Quick Reference: Setup, Maintenance and Monitoring Instructions – Anesthesia Machine as an ICU Ventilator

SETUP

- Ensure manual ventilation device readily available
- Connect/Check Central Gas Supplies
  - Check Line pressure – 45 psi or better
  - Full E-cylinders of oxygen and air as backup
  - Remove nitrous oxide hoses and cylinders
  - Bellows ventilators configured for compressed air supply Biomed can do with manufacturer guidelines
- Scavenger
  - Connect to suction or allow to enter patient room
- Vaporizers
  - Remove or drain unless sedation is planned
- Configure machine with disposables
  - Breathing Circuit
  - Filters
    - HMEF on airway, gas sampling on machine side
    - Second filter on the expiratory limb if possible (required if no filter on airway)
  - Active humidifiers NOT recommended, Will require special monitoring of humidity if placed.
  - Large (3 Liter) Reservoir Bag
  - Gas analyzer for oxygen and carbon dioxide
- Perform Self Test
  - Compliance measurement essential – do not change disposables after this
  - Confirm no errors
- Check alarms, set limits, set to max volume
  NOTE: Defaults may not apply to ICU patients
  - Inspired CO2 alarm at 5 mmHg
  - Expired CO2 alarm for permissive hypercapnia
  - Pressure alarms – High and low if apnea pressure alarm
  - Volume/Minute Ventilation
- Set APL valve to 0 cmH20

INITIATE THERAPY

- Fresh Gas Flow Options
  - Start with Fresh gas flow => minute ventilation
    - Leave absorbent in place
    - Use HMEF. If filter clogs frequently use filter only
  - Protocol for Reducing fresh gas flow to preserve humidity and conserve anesthetic agent if used
    - Reduce FGF in increments of 500 mls/min until humidity begins to appear
    - **CO2 Absorbent must be available and maintained**
    - **Inspired CO2 Alarm must be set to 5 mmHg**
- Setting Oxygen Concentration
  - Electronic Flowmeters – Set delivered concentration and monitor inspired oxygen that results
  - Mechanical Flowmeters
    - Air/oxygen mix needed for delivered O2 concentration (see table)
  - Inspired oxygen concentration will need to be monitored especially during low flows - it will be less than the set concentration
- Set Ventilator (See CCM guidance)
  - Ventilation Mode
  - Settings
    - Rate
    - Volume
    - I:E Ratio
    - PEEP
- Start Ventilator
  - **SET SPIROMETRY LOOP REFERENCE IF AVAILABLE WHEN VENTILATION STARTED**
  - **NOTE PRESSURE AND FLOW WAVEFORMS – CONSIDER PHOTO OF BASELINE SCREEN**
  - Record monitored values
    - Pressure – Volume relationships
    - Gas concentrations as expected

Procedure for Supporting Patients During the Anesthesia Machine Power Up Test To be Repeated at Least Every 72-Hours of Use

The following procedure provides a step-by-step description of the steps to be followed to complete the startup-test as safely as possible.

1) Administer neuromuscular blocker and/or sedation to prevent patient coughing
2) Have ready, a metal clamp with non-serrated jaws (e.g., perfusionists' pump tubing clamp) for the endotracheal tube (ETT), and fresh breathing circuit filters and tubing if they will be exchanged.
3) If a transport ventilator is available, prepare it by connecting to the appropriate gas and electrical outlets, put on a fresh breathing circuit with a breathing circuit filter, then power it on and perform its startup-test before using it on a patient.
4) If a transport ventilator is not available, a separate person should manually ventilate the patient. Place a HEPA filter and PEEP valve on the expiratory outlet of the patient's designated manual-resuscitator system and connect it to an oxygen source set to deliver 10L/min of oxygen. It is preferable to have a stand-alone respiratory monitor if manually ventilating, or at least a timer to pace respiratory rate.
5) Write down the current patient ventilator settings (e.g., ventilator mode, tidal volume, respiratory rate, I:E ratio, PEEP, fresh gas flow settings, etc.) to aid in programming the anesthesia machine to the identical settings after the startup-test is completed.
6) Program the portable ventilator settings to match the patient's ventilator settings as closely as possible, or set the manual-resuscitator PEEP valve.
7) Open the anesthesia machine APL valve and turn off fresh gas flows.
8) Clamp the ETT at the end of the ventilator inspiratory phase (to maintain lung volume and prevent aerosolization when the anesthesia circuit is disconnected).
9) Switch the anesthesia machine to manual ventilation mode.
10) Disconnect the ETT from the breathing circuit and HMEF (if there is one at the ETT).
11) Connect the portable ventilator or manual resuscitator system to the ETT, unclamp the ETT, and begin ventilating the patient.
12) This is a good time to place fresh breathing circuit filters and tubing on the anesthesia machine.
13) Power down the anesthesia machine, and restart to perform a startup-test.
14) When the startup-test is completed, program the anesthesia machine to match the settings that were written down in Step 5.
15) Ensure that the anesthesia machine is in manual ventilation mode.
16) Clamp the ETT during the inspiratory phase of the transport ventilator or manual resuscitator.
17) Pause ventilation with the portable ventilator ventilation or manual resuscitator.
18) Disconnect the ETT from the portable ventilator ventilation or manual resuscitator, and connect to the anesthesia machine breathing circuit.
19) Unclamp the ETT.
20) Switch the anesthesia machine to preprogrammed ventilator mode and confirm appropriate ventilation.
21) If the breathing circuit was not replaced, clean the occlusion plug used during the startup-test.

MONITORING SCHEDULE (Record manually time and value if EMR not connected to machine)

Task	Continuous	Hourly	q 4 hours	q 24 hours
Alarms	X			
Check CO2 Absorbent		X		
Monitored Parameters • Insp Oxygen • Insp and Exp CO2 • Insp Pressure • Tidal Volume • Spirometry • *Agent concentration*		X		
Inspect for humidity and secretions • Filters • Water trap		X		
Check Vaporizer Fill if Sedating				
Consider Filter/HME Replacement*			X	X
Increase FGF to MV or above if humidity is present until insp hose dries			X	
Perform Self Test**				X

*Filter supply and performance will determine the replacement interval

**Anesthesia machine WILL NOT provide ventilation during the self-test. An alternate ventilation strategy that can be maintained for several minutes is required. Consider transport ventilator if manual ventilation bag not likely to be successful.

Power to the machine should be cycled between every patient and at least every 25 days.