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 .540 and 4600 kilograms and who are between 24 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)
- FiO_2
- Inspiratory Time (I.T.)

Indications

Neonatal Respiratory Distress Syndrome
Persistent Pulmonary Hypertension
Meconium Aspiration Syndrome
Congenital Diaphragmatic Hernia
Neonatal Lung Hypoplasia
Neonatal Air Leak Syndrome

Adult and Pediatric Acute Respiratory Failure

Goals

Improve and maintain oxygenation
Eliminate CO_2 retention
Create less lung injury

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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.
One disposable breathing circuit with heated wire.
One manual water-feed system.
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	• 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.

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	• Attach air line from cooling inlet to an appropriate 50-psi wall source.
Step	**Action**
3	**<u>Perform circuit calibration:</u>** • 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 H_2O. Adjust bias gas flow slightly to achieve this pressure if necessary. **Failure to achieve this MAP indicates a leak in the circuit. Refer to troubleshooting section.**
4	**<u>Initiating treatment:</u>** • 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. • Once the physician has determined starting MAP, decrease the Bias flow rate to ~15L/min **(ISCU only)** • Adjust the <u>Mean Pressure Limit</u> knob (3100A) in a counter-clockwise fashion to a pressure of 18-22 cmH_2O **(ISCU only)** • Using the <u>Mean Pressure Adjust</u> knob set the MAP to the desired setting. • Set pressure alarms 4 cm H_2O above and below the set MAP. • Check inspired FiO_2 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

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Step	Action
5	**Troubleshooting during circuit calibration:** • 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 H_2O. • If there has been a disconnection, push reset/power and hold until oscillations resume.

Patient Management during HFOV

Step	Action
1	**Positioning:** • 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:** • Patients should be individually assessed for frequency of repositioning. • 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.**

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Assessment of Outcome

- Arterial, Venous and Capillary Blood Gas Values
- Pulse oximetry
- Chest x-rays (optimal lung inflation is 8.5 – 9 ribs)
- 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

References

Sensormedic High Frequency Oscillatory Ventilator Operating Manual.

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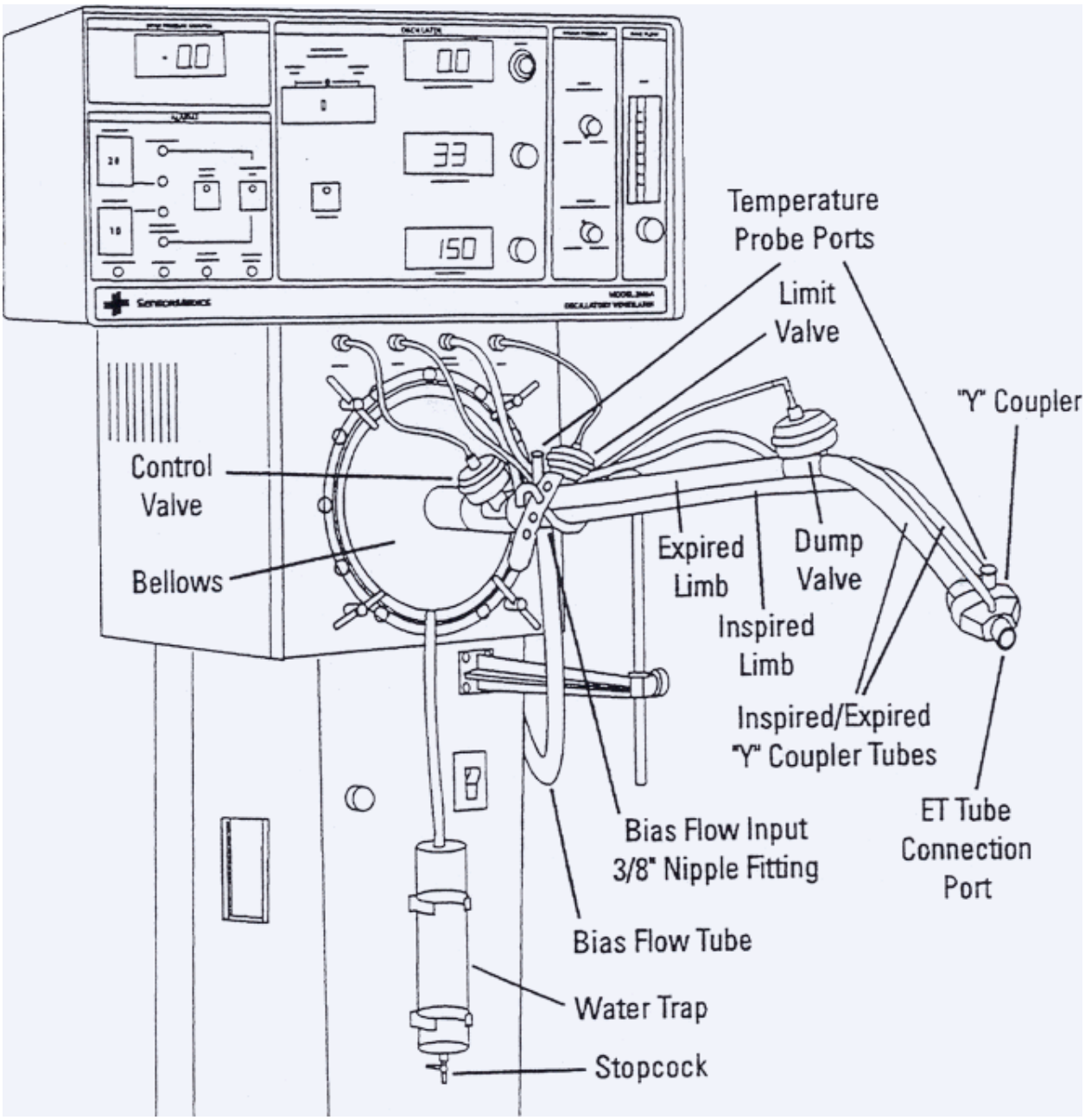
APPENDIX I.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Limit Valve
"Y" Coupler
Control Valve
Bellows
Expired Limb
Dump Valve
Inspired Limb
Inspired/Expired "Y" Coupler Tubes
ET Tube Connection Port
Bias Flow Input 3/8" Nipple Fitting
Bias Flow Tube
Water Trap
Stopcock