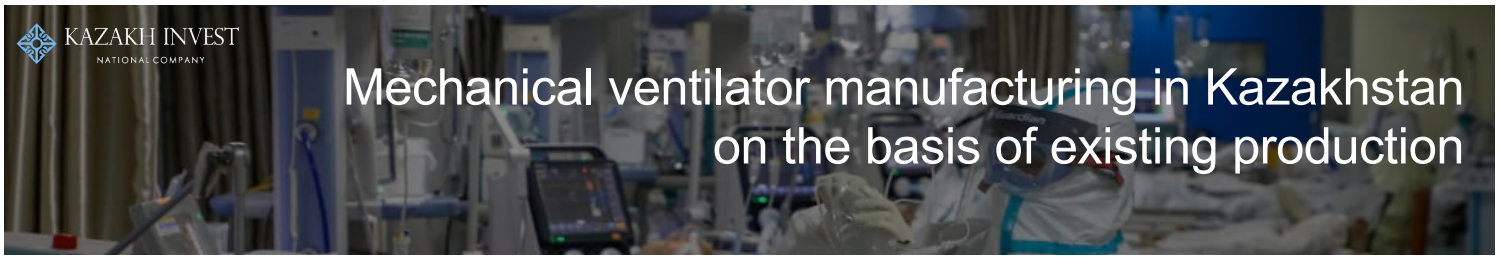
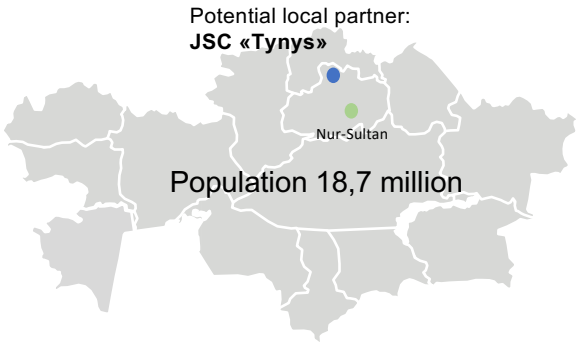


Mechanical ventilator manufacturing in Kazakhstan on the basis of existing production



Local partner provides ready production site, acquires equipment, technical documentation and CAPEX, as well as initial operational expenses (OPEX).
Strategic investment partner will be responsible for the production technology, technological documents, an engineering team, and local personnel education.
Also, establishment of service center and component part's localization at alternative facilities are required.

Market size:
Current ventilators import is about USD 25 million per year according to official sources. Demand for 2020 is at least 1,000 ventilators. Strong export potential to neighboring countries in Eurasian Economic Union and Central Asia. Government provides an offtake contract.

USD mln

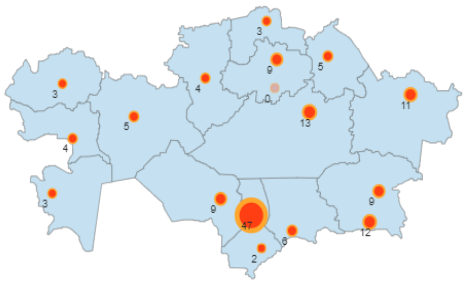
Current imports	2018	2019
Total	**28,4**	**23**
Germany	9,5	4,6
Switzerland	8,3	8,9
China	1,9	2,4
England	1,8	2
USA	1,8	1,7
Others	5,1	3,4

Component part's localization and alternative sites for production and service center:
There are several existing production facilities that have the required competence in production and localization of certain components for ventilators manufacturing:
rubber products, sanitized rooms, laboratories and testing sites are used in aerospace industry, powerful 3D printers (polymers, steel, titan, aluminum), the manufacturing of 20-layer PCBs, medical equipment, and other electronic components.

Technical requirements:
Detailed technical requirements are presented in the appendix.

Production capacity:
Existing ventilator production capacity is available on the basis national company JSC "Tynys" (https://tynys.info/en/ao-tynys/).

Healthcare indicators:
The number of hospital beds ~100 thousand
The number of healthcare organizations: 145



«Plant n.a. S.M. Kirov» JSC (Petropavlovsk) - manufacturing of communication tools, electronics.
«Kazakhstan Aselsan Engineering» LLP (Nur-Sultan) – manufacturing of PSB, optics, testing laboratories.
«Galam» LLP (Nur-Sultan) – it specializes in space technology, has modern facilities, "clean" rooms, a 3D printer, laboratory and testing capabilities;
«Delta-IT» JSC (Almaty) – it specialized in the production of communications, has modern equipment for the production of circuit boards;
«Kazmedpribor» LLP (Shymkent) - manufacturer of medical equipment, has a European certificate of quality.
«HIMAX» LLP (Pavlodar) – the production of plastic medical products. It has a fleet of modern injection machines that allow thin-walled products to be cast, as well as a line for individual packaging and a line for sterilization with ethylene oxide.
«Clever Medical» LLP (Almaty) – it produces medical angiographic sets, planned to establish the production of catheters. Has certification of premises.
«JULDYZ KENAN Co.,LTD» LLP (Almaty) – produces single-use medical devices (catheters, hoses, etc.).

Specifications for ventilators required by the Ministry of Health of the Republic of Kazakhstan

1	General characteristics:	Comments:
1.2	The device is designed for continuous controlled artificial ventilation of the lungs in adults and children in a hospital.	Required
2	Specifications:	
2.1	type of drive	pneumatic from compressor and / or turbine
2.2	Power supply	100 to 240 VAC ±10%, 50/60 Ghz
2.3	Battery operation	not less than 60 min
3	Gas Requirements:	
3.1	Gas supply	The device requires an oxygen connection, while air is supplied through the turbine
3.2	Gas supply (oxygen / air), in the range:	
3.3	Minimum value	not above 2,8 bar
3.4	Maximum value	not less than 6 bar
3.5	Inspiratory flow rate control mechanism	automatic
4	Display:	
4.1	Display dimension	not less than 12"
4.2	Touch screen fucntion	Required
4.3	Control should be carried out both using the touch screen and using the rotary-push device (encoder), as well as using additional functional quick access buttons.	Required
4.5	Russian interface	Required
5	Monitoring requirements:	
5.1	The device should be equipped with intelligent monitoring with graphic visualization of the main indicators that reflect in real time the ventilation process, the state of respiratory mechanics.	Required
5.2	Visual display of the state of pulmonary mechanics in the form of an image of a picture of the lungs. The image (shape) of the lungs should change with a change in lung compliance or airway resistance in real time, as well as with the appearance of spontaneous breaths in the patient.	Required
5.3	The function of visual graphic display of the degree of readiness of the patient for excommunication from ALV.	Required

6	ALV Modes and Methods:	
6.1	Volume controlled (VC)	Required
6.2	Pressure controlled (PC)	Required
6.3	Pressure supported (PS)	Required
6.4	Ventilation with "release" of airway pressure.	Required
6.5	Non-invasive ventilation	Required
6.6	High Flow O2 mode, high air-oxygen mixture flow	Required
7	Special ventilation modes and functions:	
7.1	Ventilation with two-phase positive airway pressure	Required
7.2	Ventilation with "release" of airway pressure	Required
7.3	Intelligent ventilation mode with passive and spontaneous breathing for adult patients and pediatric patients. Automatic ventilation control based on respiratory activity and mechanics and lung protection strategies	Required
7.4	Regeneration of the tracheobronchial tree with oxygenation of 100% oxygen.	Required
7.5	Automatic backup ventilation in cases of apnea by pressure and volume	Required
7.6	Ability to select backup ventilation parameters	Required
7.7	Automatic return to support modes when recovering spontaneous breathing	Required
7.8	Function of automatic self-testing of the device before connecting with calibration of sensors	Required
8.8	Functionality Requirements:	
8.1	Leak compensation function	Required
8.2	Endotracheal / tracheostomy tube resistance compensation function	Required
8.3	Sanitation of the tracheobronchial tree	Required
8.4	Print screen function	Required
8.5	Built-in nebulizer or port for connecting a nebulizer	Required
9	Flow Measurement Requirements:	
9.1	Structurally, the apparatus should ensure the operation of the apparatus with an external (proximal to the patient) flow sensor, which should provide better synchronization with the patient, and higher measurement accuracy.	Required
10	Special Functions:	
10.1	Automatically proposed selection of initial ventilation parameters taking into account the ideal patient weight	Required

10.2	**Automatically determine ideal weight when entering patient height and gender**	**Required**
10.3	Retrofit with new options and software versions	Required
11	Ventilation Parameters:	
11.1	Tidal volume	
11.2	Minimal volume	Not more than 20 ml
11.3	Maximum value	Not less than 2000 ml
11.4	Breathing rate	
11.5	Minimal volume	Not more 1 breath/min.
11.6	Maximum value	Not less than 120 breath/min.
11.7	Maximum Inspiratory Flow	Не менее: 150 l/min
11.8	PEEP / CPAP	от 0 до 45 cmH2O
11.9	Sensitivity Streaming Trigger Range	0.5 - 15 l/min
12	Patient Monitoring:	
12.1	The curves	Not less than 4
12.2	hinges	Not less than 2
12.3	Reference loop function	Required
12.4	Trends	trend data for at least 3 days for the selected parameter or combination of parameters
12.5	Developments	Not less than 1000
13	Parameter monitoring:	
13.1	Pressure:	
13.2	Peak airway pressure: Ppeak (cmH2O)	Required
13.3	Plateau or end-inspiratory pressure: Pplateau (cmH2O)	Required
13.4	Mean airway pressure: Pmean (cmH2O)	Required
13.6	PEEP (positive pressure at the end of expiration) and CPAP (constant positive airway pressure): PEEP / CPAP (cmH2O)	Required
13.6	Speed:	
13.7	peak expiratory flow: Exp Flow (l/min)	Required
13.8	Maximum inspiratory rate: Insp Flow (l/min)	Required
13.9	Volume:	
13.10	Expiratory flow: VTE (ml)	Required
13.11	Respiratory flow: VTI (ml)	Required
13.12	Minute expiratory volume: ExpMinVol (l/min)	Required
13.13	Spontaneous minute expiratory volume: MVSpont (l/min)	Required
13.14	Leakage rate: VLeak (ml) или Vleak (%) или MVLeak (l/min)	Required
13.15	Time / frequency:	
13.16	Inhalation to Exhalation Ratio: I:E	Required

13.17	Total respiratory rate: fTotal (b/min)	Required
13.18	Spontaneous respiration rate: fSpont (b/min)	Required
13.19	Inspiratory time: TI (s)	Required
13.21	Lung mechanics:	
13.20	Static match: Cstat (ml/cmH2O)	Required
13.21	Airway occlusion pressure: P0.1 (cmH2O)	Required
13.22	Product time pressure: PTP (cmH2O*s)	Required
13.23	Constant (constant) expiratory time: RCexp (s)	Required
13.25	Oxygen:	
13.26	The concentration of oxygen in the delivered gas	Required
13.27	CO_2:	
13.28	Fractional end-expiratory CO_2 concentration: FetCO_2 (%)	Required
13.29	CO_2 pressure at the end of exhalation: PetCO_2 (mmHg)	Required
13.30	CO_2 elimination: V'CO_2 (ml/min)	Required
14	Alarms:	
14.1	360º alarm light visibility	Required
14.2	Alarm Priorities	Not less than 3 levels
15	Humidifier and circuit requirements:	
15.1	The reusable circuit must be pre-assembled and ready for use.	Required
15.2	Heated circuit, all-in-one design	Required
15.3	Integrated temperature sensor	Required
15.4	Humidifier Warm Up Time	Not more than 30 min
15.5	The established parameters of temperature and humidity	Required
16	Equipment	
16.1	Base unit	Required
16.2	Mobile trolley with wheels (with brakes)	Required
16.3	Compressor	Required
16.4	High pressure hose for air	Required
16.5	High pressure hose for oxygen	Required
16.6	Reusable circuit for adults / children	Required
16.7	Circuit holder	Required
16.8	Streaming sensors (adult / child, at least 10 units)	Required
16.9	Expiratory valve assembly	Required
16.10	Oxygen sensor	Required
16.11	Humidifier	Required
16.12	Capnographic sensor with adapter	Required
16.13	A set of nasal cannulas for High-flow oxygen therapy (at least 3 sizes)	Required