QUICK REFERENCE GUIDE

LifePulse® HFV

Advanced High-Frequency Jet Ventilation Technology for Infants

www.bunl.com

800-800-HFJV (4358)

MODEL 204

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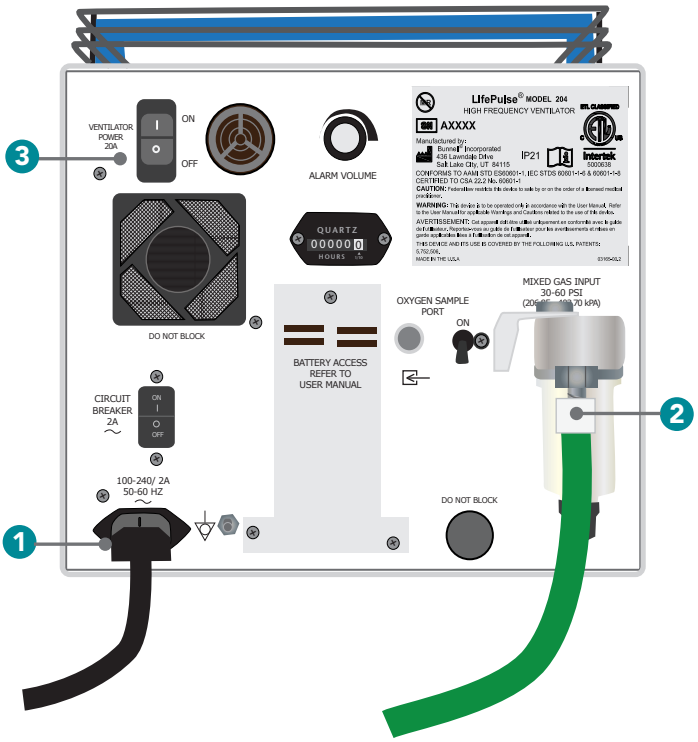
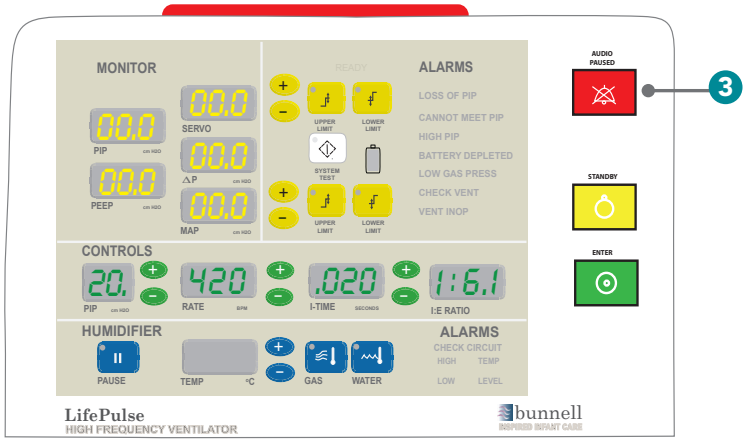
Bunnell LifePulse HFV Quick Reference Guide # 03202-00.1

Initial Ventilator Setup





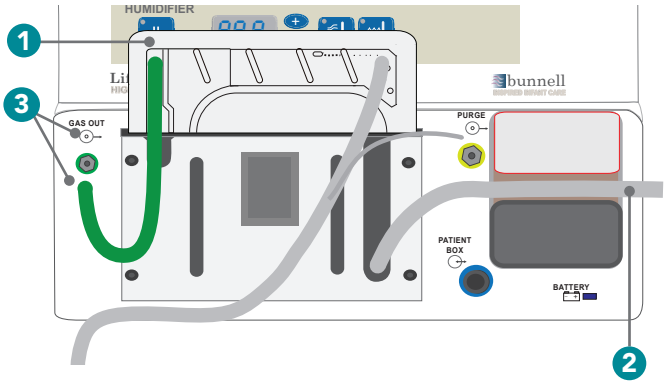
1. **Provide Electrical Power:** Plug the LifePulse into a hospital grade electrical outlet in order to power it on.

2. **Provide Gas Source:** Connect the LifePulse to the air/ oxygen supply from a low flow blender (0-30 L/min.) or from the low flow output (2-100 L/min.) of a standard blender.

3. **Turn on LifePulse:** Toggle the Ventilator Power switch on the rear panel to the ON position. Press AUDIO PAUSED to cancel the high priority “power on” audio and visual alarm.

WARNING: Latch the water inlet tube on the humidifier cartridge of the Patient Breathing Circuit into the water pump housing prior to connecting to the water supply. Failure to do so may result in cartridge overfill and delivery of water to the patient by gravity feed.

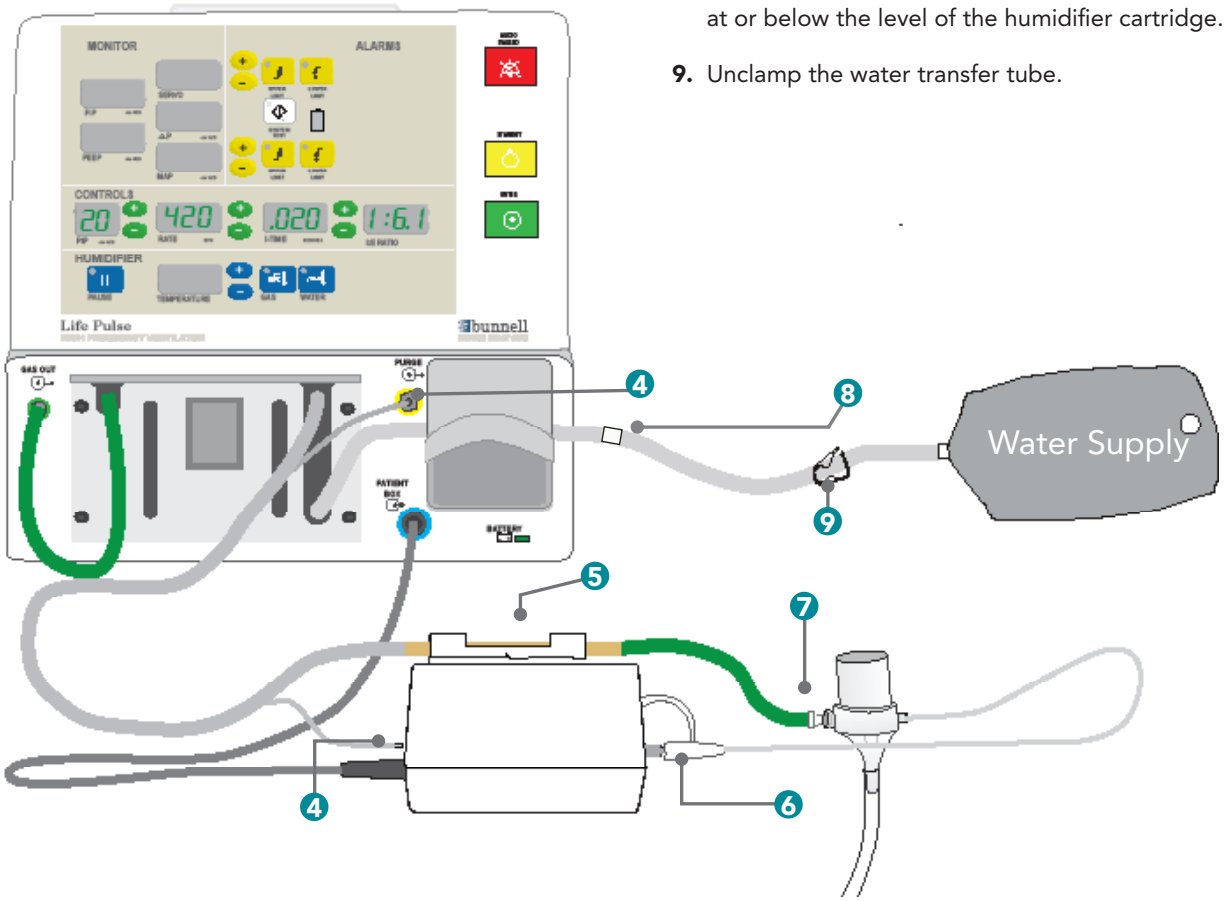
WARNING: Clamp the water supply tube prior to opening the water pump door to prevent cartridge overfill and delivery of water to the patient by gravity feed. The water supply should be positioned at or below the level of the humidifier cartridge as an added precaution.



Installing a Circuit

A Patient Circuit must be installed in order to use the LifePulse. Follow these steps to install the Patient Circuit:

1. Open cartridge door and insert humidifier cartridge into receptacle
2. Open water pump door by lifting up. Secure the water inlet tube inside the water pump and snap the pump door closed.
3. Attach the green gas inlet tube to the green-coded Gas Out port on the LifePulse.
4. Attach the purge tube to the yellow-coded Purge port on the LifePulse and to the yellow-coded port on the Patient Box.
5. Press PUSH TO LOAD on top of the Patient Box and gently stretch the pinch tube into the jaws of the pinch valve.
6. Connect the clear pressure monitoring tube from a LifePort adapter to its port on the Patient Box.
7. Insert the green delivery tube into the Jet port on the LifePort adapter.
8. Attach the water transfer tube to the water inlet tube and spike the water supply. The water supply should be at or below the level of the humidifier cartridge.
9. Unclamp the water transfer tube.



Testing and Preparation

1. **Perform System Test:** Attach a LifePort adapter and ET tube to a test lung. Press SYSTEM TEST and verify the LifePulse runs through the test sequence and returns to Standby mode with an audible and visual alarm active. Press AUDIO PAUSED to cancel the high priority "passed test" alarm.

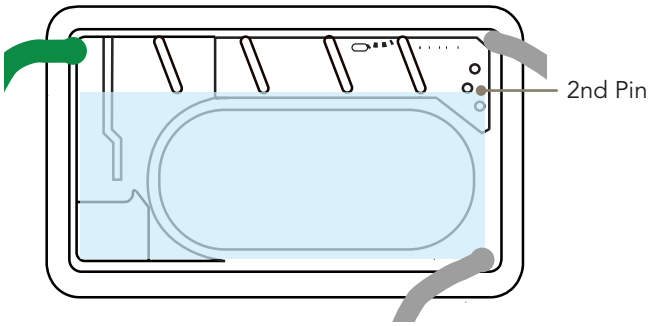
2. **Perform Operational Test:** Perform an Operational Test. Press ENTER to activate the default settings (PIP: 20, Rate: 420, I-Time: 0.020) while attached to the test lung. Verify that the READY indicator illuminates, the monitored PIP reaches the set PIP, and PEEP is 0.0 ± 1.0 cm H_2O when no PEEP is supplied by the conventional ventilator.

3. **Place LifePulse into Standby:** Place the LifePulse into Standby mode after the tests are completed and prior to connecting to the patient.

4. **Before Connecting to Patient, Remove and Save Test Supplies:** Remove the Test Supplies (LifePort, ET tube, and test lung) from the LifePulse circuit and Patient Box. Save for future use.

WARNING: Patient connections must only be made in the Standby mode. Do not connect the LifePulse Patient Breathing Circuit to the LifePort adapter on the patient's ET tube while the LifePulse is running. Failure to comply risks high pressures and volumes being delivered to the patient, which may result in volutrauma.

WARNING: Do not leave the patient's bedside while the LifePulse water pump is running during initial start-up or following a circuit change. A properly trained person must observe the cartridge fill with sterile water for inhalation, USP, to the second water level sensing pin and the water pump stop pumping.



WARNING: There will be no LOSS OF PIP alarm for the first 15 seconds after the ENTER Button is pushed. A properly trained person must observe the LifePulse reach the set PIP and have the Ready indicator illuminate before leaving the patient's bedside.

Beginning High Frequency Jet Ventilation

All infants treated with the LifePulse should be connected to a conventional ventilator and appropriate physiologic monitors. They must be intubated with a standard ET tube with a Bunnell LifePort adapter attached.

1. **Attach LifePort adapter to patient's ET tube**: Replace standard ET tube adapter with appropriate size LifePort adapter. Connect pressure monitoring tube to port on Patient Box.
2. **Connect LifePulse circuit to patient's LifePort adapter:** Remove the cap on the jet port of the LifePort adapter and connect the patient end of the LifePulse circuit to the jet port.
3. **Set HFJV PIP:** Adjust the set HFJV PIP to equal the monitored CV PIP (see Ventilation and Oxygenation flow charts on pages 6 and 7).
4. **Set HFJV Rate:** Adjust the set HFJV Rate to the frequency appropriate for the patient (420 bpm is recommended, or slower for larger patients or to address hyperinflation).
5. **Set HFJV I-Time:** Starting I-time is usually left at the default 0.020 seconds.
6. **Begin High Frequency Jet Ventilation:** Press ENTER to activate the Control settings. The PIP will quickly rise toward the set PIP. The LifePulse may pause momentarily when a conventional breath is delivered.
7. **Eliminate LifePulse Interruptions:** If the LifePulse is pausing, reduce the CV PIP until the pauses go away (CV PIP < Set HFJV PIP).
8. **Lower CV Rate:** Lower the CV rate to between 0 and 5 bpm. (Use 0 bpm if air leaks are the primary concern. Use 1-5 bpm and/or increase PEEP if atelectasis and oxygenation are the main concern.)
9. **Assure Ready Indicator is On:** Verify the Ready indicator illuminates, which indicates the pressures are stable and the LifePulse alarms are active.
10. **Adjust PEEP:** Adjust the CV PEEP setting to obtain the desired MAP and oxygenation.
11. **Reassess Blood Gases:** Observe blood gas monitored values and/or draw arterial blood gas samples after 30 minutes to determine if ventilator adjustments are necessary.

Patient Management During HFJV

GENERAL RULES

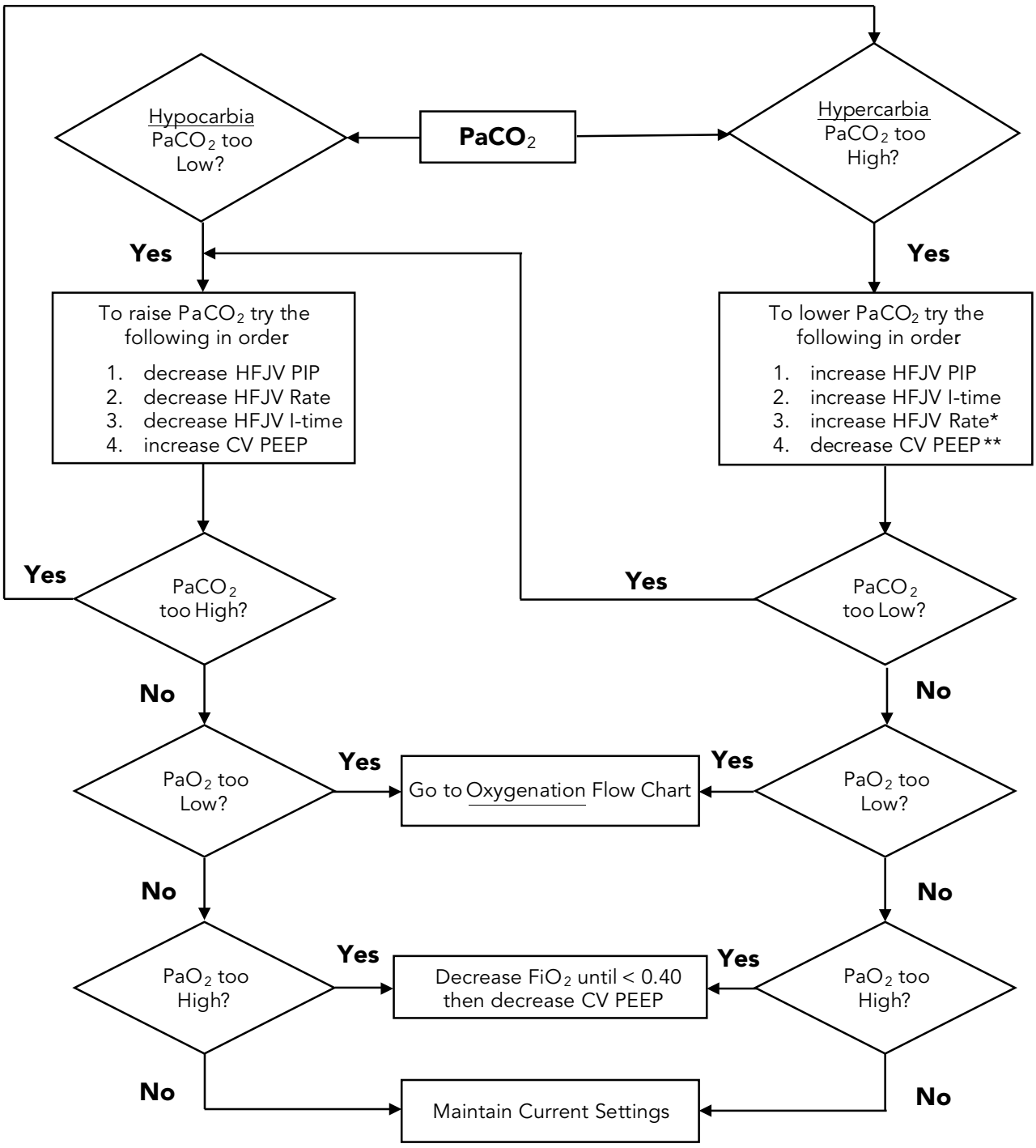
- HFJV ΔP (PIP - PEEP) is the primary determinant of $PaCO_2$. HFJV I-time and Rate are secondary.
- Resting lung volume (FRC supported by set PEEP) and mean airway pressure (MAP) are crucial determinants of PaO_2.
- Avoid hypercarbia and hypoxemia by using optimal PEEP (see "When to Raise" PEEP below).
- Minimize IMV at all times, using very low rates (typically 0 – 5 bpm), unless IMV is being used to recruit lung volume or stabilize FRC. In general, keep CV PIP at a level necessary to achieve a moderate chest rise.
- To overcome atelectasis, IMV rates up to 5 bpm can be used for 10 – 30 minutes. Thereafter, IMV rate should be dropped back to as close to 0 as possible.
- If lowering CV rate worsens oxygenation, PEEP may be too low. Higher PEEPs and lower CV rates reduce risk of lung injury.
- Lower FiO_2 before PEEP when weaning until FiO_2 is less than 0.4.

SETTING	INITIAL	WHEN TO RAISE	WHEN TO LOWER
HFJV PIP	Whatever produces desired $PaCO_2$	To decrease $PaCO_2$	To increase $PaCO_2$ (Raise PEEP if necessary to keep SpO_2 constant)
HFJV Rate	420 bpm (neonates) 300 bpm (peds)	To decrease $PaCO_2$ in smaller patients with low compliance	To eliminate inadvertent PEEP or hyperinflation by lengthening exhalation time or to increase $PaCO_2$ when weaning
HFJV I-TIme	0.020 seconds	To increase delivered tidal volume and lower $PaCO_2$	0.020 is the minimum
CV Rate	0 - 5 bpm	To reverse atelectasis as a temporary recruitment maneuver (3 – 5 bpm)	To minimize volutrauma, especially when air leaks are present, or to decrease hemodynamic compromise
CV PIP	PIP necessary to achieve moderate chest rise	To reverse atelectasis or stabilize lung volume; PIP typically < HFJV PIP	To minimize volutrauma, especially when air leaks are present, or to decrease hemodynamic compromise
CV I-Time	0.4 seconds	To reverse atelectasis or stabilize lung volume	To minimize volutrauma, especially when air leaks are present, or to decrease hemodynamic compromise
PEEP	7 – 12 cm H_2O (Neonates) 10 – 15 cm H_2O (Peds)	To improve oxygenation and decrease hyper-ventilation To find optimal PEEP: Raise PEEP until SpO_2 stays constant when switching from IMV to CPAP	Lower PEEP only • when it appears that cardiac output is being compromised; or • when oxygenation is adequate • FiO_2 < 0.4, and • when lowering PEEP doesn't decrease PaO_2
FiO_2	As needed	Raise as needed after optimizing PEEP	Lower FiO_2 in preference to PEEP when weaning until FiO_2 < 0.4

Special Air Leak Considerations:

1. Minimize IMV by using HFJV and adequate CPAP.
2. If oxygenation is compromised AND expiratory time has been optimized, raise PEEP, even if the lungs appear to be over-expanded on x-ray.

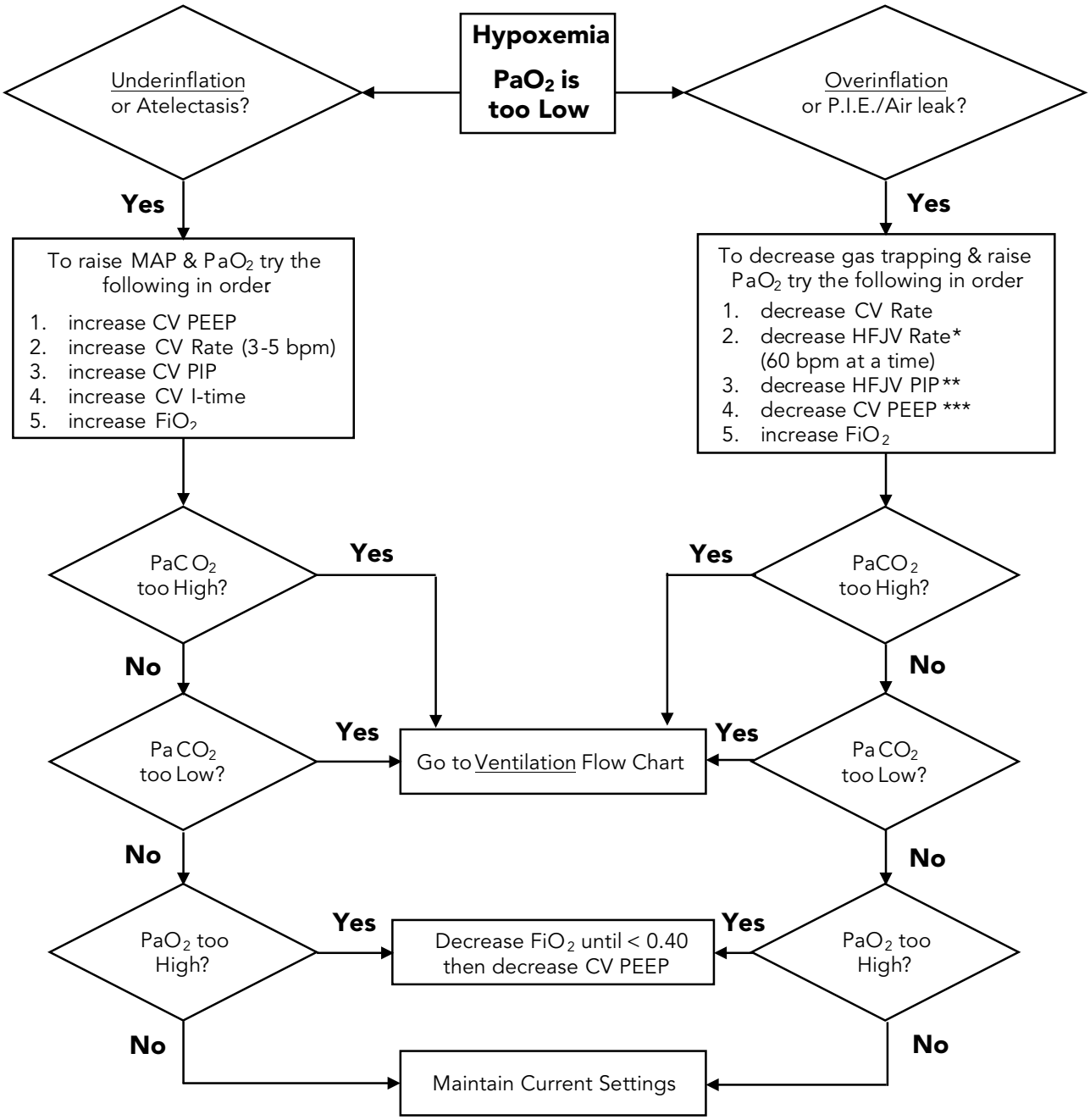
Ventilation Control Flow Chart



* Increasing HFJV Rate increases minute ventilation. However, if lungs are hyperinflated, decreasing HFJV Rate can lower $PaCO_2$ by increasing exhalation time.

** Decreasing CV PEEP increases Δ pressure (amplitude) and lowers $PaCO_2$, but it will also lower MAP, which may lower PaO_2.

Oxygenation Flow Chart

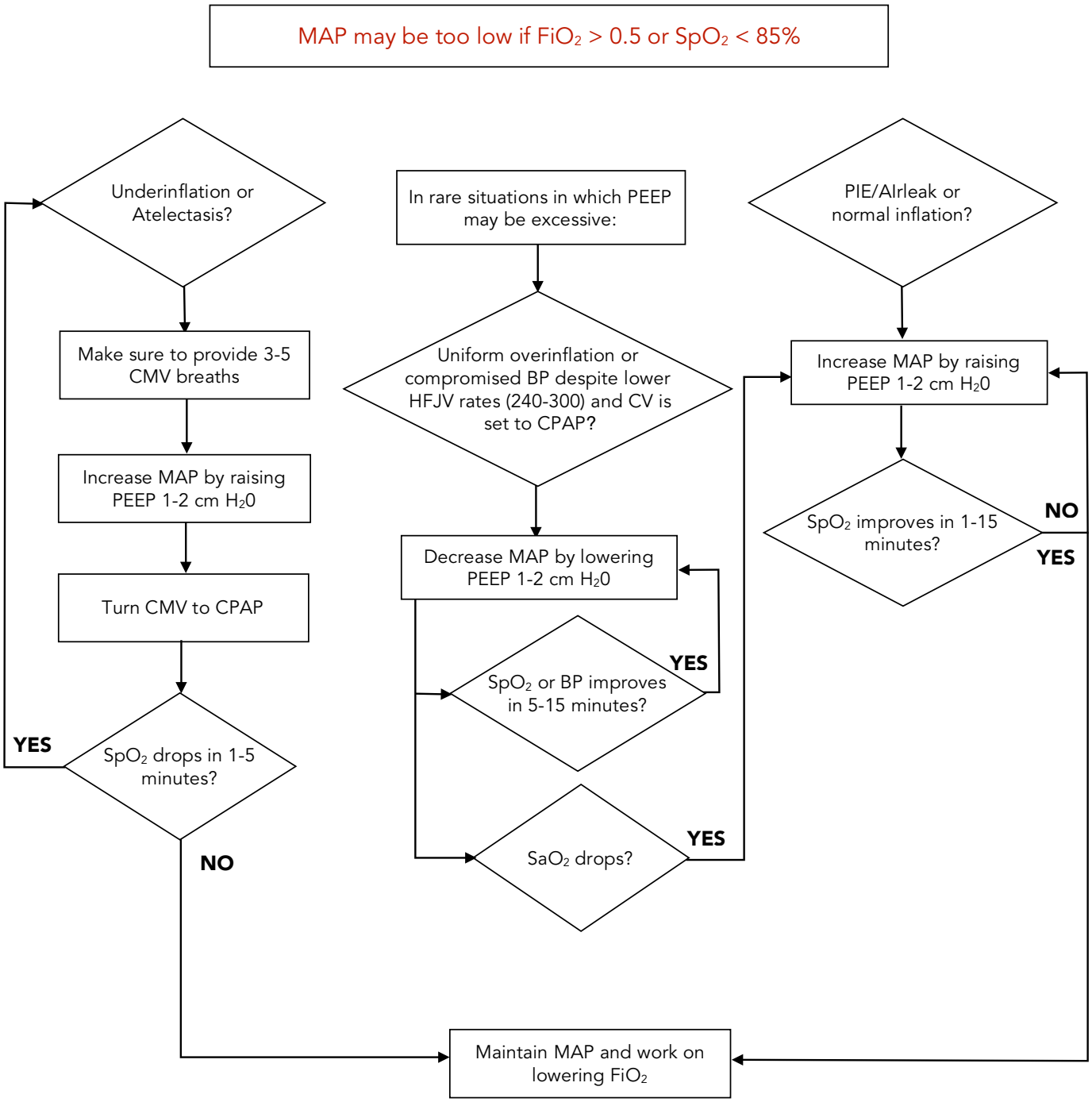


* Decreasing HFJV Rate decreases minute ventilation. It may also lower $PaCO_2$ by increasing exhalation time.

** Decreasing HFJV PIP decreases Δ pressure (amplitude) and minute ventilation ; $PaCO_2$ may increase. .

*** Decreasing CV PEEP increases Δ pressure (amplitude) and decreases MAP ; $PaCO_2$ and PaO_2 may decrease.

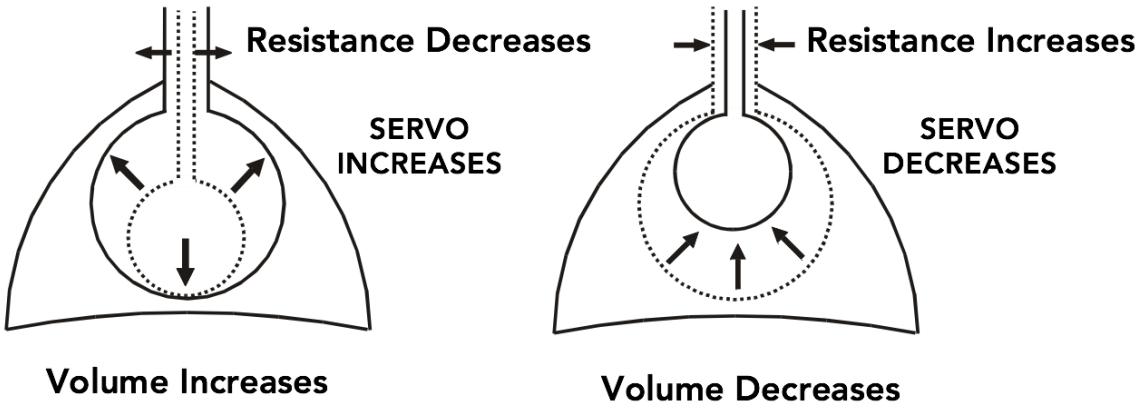
Optimizing MAP During HFJV



Titrating MAP up or down may improve oxygenation. Use your understanding of the interactions of the cardiopulmonary system to achieve optimal results.

The Importance of Servo

- Servo = driving pressure that automatically regulates flow.
- Servo changes with each change in HFJV or CV settings.
- Servo changes as lung volume or mechanics change.



Servo Increases with:

- Improving compliance or resistance
- Loose tubing connections
- Moisture interference in LifePort
- Mechanical issues with LifePulse

Servo Decreases with:

- Worsening compliance or resistance
- Patient needs suctioning
- Obstructed ET tube
- Tension pneumothorax
- Right mainstem intubation

Servo changes are early indications of changes in the patient's condition or the LifePulse's performance (assuming HFJV and CV settings have not changed).

Charting and trending Servo can help inform patient management decisions.

Weaning Patient from LifePulse

1. Lower HFJV PIP Slowly

- Avoid lowering PEEP/MAP until FiO_2 is < 0.40.
- Maintain HFJV Rate.
- Reduce the HFJV PIP (1-2 cm H_2O) as needed per PCO_2.

2. Lower HFJV and CV PIP to Teens

- Continue to reduce the HFJV PIP while keeping the Rate constant.
- Reduce the CV PIP as needed to avoid interrupting the LifePulse PIP.
- Maintain appropriate MAP (may need to increase PEEP).
- If you are weaning to CV rather than NIV, increase the CV Rate in response to PCO_2 once the HFJV PIP is < 18 cm H_2O. Interrupting the LifePulse breaths with the CV breaths may now be appropriate.

3. Evaluate Patient During CV or NIV Trial

- Observe the patient and monitored parameters to ensure patient is tolerating the weaning process.
- Increase the CV Rate or NIV support, if necessary, after the LifePulse is in Standby mode. If CV PIP has to be increased to > 18 cm H_2O, the trial is a failure and the patient should be returned to the LifePulse.

4. Consider NIV Trial

- Consider NIV trial if HFJV PIP < 18 cm H_2O, MAP ≤ 8 cm H_2O, and FiO_2 is ≤ 0.40.
- Restart the LifePulse if the trial is unsuccessful. Try again in 12-24 hours.

NOTE: During storage, plug the LifePulse into an electrical wall outlet in a properly ventilated room in order to maintain battery charge.

See the LifePulse User Manual for more information on cleaning and storage.