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Operating Instructions for High Frequency Oscillatory Ventilation (HFOV)

Purpose To provide guidelines for the initiation of therapy and troubleshooting for the Sensormedics 3100A High Frequency Oscillatory Ventilator.

Audience Physicians, Nursing staff, and Licensed Respiratory Care Practitioners.

Scope

- The Sensormedics 3100A Oscillatory Ventilator is indicated for ventilatory support and treatment of respiratory failure and barotrauma in neonates who weigh between .500 and 4.6 kilograms and who are between 23 and 43 weeks gestational age.
- The Sensormedics 3100B Oscillatory Ventilator is approved for the treatment of acute respiratory failure in adults and children weighing >35kg.

Accountability

Licensed Respiratory Care Practitioners with understanding of age specific requirements of patient populations.

Special Training

Competency-Based training in the proper application and therapeutic use of High Frequency Oscillatory Ventilation.

Physician's Order Physician orders must include the following:

- Mean Airway Pressure (MAP)
 - Amplitude (Delta P)
 - Hertz (Hz)
 - FiO₂
 - Inspiratory Time (I.T.)
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Indications

- Neonatal Respiratory Distress Syndrome
- Persistent Pulmonary Hypertension
- Meconium Aspiration Syndrome

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- Congenital Diaphragmatic Hernia
Neonatal Lung Hypoplasia
- Neonatal Air Leak Syndrome
- Adult and Pediatric Acute Respiratory Failure

Goals

Improve and maintain oxygenation
 Eliminate CO₂ retention
 Create less lung injury

Adverse Effects

The adverse effects associated with high frequency oscillatory ventilation can be divided into three categories:

Pulmonary Barotrauma:

- Lung over-distention
- Bronchopulmonary dysplasia

- Atelectasis
- Pneumothorax
- Pneumopericardium
- Pneumomediastinum
- Pneumoperitoneum
- Pulmonary interstitial emphysema

Cardiovascular Effects:

- Decreased venous return
- Decreased cardiac output
- Increased pulmonary vascular resistance
Intraventricular hemorrhage

Removal of natural defense mechanisms with intubation:

- Contamination of ventilator circuits
- Contamination through suctioning
- Vocal cord paralysis, tracheal stenosis, Tracheomalacia, tracheal-esophageal fistula
- Necrotizing Tracheobronchitis

Equipment

- One SensorMedics 3100A or 3100B High Frequency Oscillator Ventilator
- One high-output humidifier with temperature feedback circuit.

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- One disposable breathing circuit with heated wire.
- One Oxygen/ Air Blender with 50 psi connections
- One Oxygen line with 50 psi connection (to drive bias gas flow)
- One Air line with 50 psi connection (to connect to the air cooling inlet)

Procedure

Refer to the appropriate equipment manual for assembly instructions.

Step	Action
1	Assemble the Sensormedic circuit as per diagram (Appendix I).
2	<ul style="list-style-type: none"> • Connect oxygen line from the 50-psi outlet on the external Air/ Oxygen blender to inlet on the rear panel of the 3100A ventilator. • Attach external Air/ Oxygen blender lines to the appropriate 50-psi wall source.
	<ul style="list-style-type: none"> • Attach air line from cooling inlet to an appropriate 50psi wall source.
Step	Action
3	<p><u>Perform circuit calibration:</u></p> <ul style="list-style-type: none"> • Insert stopper into the patient Y connection. • Turn Bias gas flow to 20 LPM. • Turn on the power. • Adjust Mean Pressure Limit to max. • Turn Mean Pressure Adjust to max. • Depress and hold reset. • Observe MAP display for a reading of 39-43 cm H₂O. Adjust bias gas flow slightly to achieve this pressure if necessary. <p>Failure to achieve this MAP indicates a leak in the circuit. Refer to troubleshooting section.</p>
4	<p><u>Initiating treatment:</u></p> <ul style="list-style-type: none"> • Start oscillator • Set <u>Frequency</u> (Hz) to desired rate. • Check that <u>Inspiratory Time</u> (I.T.) is set at 33%, unless otherwise directed by physician. • Adjust the <u>Power</u> knob to desired level. • For preterm infants, decrease bias flow to a minimum of 10L/min or until desired MAP is achieved. Use adjust knob to lower MAP once bias flow is at 10L/min (term infants and pediatric patients may

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require bias flow of 20L/min to ensure adequate gas flow; in these patients use the adjust knob to set MAP).

- Set pressure alarms 3 cm H₂O above and below the set MAP.
- Check inspired FiO₂ levels from the Air/ Oxygen blender on the side of the oscillator using a calibrated oxygen analyzer.
- Press start to begin HFOV once connected to the patient's endotracheal tube.
- Adjust Piston Control to keep piston in a central position (**3100A only**)
- Turn humidifier on and set in the invasive humidification mode.

Procedure Continued

Step	Action
5	Troubleshooting during circuit calibration: <ul style="list-style-type: none"> • Check that the water trap is closed. • Check that Bias Gas Flow is on 20 LPM. Increase Bias Flow slightly. • Remove and check the limit, control, and dump cap/diaphragm valves. Replace valves if circuit still fails to calibrate. • Replace circuit if it cannot be calibrated to 39-43 cm H₂O. • If there has been a disconnection, push reset/power and hold until oscillations resume.

Patient Management during HFOV

Step	Action
1	Positioning: <ul style="list-style-type: none"> • The Oscillator should be placed at the head of the patient's bed. • The brakes should be on at all times. • Use of an adult Bodai adapter allows for proper positioning and turning during patient therapy.
2	Patient Repositioning: <ul style="list-style-type: none"> • Patients should be individually assessed for frequency of repositioning.

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- When patient is stable, patients should be repositioned every 2-4 hours. Repositioning is to be done only at physician direction.
- A respiratory therapist will be present for all **major** repositioning of the infant (**ISCU only**)
- Avoid disconnection during repositioning.

Caution: Inadvertent disconnection from HFOV can cause alveolar collapse and loss of lung volume.

3

Suctioning:

In-line suction catheters will be used on patients during HFOV in order to maintain MAP.

Suction is done on an as needed basis only, unless otherwise directed by the physician.

Assessment of Outcome

1. Arterial, Venous and Capillary Blood Gas Values Pulse oximetry
2. Chest x-rays (optimal lung inflation is 8.5 – 9 ribs)
3. Sputum: Culture, amount, color, consistency

Infection Control

Follow procedures outlined in Healthcare Epidemiology Policies and Procedures #2.24; Respiratory Care Services.

<http://www.utmb.edu/policy/hcepidem/search/02-24.pdf>

Safety Precautions

Oxygen safety techniques as outlined in section 3.6 of this manual will be followed.

All alarms on ventilators will be activated at all times

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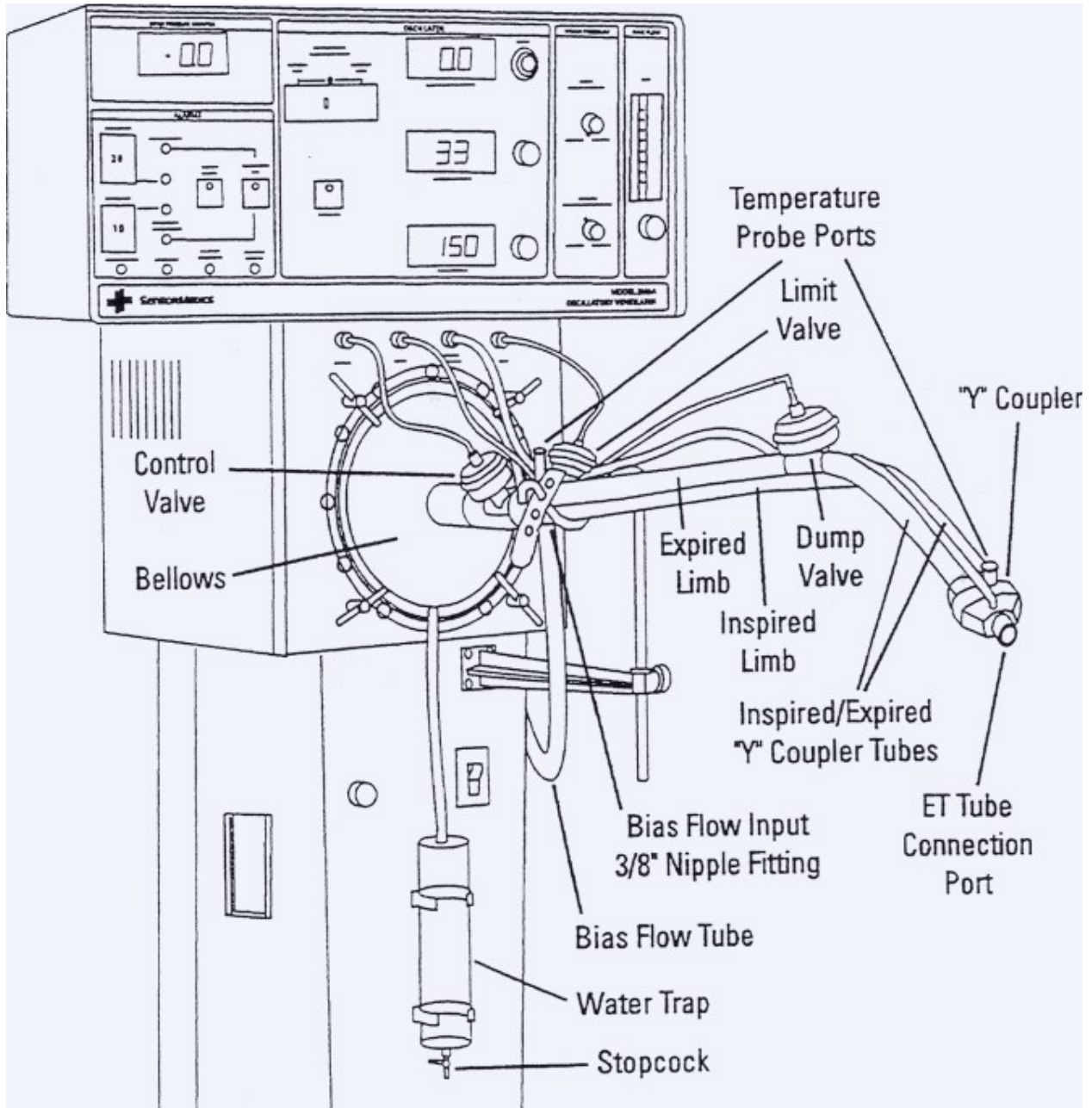
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APPENDIX I.



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