

Blood Gases in the NICU

Normal Ranges in Neonates

Remember, there can be a wide variety in normals in NICU patients*

Value	Capillary	Arterial
pH	7.32–7.42	7.35–7.45
pCO ₂ (mmHg)	40–50	35–45
HCO ₃ (mEq/L)	20–26	20–26
Base Excess	±4	±4
PaO ₂	—	50–70 (term), 45–65 (preterm)

Blood Gases and Ventilator Management

↓ pH / ↑ CO₂ – Respiratory Acidosis

🧠 Goal: Blow off CO₂

Gas example: pH 7.18 / pCO₂ 68 / HCO₃ 22

Mode	How to Fix It
Conventional	↑ Rate, ↑ PIP
HFOV	↑ Amplitude (first), ↓ Hz
HFJV	↑ PIP Jet, ↑ Servo, ↑ backup rate

↑ pH / ↓ CO₂ – Respiratory Alkalosis

🧠 Goal: Let CO₂ rise

Gas example: pH 7.51 / pCO₂ 26 / HCO₃ 22

Mode	How to Fix It
Conventional	↓ Rate, ↓ PIP
HFOV	↓ Amplitude, ↑ Hz
HFJV	↓ PIP Jet, ↓ Servo, ↓ backup rate



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↓ pH/↓HCO₃ - Metabolic Acidosis

 **Goal: Support perfusion and avoid excess ventilation**

Gas example: pH 7.21 / pCO₂ 39 / HCO₃ 15

Mode	How to Support It
Conventional	Maintain normocapnia; avoid ↑ rate/PIP unless CO ₂ is also high
HFOV	Avoid excessive amplitude or very low Hz
HFJV	Avoid overventilation (↑ PIP Jet or Servo); assess MAP

↑ pH / ↑ HCO₃ - Metabolic Alkalosis

 **Goal: Support perfusion and avoid excess ventilation**

Gas example: pH 7.21 / pCO₂ 39 / HCO₃ 15

Mode	How to Support It
Conventional	Monitor for ↓ rate or ↓ PIP that could ↑ CO ₂
HFOV	Avoid ↓ Hz or ↑ amplitude if pCO ₂ is rising
HFJV	Ensure appropriate PIP Jet and Servo; avoid weaning too quickly

↓ PaO₂ – Hypoxemia

 **Goal: Improve oxygenation**

Gas Example: pH 7.38 / pCO₂ 56 / PaO₂ 46 / FiO₂ 90%

Mode	How to Fix It
Conventional	↑ FiO ₂ , ↑ PEEP, ↑ PIP (if needed)
HFOV	↑ FiO ₂ , ↑ MAP
HFJV	↑ FiO ₂ , ↑ PEEP (on CMV), ↑ MAP



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↑ PaO₂ – Hyperoxia

🧠 Goal: Avoid oxygen toxicity

Gas Example: pH 7.38 / pCO₂ 44 / PaO₂ 150 / FiO₂ 60%

Mode	How to Fix It
Conventional	↓ FiO ₂ , ↓ PEEP
HFOV	↓ FiO ₂ , ↓ MAP
HFJV	↓ FiO ₂ , ↓ PEEP (on CMV)

Summary Table – Match Vent Settings to the Gas

Problem	Conventional	HFOV	HFJV
↓ pH, ↑ pCO ₂ : Resp. Acidosis	↑ Rate, ↑ PIP	↑ Amplitude, ↓ Hz	↑ PIP Jet, ↑ Servo
↑ pH, ↓ pCO ₂ : Resp. Alkalosis	↓ Rate, ↓ PIP	↓ Amplitude, ↑ Hz	↓ PIP Jet, ↓ Servo
↓ pH, ↓ HCO ₃ : Meta. Acidosis	Support normocapnia, avoid overventilation	Avoid ↑ amplitude or ↓ Hz	Avoid ↑ PIP Jet / Servo unless needed
↑ pH, ↑ HCO ₃ : Meta. Alkalosis	Monitor for ↑ CO ₂ (avoid ↓ rate too much)	Avoid ↓ Hz or ↑ amplitude	Avoid over-weaning; monitor CO ₂ trends
↓ PaO ₂ : Hypoxemia	↑ FiO ₂ , ↑ PEEP, ↑ PIP if needed	↑ FiO ₂ , ↑ MAP	↑ FiO ₂ , ↑ PEEP (CMV), ↑ MAP via PEEP or backup rate
↑ PaO ₂ : Hyperoxia	↓ FiO ₂ , ↓ PEEP	↓ FiO ₂ , ↓ MAP	↓ FiO ₂ , ↓ PEEP (CMV)



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