**Guideline**

# Humidified High Flow Nasal Cannula Oxygen Guideline for Metropolitan Paediatric Wards and EDs

**Summary** This Guideline presents the current best evidence for Humidified High Flow Nasal Cannula Oxygen. Its purpose is to inform practice for clinicians in Metropolitan Level 4 Paediatric Units and Metropolitan Emergency Departments caring for infants and children who may benefit from Humidified High Flow Nasal Cannula Oxygen therapy.

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**Applies to** Local Health Districts, Board Governed Statutory Health Corporations, Affiliated Health Organisations, Public Hospitals

**Distributed to** Public Health System, Divisions of General Practice, Government Medical Officers, NSW Ambulance Service, Ministry of Health, Tertiary Education Institutes

**Audience** Emergency departments; nursing; medical;clinical, level 4 paediatric units

NSW GOVERNMENT Health

GUIDELINE SUMMARY

# HUMIDIFIED HIGH FLOW NASAL CANNULA OXYGEN GUIDELINE FOR METROPOLITAN PAEDIATRIC WARDS AND EDs – 1ST EDITION

## PURPOSE

The *Humidified High Flow Nasal Cannula Oxygen Guideline for Metropolitan Paediatric Wards and ED's, 1st edition* has been developed to inform practice for clinicians caring for infants and children. This guideline was developed by a representative group of NSW Clinicians with expertise in acute paediatric care, paediatric intensive care, and paediatric respiratory care as part of a joint project between The Office of Kids and Families and MP4 (Metropolitan Paediatric Level 4 Units Sydney) and is aimed at achieving the best possible care in NSW.

## KEY PRINCIPLES

The guideline applies only to Metropolitan Paediatric Level 4 Units and Metropolitan Emergency Departments where paediatric patients are managed. It requires Chief Executives of Metropolitan Local Health Districts to determine where local adaptations are required or whether the guideline can be adopted in the current format.

The guideline reflects what is currently regarded as a safe and appropriate approach to commencement of Humidified High Flow Nasal Cannula Oxygen (HHFNC) and the care of infants while on HHFNC. The document should not be seen as a stringent set of rules to be applied without the clinical input and discretion of the managing professionals. Each patient should be individually evaluated and a decision made as to appropriate management in order to achieve the best clinical outcome.

## USE OF THE GUIDELINE

Chief Executives of Metropolitan LHD's must ensure:

- Metropolitan hospitals and facilities either adopt this protocol or adapt local protocols to comply with the *Humidified High Flow Nasal Cannula Oxygen Guideline for Metropolitan Paediatric Wards and EDs*
- Ensure that all staff treating paediatric patients are educated in the use of the locally developed paediatric protocols.

Directors of Clinical Governance are required to inform relevant clinical staff treating paediatric patients of this new guideline.

## REVISION HISTORY

| Version | Approved by | Amendment notes |
|---|---|---|
| January-2016 (GL2016_004) | Deputy Secretary, Strategy and Resources | New guideline |

## ATTACHMENTS

1. Humidified High Flow Nasal Cannula Oxygen Guideline for Metropolitan Paediatric Wards and EDs, 1st Edition: Guideline

# Humidified High Flow Nasal Cannula Oxygen Guideline for Metropolitan Paediatric Wards and EDs - 1st Edition

NSW GOVERNMENT Health

GUIDELINE

**Issue date:** January-2016

GL2016_004

# CONTENTS

# 1 PURPOSE

This guideline is aimed at achieving the best possible care in NSW. This guideline presents the current best evidence for *Humidified High Flow Nasal Cannula Oxygen.* Its purpose is to inform practice for Australian health care providers.

The document should not be seen as a stringent set of rules to be applied without the clinical input and discretion of the managing professionals. Each patient should be individually evaluated and a decision made as to appropriate management in order to achieve the best clinical outcome.

This guideline is primarily targeted to clinicians caring for infants and children undertaking any task related to Humidified High Flow Nasal Cannula Oxygen in ***Metropolitan Level 4 Paediatric Units and Metropolitan Emergency Departments***.

The systematic review underpinning this guideline was completed in 2014. The guideline was developed between October 2014 and September 2015. Public consultation occurred during June and July 2015. It is recommended that the literature is revisited and this document is reviewed in 2020.

This guideline was developed by a representative group of NSW Clinicians with expertise in acute paediatric care, paediatric intensive care, and paediatric respiratory care as part of a joint project between NSW Kids and Families and MP4 (Metropolitan Paediatric Level 4 Units Sydney).

No conflict of interest was identified.

# 2 DEFINITION

Humidified High Flow Nasal Cannula (HHFNC) therapy is a simple to use system that delivers warm, moist gas at high flow rates that generate positive airway pressure. When used at flow rates of 1- 2 L/kg/min[1] it acts a bridge between low flow oxygen therapies and Continuous Positive Airways Pressure (CPAP), reducing the need for intubation. [1,2]

# 3 INDICATIONS FOR USE

## 3.1 Inclusion Criteria

- Moderate to severe respiratory distress in **infants (0-12 months) with bronchiolitis** who have failed to respond to low flow oxygen
- May have a role in moderate to **severe respiratory distress in children** who have failed to respond to low flow oxygen, however there is limited evidence to support this [3]
- Use for indications other than bronchiolitis may have some merit but should only be considered after **senior medical consultation** and implementation of appropriate disease specific treatments.

## 3.2 Exclusion criteria

- Neonates in special care nurseries

# 4 CONTRAINDICATIONS

- Nasal obstruction
- Ingestion/toxins
- Life threatening hypoxia/apnoeas/haemodynamic instablility
- Trauma (maxillofacial/suspected base of skull fracture/chest)
- Pneumothorax
- Foreign body aspiration.

**Proceed with caution in those with:**

- Decreased level of consciousness (LOC)
- Congenital heart disease
- Asthma (never use HHFNC at the same time as nebulization– see below note)
- Chronic respiratory disease.

## 4.1 Delivery of nebulised medication during HHFNC - CAUTION

There are no studies on medication delivery via nebuliser mask during HHFNC use. HHFNC Oxygen should be used with caution in patients with Asthma.

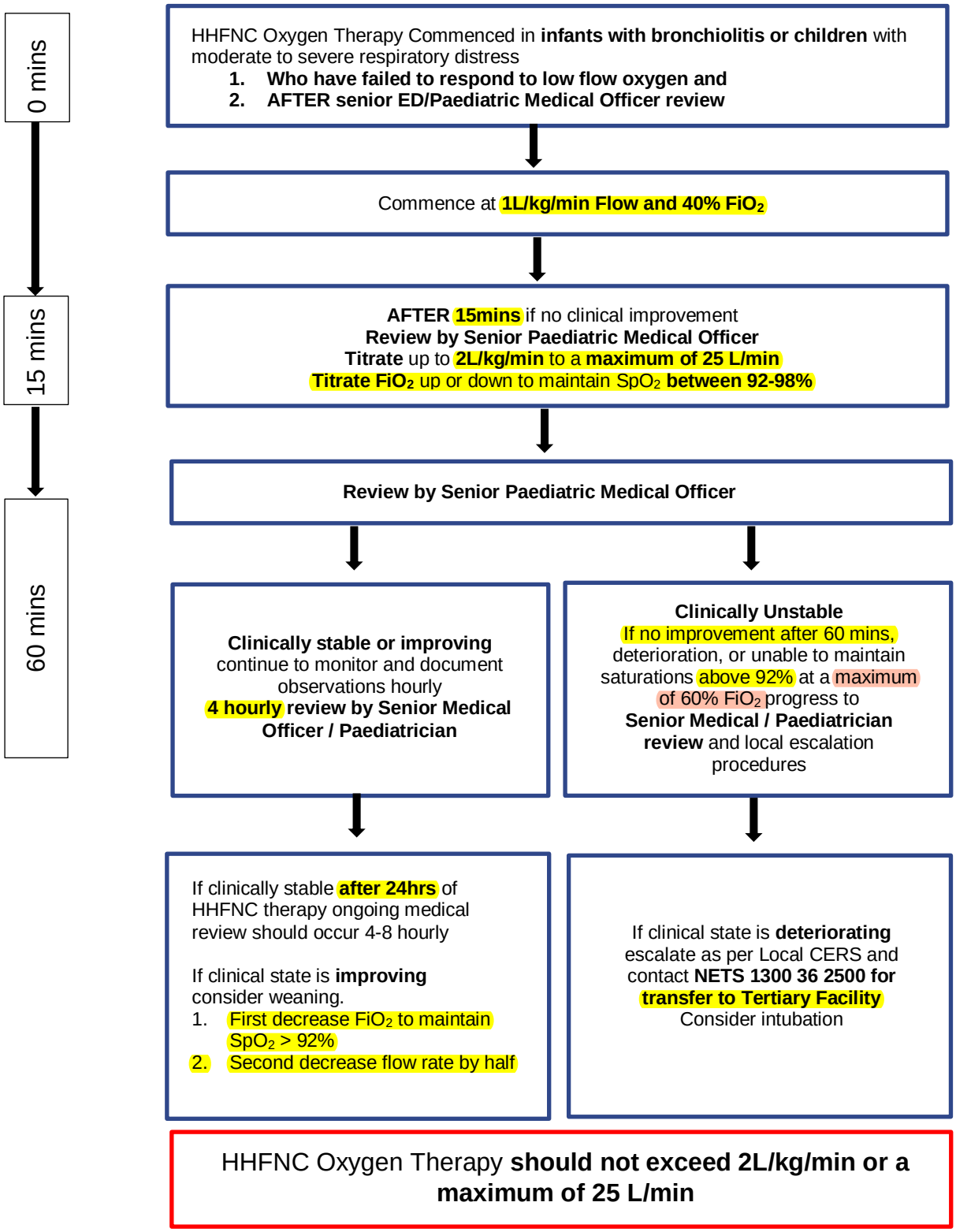
***Patients with asthma severe enough to need Continuous Positive Airway Pressure (CPAP) should have this via a face mask not via HHFNC.***

In situations where there is diagnostic uncertainty (e.g. bronchiolitis versus bronchoconstriction), the need to deliver nebulised medication must be balanced against the potential risk of deterioration with the removal of HHFNC.

**Any child requiring the administration of metered dose or nebulised medications such as Salbutamol during HHFNC will need to have HHFNC ceased or have the flow significantly reduced to 4L/min or below during the time of administration.** Not doing so will prevent the medication from being inhaled as little entrainment of room air by the patient occurs at higher flow rates. Time of aerosol medication delivery therefore should be minimised by using MDI and Spacer where possible and prescribed flow rate and oxygen returned as soon as possible. If any clinical deterioration occurs during delivery then HHFNC should be immediately resumed and the senior medical officer notified and alternate means of medication delivery considered.

There is limited evidence for the use of in line mesh vibration nebuliser adaptor, which shows drug delivery is reduced with increasing flow rates and smaller cannula sizes.[4,5]

# 5 HHFNC OXYGEN THERAPY FLOW CHART



# 6 PRESCRIPTION FOR CARE

- In Emergency Departments (ED) senior ED Medical Officer to review patient prior to HHFNC oxygen commencement
- In paediatric wards when HHFNC oxygen is considered, the most senior paediatric medical officer, paediatric or emergency consultant must have reviewed the patient **and the paediatrician on call** must have been informed and agreed to the use of HHFNC oxygen prior to its initiation
- Consultation with the carer is vital. Informed verbal consent must be obtained prior to the implementation of HHFNC Oxygen therapy and documented in the healthcare record.
- The prescription documentation for the HHFNC oxygen requires inclusion of Fraction of inspired oxygen ($FiO_2$) and flow rate in L/kg/min
- Escalate care as required according to local Clinical Emergency Response System Policy (CERS) and the Standard Paediatric Observation Charts/Paediatric Emergency Department Observation Charts (SPOC/PEDOC)
- Medical review must occur again within 1 hour following commencement of HHFNC therapy and 4 hourly at a minimum if patient stable following initial review
- The patient should be nursed with a patient ratio of 1:2 in a High Observation Area by a registered nurse who is experienced and educated in paediatric nursing care
- If patient remains stable after 24hrs of HHFNC therapy ongoing medical review should occur 4-8hourly.

# 7 EQUIPMENT

- Oxygen and air source
- Oxygen blender
- Oxygen analyser if blender not being used
- Flow meter 0-30 L/min
- Humidifier base
- Humidifier circuit
- Nasal cannula – see nasal prong size guide section 5.1 below
- Sterile 2Litre Water bag
- Nasogastric/orogastric tube
- +/- Nebuliser attachment for patients with asthma.

## 7.1 Nasal prong size guide

The following codes should be used as per the current manufacturer's instructions and should be utilised as a rough guide when selecting nasal cannula.

Nasal Cannula Size Diagram from Fisher and Paykel Healthcare https://www.fphcare.com.au/products/optiflow-junior-nasal-cannula/

**F&P OPTIFLOW JUNIOR**

| OPTIFLOW JUNIOR NASAL CANNULA | ITEM CODE | APPROX WEIGHT (KG) 2 4 6 8 10 12 14 16 18 20 22 | SPARE WIGGLEPADS |
|---|---|---|---|
| Premature Size | OPT312 | Max. flow 8 L/min | OPT010 |
| Neonatal Size | OPT314 | Max. flow 8 L/min | |
| Infant Size | OPT316 | Max. flow 20 L/min | OPT012 |
| Pediatric Size | OPT318 | Max. flow 25 L/min | |

## 7.2 Set up equipment

- See Appendices for set up instructions for Airvo 2 ® and Fisher and Paykel Healthcare ® Humidifier (MR850).

## 7.3 Starting Parameters

**Start the HHFNC system:**

- Commence at 1L/kg/min
- In general, improvement is defined by a reduction in heart rate by 20% which equates to a trend from red to yellow or yellow to blue zones on SPOC/PEDOC's. A decrease in respiratory distress and rate should follow
- If no improvement to work of breathing, heart rate (HR) and respiratory rate (RR) after 15 minutes, titrate up to 2L/kg/min to a maximum of 25 L/min
- If no improvement within the next 60 minutes, the patient requires senior medical review and local escalation procedures.

**Start the $FiO_2$:**

- Commence with 40% $FiO_2$
- Titrate up or down to maintain oxygen saturations between 92-98% (except in cyanotic heart disease)
- If unable to maintain saturations above 92% at a maximum of 60% $FiO_2$, patient requires senior medical review and local escalation procedures.

In general the guide to titrating is:

- Increased work of breathing = increase flow
- Decreased oxygenation = increase $FiO_2$.

# 8 ONGOING CARE

The use of "high flow" means the patient is unwell and requires more and not less nursing care and clinical monitoring. The child should be cared for in a High Observation Area. Nursing ratio should be 1:2 until all parameters improve and are in the blue zone of the SPOC. Nursing ratio may then revert to 1:4 following medical review and discussion with the nurse in charge.
Every patient commenced on HHNC oxygen requires a medical review no later than 1 hour after commencement of this therapy. The commencement of therapy and reviews (at least every 4 hours) must be documented in the patient's progress notes. Once the patient is stable after 24hrs of HHFNC therapy ongoing medical review should occur 4-8 hourly.

**Monitoring**:

- Continuous cardio-respiratory monitoring
- Continuous oxygen saturation monitoring
- Check and documentation of $FiO_2$, flow, circuit observations hourly
- Temperature 4th hourly
- Blood pressure once per shift unless abnormal
- Blood glucose level 6th hourly for fasting infants.

**Documentation:**

Initially every 15 mins then hourly once stable:

- Heart rate, respiratory rate, respiratory distress, oxygen saturation
- Flow rate, $FiO_2$, and humidifier temperature
- Humidifier water level/bag check

**Nursing care:**

- Check nasal prong position hourly (at a minimum):
  - Dislodgement may result in reduced respiratory support
  - Ensure that a leak is present, as obstruction of the nasal passages will inadvertently create high pressure and may lead to barotrauma
  - Check for pressure areas to nares.
- Saturation probe site change 2-4 hourly
- All infants on HHFNC should have a gastric tube insitu. The gastric tube should be vented initially to decompress the stomach which may cause respiratory compromise. Once the child is stable, it may be used for feeds
- Perform nasal hygiene to prevent crusting of secretions with nursing cares and perform effective nasopharyngeal suction as clinically indicated.

## 8.1 Feeding

- Infants on HHFNC therapy may continue to be fed depending on their respiratory status and the clinical situation
- Some infants may be able to continue breast feeding if work of breathing allows
- If the infant is too tired to feed, nutrition can be given via a naso / oro gastric tube [6]
- If the infant is not tolerating gastric feeds give intravenous fluids (see Standards for Paediatric IV Fluids 2nd edition). Two thirds maintenance is usually adequate due to respiratory humidification and risk of Syndrome of Inapproriate Antidiuretic Hormone

(SIADH). [6] A gastric tube should be left insitu for venting and for feeding once more stable.

# 9 ESCALATION AND TRANSFER

If there is any clinical deterioration or no signs of improvement within 60 minutes of therapy at 2L/kg/min and up to 60% $FiO_2$, escalate as per local CERS policy and SPOC/PEDOC charts and contact paediatrician and NETS. The patient will likely need to have a blood gas drawn, a chest xray and intravenous fluids if not already done.
If the patient requires transfer between areas (e.g. from ED to the ward) they should be accompanied by an RN, remain fully monitored and if possible high flow must not be disconnected for transfer. Ensure the receiving ward has all the required equipment to care for the infant before transfer. An unstable patient should not be moved until condition has stabilised.

**Transfer on Airvo2 system**

- An external battery is required
- If a battery is not available a Hudson mask is placed over the nasal cannula and connected to portable $O_2$ cylinder. This does not deliver HHFNC Oxygen therapy
- **Children will be at risk of deterioration during transfer while HHFNC is off.**

**Transfer on Fisher and Paykel Healthcare ® Humidifier (MR850)**

- High flow oxygen can be maintained during transport
- Humidification may be reduced due to the humidifier being off during transfer.

## 9.1 Acute deterioration/complications

- If acute deterioration, escalate as per local CERS to a rapid review
- Ensure appropriate size Bag-Valve Mask +/- Neopuff at bedside which can be used with nasal prongs insitu to provide respiratory support if needed. An effective seal can generally be maintained although sometimes this may be difficult
- Consider pneumothorax and increase $FiO_2$
- Consider nasal trauma
- Check for condensation of tubing and empty as required back into the humidifier chamber.

# 10 WEANING

Senior medical review of the patient is required before commencing weaning. If there is clinical improvement, the order to wean must be documented in the clinical notes.

**Indications for weaning:**
Mild or no increased work of breathing

- Normal parameters (HR and RR in white and blue zones of SPOC)
- Saturations > 92%

**Order of weaning:**

- First gradually wean $FiO_2$ by 10% increments, ideally aiming for 21% to maintain $SpO_2$ > 92%

Once needing less than 40% $FiO_2$ with minimal increased work of breathing:

- Then decrease flow rate to 1L/kg/min. If child remains stable for 2-4 hours then reduce again to 0.5L/kg/min and then cease.

System can be ceased once child is in air on ≤ 4L/min

- ***If flow rate is under 2L/min and there is still an oxygen requirement, swap to low flow oxygen as low flow can result in rain out of water in the high flow circuit***
- If using the Airvo 2, a flow rate of less than 2L/min will not deliver an accurate FiO2 in Junior mode. If not in Junior mode, the minimum flow rate is 5L/min.

Generally there is no need for a prolonged weaning process, as it is better to be on high flow oxygen therapy, standard low flow oxygen therapy or off oxygen therapy.

If patient develops respiratory distress while weaning is in progress, return to the previous settings.

# 11 Appendices

## 11.1 Appendix 1 References

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14. High Flow Humidified Nasal Cannula Oxygen in Paediatrics (Emergency and Children's Ward) – administration of, November 2013, Central Coast Local Health District
15. Heated Humidified Nasal Cannula (HHNC) Oxygen using Fisher and Paykel ® delivery system for infants with bronchiolitis, March 2014, Western Sydney Local Health District
16. Humidified High Flow Nasal Prong Oxygen (HHFNPO2) for the management of Children with Moderate to Severe Bronchiolitis, January 2014, Northern Sydney Local Health District
17. High flow humidified nasal cannula (hfhnc) oxygen in infants and children - administration of, August 2011, St George/Sutherland Hospitals And Health Services, South Eastern Sydney Local Health District
18. Humidified High Flow Nasal Cannula Oxygen (HHFNC02) In Paediatric Patients Suffering From Respiratory Distress, May 2014, Campbelltown Hospital, South Western Sydney Local Health District
19. Administration of High Flow Humidified Nasal Prong Oxygen in Children, April 2012, Illawarra Shoalhaven Local Health District
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## 11.2 Appendix 2 Fisher and Paykel Healthcare ® Humidifier (MR850) Set Up

Follow instructions in the MR850 User Manual

Fisher and Paykel has two modes:

- Invasive Mode - delivers saturated gas as close to body temperature (37 degrees, 44mg/L) as possible.

Suitable for patients with bypassed airways:

  - Invasive Ventilation
  - Tracheostomy attachment or mask
  - Nasal Prongs.

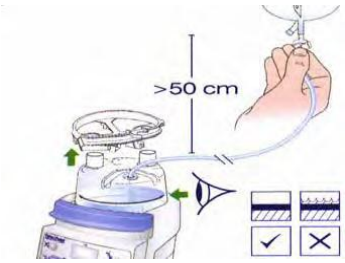
- Non-Invasive Mode – delivers gas at a comfortable level of humidity (31-36 degrees, >10mg/L).

Suitable for patients receiving:

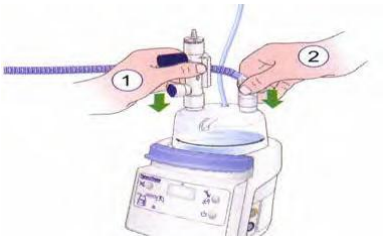
  - Face mask therapy
  - Non-invasive ventilation (CPAP/BIPAP)
  - Nebuliser mask (with RT308 circuit).

**Step 1**

**Step 2**




**Step 3**

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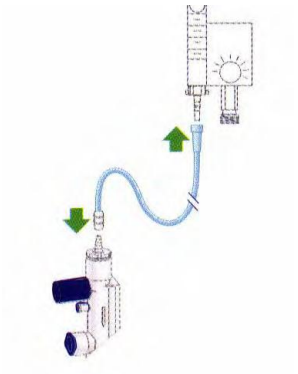
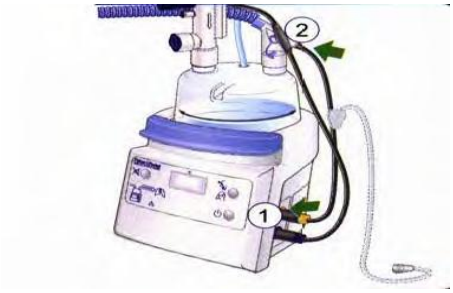
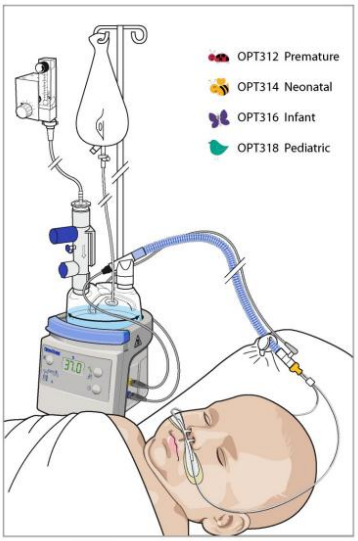


**Step 5**




**Step 6**


**Step 7**




F&P 850™ System

Images taken from Fisher and Paykel Healthcare MR850 User Manual

## 11.3 Appendix 3 Resource Airvo 2 ® Set Up

Follow instructions in the AIRVO 2 User Manual .

AIRVO 2 Humidifier has two modes:

- Junior Mode

Suitable for patients using:

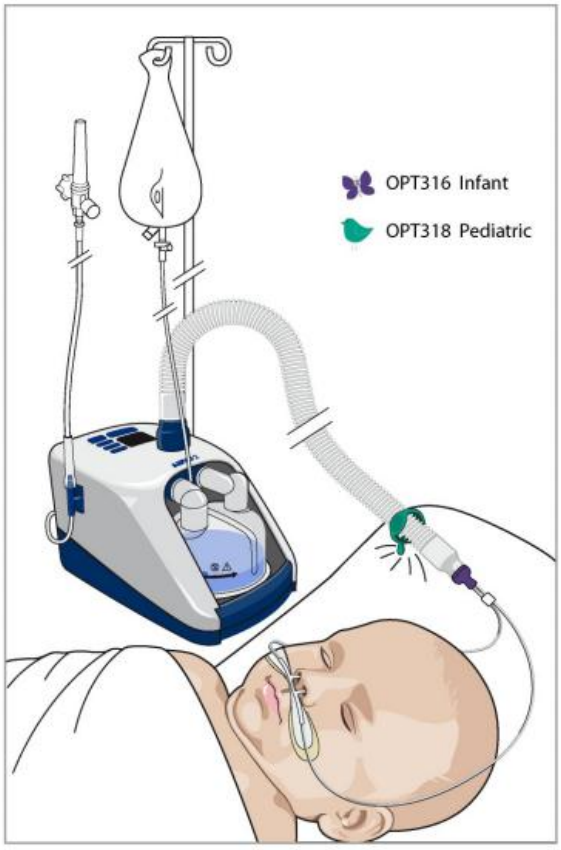
  - Optiflow Junior Infant and Paediatric Nasal Prongs.

- Standard Mode

Suitable for patients using:

  - Optiflow adult nasal prongs
  - Nebuliser mask (via Mask Interface Adaptor)
  - Tracheostomy mask (via Mask Interface Adaptor)
  - Tracheostomy direct connection.

The AIRVO 2 Humidifier requires cleaning and disinfection between patients



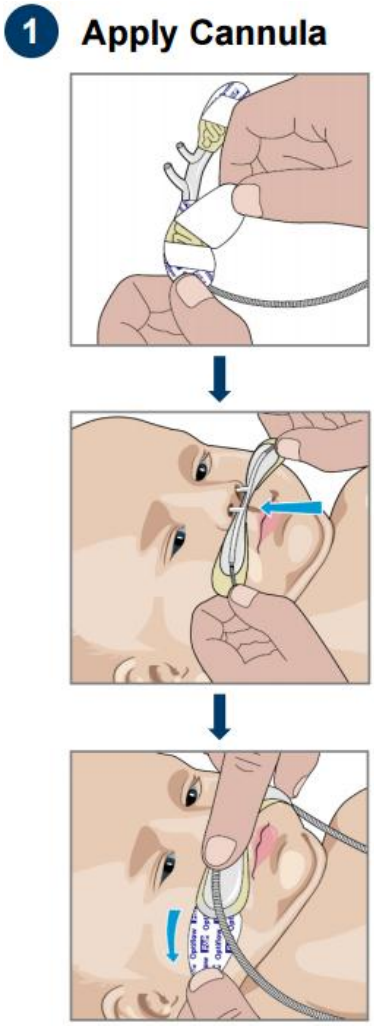

F&P AIRVO™ 2

Images taken from Fisher & Paykel Healthcare https://www.fphcare.com.au/

## 11.4 Appendix 4 Resource Nasal Cannula Selection and Application

**F&P OPTIFLOW JUNIOR**

| OPTIFLOW JUNIOR NASAL CANNULA | ITEM CODE | APPROX WEIGHT (KG) 2 4 6 8 10 12 14 16 18 20 22 | SPARE WIGGLEPADS |
|---|---|---|---|
| Premature Size | OPT312 | Max. flow 8 L/min | OPT010 |
| Neonatal Size | OPT314 | Max. flow 8 L/min | OPT012 |
| Infant Size | OPT316 | Max. flow 20 L/min | |
| Pediatric Size | OPT318 | Max. flow 25 L/min | |




Nasal Cannula Size Diagram from Fisher and Paykel Healthcare
https://www.fphcare.com.au/products/optiflow-junior-nasal-cannula/

## 11.5 Appendix 5 Resource Table for mixing oxygen and air

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 1 | 1 |
| 30% | 0.1 | 0.9 | |
| 35% | 0.2 | 0.8 | |
| 40% | 0.25 | 0.75 | |
| 45% | 0.3 | 0.7 | |
| 50% | 0.4 | 0.6 | |
| 55% | 0.44 | 0.55 | |
| 60% | 0.5 | 0.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 2 | 2 |
| 30% | 0.2 | 1.8 | |
| 35% | 0.4 | 1.6 | |
| 40% | 0.5 | 1.5 | |
| 45% | 0.6 | 1.4 | |
| 50% | 0.7 | 1.3 | |
| 55% | 0.9 | 1.1 | |
| 60% | 1 | 1 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 3 | 3 |
| 30% | 0.4 | 2.6 | |
| 35% | 0.6 | 2.4 | |
| 40% | 0.8 | 2.2 | |
| 45% | 0.9 | 2.1 | |
| 50% | 1 | 2 | |
| 55% | 1.3 | 1.7 | |
| 60% | 1.5 | 1.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 4 | 4 |
| 30% | 0.5 | 3.5 | |
| 35% | 0.7 | 3.3 | |
| 40% | 1 | 3 | |
| 45% | 1.2 | 2.8 | |
| 50% | 1.5 | 2.5 | |
| 55% | 1.7 | 2.3 | |
| 60% | 2 | 2 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 5 | 5 |
| 30% | 0.5 | 4.5 | |
| 35% | 0.9 | 4.1 | |
| 40% | 1 | 4 | |
| 45% | 1.5 | 3.5 | |
| 50% | 2 | 3 | |
| 55% | 2.2 | 2.8 | |
| 60% | 2.5 | 2.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 6 | 6 |
| 30% | 0.5 | 5.5 | |
| 35% | 1.1 | 4.9 | |
| 40% | 1.5 | 4.5 | |
| 45% | 1.9 | 4.1 | |
| 50% | 2.5 | 3.5 | |
| 55% | 2.6 | 3.4 | |
| 60% | 3 | 3 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 7 | 7 |
| 30% | 1 | 6 | |
| 35% | 1.3 | 5.7 | |
| 40% | 2 | 5 | |
| 45% | 2.2 | 4.8 | |
| 50% | 3 | 4 | |
| 55% | 3.1 | 3.9 | |
| 60% | 3.5 | 3.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 8 | 8 |
| 30% | 1 | 7 | |
| 35% | 1.5 | 6.5 | |
| 40% | 2 | 6 | |
| 45% | 2.5 | 5.5 | |
| 50% | 3 | 5 | |
| 55% | 3.5 | 5.5 | |
| 60% | 4 | 4 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 9 | 9 |
| 30% | 1.1 | 7.9 | |
| 35% | 1.7 | 7.3 | |
| 40% | 2.2 | 6.8 | |
| 45% | 2.8 | 6.2 | |
| 50% | 3 | 6 | |
| 55% | 3.9 | 5.1 | |
| 60% | 4.5 | 4.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 10 | 10 |
| 30% | 1.2 | 8.8 | |
| 35% | 1.9 | 8.1 | |
| 40% | 2.5 | 7.5 | |
| 45% | 3.1 | 6.9 | |
| 50% | 3.7 | 6.3 | |
| 55% | 4.4 | 5.6 | |
| 60% | 5 | 5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 11 | 11 |
| 30% | 1.4 | 9.6 | |
| 35% | 2.1 | 8.9 | |
| 40% | 2.7 | 8.3 | |
| 45% | 3.4 | 7.6 | |
| 50% | 4.1 | 6.9 | |
| 55% | 4.8 | 6.2 | |
| 60% | 5.5 | 5.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 12 | 12 |
| 30% | 1.5 | 10.5 | |
| 35% | 2.2 | 9.8 | |
| 40% | 3 | 9 | |
| 45% | 3.7 | 8.3 | |
| 50% | 4.5 | 7.5 | |
| 55% | 5.2 | 6.8 | |
| 60% | 6 | 6 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 13 | 13 |
| 30% | 1.6 | 11.4 | |
| 35% | 2.6 | 10.6 | |
| 40% | 3.2 | 9.8 | |
| 45% | 4.1 | 8.9 | |
| 50% | 4.9 | 8.1 | |
| 55% | 5.7 | 7.3 | |
| 60% | 6.5 | 6.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 14 | 14 |
| 30% | 1.7 | 12.3 | |
| 35% | 2.6 | 11.4 | |
| 40% | 3.5 | 10.5 | |
| 45% | 4.4 | 9.6 | |
| 50% | 5.3 | 8.7 | |
| 55% | 6.1 | 7.9 | |
| 60% | 7 | 7 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 15 | 15 |
| 30% | 1.9 | 13 | |
| 35% | 2.8 | 12.2 | |
| 40% | 3.8 | 11.2 | |
| 45% | 4.7 | 10.3 | |
| 50% | 5.6 | 9.4 | |
| 55% | 6.6 | 8.4 | |
| 60% | 7.5 | 7.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 16 | 16 |
| 30% | 2 | 14 | |
| 35% | 3 | 13 | |
| 40% | 4 | 12 | |
| 45% | 5 | 11 | |
| 50% | 6 | 10 | |
| 55% | 7 | 9 | |
| 60% | 8 | 8 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 17 | 17 |
| 30% | 2.1 | 14.9 | |
| 35% | 3.2 | 13.8 | |
| 40% | 4.2 | 12.8 | |
| 45% | 5.3 | 11.7 | |
| 50% | 6.4 | 10.6 | |
| 55% | 7.4 | 9.6 | |
| 60% | 8.5 | 8.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 18 | 18 |
| 30% | 2.2 | 15.8 | |
| 35% | 3.5 | 14.6 | |
| 40% | 4.5 | 13.5 | |
| 45% | 5.6 | 12.4 | |
| 50% | 6.8 | 11.2 | |
| 55% | 7.9 | 10.1 | |
| 60% | 9 | 9 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 19 | 19 |
| 30% | 2.4 | 16.6 | |
| 35% | 3.6 | 15.4 | |
| 40% | 4.8 | 14.2 | |
| 45% | 5.9 | 13.1 | |
| 50% | 7.1 | 11.9 | |
| 55% | 8.3 | 10.7 | |
| 60% | 9.5 | 9.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 20 | 20 |
| 30% | 2.5 | 17.5 | |
| 35% | 3.7 | 16.3 | |
| 40% | 5 | 15 | |
| 45% | 6.3 | 13.7 | |
| 50% | 7.5 | 12.5 | |
| 55% | 8.8 | 11.2 | |
| 60% | 10 | 10 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 21 | 21 |
| 30% | 2.6 | 18.4 | |
| 35% | 3.9 | 17.1 | |
| 40% | 5.3 | 15.7 | |
| 45% | 6.6 | 14.4 | |
| 50% | 7.9 | 13.1 | |
| 55% | 9.2 | 11.8 | |
| 60% | 10.5 | 10.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 22 | 22 |
| 30% | 2.8 | 19.2 | |
| 35% | 4.1 | 17.9 | |
| 40% | 5.5 | 16.5 | |
| 45% | 6.9 | 15.1 | |
| 50% | 8.3 | 13.7 | |
| 55% | 9.6 | 12.4 | |
| 60% | 11 | 11 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 23 | 23 |
| 30% | 2.9 | 20.1 | |
| 35% | 4.3 | 18.7 | |
| 40% | 5.8 | 17.2 | |
| 45% | 7.2 | 15.8 | |
| 50% | 8.6 | 14.4 | |
| 55% | 10.1 | 12.9 | |
| 60% | 11.5 | 11.5 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 24 | 24 |
| 30% | 3 | 21 | |
| 35% | 4.5 | 19.5 | |
| 40% | 6 | 18 | |
| 45% | 7.5 | 16.5 | |
| 50% | 9 | 15 | |
| 55% | 10.5 | 13.5 | |
| 60% | 12 | 12 | |

| Fi02 | 02 Flow L/min | Air Flow L/min | Total Flow L/min |
|---|---|---|---|
| 21% | 0 | 25 | 25 |
| 30% | 3.1 | 21.9 | |
| 35% | 4.7 | 20.3 | |
| 40% | 6.3 | 18.7 | |
| 45% | 7.8 | 17.2 | |
| 50% | 9.4 | 15.6 | |
| 55% | 10.9 | 14.1 | |
| 60% | 12.5 | 12.5 | |

Table developed by Rebecca King, Clinical Nurse Educator, Sydney Children's Hospitals Network, Randwick from:

Lawson S. J., *Introduction to mechanical ventilation of the neonate*, 2001 RC Educational Consulting Services, Inc.http://www.rcecs.com/MyCE/PDFDocs/course/V7042.pdf

*"Calculation of FIO2 when O2 flow and airflow are known, the FIO2 may be calculated:*

**FiO2 = (Air flow x 0.21) + (Oxygen flow x 1.0) "**

**Total Flow**

Wojciechows W., *Entry Level Exam Review for Respiratory Care, 3rd Ed,* 2011

Publisher Cengage, Learning 2011

## 11.6 Appendix 6 Working Party

| | |
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