LifePulse® HFV

Advanced High-Frequency Jet Ventilation Technology for Infants

www.bunl.com

800-800-HFJV (4358)
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Successful troubleshooting combines a thorough knowledge of the LifePulse HFV with a systematic approach to problem solving.

**In general, troubleshooting should start with the patient and work back to the ventilator.**

- Is the patient’s interaction with the vent or the patient’s condition causing the alarm? Check the patient!
- Is the ET tube in good position and clear of secretions?
- Is there moisture (excess condensation) interfering with the pressure signal in the LifePort?
- Is the LifePort adapter properly connected and is the pressure monitoring tube upward (between 10 to 2 o’clock)?
- The pressure signal originates in the LifePort. Did changing the LifePort adapter correct the problem?
- Is the circuit installed properly? Are there any kinks or poor connections?
- Is the Patient Box running properly? Has the sound or rhythm changed?
- Is the ventilator running or is it in Standby mode? Has the Servo changed significantly (> 1.0)?
- Is the humidifier running? Are the contact pins in the humidifier okay? Are the temperature controls set properly? Is there water available for the humidifier?

To be effective at troubleshooting you have to understand how the LifePulse works, what the alarms are telling you, and what can be done to correct the situation.

As always, if you can’t resolve an alarm quickly, call the Hotline, 800-800-4358 (HFJV) and have one of our clinical specialists help you.

Additionally, Appendix B contains the internal (System) and operational tests for checking the function of the LifePulse.
Upper and Lower Servo Alarms

**Definition:** The Servo alarms alert the user to changes in the internal drive pressure or flow rate required to deliver breaths at the set PIP, Rate, and I-time.

**Checks:**

**1. High Servo Alarms**
- Examine the patient for spontaneous breathing, crying, coughing, hiccups, seizures, bronchospasm, or the need for suctioning. Calm, medicate, sedate, or suction the patient.
- Inspect the LifePort adapter and connections for any leaks or cracks. If the adapter’s integrity is in question, replace it with a new one.
- Inspect the Patient Circuit for leaks, poor connections, or occlusions. Correct these conditions if present.
- Inspect the Patient Circuit between the humidifier and Patient Box for signs of excess condensation (droplets of water). If necessary, lower the Water temperature setting by 0.5°C or more to reduce condensation (see Appendix A).
  - Note: Keep Gas temperature at 40°C.
- Evaluate the Patient Box for abnormal functioning (odd sounds or visible problems with pinch valve operation). Change the Patient Box if necessary.
- Examine the patient for re-expansion of the lung due to evacuation of an air leak, such as pneumothorax or bronchopleural fistula, or for improved lung volume following recruitment.
- Evaluate first 5 conditions listed under High Servo Alarms. If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)

**2. Low Servo Alarms**
- Inspect the endotracheal tube for improper positioning, plugging, or occlusion. Correct these conditions if present.
- Examine the patient for signs of airway obstruction.
- Inspect the exhalation limb of the conventional breathing circuit for kinks.
- Examine the patient for a tension pneumothorax or atelectasis.
- Evaluate first 5 conditions listed under High Servo Alarms.

### Upper and Lower Servo Alarms Table

<table>
<thead>
<tr>
<th>Servo</th>
<th>Alarm Window</th>
<th>Approx. Patient Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>± 0.2</td>
<td>&lt;700 gm</td>
</tr>
<tr>
<td>1 - 5</td>
<td>± 20% (0.2-1.0)</td>
<td>700 - 4000 gm</td>
</tr>
<tr>
<td>&gt; 5</td>
<td>± 1.0</td>
<td>&gt; 4000 gm</td>
</tr>
</tbody>
</table>

**WARNING:** Always troubleshoot a change in Servo that is greater than 1.0 psi from the previously established baseline, especially if the LifePulse control settings have not been changed. Servo changes this large or larger usually represent a mechanical problem and may pose a risk of volutrauma.
Upper and Lower MAP Alarms

Definition: The MAP alarms alert the user to changes in the mean airway pressure, as monitored by the Life Pulse.

Checks:

1. High MAP Alarms
   - Inspect the conventional ventilator for changes in settings (e.g., PEEP) or performance.
   - Inspect the exhalation limb of the conventional breathing circuit and remove any kinks or water.
   - Inspect the pressure monitoring tube of the LifePort adapter for excess condensation or plugging. If necessary, reduce the Water temperature setting to reduce condensation (see Appendix A).
   - Note: Keep Gas temperature at 40°C.
   - Inspect the endotracheal tube or airway for obstruction.
   - Inspect the Patient Box pinch valve to verify it is closing completely.

2. Low MAP Alarms
   - Inspect the conventional ventilator for changes in settings (e.g., PEEP) or performance.
   - Inspect the pressure monitoring tube of the adapter for excess condensation or plugging. If necessary, reduce the Water temperature setting by 0.5°C or more to reduce condensation (see Appendix A).
   - Note: Keep Gas temperature at 40°C.
   - Inspect the endotracheal tube for proper positioning.
   - Inspect the Patient Circuit and humidifier cartridge for leaks, poor connections or kinks.

If the alarm persists, call the Bunnell Hotline
800.800.4358 (HFJV)

High Limit = MAP value at the time the Ready light comes on + 1.5 cm H₂O
Low Limit = MAP value at the time the Ready light comes on - 1.5 cm H₂O

**WARNING:** Do not manually adjust alarm limits around MAP and Servo to the point that they become irrelevant (are effectively off). Doing so will negate critical alarms and expose the patient to potentially unsafe conditions that may result in injury.

WARNING: Do not manually adjust alarm limits around MAP and Servo to the point that they become irrelevant (are effectively off). Doing so will negate critical alarms and expose the patient to potentially unsafe conditions that may result in injury.
LOSS OF PIP Alarm

**Definition:** The Loss of PIP alarm is activated by one or more of the following conditions:

- The monitored PIP has dropped below 25% of the Set PIP
- The monitored PIP is less than 3 cm H₂O
- The monitored value for ΔP is ≤ 2 cm H₂O.

**Checks:**

- Examine the patient for spontaneous breathing, crying, coughing, hiccups, seizures, bronchospasm, or the need for suctioning. Calm, medicate, sedate, or suction the patient.
- Excess condensation in the LifePulse circuit may be causing water droplets to interfere with pressure monitoring. Check the LifePort adapter’s orientation to make sure the pressure monitoring tube is pointed up. If necessary, reduce the Water temperature setting by 0.5°C or more to reduce condensation (see Appendix A).
  
  **Note:** Keep gas temperature at 40°C.

- Inspect the Patient Circuit and humidifier cartridge for leaks or poor connections.
- Check the pinch valve for possible malfunctions resulting in low PIP. Replace the Patient Box while the LifePulse is in the Standby mode.

  **Note:** If a Loss of PIP occurs in the Non-Ready condition, the servo control valves are turned off to decrease Servo and protect the patient. Pressing ENTER will clear the alarm and allow the LifePulse another attempt to reach the set PIP.

If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)

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**WARNING:** Place the LifePulse in Standby mode prior to troubleshooting if the Patient Box pinch valve stops operating while on a patient. This action prevents the patient from being exposed to inappropriately large volume delivery and possible volutrauma.

**WARNING:** Press the ENTER button to resume ventilation if a LOSS OF PIP alarm has occurred with the Ready indicator off. The Patient Box will be cycling but no gas (breaths) will be delivered to the patient until the LOSS OF PIP alarm is cleared by pressing the ENTER button. Always troubleshoot the potential causes of an alarm following the guidelines in the User Manual.

**WARNING:** Do not press the ENTER button during a LOSS OF PIP alarm with the Ready indicator illuminated if the patient is stable and the Servo has locked at or near an established operating value. Doing so will temporarily silence the audible alarm and unlock the LifePulse Servo. Always troubleshoot the potential causes of an alarm following the guidelines in the User Manual prior to pressing the ENTER button.
CANNOT MEET PIP Alarm

Definition: The monitored PIP has not stabilized within +2.0 and -1.5 cm H\textsubscript{2}O of the set PIP for 20 seconds within three minutes of pressing ENTER, or

The monitored PIP has not stabilized within +2.0 and -1.5 cm H\textsubscript{2}O of the set PIP before the Servo has risen to its maximum output of 20.

Checks:

- Examine the patient for spontaneous breathing, crying, coughing, hiccups, seizures, bronchospasm, or the need for suctioning. Calm, medicate, sedate, or suction the patient.

- Make sure the Servo hasn’t reached the maximum output of 20 before reaching the Set PIP. The patient may be too large to be ventilated by the LifePulse at the current settings.

- Excess condensation in the LifePulse circuit may be causing water droplets to interfere with pressure monitoring. Check the LifePort adapter’s orientation to make sure the pressure monitoring tube is pointed up. If necessary, reduce the Water temperature setting by 0.5°C or more to reduce condensation (see Appendix A).

Note: Keep gas temperature at 40°C.

- Inspect the Patient Circuit and humidifier cartridge for leaks or poor connections.

- Check the pinch valve for possible malfunction resulting in fluctuating pressures. Replace the Patient Box while the LifePulse is in the Standby mode.

If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)
High PIP Alarm

**Definition:** The monitored PIP has exceeded the set PIP setting by 5 cm H₂O continuously for 1 second, or

The monitored PIP for all breaths delivered in the last 30 seconds has exceeded the set PIP by 10 cm H₂O, or

The monitored PIP is 30 cm H₂O above the set PIP during any 0.75-second period, or

The monitored PIP is > 65 cm H₂O.

**Checks:**

- Check the conventional ventilator to see if excessive pressure is being delivered due to a failure or an occluded exhalation limb of the conventional ventilator breathing circuit.

- Inspect the endotracheal tube for improper positioning, kinking, or occlusion.

- Inspect the pressure monitoring tube of the LifePort adapter for excess condensation or kinking. Check the adapter’s orientation to make sure the pressure monitoring tube is pointed up. Replace the LifePort adapter if necessary.

- Check the pinch valve for possible malfunction resulting in high PIP. Replace the Patient Box while the LifePulse is in the Standby mode.

- If the alarm persists, it could be a stuck Servo control valve. Change out the LifePulse ventilator.

**WARNING:** Patient connections must only be made in the Standby mode. Do not connect the LifePulse Patient 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.

If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)
VENT INOP  Alarm - During Systems Test

Definition: The Vent Inop alarms during a Systems Test indicate a possible problem with the LifePulse's electronics or valves.

During System Test: Codes 02 - 04

Code 02 is related to the purge system. Causes can be:

• A lack of purge gas supply from the LifePulse, or
• A failure of the purge valve or the pressure transducer in the Patient Box, or
• A LifePulse circuit being disconnected from the LifePort adapter on the test lung, or
• A Patient Box being disconnected from the front panel of the LifePulse.

Code 03 is related to the servo control valves or the servo pressure transducer. The code will appear if

• Any of the valves do not open or are sluggish during the System Test, or
• The servo pressure transducer does not recognize (respond to) the opening of the servo control valves, or
• The dump valve is open.

Code 04 is related to watchdog circuit failure.

• The watchdog circuit resets the microprocessor in the LifePulse.

Checks:

• Inspect the purge tubing for disconnections or kinks at the front panel and Patient Box purge connectors.
• Inspect the LifePort pressure monitoring tube for disconnections or kinks at the Patient Box.
• Make sure the Patient Box cable is attached at the front panel of the LifePulse.
• Replace the Patient Box to determine if the purge valve or some other component in the Patient Box is the cause of the alarm.
• For Code 03 try running the LifePulse on a test lung for 5 minutes then run the System Test again. Sometimes this will free up a sluggish servo control valve and correct this alarm condition.

If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)
VENT INOP Alarm - During Operation

**Definition:** The Vent Inop alarms during operation indicate a possible problem with the LifePulse electronics or valves.

Codes 01 & 05-10 are all related to microprocessor or electronic problems

- Support the patient on the CV or with manual ventilation.
- Turn off the Ventilator Power switch to reset the microprocessor.
- Run the System and Operational Tests (see Appendix B) on a test lung.
- Go to Standby mode and enter the patient’s settings before restarting on the patient.

**Note:** Vent Inop alarms can be caused by electrical power fluctuations. If the power fluctuations are internal to the LifePulse, the LifePulse may need to be switched out to remedy the problem.

**Code 10** indicates a significant rise in Servo, which can be caused by a dramatic change in ventilator settings, such as changing the Rate from 420 to 240 bpm. If ventilator changes were not made just prior to the alarm:

- Check for mechanical problems such as tubing disconnects or kinks.
- Correct any disconnects or kinks before pressing ENTER to restart the LifePulse.
- If the Code 10 alarm recurs, support the patient on CV or manual ventilation and switch out the LifePulse.

**Vent Inop with No Code:**

- This alarm condition is rare. It is associated with the watchdog circuit resetting the ventilator’s microprocessor. Typically, the LifePulse will continue to run normally following a rest. This alarm can be cleared by pressing AUDIO PAUSED.

If the alarm persists, call the Bunnell Hotline
800.800.4358 (HFJV)
CHECK VENT Alarms

Definition: The Check Vent alarm indicates a problem (feedback error) with one of the valves in the LifePulse or Patient Box, or electronic failures in the Humidifier section. The following are possible causes:

- The purge gas supply is missing or the purge tube is disconnected or kinked.
- The pressure monitoring tube is disconnected or kinked at the Patient Box pressure monitoring tube connector.
- A problem exists with the purge value or pinch valve in the Patient Box, or the servo valves in the LifePulse.

Checks:

- Make sure the purge tubing is connected and not kinked at both the Purge port on the LifePulse's front panel and the From Purge port on the Patient Box.
- Make sure the pressure monitoring tube is connected to the Patient Box and not kinked.
- Make sure the purge gas supply is present at the LifePulse front panel by disconnecting the purge tube. If gas is present, reconnect the purge tube.
- Replace the Patient Box to determine if there is a purge valve failure or a problem with the pinch valve causing the alarm.
- If the purge gas supply is absent or if the alarm continues after changing the Patient Box, change out the LifePulse ventilator.
- The Humidifier codes can only be cleared by turning off and back on the Ventilator Power switch to reset the Humidifier. The patient will need to be supported during this process. Once the LifePulse powers up, enter the patient's settings and press ENTER to restart the LifePulse.

If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)

Codes displayed in the temperature display of the Humidifier section.

111 – RAM failure
222 – ROM failure
333 – A/D Converter failure
LOW GAS PRESSURE Alarm

Definition: The Low Gas Pressure alarm will appear as LOW GAS PRESS and indicates that the pressure of the gas supply to the LifePulse is below 30 psi (205.85 kPa) or the gas supply pressure switch is faulty.

Checks:

- Make sure a gas supply is connected to the blender and that the low flow output from the blender is connected to the Mixed Gas Input on the back of the LifePulse.
- Make sure the gas supply pressure is greater than 30 psi. If the supply pressure is less than 30 psi (205.85 kPa), check the high pressure supply hoses for leaks. Change the gas source, blender, or high pressure hoses as needed.
- If the alarm persists, there may be a problem with the gas supply pressure switch in the LifePulse, in which case you will have to switch out the LifePulse ventilator.

If the alarm persists, call the Bunnell Hotline
800.800.4358 (HFJV)

WARNING: Only use medical grade oxygen and air that is dry and free of dust and oil. The gas supply pressure must be 30 – 60 psi (205.85 - 413.70 kPa).
Battery Alarms

The battery alarms are progressive as the capacity of the battery decreases.

If the LifePulse is running on battery:

- the BATTERY alarm indicator will be lit
- the battery charge indicator lamp will be off
- there will be a low priority alarm
- the green bars on the battery fuel gauge will indicate the battery’s remaining capacity

If the LifePulse is plugged in and the battery has malfunctioned, is missing, or will not take a charge:

- the battery charge indicator lamp will be red continuously
- there will be a low priority alarm
- the battery fuel gauge bars will not be lit

If the battery’s capacity is low:

- the BATTERY alarm indicator will be lit
- there will be a medium priority alarm
- the battery fuel gauge bars will be depleted down to a single flashing red bar

Plug the power cord into an electrical wall outlet to re-establish the electrical power supply.

If the battery’s capacity is critically low and unable to support the LifePulse’s continued functioning:

- the BATTERY DEPLETED alarm indicator will be lit
- there will be a high priority alarm

Immediate action must be taken to keep the LifePulse from being forced into Standby mode.

Checks:

- Verify that the LifePulse’s power cord is connected securely at the back panel and at the electrical wall outlet. If it is, try plugging the power cord into a different outlet.
- If the battery has failed, switch out the LifePulse so the battery can be checked and serviced.
- If the hospital’s electrical power supply has failed, switch out the LifePulse with one that has a fully charged battery. Otherwise, support the patient with manual ventilation or other forms of ventilatory support. The battery capacity can be extended by placing the humidifier in Pause Mode.

If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)

WARNING: The LifePulse battery is low and needs to be charged when the battery fuel gauge is blinking red. Plug the LifePulse into an electrical wall outlet.

WARNING: When the battery fuel gauge is blinking red with the BATTERY DEPLETED alarm lit and a high priority alarm active the battery charge is too low to continue running the LifePulse and it will go to Standby mode in a minute or two.
Definition: The CHECK CIRCUIT – TEMP alarms indicate that the cartridge door is not properly latched or that an electrical fault is present in either the humidifier cartridge or Patient Circuit.

CHECK CIRCUIT – LEVEL alarms indicate that the humidifier cartridge did not fill to the normal operating level in 86 seconds.

Checks: Temp

• Inspect the humidifier cartridge door to make sure it is latched properly.

• Place the humidifier in Pause mode. Open the cartridge door and check the spring-loaded contact pins with a pen or pencil. Make sure they spring in and out and that all the pins are at about the same level ± 1-2 mm. Try pulling stuck pins back out to the level of the other pins. Close the cartridge door, press PAUSE again, and see if the alarm has cleared.

• If the alarm persists, press STANDBY and replace the Patient Circuit. Press ENTER to resume normal operation. If the alarm does not go away, it is likely that the humidifier module has failed internally and the LifePulse will need to be changed out.

Checks: Level

• If the alarm occurs within the first 2 minutes after pressing ENTER, check the water supply to see if it is empty or disconnected. Also, inspect the water supply tubing coming from the water supply to see if it is clamped off or disconnected.

• Repeat last 2 items above.

Note: If the circuit has been in use for less than seven days, call Bunnell for a Return Authorization number and return the circuit for a credit.

If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)
HIGH TEMP - WATER Alarm

Definition: The HIGH TEMP - WATER alarm indicates that the temperature measured in the humidifier cartridge of the Patient Circuit has exceeded the Water temperature setting by more than 3°C and has remained high for 10 minutes, or

The measured temp is 45°C, which is the upper allowable limit.

Checks:

• Place the humidifier in Pause mode. Open the cartridge door and check the spring-loaded contact pins with a pen or pencil. Make sure they spring in and out and that all the pins are at about the same level ± 1-2 mm. Try pulling stuck pins back out to the level of the other pins. Close the cartridge door, press PAUSE again, and see if the alarm has cleared.

• If the alarm persists, press STANDBY and replace the Patient Circuit. Press ENTER to resume normal operation. If the alarm does not go away, it is likely that the humidifier module has failed internally and the LifePulse will need to be changed out.

Note: If the circuit has been in use for less than seven days, call Bunnell for a Return Authorization number and return the circuit for a possible credit.

LOW TEMP - WATER Alarm

Definition: The LOW TEMP - WATER alarm indicates that the temperature measured in the humidifier cartridge of the Patient Circuit has dropped below the Water temperature setting by 3°C and remained there more than 30 minutes.

Checks:

• Place the humidifier in Pause mode. Open the cartridge door and check the spring-loaded contact pins with a pen or pencil. Make sure they spring in and out and that all the pins are at about the same level ± 1-2 mm. Try pulling stuck pins back out to the level of the other pins. Close the cartridge door, press PAUSE again, and see if the alarm has cleared.

• If the alarm persists, press STANDBY and replace the Patient Circuit. Press ENTER to resume normal operation. If the alarm does not go away, it is likely that the humidifier module has failed internally and the LifePulse will need to be changed out.

Note: If the circuit has been in use for less than seven days, call Bunnell for a Return Authorization number and return the circuit for a possible credit.

If the alarm persists, call the Bunnell Hotline
800.800.4358 (HFJV)
HIGH TEMP - GAS Alarm

**Definition:** The HIGH TEMP – GAS alarm indicates the temperature in the Patient Circuit, as measured proximal to the Patient Box, has exceeded the Gas temperature setting by more than 3°C and remained there for more than 1 minute, or

The measured temp is 45°C, which is the upper allowable limit.

**Checks:**

- Place the humidifier in Pause mode. Open the cartridge door and check the spring-loaded contact pins with a pen or pencil. Make sure they spring in and out and that all the pins are at about the same level ± 1-2 mm. Try pulling stuck pins back out to the level of the other pins. Close the cartridge door, press PAUSE again, and see if the alarm has cleared.

- If the alarm persists, press STANDBY and replace the Patient Circuit. Press ENTER to resume normal operation. If the alarm does not go away, it is likely that the humidifier module has failed internally and the LifePulse will need to be changed out.

**Note:** If the circuit has been in use for less than seven days, call Bunnell for a Return Authorization number and return the circuit for a possible credit.

LOW TEMP - GAS Alarm

**Definition:** The LOW TEMP - GAS alarm indicates the temperature in the Patient Circuit, as measured proximal to the Patient Box, has dropped below the Gas temperature setting by more than 3°C and remained there for more than 3 minutes.

**Checks:**

- Place the humidifier in Pause mode. Open the cartridge door and check the spring-loaded contact pins with a pen or pencil. Make sure they spring in and out and that all the pins are at about the same level ± 1-2 mm. Try pulling stuck pins back out to the level of the other pins. Close the cartridge door, press PAUSE again, and see if the alarm has cleared.

- If the alarm persists, press STANDBY and replace the Patient Circuit. Press ENTER to resume normal operation. If the alarm does not go away, it is likely that the humidifier module has failed internally and the LifePulse will need to be changed out.

**Note:** If the circuit has been in use for less than seven days, call Bunnell for a Return Authorization number and return the circuit for a possible credit.

If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)
**HIGH and LOW LEVEL - WATER Alarms**

**Definition:** The HIGH LEVEL alarm indicates that the water in the humidifier cartridge has reached the high water level sensor.

The LOW LEVEL alarm indicates the water in the humidifier cartridge has not reached the low water level sensor.

**Checks:**

**HIGH LEVEL - WATER Alarms**

- Make sure sterile H₂O, not saline, was used to fill the humidifier cartridge.
- Make sure the water inlet tube is installed properly in the water pump housing.
- Was the humidifier manually filled to the high level sensor?
- Was the water supply clamp opened prior to securing the water inlet tube inside the water pump housing, so that the humidifier cartridge over-filled by gravity?
- Place the humidifier in Pause mode. Open the cartridge door and check the spring-loaded contact pins with a pen or pencil. Make sure they spring in and out and that all the pins are at about the same level ± 1-2 mm. Try pulling stuck pins back out to the level of the other pins. Close the cartridge door, press PAUSE again, and see if the alarm has cleared.
- Press STANDBY and replace the Patient Circuit. Press ENTER to resume normal operation. If the alarm does not go away, it is likely that the humidifier module has failed internally and the LifePulse will need to be changed out.

**LOW LEVEL - WATER Alarms**

- Inspect the water supply tubing from the water supply to see if it is clamped off or disconnected. Unclamp or reconnect the water supply tubing.
- Inspect the water supply to see if it is empty. Replace the water supply if necessary.
- Make sure that sterile H₂O, not saline, was used to fill the humidifier cartridge.
- Follow last 2 items under HIGH LEVEL - WATER alarms.

**Note:** If the circuit has been in use for less than seven days, call Bunnell for a Return Authorization number and return the circuit for a credit.

If the alarm persists, call the Bunnell Hotline 800.800.4358 (HFJV)
Appendix A

Proper Control of Humidification for the Bunnell LifePulse

Humidification on the LifePulse may need to be adjusted for different environmental conditions. Where is the patient’s bed relative to air conditioning or heating vents, doorways, and traffic patterns? Is the patient in an open intensive care bed or a closed bed? The humidifier is programmed so that the Gas temperature is set at 40°C and the Water temperature is set at 38°C. In many situations these settings work fine, but that doesn’t mean they are always appropriate.

The Gas temperature should always remain at 40°C because the gas temperature cools as it accelerates through the Patient Box and the LifePort adapter. The delivered temperature at the ET tube is 37°C or less. To control humidity (minimize rain-out) you have to adjust the Water temperature. The first step is to lower the temperature one degree, clear the excess condensation (water droplets) from the LifePulse Patient Circuit, and wait 20-30 minutes to see if the situation improves. If it does not, lower the Water temperature 0.5°C and repeat the process. Your goal is to have the clear portion of the Patient Circuit between the humidifier and the Patient Box almost dry (small patches of mist or fog are acceptable but no droplets) and the green delivery tube between the Patient Box and the patient covered in mist, so that if you tapped the circuit, droplets would immediately form. We can help you with this process over the Hotline, 800.800.4358.

Water droplets that get pushed through the LifePort adapter from the circuit or secretions that come up and out of the patient from the ET tube cause the same symptoms with respect to pressure monitoring. They cause the monitored PIP to drop and the PEEP to rise simultaneously. Once the moisture moves through the LifePort, the monitored pressures move back, the PIP rises, and the PEEP drops. This is always characteristic of moisture interference. If the patient is causing the pressure to fluctuate it is usually isolated to the PIP dropping (or fluctuating) with the PEEP staying relatively constant in comparison.

If the patient on the LifePulse is in a closed-style ICU bed (e.g., Omni Bed™), the easiest way to control excess condensation (rainout) is to put as much of the LifePulse circuit inside the closed hood as is reasonable. Less rainout will occur with a shorter length of the circuit outside the bed.

Additional information on humidification control can be referenced in the User Manual or on the Bunnell website www.bunl.com.
Test Procedures for LifePulse HFV

The fastest way to determine if the LifePulse is functioning properly is to run it on a test lung.

The test lung should consist of a 3.5 mm LifePort adapter connected to a 3.5 mm standard ET tube with a test lung on the patient end. If you have a test lung that incorporates a Hi-Lo Jet ET (triple lumen) tube, discard the Hi-Lo Jet tube and replace it with a standard tube and LifePort adapter. The pressure monitoring tube of an old Hi-Lo ET tube can become compressed over time and result in erroneous pressure information.

Note: The conventional ventilator is not needed for testing the LifePulse. The 15 mm connection of the LifePort adapter is left open to the room during both test procedures.

The first procedure is to run an internal test by pressing the SYSTEM TEST button. This test checks all of the primary functions of the LifePulse. If a problem is detected the test sequence will stop and a code will be displayed in the I:E Ratio display in the Controls section.

If the System Test is passed, run an Operational Test by pressing the ENTER Button on the default control settings. If the set PIP is reached, the Ready indicator is illuminated (indicating the alarms have been activated), the PEEP is zero (0) ± 1 cm H₂O, and the Operational Test has been passed. If both tests are passed, the LifePulse is functioning normally and can be placed into service. This test sequence should only take 5 minutes to perform.

If either the System or Operational Test fails, call the Bunnell Hotline at 800-800-4358 (HFJV) for technical assistance.