

Write Up- Science, Technical Components of Fisher & Paykel BCPAP System

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None

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ABSTRACT

Continuous positive airway pressure (CPAP) is one of the most accepted noninvasive mode of respiratory support used in neonatal units. It is used both as a primary mode of respiratory support and following extubation from mechanical ventilation. In this review, we present the components of typical CPAP circuit (air – oxygen blender, heated humidifier BCPAP Circuit System, Dual Heated BCPAP Breathing Circuit, Pressure Manifold) and patient interface devices (Nasal prong, Nasal Mask, Nasal tubing, Infant Bonnet, Bubble CPAP generator)

Bubble CPAP (BCPAP) is one of the most accepted non-invasive and gentle method of respiratory support to spontaneously breathing infants. Bubble CPAP is commonly used in early phase of Respiratory Distress and it has been seen to improve neonatal outcomes.^{1,2}

BCPAP is the method of application of continuous pressure to spontaneous breathing babies. By providing constant airway pressure the alveoli are kept open thereby improving the FRC (Functional Residual Capacity) which then results in the lungs having improved gas exchange. In addition, CPAP increases FRC to a level above the closing volume, so the terminal airways are kept open during the respiratory cycle.^{3,4}

Clinically it is seen BCPAP helps in improved oxygenation, wash out of CO₂, prevents obstructive apnoea and it aids in better ventilation perfusion match, improved minute ventilation and decreased work of breathing.^{5,6}

COMPONENTS OF A TYPICAL BCPAP SYSTEM

1. Air Oxygen Blender (Figure 1)

1. The Air/Oxygen Blender connects to the Oxygen and Air Inlets in the Hospital
2. It consists of dual flow meters, the primary flow meter from 0-15lpm and the secondary flowmeter from 0-3.5lpm



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Figure 1. Air Oxygen Blender

3. The clinician is able to set flows and titrate the FiO₂ basis the Patient' condition.
4. A minimum of 4 bar or 50psi pressure is required in the central lines to initiate the blender

2. Heated Humidifer with BCPAP Circuit System (Figure 2)

1. State of the art F&P 950 Heated Humidifier
2. The F&P 950 is designed for “Ease of Setup”, “Minimize Condensate”, & provide Advanced Protection.
3. Three simple steps of assembly due to integrated temperature, and flow sensors
4. The F&P950 aids in regulating the temperatures across the breathing circuits which thereby prevents condensation
5. Has intuitive audible and visual alarms which promote advanced safety.

3. Dual Heated BCPAP Breathing Circuit (Figure 3)

1. The Bubble CPAP Circuit (Code 950N60) is a dual heated



Figure 2. Heated Humidifer with BCPAP Circuit System

- breathing circuit. Presence of the expiratory heated circuit aids in reducing mobile condensate formation
2. Standard accessories include Pressure manifold, Bubble jar, Adaptors and Breathing tubing
 3. Contains a dual float auto fill water chamber.

4. Pressure Manifoldre Manifold

1. Has a maximum pressure limit –17cmH₂O@ 8 LPM
2. Oxygen Inlet Adaptor
3. 22mm Female/ 15 mm Female
4. Oxygen Analyser Port

Chamber
 Inspiratory limb
 Expiratory limb
 Adapters
 Bubble CPAP generator
 Pressure manifold

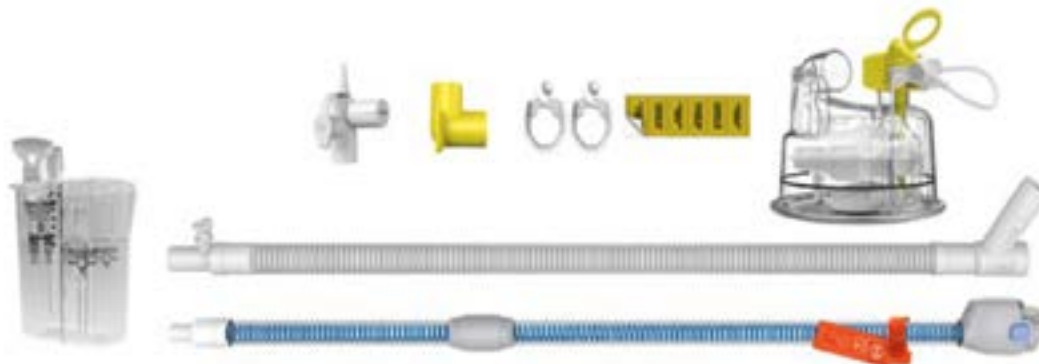


Figure 3. Dual Heated BCPAP Breathing Circuit

PATIENT INTERFACE

1. Nasal Prong (Figure 4)



Figure 4. Nasal Prong

1. Wide range of sizes based on prong diameter and septum gap.
2. Low Resistance to flow
3. Anatomically curved for a comfort fir
4. Soft, pliable, and gentle on baby's nares
5. Has a septum cut away to prevent septal

2. Nasal Mask (Figure 5)



Figure 5. Nasal Mask

1. Soft & anatomically contoured on baby's nares
2. Available in 4 sizes Small, Medium, Large and Extra Large
3. Easy to Connect

3. Nasal Tubing (Figure 6)

1. Has a low resistance to flow
2. Has a glider that keeps the prong in place with easy movement
3. Foam block holds tubing in place with detachable strips for height adjustment



Figure 6. Nasal Tubing

4. No undue pressure on baby's face
5. 3 Lengths- 50mm, 70mm and 100 mm, selected basis baby's weight

4. Infant Bonnet (Figure 7)



Figure 7. Infant Bonnet

1. Provides ease of access for all clinical procedures
2. Bonnet based on head circumference and sewn for easy set up
3. Holds nasal tubing firmly in place
4. Sizes are 17-22cm, 22-25cm, 25-29cm & 29-36 cm

5. Bubble CPAP Generator (Figure 8)



Figure 8. Bubble CPAP Generator

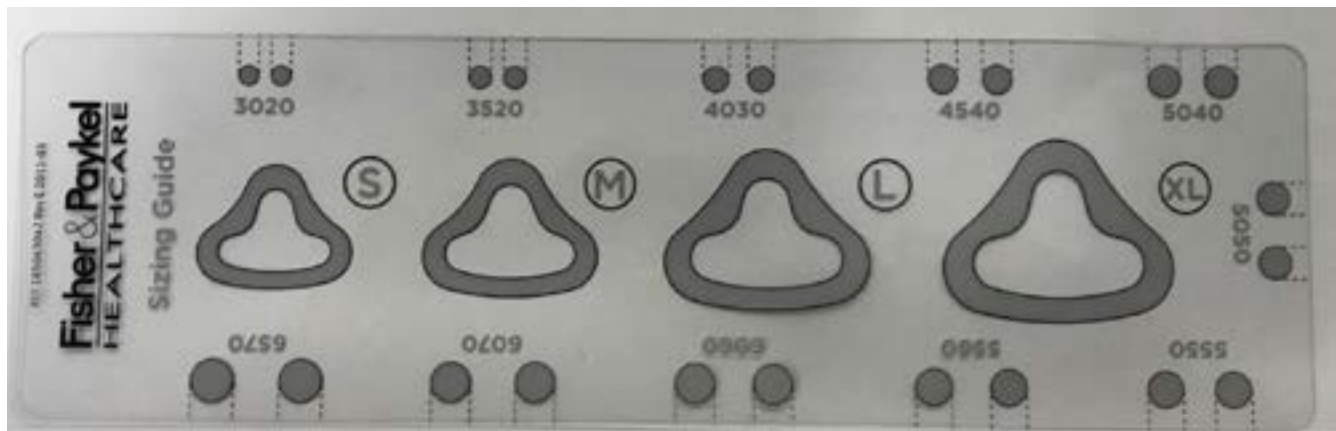


Figure 9. Procedure for connecting the BCPAP system

1. Allows for 3-10cm H₂O CPAP mean pressure
2. Volume of approximately 500mL
3. Detachable overfill jar
4. Overfill jar is a safety mechanism to prevent excess pressure for baby

PROCEDURE FOR CONNECTING THE BCPAP SYSTEM (Figure 9)

1. Connect the blender hoses to the air/oxygen inlets
2. The circuit is then removed from its packaging. Connect the inspiratory limb to the humidifier and the expiratory limb to the bubble chamber
3. The humidifying chamber and bubble jar must be filled with sterile/distilled water
4. Fix the bonnet over the baby's ears, after measuring head circumference
5. Choose the correct nasal tubing and connect the nasal prongs/masks using the sizing guide provided with nasal tubing kit (as shown below)
6. Once the appropriate Nasal Prong/Nasal Mask is chosen, secure the nasal tubing to the cap to support them from falling
7. Connect both the inspiratory and expiratory breathing tubes to the Nasal Tubing.
8. CPAP pressure can be regulated by increasing or decreasing the depth of immersion of the CPAP Stick. The pressure set is indicative of the number just visible above the jar
9. Keep the flow rate at 5 lpm and watch for bubbling in the chamber. No bubbling/poor bubbling is indicative of leaks.
10. Start with FiO₂ of 50%. SpO₂ goal should be 90-94%

CARE WHILE USING BCPAP

- Correct positioning and fixation with nasal prongs
- Prongs must be kept clean and patent.
- Keep a gap between nasal prong and columella
- Use only sterile/ distilled water in the humidification chamber and bubble jar
- Always record the CPAP pressure set

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