

Arterial Blood Gas (ABG)

Norms:

- Partial pressure of oxygen (PaO_2): Greater than 80 mm Hg
- Partial pressure of carbon dioxide (PaCO_2): 35-45 mm Hg (indicates Respiratory failure / insufficiency status)
- pH: 7.35-7.45
- Bicarbonate (HCO_3): 22-26 mEq/L
- Oxygen saturation (O_2 Sat): 95%-100%

End Tidal CO_2 (ET CO_2)

Norms:

- 30-43 mmHg (correlates with PCO_2 on ABG)

CO_2 {carbon dioxide (BMP)}

Norms:

- 20-20 mmol/L (correlates with HCO_3 serum bicarbonate level)

➤ COPD Market Size

- Over 12M people in the US diagnosed with COPD¹
- Estimated 12M to be undiagnosed with COPD¹
- Third leading cause of death in the US¹
- Major leading cause of disability¹
- Around 22% of COPD Medicare beneficiaries are readmitted to the hospital within 30 days of discharge²
- Almost 50% of elderly people (≥ 65 years) have at least three comorbidities, and 20% have five or more comorbidities³



1. National Heart, Lung, and Blood Institute 2011
2. Jencks SF et al. *New Engl J Med* 2009
3. Fabbri LM et al. *Eur Respir J* 2008

> Ventilation Acronyms

- There are many acronyms that are used when referring to ventilation. Here are the most commonly used ones:
 - IV—invasive ventilation
 - (N)IPPV—(non)-invasive positive pressure ventilation
 - (N)PPV—(nasal) positive pressure ventilation
 - (N)IV—(non)-invasive ventilation
 - (N)PSV—(non-invasive) pressure support ventilation
 - HMV—home mechanical ventilation.

Brown KA et al. *Anesthesiology* 2012

➤ NIV with a Ventilator

Spontaneous

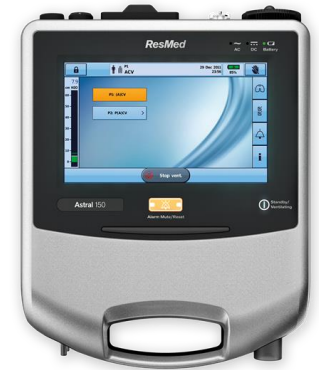
- CPAP (*Leak and Valve Circuit*)

Spontaneous Supported

- PS – Pressure support (*valve and leak circuit*)
- (S)T - Spontaneous Ventilation (PS) with back up rate (*leak and valve Circuit*)
- iVAPS – Intelligent Volume Assured Pressure Support (*Leak Circuit*)
- AVAPS- AE – Averaged Volume Assured Pressure Support -
Auto EPAP (*Leak Circuit*)

Controlled / Mandatory / Assisted (*valve circuit modes*)

- (A)CV – (Volume) Assisted controlled
- CV – (Volume) Controlled ventilation – No set Trigger
- P(A)CV – Pressure Assist controlled ventilation
- PAC – Pressure Assist Control (*leak circuit*)
- P-SIMV – Pressure Synchronized Intermittent Mandatory Ventilation
- V-SIMV – Volume Synchronized Intermittent Mandatory Ventilation





TiControl Chart

ResMed TiControl: Ti Min and Ti Max Calculation Guide

Respiratory Frequency (bpm)	Restrictive		COPD Ti Max	Normal Ti Max
	Ti Max	Ti Min		
30	1.0	0.5	0.7	1.0
29	1.0	0.5	0.7	1.0
28	1.1	0.5	0.7	1.1
27	1.1	0.6	0.7	1.1
26	1.2	0.6	0.8	1.2
25	1.2	0.6	0.8	1.2
24	1.3	0.6	0.8	1.3
23	1.3	0.7	0.9	1.3
22	1.4	0.7	0.9	1.4
21	1.4	0.7	0.9	1.4
20	1.5	0.8	1.0	1.5
19	1.6	0.8	1.0	1.6
18	1.7	0.8	1.1	1.7
17	1.8	0.9	1.2	1.8
16	1.9	0.9	1.2	1.9
15	2.0	1.0	1.3	2.0
14	2.1	1.1	1.4	2.1
13	2.3	1.2	1.5	2.3
12	2.5	1.3	1.7	2.5

➤ Setting Up a Patient with Normal Lungs

Recommended Settings	Normal Lung Mechanics
IPAP [cm H₂O]	9
EPAP [cm H₂O]	5
Ti Max [sec]*	2.0
Ti Min [sec]*	0.3
Rise time [ms]**	300
Trigger sensitivity	Medium
Cycle sensitivity	Medium
PS [cm H₂O]	4

* Ti settings based on an observed respiratory rate of 20 bpm.

** The rise time milliseconds scale is only approximate.

➤ Setting Up a Patient with Obstructive Lung Disease

Recommended Settings	Obstructive Lung Disease
IPAP [cm H ₂ O]	12
EPAP [cm H ₂ O]	6
Ti Max [sec]*	1.0
Ti Min [sec]*	0.3
Rise time [ms]**	150
Trigger sensitivity	Medium
Cycle sensitivity	High
PS [cm H ₂ O]	6

* Ti settings based on an observed respiratory rate of 20 bpm.

** The rise time milliseconds scale is only approximate.

Respiratory Assist Device (RAD) Qualifying Guidelines

CMS revision effective date: December 2014

I. Restrictive Thoracic Disorders

Documentation of neuromuscular disease or severe thoracic cage abnormality in the patient's medical record

Perform **one** of the following:

- **ABGs** (done while awake and on prescribed FiO_2) $\text{PaCO}_2 \geq 45$ mm Hg or
- **Sleep oximetry**
Oxygen saturation $\leq 88\%$ for ≥ 5 minutes, minimum 2 hours of recording time (on patient's prescribed FiO_2) or
- **For neuromuscular disease only:**
Either $\text{FVC} < 50\%$ of predicted or $\text{MIP} < 60$ cm H_2O

COPD does not contribute significantly to pulmonary limitation

(E0470) or (E0471)
Based on the treating physician's judgment

II. COPD

ABGs (done while awake and on prescribed FiO_2)
 $\text{PaCO}_2 \geq 52$ mm Hg

Sleep oximetry

Oxygen saturation $\leq 88\%$ for \geq a cumulative 5 minutes, minimum 2 hours nocturnal recording time (on 2 L/min O_2 or patient's prescribed FiO_2 , whichever is higher)

OSA and CPAP treatment has been considered and ruled out (formal sleep testing is not required if medical record demonstrates sleep apnea is not predominate cause of awake hypercapnia or nocturnal arterial oxygen desaturation)

(E0470)

For COPD patients to qualify for a RAD with backup rate (E0471):

Situation 1 After period of initial use of an E0470; **ABG** (done while awake and on prescribed FiO_2) shows PaCO_2 worsens ≥ 7 mm Hg compared to original ABG result; **facility-based PSG** demonstrates oxygen saturation $\leq 88\%$ for \geq a cumulative 5 minutes, minimum 2 hours nocturnal recording time while on an E0470 and not caused by obstructive upper airway events (ie, $\text{AHI} < 5$).

Situation 2 No sooner than 61 days after initial issue of E0470; **ABG** (done while awake and on prescribed FiO_2) shows $\text{PaCO}_2 \geq 52$ mm Hg; **Sleep oximetry** on an E0470 demonstrates oxygen saturation $\leq 88\%$ for \geq a cumulative 5 minutes, minimum 2 hours nocturnal recording time (on 2 L/min O_2 or patient's prescribed FiO_2 , whichever is higher).

Respiratory Assist Device (RAD) Documentation Requirements for Continued Coverage Beyond First 3 Months

Patients on an E0470 or E0471 device must be reevaluated no sooner than 61 days after initiating therapy.

Required Documentation

- Progress of relevant symptoms
- Signed and dated statement by treating physician declaring patient using average 4 hours per 24-hour period and patient benefiting from use

ResMed E0470 and E0471 Devices

E0470—Bilevel without a backup rate:

- AirCurve™ 10 VAuto
- AirCurve™ 10 S
- VPAP™ COPD

E0471—Bilevel with a backup rate:

- AirCurve 10 ST
- AirCurve 10 ASV
- VPAP ST-A
- Stellar™*

* For invasive use, code E0472



Tidal Volume Charts

NIH PREDICTED BODY WEIGHT (PBW) / TIDAL VOLUME CHART															
MALES								FEMALES							
HEIGHT		PBW	4	5	6	7	8	HEIGHT		PBW	4	5	6	7	8
Feet	Inches	Male	ml/kg	ml/kg	ml/kg	ml/kg	ml/kg	Feet	Inches	Female	ml/kg	ml/kg	ml/kg	ml/kg	ml/kg
4' 10"	58	45.4	180	230	270	320	360	4' 7"	55	34	140	170	200	240	270
4' 11"	59	47.7	190	240	290	330	380	4' 8"	56	36.3	150	180	220	250	290
5' 0"	60	50	200	250	300	350	400	4' 9"	57	38.6	150	190	230	270	310
5' 1"	61	52.3	210	260	310	370	420	4' 10"	58	40.9	160	200	250	290	330
5' 2"	62	54.6	220	270	330	380	440	4' 11"	59	43.2	170	220	260	300	350
5' 3"	63	56.9	230	280	340	400	460	5' 0"	60	45.5	180	230	270	320	360
5' 4"	64	59.2	240	300	360	410	470	5' 1"	61	47.8	190	240	290	330	380
5' 5"	65	61.5	250	310	370	430	490	5' 2"	62	50.1	200	250	300	350	400
5' 6"	66	63.8	260	320	380	450	510	5' 3"	63	52.4	210	260	310	370	420
5' 7"	67	66.1	260	330	400	460	530	5' 4"	64	54.7	220	270	330	380	440
5' 8"	68	68.4	270	340	410	480	550	5' 5"	65	57	230	290	340	400	460
5' 9"	69	70.7	280	350	420	490	570	5' 6"	66	59.3	240	300	360	420	470
5' 10"	70	73	290	370	440	510	580	5' 7"	67	61.6	250	310	370	430	490
5' 11"	71	75.3	300	380	450	530	600	5' 8"	68	63.9	260	320	380	450	510
6' 0"	72	77.6	310	390	470	540	620	5' 9"	69	66.2	260	330	400	460	530
6' 1"	73	79.9	320	400	480	560	640	5' 10"	70	68.5	270	340	410	480	550
6' 2"	74	82.2	330	410	490	580	660	5' 11"	71	70.8	280	350	420	500	570
6' 3"	75	84.5	340	420	510	590	680	6' 0"	72	73.1	290	370	440	510	580
6' 4"	76	86.8	350	430	520	610	690	6' 1"	73	75.4	300	380	450	530	600
6' 5"	77	89.1	360	450	530	620	710	6' 2"	74	77.7	310	390	470	540	620
6' 6"	78	91.4	370	460	550	640	730	6' 3"	75	80	320	400	480	560	640