



The Oxylator: An innovative oxygen delivery device

By Jeffrey Lindsey, PhD, EMT-P

The Oxylator sounds like a movie starring Arnold Schwarzenegger as a paramedic. However, unlike his role in *The Terminator*, as *The Oxylator*, Schwarzenegger would defeat illnesses as a result of his effective oxygen delivery to patients. Actually, the Oxylator isn't a fictional movie character, but an innovative oxygen delivery device that adjusts for changes in lung compliance.

The Oxylator offers a number of advantages over other airway management tools, and, therefore, can effectively be used to conquer the causes of death.

Patient care & safety: The “feel of the bag” has been one of the only ways providers have had to determine lung compliance changes. However, this subjective technique varies with experience. It can also differ with each manufacturer's bag-valve mask (BVM). With a BVM, it's often difficult to teach and achieve a common, across-the-board understanding of how to determine changes in lung compliance.

The Oxylator positive pressure resuscitation and inhalation systems use a patented, patient responsive technology that eliminates this problem. The Oxylator EM-100 and EMX systems operate with a mask, ET-tube or other airway device (see photo, p. 101, top left). They aren't demand valves

or ventilators but, instead, represent a new technology: pressure-limited/flow-triggered ventilation devices designed to replace the BVM during CPR/resuscitation and during patient transport.

Oxyiators are small, lightweight, rugged, easy to use and easy to decontaminate. They're ideal for confined space or toxic environment (or terrorism) rescue because of their design versatility. They require no power source other than a 50-PSI supply of compressed oxygen or air. Yes, that's right—air. A unique SCBA regulator that has two 50-PSI DISS ports is included with the Hazmat Oxylator Resuscitation Kit (LSI part # CPR-11), which allows you to use two Oxyiators in hazmat, terrorism or MCI operations where extended, closed ventilation is required and limited oxygen supply is available.

How it works: Once caregivers adjust the Oxylator EM-100 (delivering a consistent 600 cc/sec.) or the Oxylator EMX (delivering a consistent 500 cc/sec.) to attain a 1.5- to two-second inhalation time (“I” time) for the patient, the device provides consistent ventilation with each breath (EM-100 = ~900–1,200 cc/mL; EMX = ~750 cc–1,000 cc/mL).

The Oxylator technology tells the caregiver more than a traditional BVM does

The Oxylator uses a patented, patient-responsive technology to detect changes in lung compliance.

about the patient and changes in lung compliance. The properly trained crew who notices a breath per minute (BPM) rate change or shortening or lengthening of the “I” time will be alert for the following possible causes of this compliance change.

Shortening of the “I” time may indicate:

- That the patient's positional change offers an increased cm/H₂O resistance to adequate lung ventilation;
- An overall stiffer lung, possibly caused by increased fluid levels in the lung or a partial obstruction or occlusion;
- A possible collapsed lung; or
- Positioning or drifting of an endotracheal tube into the right main stem bronchi.

Lengthening of the “I” time or no cycle may indicate:

- That the patient's positional change offers *decreased* cm/H₂O resistance to adequate lung ventilation; and
- The cuff of a device has possibly deflated or the ET tube has become dislodged. Are you filling the stomach with air? Check the cuff's inflation, and then observe how much of the tube protrudes from the patient's mouth. If the ET tube is properly positioned, the cuff is adequately inflated and there's still an extended lengthening of the “I” time, the following should be considered:
 - a. A possible disconnect or other leak in the airway system;
 - b. O₂ tank capacity below 50 PSI, causing slower flows and extending “I” times;
 - c. Possible pneumothorax; or
 - d. A drug administered to improve lung compliance is now taking effect.



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PHOTOS COURTESY LSI



The Oxylator EM-100 and EMX systems operate with a mask, ET-tube or other airway device.



The Oxylator can use a special SCBA regulator to deliver sustained ventilation to patients.

Hands-free use: The Oxylator's hands-free cycling ventilation not only provides the efficiency of a ventilator during transport, but its accommodating technology prevents the potential for guessing wrong on the patient's inhalation:exhalation (I:E) ratios. Thus, "stacking" of breaths or trapping of air is prevented, even in less experienced, tired, distracted or excited hands. The stacking problem can occur with other ventilation devices, like the BVM, demand valves and many vents, but not with the Oxylator EM-100 or Oxylator EMX.

Use during CPR: One of the nicest things about the Oxylator is that it's designed to be used during CPR. The Oxylator offers another "set of hands" if you're caught in a situation when you might be required to do CPR by yourself while other team members are busy with their own victims or when you need to administer lifesaving medications or treatment while your partner performs CPR on the patient. The Oxylator's technology

cycles the patient's ventilation in sync with your chest compressions, thus delivering added volumes to the patient when needed. If it senses the pressure created by a compression, it holds the ventilation until immediately after it. An optional extension with 99.99% ("hepa" type) bacterial/viral filter (see photo lower right) and HME (heat moisture exchanger) with swivel (LSI part # CPR-29) allows you to filter out exhaled impurities as well as reduce drying of the patient's airways by trapping exhaled humidity to be returned to the patient on the following inhalation. This airway extension with filter/HME swivel also allows you to place the Oxylator on the stretcher next to the patient's head for easy access and viewing by the EMS personnel.

Consistent breaths or volumes: The provision of consistent breaths could be accomplished only by a ventilator prior to the introduction of the Oxylator technology. BVMs can't deliver consistent and proper volumes to a patient over an extended transport. Patients who might buck a vent won't buck the Oxylator because its technology works *with* the patient's natural breathing pattern, not against it.

Flow times: Lifesaving Systems Inc. (LSI) has determined approximate tank capacity run times for the Oxylator EMX. The manufacturer, CPR Medical Devices Inc., of Toronto, has indicated that the utilization of compressed gas by the Oxylator EMX varies between 10 and 12 liters per minute and is affected by the patient's inhalation lengths and I:E ratios. LSI, therefore, calculated approximate tank capacities using 11 liters per minute consumption rate. (See Table 1



Crews can use an SCBA tank to operate one or two Oxyلاتors when O₂ tank sources are depleted or can't be readily replenished.



PHOTO A.J. HEIGHTMAN

This optional extension offers a 99.99% bacterial viral filter and heat moisture exchanger.

below.) By comparison, LSI indicates that a "D" tank capacity (~396 L) at normal flows will last approximately 15 minutes when used with a BVM.

Mass casualty situations: During confined space rescues or multiple casualty situations, the Oxylator EM-100 or Oxylator EMX can be invaluable. Rescue personnel in Turkey used Oxylator EM-100s during the aftershocks of the recent earthquakes, and the Department of Homeland Security's National Medical Response Teams (NMRTs) have found the Oxyلاتors easy to operate, safe and efficient even when used by rescuers in bulky hazmat suits and wearing thick gloves.

SCBA regulator with two 50 PSI

Table 1: O ₂ Tanks	Tank Type	Capacity	Run Time
(~2,000 psig)	C Tank	~240 L	~21 minutes
(~3,000 psig)	C Tank	~360 L	~32 minutes
(~2,000 psig)	D Tank	~396 L	~36 minutes
(~2,000 psig)	Jumbo D Tank	~635 L	~57 minutes
(~3000 psig)	DD Lite	~717 L	~65 minutes

Table 2	Tank Type	Capacity	Run Time
(~2,216 psig)	SCBA Tank (45 SCF)	~1,274 L	~115 minutes/1.75 hrs*
(~3,000 psig)	SCBA Tank (59 SCF)	~1,670 L	~151 minutes/2.32 hrs*
(~4,500 psig)	SCBA Tank (45 SCF)	~1,274 L	~115 minutes/1.77 hrs*
	SCBA Tank (66 SCF)	~1,868 L	~169 minutes/2.59 hrs*
	SCBA Tank (87 SCF)	~2,463 L	~223 minutes/3.42 hrs*

*Divide run time by two if operating two Oxylator EMXs on the SCBA regulator supplied by LSI
 Source: The 1995 National Safety Council's booklet, *Oxygen Administration*, Chapter 3: "Equipment Characteristics," p. 16.

DISS ports: The SCBA regulator (LSI part # CPR-5) is used by NMRTs, Metropolitan Medical Response Systems (MMRSs) and the National Guard WMD/CSTs. In a mass casualty situation resulting from a chemical inhalation, this regulator offers crews a back-up option: They can use an SCBA tank to operate one or two Oxyiators when O₂ tank sources are depleted or can't be readily replenished. During a cyanide attack, this setup can ventilate two patients from a single SCBA for almost an hour (115 minutes divided by two).

Oxyiators can be supplied with Butyl rubber components for use in hazmat situations. They can also be set to operate in near silence if used in a tactical medicine or military environment. (*Note:* In this mode, the operator can observe the device's ventilation response by observing the small valve on top of it.)

SCBA calculation: Use the information in Table 2 (p. 101) to calculate the length of time SCBA tanks can provide air for patient ventilation (assuming 1 cubic foot [SCF] volume = 28.31685 L volume).

The Oxyiator weighs just 0.55 lbs., can be used on patients who weigh as little as 22 lbs. and comes with a five-year warranty.

Contact LSI at 866/699-5283 or via e-mail at Lsitcleve@aol.com, or visit www.lifesavingsystemsinc.com.



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