Home Ventilator
Your Prescription

Your physician has prescribed a home ventilator system for your child. This book will help you to understand how to use your home ventilator. You will also receive a manufactures owner’s manual for your ventilator. This manual is not meant to replace that manual.

Why a Ventilator is Needed:

There are many reasons why a patient is put on a ventilator in the hospital. Sometimes patients have difficulty weaning off the ventilator and have to use a ventilator at home. The following are some reasons why ventilation is needed:

- **Neurologic Disorders:** These are conditions that affect the brain and spinal cord. Injury and disease affecting the brain or spinal cord can have an effect on breathing. If this signal becomes irregular or is absent mechanical ventilation may become necessary. Damage to the spinal cord can also interrupt the signal and keep the breathing muscles from working properly. If this occurs mechanical ventilation may become necessary as well.

- **Neuromuscular Disorders:** These disorders may result in the need for mechanical ventilation when the muscles used for normal ventilation are affected.

- **Pulmonary Disorders:** Pulmonary disorders can affect the lungs to such a degree that it gets harder for the lungs to work properly. When this happens mechanical ventilation may become necessary.

- **Bronchopulmonary Dysplasia:** Bronchopulmonary dysplasia is a term used to describe infants and young children with a variety of chronic lung diseases. Children who have been diagnosed with BPD often need oxygen and/or other forms of medical therapy to help them breathe and function better. Often these children are born prematurely and lack a material called surfactant (a substance that allows the lungs to expand easily) When this occurs they are diagnosed with Hyaline Membrane Disease shortly after birth. As a result of inadequate surfactant many children require assistance with their breathing and require mechanical ventilation. With mechanical ventilation and the lack of surfactant, scar tissue develops the lung becomes more difficult to expand. BPD can also be caused by other lung disorders that include: Respiratory Syncytial Virus (RSV) sometimes requiring intensive care, near drowning victims, smoke inhalation victims, children with recurring pulmonary infections. There are various degrees of severity for BPD. Children with the most severe cases require a tracheostomy tube. Often, they will also require positive pressure to keep their airways open. This positive pressure can be delivered with mechanical ventilation.
or CPAP (Continuous Positive Airway Pressure). The use of positive pressure helps to reduce the work of breathing. This allows the calories from food to help the body grow instead of being used for increased efforts of breathing.

Children with BPD are also at risk for respiratory infections and “asthma like problems” This is due to increased difficulty in clearing mucus from their airway and sensitivity to various irritants. There are various forms of medications and therapies used to help children with BPD which include:

- Bronchodilators: medication that is inhaled including albuterol/ventolin/proventil, Xopenex, and atrovent
- Cromolyn Sodium (Intal): another medication that is inhaled
- Anitbiotics: to help clear infections
- Steroids: to decrease airway inflammation (this can be inhaled or taken orally in pill form)

There are also various goals in taking care of children with BPD, which include:

- Minimizing respiratory infections and “exacerbations”
- Minimize airway irritants in the home
- Proper use of medications and therapies through educating the caregiver
- Good nutritional program so that the abnormal inflamed and mucus producing tissue can heal and be replaced by healthy new lung tissue
- Regular schedule visits with physicians, nurses, and therapist to monitor progress

Manny infants diagnosed with BPD in infancy will function as if they have healthy normal lungs by the age of 3 to 6 years. If you have any further questions or concerns about BPD please do not hesitate to ask your physician.
Control Panel on the LTV 1150

A/C – SIMV/CPAP Mode:

- Push mode button (Will flash five sec)
- To confirm push mode button again
- When A/C is selected, the ventilator will be in Control or A/C mode, depending on the Sensitivity setting. If Sensitivity is set to “—“ it will be in the Control mode.
- When SIMV/CPAP is selected, the ventilator will be in SIMV or CPAP mode, depending on the breath rate

Breath Rate:

- Establishes the minimum rate of machine breaths the ventilator will deliver per minute
- Push the breath rate
- Change by using the Set Value Knob

Control Lock

- Locks the front control panel so that settings are not accidentally changed
- Can be set to Easy unlocking
- Can be set to Hard unlocking by holding the Control Lock for 3 seconds

On/Standby:

- To turn the ventilator on from the standby state push the On/Standby button
- To put the ventilator into standby, push and hold the On/Standby button for 3 seconds
- The Inop alarm will occur. To cancel inop alarm push the silence/reset button

Pressure Control

- This control establishes the target pressure above 0 cmH2O for Pressure Control breaths. The ventilator controls inspiratory flow to maintain the set circuit pressure for the set time
- To select Pressure Control, toggle the Volume/Pressure mode to select pressure ventilation
- To set Pressure Control level, push the Pressure Control button
• Flow termination for pressure breath can be enabled under extended features. Pressure Control display will flash when flow terminating.
• The Rise Time for Pressure Control may be selected under Extended features.

**Pressure Support**

• Establishes the target pressure above 0 cmH2O for Pressure Support breaths.
• May be terminated by flow or by time
• Push Pressure Support button
• Charge the setting using the Set Value Knob

Flow Termination: Pressure support breaths are flow terminated when the flow decreases to a set % of peak flow.

Time Termination: Pressure support breaths are time terminated when the inspiratory time exceeds 2 breath period, or when the inspiratory time exceeds the set Time Termination Limit. Pressure Support display will flash when breath is time terminated.

Rise Time for Pressure Support breaths may be selected under extended features.

**NOTE:** Be sure the Pressure Support setting is higher than the PEEP setting.

**Sensitivity:**

• Establishes the threshold level to allow the patient to flow trigger Assist and Patient breaths
• When a trigger is detected, the Patient Effort LED is illuminated briefly
• Triggers are disabled when the sensitivity sett is set to “—“
• Change the setting using the Set Value knob
• (1) is the most sensitive and 9 is the least sensitive “—“ is off.

**Tidal Volume**

• Establishes the volume gas which the ventilator will produce and deliver during Volume controlled breaths.
• Flow is delivered in tapered waveform over the inspiratory time
• Peak flow is calculated based on tidal volume and inspiratory time, with 10 lpm being the minimum flow
• To set, push the Tidal Volume button
• Change the setting using the Set Value knob
Volume / Pressure Mode

- Button to toggle between Pressure Control and Volume Control
- Push the mode button once and the LED will flash for 5 seconds
- To confirm mode, push the button again

Battery Level

- The battery level indicator shows the level of available internal battery power while running from the internal battery.
- If the battery is running on external battery, the Battery Level indicator light will be off.
- At nominal settings, the colors of the indicator show the approximate battery time.
  - Green – acceptable – 60 minutes
  - Yellow – low- 30 minutes
  - Red- critical low- 7 minutes
  - Total battery time – 1 hour 37 minutes

Charge Status

- The charge status indicator shows the charge state of the internal battery. This LED is on any time the ventilator is supplied with external power and the internal battery is being charged.
  - Flashing Yellow – Ventilator is performing pre-charge qualification testing of the battery before starting the charge process. The qualification process usually takes a few seconds but up to an hour if battery is deeply discharged
  - Green – The internal battery is charged to full capacity. It will continue to trickle charge
  - Yellow – The internal battery is being bulk charged. Battery not at full capacity
  - Red – The ventilator has detected a charge fault or internal battery fault. The internal battery cannot be charged

*NOTE: If the LED indicates a charge fault notify Breath of Life
**Ventilator Alarms:**

**Apnea:**
- When the time since the start of the last breath is longer than the set Apnea interval.
- When Apnea alarm occurs, backup ventilation begins
- To reset this alarm, push the silence/reset button twice
- If the patient takes 2 consecutive breaths, the ventilator will kick itself out of backup ventilation, the audible alarm stops, and the Apnea flashes in the window display

**Bat Empty:**
- While operating on internal battery, the battery charge level falls below the empty threshold
- LED is red and the alarm can only be temporarily silenced by pushing the silence/reset button
- The ventilator will need to be connected to an external power source immediately

**Bat Low:**
- Battery level LED is yellow
- Bat low is displayed with an audible alarm
- Push silence/reset twice to reset
- The ventilator will run for approximately 30 minutes, give or take a few minutes depending on settings

**Disc/Sense**
- Alarm will be generated if a sense line is pinched or blocked, and/or, the line becomes disconnected
- Both audible alarm and a message displayed
- Inspiration is terminated
- Push the silence/reset to silence the alarm
- Push the silence /reset to reset the alarm
LMV Off

- Displayed when the Low Minute Volume alarm has been turned off by setting it to dashes
- Push any front panel button or turn the Set Value knob

LMV LPPS Off

- The Low Minute Volume alarm has been turned off by setting it to dashes
- And the LPP Alarm has been set to VC/PC Only. When this setting is selected the Low Pressure alarm applies only to Volume Control and Pressure Control breaths

Low Pres

- Can be set to apply to all breaths (ALL BREATHS) or Volume Control (VC) and Pressure Control (PC) breaths only
- LOW PRES message displayed and an audible alarm
- Push the silence /reset button twice

LPPS OFF

- Displayed when the LPP ALARM has been set to VC/PC ONLY
- When this is selected, the low pressure alarm only applies to Volume Control and Pressure Control breaths

Alarm Operations:

Alarm Volume

- Push select and then turn set value knob
- Range: 60-85 60-85 dBA

Apnea Int

- Push the select button and turn set value knob
- Range: 10-60 sec
High Pressure Delay

- When NO DELAY is selected, the high pressure alarm is sounded for all high pressure alarms
- When delay 1 or 2 is selected, the audible alarm is not sounded until the number of consecutive breaths with a high pressure condition meets the delay setting
- If a high pressure alarm sounds for more than 3 seconds, the audible alarm will sound, regardless of the delay setting
- Push the select button while HP displays
- Turn the set value knob until the desired setting is displayed
- Push the select button

Low Peak Pressure

- Use the LPP ALARM item to select the type of breaths that the Low Pressure alarm applies to
- ALL BREATHS the low pressure alarm applies to all breaths.
- VC/PC the low pressure alarm applies only to Volume Control and Pressure Control breaths. It does NOT apply to Pressure Support breaths or spontaneous breaths.

Troubleshooting:

1. Pressure Control display flashing: PC breath terminated by flow-PC FLOW TERM set to ON
2. Pressure support display flashing: PS breath terminated by time
3. Control display flashing when setting a control: Control setting is limited
4. LMV LPP OFF is displayed: Alarm is turned off

REMEMBER: Always check for leaks, check high and low sensor lines (Make sure they are not pinched, occluded or loose), check exhalation valve and check extended features. If the problem cannot be fixed, call Breath of Life
Maintaining the Ventilator

Breath of Life will monitor your equipment on each follow up visit each month. Your Respiratory Therapist will bring your supplies and will check the vent to make sure it is working appropriately.

Ventilator Checks

Vent checks should be made on a regular basis to ensure that the patient is on the proper settings that were prescribed by the physician. During this check the respiratory rate, tidal volume, system pressure and alarm functions must be checked. You must also look to make sure there are no kinks in the patient tubing and look at the patient to make sure the patient is being ventilated appropriately.

The ventilator is equipped with alarms that are sensitive to high and low pressures in the circuit. Excessive secretions or coughing may cause the high pressure alarm to sound. If the patient becomes disconnected from the ventilator the low volume alarm will sound. Someone needs to be within hearing distance of the vent to hear the alarms.

It is very important that the patient remain on the settings that the physician has prescribed. One way of ensuring this is occurring is to do a vent check twice a day. The vent check consists of the following:

- Date and Time the check was done
- Ventilator mode (SIMV/CPAP, A/C, Control, Pressure Limit, Pressure Support)
- Oxygen Concentration (FiO2 or LPM) if the patient is not receiving oxygen, the oxygen concentration would be 21%, if the patient is on oxygen record the lpm.
- Tidal Volume- Observe the volume control indicator. Record the volume noted in the indicator. NOTE: This volume should never be changed without a physicians order.
- Breath Rate Ventilator – Observe the breath rate display and record the number of breaths the ventilator is delivering to the patient
- Breath Rate Patient – Count the number of times the patient is breathing in 60 seconds. That will give you the patient’s respiratory rate.
- Patient Pressure – Look at the pressure manometer and watch the needle on the face dial during inspiration. The highest pressure reached is the patient’s pressure. This may vary from breath to breath. Record the average number.
- Inspiratory Time – Observe the inspiratory time control. Record the inspiratory time observed
- Breathing Effort – If the vent is in the Control mode, mark this selection with N/A. If the ventilator is in the A/C or SIMV mode, observe the pressure manometer and the
assist/spontaneous light on the front panel. Record the negative pressure required to cycle the ventilator on. The assist/spontaneous indicator will light to indicate the patient has taken a spontaneous breath. Record the pressure required for the spontaneous breath. This value should be recorded as a negative number.

- **Low pressure alarm setting** – Observe the low pressure alarm setting and record the setting observed.
- **Is the low pressure audible alarm operational?** Disconnect the patient from the circuit and wait 15-20 seconds. You may need to ventilate with an ambu bag during this procedure. After the alarm sounds reconnect the patient to the vent and reset the alarm. Record a yes if an audible alarm is heard.
- **High pressure alarm setting** – Observe the high pressure alarm setting and record the setting observed.
- **Is the high pressure audible alarm operational?** Disconnect the patient from the ventilator and with a gloved hand occlude the air flow at the patient end of the circuit. Adjust the pressure limit knob clockwise or counter clockwise until the needle on the manometer stops rising at the desired maximum pressure point and the audible alarm sounds. Record a yes if an audible alarm is heard.
- **Positive End Expiratory Pressure- (PEEP)** if the patient is on PEEP record the amount of PEEP they are on.
- **Pressure Support Setting** – If there is pressure support ordered, record the number that is prescribed.
- **Humidifier Heater Setting** – Observe the number set on the humidifier and record that setting. If the patient is not on a heated humidifier record N/A.
- **Temperature**- Observe and record the temperature on the thermometer.
- **Battery Check. Is the internal charge ok?** Check the internal battery charge following the manufacturer’s instructions and record yes or no.
- **Battery Check. Is the external battery charge level ok?** Check the external battery charge following the manufacturer’s instructions and record yes or no.
- **Caregiver initials**- This is the initials of the person performing the check.
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*Patient Name:* ____________________
Changing the Patient Circuit:

The patient circuit includes the trach tube, inner cannula, and ventilator tubing and humidification system and must be changed and/or cleaned on a routine basis. This must be done at least weekly. It is important that this be done on a regular basis in order to cut down on infection.

Equipment Required:

- Clean patient circuit
- Ambu bag
- Oxygen Source

Two people should be present when changing out the vent circuit. The following procedure should be followed:

1. Wash your hands
2. Place the ambu bag at your side
3. Have the circuit assembled and ready to use
4. Tell the patient that you are going to change out their circuit which may interrupt their breathing for 1-2 seconds.
5. Disconnect the dirty tubing from the ventilator and the patient
6. Ventilate the patient with the ambu bag during the procedure
7. Connect the clean circuit and test for leaks.
8. Reconnect the patient and ensure proper operation of the ventilator and the circuit
9. Observe the patient’s chest and pressure manometer during the next inspiration. Both should rise.
10. If the patient is using reusable circuits, clean and disinfect the permanent patient circuit for reuse and discard any disposable items
11. Wash your hands thoroughly to maintain clean conditions
Changing the Heated Humidifier

1. Wash your hands
2. Fill the clean humidifier with distilled water
3. Bypass the dirty humidifier by connecting the patient tubing on the humidifier directly to the ventilator
4. Remove the dirty humidifier chamber and replace it with a clean one
5. Connect the patient circuit to the clean humidifier
6. Connect the clean short connective tube to the humidifier inlet
7. Connect the short connective tube from the humidifier inlet to the ventilator
8. Observe the patient’s chest and pressure manometer during the next inspiration. Both should rise.
9. If the ventilator is functioning properly, monitor the ventilator and chart your observations. Do a ventilator check at this time.
10. If the ventilator does not appear to be functioning correctly, ventilate the patient with the ambu bag until the problem can be corrected.
11. Wash your hands

Equipment Disinfecting:

Ventilator patients are very susceptible to getting infections. Their immune systems are down and they can get sick very easily. It is important to keep equipment clean on a routine basis so that the patient does not get sick.

Water Accumulating in the Tubing:

Sometimes water can collect in the ventilator tubing. This is due to the humidity setting on the humidifier. If you notice you are getting too much rain out in the vent circuit, turn down the humidification temperature. You can tell when there is too much water in the vent tubing by hearing a swishing noise in the vent tubing during inspiration. When this occurs, disconnect the vent tubing from the patient and empty the water from the tubing into a container. Do not drain the water back into the humidifier chamber. The humidifier chamber must be lower than the patient’s head.
The Ambu Bag

The ambu bag is a device that is used to ventilate the patient’s lungs by delivering a volume of air as the bag is squeezed. The ambu bag is to be used if the patient is not able to breathe on his/her own or if they are have low oxygen levels. Patient’s can also be bagged with the ambu prior to suctioning to help elevate low oxygenation while suctioning.

The ambu bag works by placing the bag on the trach tube and squeezing the bag to give a breath. When the bag is squeezed air is pushed into the patient’s lungs. When the bag is released the patient can then exhale through the patient valve. Fresh air re-enters the bag as the bag is released. A mask in also available to use in case of an emergency.

Equipment Needed:

Ambu bag
Oxygen source (if needed)

Instructions:

- Connect the ambu bag to the tracheostomy
- If the patient is able to breathe on his/her own squeeze the bag as they begin to inhale. Try to time the breaths that you are giving with the patient’s own breaths. If the patient does not breathe on his/her own begin to squeeze the bag as soon as the bag is attached to the trach.
- Observe the chest rise and fall while squeezing the bag.
- Expiration should always be about as twice as long as inspiration

Cleaning and Disinfecting of the Ambu Bag

It is also important to keep the ambu bag clean to prevent infection. The following supplies are needed:

Equipment Needed:

- Liquid dishwashing liquid
- Two buckets
- White vinegar
- Water
Instructions:

- Remove the valves from the bag
- Disassemble the valves
- Wash all parts in mild detergent
- Rinse all parts well
- Soak the parts for 30 minutes in the bucket which should have equal parts of water and vinegar in it.
- Rinse all parts well
- Let the parts air dry and put them back together

Figure 1 - Basic components of the manually operated self-inflating resuscitation bag and of the oxygen reservoir.
Safety Precautions

Never immerse the ventilator in water

Never plug the ventilator in if it is wet

Do not store any liquid on the ventilator

Never plug the ventilator into an electrical outlet that is being used to supply power to another major appliance. Plug the vent into an outlet that has no other appliance attached to it.

Never try to repair the ventilator. A ventilator is considered to be a lifesaving piece of medical equipment. Please contact Breath of Life if your vent needs to be replaced.

Do not use a power strip or an extension cord. Always plug the ventilator directly into the outlet.

Make sure the patient’s home address is visible from the street. This makes it easier for EMS to find the house.