the switch to number two positions higher.



You will find that the concentrator will perform better at either the higher or lower setting.

The normal adjustment range is between timing positions 3 and A.

10. Continue to change setting one step at a time (up or down) until the concentration is the highest value achievable.
11. Once concentration has reached specification, retiming is complete.
12. Run unit and inspect for leaks. Refer to 8.1 Leak Test, page 38.
13. If no leaks detected, turn power Off (O) and unplug the unit.
14. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

8 Testing

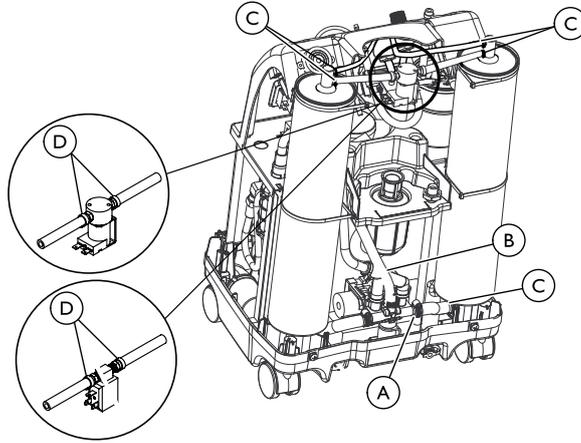
8.1 Leak Test



DANGER!
Risk of Death, Injury or Damage

To prevent electrical shock:

– ALWAYS disconnect concentrator from electrical outlet before servicing.

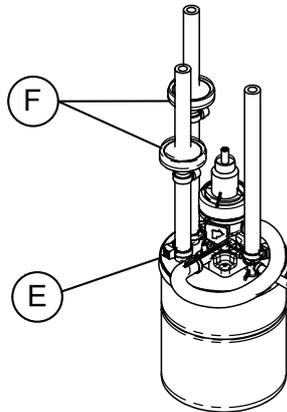
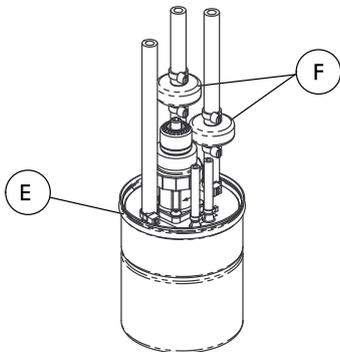


There are two configurations of the PE valve assembly, a circular shape PE valve assembly and a rectangular shape PE valve assembly. Only the circular shape PE valve assembly is shown in the unit.

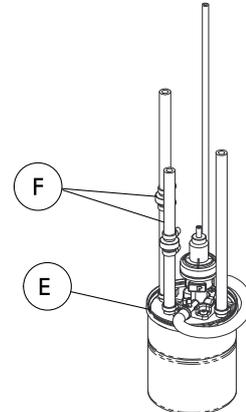
Depending on date of manufacture, the circular shape PE valve assembly will either be located in the middle of the two sieve beds or shifted closer to the left sieve bed as shown.

The rectangular shape PE valve assembly will always be located closer to the left sieve bed.

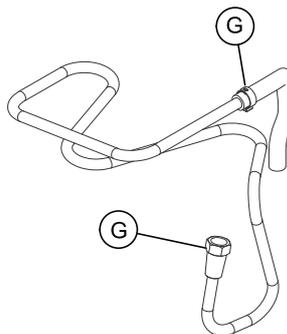
Product Tanks Before May 2016



Product Tank After May 2016



HEAT EXCHANGER ASSEMBLY



1. Turn power Off (O) and unplug the unit
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Plug in unit.
4. Turn the concentrator On (I).
5. Let concentrator run for 30 minutes.



WARNING!

Risk of Injury or Damage

To avoid injury or damage from misuse:

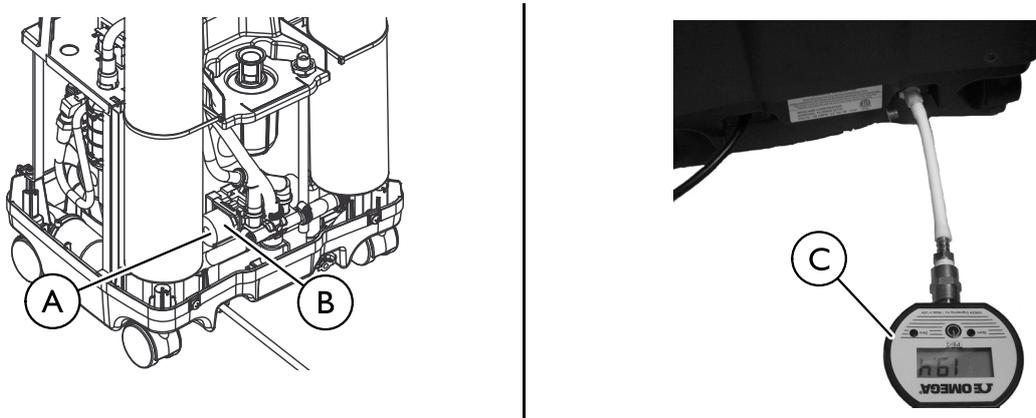
- Apply small amount of leak test solution to fittings only. Avoid all other components.
- Carefully leak test for pressure leaks around sieve bed hoses at 4-way valve.
- DO NOT leak test 4-way valve body.
- DO NOT allow leak test solution to enter into 4-way valve and system.

6. With "leak-test" solution or equivalent soapy water, leak test the following:
 - a. The two sieve bed hose connection at the 4-way valve/manifold assembly (A).
 - b. Leak test the hose fitting on center port of 4-way valve/manifold assembly (B).
 - c. Hose connections to top and bottom fittings of sieve beds (C).
 - d. PE valve hose connections (D).
 - e. Hose fittings at product tank cap (E) and check valves (F).
 - f. Both fittings (G) on heat exchanger assembly.
7. If no leaks are found, proceed to STEP 11. If leaks are found, proceed to STEP 8.
8. Turn power Off (O) and unplug the unit.
9. Replace any tubing that appears cracked, worn, etc.
10. Repeat STEPS 3-7.
11. Re-install cabinet. Refer to 6.1 Removing Cabinet, page 17. and reverse all steps.

8.2 4 Way Valve Function Test



For this procedure, refer to images in 8.1 Leak Test, page 38.



The 4-way valve used in the Perfecto₂ Series Concentrators does have an acceptable tolerance of leakage per Aventics®.

By nature of the valve design it is possible for the valve to experience small leaks, and still operate without affecting the overall performance of the unit. The valve is assembled where the components that make up the valve "Snap" together. The only screws in the valve are for securing the valve to the manifold assembly.

According to Aventics® (formerly RexRoth®) there is an acceptable leak specification of 60 cc per minute at 20 psi on each valve. Valves that have leaks within this specification will function properly without any adverse effects to the performance of the concentrator. A leak in the amount of 60 cc or less would be indicative of the type of small leak you would notice where the end caps connect to the main body or where the three pieces of the main body connect together. A 60 cc leak would not be noticeable when examining the system pressure swings.

Leaks greater than 60 cc are indicative of cracks in the end caps, or a blown seal where the end cap connects to the main body of the valve. These leaks are detected by either reading the system swing pressures, noticing two consecutive swings not being equal or by hearing an audible leak every other cycle. Leaks of this extreme nature indicate the valve needs to be replaced.

Valves should only need to be replaced when the following conditions exist:

1. A visible crack is noted on either of the end caps (A) or main body of the 4 way valve (B), regardless of the amount of leak.
2. A large leak is present on the valve that causes an imbalance in the sieve bed swing pressures. Example: Sieve Bed 1 pressure swings from 14 psi to 16 psi, within 7-20 seconds and Sieve Bed 2 pressure swings from 13 psi to 16 psi slowly, and may take as long as 25-30 seconds before shifting (times over 30 second will shut down automatically).
3. Valve will not shift and the pilot valve solenoid and circuit board are working properly.

 The concentrator's P. C. B. should exhibit an error code for High Pressure Failure (1 Red/ 2 Green).

The best method to test the 4-way valve operation is by measuring the unit pressure swings. Refer to 8.9 Checking Sieve Bed Pressure, page 43 for pressure testing.

8.3 Power Loss Alarm



DANGER!
Risk of Death, Injury, or Damage

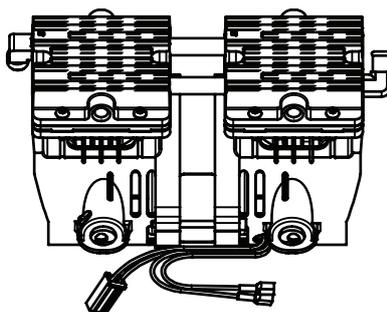
- To prevent electrical shock:
- ALWAYS disconnect concentrator from electrical outlet before servicing.
 - Check alarms periodically for proper function.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Plug in unit.
4. Turn the concentrator On (I).
5. With the unit running, remove the line cord from power source.

 The power loss alarm mode should sound the audible alarm IMMEDIATELY or within 30 seconds.

 With the unit unplugged and inoperable for a short period of time, the battery free circuit will be drained. If power failure alarm does not sound with unit unplugged and power switch On (I), the battery free circuit is drained. It will recharge when unit is plugged in and switched On (I).

8.4 Low Pressure Test



 If any alarm fails to perform to specification, contact Invacare Technical Service.

1. There are two separate failure modes for Low Pressure:
 - Low product tank pressure. (Pressure in tank drops below a preset value, typically 7 psi).
 - Failure to reach the set point pressure within a prescribed time limit, or Timeout Failure.

Low Product Tank Pressure Test

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Plug in unit.
4. Turn the concentrator On (I).
5. With unit running, set flow at maximum rating.
6. When the main valve switches, pull the stem on the compressor relief valve (A) out as far as it will go and hold it.
7. The low pressure alarm should activate within 30 seconds. Release stem once the sound is heard. The front red panel light will illuminate with a continuous audible alarm.

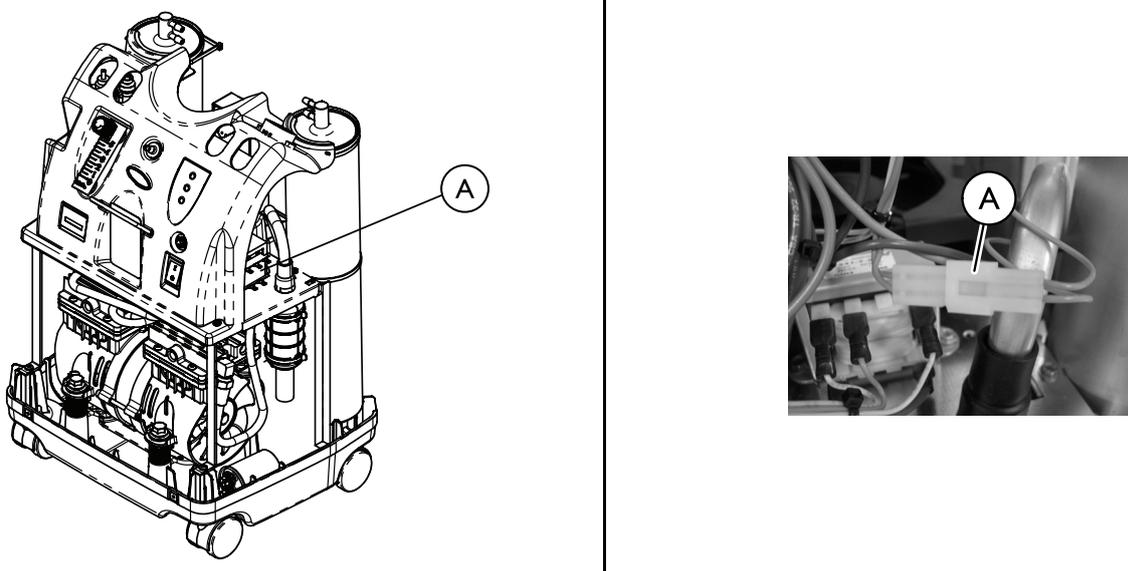
Set Point Pressure Test

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Plug in unit.
4. Turn the concentrator On (I).
5. With unit running, set flow at maximum rating.
6. Remove the pressure sensor tubing (tie-wrap) from the top of the product tank (not shown).
7. The low pressure alarm should activate within 30 seconds. Release stem once the sound is heard. Refer to Senso₂ Alarm Threshold Table in 8.7 Oxygen Sensor, page 41 for shutdown mode.
8. Replace tubing and tie wrap.

8.5 Time-Out Test

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Disconnect the compressor connector from the main wiring harness.
4. Plug unit in and turn power On (I).
5. The Time-Out Failure alarm should activate within 40 seconds. The front red panel light will illuminate with a continuous audible alarm.
6. Reconnect the compressor connector to the main wiring harness.

8.6 High Pressure Test

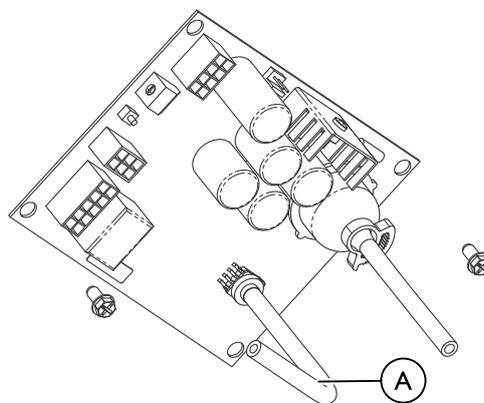


i If any alarm fails to perform to specification, contact Invacare Technical Service.

- High Pressure - Occurs when pressure in product tank rises beyond a preset value, typically 23 psi \pm 1 psi for 5 liter and 27 psi \pm 1 psi for 10 liter.
- Main Valve Coil - Alarm sequence occurs when the main valve coil, connection or P.C. board circuitry has failed.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet.. Refer to 6.1 Removing Cabinet, page 17.
3. Plug in unit.
4. Turn the concentrator On (I).
5. With the unit running and flow set at 5 L/min., disconnect in-line connector **A** shown above.
6. The main valve coil alarm should activate within 40 seconds. The front red panel light will illuminate with a continuous audible alarm.
7. Replace tubing and tie wrap.

8.7 Oxygen Sensor



Alarm sequence occurs when concentration levels fall below a preset value, typically 73% \pm 3% or 85% \pm 2%.

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Plug in unit.
4. Turn unit On (I). Set output flow at approximately 5 L/min.
5. Monitor the O₂ level.

6. With the O₂ level greater than 85% after five minutes, the GREEN panel indicator light will remain illuminated.
7. Slowly adjust flow beyond maximum rated flow until you can achieve a concentration level greater than 75% but less than 84%. Within 30 minutes the YELLOW panel indicator light will illuminate and the unit will continue to run.
8. Clamp off the 1/8-inch oxygen sensor tubing (A) between the oxygen sensor and the product tank regulator.

⚠ WARNING!
Risk of Injury or Damage
 To avoid damage to the tubing and injury from an oxygen sensor failure:
 – Do not cut oxygen sensor tubing when clamping the oxygen sensor tubing.

9. Within 30 minutes, the front red panel light will illuminate with a continuous audible alarm. The compressor will shut down with the alarm.

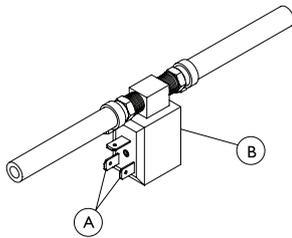
SENSO ₂ ALARM THRESHOLD		
LABEL SYMBOL	STATUS	INDICATOR LIGHTS
O ₂	SYSTEM OKAY O ₂ over 85%	GREEN Indicator Light
⚠	O ₂ Between 73% to 85%	YELLOW Indicator light 1. YELLOW Solid 2. YELLOW Flashing Sensor Failure Call a qualified technician.
🔔	SYSTEM FAILURE O ₂ Below 73%	RED Indicator light Continuous Audible Alarm Sieve-GARD™ Compressor Shutdown Call a qualified technician

8.8 PE Valve Coil Test

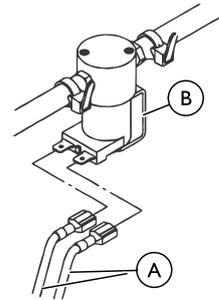
- i** If any alarm fails to perform to specification, contact Invacare Technical Service.
 If problems arise during test, contact Invacare Technical Service for further assistance.

PE Valve Coil - Alarm sequence occurs when the P. E. Valve Coil, connection or P. C. Board Circuitry has failed.

Rectangular PE Valve



Circular PE Valve



- i** The wires (A) are not shown in the view for the rectangular PE valve, only the location of the wire connection .

1. Turn power Off (O) and unplug the unit.
2. Remove cabinet. Refer to 6.1 Removing Cabinet, page 17.
3. Plug in unit.
4. Turn the concentrator On (I)
5. With the unit running and flow set at approximately 5 L/min., remove one wire (A) from the P. E. valve coil (B). The P. E. valve coil alarm should activate within 10 seconds.
6. Reinstall cabinet. Refer to 6.1 Removing Cabinet, page 17 and reverse all steps.

Use the chart in 5.7 Preventative Maintenance Record, page 16 to record date and number of hours when preventive maintenance was performed on the concentrator or any repairs made.

8.9 Checking Sieve Bed Pressure

Disassembly



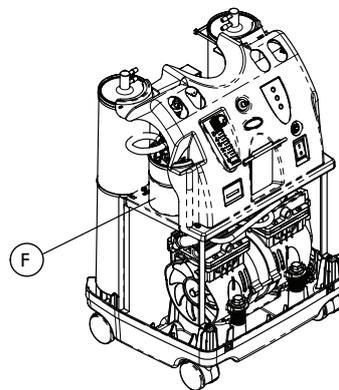
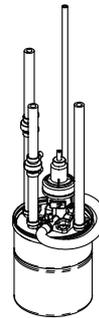
DANGER!

– To prevent electrical shock, ALWAYS disconnect concentrator from electrical outlet before servicing.

PRODUCT TANKS ⑥ BEFORE MAY 2016

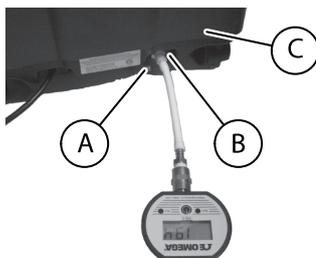


PRODUCT TANK ⑥ AFTER MAY 2016



1. Turn power Off (I) and unplug unit.
2. Turn unit so back faces you.
3. Plug unit in and turn power On (O).

Pressure Testing



1. Connect pressure gauge to the ¼ x 2-inch silicone tubing with connector (p/n 1131392).
2. Remove plug (A) in HomeFill port (B) in back of concentrator (C).
3. Connect ¼ x 2-inch silicone tubing with connector (D) to HomeFill port.
4. Check each connection to make sure it is tight.
5. Turn the concentrator On (I).
 -  Adjust the concentrator to MAXIMUM rated liter flow to 5 L/min.
 - Wait approximately five minutes to allow system pressures to achieve proper equilibrium before testing.
6. The pressure in the concentrator should rise within 20 seconds to 21 psi ± 0.3 and shift the 4-way valve to the opposite sieve bed.
7. After the 4-way valve shift, the pressure in the concentrator will drop to 12 psi ± 2 before rising within 20 seconds to 21 psi ± 0.3 and shift the 4-way valve to the opposite sieve bed.
8. If pressure reading on pressure gauge (E) is 21 psi ± 0.3 when both valve shifts are made, proceed to STEP 10.
9. If pressure in the concentrator does not fall into the specifications listed above, refer to 9.1 Troubleshooting, page 44.
10. Turn the concentrator Off (O).
11. Disconnect pressure gauge from the HomeFill port and reinstall plug.

9 Troubleshooting

9.1 Troubleshooting

 OXYGEN CONCENTRATOR Refer to Service Manual DIAGNOSTIC ALARM SYSTEM			
...ADJUSTMENTS BY UNAUTHORIZED PERSONNEL VOIDS WARRANTY...			
ALARM	LED FLASHES		PROBABLE CAUSE
	RED	GREEN	
BEEP AT START UP	0	0	NO PROBLEM, SYSTEM OK
SHORT BEEP WITH LONG PAUSE	0	0	MAIN POWER LOSS
CONTINUOUS	1	1	LOW PRESSURE; MAJOR LEAK
CONTINUOUS	1	2	HIGH PRESSURE; NO SWITCHING
CONTINUOUS	1	3	TIME OUT FAILURE; COMPRESSOR
CONTINUOUS	1	5	PILOT VALVE CIRCUIT
CONTINUOUS	2	1	73% SHUTDOWN; LOW O2
CONTINUOUS	2	3	PE VALVE COIL
CONTINUOUS	2	4	EEPROM FAILURE
CONTINUOUS	3	1	OXYGEN SENSOR FAILURE
NOTE: CYCLE POWER ON AND OFF FIVE (5) TIMES TO CLEAR INTERNAL FAULT CODE.			
PERFORMANCE SPECIFICATION			
Flow: 0.5 to 5.0 L/min. Oxygen Concentration: 95.6% to 87%		Flow: 2.0 to 10.0 L/min. Oxygen Concentration: 94% to 87%	
1137267 REV B			

Symptom	Probable Cause	Solution
Normal Operation: Internal Status Indicators: RED: Off GREEN: Off Unit plugged in, power switch On (I). Single beep on start up.	No Problems.	System Okay.
Power loss: Internal Status Indicators: RED: Off GREEN: Off Unit unplugged, power switch On (I), alarm off	No Problems.	Battery Free Circuit drained. Plug in cord and turn power switch On (I) to recharge.
Power loss: Internal Status Indicators: RED: Off GREEN: Off Unit plugged in, power switch, alarm off, battery Free circuit drained.	No power at outlet.	Check electrical outlet with a voltmeter set on 50–200 VAC scale. If outlet isn't working, check protective device in home's electrical panel or consult an electrician. Also ensure that unit is properly plugged in. DO NOT use extension cords. Move to another outlet or circuit.
	Power cord: 1. Frayed. 2. Broken or damaged spade. 3. Spade connector from power cord loose or disconnected (inside back of unit).	1. Reattach cord. 2. Replace power cord connectors on plug. 3. Reattach connector.
	Circuit breaker tripped.	Reset breaker. NOTE: Breaker may trip to safeguard concentrator during a power surge. If breaker trips IMMEDIATELY, there is a probable short in the unit. Check for pinched or charred wires. If the breaker does not trip, run unit for approximately two hours. The circuit breaker should be less than 10 ohms. If breaker trips again, there is an internal problem.

Symptom	Probable Cause	Solution
	On/Off (I/O) switch. 1. Disconnected wire. 2. Faulty switch.	Check all electrical connections to the ON/OFF (I/O) switch for any disconnected wires. If the concentrator does not come on at all and wiring is intact, color code and remove wires one at a time. Remove and replace with new one. Transfer wires from old switch to new switch one at a time to the matching contact.
	P. C. board. 1. P. C. board damaged. 2. Loose or damaged connector.	1. Replace P. C. Board. Refer to 6.12 Replacing P.C. Board, page 29. 2. Repair or replace connector.
Internal Power Loss Senso ₂ : Internal Status Indicators: RED: Off GREEN: Off Alarm may or may not be on.	P.C. board faulty.	Replace P. C. board. Unit requires retiming after P. C. board replacement. Refer to 6.12 Replacing P.C. Board, page 29.
Control panel Indicators: RED: Off YELLOW: Off GREEN: Off Fan operates, Compressor not operating.	Transformer assembly. 1. Faulty. 2. Connector loose or disconnected. 3. Faulty wiring.	1. Replace. Refer to 6.13 Replacing the Transformer, page 30. 2. Reattach connector. 3. Replace transformer assembly. Refer to 6.13 Replacing the Transformer, page 30.
High Pressure: Internal Status Indicators: RED: One Flash GREEN: Two Flashes Unit plugged in, power switch On (I), continuous alarm. Compressor shut down.	P. C. board: 1. Malfunction 2. Disconnected wire. 3. Shifting valve at pressures greater than 25 psi for concentrator.	1. Set flow to max L/min. for concentrator. Check voltage across Pilot Valve 1 on 200 volt scale. If meter reads 0 volts when unit is turned on, replace P. C. board. 2. Check spade connectors on pilot valves 1 or 2 and connectors on P. C. board. 3. Replace P. C. board. Unit requires retiming after P. C. board replacement. Refer to 6.12 Replacing P.C. Board, page 29.
	4-way Valve: 1. Pilot Valve not shifting. 2. Coil Resistance. 3. 4-way Valve/Manifold assembly is stuck.	1. Check the resistance on the pilot valve. Replace the valve if shorted or open. Refer to 6.18 Replacing Pilot Valve Poppets and O-Rings, page 34. 2. Coil resistance should measure 82 ohms ± 5. 3. Replace 4-way valve. Refer to 6.17 Replacing 4-Way Valve and/or Manifold Assembly, page 33.
LOW PRESSURE: Internal Status Indicators: RED: One Flash GREEN: One Flash Or RED: One Flash GREEN: Three Flashes Control Panel Indicators: RED: On YELLOW: Off GREEN: Off	Heat exchanger: 1. Leak at tubing or body chamber. 2. Inspect tubing and heat exchanger.	1. Replace or retighten tubing. 2. Replace heat exchanger. Refer to 6.9 Replacing Heat Exchanger Assembly, page 25.
	Compressor: 1. Leaks at fittings or tubing. 2. Leaking or defective relief valve. 3. Insufficient voltage at outlet. 4. Worn cup seals or gaskets.	1. Replace or repair. 2. Repair lead or replace. 3. DO NOT use extension cords. Use another outlet. 4. Replace compressor. Refer to 6.2 Replacing Compressor Assembly, page 18.

Symptom	Probable Cause	Solution
Unit plugged in, power switch On (I), continuous audible alarm. Compressor shut down (Failure to cycle due to low pressure).	Regulator cracked or leaking.	Replace regulator. Refer to 6.7 Replacing Regulator, page 24.
	PE valve leaking.	<p>Replace PE Valve. Check voltage at PE valve connector on 24 volt D.C. scale. The PE Valve activates or energizes approximately one second prior to the activation of the 4 way valve with approximately 24 volts. If voltage is in excess of 24 volts consistently, replace the P. C. board. Refer to 6.12 Replacing P.C. Board, page 29. If the P. C. board voltage acts normally, replace the PE valve. Refer to 6.4 Replacing PE Valve, page 21.</p> <p> Check for leaks starting at the compressor output through all the pneumatic connections. Major leaks will cause system pressures to remain below adequate shift (exhaust) pressures and will cause compressor shutdown.</p>
	Compressor inlet filter dirty or plugged.	Replace compressor inlet filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.
<p>Defective Parts:</p> <p>Internal Status Indicators:</p> <p>RED: One Flash</p> <p>GREEN: Five Flashes</p> <p>Or</p> <p>RED: Two flashes</p> <p>GREEN: Three Flashes</p> <p>Control Panel Indicators:</p> <p>RED: On</p> <p>YELLOW: Off</p> <p>GREEN: Off</p> <p>Unit plugged in, power switch On (I), continuous audible alarm.</p> <p>Compressor shut down.</p>	Defective main valve coil.	<ol style="list-style-type: none"> 1. Replace main valve. 2. Replace main valve coil.
	Connector loose.	Reattach connector.
	Defective PE valve coil. (Resistance 82 ohms +/- 5.)	Replace PE coil if shorted or open on resistance check. Refer to 6.4 Replacing PE Valve, page 21.
	Defective PE valve.	Replace PE valve. Refer to 6.4 Replacing PE Valve, page 21.
	Connector loose.	Reattach connector.
	Defective P. C. board.	Replace P. C. board. Refer to 6.12 Replacing P.C. Board, page 29.
<p>Unit not operating:</p> <p>Alarm: On or Off</p> <p>Internal Status Indicators:</p> <p>RED: Two Flashes</p> <p>GREEN: Four Flashes</p>	P. C. board Failure.	Replace P. C. board. Refer to 6.12 Replacing P.C. Board, page 29.

Symptom	Probable Cause	Solution
<p>Low Concentration:</p> <p> Check for O₂ purity using a calibrated Oxygen Analyzer at Test Point I (oxygen outlet) of the concentrator.</p>	<ol style="list-style-type: none"> Cabinet filters dirty. Compressor inlet filter dirty. 	<ol style="list-style-type: none"> Clean or replace. Refer to 5.1 Cleaning the Cabinet Filter, page 12 and 5.3 Replacing the Outlet HEPA Filter, page 13. Replace inlet filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.
<p>Internal Status Indicators:</p> <p>RED: Two Flashes</p> <p>GREEN: One Flash 73%</p> <p>Shutdown Control Panel</p> <p>Indicators: SensO₂ ONLY:</p> <p>RED: On</p> <p>YELLOW: Off</p> <p>GREEN: Off</p> <p>For SensO₂ units, the RED indicator will signal extremely low purity and will be accompanied by a continuous audible alarm and a system shutdown. Repairs are required.</p>	<p>Compressor:</p> <ol style="list-style-type: none"> Defective. Faulty capacitor. Bad motor windings. Worn seals. Bad bearings. Leak at fittings or tubing. Leaky or defective relief valve. Insufficient voltage (outlet). 	<ol style="list-style-type: none"> Replace compressor. Refer to 6.2 Replacing Compressor Assembly, page 18. Replace capacitor. Refer to 6.3 Replacing Capacitor, page 20. Replace compressor. Replace the compressor. Refer to 6.2 Replacing Compressor Assembly, page 18. Replace compressor. Refer to 6.2 Replacing Compressor Assembly, page 18. Replace fittings or tubing. Replace relief valve. DO NOT use extension cords.
	<p>Heat exchanger:</p> <ol style="list-style-type: none"> Leak at tubing or body chamber. Inspect tubing and heat exchanger. 	<ol style="list-style-type: none"> Replace or retighten. Replace or retighten. Replace heat exchanger. Refer to 6.9 Replacing Heat Exchanger Assembly, page 25.
	<p>Regulator cracked or leaking.</p>	<p>Replace. Refer to 6.7 Replacing Regulator, page 24.</p>
	<p>Leaky Check Valves</p>	<p>Set the concentrator to 2 L/min. If the oxygen concentration falls below 87% oxygen, replace the check valves. Refer to 6.6 Replacing Check Valves, page 23.</p>
	<p>Exhaust muffler dirty or plugged.</p>	<p>Replace. Refer to 5.5 Replacing the Muffler Assembly, page 14.</p>
	<p>Fan:</p> <ol style="list-style-type: none"> Not operating. Unit overheating. Faulty fan. 	<ol style="list-style-type: none"> Leads to fan disconnected. Reconnect. Replace. Refer to 6.11 Replacing Cooling Fan, page 28.
	<p>Sieve beds defective.</p>	<p>Replace. Refer to 8.9 Checking Sieve Bed Pressure, page 43.</p>
	<p>Tubing kinked or blocked.</p>	<p>Repair or replace.</p>
	<p>P. C. board:</p> <ol style="list-style-type: none"> Shifts at wrong pressures. 	<p>Check pressure at product tank. Pressure should rise to 21 psi at shift point. If not, replace P. C. Board. Refer to 6.12 Replacing P.C. Board, page 29.</p>
	<p>Flowmeter:</p> <ol style="list-style-type: none"> Flowmeter opened beyond maximum flow rate. Cracked or broken fitting. Input tubing leaking or loose. 	<ol style="list-style-type: none"> Return flow to maximum setting. Replace fitting. Repair or replace. Refer to 6.15 Replacing Flowmeter, page 31.
	<p>Timing.</p>	<p>To accommodate for varying tolerances when replacing components, an adjustable timer is used to control the shifting of the Pressure Equalization (PE) valve. Refer to 7.1 Autotuning, page 36 or 7.2 Manual Tuning, page 37.</p>
	<p>PE valve:</p> <ol style="list-style-type: none"> Bad coil. Restrictor blockage. 	<ol style="list-style-type: none"> Replace PE valve. Refer to 6.4 Replacing PE Valve, page 21 Replace PE valve. Refer to 6.4 Replacing PE Valve, page 21.
	<p>Inspect P. C. board restrictor tubing for kinks or tears.</p>	<p>Replace P. C. board. Unit may need retiming after board replacement. Refer to 6.12 Replacing P.C. Board, page 29.</p>

Symptom	Probable Cause	Solution
Fluctuating Flow:	Regulator/Flowmeter: <ol style="list-style-type: none"> 1. Incorrectly set regulator. 2. Flowmeter malfunction. 	<ol style="list-style-type: none"> 1. Check pressure at oxygen outlet. Adjust regulator. 2. If flow is still unstable, check for leaks starting at the compressor outlet fitting through all pneumatic connections. If no leaks are found and flow is still fluctuating, replace the regulator. If pressure at test point is within spec (5 psi ± 0.5 max. [34.4 kPa ± 6.89]), replace flowmeter. Refer to 6.15 Replacing Flowmeter, page 31.
	Outlet HEPA filter: <ol style="list-style-type: none"> 1. Dirty or plugged 	<ol style="list-style-type: none"> 1. If low flow conditions persist, replace outlet HEPA filter. Refer to 5.3 Replacing the Outlet HEPA Filter, page 13.
Unit Excessively Loud:	Pneumatic exhaust: <ol style="list-style-type: none"> 1. Muffler cracked, damaged or missing. 2. Muffler tubing disconnected or damaged. 	<ol style="list-style-type: none"> 1. Replace. Refer to 5.5 Replacing the Muffler Assembly, page 14. 2. Reconnect or replace tubing.
	Compressor inlet filter missing and/or orange sticker removed.	Replace compressor inlet filter. Refer to 5.4 Replacing the Compressor Inlet HEPA Filter, page 13.
	Incorrect style of inlet filter (aftermarket).	Replace with factory OEM sound reduced style inlet HEPA filter.
	Compressor removed.	Replace Compressor. Refer to 6.2 Replacing Compressor Assembly, page 18.
Unit Overheats:	Base exhaust vent plugged or restricted.	Place unit at least 12 inches from any wall. DO NOT place unit on pile or shag carpeting that may restrict air flow.
	Cabinet filters dirty or blocked.	Clean or replace. Refer to 5.1 Cleaning the Cabinet Filter, page 12.
	Fan: <ol style="list-style-type: none"> 1. Leads to fan disconnected. 2. Defective fan. 3. Fan installed upside down. 	<ol style="list-style-type: none"> 1. Reconnect leads. 2. Replace fan. Refer to 6.11 Replacing Cooling Fan, page 28. 3. Install fan with air flow arrow pointing down.
	Heat exchanger: <ol style="list-style-type: none"> 1. Dirty or plugged. 2. Damaged. 	<ol style="list-style-type: none"> 1. Clean heat exchanger. 2. Replace heat exchanger. Refer to 6.9 Replacing Heat Exchanger Assembly, page 25.
	Compressor: <ol style="list-style-type: none"> 1. Defective. 2. Faulty capacitor. 3. Bad motor windings. 4. Worn seals. 5. Bad bearings. 	<ol style="list-style-type: none"> 1. Replace compressor. Refer to 6.2 Replacing Compressor Assembly, page 18. 2. Replace capacitor. Refer to 6.3 Replacing Capacitor, page 20. 3. Replace compressor. Refer to 6.2 Replacing Compressor Assembly, page 18. 4. Replace compressor. Refer to 6.2 Replacing Compressor Assembly, page 18. 5. Replace compressor. Refer to 6.2 Replacing Compressor Assembly, page 18.
	Line voltage excessive (surge).	Have line voltage inspected by certified electrician. A voltage regulator may be required and is obtainable from your local electric company.

Symptom	Probable Cause	Solution
<p>Oxygen Purity: Good</p> <p>Internal Status Indicators: Control Panel Indicators: RED: Off YELLOW: On GREEN: On</p> <p>After 30 minutes of run time, unit operates normally, oxygen purity within normal range. GREEN or YELLOW panel indicator should illuminate.</p>	<p>P. C. board defective.</p>	<p>Replace P. C. board. Refer to 6.12 Replacing P.C. Board, page 29. Unit may need retiming after P. C. board replacement. Refer to 7.1 Autotuning, page 36 or 7.2 Manual Tuning, page 37.</p>
<p>Unit Not Operating,</p> <p>Internal Status Indicators: RED: Off GREEN: Off</p> <p>Control Panel Indicators: RED: Off YELLOW: Off GREEN: Off</p> <p>Power Switch ON. Continuous audible alarm.</p>	<p>Transformer assembly:</p> <ol style="list-style-type: none"> 1. Assembly connector disconnected. 2. Faulty transformer assembly. 	<ol style="list-style-type: none"> 1. Reattach connector. 2. Replace transformer assembly. Refer to 6.13 Replacing the Transformer, page 30.
<p>Unit Operating,</p> <p>Internal Status Indicators: RED: Three Flashes GREEN: One Flash</p> <p>Control Panel Indicators: RED: Off YELLOW: Flashing GREEN: On</p>	<p>Internal repairs required.</p>	<p>Replace SensO₂ circuit board. Refer to 6.12 Replacing P.C. Board, page 29.</p>
<p>Potential Obstruction Alert does not activate on flows less than 0.5 L/min.</p>	<p>System leak.</p>	<p>Repair leak in product tank, regulator, tubing, fittings, or flow meter.</p>
	<p>Defective check valves.</p>	<p>Replace check valves. Refer to 6.6 Replacing Check Valves, page 23.</p>

10 Technical data

10.1 Specifications

Electrical Requirements:	120 VAC + 10, -15% (132 VAC/102 VAC), 60 Hz
Rated Current Input:	3 A
Sound Level:	43 ± 2 dBA Average for Perfecto ₂ Models
Altitude:	<p>All Perfecto₂ Models:Up to 8,000 ft (2438 m) above sea level without degradation of concentration levels.</p> <p>All Perfecto₂ Models while filling a HomeFill System:Up to 6,000 ft (1828 m) above sea level without degradation of concentration levels.</p> <p>Atmospheric Pressure Range: 101.3 kPa – 75.0 kPa</p>
Oxygen Output Concentration Levels:	<p>87% to 95.6% at 0.5 to 5 L/min</p> <p> Concentration levels achieved after initial warm-up period (approximately 30 minutes)</p>
Maximum Outlet Pressure:	5 psi ± 0.5 psi (34.5 kPa ± 3.45 kPa)
Low Flow Alarm:	0.5 to 5 L/min (maximum). For flowrates less than 1 L/min, we recommend the use of the Invacare Pediatric Flowmeter Accessory (IRCPF16).
Potential Obstruction Alert:	<p>0 L/min to 0.5 L/min</p> <p>The concentrator detects a condition that may indicate a potential obstruction of the output oxygen. Rapid audible beeping alert (this alert is deactivated when accessories are connected). May be associated with flow setting of 0.5 L/min or less.</p>
Power Consumption:	280 W (Operating at 3 L/min)
Pressure Relief Mechanism Operational at:	30 psi to 45 psi (207 kPa to 310 kPa)
Change in maximum recommended flow when back pressure of 7kPa is applied:	0.7 L/min (Back Pressure of 7kPa applied)
Filters:	Cabinet, Outlet HEPA and Compressor Inlet
Safety System:	<p>Current overload or line surge shutdown.</p> <p>High temperature compressor shutdown.</p> <p>High Pressure Alarm with compressor shutdown.</p> <p>Low Pressure Alarm with compressor shutdown.</p> <p>Battery Free Power Loss Alarm.</p> <p>SensO₂ Oxygen System.</p> <p>Possible Obstruction Alert.</p>
Width:	15 in ± 3/8 in (38.1 cm ± 1 cm)
Height:	23 in ± 3/8 in (58.4 cm ± 1 cm)
Depth:	12 in ± 3/8 in (30.5 cm ± 1 cm)
Weight:	Perfecto ₂ Models - 43 lbs ± 2 lbs (19.5 kg ± 1 kg)
Shipping Weight:	Perfecto ₂ Models – 48 lbs ± 2 lbs (21.8 kg ± 1 kg)
Operating Ambient Temperature and Humidity:	Perfecto ₂ Models – 50°F - 95°F (10°C - 35°C) at up to 60% maximum relative humidity
Cabinet:	Impact Resistant flame-retardant plastic cabinet that conforms to UL 94V-0
Standards and Regulatory Listing:	Double Insulated Product ETL certified complying with ULI431 and UL 1097 ETL certified to CSA C22.2 No. 68.
Electrical:	No extension cords

Placement:	<p>No closer than 12 in (30.5 cm) from any wall, furniture, draperies or similar surfaces to assure sufficient air flow.</p> <p>Avoid deep pile carpets and heaters, radiators or hot air registers.</p> <p>Floor location only.</p> <p>No confined spaces (Example: No closets).</p>
Tubing:	<p>7 ft (2 m) cannula with a maximum 50 ft (15 m) of Crush-Proof Tubing (DO NOT pinch)</p>
Time of Operation:	<p>Up to 24 hours per day</p>
Recommended Storage and Shipping Temperature:	<p>-20° F to 150° F (-29° C to 65° C) at up to 95% relative humidity</p>

 Measurement uncertainty is included in the device specification. All conditions at ATPD.

II Warranty

II.1 Limited Warranty

For warranty information, please refer to the original user manual which came with this product, or contact Invacare for more information.

Invacare Corporation

USA

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