Pocket guide

3100B High-Frequency Oscillatory Ventilator

CareFusion

This clinician guide describes equipment set-up and patient management procedures for the 3100B High-Frequency Oscillatory Ventilator *(HFOV).*

Warning

Do not use this pocket guide as a substitute for *(1)* reading and understanding the operator manual, *(2)* obtaining proper training or *(3)* competently using the 3100B HFOV. Use this document as a guideline for initiating and managing the patient on HFOV. Patient management on the 3100B HFOV must be altered based on the patient's individual clinical needs. This document is not intended to be used as a substitute for clinical experience or medical guidance.

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Indications and contraindications

Indications

The 3100B HFOV is indicated for use in the ventilatory support and treatment of selected patients weighing 35 kg and greater with acute respiratory failure.

Contraindications

The 3100B HFOV has no specific contraindications.

Identifying patients for high-frequency oscillatory ventilation

Patients with ALI or ARDS weighing 35 kg or greater who are currently failing on conventional ventilation with a protective lung strategy benefit from HFOV. The following criteria are generally used for determining the feasibility of using HFOV:

- FiO_2 ≥60, PEEP ≥10 with a P/F ratio <200.
- Plateau pressure >30 cmH_2O.
- Presence of bilateral infiltrates on the CXR consistent with ARDS.
- Oxygenation index >24.

Note: Several clinical papers and randomized control trials *(RCTs)* have demonstrated that the earlier application of HFOV on patients with severe ARDS may be important for successful outcomes.

The Multicenter Oscillatory Ventilation for Acute Respiratory Distress Syndrome Trial *(MOAT)*[1] excluded severe chronic obstructive pulmonary disease *(COPD)* and asthma patients from the 3100B HFOV RCT. In diseases with increased airway resistance, high-frequency oscillatory ventilation may result in air trapping and hyperinflation.

Important considerations before placing a patient on HFOV

- Hemodynamic status
  - The patient should be hemodynamically stable with a MAP of at least 75 mmHg.
  - If the MAP is less than 75 mmHg, fluids and/or vasopressors should be considered to optimize the hemodynamic status before the oscillator is started.
- ABG
  - Ideally, the pH should be greater than 7.2.
  - If the pH is less than 7.2, a buffer for correction should be considered for transition.
- Sedation status
  - Sedation and neuromuscular blockades should be considered for transition. Due to the fixed bias flow of the device, patients are unable to actively breathe and maintain a stable airway pressure and lung volume.
  - Once transitioned, patients may be maintained on sedation only. The following factors should be considered:
  - If the patient has recently had a CXR.
  - The patient's mattress type. The mattress should be firmer if needed.

- If the patient requires an off-unit procedure, such as a CT scan or MRI. If the off-unit procedure is required, it should be considered before the patient is placed on HFOV.
- If an in-line suction catheter is in use, the circuit must fit, and the patient must be suctioned before the patient is placed on HFOV.
- A brief explanation of HFOV should be given to the family and patient to prepare them for noise, chest wiggle or other activity.
- Treatment with oscillation and open lung strategy *(TOOLS)* if lung recruitment maneuvers are not part of the ventilation protocol.

Pre-use checklist review

The following steps should be performed before use:

1. Connect the source gases to the system.
2. Connect the power to the system.
3. Check that the patient circuit support is installed on the system.
4. Connect the patient circuit and humidifier to the system.
5. Connect the patient circuit control and pressure sense lines to the system.
6. Turn on the power.
7. Check that the source gas lights are off.
8. Check that the start/stop light is off.
9. Check that the alarm silence light is on.
10. Perform the patient-circuit calibration described in the following section.
11. Perform verification performance.
12. Perform the alarm-check procedure as described in the operator manual.
13. Pre-set the flow, frequency, % I-time, power and running MAP.
14. Set the Max Paw and Min Paw switches.
15. Set the blender and humidifier controls for the desired operation.
16. Remove the stopper from the patient circuit, and connect it to the ET tube.

Patient circuit calibration

Perform the patient circuit calibration procedure before ventilating a patient. Each circuit used on the oscillator must be calibrated. The circuit calibration procedure verifies the circuit does not leak and will hold pressure. Perform this procedure before placing a patient on the 3100B HFOV and changing a circuit component at any time:

1. Insert the stopper in the patient circuit wye, and turn on the bias flow gas.
2. Rotate the ADJUST control to Max.
3. Set the Max Paw alarm to 59 cmH_2O.
4. Set the bias flow to exactly 20 LPM.
5. Depress and hold RESET.
6. Observe the mean pressure display, and adjust the patient circuit calibration screw for a reading of 39 to 43 cmH_2O.
   a. Before adjusting the calibration screw, confirm a leak-free circuit, 20 LPM bias flow and correct circuit set-up. See the troubleshooting guide for more information.
   b. Use caution when adjusting the calibration screw. Do not overtighten or apply excessive force, which can cause equipment damage.

Ventilator performance check

The ventilator performance check ensures the 3100B HFOV is functioning properly. Perform this procedure before placing a patient on the 3100B HFOV:

1. Insert the stopper in the patient circuit wye, and turn on both gas sources.
2. Turn the Adjust control to the 12:00 position.
3. Set the bias flow at 30 LPM.
4. Pressurize the system by pressing and holding Reset and Adjust for a mean pressure of 29 to 31 cmH_2O.

Altitude *(feet)*	mPaw *(cmH_2O)*	ΔP *(cmH_2O)*
0–2,000	26–34	113–135
2,000–4,000	26–34	104–125
4,000–6,000	26–34	99–115
6,000–8,000	26–34	86–105

5. Set the frequency to 6.0 Hz, set the % I–time to 33 and press START/STOP to start the oscillator.
6. Set the power to 6.0.
7. Observe the following parameters using the appropriate altitude range, and verify they fall within the ranges specified:

Note: See Troubleshooting on pages 19 to 27 for additional information.

Initial settings and management

1. Set the bias flow between 25 to 40 LPM. Patients with severe air-leak syndrome or cuff leak may require a higher bias flow to achieve the desired mPaw.
2. Set the mPaw at 5 cmH_2O pressure above the conventional ventilator mPaw.
   a. Consider a recruitment maneuver first if the patient is extremely hypoxic by applying 40 cmH_2O for 40 to 60 seconds.
   b. If oxygenation worsens, increase the mPaw in 3 to 5 cmH_2O increments every 30 minutes until reaching the maximum setting.

Note: Oxygenation typically worsens in the first 30 minutes of recruitment in severe ARDS.

   c. Check a CXR within one to four hours of initiating HFOV to assess the lung volume.
3. Set the power at 4.0, and rapidly increase it to achieve chest wiggle *(a visual vibration from the shoulders to mid-thigh area).*
   a. Consider transcutaneous monitoring for CO_2 *($TcCO_2$).*
   b. If the $PaCO_2$ worsens *(but pH >7.2),* increase the power setting to change the amplitude in 10 cmH_2O pressure increments every 30 minutes, up to the maximum setting.
   c. If pH is <7.2, consider buffering pH.

d. Consider an abrupt rise in $PaCO_2$ in an otherwise stable patient an obstruction of the ET tube until proven otherwise.

4. Set the Hz at a range of 5 to 6 initially.

Note: Some studies suggest that a higher frequency setting *(and corresponding higher amplitude)* may be more lung protective.

a. Consider decreasing the Hz if you cannot control the $PaCO_2$ with an amplitude of approximately 90 cmH_2O.

b. Decrease the Hz by 1 Hz at a time every 30 minutes until you reach a level of 3 Hz.

5. Set the IT % at 33%.

a. Consider increasing this value up to 50% if you cannot ventilate by increasing the amplitude or by first decreasing the frequency.

6. For severe hypercapnia with pH >7.2, consider decreasing the ET tube cuff inflation to produce a leak.

Caution

Using flows higher than 40 LPM may increase the risk of an increasing $PaCO_2$ by decreasing the effectiveness of the active exhalation.

a. Reduce the inflation of the cuff until you see a drop in the mPaw by 5 cmH_2O. Read just the bias flow to correct the mPaw level.

b. Rule out obstruction in the ET tube with bronchoscopy.

7. Set the initial FiO_2 at the transition to HFOV to 1.0. Alternatively, increase the current FiO_2 by 10%.

8. As oxygenation improves, gradually wean the FiO_2 to 0.40, and then slowly reduce the mPaw 2 to 3 cmH_2O every four to six hours until the mPaw is in a 22 to 24 cmH_2O range.

9. When the above goal is met *(but no sooner than 24 hours),* switch to PCV or APRV. Initial settings:

- PIP titrated to achieve a delivered Vt of 6 to 8 mL/kg
- Pplat of <35 cmH_2O
- I:E of 1:1
- PEEP of 12 cmH_2O
- Rate of 20 to 25/min
- MAP of about 20 cmH_2O *(± 2 cmH_2O)*

Oxygenation and ventilation management

↑ PaO_2

- Wean the FiO_2 slowly *(5%)* to <0.60. Recheck the x-ray for a lung volume assessment. If the lung volume is adequate, continue to wean the FiO_2 to 0.40. If the lung volume is approaching a hyperinflation state, consider weaning the mPaw by 1 to 2 cmH_2O and continue to wean the FiO_2 to 0.40.
- Once the FiO_2 <0.40, attempt to wean the mPaw by 1 to 2 every four to six hours to maintain adequate lung inflation and oxygenation.

↓ PaO_2

- Increase the FiO_2 as needed to 1.0.
- Increase the mPaw by 3 to 5 every 20 to 30 minutes to obtain adequate lung inflation and oxygenation.
- Check the x-ray to ensure the appropriate lung volume.
- Check for hemodynamic status for adequate perfusion.

↑ pH

- Decrease power, maintaining adequate CWF.
- Increase Hz.
- Decrease % I-time to 33% if at 50%.

↓ pH

- Increase power, obtaining or maintaining adequate CWF.
- Decrease Hz *(minimum of 3.0).*
- Generate ET tube leak.
- Increase % I-time to 50% if at 33%.

$PaCO_2$

- Accept hypercapnia if pH allows *(>7.2).*
- Consider buffering pH to allow permissive hypercapnia.

HFOV patient assessment

ABG

- Sixty minutes after HFOV initiation.
- ABG frequency based on clinical status.
- Within one hour of any major setting change or as clinically indicated.

CXR

- Within one to four hours after HFOV initiation.
- Whenever lung overinflation or underinflation is suspected.

Patient assessment

Patient assessment should be done every two hours with:

1. CWF: Note visible vibration from the shoulder to mid-thigh and bilateral. This check ensures air movement through the airway structure and lung:
   a. Check for the degree of vibration noted and symmetry.
   b. Question changes in CWF. For example:
   - An increase with improved compliance
   - A decrease with worsening compliance or secretions
   - Changes on only one side of the chest due to the ET tube slipping down the main bronchus or pneumothoraces

2. Auscultation: Breath sounds cannot be heard; however, consider denoting changes in the intensity of the piston sounds.
3. Heart and gastrointestinal sounds: Stop the piston temporarily. Lung inflation will maintain.
4. Vital signs: Use HR, BP, MAP, urine output, PCWP, PAP and CVP monitoring to ensure adequate perfusion, though they are not required.
5. Oxygen saturation: Maintain between 88 to 93%.
6. FiO_2: Make changes based on improved oxygen saturation.
7. Transcutaneous PCO_2 if available: Use for trending $PaCO_2$ and as indication of ventilatory status change.
8. Adequate perfusion status: Monitor by assessing capillary refill, skin turgor and color, urine output change and persistent metabolic acidosis.
9. Secretions: Present problems with ventilation if present. Usually, secretions are noted by a rapid rise in $PaCO_2$, decreased oxygen saturation and visibly decreased chest wiggle.
10. Cuff leak: Monitor closely during position changes. Note any changes in amplitude and mPaw reflected on the 3100B HFOV.

Oscillator setting documentation

- Verify and record the ventilator settings *(frequency, bias flow, % I-time, power, Max mPaw and Min mPaw)* and measurements *(mPaw and amplitude).*

Note: If mPaw or amplitude measurements change independent of setting changes, assess clinical changes, circuit issues or airway issues before dialing for a given measurement.

- Record an intentional cuff leak.
- Record the FiO_2 *(must be analyzed).*

Weaning HFOV and transitioning to conventional ventilation

When the following goals are met *(but no sooner than 24 hours)*, switch to PCV:

- FiO_2 is weaned to 0.40.
- mPaw is 22 to 24 cmH_2O
- SpO_2 >88% *(or as ordered)*

The patient should be stable on the above settings and able to tolerate suctioning and brief disconnects. The CXR should show resolution of the underlying process.

Transitioning to conventional ventilation

1. Use a mode most conducive to the patient, usually PCV/APRV.
2. Set the MAP to be the same in CMV as on HFOV.
3. Adjust the inspiratory pressure to achieve Vt 6 to 10 mL/kg of ideal body weight.
4. Set PEEP, FiO_2 and rate based on the most recent ABG.

Troubleshooting clinical issues

These clinical troubleshooting guidelines can help reveal causes for clinical changes. By no means all-inclusive, these guidelines only address common problems.

Problem: The patient experiences an abrupt deterioration *(with a rapid rise in $PaCO_2$)* while on mechanical ventilation with the high-frequency oscillator.

Issues to consider:

- Acute airway obstruction *(mucous plug)*
- Bronchospasm
- Pneumothorax
- Right mainstem intubation or extubation

Responses under these circumstances:

- Assess airway function/patency *(e.g., ET tube suctioning, auscultation, direct laryngoscopy, $tcPCO_2$ assessment, diminished chest wiggle).*
- Recommend bronchoscopy.
- Draw an ABG if the acute decompensation results in profound hypoxemia *(SpO_2 <80%)* or acute hypotension *(mean BP drop of >20 mmHg).*
- Notify the physician of these developments immediately, and recommend a "stat" CXR.
- Consider removing the patient from the oscillator and hand resuscitating.

Problem: The patient experiences an abrupt deterioration with a drop in oxygen saturation.

Issues to consider:

- Airway patency
- Changes in MAP
- Disconnection from the HFOV device with loss of lung volume
- Possible pneumothorax

Responses under these circumstances:

- Consider fluid boluses and/or pharmacologic support to maintain a MAP of 75 mmHg or greater.
- Re-check the x-ray to assess or rule out the presence of pneumothoraces.
- For an accidental disconnect, consider a recruitment maneuver and/or increase in FiO_2 initially.

Problem: The patient experiences hypotension. Increased intrathoracic pressure from the elevated mPaw may decrease blood flow, reducing the right ventricular preload.

Issues to consider:

- Fluid bolus
- Pharmacologic support
- Reduced mPaw

Troubleshooting equipment issues

Circuit does not pass patient circuit calibration

- Visually check for leaks, cracks and open ports on the circuit.
- Check cap/diaphragms.
- Check the water trap stopcock *(may be open or missing).*
- Ensure the circuit is set up correctly.
- Confirm the bias flow is set exactly at 20 LPM *(the middle of the ball is at the 20 LPM line—you may need to bend down to see this accurately).*
- Check the airway pressure luer fittings for cracks.
- Check the calibration screw *(clicking indicates a defective valve).*
- Confirm the pressure transducer is zero: With the circuit stopper in place, but the system not pressurized, the Paw should read 0 cmH_2O *(± 0.5 cmH_2O).*

Ventilator does not pass the performance check

If the ventilator does not pass the performance check due to the following issues, follow these instructions:

Low amplitude

- Bypass the humidifier.
- Check the power knob *(0.0 to 10.0).*

Low mPaw
(with or without low amplitude)

- Crimp the airway pressure line *(mPaw should read 130 to 140 cmH_2O).*
- Check the flow meter.

Driver does not start oscillating

- Check the power knob.
- Check the mPaw.
- Check if the humidifier chamber is empty *(may drop the amplitude by as much as 10 cmH_2O).*
- Bypass the humidifier.

Fluctuating mPaw

- Verify Auto-Limit feature activation.
- Check the high-pressure setting.
- Check for spontaneous breathing.

Illuminated low source gas

- Check the input gas lines, as this condition indicates an input pressure of less than 30 psi from the blender or cooling air.
- Ensure all hoses are plugged into a gas source.
- Check the blender set-up configuration.
- Remove the wye or T-fitting to check internal restriction.
- Replace the input water trap filter if needed.
- Call CareFusion Technical and Clinical Support to report any internal leak.

High Pressure alarms
(alarm setting or >60 cmH_2O)

- Spontaneous breathing: Consider the clinical status of the patient, assess the sedation level or insufficient bias flow rate and readjust the mPaw using a higher flow.
- Obstruction in the expiratory limb or pressure sense line: Replace the patient circuit.
- Improper alarm setting: Change the alarm setting.
- Patient circuit temperature rise: Check and correct the circuit temperature.
- Radio transmitter interference: Remove the source of interference.

Low Pressure alarms
(alarm setting or <5 cmH_2O)

- Spontaneous breathing: Consider the clinical status of the patient, assess the sedation level or insufficient bias flow rate and readjust the mPaw using a higher flow.
- Improper alarm setting: Change the setting.
- Improper mPaw or flow meter setting: Change the setting.
- Patient circuit temperature drop: Check and correct the circuit temperature.
- Humidifier or patient circuit leak: Fix the leak or replace the patient circuit.
- Cap diaphragm leak: Replace the cap diaphragm.

- Open water trap stopcock:
  Close the water trap stopcock.
- Radio transmitter interference:
  Remove the source of interference.

Stopped oscillator with no other alarm occurring

- Low power setting and ≤7 cmH_2O amplitude:
  Adjust the setting for desired amplitude.
- Oscillator failure:
  Call CareFusion Technical and Clinical Support.

Amplitude changed over the past couple hours while the power setting remained unchanged

- Increased amplitude:
  Increase airway resistance and/or decrease total lung compliance.
- Decreased amplitude:
  Decrease airway resistance and/or increase total lung compliance.

Amplitude changes are normal as the patient's pulmonary status changes. Assess changes in the patient's status and adjust ventilator settings if appropriate.

General guidelines

- Do not reuse ventilator circuits. Washing and sterilizing reduces overall performance and increases the risk of malfunction.
- Use caution when storing ventilator circuits. Some components may break if compressed tightly.
- Use personal protective equipment or the filtered oscillator circuit, as water exiting the exhalation valve is normal.

Recruitment maneuvers for adult patients on HFOV

A recruitment maneuver is a technique that attempts to recruit alveoli and increase lung volume by using sustained inflation accomplished by a set mPaw of 40 cmH_2O pressure for 40 seconds with the piston in a stopped position. This technique, when combined with HFOV, may further improve oxygenation and lung recruitment:[3]

1. Set the FiO_2 to 1.0.
2. Inflate the cuff.
3. Stop the oscillator *(START/STOP button).*
4. Increase the mPaw to 40 cmH_2O; then, maintain that pressure for 40 seconds.
5. Return to the previous oscillator settings by:
   - **a.** Decreasing mPaw.
   - **b.** Resuming oscillation.
   - **c.** Establishing the previous cuff leak.

Recruitment maneuver guidelines

- Perform a recruitment maneuver after any circuit disconnect.
- Perform a recruitment maneuver before an increase in mPaw.
- Repeat a recruitment maneuver up to three times to improve oxygenation with the ability to reduce FiO_2.

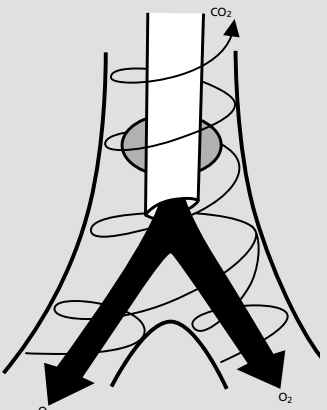
Caution

Do not perform a recruitment maneuver under these conditions:

- Pneumothorax is present with an active air leak.
- Patient is hemodynamically unstable. For example:
  - MAP <60 mmHg or >20 mmHg during the maneuver.
  - Heart rate is >140 and <60.
  - New arrhythmias are noted.
  - SpO_2 is <85%.

Cuff leak procedure

The cuff leak procedure is a technique that may be employed with HFOV to help clear the tracheal dead space of CO_2 and maintain an adequate pH. Decreasing cuff pressure allows gas *($PaCO_2$)* to escape around the ET tube and excrete through the mouth. In some cases, $PaCO_2$ can drop by 30 to 40 mmHg *(or more).* However, note that an active air leak from a chest tube may minimize or eliminate the effect of a cuff leak.



Indications

The following are indications for the cuff leak procedure:

- Power/Amplitude and mPaw have been optimized with no net improvement in $PaCO_2$.
- Frequency has been lowered to four Hz or less with no improvement in $PaCO_2$.
- I-Time % has increased with no improvement in $PaCO_2$.

Procedure

1. With a syringe attached to the ET tube pilot balloon, withdraw air.
2. Reduce the inflation of the cuff until you see a drop in the mPaw by approximately 5 cmH_2O.
3. Increase the bias flow to attain the desired mPaw level.

Monitoring for cuff leak patency

If the mPaw increases, suction the hypopharynx and reassess the mPaw level. If the mPaw is lower than desired, reassess and readjust the cuff air pressure to the target mPaw. The MAP may change after the patient position changes; if so, reassess the MAP.

Caution

Before producing a cuff leak, consider:

- If the patient has been suctioned.
- If a bronchoscopy was performed to clear the airway of any obstruction.
- If a recent CXR shows the appropriate lung volume. Note that the distal mPaw is less with the cuff deflated even though the monitored mPaw is the same.
- Increasing the mPaw if the oxygen saturation drops with this procedure.

Table 1: PaO_2/FiO_2 ratio

	21	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
40	190	160	133	114	100	89	80	73	67	62	57	53	50	47	44	42	40
50	238	200	167	143	125	111	100	91	83	77	71	67	63	59	56	53	50
60	286	240	200	171	150	133	120	109	100	92	86	80	75	71	67	63	60
70	333	280	233	200	175	156	140	127	117	108	100	93	88	82	78	74	70
80	381	320	267	229	200	178	160	145	133	123	114	107	100	94	89	84	80
90	429	360	300	257	225	200	180	164	150	138	129	120	113	106	100	95	90
100		400	333	286	250	222	200	182	167	154	143	133	125	118	111	105	100
110		440	367	314	275	244	220	200	183	169	157	147	138	129	122	116	110
120			400	343	300	267	240	218	200	185	171	160	150	141	133	126	120
130			433	371	325	289	260	236	217	200	186	173	163	153	144	137	130
140				400	350	311	280	255	233	215	200	187	175	165	156	147	140
150				429	375	333	300	273	250	231	214	200	188	176	167	158	150
160					400	356	320	291	267	246	229	213	200	188	178	168	160
170					425	378	340	309	283	262	243	227	213	200	189	179	170
180						400	360	327	300	277	257	240	225	212	200	189	180
190						422	380	345	317	292	271	253	238	224	211	200	190
200							400	364	333	308	286	267	250	235	222	211	200
210							420	382	350	323	300	280	263	247	233	221	210
	<200 ARDS				<300 ALI				<400 abnormal				>400 WNL				

Table 1: PaO_2 / FiO_2 ratio *(continued)*

	21	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
220								400	367	338	314	293	275	259	244	232	220
230								418	383	354	329	307	288	271	256	242	230
240									400	369	343	320	300	282	267	253	240
250									417	385	357	333	313	294	278	263	250
260										400	371	347	325	306	289	274	260
270										415	386	360	338	318	300	284	270
280											400	373	350	329	311	295	280
290											414	387	363	341	322	305	290
300												400	375	353	333	316	300
310												413	388	365	344	326	310
320													400	376	356	337	320
330													413	388	367	347	330
340														400	378	358	340
350														412	389	368	350
360															400	379	360
370															411	389	370
380																400	380
390																411	390
400																421	400
	<200 ARDS				<300 ALI				<400 abnormal				>400 WNL				

Outcome assessment form

This form is **not** intended to encourage or deny HFOV. The following is a portion of the form only. The full outcome assessment form is available at **carefusion.com/hfov.**

	Low risk *(zero points)*	Moderate risk *(one point)*	High risk *(two points)*	Max risk *(three points)*	Score
Days P/F <200	<2 days	2–4 days	5–6 days	>7 days	
Days of CMV	<6 days		>7 days		
$PaCO_2$	35–55	<35	55–80	>80	
Organ failures	Pulmonary only	2 or more			
PIP	<38	39–49	>50		
Immune comp.	No	Yes			
OI	<19	20–30	31–40	>41	
OI trend			Slowly worsening	Dramatically worsening	
OI = [*(FiO_2 x 100)* x mPaw /PaO_2]					

Score: 1–7 Low anticipated mortality; 8–13 Moderate anticipated mortality; 14–19 High anticipated mortality

Useful information

HFOV clinical and technical support

Registered respiratory therapists are available for clinical and technical support during normal business hours and for emergency support 24 hours per day.

Call **800.520.4368**, and follow the prompts.

For technical support in Canada, call **800.268.7916**.

3100B HFOV rental program

The 3100B HFOV rental program is designed to assist customers who own the 3100B HFOV and need additional units, or customers trained on the 3100B HFOV and approved to rent the device as a short-term solution bridging a purchase. Delivery is within 24 hours in most cases. This program is available 24 hours per day.

Call **800.520.4368**, and follow the prompts.

References

1 Derdak, S., Mehta, S. et al. High-frequency oscillatory ventilation for acute respiratory distress syndrome in adults: A randomized, controlled trial. *Am J Resp Crit Care Med*, 2002, 166:801–808. 2 Ferguson, N., Chiche, J. et al. Combining high-frequency oscillatory ventilation and recruitment maneuvers in adults with early acute respiratory distress syndrome. The treatment with oscillation and open lung strategy *(TOOLS)* pilot study. *Crit Care Med,* 2005, 33:479–486. 3 Johnson, J., Bachman, T. Refining and validating a risk assessment tool for HFOV rescue of ARDS patients. *Respiratory Therapy,* 2006, 2:42–47.

Abbreviations

ARDS	Acute respiratory distress syndrome
ALI	Acute lung injury
ABG	Arterial blood gas
APRV	Airway pressure release ventilation
BP	Blood pressure
cmH_2O	Centimeters of water
CO_2	Carbon dioxide
COPD	Chronic obstructive pulmonary disease
CT	Computed tomography
CVP	Central venous pressure
CWF	Chest wiggle factor
CXR	Chest x-ray
ET	Endotracheal tube
FiO_2	Fraction of inspired oxygen
HR	Heart rate
I-time	Inspiratory time
MAP	Mean arterial pressure
MRI	Magnetic resonance imaging
mPaw	Mean airway pressure
Paw	Mean airway pressure display on the 3100B HFOV
OI	Oxygenation index: *(mPaw x FiO_2 x 100)*/PaO_2
P/F ratio	PaO_2/FiO_2
$PaCO_2$	Partial pressure of carbon dioxide
PAP	Pulmonary artery pressure
PCV	Pressure control ventilation
PCWP	Pulmonary capillary wedge pressure
PEEP	Positive end-expiratory pressure
Pplat	Plateau pressure
PIP	Peak inspiratory pressure
$tcPCO_2$	Continuous transcutaneous monitoring of $PaCO_2$
$TcCO_2$	Transcutaneous CO_2
WNL	Within normal limit

Notes

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Notes

⚠ **WARNING**—U.S. Federal Law restricts this device to sale by or on the order of a physician.

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