# NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE

## 1) INTRODUCTION

The benefit of Non Invasive ventilation (NIV) is to enable ventilatory support without the need for intubation. Women find the therapy and mask comfortable, it is portable and women are able to receive this treatment intermittently and can communicate between times off the machine. NIV is pressure ventilation delivered as BiPAP (two levels of ventilatory support) known as inspired positive airway pressure (IPAP) and expired positive airway support (EPAP). One level of support can also be delivered which is delivered as EPAP or CPAP which is delivered throughout the respiratory cycle.

The aim is to maintain adequate ventilation and minimize the effort of breathing.

## 2) DESIGNATED AREAS FOR BIPAP

All women needing NIV via the V60 machine will require admission to Acute Care Centre for closer haemodynamic monitoring and higher acuity nurse/patient ratio. Staffing will be arranged by the Nurse Manager if short term NIV is required in Recovery for the postoperative woman.

## 3) STAFFING REQUIREMENTS

The woman requiring NIV will be nursed 1:1 on commencement and can be nursed 1:2 once stable.

## 4) STAFF COMPETANCE

Staff are to attend a competency assessment prior to caring for a woman on NIV- see Appendix 3.

## 5) INFECTION CONTROL

Standard precautions are required when handling the NIV equipment. If waiting determination or uncertain of the woman's respiratory status consideration should be given to whether the woman is placed into a negative pressure room and respiratory precautions instituted.

## 6) RESPIRONICS V60 VENTILATOR

This machine is currently used for NIV in ACC. See Appendix 1 for definitions of settings and Appendix 2 to guide the setup of the circuit. The machine is powered by AC power and has an internal battery which can be used in power failure or inter hospital transfers. The battery fully charged will last for 6 -8 hours. When not in use the V60 machine should remain plugged into the electricity. The machine manual is stored under the machine.

## 7) DEFINITIONS

NON INVASIVE VENTILATION- NIV is ventilatory support via a face mask.

BILEVEL POSITIVE AIRWAY PRESSURE (BIPAP)-is non invasive Bi-level positive pressure ventilation (two levels). The machine provides positive pressure support ventilation by mimicking normal ventilation patterns with changes in inspiratory and expiratory pressures (IPAP > EPAP).

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## NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE cont'd

INSPIRATORY POSITIVE PRESSURE (IPAP)-is titrated to maintain tidal volume, support ventilation and reduce the work of breathing and thereby reducing C02 retention.
EXPIRED POSITIVE AIRWAY PRESSURE (EPAP) – is titrated to eliminate upper airway obstruction and prevent end expiratory collapse of airways, thereby maintaining or improving oxygenation.

CPAP- is positive airway pressure ventilation therapy delivered throughout the respiratory cycle to spontaneous breathing patients. A nominated pressure splints the airway opened throughout the respiratory cycle thereby maintaining oxygen saturation, functional residual capacity and preventing alveolar collapse.

### 8) INDICATIONS FOR NIV

- Atelectasis
- Muscle fatigue
- High C02 respiratory failure with moderate to severe □yspnea
- Ph<7.35 or PaC02 >45mmHg,Pa02 <60mmHg,RR>24 bpm
- Use of accessory muscles for breathing
- Hypoxemia
- Alveolar hypoventilation
- Lung disease eg CAL
- Fluid overload

### 9) PRIOR TO COMMENCING

It is important that the following criteria be met before starting patients on NIV:

- The woman is conscious and breathing spontaneously.
- The woman is not nauseous or vomiting and must have an adequate gag and cough reflex.
- The woman must be cognitively aware so that he or she knows if and when the mask needs to be removed.
- The mask is fitted correctly using the provided template on the setup packaging so that an adequate seal can be maintained.

### 10) CONTRAINDICATIONS TO NIV

- Women documented "Not for resuscitation" or has a decreased level of consciousness
- Women who have had a recent pneumothorax or recent lung resection or excessive respiratory muscle fatigue.
- Women with a decreased level of consciousness
- Facial trauma
- Any indication for endotracheal intubation.

### 11) INITIATING NON INVASIVE VENTILATION

- The order is written by the Anaesthetist or Physician in the woman's integrated notes and the prescription is documented on the Ventilation Assistance Chart.
- Prescriber's orders are written every 24hours with goal Sa02 and frequency on and off machine as per prescription chart.
- All circuits and water for Irrigation is located in the storeroom.

## NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE cont'd

- There is a setup guide attached to the machine and in Appendix 2 (slides). If you have any problems with the setup ring ICU, the CNC ACC or the Respironics rep to clarify your query.
- Women require a high level of psychological preparation and support during the initial stages of non-invasive ventilation. To relieve some of this anxiety an explanation of the following is required:
  - the purpose of the ventilation
  - the expected duration of therapy and time on and off therapy.
  - the mask and the quick release clips.
  - the importance of keeping the mask on.
  - the noise of the machine and on the high flow of air onto the face.

*An education resource on NIV is given to the patients prior to initiating BiPap or when feeling well enough to read it.*

**12) MONITORING**

- Attach woman to ECG and O2 saturation monitor and check the monitor's alarms.
- Record baseline RR, BP, HR, Sa02 observations and take observations 5 minutely for 15 minutes (due the initial effects of positive pressure ventilation on the cardiovascular system) then hourly after commencement of NIV.
- Whilst on NIV the nurse is required to stay close to the woman in case of deterioration or to troubleshoot machine alarms.
- 02 sats must remain above 92% unless otherwise specified by the Anaesthetist.
- Hourly observations are required once the patient is stable.
- Document observations on the woman's observation chart and in the ventilator assistance chart.
- +/- baseline CXR to diagnose condition and exclude a pneumothorax
- +/- baseline ABGs to determine the need type of ventilation and to provide baseline data for comparison of effectiveness of treatment
- Position patient upright or when well enough sit out of bed to maximize oxygenation
- Encourage deep breathing during breaks from the therapy.
- Promote rest once stable

**13) MASK FIT**

- Choose mask according to sizing template on disposable setups.
- The mask should fit comfortably on the woman's nose not occluding the nares and the base of the mask should fit comfortably between the chin and bottom lip see picture on setup guide.
- Headgear should fit comfortably not tight. The bottom edge of the headgear should sit at the base of the nape of the neck with side straps underneath the earlobes.
- The face masks are better for women who are dyspnoeic and tachypnoeic as they tend to mouth breathe with a nasal mask and reduce the effectiveness of the ventilation. Masks that are too tight are uncomfortable and cause pressure areas and masks that are too loose leak which reduce the efficiency of the system.
- When using a nasal mask the women must keep their mouth closed to obtain the desired effect of the ventilation.
- Consider the use of a skin protectant to the bridge of the nose to protect the skin.

# NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE cont'd

## 14) COMMENCING NIV

- Set up machine circuit using disposable mask and circuit setups only. Ensure that there is always an exhalation port at the base of the mask for C02 to be expired.
- Set mode and settings as per doctor's prescription on Ventilation chart.
- See Appendix 1 for definitions of all modes, usual and alarm settings.
- Set Alarms on machine-see usual alarm settings and check alarm settings with Anaesthetist.
- Turn on machine and gently hold mask over nose/face until woman becomes accustomed to the airflow. Attach the head strap. Stay with the woman until the 02 saturations and observations are stable.
- Return ventilation to 02 mask if there is any deterioration of observations and have woman reviewed by calling the appropriate CERS call.

Monitor patient's response for:

- Decreased HR, RR, BP
- Decreased sweating
- Decreased work of breathing (as per baseline observations)
- Patient feels more comfortable
- Patient finds it easier to breathe

## 15) ONGOING CARE

Alert Anaesthetist to abnormal observations and signs of failure of therapy i.e:

- increasing respiratory effort, worsening agitation, sweating, inability to clear secretions, inability to accept face mask/nasal mask, haemodynamic instability or decreasing 02 saturations.
- Repeat ABG as ordered or if clinically indicated.
- Insert arterial line if frequent ABGs are required
- Adjust pressures according to Anesthetists' orders.
- Observe for signs of gastric distension, upper airway obstruction and vomiting Review re need for a NGT.
- Remove mask 2nd hourly/prn for regular mouth care, eye care, skin assessment and facial care.
- Women receiving supplemental oxygen while on NIV will require supplemental oxygen via mask when not on NIV.
- Supplemental oxygen may need to be increased to maintain prescribed $SpO_2$ levels while not on NIV.
- All women receiving NIV require a bowel or stool chart and a fluid balance chart to assess elimination and fluid status

## 16) FAILURE OF NIV SHOULD BE SUSPECTED IF;

- The woman is unable to maintain adequate oxygenation, decreasing 02 saturations despite increases in 02. There is a reduction in neurological or conscious state
- the woman has excessive secretions or increasing respiratory rate.
- failure of PaCO2 or PH to improve on ABG sample
- Poorly compliant lungs

An Anaesthetic review and possibly an ICU referral will be required if the woman's condition meets any of the above criteria. An ICU review is obtained by the Anaesthetic fellow calling POWH ICU on ext 24701.

## NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE cont'd

**17) NEBULISERS**

- In line □yspnea□t can be attached to the base of the face mask using a white piece located with the NIV equipment.
- If □yspnea□t is used for a woman with suspected or confirmed respiratory infection, the patient should be in a single room and staff need to wear airborne PPE.
- Insert medication into □yspnea□t bulb and attach to T-piece.
- Use T-piece □yspnea□t placed between the mask and inspiratory tubing. The □yspnea□t needs to be held upright to nebulise adequately. Inhalation medication –has a greater distribution if given while patient is on NIV. Use air for □yspnea□tion unless patient requires> 6 l/min $O_2$
- An increase in supplemental $O_2$ may be required if $SpO_2$ decreases from the additional air diluting the concentration of inspired oxygen.

**18) WEANING OR CESSATION IF NIV;**

- Normalization of PaC02 and maintaining O2 saturations with minimal oxygen
- Reduction in respiratory rate
- Intolerance of NIV
- Reduced □yspnea
- Normal overnight ventilation
- Women receiving palliative treatment
- Many women will need only 4-24 hours of continuous NIV and thereafter intermittent or nocturnal support.

A guide for weaning as tolerated by the woman's respiratory status is:

- Remove NIV for more frequent periods during the day. Encourage use when – patients are resting, after exertion, or sleeping.
- Use NIV at night only.
- Cease NIV as per Doctor's orders.
- Record in woman's notes.
- If the IPAP mode is inappropriate the IPAP may be reduced towards the EPAP value to reduce level of support. Oxygen is weaned as ordered.

**19) CLEANING**

- Wearing PPE discard disposable bacterial filter, mask and tubing in general waste.
- The bacterial filter encased on the side of the machine requires replacement when discoloured.
- Wipe over machine and trolley with neutral detergent.

**20) TRANSFERS**

- The V60 machine has an internal battery and fully charged will last 6-8 hours.
- It will be decided by the Anaesthetist whether the woman requires transfer using NIV or oxygen via the mask. If the woman is on greater than or equal to 70% 02 determination whether it is safe to transfer due to amount of 02 required on transfer or if retrieval by ICU staff is required.
- For all transfers to ICU an Anaesthetist, Nurse and porter will escort the woman.
- Two full 02 cylinders will be required for transfer.

## NON INVASIVE VENTILATION USING THE RESPIRONICS V60 MACHINE cont'd

**REFERENCES:**

New South Wales Agency for Clinical Innovation (NSW ACI): Non-invasive ventilation guidelines for adult patients with acute respiratory failure (2014)

*Noninvasive Ventilation - Therapeutic guidelines*
*https://tgldcdp.tg.org.au.acs.hcn.com.au/viewTopic?topicfile=noninvasive-ventilation*
*accessed on 06/04/2020*

Pearce, L. (2017). Acute non-invasive ventilation. *Emergency Nurse (2014+), 25*(5), 11. doi: /10.7748/en.25.5.11.s11

**REVISION & APPROVAL HISTORY**
Reviewed and endorsed CERS 2/6/20
Approved Quality & Patient Care Committee 18/7/13
Endorsed Operating Theatre Committee July 2013

**FOR REVIEW : JUNE 2025**

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**APPENDIX 1**

**DEFINITIONS AND USUAL SETTINGS**

| **Settings** | Settings Active in CPAP | Settings Active in BiPAP | Description | Range | Usual setting used in ACC |
|---|---|---|---|---|---|
| CPAP MODE | • | | Continuous Positive Airway Pressure | 4-25 cm H20 | 8-14 |
| S/T or BiPAP MODE | | • | Spontaneous Timed or BiLevel Positive Airway Pressure Ventilation. Two level system of alternating during non invasive ventilation in sync with breathing-set IPAP and EPAP | - | - |
| EPAP | • | • | Expired Positive Airway Pressure. Recruits under ventilated alveoli to remain open during expiration by providing a constant pressure throughout resp cycle. Must be less than or equal to IPAP | 4-25 cm h2o | 5-14 |
| IPAP | | • | Inspired Positive Airway Pressure provides pressure throughout the inspiratory phase to support pt ventilation | 4-40 cm h20 | 10-20 |
| I-time | | • | Inspiratory time- time taken to inspire in seconds | 0.3-3.0 s | 1:3 |
| Fi02 | • | • | Oxygen delivered | 21-100% | As ordered |
| Ramp time | • | • | The Ramp Time function helps your pt adapt to ventilation by gradually increasing inspiratory and expiratory pressure over a set interval (minutes). This time gradually delivers pressures so to reduce pt anxiety and increases comfort. | OFF or 5-45 min | 10 mins |
| Rate (resp rate) | | • | Pts respiratory rate | 4-60BPM | 4 |
| Rise time | | • | Speed at which the inspiratory pressure rises to the set pressure. | 1-5 (1 is the fastest) | Set at 3 |

**Patient Data**

| Data | Description | Range | Usual setting in ACC |
|---|---|---|---|
| Breath phase/trigger Indicator | Bar in left hand corner. Coloured according to breath trigger. | n/a | **n/a** |
| PIP | Positive Inspiratory pressure | 0-50 | **n/a** |
| Patient total leak | Est or unintentional leak | 0-200L | **n/a** |
| Patient trigger | Pt triggered breaths as a percentage | 0-100% | **Should be 100%** |
| Respiratory Rate | Respiratory rate | 0-90 BPM | **n/a** |
| Ti/Ttot | Inspiratory duty cycle or inspiratory time divided by total cycle time | 0-91% | **n/a** |
| Minute Volume | Est minute ventilation. TV x rate=MV | 0-99l/min | **n/a** |
| Tidal volume | Est. expired tidal volume | 0-3000 ml | **n/a** |

**Alarms**

| Alarm | Description | Range | To set as per policy |
|---|---|---|---|
| Hi Rate | High respiratory rate alarm | 5-90 BPM | 10 breaths above pts own |
| Low Rate | Low respiratory rate alarm | 1-89 BPM | 5 breaths below its own |
| Hi VT | High tidal volume alarm | 200-2500 ml | 200 ml above pts own |
| Low VT | Low tidal volume alarm | OFF-1500 ml | OFF |
| HIP | High inspiratory pressure alarm | 5-50 cm H20 | 10cm above IPAP |
| LIP | Low inspiratory pressure alarm | OFF, 1-40 cm H20 | OFF |
| Lo VE | Low minute vent alarm | OFF, 0.1 to 99L/min | OFF |
| LIP T | Low inspiratory delay time | 5-60 secs | 5 secs |

CPAP settings

- Set CPAP level as ordered
- Set 02 as ordered
- Set Ramp time as ordered
- Set C-Flex at 3

BiPAP settings

- Set breath rate as ordered
- Set I-time as 1.3
- Set EPAP as ordered
- Set IPAP as ordered
- Set rise time as ordered

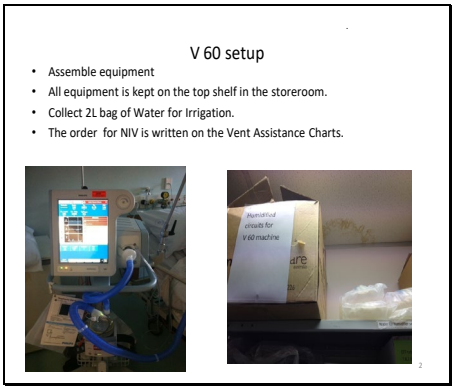
- Set 02 as ordered and ramp time as ordered

**APPENDIX 2**

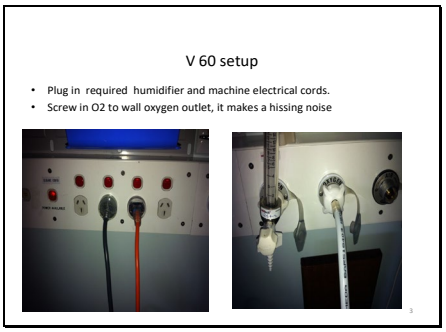
## Set up

Slide 1


Slide 2



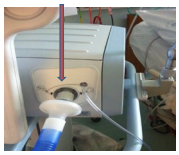

lide 3

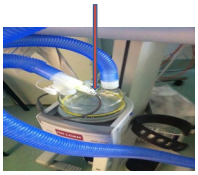


Slide 4

## Install circuit

Connect tubing and filter to outlet and then clip in humidifier. Add second inspiratory line. **Connect grey humidifier lead to tubing for warming of inspired air.**





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Slide 5

## Important: ensure the connections are placed correctly.

**Connect humidifier to circuit by inserting grey lead into 3 leaf clover connection**

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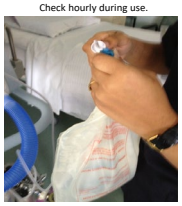
Slide 6

## Humidification of Circuit

Connect drip spike into bag of water for irrigation-it will fill itself to the black line. Check hourly during use.



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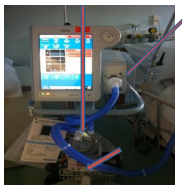
Slide 7

## V 60 setup

Ensure proximal pressure tubing is connected to prox. pressure port

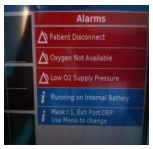
Ensure humidifier is connected to circuit and light is on. Turn on and adjust humidifier temp to low medium or high.



Slide 8

## Correct mask and exhalation port

- Ensure that the mask has no. 1 on the base and there is an exhalation port in place which is noted in messages as Exh Port: DEP
- To change these settings go to Menu window, select mask/Port
- Select no. mask and accept. This would be **an unusual** occurrence as we only have the one type of mask and this setting shouldn't need changing.
- Select desired exhalation port type and accept. This should always be DEP (disposable exhalation port) and we have only one brand of setup.

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Slide 9

## Alarms

- Alarms and messages alert you to situations that require your attention.
- Always respond immediately to an alarm. **Firstly ensure sufficient and effective ventilation for pt and then silence the alarm**
- Correct the alarm condition.
- Information messages- are on a blue background,
- Red message- HIGH PRIORITY- respond immediately- correct condition or place pt on 02 mask whilst troubleshooting.
- Yellow message-LOW PRIORITY- respond promptly correct condition or place pt on 02 mask whilst troubleshooting.


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