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A Guide to Portable Oxygen Concentrators

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Points to Ponder Before Selecting a Portable Oxygen Concentrator (POC)

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Over the past several years, there have been some tremendous breakthroughs in the area of long-term oxygen therapy support. One of the most notable is that of the oxygen concentrator.

Unlike gaseous or liquid oxygen that are the products of oxygen manufacturing companies, oxygen concentrators actually "make" their own oxygen by removing nitrogen from atmospheric air. Recalling our high school science class when we were taught that atmospheric air is composed of approximately 79% nitrogen and 21% oxygen, oxygen concentrators *concentrate* the oxygen from atmospheric air by filtering out or separating the nitrogen from the oxygen. The oxygen passes through the filter system and is then stored within the device (storage volumes vary from device to device) and is available for breathing by the patient.

Twenty years ago, there were no portable oxygen concentrators (POCs). There were only stationary oxygen concentrators that were relatively large and quite heavy. But in most instances, these stationary units were capable of producing continuous flows of oxygen at flows up to 5 liters per minute.

However, in the last decade we witnessed the advent of the portable oxygen concentrator. Portable concentrators are lighter in weight — some weigh as little as 5 pounds! In addition to standard household AC 110 current, POCs can also be powered from the DC outlet found in motor vehicles and from rechargeable batteries. Portable concentrators have opened entirely new vistas by making it possible for oxygen patients to take their oxygen with them whenever, wherever, and however they decide to do so.

POCs can be classified as able to deliver continuous flow (CF) or intermittent flow (IF). So a choice has emerged for oxygen users: Should I select a continuous flow or intermittent flow device? Please bear this in mind as you review the following information. As you will see from the table on page 9, some POCs are capable of delivering both continuous and intermittent flows while others are capable of intermittent flow only. Please note that intermittent flow devices, unlike machines with continuous flow capabilities, only deliver oxygen during inhalation — oxygen is NOT delivered during exhalation. By and large, this oxygen delivery method can meet the supplemental oxygen needs of most patients.

You may find that the oxygen delivery pattern of some POC devices will provide you with the supplemental oxygen necessary to increase the amount of oxygen in your blood required at both minimum and maximum activity levels. How do you know what's best for you? The best way to learn the answer is to use a particular POC model and then use an accurate pulse oximeter to continuously record the percentage of oxygen saturation in your blood during normal activities. Supplemental oxygen should be prescribed with the goal of maintaining an oxygen saturation range identified by your physician as the maximum and minimum range for you, both at rest and during activities.

POCs can be extraordinarily liberating for many, but only if the POC selected first meets your physiologic needs. In other words, no matter what device is chosen, it must first and foremost achieve goal No. 1 for you and that is to relieve your hypoxia while you carry out normal activities of daily living during the entire time it is being used.

Trade-offs

As with all things in life, the decision to select the right POC is sprinkled with trade-offs. Virtually all patients want a POC that meets their needs for oxygenation at all activity levels. They also want this device to be small, lightweight, easy to carry, have an extended battery life sufficient to allow users to travel freely, and be relatively inexpensive.

Each and every one of the foregoing is important, but in order for consumers to make the right choice in conjunction with their physicians and therapists, it is helpful to undertake a simple prioritization exercise. Since we already know that the No. 1 priority of all supplemental oxygen delivery devices is to relieve low blood oxygen levels, it is highly recommended that when considering a portable oxygen concentrator that you first “test-drive” the device while using an accurate pulse oximeter. First and foremost, you must establish that the device can meet your supplemental oxygenation needs during your various activities of daily living (i.e., sitting, walking, and climbing stairs).

Suffice it to say that if a particular POC model/device is tried and is unable to adequately oxygenate you, that POC model/device is not appropriate for you. That does not mean that the device would not work for others, but it does mean that this particular device is not a good clinical fit for you. All the devices on the market have a place, but not all devices on the market can meet all oxygen user needs. We first must have a good fit from a physiologic standpoint. We now have narrowed the list down after applying this first criterion, giving us a more limited list. Now is the time to use the results of our prioritization exercise. What’s the next important criterion considering your needs? Is it weight? Is it battery life? Is it price? Only you can decide this with assistance from your attending physician and respiratory therapists.

As a general rule of thumb, the more robust portable concentrators (i.e., those that are able to supply patients with the highest oxygen needs) tend to be the heaviest. And, not surprisingly, they tend to have a shorter battery life than the more lightweight but less robust systems. When you think about it, it stands to reason that the hardware and software required to “make” larger volumes of oxygen from atmospheric air require higher power requirements. Moreover, their larger physical size is a huge influence on the weight of the device. That’s why some have carts and wheels.

As you review the following tables, you will see the performance characteristics as reported by the companies that manufacture this equipment. This survey was done so that you could get information in an organized fashion comparing one device to the next and then make an informed decision on what POC will work best for you.

You should also keep in mind that your oxygen requirements may change over time, which should be considered when deciding whether to rent or purchase a unit. That is, if you are at the maximum settings now, this unit may not meet your needs in the future.

Some users have mentioned that they would like to see alarms on some devices. This is especially important in devices that are used by patients who might develop low oxygen levels while sleeping. Such additional feature reviews are beyond the scope of this first survey. However, we ask that after you review information in "A Guide to Portable Oxygen Concentrators" that you send us questions describing what else you feel you need to know in order to:

A. Have your supplemental oxygenation needs met while using a POC,

B. Ensure your doctor and home care company have adequate technical information on POC performance so your needs can be matched with the best device, and

C. Help you maximize use of the device as prescribed by your doctor so that you achieve the best possible benefits.

Other Considerations

As a rule of thumb, all supplemental oxygen devices that are capable of continuous flow are designed and calibrated to deliver flow in liters per minute. This traditional designation has been used for well over 70 years. In the hospital you may recall seeing oxygen flow meters plugged into the wall outlets located at the head of the bed. These flow meter devices deliver continuous flow and are calibrated in liters per minute.

Devices that provide intermittent flow cannot use the designation *liters per minute* since there is no continuous flow. As an alternative, you will note that some devices are calibrated in *milliliters per breath*, known as a *fixed bolus volume,* while others are calibrated in *milliliters per minute*, known as a *fixed minute volume*. The difference in these units is traceable to how the device actually "makes" oxygen (or removes nitrogen). Which is better? Once again, it depends on the user. As you will see in the following tables, many of the intermittent flow only devices produce a predetermined, fixed amount of oxygen per minute and per setting, commonly referred to as a *fixed minute volume* method; and other devices use a *fixed bolus volume* method (bolus is defined as the amount of oxygen in milliliters delivered per breath). These may sound similar, but there are some specific differences in these two methods that you should be aware of, although both methods are shown to be clinically effective.

- **Fixed Bolus Volume**. This method of oxygen delivery uses a predetermined bolus size that is calculated for each POC setting. Regardless of breathing rate, the POC delivers the same bolus volume per breath for the given setting. For example, if a POC on setting 2 delivers 15 milliliters per breath, it would deliver that same 15 milliliter bolus per breath if the breathing rate was 20, 30, or 35. At very high breathing rates, some fixed bolus POCs may experience a drop in the oxygen purity because the total volume of oxygen being delivered in the course of each minute exceeds the production capacity for the specific setting.

- **Fixed Minute Volume**. This method of oxygen delivery establishes a predetermined volume of oxygen that will be produced for each POC setting over the course of a minute. The bolus amount delivered per breath is mathematically determined by the breathing rate (minute volume ÷ breathing rate). Since the amount of oxygen produced per minute remains steady as

the breathing rate increases, the amount of oxygen delivered per breath becomes smaller. Conversely, as your breathing rate decreases, the bolus size gets larger. For example, a POC with a fixed minute volume of 300 milliliters of oxygen at the 2 setting would deliver 30 milliliters per breath at a breathing rate of 10, 15 milliliters per breath at a breathing rate of 20, and so on. In all cases, the *total* amount of oxygen delivered each minute remains steady, as should the oxygen purity.

Please keep these performance differences in mind when selecting a POC. It bears repeating that the only way to know for sure that a supplemental oxygen user's oxygenation levels are within the targeted range prescribed by the physician is to use a pulse oximeter to directly measure the oxygen saturation at minimum and maximum required levels. Then and only then will you be assured that the POC, or POCs, you have selected will meet your physiological needs and embrace the priorities concerning weight, battery life, etc. that you have identified beyond those needs.

Acknowledgments

I want to acknowledge the support and collaboration of the following companies that assisted in organizing and implementing this survey. I'm proud to say that 100% of the manufacturers that we asked to participate did so. If you have questions that are specific to their devices, please feel free to contact them directly. They are AirSep, CAIRE SeQual, DeVilbiss Healthcare, Inogen, Inova Labs, Invacare, Philips Respironics, Precision Medical, O2 Concepts, and Oxus. (See their websites on next page.) Thank you one and all for helping us help our patients understand the value of your products.

I also want to acknowledge individuals who have assisted with the survey and presentation of its results. First, I want to thank Greg Spratt, BS, RRT, CPFT, AARC's current Chair of the Home Care Section. Greg is currently the Director of Clinical Marketing at Covidien – Oridion Capnography. I also want to thank Joe Lewarski, BS, RRT, FAARC, a Past Chair of AARC's Home Care Section for his assistance and guidance. Joe is currently the Vice President of Clinical Affairs at Invacare Corporation.

Bob McCoy, BS, RRT, FAARC, and Ryan Diesem, BA, were also asked to contribute. Bob is a Past Chair of AARC's Home Care Section and Ryan, who is Bob's partner, has permitted me to call on him in order to draw on his extensive experience in this area of our technology. Bob is currently the Managing Director for Valley Inspired Products. Finally, I want to thank Patrick Dunne, MEd, RRT, FAARC, yet another Past Chair of AARC's Home Care Section, but also a Past President of AARC, who works as an independent consultant with extensive experience in respiratory home care and supplemental oxygenation. Without the advice and support from the foregoing group, our ability to present this information would be much diminished.

Summary

Technology can be a boon or it can be a curse. It's up to us to master emerging technologies, especially within the realm of respiratory care. Even though POC technology is still in its infancy, we are already seeing significant performance improvements in this category. I suspect that POC

technology is about where laptop computers were five to ten years ago. If so, we are on the verge of a technological explosion in the area of supplemental oxygen that will provide not only more effective devices to meet patients' needs, but also packaging of these devices in lightweight systems that will stretch battery life beyond current levels. Portable oxygen concentrator technology will not only liberate, it will also enable patients with chronic lung diseases to enjoy a higher quality of life by staying more active. Many of us feel that increased activity levels, with supplemental oxygen when needed, will go a long way toward minimizing expensive chronic pulmonary disease exacerbations.

In closing, I want to invite all of you to submit questions that you may have to my attention at AARCPOC@aarc.org. The AARC sees this as a first in what will be a series of surveys to help our community, which consists of, first and foremost, our patients, followed by respiratory therapists, physicians, and nurses. All need to understand how POCs work and how to make sure every POC ordered by any physician for any patient and provided by any home care company is the proper match for the patient under all conditions of use.

Thank you.

POC Manufacturer Links

http://www.airsep.com/medical/portableoxygen.html

http://www.cairemedical.com/SeQual.aspx

http://www.DeVilbissHealthcare.com

http://www.inogenone.com/

http://www.inovalabs.com/

http://www.invacare.com/cgi-bin/imhqprd/default.jsp

http://www.o2-concepts.com/

http://www.oxusamerica.com/home

http://www.healthcare.philips.com/main/homehealth/respiratory_care/simplygo/

http://www.precisionmedical.com/

Appendix 1, located at page 23, is a Survey of Home Oxygen Equipment Performance Characteristics

Current Portable Oxygen Concentrators

AirSep

CAIRE SeQual

DeVilbiss

Inogen

Inova Labs

Invacare

O2 Concepts

Oxus

Philips Respironics

Precision Medical

Devices are not to scale

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Manufacturer	Product Name and Model	Delivery Method	Weight Without Battery (if removable)	Weight With Battery	Delivery Selector Values	Unit of Measure for Each Selector Value	Manufacturer Notes on Delivery *
AirSep	FreeStyle, Model 3	IF Only	N/A	4.4 lbs	1 to 3	Reference Number Only	* Bolus size (in mLs) is variable and changes with the patient's breathing rate to provide a fixed minute volume of oxygen * Focus, FreeStyle, and FreeStyle 5 units manufacture and deliver a constant per minute volume of oxygen for each setting. As a patient's breath rate changes, the amount of oxygen that they are receiving per bolus varies, yet the total amount received per minute remains constant.
	FreeStyle, Model 5	IF Only	N/A	6.2 lbs	1 to 5	Reference Number Only	
	Focus	IF Only	1.75 lbs	2.82 lbs	Not adjustable	Reference Number Only	
CAIRE SeQual	Eclipse, Model 3	CF and IF	15 lbs	18.4 lbs	CF 0.5 to 3 IF 1 to 9	L/min # of 16 mL/breath	
DeVilbiss Healthcare	iGo, Model 306DS	CF and IF	15.5 lbs	19 lbs	CF 1 to 3 IF 1 to 6	L/min mL/breath	
Inogen	Inogen One G2, Model IS-200	IF Only	5.6 lbs	7.2 lbs	1 to 5	Reference Number Only	* At 17 breaths per minute (210 mL per setting)
	Inogen One G5, Model IS-300	IF Only	3.5 lbs	4.8 lbs	1 to 4	Reference Number Only	
Inova Labs	LifeChoice Activox, Model XYC100B	IF Only	N/A	4.83 lbs	1 to 3	# of 10 mL/breath	
Invacare	Solo2 Portable Concentrator, Model XPO100B or XPO100	CF and IF	17 lbs	19.9 lbs	CF 0.5 to 3 LPM IF 1 to 5	L/min mL/min	* Fixed Minute Volume Technology * Invacare uses fixed minute volume technology in their pulse dose devices. Each setting will deliver a fixed amount of oxygen over the course of a minute; individual bolus amounts will be determined by the breath rate of the patient over the course of that minute
	XPO2 Portable Concentrator, Model XPO100B or XPO100	IF Only	N/A	6 lbs	1 to 5	mL/min	
O2 Concepts	Oxlife Independence, Model 800-0001-1	CF and IF	16.7 lbs	19.4 lbs	CF 0.5 to 3.0 IF 0.5 to 6.0	L/min mL/min	
Oxus	Oxus POC, Model RS-00400	IF Only	8.4 lbs	9.9 lbs	1 to 5 in 0.5 steps	# of 8.5 mL/breath	
Philips Respironics	Simply Go, Model 1068987	CF and IF	8.5 lbs	10 lbs	CF 0.5 to 2.0 IF 1 to 6	L/min mL/min	
Precision Medical	EasyPulse POC, Model PM4150	IF Only	N/A	6.8 lbs	0 to 5	mL/min	

Definitions

BPM	Breaths/minutes	lbs	pounds
CF	Continuous Flow	N/A	Not applicable
IF	Intermittent Flow	L	liters
Oxygen Purity	Oxygen Purity is determined by internal bench-testing with V_t = 500 mL, I:E = 1:2	min	minute
		mL	milliters

Manufacturer	Product Name and Model	Intermittent Flow Delivered Volume at Selector Setting (in mL/breath unless otherwise noted)														
		0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	7	8	9
AirSep	FreeStyle, Model 3		228 mL/min		420 mL/min		500 mL/min									
	FreeStyle, Model 5		228 mL/min		420 mL/min		630 mL/min		840 mL/min		1000 mL/min					
	Focus				333 mL/min											
CAIRE SeQual	Eclipse, Model 3		16		32		48		64		80		96	128	160	192
DeVilbiss Healthcare	iGo, Model 306DS		14		28		42		56		70		84			
Inogen	Inogen One G2, Model IS-200		12.4		24.8		37.1		49.4		61.8					
	Inogen One G5, Model IS-300		12.4		24.8		37.1		49.4							
Inova Labs	LifeChoice Activox, Model XYC100B		10 ± 20%		20 ± 20%		30 ± 20%									
Invacare	Solo2 Portable Concentrator, Model XPO100B or XPO100		20 @ 20 BPM		40 @ 20 BPM		60 @ 20 BPM		80 @ 20 BPM		100 @ 20 BPM					
	XPO2 Portable Concentrator, Model XPO100B or XPO100		15 @ 20 BPM		23 @ 20 BPM		31 @ 20 BPM		37 @ 20 BPM		42 @ 20 BPM					
O2 Concepts	Oxlife Independence, Model 800-0001-1	8	16	24	32	40	48	56	64	72	80	88	96			
Oxus	Oxus POC, Model RS-00400		8.5	12.75	17	21.25	25.5	29.75	34	38.25	42.5					
Philips Respironics	Simply Go, Model 1068987		12	18	24	30	36	42	48	54	60	66	72			
Precision Medical	EasyPulse POC, Model PM4150		12 @ 20 BPM 8 @ 30 BPM		19 @ 20 BPM 13 @ 30 BPM		26 @ 20 BPM 17 @ 30 BPM		33 @ 20 BPM 22 @ 30 BPM		39 @ 20 BPM 26 @ 30 BPM					

Definitions

BPM	Breaths/minutes	lbs	pounds
CF	Continuous Flow	N/A	Not applicable
IF	Intermittent Flow	L	liters
Oxygen Purity	Oxygen Purity is determined by internal bench-testing with V_t = 500 mL, I:E = 1:2	min	minute
		mL	milliters

Manufacturer	Product Name and Model	Oxygen Purity at Lowest Setting:	Oxygen Purity at Highest Setting:	Oxygen Purity at Lowest Setting:	Oxygen Purity at Highest Setting:	Oxygen Purity at Lowest Setting:	Oxygen Purity at Highest Setting:
		12 BPM		20 BPM		30 BPM	
AirSep	FreeStyle, Model 3	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5
	FreeStyle, Model 5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5
	Focus	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5
CAIRE SeQual	Eclipse, Model 3	87%–95.5%	87%–95.5%	87%–95.5%	87%–95.5%	87%–95.5%	87%–95.5%
DeVilbiss Healthcare	iGo, Model 306DS	* At 10 BMP: Setting 1 -AC, Battery, and Auto Adapter = 92.6%		* At 20 BMP: Setting 3 -AC, Battery = 91.1% -Auto Adapter = 90.9%		* At 30 BMP: Setting 6 -AC = 91.1% -Battery, Auto Adapter = 90.4%	
Inogen	Inogen One G2, Model IS-200	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6
	Inogen One G5, Model IS-300	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6
Inova Labs	LifeChoice Activox, Model XYC100B	90 ± 3%	90 ± 3%	90 ± 3%	90 ± 3%	90 ± 3%	90 ± 3%
Invacare	Solo2 Portable Concentrator, Model XPO100B or XPO100	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6
	XPO2 Portable Concentrator, Model XPO100B or XPO100	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6	90% -3/+6
O2 Concepts	Oxlife Independence, Model 800-0001-1	93 ± 3%	93 ± 3%	93 ± 3%	93 ± 3%	93 ± 3%	93 ± 3%
Oxus	Oxus POC, Model RS-00400	87 - 96%	87 - 96%	87 - 96%	87 - 96%	87 - 96%	87 - 96%
Philips Respironics	Simply Go, Model 1068987	> 87 %	> 87%	> 87 %	> 87%	> 87 %	> 87%
Precision Medical	EasyPulse POC, Model PM4150			95% 94% 95% 94%		95% 94% 95% 94%	

Definitions

BPM	Breaths/minutes	lbs	pounds
CF	Continuous Flow	N/A	Not applicable
IF	Intermittent Flow	L	liters
Oxygen Purity	Oxygen Purity is determined by internal bench-testing with V_t = 500 mL, I:E = 1:2	min mL	minute milliters

Manufacturer	Product Name and Model	Other Breathing Rates as Published by Manufacturer	Oxygen Purity at Lowest Setting:	Oxygen Purity at Highest Setting:	Manufacturer Notes *
AirSep	FreeStyle, Model 3				* Oxygen concentration is the same for all breathing rates because the unit produces a set per minute volume
	FreeStyle, Model 5				
	Focus				
CAIRE SeQual	Eclipse, Model 3				*If the maximum breath rates are exceeded for the correlating bolus size, the O_2 concentration will begin to drift outside of 87%-95.5%. The exact rate as to how far this concentration will drop is not defined.
DeVilbiss Healthcare	iGo, Model 306DS	20 BPM	91%+	91%+	*Bolus size delivery specification is based on delivery at the end of 35 foot tubing
Inogen	Inogen One G2, Model IS-200				
	Inogen One G5, Model IS-300				
Inova Labs	LifeChoice Activox, Model XYC100B				
Invacare	Solo2 Portable Concentrator, Model XPO100B or XPO100				
	XPO2 Portable Concentrator, Model XPO100B or XPO100	35 BPM	90% -3/+6	90% -3/+6	
O2 Concepts	Oxlife Independence, Model 800-0001-1				
Oxus	Oxus POC, Model RS-00400				
Philips Respironics	Simply Go, Model 1068987	10 to 40 BPM	> 87%	> 87%	* Device will deliver > 87 % O_2 to the cannula line for any breath rate between 10 to 40.
Precision Medical	EasyPulse POC, Model PM4150				* The EasyPulse POC setting volume specifications, as stated in their literature, are in minute volume. To determine bolus size at a specific breath rate, you divide minute volume by the breath rate.

Definitions

BPM	Breaths/minutes	lbs	pounds
CF	Continuous Flow	N/A	Not applicable
IF	Intermittent Flow	L	liters
Oxygen Purity	Oxygen Purity is determined by internal bench-testing with V_t = 500 mL, I:E = 1:2	min	minute
		mL	milliters

Manufacturer	AirSep		
Product Name and Model	**FreeStyle, Model 3**	**FreeStyle, Model 5**	**Focus**
Type of Device:			
POC delivery mode: **IF Only or CF and IF**	**IF** Only	IF Only	IF Only
Weight of Unit:			
Without Battery	N/A	N/A	1.75 lbs
With Battery	(Internal Battery) 4.4 lbs	(Internal Battery) 6.2 lbs	2.82 lbs
The numerical range on the selector switch:	1 to 3	1 to 5	2 to 2
How Calibrated:			
Unit of Measure for Each Setting:	Reference Points Only	Reference Points Only	Reference Points Only
Is the device capable of providing **both** IF and CF?	No	No	No
List the delivered volume for all numerical settings when in the IF mode:			
Setting/ BOLUS Size (in mLs)			
1	228 mLs/minute	228 mLs/minute	
2	420 mLs/minute	420 mLs/minute	333 mLs/minute
3	500 mLs/minute	630 mLs/minute	
4		840 mLs/minute	
5		1000 mLs/minute	
Manufacturer Notes *	*Bolus size (in mLs) is variable and changes with the patient's breathing rate to provide a fixed minute volume of oxygen * Focus, FreeStyle, and FreeStyle 5 units manufacture and deliver a constant per minute volume of oxygen for each setting. As a patient's breath rate changes, the amount of oxygen that they are receiving per bolus varies, yet the total amount received per minute remains constant.		
Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):			
At 12 breaths per minute:			
Oxygen purity at lowest setting:	90% -3/+5.5	90%-3/+5.5	90% -3/+5.5
Oxygen purity at highest setting:	90% -3/+5.5	90%-3/+5.5	90% -3/+5.5
At 20 breaths per minute:			
Oxygen purity at lowest setting:	90% -3/+5.5	90%-3/+5.5	90% -3/+5.5
Oxygen purity at highest setting:	90% -3/+5.5	90%-3/+5.5	90% -3/+5.5
At 30 breaths per minute:			
Oxygen purity at lowest setting:	90% -3/+5.5	90%-3/+5.5	90% -3/+5.5
Oxygen purity at highest setting:	90% -3/+5.5	90% -3/+5.5	90% -3/+5.5
Other breathing rate:			
Please specify the breathing rate that you do use:_____ breaths per minute			
Oxygen purity at lowest setting:			
Oxygen purity at highest setting:			
Manufacturer Notes*	*Oxygen concentration is the same for all breathing rates because the unit produces a set per minute volume		

FreeStyle Model 3

FreeStyle Model 5

Focus

Manufacturer	CAIRE SeQual
Product Name and Model	**Eclipse, Model 3**

Type of Device:

POC delivery mode: **IF Only or CF and IF** — CF and IF

Weight of Unit:

Without Battery	15 lbs
With Battery	18.4 lbs

The numerical range on the selector switch: 0.5 to 3 for CF; 1 to 9 for IF

How Calibrated:

Unit of Measure for Each Setting: L/min for CF; mL/breath for IF

Is the device capable of providing **both** IF and CF? Yes

List the delivered volume for all numerical settings when in the IF mode:

Setting	BOLUS Size (in mLs)
1	16
2	32
3	48
4	64
5	80
6	96
7	128
8	160
9	192

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):

At 12 breaths per minute:
Oxygen purity at lowest setting: 87% - 95.5%
Oxygen purity at highest setting: 87% - 95.5%

At 20 breaths per minute:
Oxygen purity at lowest setting: 87% - 95.5%
Oxygen purity at highest setting: 87% - 95.5%

At 30 breaths per minute:
Oxygen purity at lowest setting: 87% - 95.5%
Oxygen purity at highest setting: 87% - 95.5%

Other breathing rate:
Please specify the breathing rate that you do use:_____ breaths per minute
Oxygen purity at lowest setting:
Oxygen purity at highest setting:

Manufacturer Notes*

*If the maximum breath rates are exceeded for the correlating bolus size, the O_2 concentration will begin to drift outside of 87%- 95.5%. The exact rate as to how far this concentration will drop is not defined.

Manufacturer	DeVilbiss Healthcare
Product Name and Model	**iGO Model 306DS**

Type of Device:

POC delivery mode: **IF Only or CF and IF** — CF and IF

Weight of Unit:

Without Battery	15.5 lbs
With Battery	19 lbs

The numerical range on the selector switch: — 1 to 3 for CF
1 to 6 for IF

How Calibrated:

Unit of Measure for Each Setting: — L/min for CF
mL/breath for IF

Is the device capable of providing **both** IF and CF? — Yes

List the delivered volume for all numerical settings when in the IF mode:

Setting	BOLUS Size (in mLs)
1	14
2	28
3	42
4	56
5	70
6	84

Manufacturer Notes*

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):

At 12 breaths per minute:
Oxygen purity at lowest setting: — *At 10 breaths/min: Setting 1
-AC Adapter, Battery Power, Auto Adapter= 92.6%

At 20 breaths per minute:
Oxygen purity at lowest setting: — *At 20 breaths/min: Setting 3
-AC Adapter and Battery Power= 91.1%
-Auto Adapter= 90.9%

At 30 breaths per minute:
Oxygen purity at lowest setting: — *At 30 breaths/min: Setting 6
-AC Adapter= 91.1%
-Battery Power and Auto Adapter= 90.4%

Other breathing rate:
Please specify the breathing rate that you do use:_____ breaths per minute — At 20 breaths per minute:
Oxygen purity at lowest setting: — 91%+
Oxygen purity at highest setting: — 91%+

Manufacturer Notes* *Bolus size delivery specification is based on delivery at the end of 35-foot tubing.

Manufacturer	Inogen	
Product Name and Model	**Inogen One G2, Model IS-200**	**Inogen One G3, Model IS-300**
Type of Device:		
POC delivery mode: **IF Only or CF and IF**	IF Only	IF Only
Weight of Unit:		
Without Battery	5.6 lbs	3.5 lbs
With Battery	7.5 lbs	4.8 lbs
The numerical range on the selector switch:	1 to 5	1 to 4
How Calibrated:		
Unit of Measure for Each Setting:	Reference Points Only	Reference Points Only
Is the device capable of providing **both** IF and CF?	No	No

List the delivered volume for all numerical settings when in the IF mode:

Setting	BOLUS Size (in mLs)	BOLUS Size (in mLs)
1	12.4	12.4
2	24.8	24.8
3	37.1	37.1
4	49.4	49.4
5	61.8	

Manufacturer Notes * *At 17 breaths per minute (210 mL per minute setting)

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):

At 12 breaths per minute:		
Oxygen purity at lowest setting:	90% -3/+6	90% -3/+6
Oxygen purity at highest setting:	90% -3/+6	90% -3/+6
At 20 breaths per minute:		
Oxygen purity at lowest setting:	90% -3/+6	90% -3/+6
Oxygen purity at highest setting:	90% -3/+6	90% -3/+6
At 30 breaths per minute:		
Oxygen purity at lowest setting:	90% -3/+6	90% -3/+6
Oxygen purity at highest setting:	90% -3/+6	90% -3/+6

Other breathing rate:
Please specify the breathing rate that you do use:_____
breaths per minute
Oxygen purity at lowest setting:
Oxygen purity at highest setting:

Inogen One G2

Inogen One G3

Manufacturer	Inova Labs
Product Name and Model	**LifeChoice Activox, Model XYC100B**

Type of Device:

POC delivery mode: **IF Only or CF and IF** — IF only

Weight of Unit:

Without Battery	N/A
With Battery	(Internal Battery) 4.83 lbs

The numerical range on the selector switch: 1 to 3

How Calibrated:

Unit of Measure for Each Setting: 10 mL/breath

Is the device capable of providing **both** IF and CF? No

List the delivered volume for all numerical settings when in the IF mode:

Setting	BOLUS Size (in mLs)
1	10 mL/breath ± 20%
2	20 mL/breath ± 20%
3	30 mL/breath ± 20%

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):

At 12 breaths per minute:
Oxygen purity at lowest setting: 90 ± 3%
Oxygen purity at highest setting: 90 ± 3%

At 20 breaths per minute:
Oxygen purity at lowest setting: 90 ± 3%
Oxygen purity at highest setting: 90 ± 3%

At 30 breaths per minute:
Oxygen purity at lowest setting: 90 ± 3%
Oxygen purity at highest setting: 90 ± 3%

Other breathing rate:
Please specify the breathing rate that you do use:_____
breaths per minute
Oxygen purity at lowest setting:
Oxygen purity at highest setting:

Manufacturer	Invacare	
Product Name and Model	**Solo2 Portable Concentrator, Model TP0100B**	**XP02 Portable Concentrator, Model XP0100B or XP0100**
Type of Device:		
POC delivery mode: **IF Only or CF and IF**	CF and IF	IF Only
Weight of Unit:		
Without Battery	17 lbs	N/A
With Battery	19.9 lbs	6 lbs
The numerical range on the selector switch:	1 to 5 for IF 0.5 to 3 LPM for CF	1 to 5
How Calibrated:		
Unit of Measure for Each Setting:	L/min for CF mL/min for IF	mL/min
Is the device capable of providing **both** IF and CF?	Yes	No

List the delivered volume for all numerical settings when in the IF mode:

Setting	BOLUS Size (in mLs)	BOLUS Size (in mLs)
1	20 @ 20 BPM	15 @ 20 BPM
2	40 @ 20 BPM	23 @ 20 BPM
3	60 @ 20 BPM	31 @ 20 BPM
4	80 @ 20 BPM	37 @ 20 BPM
5	100 @ 20 BPM	42 @ 20 BPM

Manufacturer Notes *

*Fixed Minute Volume Technology

*Invacare uses fixed minute volume technology in their pulse dose devices. Each setting will deliver a fixed amount of oxygen over the course of a minute; individual bolus amounts will be determined by the breath rate of the patient over the course of that minute.

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):

At 12 breaths per minute:		
Oxygen purity at lowest setting:	90% -3/+6	90% -3/+6
Oxygen purity at highest setting:	90% -3/+6	90% -3/+6
At 20 breaths per minute:		
Oxygen purity at lowest setting:	90% -3/+6	90% -3/+6
Oxygen purity at highest setting:	90% -3/+6	90% -3/+6
At 30 breaths per minute:		
Oxygen purity at lowest setting:	90% -3/+6	90% -3/+6
Oxygen purity at highest setting:	90% -3/+6	90% -3/+6
At 35 breaths per minute:		
Oxygen purity at lowest setting:	N/A	90% -3/+6
Oxygen purity at highest setting:	N/A	90% -3/+6

Solo2

XPO2

Manufacturer	O2 Concepts
Product Name and Model	**Oxlife Independence, Model 800-0001-1**

Type of Device:

POC delivery mode: **IF Only or CF and IF** — CF and IF

Weight of Unit:

Without Battery	16.7 lbs
With Battery	19.4 lbs

The numerical range on the selector switch: 0.5 to 6.0 for IF, 0.5 to 3.0 for CF

How Calibrated:

Unit of Measure for Each Setting: L/min for CF, mL/breath for IF

Is the device capable of providing **both** IF and CF? Yes

List the delivered volume for all numerical settings when in the IF mode:

Setting	BOLUS Size (in mLs)
0.5	8
1	16
1.5	24
2	32
2.5	40
3	48
3.5	56
4	64
4.5	72
5	80
5.5	88
6	96

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):

At 12 breaths per minute:
Oxygen purity at lowest setting: 93 ± 3%
Oxygen purity at highest setting: 93 ± 3%

At 20 breaths per minute:
Oxygen purity at lowest setting: 93 ± 3%
Oxygen purity at highest setting: 93 ± 3%

At 30 breaths per minute:
Oxygen purity at lowest setting: 93 ± 3%
Oxygen purity at highest setting: 93 ± 3%

Other breathing rate:
Please specify the breathing rate that you do use:_____
breaths per minute
Oxygen purity at lowest setting:
Oxygen purity at highest setting:

Manufacturer	Oxus
Product Name and Model	Oxus POC, Model RS-00400

Type of Device:

POC delivery mode: **IF Only or CF and IF** — IF Only

Weight of Unit:

Without Battery	8.4 lbs
With Battery	9.9 lbs

The numerical range on the selector switch: 1 to 5 in 0.5 steps

How Calibrated:

Unit of Measure for Each Setting: mL/breath

Is the device capable of providing **both** IF and CF? No

List the delivered volume for all numerical settings when in the IF mode:

Setting	BOLUS Size (in mLs)
1	8.5
1.5	12.75
2	17
2.5	21.25
3	25.5
3.5	29.75
4	34
4.5	38.25
5	42.5

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):

At 12 breaths per minute:
Oxygen purity at lowest setting: 87 - 96%
Oxygen purity at highest setting: 87 - 96%

At 20 breaths per minute:
Oxygen purity at lowest setting: 87 - 96%
Oxygen purity at highest setting: 87 - 96%

At 30 breaths per minute:
Oxygen purity at lowest setting: 87 - 96%
Oxygen purity at highest setting: 87 - 96%

Other breathing rate:
Please specify the breathing rate that you do use:_____
breaths per minute
Oxygen purity at lowest setting:
Oxygen purity at highest setting:

Manufacturer	Philips Respironics
Product Name and Model	Simply Go, Model 1068987

Type of Device:

POC delivery mode: **IF Only or CF and IF** — CF and IF

Weight of Unit:

Without Battery	8.5 lbs
With Battery	10 lbs

The numerical range on the selector switch: 0.5 to 2.0 for CF; 1 to 6 for IF

How Calibrated:

Unit of Measure for Each Setting: L/min for CF; mL/breath for IF

Is the device capable of providing **both** IF and CF? Yes

List the delivered volume for all numerical settings when in the IF mode:

Setting	BOLUS Size (in mLs)
1	12
1.5	18
2	24
2.5	30
3	36
3.5	42
4	48
4.5	54
5	60
5.5	66
6	72

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):

At 12 breaths per minute:
Oxygen purity at lowest setting: > 87%
Oxygen purity at highest setting: > 87%

At 20 breaths per minute:
Oxygen purity at lowest setting: > 87%
Oxygen purity at highest setting: > 87%

At 30 breaths per minute:
Oxygen purity at lowest setting: > 87%
Oxygen purity at highest setting: > 87%

Other breathing rate:
Please specify the breathing rate that you do use:_____ 10 to 40 breaths per minute
Oxygen purity at lowest setting: > 87%
Oxygen purity at highest setting: > 87%

Manufacturer Notes* * Device will deliver > 87% O_2 to the cannula line for any breath rate between 10 to 40.

Manufacturer	Precision Medical
Product Name and Model	EasyPulse POC, Model PM4150

Type of Device:

POC delivery mode: **IF Only or CF and IF** — IF Only

Weight of Unit:

Without Battery	N/A
With Battery	(Internal Battery) 6.8 lbs

The numerical range on the selector switch: 0 to 5

How Calibrated:

Unit of Measure for Each Setting: L/min

Is the device capable of providing **both** IF and CF? No

List the delivered volume for all numerical settings when in the IF mode:

Setting	BOLUS Size (in mLs)	At 20 BPM	At 30 BPM
1		12 @ 20 BPM	8 @ 30 BPM
2		19 @ 20 BPM	13 @ 30 BPM
3		26 @ 20 BPM	17 @ 30 BPM
4		33 @ 20 BPM	22 @ 30 BPM
5		39 @ 20 BPM	26 @ 30 BPM

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E= 1:2):

At 20 breaths per minute:		
Oxygen purity at lowest setting:	95%	95%
Oxygen purity at highest setting:	94%	94%
At 30 breaths per minute:		
Oxygen purity at lowest setting:	95%	95%
Oxygen purity at highest setting:	94%	94%

Other breathing rate:

Please specify the breathing rate that you do use:_____ breaths per minute

Oxygen purity at lowest setting:

Oxygen purity at highest setting:

Manufacturer Notes*

*The EasyPulse POC setting volume specifications, as stated in their literature, are in minute volume. To determine bolus size at a specific breath rate, you divide minute volume by the breath rate.

Appendix 1

AMERICAN ASSOCIATION FOR RESPIRATORY CARE

Survey of Home Oxygen Equipment Performance Characteristics

Use one survey per product

The survey is being sent to the manufacturers of portable devices used to deliver long-term oxygen therapy via continuous flow (CF), intermittent/pulse flow (IF), or both modes. Such equipment would include the following:

- ***Portable oxygen concentrators (POCs) delivering IF only, or***
- ***Portable oxygen concentrators (POCs) capable of delivering both CF and IF***

Some will receive more than one survey instrument since we have you listed as manufacturing more than one such device, and one survey per specific model is requested. If you need additional survey instruments, we will be happy to accommodate your request.

Manufacturer: _____

Product Name: _____ **Model:** _____

Type of Device:

____ POC delivering IF only ____ POC delivering both CF and IF

What is the numerical range on the selector switch? _____ to _____

How Calibrated:

What is the unit of measure for each setting?

_____ L/min _____ mL/breath _____ reference points only

Is the device capable of providing **both** IF and CF? _____ Yes

List the delivered volume for all numerical settings when in the IF mode:

SETTING	BOLUS SIZE (in mLs)	SETTING	BOLUS SIZE (in mLs)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Oxygen Purity (as determined by internal bench-testing with V_t = 500 mL, I:E = 1:2):

At 12 breaths per minute:

Oxygen purity at lowest setting: _____ %

Oxygen purity at highest setting: _____ %

At 20 breaths per minute:

Oxygen purity at lowest setting: _____ %

Oxygen purity at highest setting: _____ %

At 30 breaths per minute:

Oxygen purity at lowest setting: _____ %

Oxygen purity at highest setting: _____ %

Other breathing rate:

Please specify the breathing rate that you do use: _____ breaths per minute

Oxygen purity at lowest setting: _____ %

Oxygen purity at highest setting: _____ %

PLEASE NOTE: We respect your need to avoid sharing proprietary information about your products. Should you choose not to respond to this survey, we cordially ask that you mark the appropriate reason below and return the survey. This action will allow your company to be identified as a respondent. All respondents will be provided a copy of the survey results.

_____ This is proprietary information and not for public disclosure.

_____ The information is available on our website.

_____ The information is available in our product literature.

Other (PLEASE EXPLAIN): _____

This survey is funded by the American Association for Respiratory Care in order to educate patients, providers and policymakers about the wide range of product choices currently available in the marketplace and the significant progress that has been made by the various manufacturers of long-term oxygen equipment.

Free Audiobook

The American Association for Respiratory Care
as a long-time friend and colleague of the late

Dr. Thomas Petty

is both honored and privileged to provide his final book,

"Adventures of an Oxy-Phile2,"
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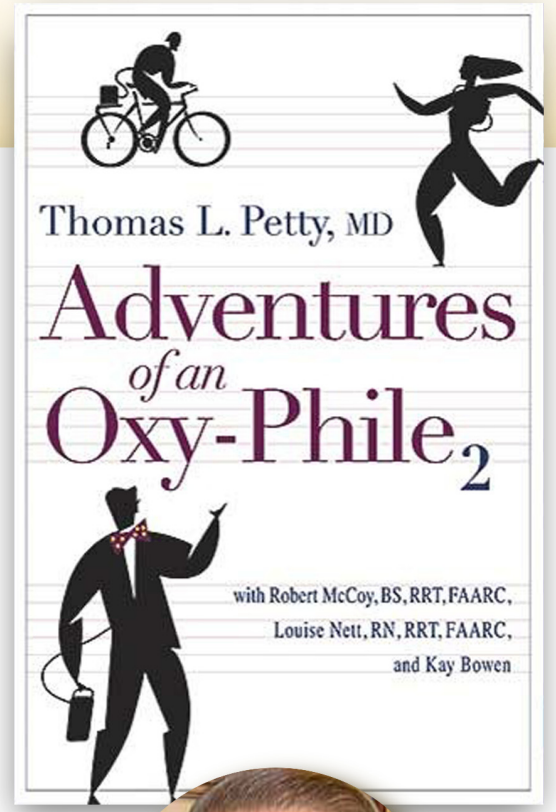

@ www.aarc.org/go/nd1

Additional Oxygen Resources

are available online via the AARC's journal, Respiratory Care.

Visit the AARC's journal, Respiratory Care @

http://rc.rcjournal.com/content/58/1.toc

Access The 50th Respiratory Care Journal Conference OXYGEN SPECIAL ISSUE.

Co-Chairs Richard D Branson MSc RRT FAARC and John E Heffner MD

- John E Heffner: The Story of Oxygen
- Robert L Owens: Supplemental Oxygen Needs During Sleep. Who Benefits?
- Gerard J Criner: Ambulatory Home Oxygen: What Is the Evidence for Benefit, and Who Does It Help?
- Robert W McCoy: Options for Home Oxygen Therapy Equipment: Storage and Metering of Oxygen in the Home
- Richard D Branson and Jay A Johannigman: Pre-Hospital Oxygen Therapy
- Jeffrey J Ward: High-Flow Oxygen Administration by Nasal Cannula for Adult and Perinatal Patients
- Richard H Kallet and Michael A Matthay: Hyperoxic Acute Lung Injury
- Neil R MacIntyre: Supporting Oxygenation in Acute Respiratory Failure
- Nelson Claure and Eduardo Bancalari: Automated Closed Loop Control of Inspired Oxygen Concentration
- Ross P Martini, Steven Deem, and Miriam M Treggiari: Targeting Brain Tissue Oxygenation in Traumatic Brain Injury
- Thomas C Blakeman and Richard D Branson: Oxygen Supplies in Disaster Management
- Kevin R Ward, Gary S Huvard, Mark McHugh, Rajender R Mallepally, and Richard Imbruce: Chemical Oxygen Generation
- David J Pierson: Oxygen in Respiratory Care: A Personal Perspective from 40 Years in the Field

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