Advanced nasal CPAP system
Neonatal nasal CPAP therapy
Nasal CPAP therapy aims to support neonates, especially pre-term and low-birthweight newborns, who can breathe spontaneously but inadequately. The therapy is noninvasive, low cost, clinically effective and safe. When applied properly and promptly, nasal CPAP can minimize both the need for intubation and mechanical ventilation and promote early extubation, as well as decrease incidence of chronic lung disease. Nasal CPAP, developed in the 1930s and used widely for nearly 40 years, is popular today in neonatal intensive care units, nurseries and even delivery rooms, in industrialized countries.

Nasal CPAP therapy provides and maintains an elevated pressure baseline (CPAP) at which a neonatal patient breathes throughout the respiratory cycle. The advantages of the new elevated pressure baseline include a significant reduction of the patient’s breathing efforts required to meet their physiological needs, stabilization of the airway, restoration of the FRC, and correction of hypoxemia. The therapy, if properly applied, often relieves the patient’s dyspnea effectively and quickly.

Nasal CPAP systems
Nasal CPAP systems are a specialized set of clinical tools to facilitate nasal CPAP therapy. They fall into two categories: classic nasal CPAP systems with constant flow and advanced nasal CPAP systems with variable flow. Advanced nasal CPAP further reduces work of breathing and improves patient comfort.

HAMILTON MEDICAL’s ARABELLA
Bringing together its engineering expertise and clinical knowledge, HAMILTON MEDICAL has pioneered the development of advanced nasal CPAP systems. Over a thousand of ARABELLA systems are in active use in hospitals around the world to help countless newborn babies come through the first, perhaps the most difficult, phase of their lives.
Monitoring
Gas Mixer

Heated delivery circuit

Universal Generator

Active humidifier

Five-leg stand

Caps available in five sizes
ARABELLA is a complete advanced nasal CPAP system, which is composed of the following parts:

1. Monitoring Gas Mixer (the flow driver)
2. Universal Generator
3. Patient interface such as a nasal prong or a nasal mask
4. Heated delivery circuit
5. Active humidifier and accessories
6. Elastic cap for fixation of Universal Generator and patient interface
7. Five-leg stand
8. Gas hoses and connectors

In comparison with other nasal CPAP systems, the ARABELLA provides the following advantages:

- Patented, effective and lightweight Universal Generator with minimal dead space
- A full range of sizes of nasal prongs, nasal masks and caps for optimal fitting of individual patients
- Compact, quiet, easy-to-operate Monitoring Gas Mixer (the flow driver) with precise control of gas flow delivery and oxygen concentration, proximal pressure and oxygen monitoring, and integrated alarms and reliable safety mechanisms. Monitoring Gas Mixer supports an additional flowmeter that permits the delivery of blended gases through a low-low cannula, manual resuscitator, or oxygen hood or for nebulizer therapy.
- Elastic caps for easy and optimal fixation, allowing the baby’s free movement
- Single-patient use accessories to eliminate the risk of cross-contamination
- Proven effectiveness and safety of the entire system
To patient via a nasal prong or nasal mask

Proximal pressure port for monitoring

Mixed gas inlet

Expiratory gas

Injector jet

To patient via a nasal prong or nasal mask
During nasal CPAP therapy, a neonatal patient breathes spontaneously at an elevated pressure baseline throughout the respiratory cycle. With classic nasal CPAP therapy with constant flow, the patient’s inspiratory effort creates a pressure drop, and the expiratory effort creates a pressure rise. Such pressure fluctuations represent additional patient work of breathing.

With variable flow, the flow toward the patient increases slightly during inspiration and decreases slightly during exhalation. As a result, the pressure baseline fluctuates less during spontaneous breathing, reducing work of breathing.

This phase-related flow variation results from the Universal Generator’s unique design, which exploits three physical laws: the Bernoulli effect, the Venturi principle and the Coanda effect.

**Inspiration**

A jet of air flows at a constant speed for a certain distance before it disperses its kinetic energy into the atmosphere (Bernoulli). The ARABELLA takes advantage of this effect by incorporating individual injector jets directed at each nasal passage to maintain a constant NCPAP throughout the respiratory cycle. During inspiration, flow toward the injector jets provides inspiratory flow for the patient. At high inspiratory demand, additional flow is entrained by the venturi action of the injector jets.

**Exhalation**

Upon exhalation, flow beyond the portals (into the passageway) enters a low-pressure area with minimal backpressure, resulting in decreased flow. The decreased flow causes the gas to reverse its direction or “flip,” resulting in exhalation.

The unique pressure flow stalling characteristics of the dual-injector jets allow the patient to passively exhale without additional imposed work. The constant gas flow provides a residual gas pressure to ensure stable NCPAP delivery throughout the respiratory cycle.
# Technical specifications

## ARABELLA Monitoring Gas Mixer (the flow driver)

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<td>Flow 0 to 10 l/min</td>
<td>NCPAP 0 to 12 cmH₂O</td>
<td>High pressure 3 cmH₂O above set NCPAP level</td>
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<tr>
<td>Oxygen 21 to 100%</td>
<td>Oxygen 21 to 100%</td>
<td>Low pressure 2 cmH₂O below set NCPAP level</td>
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### Alarms

- High pressure: 3 cmH₂O above set NCPAP level
- Low pressure: 2 cmH₂O below set NCPAP level
- Independent zero pressure alarm
- High and low oxygen: ±5% of set oxygen level
- Gas supply: Active if pressure difference between two gas supplies exceeds 1.38 bar / 20 psi /138 kPa, e.g., if one gas supply fails
- Alarm silence: 30 seconds
- Internal pop-up valve: Opens if system pressure > 150 cmH₂O
- Patient pressure relief valve: Opens if monitored NCPAP exceeds 11 cmH₂O, and alarm (Flow delivery resumes after 3 seconds)
- Acoustic alarm volume: Approximately 51.5 dB(A)

### Electronic displays

- Brightness: Automatic dimming
- Monitored CPAP: ±1 cmH₂O in resolution
- Monitored oxygen: ±1% in resolution

### Gas and electric supply

- Air and oxygen supply: 2 to 4.8 bar / 29 to 70 psi / 200 to 480 kPa
- Maximal acceptable pressure difference between air and oxygen supplies: < 1.38 bar / 20 psi /138 kPa
- Electric power: 100 to 240 VAC, 50 / 60 Hz, 45 VA

## Physical characteristics

- Dimensions (W x D x H): 210 x 175 x 145 mm
- Weight: 6.2 kg

## Environment

- Operating temperature: 10 to 40 °C at 0 to 75% relative humidity, non-condensing
- Storage temperature: -10 to 60 °C at 0 to 75% relative humidity, non-condensing
- Atmospheric pressure: 700 to 1060 hPa / 10 to 15 psi

## Major standards

- IEC 60601-1, IEC 60601-1-2

## Accessories for ARABELLA

- Universal Generator set: Contains a generator assembly, nasal prongs, KNOSCUSHION, and other items
- Delivery Circuit:
  - Types: 3 types (16 V, 21 V, and 28 V)
  - Compatible humidifier models: Fisher & Paykel MR730 and MR850
- Elastic positioning cap sizes: 1 (small, S), 2 (medium, M), 3 (large, L), 4 (extra large, XL) and 5 (extra extra large, XXL)
- Nasal masks sizes: 0 (small, S), 1 (medium, M), and 2 (large, L)
- Nasal prongs sizes: Small (S), medium (M), large (L), and extra large (XL)
- Five-leg stand: Pole mount for ARABELLA Monitoring Gas Mixer (flow driver)

*Subject to change. Visit www.hamilton-medical.com/arabella for an updated list.*