RESPIRATORY DISTRESS: CARE OF THE INFANT RECEIVING BUBBLE CPAP - CICU - SCH

PRACTICE GUIDELINE ©

DOCUMENT SUMMARY/KEY POINTS

- Bubble CPAP is used as a form of respiratory support and as a weaning strategy from endotracheal intubation and ventilation **for infants <10kg**
- At SCH, Randwick. Bubble CPAP is used within the Intensive Care Unit for infants with respiratory distress, including infants with respiratory viruses.
- Bubble CPAP is commenced following discussion with the medical team.
- For the Bubble CPAP to deliver support the system must 'Bubble' on expiration
- Alternate between prongs and mask 4th hourly to reduce the risk of pressure areas around the nose and septum.
- The infant should have a nasogastric/orogastric tube in situ to decompress the stomach of air and feed when able.
- The humidifier temperature should be set at 37°C to maintain the humidified gas at 100% to prevent damage to the mucosa.
- Two registered nurses at the handover of each shift should check all respiratory support systems. In line with NSW DOH directives.
- **ALERT:** As there are no audible alarms to indicate a leak in the system, staff must be vigilant for any cessation of bubbling in the underwater chamber
- Pressure set at PEEP controller is the pressure at nares
- CPAP pressure is adjusted by lowering or raising the PEEP controller

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1st May 2022	**Review Period**: 3 years
Team Leader:	Research Nurse	**Area/Dept**: CICU - SCH

CHANGE SUMMARY

- Document due for mandatory review
- IIMS reporting changed to ims+.

READ ACKNOWLEDGEMENT

- CICU staff are required to read and acknowledge they understand the document.

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1 What is Bubble CPAP?

Bubble CPAP is a type of respiratory support that can only be used on a spontaneously breathing infant. The clinician sets the peak end expiratory pressure (PEEP), which is measured in cmH2O. The depth of the expiratory limb in the water determines the level of PEEP delivered to the infant. The pressure is continuous throughout the respiratory cycle keeping the airways open. Thus increasing functional residual capacity [(1)]. The goal of CPAP is to improve oxygenation by providing support to the small airways and preventing atelectasis of the lungs [(2)(3)].

2 Indications for the use of Bubble CPAP

The predominant use for the Fisher and Paykel Bubble Flow System (Bubble CPAP) within the Intensive Care Unit at The Sydney Children's Hospital, Randwick, is respiratory distress. Bubble CPAP is used to provide respiratory support. This support can be initiated by the medical team at any time during the infant's admission or used to transition infants from intubation and mechanical ventilation when a patient weighs < 10kg.

3 Respiratory Distress

Respiratory distress is one of the most common conditions for which children seek medical care. Respiratory distress, particularly in neonates and infants, must be promptly recognised and treated because they may decompensate very quickly [(4)]. Respiratory distress occurs when breathing doesn't match the body's metabolic demand for oxygenation and/or ventilation [(5)].

Bronchiolitis is a respiratory virus that is broadly defined as a clinical syndrome that causes respiratory distress in children less than 2 years of age. Bronchiolitis is characterised by upper respiratory symptoms followed by lower respiratory tract infection (LRTI). The LRTI includes inflammation and results in wheezing and/or crackles. Bronchiolitis is typically caused by a viral infection. Respiratory syncytial virus (RSV) is the most common cause. Other viruses include: rhinovirus, para influenza, human metapneumovirus, adenovirus, coronavirus and human boca virus [(6)].

3.1 Signs of respiratory distress

The dominant signs of respiratory distress are:

- Tachypnoea, nasal flaring, intercostal or subcostal recession/retractions, audible grunting and cyanosis
- Abnormal breathing sounds such as stridor or wheeze [(4) (7) (2)]

Other crucial and often late signs are:

- Inadequate respiratory effort – due to exhaustion and decompensation [(4)]
- Apnoea in newborns [(6)]

3.2 Normal parameters for age

AGE	APPROXIMATE WEIGHT	SYSTOLIC BLOOD PRESSURE	HEART RATE (Beats per min)	RESPIRATORY RATE (Breaths per min)
Term	3.5 kg	60 – 100	110 - 160	30 - 55
3 Months	6 kg	60 - 100	100 - 160	30 - 45
6 Months	8 kg	70 – 110	100 - 160	30 - 45
1 Year	10 kg	90 - 110	90 - 140	20 - 40

(NSW Health. Between the Flags Standard Paediatric Observation Charts, 2011)

4 Bubble CPAP Set Up

4.1 Equipment required for the Fisher and Paykel Bubble Flow System

- Fisher and Paykel Bubble CPAP circuit (BC161)
- Fisher and Paykel Bubble CPAP snorkel (long or short)
- Humidifier base with yellow heater wire
- Temperature Probe (blue)
- Sterile Water for underwater chamber
- Water for injection 1L bag for humidifier
- Oxygen Tubing
- Appropriate sized head gear/ bonnet (see sizing guide)
- Appropriate sized prongs or mask (see sizing guide)

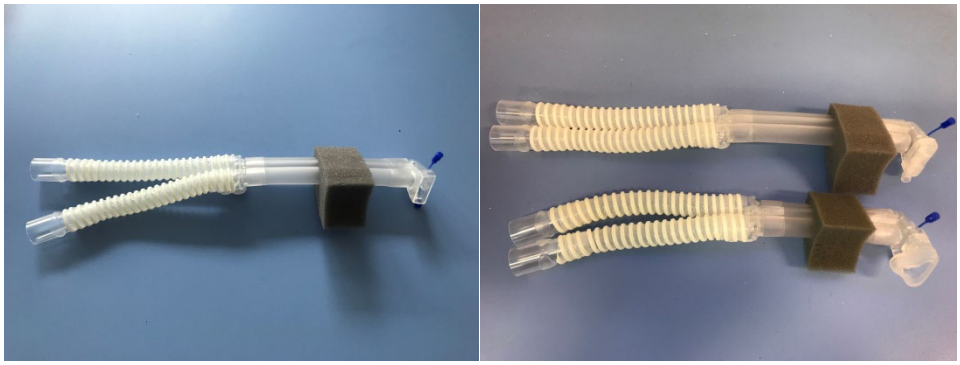
See Appendix 2 for full Bubble CPAP set up diagram

4.2 Measurement of nostrils and head circumference to obtain appropriate size prongs/mask and headgear

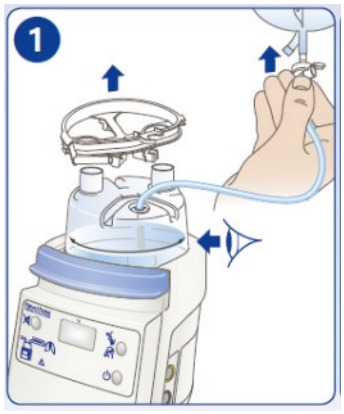
4.3 Fit the appropriate length snorkel to the prongs/mask

Please see Appendix 1 for correct fitting of midline positioning checklist.

Prior to connection of Bubble CPAP gently suction nares



4.4 Set Up of the Fisher and Paykel Bubble Flow System



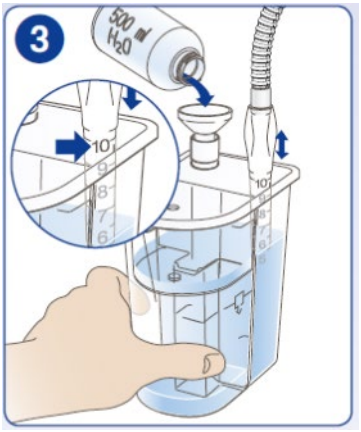
1. Place the humidifier into the humidifier base. Pierce the Water for Injections bag with the spike attached to the humidifier.
   Ensure that the water is flowing freely into the humidifier.

2. **a)** Place the oxygen flow regulator onto one of the holes in the humidifier. Attach one end of the oxygen tubing to the port in the top of the flow regulator and the other end of the oxygen tubing to the oxygen flow meter at the wall.

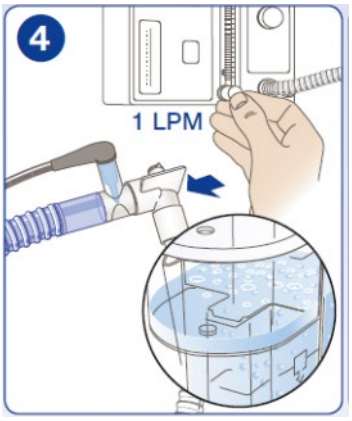
   b) Place the inspiratory tubing (blue) onto the second hole in the humidifier. Insert the blue temperature probe into the port in the side of the humidifier base then place the sensor into the hole on the side of the tubing where it sits in the humidifier. Insert the sensor at the end of the temperature probe into the hole at the end of the tubing nearer the patient.

   Place the yellow heater wire into the port in the side of the humidifier base (above the blue port) then insert the sensor into the end of the tubing where it sits in the hole of the humidifier.

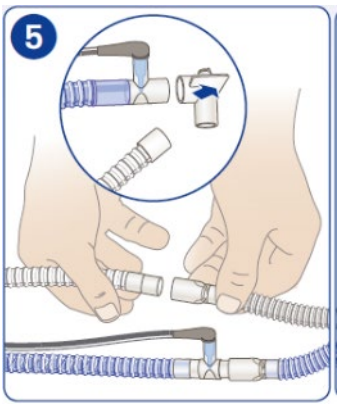
   c) Place the PEEP controller into the CPAP generator. Set the PEEP at 5 initially. Insert the expiratory tubing (white) into the top of the PEEP controller.



3. Fill the CPAP generator with sterile H2O to the water fill level line, as indicated on the side of the generator.

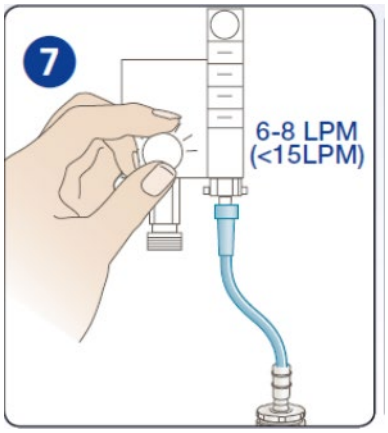


4. Join the patient ends of both the Inspiratory and Expiratory tubing together with the white connector provided, this will keep the circuit clean. Turn up the oxygen to a flow of 1 litre per minute. If the circuit is patent, bubbling will occur in the chamber.

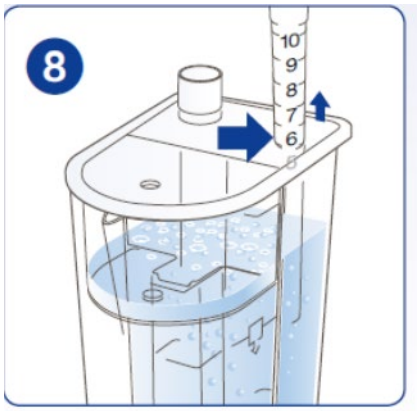


5. Remove the white connector from the ends of the tubing and attach to the snorkel. Ensure that the inspiratory tubing (blue) is attached to the blue tubing on the snorkel, and the expiratory tubing (white) is attached to the white tubing of the snorkel

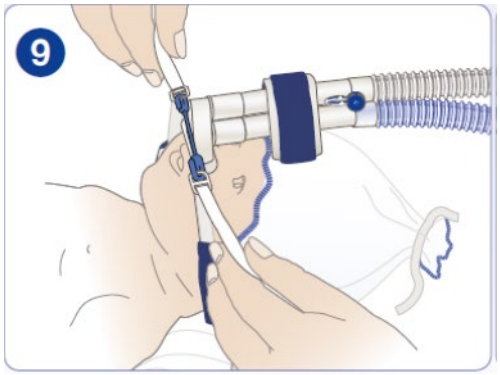
6. Turn on the humidifier.



7. Increase the oxygen flow up to 8 litres per minute.



8. Adjust the PEEP controller to the setting required, as per the medical team.



9. Apply the snorkel to the infant.

10. If using the prongs ensure that the light is on behind the picture of the endotracheal tube – this indicates **'Invasive' mode**. If using the mask, ensure that the light is on behind the picture of the mask – this indicates **'non-invasive' mode**'.

4.2 Confirming a closed circuit and effective CPAP

Once the Bubble CPAP has been applied the "Bubbling" should be heard on the infants expired breath. Bubbles will also be seen in the clear CPAP generator.

If there is no 'Bubbling' present the circuit is not closed.

Troubleshoot the circuit by checking:

1. The prongs or mask for a good seal around the infant's nostrils.
2. The inspiratory limb of the circuit (blue tubing) from the infant to the humidifier, checking the temperature probe ports for any leaks.
3. The expiratory limb of the circuit (white tubing) from the infant to the CPAP generator.

5 Ongoing care of the child receiving Bubble CPAP

5.1 Monitoring

Continuous monitoring of the Infant's heart rate, blood pressure, respiratory rate, respiratory effort and oxygen saturations [8] [9]. This should be documented hourly as per Observations in CICU – Minimum Standard – SCH practice guideline [10]. Temperature can be monitored 2 – 4th hourly if stable and agreed on by the intensivist.

5.2 Patency of circuit

Observe the Inspiratory limb of the circuit (blue tubing) for 'rain out' from the humidifier. If water is present, carefully lift the tubing so that the water runs back into the humidifier. Be careful not to let the water run towards the infant.

5.3 Pressure area care

Regular pressure area care of the infant is to be done with routine nursing cares. Pressure area care on the infant's forehead and around the infant's nose requires particular care and attention. **The whole system should be taken off a MINIMUM of every 4 hours and prongs and mask should be interchanged**, observing the forehead, nostrils and septum for pressure marks or breakdown of the skin (3). A pressure relieving dressing may be applied, if required, to the forehead, bridge of nose and around the nostrils to help prevent pressure marks.

Pressure injuries must be reported in ims+ and documented in the eMR progress notes. The Nurse in Charge, medical staff and parents/carer need to be informed.

5.4 Positioning of the child

Consider requesting a second person to assist with repositioning the infant. Excessive movement increases the risk of nasal septum irritation [(11)].

Swaddling can assist in minimising movement and therefore movement of the Bubble CPAP tubing [(12)].

A small towel can be used to support the weight of the tubing and prevent it from pulling the prong/mask down

5.5 Comfort

Consider placing the infant in a nest of blankets and using a dummy to settle (**the use of a dummy requires parental consent**). The dummy will help to form a seal in the mouth-breathing infant and aid the effectiveness of the CPAP [(3)] [(12)].

5.6 Gastric Distension

Ensure the infant has a nasogastric or orogastric tube insitu. 4th hourly gastric aspiration will remove any air in the infant's stomach and reduce gastric distension. This nasogastric or orogastric tube can be used for enteral feeds when the medical team are happy to feed.

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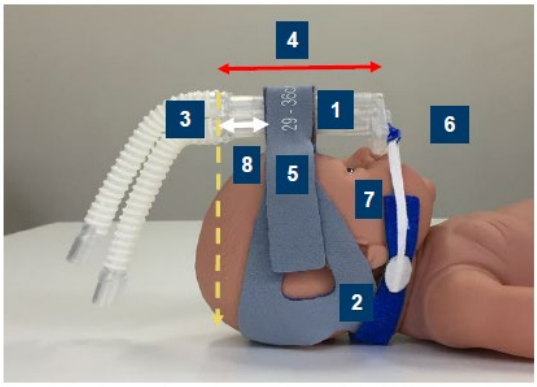
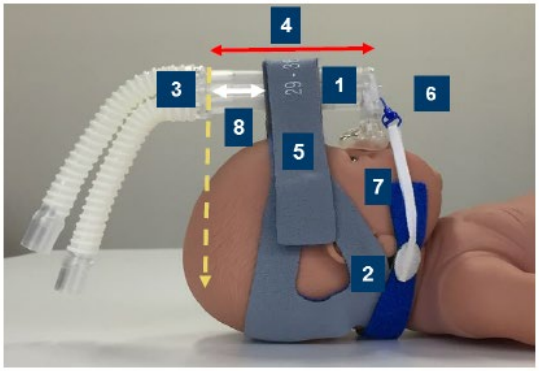
Appendix 1: Headgear – Midline Positioning Check List

Headgear - Midline Positioning Check List



1. Is the headgear the right size? Head circumference is needed.
2. Is the headgear on correctly? Above the eyes, over the ears & on the nape of the neck?
3. Is the midline the correct length? Too long = hangs over back of head. Too short = lost inside the foam.
4. Is the midline horizontal / parallel to the infants face?
5. Do you need to remove / insert foam pieces?
6. Is the blue glider centred?
7. Can you see at least 2mm of the nasal cannula? (off the septum)
8. Is there a gap between the foam and the FlexiTrunk?



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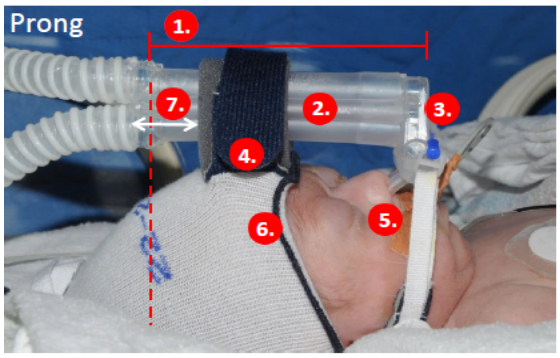
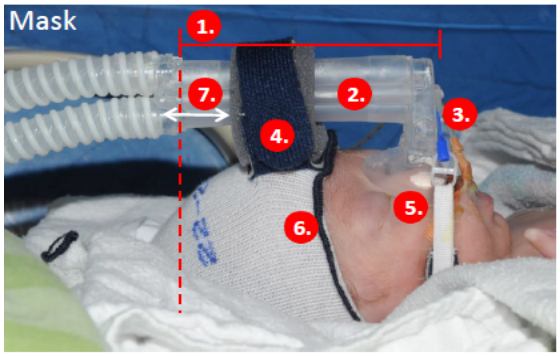
2. Is the headgear on correctly? Above the eyes, over the ears & on the nape of the neck.
3. Is the midline the correct length? Too long = hangs over back of head. Too short = lost inside the foam.
4. Is the midline horizontal / parallel to the infants face?
5. Do you need to remove / insert foam pieces?
6. Is the blue glider centred?
7. Mask should not be flattened or squashed - minimal tension required.
8. Is there a gap between the foam and the FlexiTrunk?

Fisher&Paykel HEALTHCARE

Midline Positioning Check List



1. Is the midline the correct length? (Roughly nose to top of head)
2. Is the midline horizontal?
3. Blue glider should be centred.
4. Do you need to remove/place foam inserts?
5. Can you see at least 2mm of prong showing?
6. Bonnet should be positioned just above eyes.
7. Is there a gap between foam & FlexiTrunk?



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3. Blue glider should be centred.
4. Do you need to remove/place foam inserts?
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7. Is there a Gap between foam & FlexiTrunk?

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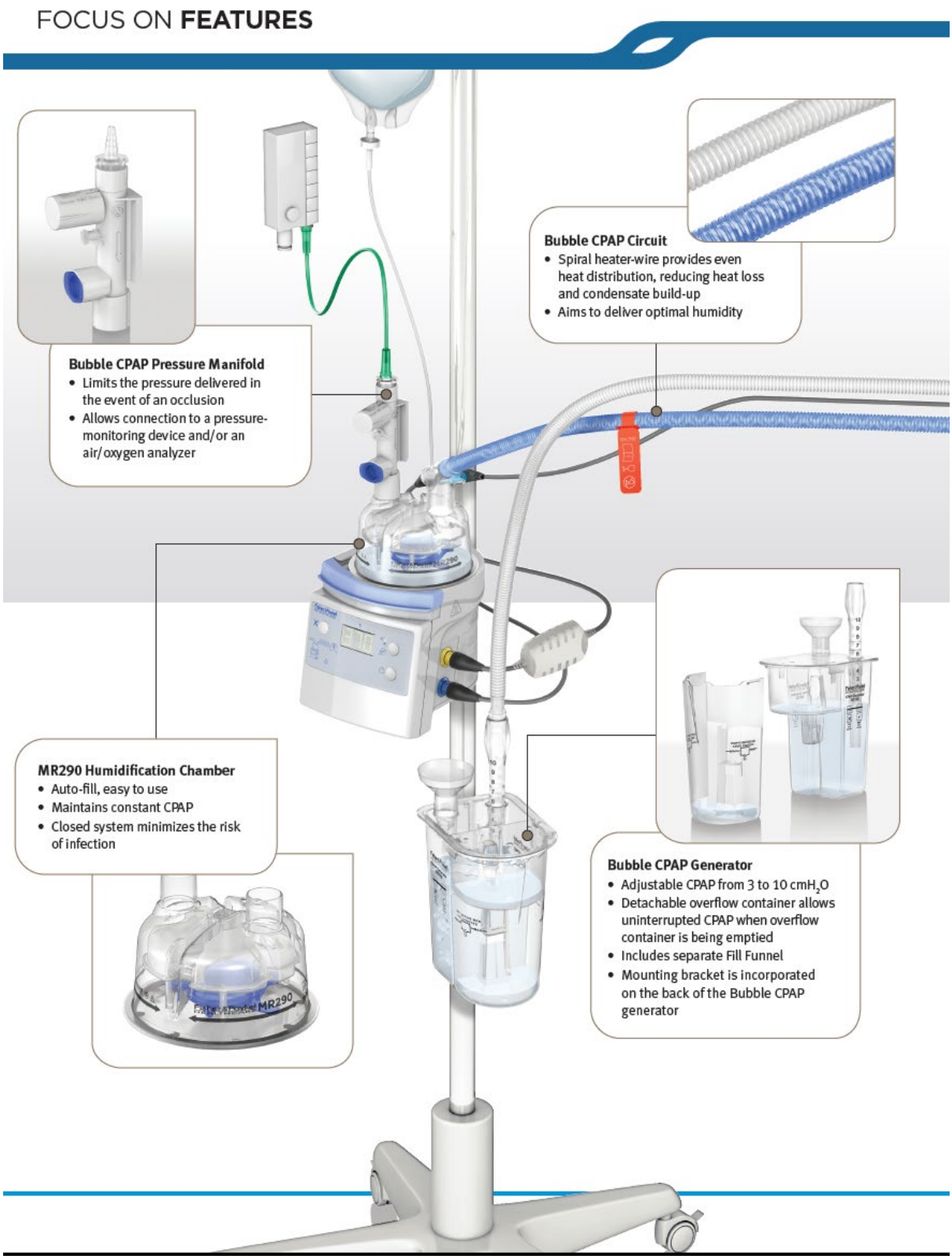
Appendix 2: Full Bubble CPAP set up