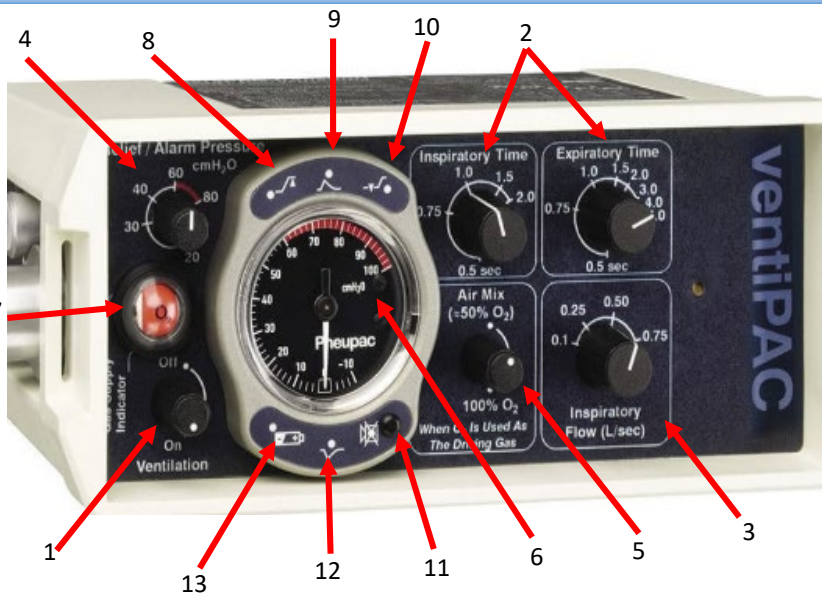


## Irish Paediatric Acute Transport Service

### Clinical Guideline

Document Details	
<b>Document Type:</b>	Guideline
<b>Document Name:</b>	Pneupac VentiPAC Paediatric Invasive Ventilation Guideline
<b>Document Location:</b>	IPATS
<b>Version:</b>	1.0
<b>Effective From:</b>	18/09/2019
<b>Review Date:</b>	18/09/2022
<b>Author:</b>	Dr Cathy Gibbons
<b>Approved by:</b>	Dr Dermot Doherty, Clinical Director NASCCRS
<b>Related Documents:</b>	
<p>The Irish Paediatric Acute Transport Service (IPATS) has produced this clinical guideline. It has been designed for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children.</p> <p>This guideline represents the views of IPATS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.</p>	

- The VentiPAC 200D is a **gas driven time cycled** paediatric/adult transport ventilator
- Minimum weight 5Kg
- Minimum tidal volume is 50ml



## “Knobology”

1. **On/Off** – turns on ventilator. If gas attached and set to ‘off’ – will deliver 100% O<sub>2</sub>
2. **Inspiratory & Expiratory times.** Used to set Ti and ventilator rate – see table below
3. **Frequency flow control.** Used to determine tidal volume delivery. The product of flow in L/sec and Ti (sec) gives the delivered Tv in Litres. i.e. a flow of 0.5L/sec x Ti of 1sec = 0.5x1 = 0.5 or 500ml Tv per breath.
4. **High Pressure Relief Valve.** Set to maximum acceptable PIP for Tv desired.
5. **Air mix control.** Allows switch between either 45% oxygen (air mix) or 100% oxygen (no air mix)

## Alarms & Monitoring

6. **Patient Pressure Manometer** – displays patients pressure during respiratory cycle
7. **Supply Gas Failure alarm** – Low gas pressure displays red. Adequate oxygen pressure is white
8. **High pressure alarm** – Will alarm if PEEP set to >10cmH<sub>2</sub>O - can be muted if desired
9. **Cycle indicator** – A green flash indicates each time the patient inflation pressure rises through 10cmH<sub>2</sub>O
10. **Low pressure/Disconnect alarm** – will alarm to warn of possible disconnect or vent not cycling correctly ie vent does not cycle through 10cmH<sub>2</sub>O q8sec – an asthmatic with RR of <7bpm will trigger this alarm)
11. **Silencing & Muting of audible alarms**
12. **Breathing detect indicator** – Green visual indicator to indicate a spontaneous breathing effort is detected
13. **Low battery alarm** – Battery only powers alarms NOT the ventilator itself.

## Recommended Modes of Ventilation with VentiPAC Ventilator

- CMV is the recommended mode when ventilating infants and children with this ventilator. The Tidal Volume and Rate are user determined using the manometer to assess delivered pressure and a peak pressure valve to set a Max PIP. PEEP is optional using a PEEP valve.

## How to set the Rate & Tidal Volumes

Temp ↓	Frequency/RR					
0.5	60	48	40	30	24	17
0.75	48	40	34	27	22	16
1	40	34	30	24	20	15
1.5	30	27	24	20	17	13
2	24	22	20	17	15	12
3	17	16	15	13	12	10
4	13	13	12	11	10	9
6	9	9	9	8	7	7
<b>T ins →</b>	<b>0.5</b>	<b>0.75</b>	<b>1</b>	<b>1.5</b>	<b>2</b>	<b>3</b>
<b>Flow ↓</b>						
0.1	50	75	100	150	200	300
0.25	125	185	250	375	500	750
0.5	250	375	500	750	1000	1500
0.75	375	560	750	1125	1500	2250
1	500	750	1000	1500	2000	3000

- The ventilator rate is a product of the inspired and expired time. It is important to remember to preserve an appropriate I:E ratio at all times –aiming for close to 1:2 as standard care.

	I:E Ratio
	1:1
	1:1.5 - 1:2
	1:3
	1:4

- The Tidal Volume is a product of the Ti and the flow. A tidal volume of 5-7ml/kg/min is generally acceptable – see caveats overleaf.

## Common indications for intubation in the acute setting

It is often prudent to pre-emptively intubate a deteriorating child in advance of collapse – contact the PICU referral line for advice – 1800 222378

- **Airway protection/patency**
- **Respiratory Failure** – Progressive hypoxaemia/hypercarbia or respiratory muscle failure
- **Cardiovascular Support** - congenital heart disease/myocarditis (*discuss with PICU prior to intubation – can be ++Risk*) or impending cardiovascular collapse i.e. Severe Sepsis
- **Neuroprotection** – to facilitate scanning/optimize pCO<sub>2</sub> and reduce cerebral metabolic O<sub>2</sub> demands
- **Facilitate a procedure** i.e. Central Venous Access / Chest drain insertion

## Pre-Intubation Considerations

1. **Location** – Aim to move child as little as possible as this can cause significant delays - bring equipment/staff to the child where possible i.e. Resus/HDU bay
2. **Equipment Selection** – Use intubation/airway guide @ <http://www.nasccrs.ie/IPATS/Guidelines/Respiratory/Intubation-and-Airway-guide-1-.pdf> as an aide memoire if required
3. **Induction agents** – Ketamine 2mg/kg + Rocuronium 1mg/kg IV is a cardio-stable and reliable induction combination for most children. For older haemodynamically stable children, propofol + muscle relaxation is generally well tolerated. Atropine can be a useful adjunct in the ill neonate at risk of vagal stimulation and bradycardia.
4. **Pre intubation checklist / team huddle** – We recommend printing & using the 'pre intubation checklist' to ensure all monitoring/ equipment and team dynamics have been discussed prior to intubation.  
<http://www.nasccrs.ie/IPATS/Guidelines/Respiratory/intube.pdf>

## Post Intubation Checklist

**ETT Confirmation:** Auscultation  + ETCO<sub>2</sub> waveform Capnography  + **CXR**  (**Chest X Ray is mandatory before transfer**). **Naso/Oro gastric tube placement is required in all ventilated children – on free drainage for transfer**

**Ongoing sedation:** Young/unstable children – Morphine 20mcg/kg/hr (10-40mcg/kg/hr) + Midazolam 2mcg/kg/min (1-5mcg/kg/min). Older stable children can be sedated with Propofol infusion. We recommend intermittent muscle relaxation in all ventilated patients for transfer. Urinary catheterisation of all paralysed patients is recommended.

**Blood Gas:** Any blood source (cap/ven/art) is acceptable in paediatrics. Perform **at least one gas** on transport ventilator prior to departure - ideally after approx. 10min of stable ventilator settings. Correlate with ETCO<sub>2</sub> for ambulance journey.

## Suggested Starting Ventilator Settings

Patient	Peak Pressures <small>Start at lowest pressure to achieve chest rise</small>	Tidal Vol	PEEP	Rate	I Time	I:E ratio	Target Sats
Infant	15-25	5-7ml/kg/min is a safe tidal volume target for most infants and children. Peak pressures should be weaned to target this volume to limit barotrauma whenever possible	5	35	0.5	1:2	>94%
Young child	15-30		5	25-30	0.7	1:2	>94%
Adolescent			5	15-20	1	1:2	>94%
+Asthma			To move chest	0-5	12-20	1	1:2-1:4
+ARDS	To move chest		5-15	15-20	1	1:1.5 -1:2	>88%

## Troubleshooting Ventilation

- D**isplaced ETT    Ensure ETCO<sub>2</sub> reading, auscultate chest, check ETT depth at lips
- O**bstructed ETT    Suction ETT with largest possible catheter, **saline lavage can be very helpful** (1ml/kg up to 10ml per lavage)
- P**neumothorax    Check trachea is midline/look + auscultate, CXR if unsure / trans illuminate if neonate
- E**quipment    Check ventilator settings and circuit. Higher pressure may be required to ventilate children on T/port vents
- S**tomach    Ensure NG/OG is open and aspirate to ensure diaphragm splinting is not occurring

**Deadspace** – This can be difficult to manage in small infants on transport ventilators. If PcO<sub>2</sub> is difficult to clear - ensure rate is optimised & breath stacking is not occurring; consider cutting ETT (leave 4cm); Ensure appropriate sized circuit is in use. Contact PICU 180022237 for further advice if these measures are ineffective. **Do NOT remove the HME filter or ETCO<sub>2</sub>**