Nasal High Flow using F&P Airvo™ 3 for primary support in newborn infants in non-tertiary SCNs

1. Overview / Description

PIPER (Paediatric, Infant and Perinatal Emergency Retrieval) is a service which provides care for babies, children and pregnant women. It is available for health professionals 24 hours a day for telephone advice, video consultations and for retrieval of critically ill children, newborn infants and pregnant women in Victoria, Tasmania, and Southern New South Wales.

Regarding non-invasive respiratory support, PIPER provides advice, retrieval and education to medical and nursing staff working in non-tertiary maternity hospitals.

This guideline outlines the use of Nasal high flow therapy using the Fisher & Paykel Airvo ™ 3 device, in Victorian and Southern NSW non-tertiary Maternity units during stabilisation of the neonate/newborn and/or whilst awaiting PIPER retrieval. This guide should be used in conjunction with PIPER consultation.

2. Related Documents

PIPER Guideline - Referral to PIPER

3. Definition of Terms

BPD	Broncho-pulmonary dysplasia
HFNC	High flow nasal cannula
F&P	Fisher & Paykel
nHF	Nasal High flow. Support as described here refers to the provision of heated, humidified, blended gas at flows ≥ 2 L/min.
nCPAP	Nasal Continuous Positive Airway Pressure
nLF	Nasal low flow
RDS	Respiratory distress syndrome

4. Responsibility

Maternity hospitals in the State of Victoria and Southern New South Wales.

5. Procedure

5.1. Background

Nasal high flow (nHF) is an increasingly popular mode of respiratory support for neonates in Australia and around the world.[1]

Nasal high flow has some advantages in comparison to nCPAP: it is associated with a reduced incidence of nasal trauma, is preferred by parents and nursing staff, who report that it is easier to use and more comfortable for infants.

Nasal high flow therapy delivers heated, humidified flows >1-2 L/min, usually in the range 2-8 L/min for neonatal patients through small binasal prongs, with different concentrations of oxygen as required.[2,3]

Nasal prongs **need to sit loose** in the nares to avoid excess pressure being delivered to the baby (unlike nCPAP prongs which need to fit snugly). The greater the set gas flow, the higher the associated pressure, but the pressure is not regulated or displayed, i.e. nasal high flow of 8 L/min is not identical to a CPAP of 8 cmH_2O and is likely to deliver a lower pressure.

Note: *The terms prongs and cannula are used interchangeably depending on the resource you are referring to.*

5.2. Summary of the evidence for the use of nHF as primary support in preterm and term infants

5.2.1. nHF compared with CPAP airway pressure for primary respiratory support in PRETERM infants

A recent systematic review (2023) updated the evidence for the use of nHF vs CPAP as primary respiratory support in preterm infants ≥28 weeks' gestation. Twelve randomised control trials included this comparison, further studies are currently ongoing. Results showed:

- nHF may result in little to no difference in the combined or separate outcomes of death or BPD
- nHF likely results in an increase in treatment failure within 72 hours of trial entry. However, it likely does not increase the rate of intubation and mechanical ventilation, if nCPAP is available as back up.
- nHF use likely results in less nasal trauma and a likely reduction in pneumothorax

Evidence is lacking for the use of nHF for primary respiratory support in extremely preterm infants <28 weeks' gestation. There are no studies comparing nHF with ambient oxygen or comparing nHF with nLF in this population.[4,5]

5.2.2. nHF compared with CPAP airway pressure for primary respiratory support in TERM infants

Another systematic review (2023) updated the evidence for the use of nHF vs CPAP as primary respiratory support in term infants. Four randomised control trials included this comparison. Results showed:

- No deaths recorded by the studies, and no infants needed oxygen at 28 days (used as BPD criteria)
- nHF may have little to no effect on treatment failure
- nHF may have little to no effect on the duration of respiratory support
- nHF likely results in little to no difference in the length of stay in NICU
- nHF may reduce the incidence of nasal trauma and abdominal overdistension

There is limited evidence comparing nHF with nLF (2 studies). The evidence suggests nHF may reduce treatment failure slightly.[5,6]

5.3. Mechanism of action

Potential physiological mechanisms include:

- Generating positive continuous distending pressure (although nHF delivery devices do not have a direct measure of the pressure applied to the airway)
- Flushing CO_2 from nasopharyngeal dead space[7,8]
- Delivery of warm hand humidified inspired gas, therefore improving lung and airway mechanics[7,8]
- Providing an adequate flow of gases to support inspiration thereby reducing inspiratory work of breathing.[7]

5.4. Advantages of nHF (compared to nCPAP)

- Decreased nasal trauma
- Ease of use
- Infant's comfort[8]

5.5. Disadvantages of nHF (compared to nCPAP)

- Delivered pressure is not known and therefore unregulated.
- This support is less powerful than nCPAP. Some infants may need to be rescued with CPAP to avoid intubation.
- Abdominal distension
- Pressure areas around nose or on face (less frequent than nCPAP)
- Blocked prongs due to secretions
- Pneumothorax/air leak (less frequent than nCPAP)

5.6. Indications of nHF therapy with Airvo 3 in non-tertiary maternity hospitals

- Newborn infants **≥1500g** with respiratory distress and an **oxygen requirement ≤40%**, after stabilisation at birth where ongoing face mask CPAP is being provided, while awaiting PIPER retrieval
- Newborn with early onset respiratory distress, for whom non-invasive support is considered (**oxygen requirement ≤40%** provided there is no contraindication for nHF, see below), while awaiting PIPER retrieval

  Note: *nHF may be indicated for higher oxygen requirements if HF is the only available respiratory support, under PIPER's guidance.*
- Respiratory support during viral illnesses such as bronchiolitis: Consult PIPER if considering nHF in this instance for advice about prescribed flows.

5.7. Contraindications/ Limitations for nHF therapy in non-tertiary maternity hospitals

Babies with the following conditions should be discussed urgently with the duty **PIPER** neonatal consultant. These babies may require specific management strategies to be commenced in the referring hospital prior to retrieval[9]:

- Upper airway abnormalities that make nHF ineffective or dangerous such as: Choanal atresia, cleft palate, oesophageal atresia (+/- tracheoesophageal fistula - TOF)
- Congenital abnormalities such as: Congenital diaphragmatic hernia, gastroschisis, exomphalos
- Unstable respiratory drive with frequent apnoeic episodes resulting in desaturation and/or bradycardia
- Other infants with severe cardiovascular instability (hypotension, poor ventricular function, pneomothorax, severe hypoxia) requiring immediate higher level of respiratory support.

5.8. Equipment and resources required for nHF delivery

5.8.1. ***Staffing***

Appropriately skilled medical and nursing staff at appropriate staff patient ratios are necessary as the need for observations are comparative to those of a neonate receiving nCPAP[10], particularly at the start of the therapy.

Nasal High Flow using F&P Airvo™ 3 for primary support in newborn infants in non-tertiary SCNs

*5.8.2. **Device, flow ranges and interfaces***

Device: Airvo™ 3 is a nHF standalone device suitable to provide nHF to newborn infants >1.5 kg, particularly useful for outreach Special Care Nurseries where a nCPAP device may not be available. The equipment (**Figure 1**) is mounted on a pole①. It has an inbuilt humidifier ② and an oxygen blender/reader ③ depending on whether the device is connected directly to a wall oxygen source or an oxygen flowmeter (**Appendices A & B**). A water bag feeds the system ④, and the humidified/warm gas travels to the nasal HF prongs via the circuit tube (called AirSpiral™ breathing tube⑤). The nHF range depends on the size of the interface (nHF prongs, called Optiflow Junior 2 prongs) and the type of Airvo™ device being used. **Airvo™ 3** can provide nHF to newborns ≥1.5 kg (nasal prong sizes M, L and XL). Below are F&P links to Airvo™ 3 Product brochure and User Manual.

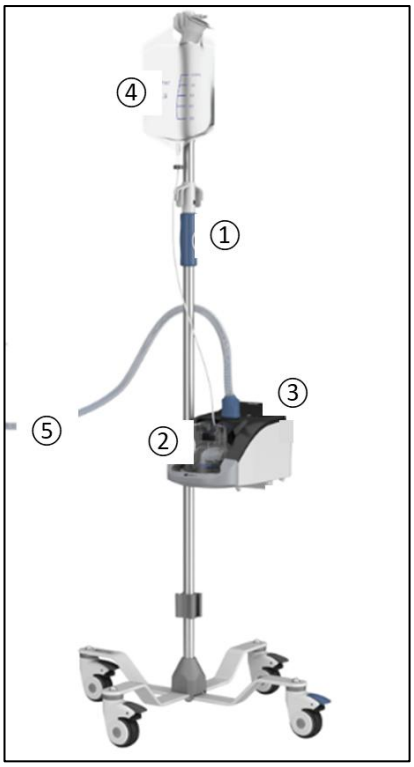


Figure 1

myairvo-3-product-brochure-pm-629184.pdf

airvo-3-user-manual-ui-620523.pdf





Flow ranges and Interfaces (see Figure 2 below):

- **Flow range** capability with the **Airvo™ 3** depends on the nHF prongs' size: Size M 2-7 L/min, size L 2-20 L/min, size XL 2-25 L/min. The maximum flow of 7 L/min in size M can be increased temporarily (i.e to 8 L/min) if clinically indicated, under PIPER's guidance. This will decrease humidity, which will lead to a decrease in temperature (ie from 37°C to 35°C), so eventually the device alarm will go off. To increase temperature again, the flow rate will need to be reduced. The maximum flow of 20-25 L/min (nHF prong sizes L and XL) can be limited for safety purposes for neonatal use (i.e. to 10L/min). It is not recommended to change these settings without consultation with PIPER.
- **Interfaces:** Optiflow Junior 2 prongs sizes M, L and XL (**Figure 2**).

Nasal High Flow using F&P Airvo™ 3 for primary support in newborn infants in non-tertiary SCNs

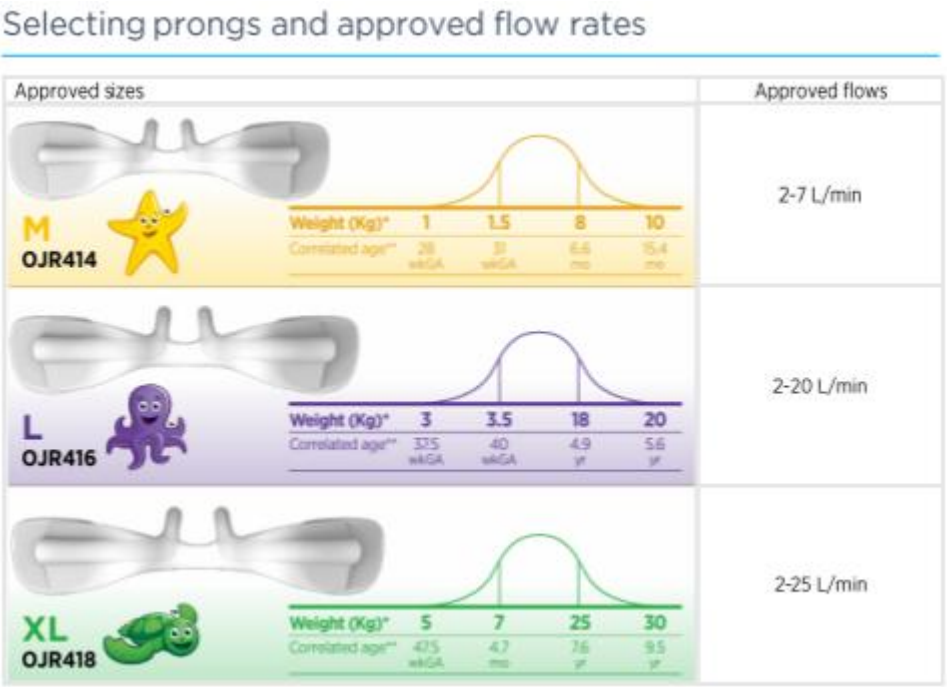


Figure 2. Sizing the Optiflow™ nasal cannulae for outreach hospitals when using the Airvo™ 3 device for nHF. Of note: **Gas flow range for neonatal patients is 4-8 L/min.**

5.9. Other equipment setup for a neonate commencing respiratory support on nHF

- Cardio-respiratory monitor
- Non-invasive BP monitoring if available
- Pulse oximeter with neonatal probe and securing strap or posey
- Low pressure suction unit
- Suction catheters size 6, 8 and 10 FR
- T-piece device and/or self-inflating bag device with the correct size face mask for the baby ensuring it has been checked and ready for use
- Resuscitation drugs (Adrenaline 1:10,000 and 0.9% sodium chloride)
- Supraglottic airway device neoResus - presentations - SGAD insertion in neonates
- Intubation equipment Safer Care Victoria - Newborn Intubation , neoResus-presentations-Intubation of the newborn
- Size 8 FR orogastric tube (OGT)
- Equipment for identification and needle aspiration of pneumothorax and intercostal catheter insertion Safer Care Victoria - Pneumothorax drainage in neonates.

5.10. Initiating nHF

Each nursery should have guidelines in place for the use of nHF.

The medical officer responsible must prescribe the following parameters:

- Flow: Generally, a blender flow of 4-8 L/min is prescribed. When commencing nHF for RDS in a neonate, a starting flow of 6-8 L/min is appropriate[8]. The medical officer is also responsible for

prescribing any adjustment to the flow. Nasal HF delivered at <4 L/min is unlikely to deliver a clinically significant level of respiratory support. Flows should generally not be decreased below 4 L/min

- Oxygen concentration adjusted as required by the infant to maintain oxygen saturations between 90%-95%
- Set flow as prescribed. Note: flows are limited by the cannula size. See manufacturer's guidelines for details
- Connect patient end of gas delivery circuit to the selected nasal cannula
- Check connection by feeling air flow through the cannula **before** applying to the neonate
- Secure selected nHF cannula as per manufacturer's guidelines. Use the sizing chart included in the cannula packaging as it can help with choosing the correct size interface for the neonate. However, it is the patient's **nare size** that is the primary consideration when selecting the correct size of the nasal cannula. The cannula **must not** fill the nares; ensure there is a gap around each cannula. As a guide, choose cannula that occlude approximately half of the nare (refer to video **QR codes below**)
- Ensure there is a small gap between the bridge of the cannula and the neonate's septum
- Use the tube clip to help support the circuit and thus avoiding tension on the prongs
- Ensure continuous clinical cardio-respiratory and SpO_2 monitoring is in progress and alarms set appropriately. These alarms cannot be set on the Airvo device.

Appendices A and B are Quick Airvo™ 3 User set up guides, depending on oxygen delivery system available (Appendix A - High pressure O_2 delivery, Appendix B – Low pressure O_2 delivery).

The **QR codes below** are links to F&P set-up videos and prong fitting/removing/replacing videos.

Set-up videos

Prong fitting (first 3min25s)/removing/replacing

5.11. Nursing care specific to nHF

- The primary goal is to keep the airway patent and free of secretions. The interface should be secured in place and verified by physical assessment
- Delivering heated and humidified inspired gas is very important when administering nHF to a neonate. Without it, secretions may become thickened and result in pooling mucous. This increases the resistance to airflow and increases the work of breathing (WOB); it can even cause complete blockage of the airway
- Ensure suction apparatus and resuscitation equipment is readily available. Sizes 6, 8 and 10 FR suction catheters should be available at the bedside

- Suction mouth and nose when indicated to maintain airway patency
- Be prepared for worsening of clinical condition or sudden collapse. Neonatal resuscitation equipment should be readily available and in working order, including supraglottic airway device, intubation and emergency pneumothorax equipment. Know the escalation process for a deteriorating newborn in your hospital.
- The gas delivery system's integrity, nHF set gas flow, FiO_2, humidifier temperature settings (set and actual), humidifier chamber water level and cannula position should be checked frequently and documented at least hourly
- Observe for "rain out"/condensation in the circuit tube (**Figure 1** ⑤). If this happens, carefully drain or move (by tapping the tube) the accumulated water back to the humidifier (at a lower level than the patient), while keeping the circuit connected. Occasionally a brief disconnection of the prongs from the tube may be required to empty the water content from the circuit tube end
- Respond to patient cardio-respiratory and SpO_2 alarms immediately
- Physical assessment should be performed by the nurse at least half hourly in the initial stabilization period. Thereafter, hourly observations are sufficient as long as the infant's condition remains stable. Document findings of assessment on the neonate's observation chart or the Victorian Children's Tool for Observation and Response (ViCTOR), Special Care Nursery track and trigger chart. The Chart can be found using this link: Victorian children's tool for observation and response (ViCTOR) | Safer Care Victoria.

5.12. Fluid balance

- Babies who receive nHF for acute respiratory distress in the first 24 hours awaiting PIPER retrieval should be kept nil by mouth. Therefore, maintenance IV fluids are required. This is IV 10% Glucose at 60mL/kg/day for day 1
- Babies should have an oro/nasogastric tube *in situ* on free drainage to prevent the accumulation of air in the stomach. The size is dependent on weight/postmenstrual age. The gastric tube should be aspirated for air at least 4 hourly.

5.13. Complications associated with nHF

- Obstruction of nasal cannula from mucus plugging or kinking
- Malposition or displacement of nHF cannula
- Obstruction of high-flow circuit due to kinking
- Unintended high pressures may be generated if nasal cannulae fit too snuggly or gas flow is too high, increasing the risk of air leak
- The device is unable to limit the pressure in the upper airway.

5.14. Clinical complications

- Lung over-distension leading to air leak syndromes
- Abdominal distension and gastric insufflation and associated feed intolerance
- Nasal pressure injury

- Skin irritation and pressure injury from lying on tubing
- Nasal mucosal damage due to inadequate humidification
- Infants are not receiving sufficient respiratory support if evidence of:
  - Increasing oxygen requirements
  - Increasing gas flow requirements (maximum flow 8 L/min)
  - Increasing work of breathing
  - Respiratory acidosis
- These neonates should be discussed with the duty **PIPER** neonatal consultant as they require an alternative mode of respiratory support (intubation and ventilation) whilst awaiting transfer to a higher level of care.

5.15. Conclusion

In all instances, **PIPER** should be consulted with for any newborn/neonate that is being considered for treatment with nHF for stabilisation in a non-tertiary SCN, whilst awaiting retrieval by PIPER.

6. References

1. Chow SSW. Report of the Australian and New Zealand Neonatal Network 2010. Sydney: ANZNN. 2013.
2. The Royal Women's Hospital Neonatal Services. (2024). Procedure - Respiratory support: nasal high-flow in NICU/SCN. Melbourne: Internal publication.
3. Gardner, S.,Enzman-Hines, M. & Nyp, M. (2021). Respiratory diseases. In Gardner, S.L., Carter, B.S., Enzman-Hines, M., & Niermeyer, S. Merenstein and Gardner's Handbook of Neonatal Intensive Care (9th ed). St Louis, Elsevier.
4. Hodgson KA, Wilkinson D, De Paoli AG, Manley BJ. Nasal high flow therapy for primary respiratory support in preterm infants. Cochrane Database Syst Rev. 2023 May 5;5(5):CD006405. doi: 10.1002/14651858.CD006405.pub4. PMID: 37144837; PMCID: PMC10161968. (Hodgson et al. 2023 Nasal high flow therapy for primary respiratory support in preterm infants)
5. Roehr CC, Farley HJ, Mahmoud RA, Ojha S. Non-Invasive Ventilatory Support in Preterm Neonates in the Delivery Room and the Neonatal Intensive Care Unit: A Short Narrative Review of What We Know in 2024. Neonatology. 2024;121(5):576-583. doi: 10.1159/000540601. Epub 2024 Aug 22. PMID: 39173610; PMCID: PMC11446298.6.
6. Dopper A, Steele M, Bogossian F, Hough J. High flow nasal cannula for respiratory support in term infants. Cochrane Database Syst Rev. 2023 Aug 4;8(8):CD011010. doi: 10.1002/14651858.CD011010.pub2. PMID: 37542728; PMCID: PMC10401649. (Dopper et al 2023 High flow nasal cannula for respiratory support in term infants)
7. Goldsmith, J. P., Karotkin, E. H., Keszler, M. & Suresh, G. (Eds.). (2017). Assisted ventilation of the neonate: an evidence-based approach to newborn respiratory care. (6th ed.). Philadelphia: Elsevier Inc.
8. Roberts CT, Hodgson KA. Nasal high flow treatment in preterm infants. Maternal Health Neonatol Perinatol. 2017 Sep 6;3:15. doi: 10.1186/s40748-017-0056-y. PMID: 28904810; PMCID: PMC5586012.
9. Kain, V & Mannix, T. (Eds). (2018). Neonatal nursing in Australia and New Zealand: principles of practice. Australia: Elsevier Inc. ISBN 978-0-7295-4389-7.

7. Disclaimer

The Paediatric, Infant Perinatal Emergency Retrieval (PIPER) Neonatal and Paediatric guidelines were developed by PIPER clinicians for the sole use within the PIPER service at The Royal Children's Hospital Melbourne.

The authors of these guidelines have made considerable effort to ensure the information upon which they are based is accurate and up to date. Users of these guidelines are strongly recommended to confirm that the information contained within them especially drug doses is correct by way of independent resources. The authors accept no responsibility for any inaccuracies or information perceived as misleading.

Nasal High Flow using F&P Airvo™ 3 for primary support in newborn infants in non-tertiary SCNs

Appendix A. F&P quick Airvo™ 3 neonatal setup guide – High pressure O_2 delivery (O_2 white hose is directly connected to the wall)



Nasal High Flow using F&P Airvo™ 3 for primary support in newborn infants in non-tertiary SCNs

Use


1 Plug in


2 Hold ⏻ to turn on



3 Confirm clean status



4 Select flow tile



5 Adjust flow using +/- buttons, then "Confirm"



6 Select FiO_2 tile



7 Adjust FiO_2 using +/- buttons, then "Confirm"



8 Press "START" to commence therapy



8 Wait for "Therapy on" if patient condition allows

Selecting prongs and approved flow rates

Approved sizes	Approved flows
M OJR414 — Weight (Kg)* 1 – 1.5 – 8 – 10	2-7 L/min
L OJR416 — Weight (Kg)* 3 – 3.5 – 18 – 20	2-20 L/min
XL OJR418 — Weight (Kg)* 5 – 7 – 25 – 30	2-25 L/min

Nasal High Flow using F&P Airvo™ 3 for primary support in newborn infants in non-tertiary SCNs

Fitting Prongs



Made in collaboration with PIPER Neonatal Education and Fisher & Paykel Healthcare
Last revised: May 2026

Please refer to the Airvo 3 User Instructions for a full list of warnings and cautions
Further resources and documents available via www.fphcare.com

Nasal High Flow using F&P Airvo™ 3 for primary support in newborn infants in non-tertiary SCNs

Appendix B. F&P quick Airvo™ 3 neonatal setup guide – Low pressure O_2 delivery (O_2 tubing is connected to an O_2 flowmeter)

Gather

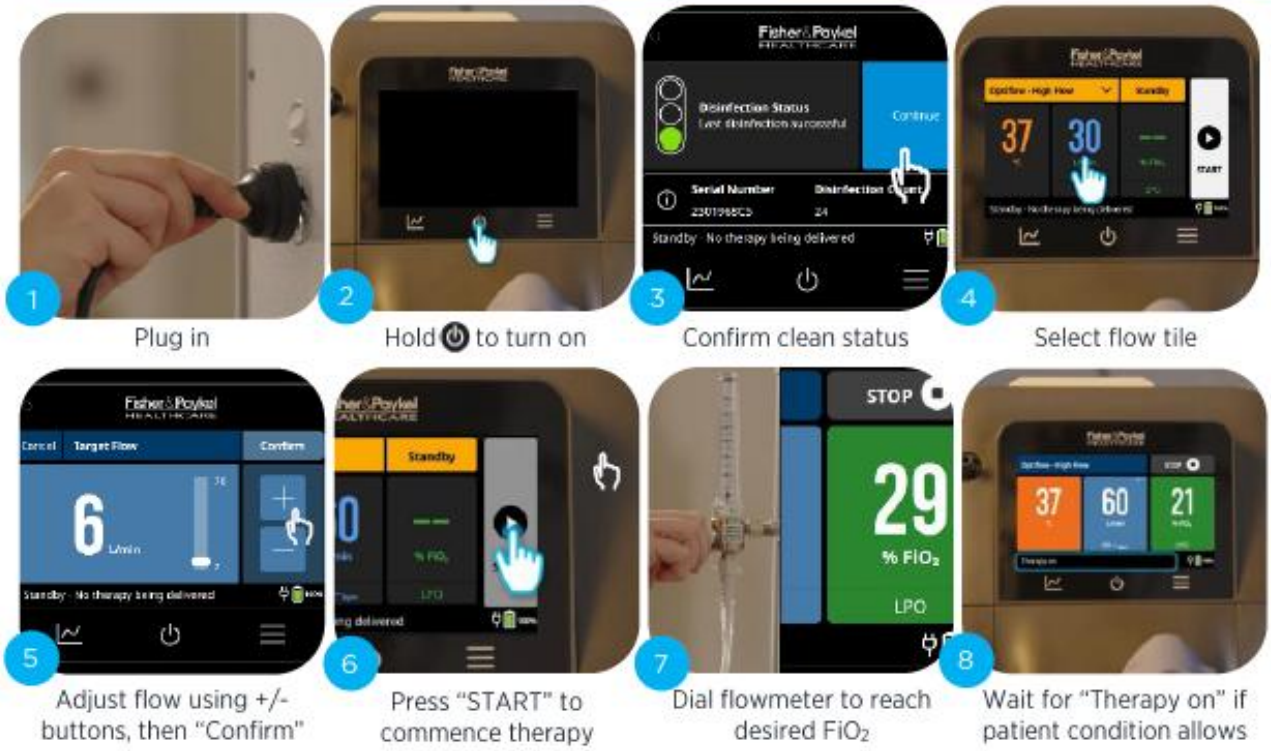


Setup



Nasal High Flow using F&P Airvo™ 3 for primary support in newborn infants in non-tertiary SCNs

Use



Selecting prongs and approved flow rates

Approved sizes	Approved flows
 M OJR414  Weight (Kg)* 1 1.5 8 10; Correlated age** 28 wkGA 31 wkGA 6.6 mo 15.4 mo	2-7 L/min
 L OJR416   Weight (Kg)* 3 3.5 18 20; Correlated age** 375 wkGA 40 wkGA 4.9 yr 5.6 yr	2-20 L/min
 XL OJR418   Weight (Kg)* 5 7 25 30; Correlated age** 475 wkGA 4.7 mo 7.6 yr 9.5 yr	2-25 L/min

Nasal High Flow using F&P Airvo™ 3 for primary support in newborn infants in non-tertiary SCNs



Made in collaboration with PIPER Neonatal Education and Fisher & Paykel Healthcare
Last revised: May 2026

Please refer to the Airvo 3 User Instructions for a full list of warnings and cautions
Further resources and documents available via www.fphcare.com

i