Brazilian recommendations of mechanical ventilation 2013. Part I

Recomendações brasileiras de ventilação mecânica 2013. Parte I

Workgroup of the Brazilian Association of Intensive Care Medicine and the Brazilian Thoracic Society

Chart 1 - Available ventilators for noninvasive ventilation.

Manufacturer/ Model	Context of use	Available modes	Special modes	Observations
Philips				
BIPAP A30	Specific for NIV	AVAPS Auto-trak	Oximetry coupling	Memory card and trends can be coupled
TRILOGY-100	NIV and IMV	PSV, PCV and VCV AVAPS	Leak compensation *Auto-trak* Heated humidification	Monitoring screen 6-8 hour battery
Dixtal				
DX3012	NIV and IMV	PSV, PCV, VCV,SIMV, CPAP	Leak compensation Active and passive humidification	Monitoring screen, volumetric capnography
Philips respironics				
BIPAP-vision, focus and ST	Specific for NIV	BIPAP and CPAP	Auto-trak Leak compensation Slope adjustment FIO_2 control in vision	Monitoring screen
Resmed				
Stellar	NIV and IMV	PSV with automatic pressure adjustment iVAPS	FIO_2 control Portable Data *download*	Monitoring screen, preset values for diseases, mask adjustment
Covidien				
Covidien 840	NIV module	Spontaneous + PSV A/C and SIMV	Slope and expiratory sensitivity can be adjusted in PSV	Possible *back up* with manual ventilation and/or Vf
Servo				
Servo I	NIV module	Spontaneous and PSV	FIO_2 control Adjustment of slope and expiratory cycling	Monitoring screen
Drager				
Ventilator Carina	Specific for NIV	VC-SIMV Auto-Flow PC-BIPAP PC-AC SPN-PS (VG) SPN-CPAP Apnea ventilation	1-hour internal battery, 9-hour external battery Automatic triggering and slope control	Monitoring screen and automatic leak compensation
EVITA XL	Special module for NIV	PSV	Automatic adjustments	Monitoring screen
GE				
Engstron Pro	VNI and VMI	Multiple modes of ventilation	Internal battery	Monitoring screen and automatic adjustments
Alliance				
Care fusion-VELA	Special module for NIV	PSV	6-hour battery Leak compensation	Monitoring screen
Intermed				
Care Fusion: IX-5	Special module for NIV	A/C, SIMV, CPAP, PSV	Adjustment of inspiratory and expiratory sensitivity and rise time	Monitoring screen with up to 5 simultaneous curves
Care Fusion: Inter 7 plus	Special module for NIV	A/C, SIMV, CPAP, PSV	Adjustment of inspiratory and expiratory sensitivity and rise time	3-hour internal battery
VIVO				
VIVO 40 (pressure up to 40 cmH_20) and VIVO 30 (pressure up to 30 cmH_20)	Special module for NIV	PSV, PCV and CPAP	Adjustment of inspiratory and expiratory sensitivity and rise time	External battery Humidification system

Chart 1 - Continued...

Manufacturer/ Model	Context of use	Available modes	Special modes	Observations
Breas				
I-sleep 20 (pressure up to 20 cmH_20)	Special module for NIV	CPAP	Adjustable slope Leak compensation	Heated humidifier

BIPAP - bilevel positive air pressure; NIV - noninvasive ventilation; AVAPS - average volume assured pressure support; IMV - invasive mechanical ventilation; PSV - pressure support ventilation mode; VCV - volume controlled ventilation mode; PCV - pressure controlled ventilation mode; SIMV - synchronized inspiratory mandatory ventilation; CPAP - continuous positive air pressure; iVAPS - intelligent volume-assured pressure support; FIO_2 - fraction of inspired oxygen; Vf - respiratory rate; SPN-PS (VG) - spontaneous - pressure support (volume guarantee); SPN - spontaneous - pressure support; A/C - assist/control.

Chart 2 - Basic ventilators (without curve monitoring).

Manufacturer/Model	Age range	Context of use	Available modes	Flow (VCV)	Special modes	Observations
Air Liquide						
Taema Osiris	Ad, Ped	Transport	A-C (VCV)	Continuous	- - -	- - -
Bio-Vent						
CrossVent CV-3 / CV-4	Ad, Ped	ICU, Transport	A-C (VCV), SIMV, CPAP/ spontaneous, PSV	Continuous	- - -	- - -
Care Fusion						
Omni-Tech Omni-Vent	Ad, Ped	Transport	A-C (VCV)		- - -	Can be used in MRI Allows for hyperbaric ventilation
Allied EPV 200	Ad	Transport	A-C (VCV)	Continuous	- - -	- - -
Allied Life Support Autovent 2000, 3000 & 4000	Ad	Transport	A-C (VCV), CPAP/ spontaneous	Continuous	- - -	- - -
Drager						
Oxylog 2000 Plus	Ad	Transport	A-C (VCV), SIMV, CPAP/ spontaneous	Continuous	- - -	- - -
Oxylog 3000	Ad, Ped	Transport	A-C (VCV), PCV, SIMV, CPAP/ spontaneous, PSV	Continuous	- - -	- - -
Oxylog 3000	Ad, Ped	Transport	A-C (VCV), PCV, SIMV, CPAP/ spontaneous, PSV	Continuous	- - -	Capnometry. Optional: *autoflow*
GE					**- - -**	
Bi-Level 40	Ad, Ped	Transport	A-C (VCV), PCV, SIMV, CPAP/ spontaneous, PSV	Continuous	- - -	- - -
K. Takaoka						
Mini-ventil 600	Ad	Transport	A-C (VCV)	Continuous	- - -	- - -
MicroTak 920	Ad, Ped	Transport	A-C (VCV), SIMV, CPAP/ spontaneous	Continuous	- - -	- - -
Leistung						
PR 4D-02	Ad, Ped	Transport	A-C (VCV)	Continuous	- - -	Time-cycled
Res Med						
VS III	Ad, Ped	ICU, NIV	A-C (VCV), PCV, SIMV, CPAP/ spontaneous, PSV	Continuous	- - -	- - -
Tyco / Covidien						
Newport HT 70	Ad, Ped	Transport	A-C (VCV), PCV, SIMV, CPAP/ spontaneous, PSV	Continuous Decelerating	Rise time % expiratory time-PSV	- - -
Vent-Logos						
VLP 2000 – E	Ad	Transport	A-C (VCV)	Continuous	- - -	- - -
VLP 4000 – P	Ad	Transport	A-C (VCV)	Continuous	- - -	- - -

Ad - use in adults; Ped - use in children (non-newborn); A-C - assist control; VCV - volume controlled ventilation mode; SIMV - synchronized inspiratory mandatory ventilation; CPAP - continuous positive air pressure; PCV - pressure controlled ventilation mode; PSV - pressure support ventilation mode; MRI - magnetic resonance imaging; transport - use for transportation of patients under invasive mechanical ventilation; ICU - appropriate for use in intensive care unit; NIV - use for noninvasive ventilation.

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Chart 3 - Ventilators with basic resources and with curves.

Manufacturer/ Model	Age range	Context of use	Available modes	Flow (VCV)	Monitoring	Special modes	Observation
Air Liquide							
Extend XT	Ad, Neo	ICU	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves, loops	- - -	Capnography
Care Fusion							
Intermed Inter-5 Plus	Ad, Ped	ICU	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	- - -	Separate monitor
Drager							
Savina 300	Ad, Ped	ICU	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	BiLevel	*Auto-Flow*
GE							
Ventil Pulmonar 101	Ad, Ped	ICU, home	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	PRVC, volume guaranteed	iVent MRI: can be used in MRI
Hamilton							
Galileo Gold	Ad, Ped	ICU	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves, loops	ASV, APRV, automatic tube compensation	Automatic P-V curve, P0.1
Raphael Color	Ad, Ped	ICU, ER	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves, loops	ASV, APRV, automatic tube compensation	- - -
T-1	Ad, Ped	Transport	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	ASV	Automatic P-V curve Capnometry Barometric pressure compensation (air transportation)
MR-1	Ad, Ped	Transport	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	ASV	For MRI "Extra" monitor
K-Takaoka							
Smart	Ad, Neo	ICU, ER	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves, loops	BiLevel, orotracheal tube compensation	P0.1 PiMax
Carmel	Ad, Neo	ICU	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	PSV: RiseTime & time adjustment (% flow), PCV volume guaranteed	Capnometry
Leistung							
Luft 1-g	Ad, Ped	ICU, ER	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	- - -	- - -
Luft 2-g	Ad, Ped	ICU	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves, loops	MMV, BiLevel, PSV volume guaranteed, APRV	- - -
PR - 4g	Ad, Ped	Transport	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	- - -	- - -
Magnamed							
Fleximag	Ad, Neo	ICU, ER	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	BiLevel, PSV: rise time	Capnography (optional)
Oxymag	Ad, Neo	Transport	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	BiLevel, APRV	Capnography (optional)
Neumovent							
GraphNet T5	Ad, Ped	ICU, ER	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves	- - -	- - -
Tyco/Covidien							
Newport e360	Ad	ICU, ER	A-C (VCV), PCV, SIMV, CPAP/spontaneous, PSV	Continuous, decelerating	Curves, loops	BiLevel, PSV: rise time & time adjustment (% flow), APRV	- - -

Ad - use in adults; Ped - use in children (non-newborn); Neo - use in neonatology; ICU - appropriate for use in ICU; PSV - pressure support ventilation mode; VCV - volume controlled ventilation mode; PCV - pressure controlled ventilation mode; SIMV - synchronized inspiratory mandatory ventilation; CPAP - continuous positive air pressure; APRV - airway pressure release ventilation; PRVC - pressure regulated volume controlled; ASV - adaptative support ventilation; MMV - minute mandatory ventilation; ER - use in emergency room.

Chart 4 - Ventilators with curve monitoring and advanced resources.

Manufacturer/ Model	Age range	Context of use	Basic modes	Flow (VCV)	Monitoring	Special modes	Observations
Air Liquide							
Monnal T-75	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves, loops	BiLevel CPAP, PRVC	Capnography
Care Fusion							
Viasys Vela	Ad, Ped	ICU	Yes	Continuous, decelerating	Curves, loops	PSV: RiseTime & time adjustment (% flow), PRVC, APRV	Capnography
Viasys Avea	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves, loops	V-PSV, PSV: RiseTime & time adjustment (% flow), Vsync, PRVC, AAC (tube compensation)	Capnography Measures P0.1, Pimax, WOB (esophageal)
Intermed i X5	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves, loops	PSV: RiseTime & time adjustment (% flow), TGI, tube compensation	Measures P0.1
Intermed Inter-7 Plus	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves, loops	PSV: RiseTime & time adjustment (% flow), VAPS, BiLevel, TGI, APRV (BiPEEP)	Measures P0.1
Drager							
Evita 4	Ad, Ped	ICU	Yes	Continuous, decelerating	Curves, loops	MMV, Auto-Flow, APRV, PPS (optional), ATC – tube compensation	Capnography, PiMax, Vd/Vt
Evita XL	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves, loops	Auto-Flow, automatic tube compensation, Smart Care Variable SP, BiLevel, PC-APRV, Recruitment maneuver, Low flow maneuver	Capnography, oximetry, Lung protection package (optional)
GE							
Engstron Carestation	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves, loops	BiLevel PSV: RiseTime & time adjustment (% flow), Automatic tube compensation, APRV, PC-volume guaranteed	P0.1, PiMax, Measures FRC, indirect calorimetry
Engstron Pro	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves, loops	BiLevel, PSV: RiseTime & time adjustment (% flow), automatic orotracheal tube compensation, APRV, PC-volume guaranteed	P0.1
Hamilton							
C-3	Ad, Ped	ICU, ER	Yes	Continuous, decelerating	Curves	ASV, APRV	Volumetric capnometry (optional),
C-2	Ad, Ped	ICU, ER	Yes	Continuous, decelerating	Curves, loops	ASV, APV, Tube compensation, APRV	Automatic P-V curve, Volumetric capnometry (optional),
S-1	Ad, Ped	ICU	Yes	Continuous, decelerating	Curves, loops	ASV, APRV	Automatic P-V curve, capnography,
G-5	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves, loops	ASV, BiLevel, APRV, APV	Allows heliox (optional), Volumetric capnography (optional),
K Takaoka							
Color	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves	MMV, PSV-volume guaranteed, BiLevel, tube compensation	P0.1, PiMax, Capnometry
Maquet Getinge							
Servo-i	Ad, Ped	ICU	Yes	Continuous, decelerating	Curves, loops	NAVA (optional), AutoMode, BiLevel, PSV: RiseTime & time adjustment (% flow), PRVC, APRV	Capnography, P0.1, WOB (*in-line*)

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Chart 4 - Continued...

Manufacturer/ Model	Age range	Context of use	Basic modes	Flow (VCV)	Monitoring	Special modes	Observations
Servo-S	Ad, Ped	ICU	Yes	Continuous, decelerating	Curves, loops	BiLevel, PSV: RiseTime & time adjustment (% flow), PRVC, APRV	P0.1
Mindray							
Synovent E3	Ad, Ped	Hospital, ICU, ER	Yes	Continuous, decelerating	Curves, loops	Bilevel, PSV, optional automatic expiratory trigger control, rise time, time adjustment, tube compensation	Capnography, P0.1, WOB, PiMax, enables connectivity with the hospital system (Bnelink/HL7)
Synovent E5	Ad, Ped	ICU	Yes	Continuous, decelerating	Curves, loops	PRVC, APRV, Bilevel, PSV, optional automatic expiratory trigger control, rise time, time adjustment, tube compensation	Capnography, P0.1, WOB, PiMax, low flow maneuver, enables connectivity with the hospital system (Bnelink/HL7), displays 4 simultaneous curves (P/T, V/T, F/T and capnography)
Neumovent							
GraphNet Advance	Ad, Neo	ICU	Yes	Continuous, decelerating	Curves, loops	PRVC, APRV	Capnography
Philips							
Dixtal DX-3012 Plus	Ad, Ped	ICU	Yes	Continuous, decelerating	Curves, loops	BiLevel, PS-volume guaranteed, MMV, PSV: rise time & time adjustment (% flow), APRV	P0.1, Capnography
Dixtal DX-3012	Ad, Ped	ICU	Yes	Continuous, decelerating	Curves, loops	BiLevel, PS-Vol Gar, MMV, PSV: rise time & time adjustment (% flow), APRV	Capnography, P0.1, PiMax
Tyco/Covidien							
Puritan Bennett 840	Ad, Ped	ICU	Yes	Continuous, decelerating	Curves, loops	BiLevel, PSV: rise time & time adjustment (% flow), PAV-Plus, automatic tube compensation, APRV	

Ad - use in adults; Ped - use in children (non-newborn); Neo - use in neonatology; ICU - appropriate for use in ICU; PSV - pressure support ventilation mode; Bipap - bilevel positive air pressure; VCV - volume controlled ventilation mode; PCV - pressure controlled ventilation mode; SIMV - synchronized inspiratory mandatory ventilation; CPAP - continuous positive air pressure; iVAPS - intelligent volume-assured pressure support; APRV - airway pressure release ventilation; PRVC - pressure regulated volume controlled; ASV - adaptative support ventilation; MMV - minute mandatory ventilation; ER - use in emergency room; VAPS - volume assured pressure support ventilation mode; Pimax - maximal inspiratory pressure; FRC - functional residual capacity; NAVA - neurally adjust ventilatory assist; PAV - proportional assist ventilation; APV - adaptative pressure ventilation; PS - pressure support.

Chart 5 - Mode-dedicated ventilators HFOV (adults).

Manufacturer/Model	Age range
Care Fusion	
SensorMedics 3100 B	Ad, Ped

HFOV - high frequency oscillatory ventilation; Ad - use in adults; Ped - use in children (non-newborn).