LTV VENTILATOR MANUAL

children's health®

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WHAT IS A VENTILATOR?

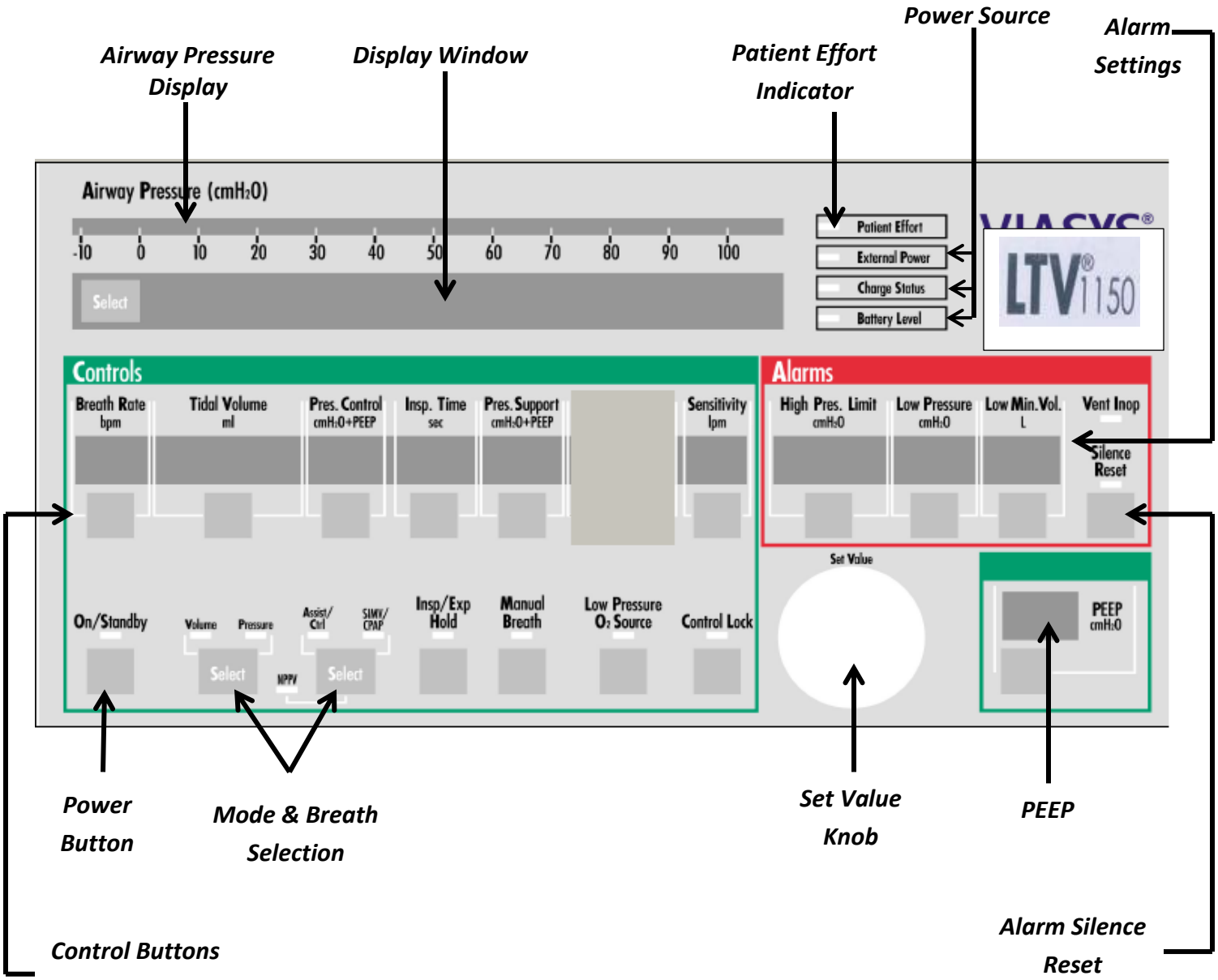
A ventilator is a small, portable machine that moves air in and out of the lungs of children who have trouble breathing on their own. Ventilators connect to your child through plastic tubing, called the ventilator circuit. This ventilator circuit then connects to their trach.

The ventilator is used to help your child with breathing. The length of time your child stays on the ventilator will depend on their condition; some children need support for only a few hours of the day, some children need support only during the night, and some children need the ventilator for 24 hours a day.

NOTE PAGE

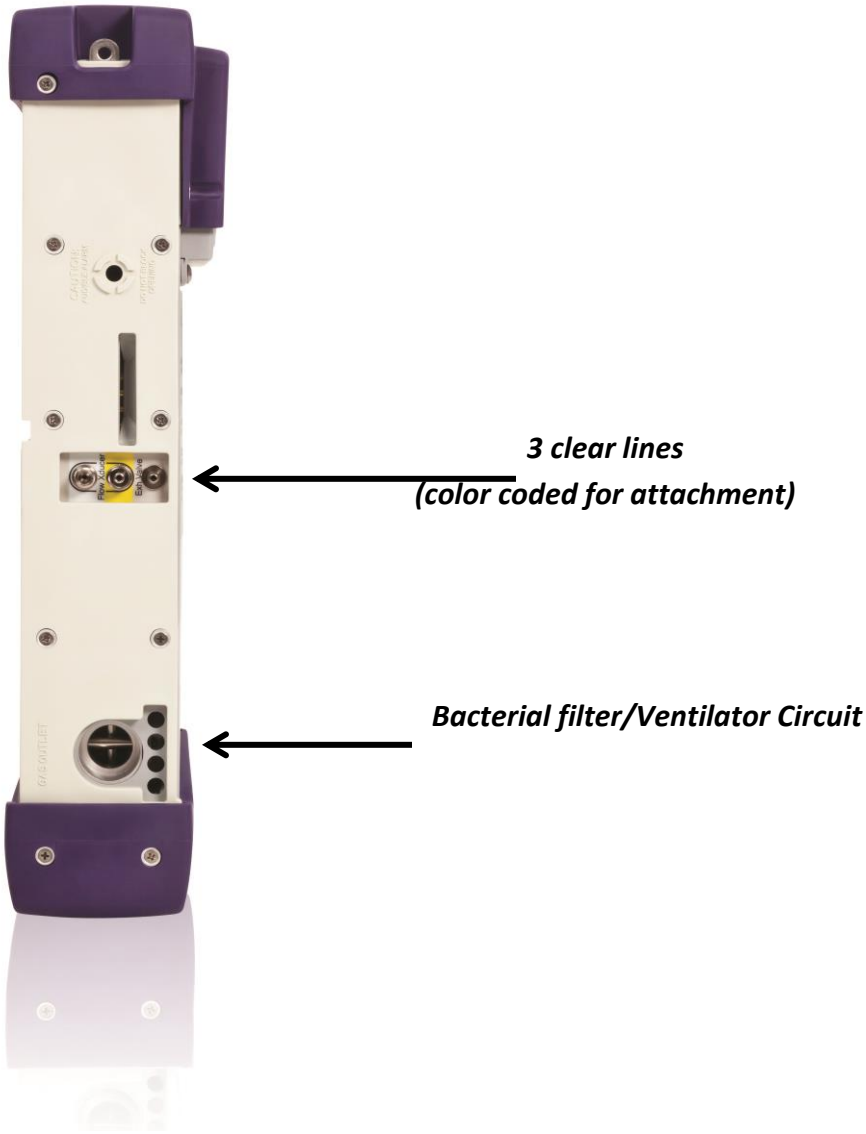
THE FRONT PANEL OF THE LTV

It is important to know where key buttons are located on your child's ventilator. See below for the front panel display.



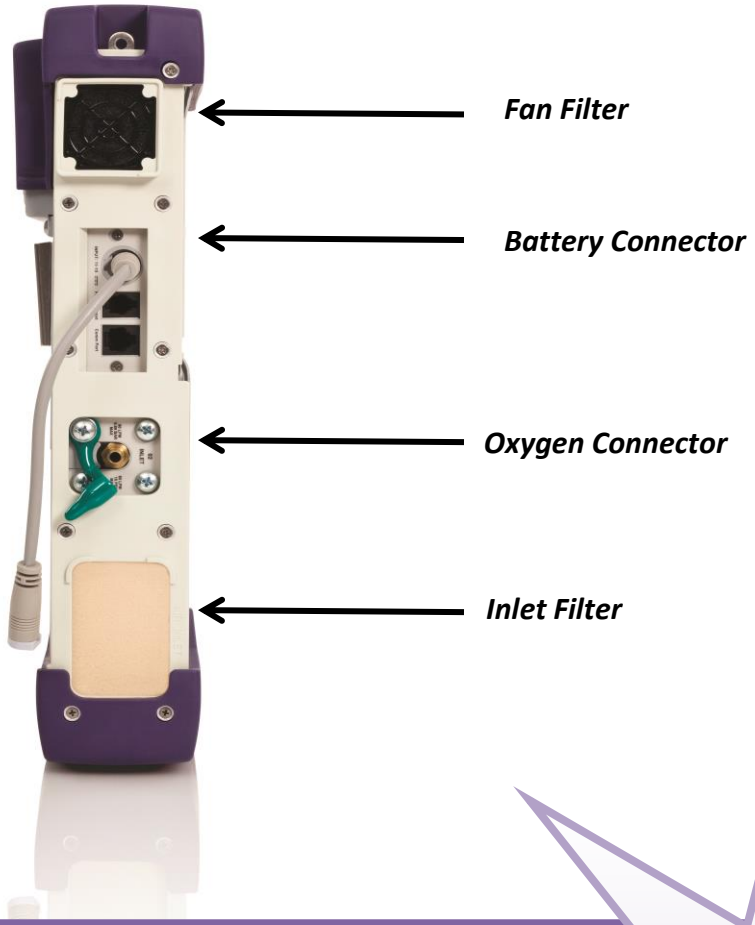
THE RIGHT SIDE OF THE LTV

It is important to know where to connect the ventilator circuit. See below for circuit connections.



LEFT SIDE OF THE LTV

It is important to know where the filters are located so that they can be removed and cleaned. The battery and oxygen connector are also located on the left side of the ventilator.



How To Clean The Air Filters:

1. *Remove the filters from the ventilator.*
2. *Wash the filters in warm water and mild soap.*
3. *Rinse thoroughly with clean water.*
4. *Allow to air dry.*
5. *Replace back into the ventilator.*
6. *If you notice your filters are beginning to break down, contact your DME Company for a replacement.*

doctor

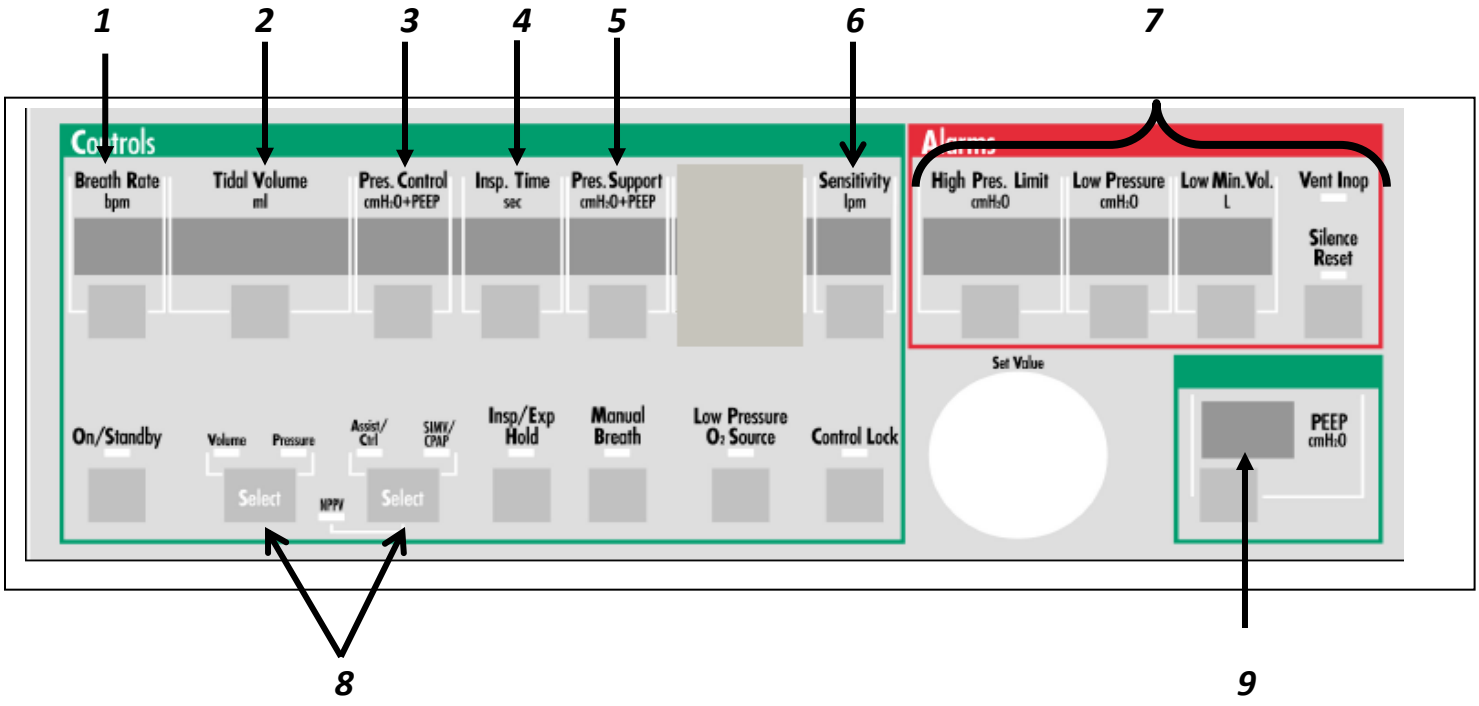
Remove & clean your filters at least once every week. Replace your entire filter once every 6 months.

THE LTV FRONT PANEL-VENTILATOR SETTINGS

Your child's doctor will order the ventilator settings. They are ordered based on your child needs. We will teach you the settings you will need to know for your child's ventilator. Don't feel like you need to memorize these definitions this page is for your reference.

1. ***Breath Rate****: the number of breaths per minute your child will get from the ventilator.*
2. ***Tidal Volume****: the amount of air that goes into your child's lung each breath.*
3. ***Pres. Control****: the amount of pressure that is applied to the lungs when your child breathes in.*
4. ***Insp.Time****: this is the amount of time the pressure is applied to the lung.*
5. ***Pres. Support****: the amount of pressure that the ventilator applies to the lungs during a breath your child takes on their own.*
6. ***Sensitivity****: this is how easy it is for your child to get a breath from the ventilator.*
7. ***Alarm Limits****: these are limits that protect your child from too much and/or too little pressure from the ventilator.*
8. ***Mode****: this is ordered by your child's doctor and will be a pressure or volume mode.*
   PEEP*: this is a constant pressure that still flows even when your child breaths out.*

Use this picture and fill in the ordered ventilator settings for your child with the help of your respiratory therapist. This will help you remember your settings when you go home. We suggest you write these settings in pencil and bring this picture to vent clinic and also change the settings on the picture when you change them on the ventilator.

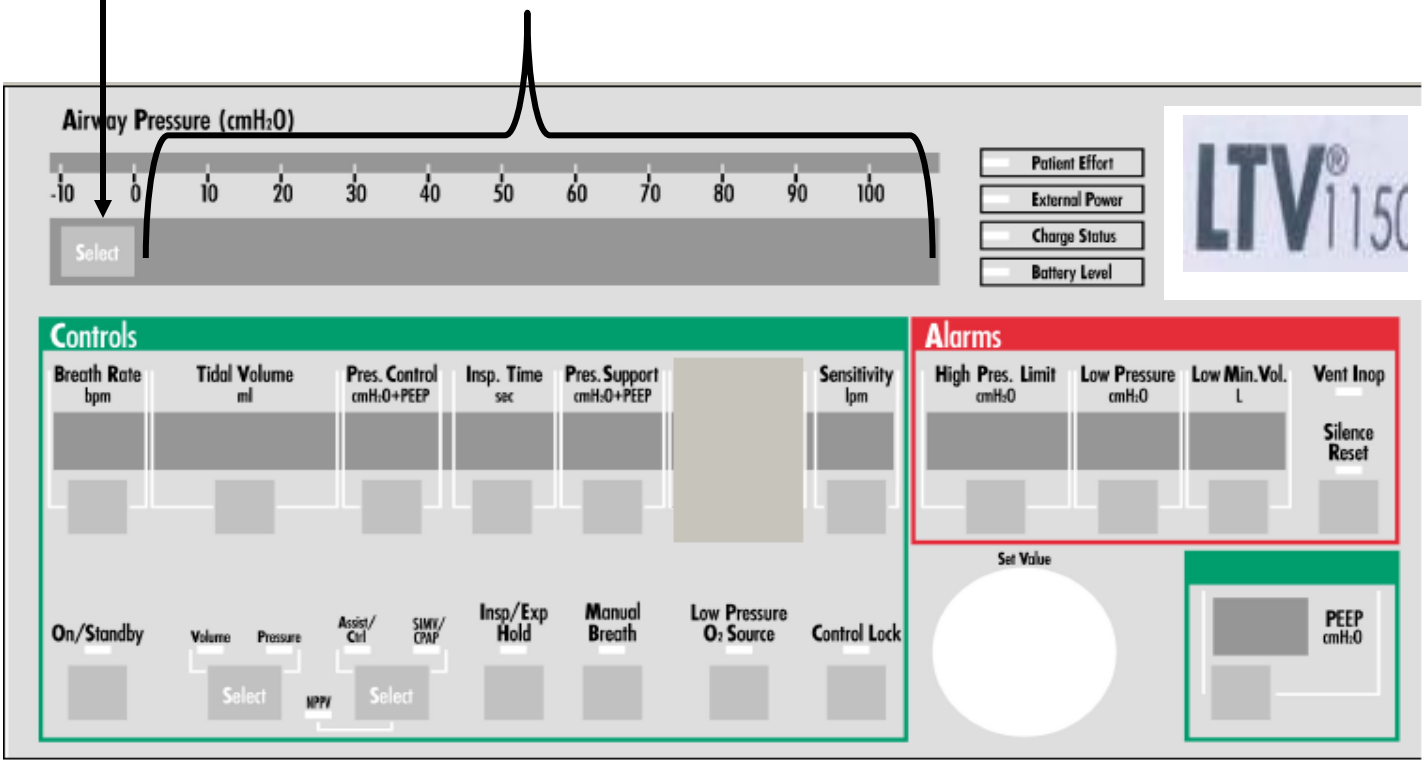


Your child's doctor will order any changes made to the settings on the ventilator.

THE LTV DISPLAY SCREEN-MONITORING

*Information about your child's breathing can be found on the ventilator. Just press the **Select Button**. The data located on this screen is based on how your child is breathing. These readings can be helpful in assessing your child. Useful readings that can be found here are: total respiratory rate (f), tidal volume (Vte), and peak pressures (PIP).*

Select Button ***f, Vte and PIP are shown here***

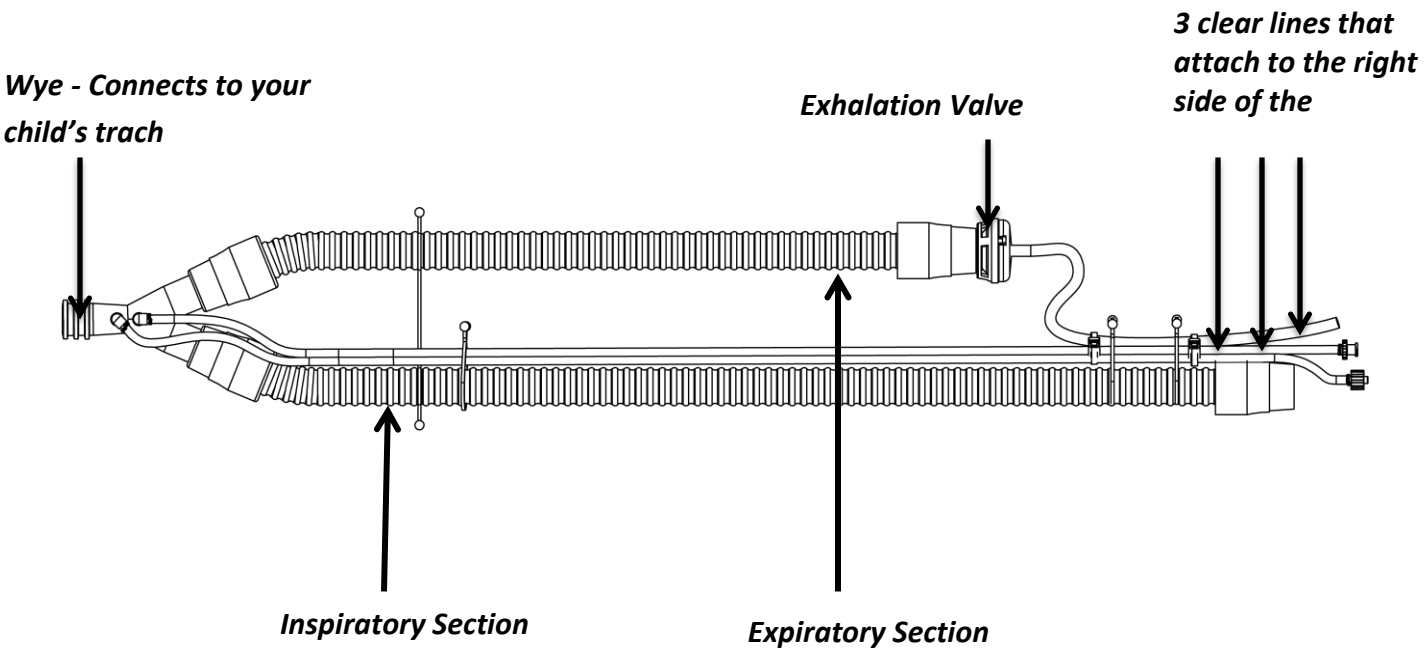


- ***f*** *on the monitoring screen is the total respiratory rate or the number of breaths your child is given by the ventilator in one minute.*
- ***Vte*** *on the monitoring screen is the tidal volume or the amount of volume returning to the ventilator from your child's lungs.*
- ***PIP*** *is the peak pressures or the amount of pressure delivered to your child's lungs during a breath.*

THE VENTILATOR CIRCUIT

The ventilator circuit connects the ventilator to your child's trach. This lets air travel from the ventilator to your child's lungs.

The LTV ventilator circuit has 2 pieces of tubing. The first is a short piece of tubing that connects from the ventilator to the water chamber. The second piece of tubing is longer and connects from the water chamber to your child's trach. The longer tubing has two sections an inspiratory section which takes air from the ventilator to your child and an expiratory section which lets air come out of your child's lungs and enter the room through the exhalation valve. The long tubing also has 3 clear lines attached, these 3 lines monitor your child's breathing.



Clearing Condensation from the Circuit

Water in the tubing is normal. It is usually seen in the longer tubing. If you notice water in the tubing, it is important to empty the water. You do not want the water to enter your child's trach. You can empty the water by quickly disconnecting the tubing from your child's trach tube and drain the extra water out onto a towel or wastebasket. Be careful not to touch the tubing to any surfaces that can get it dirty. Then, reconnect the tubing to your child.

CHANGING THE VENTILATOR CIRCUIT

The ventilator circuit will be supplied by the Durable Medical Equipment (DME) Company that you choose prior to discharge home. The DME Company will instruct you on how often to change the circuit after you discharge home. The circuit may need to be changed more often if you notice a hole in the circuit, the circuit tears or it is dirty. We will practice connecting the ventilator circuit to the ventilator here in the hospital before you go home.

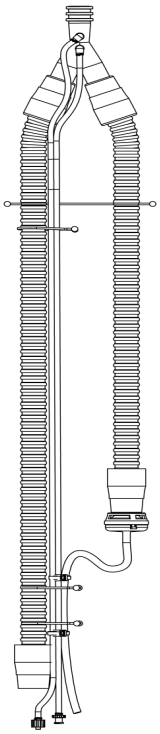
If you have a backup ventilator, place your child on the backup ventilator while you change the circuit on the ventilator that needs a clean circuit. If you do not have a backup ventilator, one person will give breaths to your child using the self-inflating bag while you change the circuit. If your child is only on the ventilator while sleeping then change the circuit while your child is awake and not on the ventilator.

Supplies Needed

- *Clean ventilator circuit*
- *Bacterial filter*
- *New or clean water chamber*
- *Self-inflating bag*

Steps for Assembling & Changing the Circuit

1. *Wash your hands with soap and water for 15 seconds and dry your hands with a clean towel.*
2. *Gather your supplies.*
3. *Open the new circuit and lay it out on a clean surface.*
4. *Check the new circuit to make sure you have all of the circuit pieces needed.*
5. *Remove the existing circuit from the trach and ventilator.*
6. *Remove the heater wire from the dirty circuit.*
7. *Place your child on the backup ventilator or ask a second person to begin giving breaths to your child using the self-inflating bag.*
8. *Turn ventilator off.*
9. *Attach the clean bacterial filter to the ventilator.*
10. *Connect one end of the short tubing to the bacterial filter that connects to the ventilator.*
11. *Connect the other end of the short tubing to the water chamber.*
12. *Connect the angled end of the long tubing to the water chamber.*
13. *Connect the two exhalation flow transducer sense lines to the ports marked Flow Xducer and the exhalation valve driver line to the port marked Exh Valve on the right side of the ventilator.*
14. *Insert the heater wire probes into the correct temperature probe ports on the circuit.*



15. *Perform a **leak test** before placing your child back on the ventilator.*
    a) *Press and hold the on/standby button and the select button at the same time for 3-5 seconds.*
    b) *Keep holding these buttons until the summary screen says "remove patient".*
    c) *Press the silence/reset button.*
    d) *The summary screen will read "vent check".*
    e) *Press the select button.*
    f) *The summary screen will now read "ALARM".*
    g) *Turn the wheel clockwise (to the right) until the summary screen says "Leak".*
    h) *Block the ventilator circuit at the Wye (the end that connects to your child's trach tube) with your hand.*
    i) *Press the select button this will begin the leak test; this usually takes 20 seconds.*
    j) *The summary screen should read "PASS".*
    k) *If screen reads "Fail", check the ventilator circuit connections and repeat the leak test.*
    l) *Press the control lock button 3 times; this will take you back to the ventilator settings.*
    m) *The summary screen will read "same patient". Press the select button to return to your child's ordered ventilator settings.*
16. *Turn the ventilator on and reconnect your child to the circuit.*
17. *Briefly check your child for chest rise to make sure the ventilator is working correctly.*

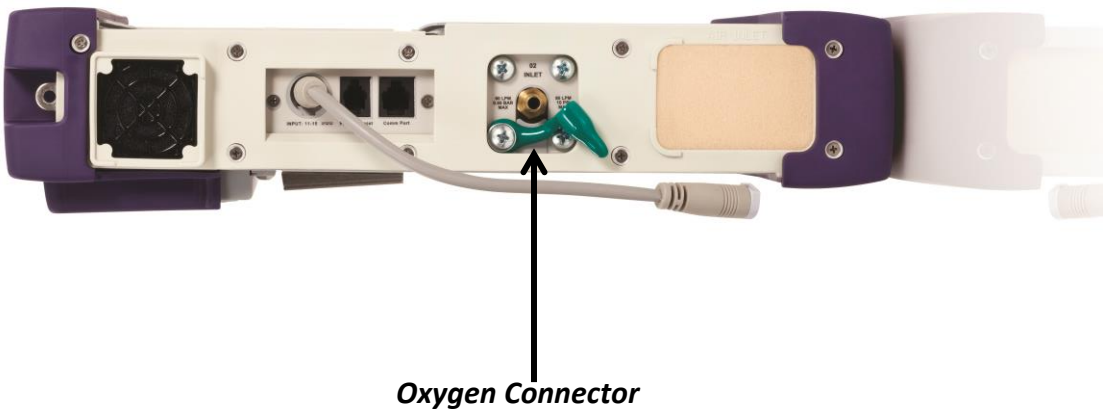
OXYGEN ADMINISTRATION

Supplies Needed

- *Oxygen concentrator*
- *Oxygen tanks*
- *Oxygen tubing*
- *Oxygen connector (this should be attached to your home ventilator)*

Steps for administering oxygen

1. *Make sure the connector is attached to the left side of the LTV.*
2. *Attach oxygen tubing to the oxygen concentrator.*
3. *Attach oxygen tubing to the oxygen connector.*
4. *Turn the oxygen concentrator on and change to the prescribed oxygen liter flow.*
5. *If your child needs more oxygen you can turn up the liter flow on the concentrator.*
6. *If your child needs more oxygen than the oxygen concentrator can provide switch the oxygen tubing to the oxygen tank and adjust the liter flow.*



VENTILATOR ALARMS

Ventilators have many alarms that sound for different reasons. The ventilator will alarm to let the caregiver(s) know there is a problem. Most of the time the problem is easy to fix and an emergency can be stopped from happening. We will help you with learning what to do when the ventilator alarms.

The following table lists the alarm, why the alarm happens and what to do. ***Each time the ventilator alarms you must look at your child to be sure they are ok. If your child is having trouble breathing, begin giving your child breaths using the self-inflating bag. You may need to call 911 for help if your child is not doing well.*** *If your child is breathing ok on the ventilator while it is alarming use the table below to try and figure out what to do to stop the alarm. If you are not able to find out why the ventilator is alarming contact your DME Company immediately.*

Alarm	***Why the alarm happens***	***What to do***
HIGH PRESS	*The circuit pressure is higher than the High Pressure Limit alarm setting. Your child may be coughing, sneezing or crying or have extra mucus or a mucus plug in the trach. Check the circuit because it may be kinked or there may be a lot of water in the tubing.*	*Suction the trach tube. If you are not able to pass the suction catheter, change the trach tube. If there is water, empty the water from the circuit. If there is a kink in the tubing, straighten the tubing immediately.*
LOW PRESS	*The peak inspiratory pressure is less than the Low Pressure alarm setting. Your child's trach tube may have come out or the cuff maybe deflated which would cause an air leak. There could be a hole or tear in the tubing or the circuit could be loose or come off*	*Check your child's trach to make sure it is properly in place. Check the cuff to make sure the balloon is properly inflated to the correct volume. Check the circuit for a hole or tear and make sure it is connected properly.*
LOW MIN VOL	*The low minute volume is less than the Low Minute Vol alarm setting. Your child may have more air leaking due to decreased cuff inflation or if your child is sleeping their airway may be relaxed. Your child's respiratory rate may be decreased if they are sleeping or if they are taking sedation medicines. There could also be a hole or tear in the tubing.*	*Check the cuff to make sure the balloon is properly inflated to the correct volume. Move your child around to reduce an air leak if they are sleeping. Check the circuit for a hole or tear and make sure it is connected properly.*
DISC/SENSE	*A piece of the circuit or a pressure line has come off. It can also be caused if a pressure line has become pinched or blocked.*	*Check the circuit and pressure lines to make sure they are connected properly. Check the pressure lines for water and try to clear them using your suction machine.*
APNEA	*Your child is not breathing on their own greater than the Apnea Interval setting.*	*Check to see why your child is not breathing on their own (i.e. sedation medication). The alarm will shut off when your child starts to breath on their own higher than the Apnea Interval setting, otherwise it will continue to deliver a respiratory rate of 12 breaths per minute.*

Alarm	Why the alarm happens	What to do
HIGH f	*Your child's respiratory rate is more than the High f alarm setting.*	*Find the cause for the increased respiratory rate. Does your child need to be moved around, suctioned, or given more oxygen? The alarm will shut off when your child's respiratory rate is less than the High f alarm setting.*
HIGH PEEP	*The circuit positive end expiratory pressure (PEEP) is greater than the High PEEP alarm setting. The circuit and or exhalation valve may be blocked.*	*Clean and check the circuit and exhalation valve.*
LOW PEEP	*The circuit positive end expiratory pressure (PEEP) is less that the Low PEEP alarm setting. The circuit and or exhalation valve may have a leak.*	*Clean and check the circuit and exhalation valve.*
RESET OR RESET 1	*The ventilator restarts following a condition other than being shut down by pressing the On/Standby button. The ventilator will do a self-test if no problems are detected the ventilator will continue to operate.*	*Repeated Reset or Reset 1 alarms mean there is a problem with the ventilator. Switch your child to the backup ventilator and contact your DME Company. If your child does not have a backup ventilator begin giving breaths to your child with a self-inflating bag and call 911.*
REMOVE PTNT	*The ventilator is powered up in the Ventilator Checkout or Ventilator Maintenance mode. This happens when you are turning the ventilator on to complete a Leak Test. The ventilator is not delivering gas.*	*Make sure your child is taken off the ventilator. Complete the Leak Test before placing your child back on the ventilator.*
LOCKED	*The control buttons are locked. If a button is pressed this message will display on the front panel screen.*	*Press the Control Lock button to unlock the control buttons.*
BAT LOW	*The ventilator is running from the internal battery power and the battery charge level is low.*	*Plug the ventilator into an electrical outlet or attach a fully charged battery.*
BAT EMPTY	*The ventilator is running from the internal battery power and the battery charge level is* ***dangerously*** *low.*	*Plug the ventilator into an electrical outlet or attach a fully charged battery.*
POWER LOW	*The ventilator is running on external power and the voltage drops to the low level.*	*Plug the ventilator into a different electrical outlet or attach a fully charged external battery.*
POWER LOST	*The ventilator is turned on without an external source of power, or is running on external power and switches to the internal battery.*	*check to see if the internal battery is fully charged and attach a fully charged external battery.*

Alarm	Why the alarm happens	What to do
INOP	*The ventilator detects any condition that makes it unsafe for your child to be on the ventilator.*	*Switch your child to the backup ventilator and contact your DME Company. If your child does not have a backup ventilator begin giving breaths to your child with a self-inflating bag and call 911.*
HW Fault	*The ventilator detects a problem with the ventilator hardware.*	*Switch your child to the backup/travel ventilator and contact your DME Company. If your child does not have a backup ventilator begin giving breaths to your child with a self-inflating bag and call 911.*
NO CAL DATA, NO CAL	*The ventilator detects invalid or missing calibration records on power up.*	*Switch your child to the backup/travel ventilator and contact your DME Company. If your child does not have a backup ventilator begin giving breaths to your child with a self-inflating bag and call 911.*
DEFAULTS	*The ventilator detects invalid settings during the power on self-test.*	*Switch your child to the backup/travel ventilator and contact your DME Company. If your child does not have a backup ventilator begin giving breaths to your child with a self-inflating bag and call 911.*
DEFAULTS SET	*The SET DEFAULTS option has been used to reset all controls and extended features setting to the factory-set default values.*	*Check all Controls, Alarms and Extended Features options and return them to the correct settings.*
XDCR FAULT	*The ventilator detects a problem when warming up or there is an environmental change. If the ventilator cannot correct the problem the alarm will continue.*	*Switch your child to the backup/travel ventilator and contact your DME Company. If your child does not have a backup ventilator begin giving breaths to your child with a self-inflating bag and call 911.*

VENTILATOR BATTERIES

Your ventilator will be plugged into an electrical outlet once you are home. During car trips and outings your child's ventilator will use a detachable (battery that comes off and on) or external battery. You will need to know the amount of time the battery will last. Some ventilators have car adapters so they can be plugged in during a car trip. When you are planning to leave the home, always make sure your battery is fully charged. Always have your back-up battery with you as well.

AC Power/Internal Battery

- *AC Power charges the internal and detachable battery.*
- *The internal battery is made for use during short periods. The length of time the ventilator will operate on internal power (up to 60 minutes) depends on settings, charge level and condition of the battery.*
- *If the battery dead, it takes up to 8 hours to re-charge.*

Detachable Battery (Sprint Pack)

- *If the LTV is not connected to a power source or external battery, it will work on the detachable battery.*
- *The detachable battery (includes 2 lithium batteries) will work the LTV up to 5 hours.*
- *When the LTV is connected to an electrical outlet, it automatically charges the detachable battery.*

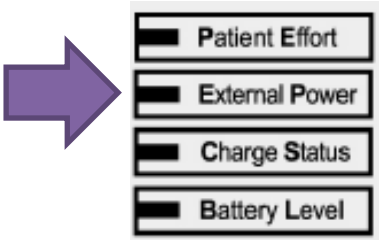
External battery

- *The LTV can work from a 12V DC Free Standing car battery using the external battery cable connector or using a DC car adaptor.*
- *The External Battery Packs can only be recharged using the CareFusion External Battery Charger.*

VENTILATOR BATTERY CHARGE STATUS/LEVEL

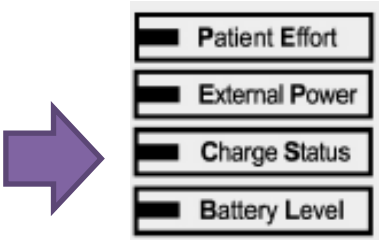
*The **External Power** indicator shows the level of external power while the ventilator is operating from an external power source. When the ventilator is running form the internal battery, the External Power indicator is off. See below:*

LED Color	***Charge Status***
Green	*The external battery charge level is acceptable.*
Amber	*The external battery charge level is low.*



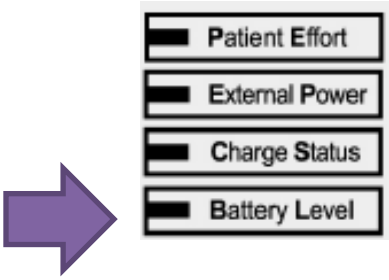
*The **Charge Status** indicator shows the charge state of the internal battery. This LED is on when the ventilator is plugged in to a power source and the internal battery is being charged. See below:*

LED Color	***Charge Status***
Flashing Amber	*The ventilator is going through a pre-charge test of the battery before starting the charge process.*
Green	*The internal battery is fully charged.*
Amber	*The internal battery is being charged but has not reached a full charge level.*
Red	*The ventilator has found a charge internal battery fault and cannot be charged.*



*The **Battery Level** indicator shows the level of internal battery power while running from the internal battery. When the ventilator is running from an external power source, the Battery Level indicator is off. The length of time the ventilator will work on internal power (up to 60 minutes) depends on settings, charge level and condition of the battery. See below:*

LED Color	***Battery Level***	***Approximate Battery Time***
Green	*Internal battery level is acceptable*	*45 minutes*
Amber	*Internal battery level is low*	*10 minutes*
Red	*Internal battery level is critically low*	*5 minutes*



EMERGENCY PREPARDNESS

Packing Your Emergency Bag

When you are traveling or simply just at home with your child, an emergency bag of equipment should always be ready for you to use. Accidents can happen. We want you to be ready. Your emergency bag should be large enough to have all the supplies in 1 bag. As you get close to going home, we want you to bring a bag to the hospital.

Travel supplies/equipment

- *Same size trach and obturator*
- *Smaller size trach and obturator*
- *Suction catheters*
- *Self- inflating bag WITH face mask*
- *Normal saline*
- *Extra trach ties*
- *Lubricating jelly*
- *Scissors*
- *Syringe if your child has a cuffed trach*
- *HME'S*
- *Phone list of emergency contacts and physicians*

- *Ventilator*
- *Feeding Pump*
- *Portable Suction Machine*
- *Pulse Oximeter Machine*
- *Oxygen Tank*
- *Nebulizer (if necessary)*

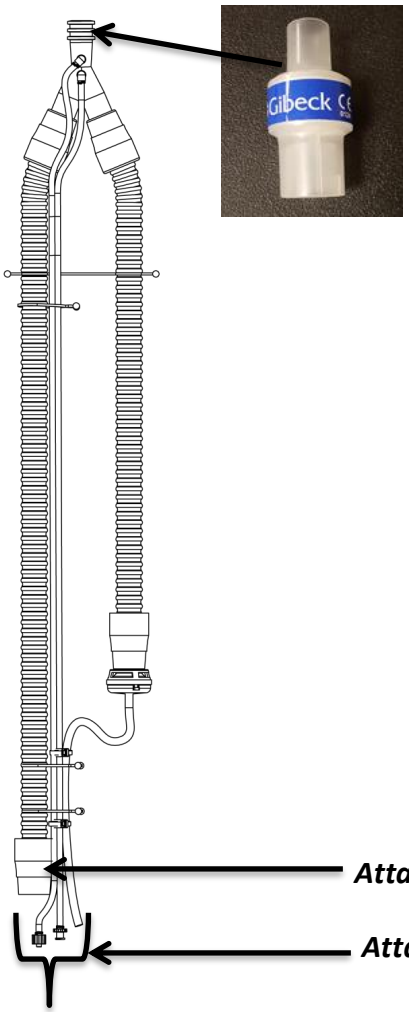
- *Fully charged back-up battery*
- *Car adapter for your battery*

Be sure to take all electrical cords for equipment in case you need to plug equipment into an electrical outlet when you reach your destination.

PREPARING FOR TRANSPORT

Steps for Assembling the Circuit for transport

1. *Wash your hands with soap and water for 15 seconds and dry your hands with a clean towel.*
2. *Gather your supplies.*
3. *Turn heater off.*
4. *Remove the heater wires from the temperature probe ports on the circuit.*
5. *Remove the short tubing from the bacterial filter that connects to the ventilator.*
6. *Remove the angled end of the long tubing from the water chamber and connect to the bacterial filter.*
7. *Briefly check your child for chest rise to make sure the ventilator is functioning correctly.*



Be sure to attach a HME in line with the ventilator circuit for transport.

Attach angled end of ventilator circuit to the bacterial filter.

Attach the 3 clear tubes to the right side of the ventilator.

SAFETY

Safety Precautions

- *Be sure to organize your child's equipment (ventilator, suction machine, etc.) so it is easily available to you or your home health nurse.*
- *Never put the ventilator in water.*
- *Never plug the ventilator in if it is wet.*
- *Do not store any liquid on or near the ventilator.*
- *Do not store your child's ventilator near any fire hazards (stoves, fireplaces, open flames) where it could catch on fire.*
- *Never plug the ventilator into an electrical outlet that is being used to power to another appliance. Plug the vent into an electrical outlet that has no other appliance attached to it.*
- *Always plug your ventilator directly into an electrical outlet or use a power strip provided by your DME Company.*
- *Never try to fix the ventilator. Contact your DME Company to schedule any repairs needed for your child's ventilator.*
- *Take extra care to see that younger children do not play with the ventilator screen and accidentally change your child's ventilator settings.*
- *Always have a working phone with you in case an emergency should happen.*

Oxygen Safety

- *Oxygen tanks should be secured so that they will not tip over.*
- *Oxygen tanks should be stored away from things that can cause fires like a fireplace, space heater, or kitchen stove.*
- *Do not use aerosol sprays around your child.*
- *Always plug your oxygen concentrator directly into an electrical outlet or use a power strip provided by your DME Company.*
- *You should never smoke around your child or oxygen.*

LTV VENTILATOR & SAFETY CHECKLIST

Physician Ordered Settings	*Patient summary window read out data*
Mode	*Exhaled Tidal Volume*
Set Breath Rate	*Peak Pressure*
Tidal Volume	*PEEP*
Pressure Control	*Total Respiratory Rate (f)*
Inspiratory Time	
Pressure Support	
Sensitivity	
Peep	
Ventilator Settings	
Mode	
Set Breath Rate	
Tidal Volume	
Pressure Control	
Inspiratory Time	
Pressure Support	
Sensitivity	
Peep	
Alarms	
High Pressure Limit	
Low Pressure Limit	
Low Minute Volume	
Equipment Safety Check	*Patient Safety Check*
☐ *Spare trachs readily available* ☐ *Same size w/obturator* ☐ *Smaller size w/obturator* ☐ *Self-inflating bag w/mask attached to oxygen tank* ☐ *15-liter flow regulator attached to oxygen tank* ☐ *Oxygen tank fill level* ☐ *Suction machine readily available* ☐ *Detachable battery fully charged*	☐ *Trach tie one finger tight* ☐ *Connected to Pulse Oximeter as ordered* ☐ *Ventilator set as ordered*

EQUIPMENT CLEANING/MAINTENANCE GUIDELINES

Equipment/Supply/Filter	***Clean***	***Replace***
Suction Machine	*Daily* • *damp cloth with hot water and mild detergent*	*NA*
Suction Machine Canister	*Daily* • *hot water and mild detergent*	*Per DME*
Suction Machine Filter	*NA*	*As needed*
Oxygen Concentrator	*Daily* • *damp cloth with hot water and mild detergent*	*NA*
Oxygen Concentrator Filter	*As Needed* • *remove dust from filter/vent*	*Per DME*
Pulse Oximeter Machine	*Daily* • *damp cloth with hot water and mild detergent*	*NA*
Ventilator	*Daily* • *damp cloth with hot water and mild detergent*	*NA*
Ventilator Circuit	*NA*	*Per DME*
Green Circuit Adapter – Trilogy vents only	*NA*	*Each circuit change*
Heater Chamber (reusable vs. disposable)	*Each circuit change* • *hot water and mild detergent*	*Each circuit change clean or change*
Heater Wires	*Each circuit change* • *damp cloth with hot water and mild detergent*	*NA*
Bacterial Filter	*NA*	*Each circuit change*
Ventilator Foam Filter	*As Needed* • *hot water and mild detergent*	*Every 6 months*
Cough Assist Machine	*Daily* • *damp cloth with hot water and mild detergent*	*NA*
Cough Assist Foam Filter	*As Needed* • *hot water and mild detergent*	*Every 6 months*
IPV Machine	*Daily* • *damp cloth with hot water and mild detergent*	*NA*
IPV Foam Filter	*As Needed* • *hot water and mild detergent*	*Every 6 months*
Enteral Feeding Pump	*Daily* • *damp cloth with hot water and mild detergent*	*NA*

General Guidelines:

- *Do not use harsh cleaners/disinfectants as this may cause damage to equipment.*
- *Keep all equipment in a well-ventilated area.*
- *Keep all equipment out of direct sunlight.*

GLOSSARY

Carbon Dioxide: *waste gas breathed out from the lungs*

Condensation*: when water vapor is changed into liquid water*

Cuff*: a small balloon on the inside of the trach that is either filled with air or water*

Exhalation*: breathing air out*

Exhalation Limb: *a piece of the ventilator circuit which allows air to exit your child's lungs and enter the room*

Exhalation Valve*: part of the expiratory tube; where air exits into the room*

Inhalation*: breathing air in*

Inspiratory Limb: *a piece of the ventilator circuit which takes air from the ventilator to your child*

Mucus Plug: *a collection of mucus in the trach making it difficult for your child to breathe*

Normal saline*: sterile salt water*

Oxygen*: a gas we breathe in*

Self-inflating bag*: a breathing bag that fills with air and does not need any oxygen to fill; also known as an Ambu Bag*

Trachea*: the windpipe or airway that connects to the lungs*

Ventilator*: a small, portable machine that moves air in and out of the lungs*

Ventilator Circuit*: plastic tubing that connects the ventilator to your child's trach*

Wye*: where the ventilator pressure lines and inspiratory/expiratory limbs attach; resembles the letter "Y"*

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