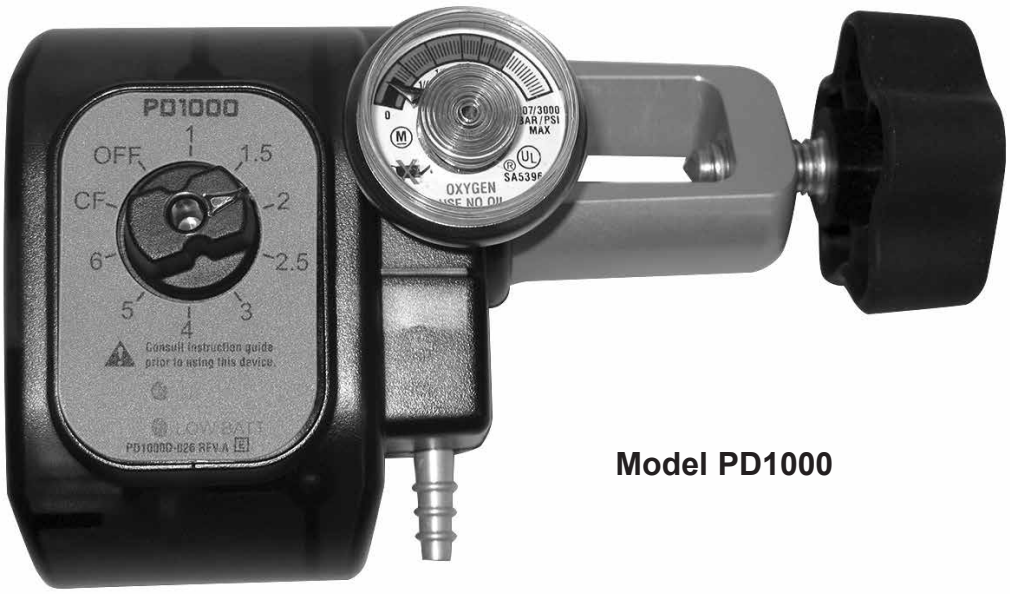
DeVilbiss® PulseDose® Compact Conserving Device
Service Manual



Model PD1000

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

TABLE OF CONTENTS

I. GENERAL INFORMATION

A. Initial Inspection

An initial inspection should be performed on the PD1000 as soon as possible after receipt. When removed from carton, an inspection should be made for any damage due to shipping. If shipping damage has occurred, call DeVilbiss Healthcare at 800-338-1988 (814-443-4881) for replacement instructions.

B. Maintaining the PD1000

The PD1000 should be periodically maintained according to the guidelines set forth in Section IV. Maintenance, and testing should only be done by qualified service personnel. Failure to follow the procedures set forth in this manual may void the warranty.

C. General Description

The PD1000 PulseDose system delivers a pulse or "bolus" of oxygen at the leading edge of inspiration. This bolus is delivered at both the proper flow and volume so that it is delivered deep into the lungs where gas exchange takes place. The PD1000 PulseDose is rate responsive from 6 BPM to 40 BPM.

II. THEORY OF OPERATION

The PD1000 utilizes a vacuum switch to detect the negative pressure at the beginning of each inspiration (approximately .1 inches water column due to inhalation). That, in turn, opens the solenoid for a time interval that corresponds to the flow rate selected on the rotary selector. At higher flow rates, the valve is open longer resulting in increased pulse volumes.

Atmospheric pressure compensation occurs automatically because the pressure side of the vacuum switch is open to atmosphere.

All PD1000 units are set on 2 liters per minute continuous flow from the factory. Changing to a different continuous flow rate involves changing the cannula fitting as outlined in Section VI, D.

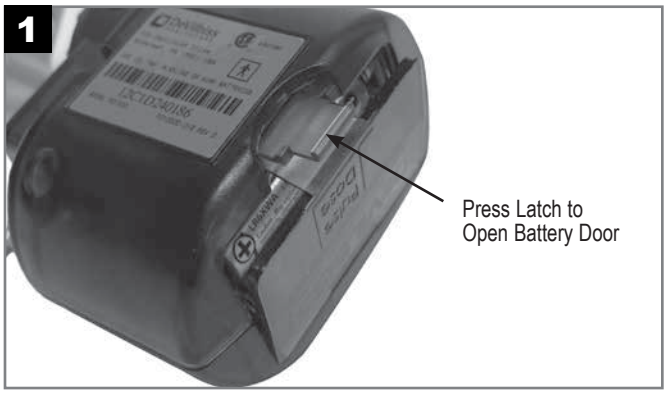
The PD1000 delivers 16.5 cc 0_2 per setting number (i.e. setting 2 = 33cc 0_2).

III. INSTALLATION AND OPERATION

A. Installation

The PD1000 utilizes a rotary selector that has three modes for use by the patient. Those modes are: OFF, "PulseDose", and Continuous Flow. The PD1000 is battery operated and is turned off by turning the Rotary Selector to the "OFF" position. The unit requires (2) "AA" batteries to operate in PulseDose mode (Figure 1). The batteries will not become discharged as a result of not turning the Rotary Selector to the "OFF" position.

1



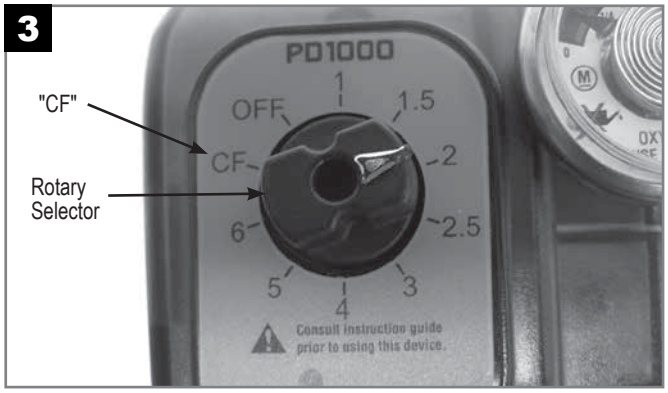
The PD1000 mounts on a standard CGA870 type post using guide pins and the knob (Figure 2). It can be used on C, D, E, ML-6, M4 and M-6 size tanks at pressures between 500-2250 PSIG. Also verify that the regulator seal (Part #9286-RD) is in place and in good condition (Section VI, A). Position the guide pins into the tank post holes, and tighten the knob until the PD1000 is securely in position and there are no seal leaks.

2

The tank valve can now be slowly opened and the rotary selector can be set to the prescribed flow rate. Verify that a pulse is being delivered at the leading edge of each inhalation. As the flow rate is increased, so is the duration of the pulse (Figure 3).

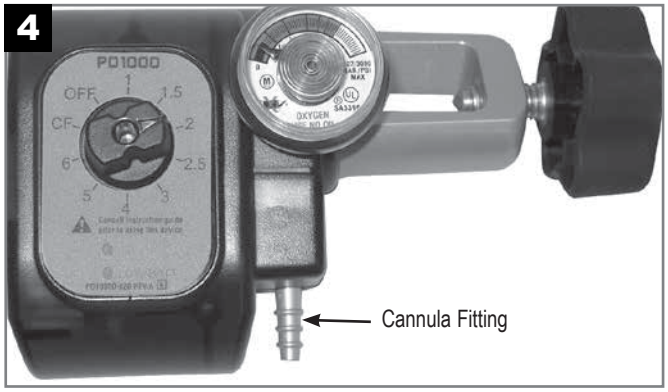
To use the PD1000 in the "Continuous Flow" mode, turn the Rotary Selector to the "CF" position (Figure 3). See Note in the Important Parts section of the instruction guide A-1000.

3



The "CF" flow rate is set at 2 liters per minute. This flow rate can be changed by changing cannula fittings (Figure 4). See Service Instructions Section VI, D.

4



B. Operation

When using the PD1000 in the PulseDose mode, the patient must breathe through the nose only. A standard nasal cannula must be used. Do not use a pediatric or low-flow cannula. The cannula with tubing can be up to 35 feet in length, but a 10 foot maximum is recommended to lessen the chances of the oxygen cylinder tipping over while in use.

Do not use on patients who can only mouth breathe. The PD1000 should only be used on patients capable of nose breathing.

Remaining battery life can be observed as the Pulse Indicator Lights illuminate with each breath (Figure 5).

5

If the Green Pulse Indicator Light illuminates with each breath, the batteries have sufficient power (8 or more hours).

If the Red Pulse Indicator Light illuminates with each breath, the batteries have between 4-8 hours of battery life remaining.

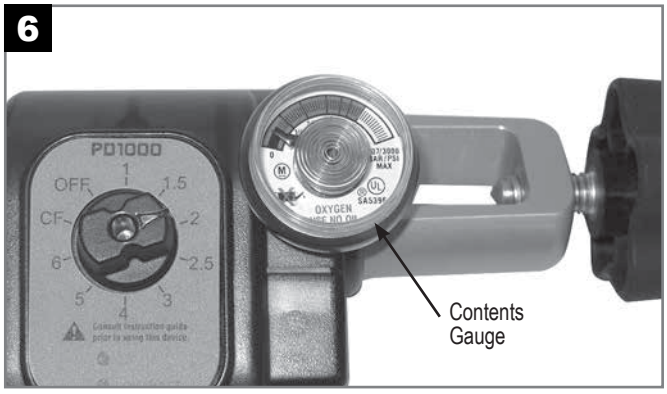
If the Red Indicator Light illuminates continuously, the batteries must be changed. The unit can be used on the continuous flow "CF" setting if no batteries are immediately available.

NOTE-*Turn the Rotary Selector to the OFF setting prior to changing batteries.*

NOTE-*The oxygen cylinder will not last as long in continuous flow mode as it would in PulseDose mode.*

The contents gauge indicates the approximate amount of oxygen left in the tank. It reads 1/4, 1/2, 3/4, and full. It also has a red area to emphasize when the tank needs to be changed (Figure 6).

6



IV. MAINTENANCE PROCEDURES

A. Testing

NOTE-*The following should be performed after repair or between patients*

1. Install known good batteries.
2. Connect the unit to a pressurized oxygen cylinder as described in Section III-A and connect a nasal cannula.
3. Open the tank valve and verify that the PD1000 contents gauge indicates that there is a full tank.
4. Verify that there are no leaks around the tank seal between the PD1000 and the oxygen tank.
5. Select any flow rate and simulate an inhalation through the nasal cannula while verifying that a "pulse" or bolus of oxygen is delivered with each simulated breath.
6. Position the Rotary Selector to the "CF" position and verify that the Continuous Flow Mode of operation is functioning.
7. Verify that the top and bottom covers are not cracked or broken.
8. Verify that the label can be read and is not damaged.
9. Turn the Rotary Selector to the "OFF" position, dose the tank valve, and remove PD1000 from cylinder.

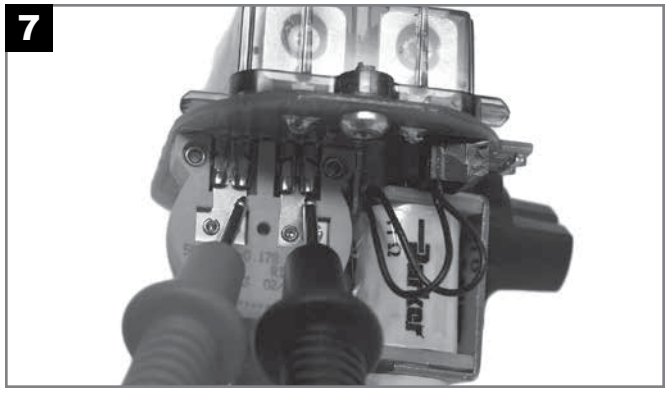
B. Cleaning

Wipe with a damp cloth having a maximum 5.25% Sodium Hypochlorite (Bleach) or 3% Hydrogen peroxide solution. Avoid getting fluids or debris such as sand or dirt inside the oxygen connections. Do not immerse in water.

V. TROUBLESHOOTING

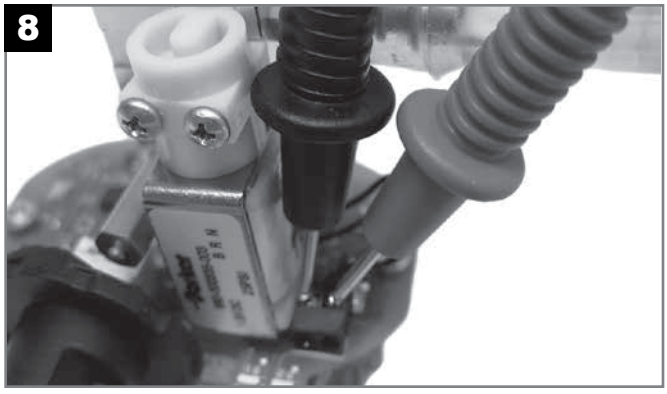
PROBLEM	SOLUTION
Type I- The unit does not deliver a pulse with each inhalation while properly connected to a pressurized cylinder with the post valve open.	1. Verify that the batteries are good and of specified type.
	2. If batteries are good, verify proper cannula connection and that patient is nose breathing.
	3. If yes, remove top and bottom covers (Section VI, C). Use a digital volt meter and check the resistance across the Vacuum Switch (figure 7) with Rotary Selector "OFF" when breath is simulated.
	4. Refer to Section VI, E. If the resistance doesn't go to "0" when breath is simulated, change the vacuum switch.
	5. If the resistance goes to "0" check the solenoid voltage (3VDC) when breath is simulated and set to 6 LPM. (Refer to Figure 8)
	6. If no voltage is present, change the PC Board.
	7. If voltage is present, change the solenoid.
Type II- The regulator is leaking or the gauge is broken or not reading accurately.	Refer to Section VI, C to remove the Regulator/Gauge Assembly and replace the gauge or regulator.
Type III- The cannula fitting is broken.	Refer to Section VI, D to change the cannula fitting.
Type IV- There is leakage between the tank and the PD1000.	Close the tank valve, loosen the knob and verify that the post, the PD1000 regulator yoke and the tank surfaces are smooth and free of burrs. If they are smooth, replace the regulator seal (#9286-RD). Refer to section VI, A.
Type V- Broken, damaged, or non-functioning rotary selector.	Remove covers and replace rotary selector. Refer to Section VI, C.

7



Testing Vacuum Switch

8

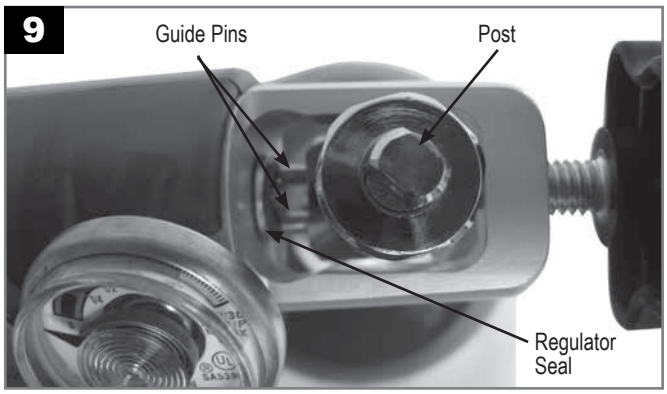


Testing Solenoid Voltage

VI. SERVICE INSTRUCTIONS

A. Regulator Seal Replacement

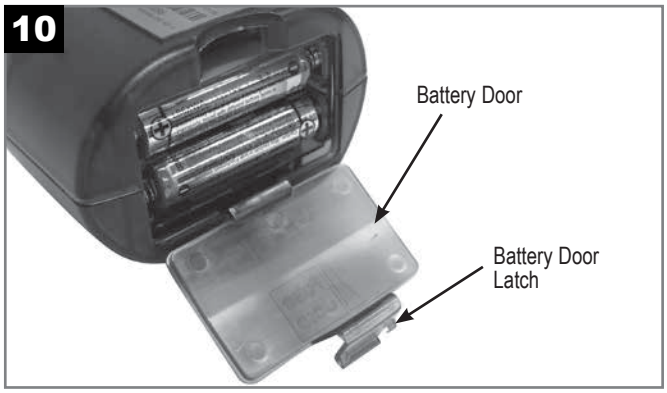
Start by closing the tank valve so that no pressure is supplied to the PD1000. Loosen the knob so that the guide pins slide out of the indexing holes in the tank post. Remove and replace the defective seal (Part # 9286-RD) (Figure 9).



B. Battery Replacement

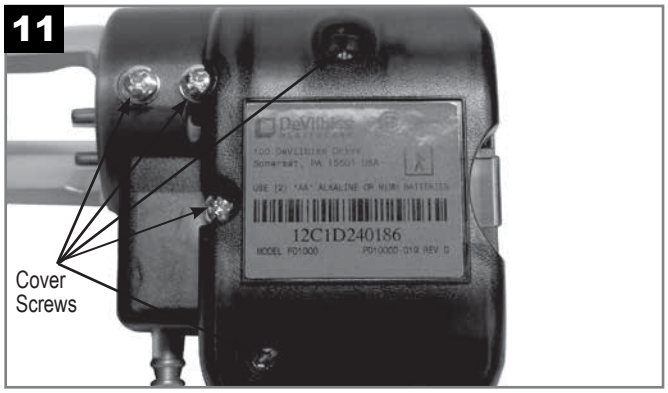
NOTE-*Turn the rotary selector to the "OFF" setting and wait approximately 15 seconds prior to changing batteries.*

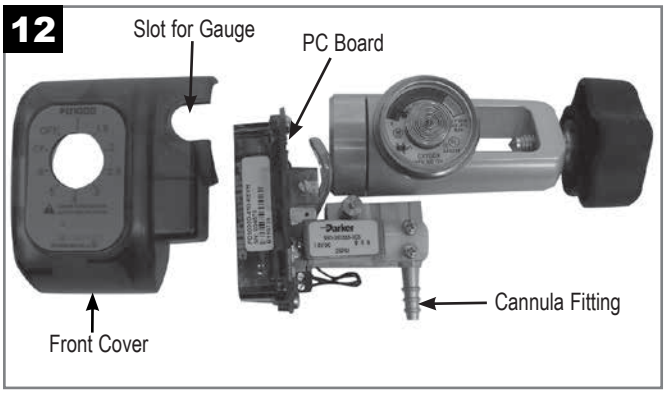
Open the battery door by pushing back on the latch and lifting (Figure 10). Remove batteries and note the polarity. The polarity is also indicated in the battery compartment. Replace with standard "AA" alkaline or NiMH batteries.

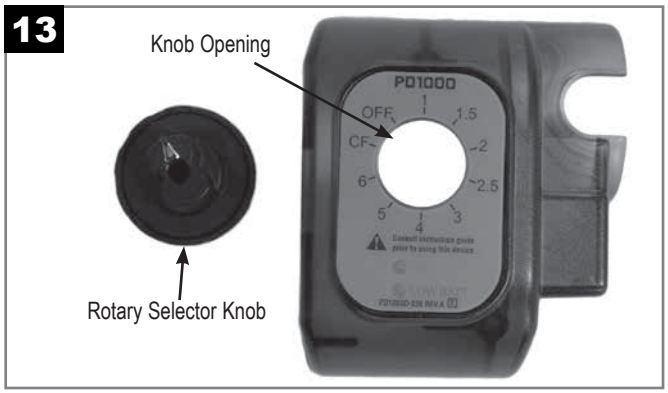


C. Cover/Regulator and Gauge Removal

Position the PD1000 face down so that the back cover is facing up. Remove the 5 cover screws (Figure 11) and then remove the rear cover. Stand the unit on its side and (Figure 12) remove the circuit board/manifold assembly. Then slide the front cover off the regulator. The Rotary Selector will also lift out when the front cover is removed (Figure 13). The regulator/gauge can then be removed by disconnecting the regulator hose. Refer to Section VII-Internal Parts.







D. Cannula Fitting Removal/Replacement

First remove the front and back covers.

NOTE-*When removing or installing the cannula fitting, orient the manifold so the fitting faces down to prevent any debris from falling into the manifold which could obstruct the continuous flow orifice.*

Use a 5/16" open end wrench and remove the cannula fitting by turning it counter-clockwise (Figure 12). Replace with a new cannula fitting and torque to 10 inch-lbs.

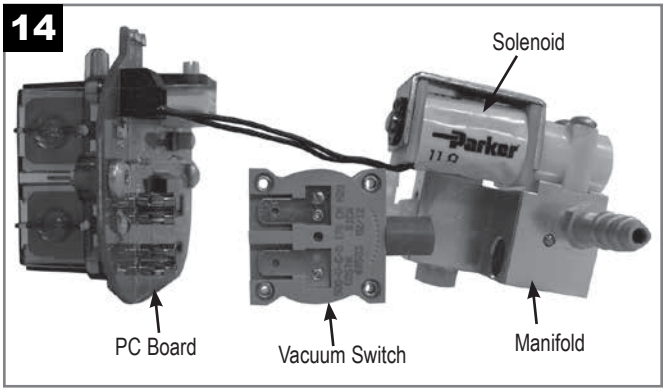
E. Solenoid/Vacuum Switch Testing and Removal

Connect a piece of tubing to the cannula fitting so that a negative pressure can be created. Using a digital voltmeter, check the resistance across the vacuum switch as a negative pressure is created (Figure 7). If the resistance doesn't go to "0" when a breath is drawn, replace the vacuum switch.

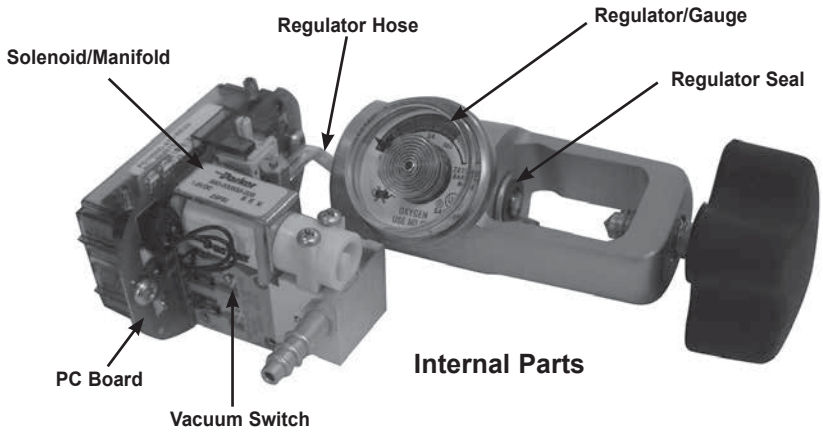
If it goes to "0" but the solenoid doesn't open, check the solenoid voltage (3VDC) (Figure 8). If there is no voltage, change the PC Board. If there is voltage, replace the solenoid (Figure 14).

To replace the vacuum switch, pull it apart from the manifold/solenoid and the PC Board terminals (Figure 14). The vacuum switch can then be replaced by pushing the manifold, vacuum switch, and PC Board together. No tools are required.

14

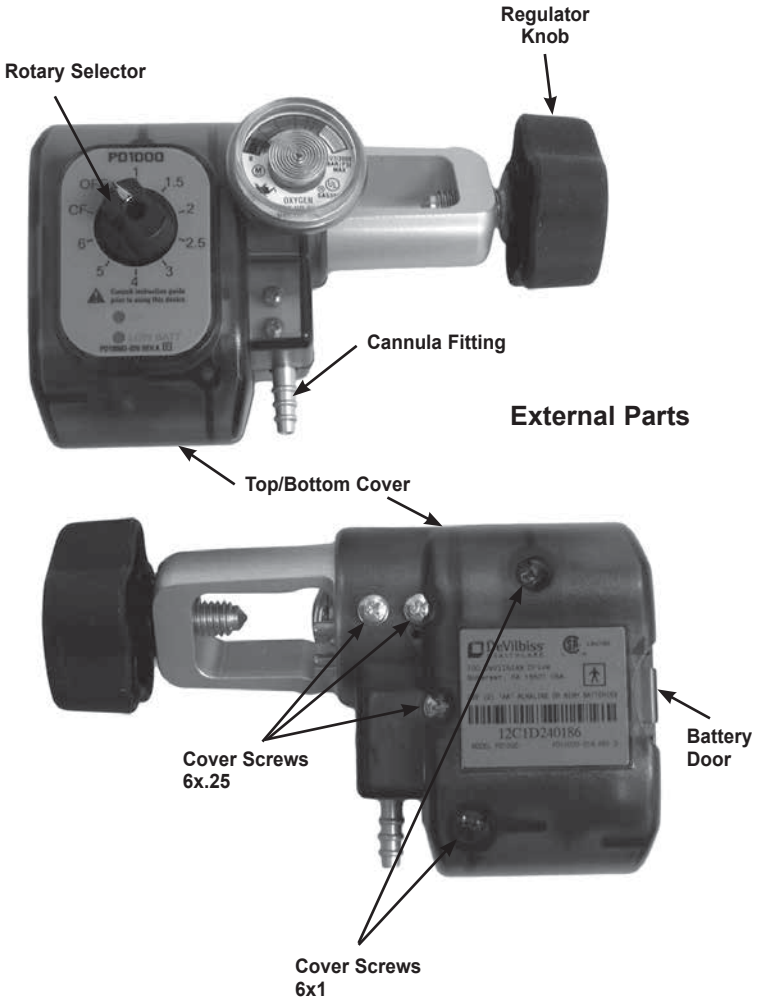


VII. PARTS AND ILLUSTRATIONS



Internal Parts

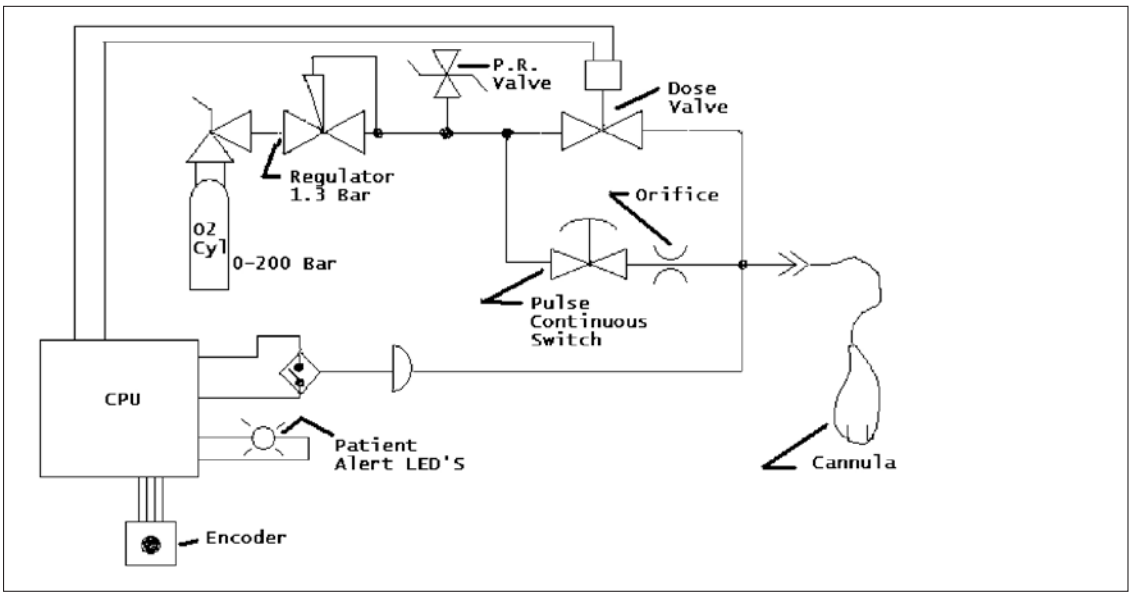
INTERNAL PARTS LISTS	
9286-RD	Regulator Seal
PD1000D-604	Solenoid/Manifold
PD1000D-605	Vacuum Switch
PD1000D-606	Regulator/Gauge
PD1000D-607	PC Board
	Regulator Hose



External Parts

EXTERNAL PARTS LISTS	
PD1000D-601	Top/Bottom Cover
PD1000D-602	Rotary Selector
PD1000D-608	Battery Door
PD1000D-609	Regulator Knob
PD1000D-610	Cover Screws 6 x 1
PD1000D-611	Cover Screws 6 x .25
Cannula Fitting	
PD1000D-612	Aluminum-2 lpm
PD1000D-613	Gold-3 lpm
PD1000D-614	Green-4 lpm
PD1000D-615	Blue-5 lpm
PD1000D-616	Red-6 lpm

VIII. PNEUMATIC DIAGRAM



IX. UNIT SPECIFICATIONS

Weight	14. 7 ounces (16.3 ounces with battery)
Dimensions	4.75"L x 3.4"W x 2.8"H (12.06 cm L x 8.64 cm W x 7.11 cm H)
Power Supply	(2) Standard "AA" alkaline or NiMH. **NOTE**-*Batteries other than alkaline or NiMH are not recommended due to their limited capacities.*
Operational Voltage Range	2.3 to 3.6V DC
Operating Temperature Range	5° to 40° C (41˚ to 104°F)
Operating Pressure Range	500 to 2250 PSIG (34 to 155 Bar) tank pressure
Operating Atmospheric Conditions	500 to 1020 millibar
Operating Humidity Range	0 to 95% R.H., non-condensing
Storage and Transportation Temperature Range	20° to 60° C (-4° to 140° F)
Storage and Transportation Humidity Range	Up to 95% R.H., Non-condensing
Degree of Protection Against Ingress of liquids	None
Degree of Protection Against Electric Shock	TYPE BF applied part
Power Requirements	Average steady state “ON” current 1.6 uA. Batteries other than alkaline or NiMH are not recommended due to the capacity needed for operation and battery life of the unit. Typical new battery life is 200 hours when used at 25°C, 2 LPM and 20 BPM. Settings and breath rate will affect battery life. After the Low Battery (flashing red) light illuminates, the unit will continue to operate about four hours when used at 25°C, 20 BPM and the 6 LPM setting. Settings, breath rate, and battery conditions will affect use times. Refer to local regulations for battery recycling and/or disposal requirements
Expected Shelf and Service Life (excluding batteries)	5 years based on 4 hours use per day at 20 BPM
Modes of Operation	Continuous/Pulsed
Approval Body And Safety Standards	IEC 601-1;CAN/CSA-C22.2 No. 601.1-M90 and IEC 601-1-2
US Patents	4,519,387; 5,755,224; 4,457,303

X. PROVIDER’S NOTES

No routine calibration or service is required provided the device is used in accordance with the manufacturer’s directions. Between patients wipe with a damp cloth having a maximum 5.25% Sodium Hypochlorite (Bleach) or 3% Hydrogen peroxide solution. Avoid getting fluids or debris such as sand or dirt inside the oxygen connections. Do not immerse in water.

XI. DEVILBISS GUIDANCE AND MANUFACTURER'S DECLARATION

WARNING

Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to the Electromagnetic Compatibility [EMC] information provided in the accompanying documents.

Portable and Mobile RF Communications Equipment can affect Medical Electrical Equipment.

The equipment or system should not be used adjacent to or stacked with other equipment and that if adjacent or stacked use is necessary, the equipment or system should be observed to verify normal operation in the configuration in which it will be used.

NOTE– *The EMC tables and other guidelines provide information to the customer or user that is essential in determining the suitability of the Equipment or System for the Electromagnetic Environment of use, and in managing the Electromagnetic Environment of use to permit the Equipment or System to perform its intended use without disturbing other Equipment and Systems or non-medical electrical equipment.*

Guidance and Manufacturer's Declaration – Electromagnetic Emissions		
This device is intended for use in the electromagnetic environment specified below. The customer or the user of this device should assure that it is used in such an environment.		
Emissions Test	**Compliance**	**Electromagnetic Environment – Guidance**
RF Emissions CISPR 11	Group 1	This device uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions CISPR 11	Class B	This device is suitable for use in all establishments including domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	N/A	
Voltage fluctuations / flicker emissions	N/A	

Guidance and Manufacturer's Declaration – Electromagnetic Immunity			
This device is intended for use in the electromagnetic environment specified below. The customer or the user of this device should assure that it is used in such an environment.			
Immunity Test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic Environment - Guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6kV contact ±8kV air	Complies	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%
Radiated RF IEC 61000-4-3	3 V/m 80MHz to 2.5GHz	Complies	Field strengths outside the shielded location from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than 3 V/m. Interference may occur in the vicinity of equipment marked with the following symbol: 
Conducted RF IEC 61000-4-6	3 Vrms 150kHz to 80MHz	N/A	
Immunity Test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic Environment - Guidance**
Electrical fast transient IEC 61000-4-4	±2kV power line ±1kV I/O lines	N/A	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1kV differential ±2kV common	N/A	
Power frequency magnetic field IEC 61000-4-8	3 A/m	Complies	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Voltage dips, short interrupts and voltage variations on power supply input lines IEC 61000-4-11	>95% dip 0.5 cycle 60% dip 5 cycles 70% dip 25 cycles 95% dip 5 secs.	N/A	Mains power quality should be that of a typical commercial or hospital environment. If the user of this device requires continued operation during power mains interruptions, it is recommended that the device be powered from an uninterruptible power supply or battery.
This device has been tested to and meets the EMC requirements of EN60601-1-2. Do not place the device near other equipment or devices that create or attract electromagnetic fields. Examples of such equipment are defibrillators, diathermy equipment, CB radios, microwave ovens, etc. Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the unit is used exceeds the applicable RF compliance level above, the unit should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the unit.			

XII. PARTS RETURN AND ORDERING POLICY

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

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

- Catalog Number
- Unit Serial Number
- Account Number
- Company name, address, and phone number

ORDERING INFORMATION

When ordering components, instruction guides, or service manuals the following must be provided:

- Unit Catalog Number
- Unit Serial Number
- Part Number
- Quantity Required
- Orders may be placed by calling Customer Service at 800-338-1988 / 814-443-4881

Technical Service 800-338-1988

XIII. WARRANTY

Three-Year Limited Warranty

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

USA 800-338-1988 or 814-443-4881
Europe +49-621-178-98-230

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

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

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

DeVilbiss Healthcare LLC
100 DeVilbiss Drive
Somerset, PA 15501-2125
USA
800-338-1988 • 814-443-4881

DeVilbiss Healthcare Ltd
Unit 3, Bloomfield Park
Bloomfield Road
Tipton, West Midlands DY4 9AP
UNITED KINGDOM
+44 (0) 121 521 3140

DeVilbiss Healthcare Pty. Limited
15 Carrington Road, Unit 8
Castle Hill NSW 2154
AUSTRALIA
+61-2-9899-3144

EC REP CE 0044
DeVilbiss Healthcare SAS
13/17, Rue Joseph Priestley
37100 Tours
FRANCE
+33 (0) 2 47 42 99 42

DeVilbiss Healthcare GmbH
Kamenzer Straße 3
68309 Mannheim
GERMANY
+49-621-178-98-230

DeVilbiss Healthcare LLC • 100 DeVilbiss Drive • Somerset, PA 15501 • USA
800-338-1988 • 814-443-4881 • www.DeVilbissHealthcare.com

LT-1859 Rev. B