Emergency Medical Retrieval Service (EMRS)

www.emrs.scot.nhs.uk

Standard Operating Procedure
Public Distribution

<table>
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<th>Title</th>
<th>Oxylog 3000 &amp; 3000 Plus ventilator</th>
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<td>3</td>
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<tr>
<td>Related Documents</td>
<td>Oxygen SOP</td>
</tr>
<tr>
<td>Author</td>
<td>Corfield / Inglis / Thorpe/ Munro</td>
</tr>
<tr>
<td>Reviewer</td>
<td>C McKiernan</td>
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**Aims**
To ensure all staff are familiar with the capabilities and operation of the standard ventilator used by EMRS

**Background**
The Oxylog 3000 and 3000 Plus are electrically driven portable ventilators. They allow all commonly used modes of invasive and non-invasive ventilation.

**Application**
EMRS Team Members
SAS airwing paramedics

**Oxylog 3000 and Oxylog 3000+**
EMRS has both Oxylog 3000 and Oxylog 3000+ ventilators. These are essentially the same ventilators although the 3000+ has some additional functionality. A comparison of the control panels is shown below (Fig 2 & Fig 3)

A tutorial is available at

Both types of ventilator can ventilate adults or children >10kg (using specific blue Paediatric Disposable Hose set). The Oxylog 3000 Plus is kept set up for paediatric transfers with a paediatric disposable circuit attached. It is clearly identified with a laminate label (see picture)
Operation

See diagram on page 3

Pre use checks

- Fully charged (charging light on prior to use)
- Spare battery available for use
- Full self test (if time allows). When the Oxylog 3000 is first turned on, it will perform a brief self test (5-10 seconds). During this time, if the rotary knob is pressed, the machine will enter a full self test which takes approximately 2-3 minutes and requires the ventilator to be attached to an oxygen supply and test lung attached to ventilator
- Portable lightweight oxygen cylinder available & full (contains 300 litres oxygen)
- Ensure fresh disposable tubing has been attached. NB include catheter mount

Carriage

- The ventilator weighs 4.9 kg and should be stored securely on aircraft and in land ambulances
- There is a specific aeromedical bracket for use in the King Air and Helimed 5. This is now fitted as standard to Helimed 5 though this should be checked as part of the pre-mission equipment checks in case it has been removed for any reason. Bond engineers are required to fit the bracket to Helimed 5
- It may be prudent to phone ahead for the bracket to be fitted to King Air before a mission
- The handle can be attached to the side rails for transport of patient via SAS or hospital trolley

Turning on

- Press the on/off button in the bottom right hand corner.
- The ventilator will show a default of adult disposable hose/tubing set. Press the rotary knob to confirm or rotate to paediatric disposable hose/tubing and confirm if blue paediatric circuit in use.
- The ventilator will default to IPPV. To change ventilation mode, press the desired ventilation mode then press the rotary knob to confirm. Alternatively, the desired ventilation mode can be pressed and held for 3 seconds to change.
**Oxygen supply**

- The oxygen supply is via a standard Schraeder valve fitting which will fit all medical oxygen points in hospital as well as EMRS, SAS and military O₂ cylinders.
- The oxygen concentration for all modes of ventilation is controlled by the oxygen knob and can be varied continuously between 40% and 100%. To achieve O₂ concentrations below 100%, the ventilator will entrain outside air. If you wish to prevent this i.e. atmospheric contamination with smoke/pollutants either change the O₂ concentration to 100% or press the 100% O₂ button which will provide 3 minutes of 100% O₂ before defaulting to the original O₂ concentration.
- The EMRS portable lightweight oxygen cylinder contains 300 litres oxygen and will supply approximately 45 minutes IPPV at 12 x 500ml with 100% O₂. Caution should be exercised using non-invasive ventilation as this can use oxygen at very high rates (>30 litres/min) and quickly exhaust supplies.
1 Screen with screen pages for the specific application
2 Key » Alarms « for setting and displaying alarm limits
3 Key » Settings « for setting other ventilation parameters on the screen
4 Key for ventilation modes CPAP, CPAP/ASB (CPAP/PS)
5 Key for ventilation modes IPPV (CMV), IPPV Assist (CMV Assist)
6 Key for ventilation modes SIMV, SIMV/ASB (SIMV/PS)
7 Key for ventilation modes BiPAP (PCV+), BiPAP/ASB (PCV+/PS)
8 Red and yellow lamps as alarm indicators
9 Key » Δ « or muting the alarm tone for 2 minutes
10 Key » Alarm Reset « for acknowledging alarm messages
11 Key » O₂-Inhalat. « for changing over to O₂ inhalation or key » 100 % O₂ « for oxygenation
12 Key » Insp. hold « for manual inspiration
13 Key » Ø « for switching the ventilator ON/OFF
14 Display symbols for the power supply
   □ Status indicator of the internal battery
   ○ Mains power supply connected
15 Central rotary knob for making selections / settings and for confirming these
16 Control knob for setting the O₂ concentration » O₂ « to 40% or 100%
17 Control knob for setting the maximum inspiratory pressure » Pmax «
18 Control knob for setting the ventilation frequency » Freq. «
19 Control knob for setting the tidal volume » VT «
20 Key » Curves « for zooming the curve display and changing over between displayed "Flow" and "Paw" curves
21 Key » Values « for displaying measured values

Fig.1 (Above); Oxylog 3000

SOP- Oxylog 3000 & Oxylog 3000 Plus
**Ventilation modes**

The mode selected should:

Ensure adequate oxygenation by
- $\uparrow$ FiO$_2$
- $\uparrow$ PEEP (may increase PaCO$_2$ +/- cause hypotension)
- Use scale of FiO$_2$ : PEEP as a guide,

<table>
<thead>
<tr>
<th>FiO$_2$</th>
<th>0.4</th>
<th>0.45</th>
<th>0.5</th>
<th>0.55</th>
<th>0.6</th>
<th>0.65</th>
<th>0.7</th>
<th>0.75</th>
<th>0.8</th>
<th>0.85</th>
<th>0.9</th>
<th>1.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEEP</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- $\uparrow$ minute ventilation (e.g. if PaCO$_2$ also raised)
- change I:E ratio to 1:1 or reversing to 2:1 (may cause hypercapnia)

Ensure adequate gas exchange
- PaCO$_2 \propto 1/V_A$ i.e. to reduce PaCO$_2$, minute ventilation must be increased

Take account of patients underlying pathology
- avoid high levels of PEEP in asthma, pneumothoraces

Minimise lung injury
- Use baby lung concept
- Aim for tidal volumes ($V_t$) 4-6 ml/kg with PEEP +5 to +20
- Risk of hypercapnia
IPPV (Intermittent Positive Pressure Ventilation) 5
SIMV (Synchronised Intermittent Mandatory Ventilation) 6

Volume controlled ventilation. Each breath is delivered to a predetermined volume and volume not pressure. Rate and volume set by the operator. In SIMV mode, will support the patient’s own respiration by triggering an inspiration on a patient’s own breath. Both modes automatically default to provide PEEP +5

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tidal volume ($V_T$)</td>
<td>aim for c. 6 ml/kg</td>
</tr>
<tr>
<td>Frequency (f)</td>
<td></td>
</tr>
<tr>
<td>$P_{\text{max}}$</td>
<td>usually set at c. 40 mbar</td>
</tr>
<tr>
<td>PEEP</td>
<td>maintain at +5 unless oxygenation issue</td>
</tr>
<tr>
<td>Inspiratory / Expiratory (I:E) ratio</td>
<td>starts at 1:2</td>
</tr>
</tbody>
</table>

Minute volume = ($V_T \times f$)

BIPAP (BiLevel Positive Airway Pressure)

Pressure controlled ventilation.

Parameters

Inspiratory pressure (IPAP) – defaults to 20 mbar
Expiratory pressure (EPAP) – defaults to 5 mbar

CPAP (Continuous Positive Airway Pressure) +/- Assisted Spontaneous Breaths (ASB) 4

Constant background pressure support. Can be used with ASB to give pressure support on inspiration. Only used in spontaneously breathing patients, therefore EMRS use may be limited. Can be altered to provide non-invasive ventilation (NIV) via the settings screen.

**NB There is no background ventilation rate so the patient can become apnoeic!**

Parameters

$\Delta$ASB is the increment above of support above EPAP (cf ASB = IPAP) – usually start at +10
PEEP equivalent to Expiratory pressure (EPAP) – usually started at +5
PEEP & ASB are all changed via the settings screen and rotary knob.
**Alarm Codes**

3 different types

- **Top priority** – continuous flashing red LED with !!! display warning and audible warning repeated every 7 seconds until acknowledged by pressing 10
- **Medium priority** – continuous flashing yellow LED with !! display warning and audible warning repeated every 20 seconds until acknowledged by pressing 10
- **Low priority** – yellow LED lights with ! display warning and once only audible warning

Alarms can be silenced for 2 minutes by pressing 9. Alarm parameters are altered via alarm button 2

- In the event of ventilator failure, Helimed 5 and some land ambulances carry a basic ventilator which can be used as an emergency alternative.
- A bag valve mask should be carried with a ventilated patient at all times as a further alternative.

**Battery change**

- The Oxylog 3000 will deliver 4 hours operation from a fully charged battery. A spare battery should be carried to extend this to 8 hours operation.

- To change the battery, unscrew the screw (marked as 2 on diagram) and open the door. Remove the battery and replace with another battery. This can be done with the ventilator on,“hot swap”, and the ventilator settings will be saved and recommenced when the battery swap has been completed. A battery swap takes 5-10 seconds and patients would not normally need alternative ventilation during this time unless they are PEEP dependent.
**After use**

- Plug Oxylog 3000 back into power supply and ensure charging light appears on ventilator
- Ensure the spare battery is fully charged or recharged if it has been used
- Restore default dial settings – $V_t$ 500mls; Freq 12/min; $P_{\text{MAX}}$ 40
- Attach fresh set of disposable tubing including catheter mount

**Notes**

- The narrow hose (dual) on the side is the flow measuring hose and connects to the flow sensor next to the breathing valve. This sometimes disconnects.
- The angled connector between the flow sensor and the ETT/ filter must always be connected to ensure the flow meter measures accurately.
- Straps for adapting current face masks for use with non-invasive ventilation are stored with in the bag valve mask in the medical equipment pack.

**Oxylog charger**

- Consider taking the oxylog charger on prolonged missions, charging may be possible in King Air or most ambulances
- Oxylog battery indicators;

```markdown
<table>
<thead>
<tr>
<th>Control Lamp Indications</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red - off, Green - off</td>
<td>Charger is ready for use</td>
</tr>
<tr>
<td>Red - off, Green - on</td>
<td>Inserted battery is correct type and is currently being charged</td>
</tr>
<tr>
<td>Red - off, Green - blinks</td>
<td>Battery is charged and can be removed for use</td>
</tr>
<tr>
<td>Red - blinks, Green - on</td>
<td>The charger is discharging the battery as part of the automatic calibration cycle</td>
</tr>
<tr>
<td>Red - both blink, Green - both on</td>
<td>Battery not recognised as a Smart Battery, either a conventional battery is inserted or an extremely discharged Smart Battery, it will be reactivated within 5 mins and recharged. If this is not the case, both lamps will light- see below.</td>
</tr>
<tr>
<td>Red - on, Green - off</td>
<td>Battery is too hot or cold to be charged without damage. If the battery is too cold it will be charged as soon as it has warmed up sufficiently. If the battery is too hot it should be removed to cool down</td>
</tr>
<tr>
<td>Red - both on</td>
<td>Either - the battery is badly damaged and must be replaced, or - it is a conventional battery which cannot be recharged</td>
</tr>
</tbody>
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