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VENTILATOR SYSTEM

Technical Specification

1. General Requirements

The ventilator is a microprocessor-controlled, turbine-driven critical care ventilator suitable for neonatal, pediatric, and adult patients for use in ICU, HDU, Emergency, and OT settings.

1.1 Gas Supply

Oxygen (O ₂) Supply	
High Pressure Input	41 to 87 psi (283 to 600 kPa) Flow: ≥180 L/min
Low Pressure Input	Max 11 psi (75 kPa) Flow: ≥15 L/min
Air Supply	
Air Source	Internal radial turbine blower

1.2 Display

Display Size	≥30 cm, diagonal
Display Type	TFT LCD with capacitive touchscreen
Resolution	XGA (1024 x 768)

1.3 Patient Categories

- Adult, Pediatric
- Neonatal (optional)

1.4 General Features

- Automatic compliance compensation and leakage compensation for breathing circuit
- Tube compensation with adjustable settings for ETT or tracheostomy tube (ID 2.0 to 10.0 mm)
- Leak compensation: invasive (ON/OFF) and non-invasive (ON only)
- Apnea ventilation with configurable backup rate and tidal volume

- Sigh function with adjustable factor and interval

2. Ventilation Modes

2.1 Invasive Ventilation

- A/CMV – Pressure Control (A/CMV-PC)
- A/CMV – Volume Control (A/CMV-VC)
- A/CMV – Pressure Regulated Volume Control (A/CMV-PRVC)
- SIMV – Pressure Control + Pressure Support (SIMV-PC-PS)
- SIMV – Volume Control + Pressure Support (SIMV-VC-PS)
- SIMV – Pressure Regulated Volume Control + Pressure Support (SIMV-PRVC-PS)
- Spontaneous – CPAP (SPONT-CPAP)
- Spontaneous – Pressure Support (SPONT-PS)
- Spontaneous – Volume Support (SPONT-VS)
- Airway Pressure Release Ventilation (APRV)

2.2 Non-Invasive Ventilation (NIV)

- A/CMV – Pressure Control (A/CMV-PC)
- SIMV – Pressure Control + Pressure Support (SIMV-PC-PS)
- Spontaneous – CPAP (SPONT-CPAP)
- Spontaneous – Pressure Support (SPONT-PS)
- Airway Pressure Release Ventilation (APRV)

2.3 Oxygen Therapy

- O₂ Therapy mode: OFF, 1–15 L/min (Neonate), OFF, 1–30 L/min (Pediatric), OFF, 1–60 L/min (Adult)

3. Ventilation Settings

3.1 Core Settings

Tidal Volume (VT)	
Neonate	5 to 100 mL
Pediatric	20 to 1000 mL
Adult	100 to 2000 mL
Pressure Control / Pressure Support	
Neonate	2 to 60 cmH ₂ O (limited by PEEP)
Pediatric	2 to 70 cmH ₂ O (limited by PEEP)

Adult	2 to 80 cmH ₂ O (limited by PEEP)
PEEP / CPAP	
Neonate	0 to 30 cmH ₂ O
Pediatric	0 to 40 cmH ₂ O
Adult	0 to 50 cmH ₂ O

3.2 Respiratory Rate

Neonate	1 to 150 bpm
Pediatric	1 to 120 bpm
Adult	1 to 80 bpm

3.3 Other Settings

FiO₂	21 to 100%
I:E Ratio	4.0:1 to 1:299
Inspiratory Time (TI) – Volume Control	0.20 to 3.0 s (Neonate/Pediatric), 0.20 to 5.0 s (Adult)
Inspiratory Time (TI) – Pressure Control	0.20 to 10.0 s (all patients)
Inspiratory Pause	OFF, 0.1 to 2.0 s
Flow Type	Square, Descending 50%
Flow Rate – Volume Control (Neonate)	1 to 30 L/min
Flow Rate – Volume Control (Pediatric)	1 to 60 L/min
Flow Rate – Volume Control (Adult)	1 to 150 L/min
Pressure Trigger	0.1 to 10 cmH ₂ O
Flow Trigger (Adult)	0.1 to 20 L/min
Flow Trigger (Pediatric)	0.1 to 15 L/min
Flow Trigger (Neonate)	0.1 to 10 L/min
Expiratory Trigger (ET%)	1 to 80%
Slope	5% (slowest) to 100% (fastest)
APRV P-HIGH	1 to 50 cmH ₂ O

APRV P-LOW	0 to 49 cmH ₂ O
APRV T-HIGH / T-LOW	0.1 to 30 s each

4. Monitored Parameters

4.1 Pressure Parameters

Peak Inspiratory Pressure (Ppeak)	0 – 100 cmH ₂ O
Plateau Pressure (Pplat)	0 – 100 cmH ₂ O
Plateau Pressure, Estimated	0 – 100 cmH ₂ O
Mean Airway Pressure (Pmean)	0 – 100 cmH ₂ O
PEEP	0 – 99.9 cmH ₂ O
Total PEEP (auto-PEEP included)	0 – 99.9 cmH ₂ O
Intrinsic / Auto-PEEP	0 – 99.9 cmH ₂ O
Occlusion Pressure (P0.1)	<0.5, 0.5–6.0, and >6.0 cmH ₂ O
Driving Pressure	0 – 99.9 cmH ₂ O

4.2 Volume & Flow Parameters

Inspiratory Tidal Volume (VTI)	0 – 3,500 mL
Tidal Volume (VT)	0 – 3,500 mL
Tidal Volume per kg (VT/kg)	0 – 50 mL/kg
Minute Volume (MV)	0.00 – 99.9 L
Spontaneous Minute Volume	0.00 – 99.9 L/min

4.3 Rate & Timing Parameters

Total Respiratory Rate	0 – 200 bpm
Spontaneous Respiratory Rate	0 – 150 bpm
Mandatory I:E Ratio	16.0:1 to 1:299
Spontaneous Inspiratory Time	0.10 – 2.0 s

Spontaneous Duty Cycle (TI/Ttot)	10 – 90%
Expiratory Time (TE)	0.10 – 99.99 s

4.4 Mechanics Parameters

Static Inspiratory Resistance	1 – 200 cmH ₂ O/L/s
Static Compliance	0.1 – 120 mL/cmH ₂ O
Expiratory Resistance	1 – 200 cmH ₂ O/L/s
Dynamic Resistance, Estimated	1 – 200 cmH ₂ O/L/s
Dynamic Compliance, Estimated	0.1 – 120 mL/cmH ₂ O
Exhalation Time Constant	0.01 – 6 s
Imposed Work of Breathing	0 – 99.9 J/min
C20/C	0.1 – 3.0
RSBI	0 – 9999 bpm/L
RSBI per kg	0 – 300 bpm/mL/kg

4.5 Gas Monitoring (required if available)

Oxygen Concentration (FiO₂)	18 – 100%
SpO₂	50 – 100% (required module if optional)
Pulse Rate	25 – 240 bpm
End-Tidal CO₂ (EtCO₂)	0 to 100 mmHg (required module if optional)

5. Display – Waveforms & Loops

Maximum Simultaneous Waveforms	4
Maximum Simultaneous Loops	2
Required Waveforms	Pressure, Flow, Volume, Estimated Tracheal Pressure, CO ₂ Capnogram
Required Loops	Pressure–Volume (with autoscale), Flow–Volume (with autoscale), Single Breath Volumetric

6. Alarm System

6.1 Adjustable Alarms

Airway Pressure, High	5 – 100 cmH ₂ O
Minute Ventilation, High	0.02–20.0 L/min (Neonate), 0.03–40.0 (Ped), 0.03–60.0 (Adult)
Minute Ventilation, Low	0.01–19.0 L/min (Neonate), 0.02–39.0 (Ped), 0.02–59.0 (Adult)
Tidal Volume (mL/kg), High	2 – 30 mL/kg, OFF
Tidal Volume (mL/kg), Low	OFF, 1 – 29 mL/kg
Respiratory Rate, High	10 – 150 bpm (Neonate/Ped), 10 – 120 bpm (Adult), OFF
Apnea	5 to 60 s (OFF available in NIV)
Leak, High	20 – 95%, OFF
SpO₂, High / Low	51–100% / 50–99% (optional)
Pulse Rate, High / Low	31–300 / 30–299 bpm (optional)
EtCO₂, High / Low	2–99 mmHg / 1–98 mmHg (optional)

6.2 Alarm Audio

- Configurable minimum alarm volume
- Audio pause: 2 minutes maximum

7. Monitoring, Data Management & Connectivity

7.1 Trending & Logging

- Trending with configurable storage duration
- Event log for alarms and error traceability
- Log download via USB port

7.2 Connectivity

- Compatible with patient monitoring and bedside monitoring systems
- Patient data management systems with HL7 support
- Ventilator gateway for network integration

8. Electrical & Power

Mains Power	220 to 240 V AC, 50/60 Hz
Extended Battery	Li-ion, 14.4 V, 9.0 Ah Run time: ≥3 hr
Plug Type	13 Amp hospital-grade Type G

9. Environmental Specifications

Operating Conditions	
Temperature	10 to 40°C (50 to 104°F)
Humidity	10 to 95% non-condensing
Storage Conditions	
Temperature	-20 to 50°C (-4 to 122°F)
Humidity	10 to 95% non-condensing

10. Standards & Certifications

Ingress Protection	IP21 (IEC standard)
Critical Care Ventilators	ISO 80601-2-12:2020
General Safety	IEC 60601-1:2012 (Ed 3.1)
Electromagnetic Compatibility	IEC 60601-1-2:2020
Usability	IEC 60601-1-6:2013
Alarm Systems	IEC 60601-1-8:2012
Battery Safety	IEC 62133:2012
Respiratory Gas Monitors	ISO 80601-2-55:2018
Biocompatibility (Risk Management)	ISO 10993-1:2018
Breathing Gas Pathway Biocompatibility	ISO 18562-1:2017

11. Warranty & Documentation

11.1 Warranty

- Minimum 12 months comprehensive warranty from date of installation and commissioning
- Availability of spare parts and service support for a minimum of 5 years.

11.2 Required Documentation (in English)

- User Manual
- Technical / Service Manual
- Maintenance Manual
- Calibration and inspection certificate
- Recommended preventive maintenance schedule

11.3 Training

- On-site user training for nursing and clinical staff.
- Technical training for Biomedical Engineers covering operation, troubleshooting, and preventive maintenance

12. Accessories and Module Requirements

- Integrated SpO₂ and CO₂ monitoring module (including required hardware board and software package)
- Respiratory mechanics monitoring
- Neonatal ventilation software package if optional
- Medical oxygen high-pressure hose, 8 ft., conductive, NIST female to British Standard male connection
- Medical oxygen high-pressure hose, 3 ft., conductive, NIST female to NIST female connection (transport configuration)
- Compact mobile trolley
- Humidifier mounting bracket (for compact trolley)
- Support arm assembly (mounting hardware ordered separately as required)
- Rail-mounted bracket for support arm
- Breathing circuit holder (for support arm configuration)
- HEPA air inlet filter