	High end ventilator characteristics
	Minimal characteristics
1	**Modes of ventilation and types of breaths**
1.1	IPPV, IPPV/Assist (CMV, Assist/Control) with minimally: - volume controlled breaths (VCV), - pressure controlled breaths(PCV), - hybrid mode (double controlled breaths (PRVC/VG/AutoFlow/VC+/APV or equivalent)
1.2	SIMV with pressure support in spontaneous breaths (SIMV+PS) with minimally: - volume controlled breaths (VCV), - pressure controlled breaths(PCV), - hybrid mode (double controlled breaths (PRVC/VG/AutoFlow/VC+/APV or equivalent)
1.3	Ventilation on 2 pressure levels with spontaneous breaths available on both levels and pressure support on both pressure levels (BIPAP, Bi-Level, DuoPAP, Bivent, Bi-VENT or eauivalent mode. Each mode should offer additional PS) - inversed ratio ventilation (I:E 4:1 or more); (IRV, APRV er equivalent)
1.4	Spontaneous breaths with positive end expiratory pressure (CPAP/PEEP) and - pressure support (CPAP + PS) - volume support (CPAP + VS) - with tube compensation (CPAP+ TC)
1.5	Automated (close loop ventilation) mode(s): - automatic shift form spontaneous to controlled modes ((ASV, AVM, ALPV, INTELiVENT, AUTOMODE or equivalnet) - all automated modes should follow protective ventilation principle
1.6	Triggering spontaneous breaths: - pressure trigger - flow trigger
1.7	APNEA ventilation in invasive and non invasive ventilation with selected apnea modes: - VCV and/or PCV - adjustable apnea interval
1.8	Non-invasive ventialtion (NIV) with: - pressure support in spontaneous modes (CPAP + PS) - adjustable inspiratory flow rise (pressure rise% or equivalent) - adjustable ekspiratory trigger (Esens or equivalent) - maximal inspiratory flow: at least 200 l/min
1.9	High Flow Oxygen Therapy (HFOT) - maximal flow: 60 l/min
2	**Parameters**
2.1	Patient heigh and gender, calculated ideal body mass (IBM)
2.2	Parameters should be in the range to allow ventilation patients 40 kg and more
2.3	Minimal reauirements: - Setting inversed ratio ventialtion (I:E or T_H:T_L in BIPAP or eqivalent) > 4:1 - PEEP ($PEEP_L$) at least 50 cmH_2O - inspiratory presure (P_{insp} ($PEEP_H$) minimal 70 cmH_2O - sigh meneouver (1 breath with in the given breathing cycle with configurable Vt/ Pinsp/PEEP and duration)
2.4	Synchronization in assisted/controlled modes - setting inspiratory time, I:E time or peak inspiratory flow
2.5	Setting the FiO_2 (inspiratory O_2 concentration): between 21% and 100% in 1% increments

2.6	Standby mode
2.7	O2 Flush mode (FiO_2 increase to 1.0)
3	**Monitoring**
3.1	All sensors (flow, pressure, FiO_2, CO_2) must be integrated part of the ventialtor. Aditional use of therapeutic gasses/vapors (inhaled nitric (II) oxyde, volatile anesthetics) should not interfere with sensors' measurements.
3.2	Graphical and numerical display of set and actual (measured and calculated) parameters: flow/time, volume/time and pressure/time curves, volume/pressure, flow/volume loops must be scaled to operators demand. At least 3 curves and 2 loops should be displayed simultaneously.
3.3	Trending for the past 24 hrs (graphical and numerical).
3.4	On ventialtor display set and actual values should be displayed separately with minimal requiremets being: - FiO_2, resrpiratory rate, alveolar pressure, tidal volume (Vt), tidal volkume to IBM, , minute ventilation, PEEP, transpoulmonary pressure, time constant, $EtCO_2$.
3.5	Ventilatory associated infection prevention (VAP control). Ventilator must be equipped with internal automatic cuff controller. Automatic Cuff control software must follow and compensate transient increase in alveolar pressure (eg cough). Automatic Cuff control software must also allow fixed pressure values in cuff. In case of cuff leakage alarm must be set. Ventilator must possibility to insert antibacterial, antiviral and antifungal filter at the inspiratory and expiratory outlet/hosing. Introducing inspiratory and expiratory antibacterial, antiviral and antifungal filter in breathing circuit should not interfere with ventilatory performance/breath delivery and expiration. Inspiratory and expiratory valves/ cassettes must be reusable and allow multiple sterilization processes.
4	**Respiratory mechanics, inspiratory gasses humidification, exhaustion and inhlatory medication**
4.1	End Inspiraotry and End Expiratory hold must be configured. After performing both inspiraotry and expiratory maneuver values for compliance, time constant, plato pressure, total/autoPEEP must be displayed.
4.2	Automatic recruitment software must be integrated in the ventilator
4.3	Software for optimal PEEP (individualization) setting must be integrated
4.4	Active humidifier with automatically controlled heating in inspiratory and expiratory hosing must be supplied with ventilator.
4.5	Expiratory orifice must allow therapeutic gasses scavenging (volatile anesthetics, iNO, nitric (IV) oxyde) via carbon scavenger capsule or central hospital scavenging system
4.6	Quartz crystal based inhalation device for inhalation of medication must be integrated in ventilator (Treatment with beta agonist, inhaled antibiotics, antimycotics etc.)
5	**Alarms**
5.1	Alarm history for last 24 hrs should be displayed
5.2	Apnea alarm, alarms during disconnection or inspiratory/expiratory flow block
5.3	Techncal alarms: batery empty, no electicity, low pressure in gass circuit, low/high FiO_2
5.4	Adjustable alarms for - low and high inspiratory alveolar pressure - low and high expiratory tidal volume (Vt) - low and high expiratory minute ventilation - low and high respiratory rate
6	**Medica gasses**

6.1	Central high pressure (hospital) oxygen outlet with adequte DIN connectors. Ventilator must use ambient air as an air source - use in working areas where no high pressure air outlet is available.
6.2	Slovene sockets/electrical power compatible (220V) and use of internal batery. Batery must supply for at least 1 (one) hour of operation.
7	**Display**
7.1	Color display with: - touch screen technology only - with no knobs, buttons or rotatory elements in order to minimize cross contamination - minimally 12 inch diagonal display - clearly visible set and measured values - possibility of separate screen mounting - separate screen must be “touch screen” and allow ventilatory settings change - screen lock to prevent unwanted changes (eg during cleaning/desinfection) - display must be be easily cleaned and desinfected
7.2	Connection to printer, computer, USB, hospital information system via minimum 2 RS 232 connectors.
8	**Accessories:**
8.1	Gurney with brakes and arm supporting breathing circuit. Gurney must have inbuilt carrier for 2 additional gas tanks for intrahospital transport.
8.3	Active heating - **4.4**
8.4	Ventilator must be compatible with ventilator hosing already in use in University Medical Center Ljubljana hospital. Inhalation units must be compatible with hosing already in use in University Medical Center Ljubljana hospital.
9	**Additional requirements**
9.1.	User manual in Slovene language. Medical personnel training (physicians, nurses) and hospital engineers/service staff training.
9.2.	24/7/365 maintenance and hotline must be guaranteed by the ventilator selling company. In case of ventilator disfunction immediate supply of the same ventilator must be guaranteed. During regular service company must supply substitute/spare ventilator.