TH-1(A) Ventilator

Operation Manual
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1. Preface
Thanks for your purchasing our company’s product. Please read carefully the Manual before begin to use this machine so that to guarantee the safety and reliability when using.
This Manual contains in detail the major performance and technical regulations of the ventilator, as well as the responsibility that the User and Manufacturer should undertake.

1.1 Attention Items
1.1.1 The ventilator have to be operated by professional anesthetist, and work together with an anaesthetic breathing system in accordance with ISO 8835-2, and an anaesthetic gas scavenging transfer and receiving system in accordance with ISO 8835-3.
1.1.2 The user has to read carefully the Manual for Ventilator before and follow closely the application procedure provided in this Manual.
1.1.3 The safety requirements about clinical usage have been well considered in designing Ventilator, but it is non-neglectful for user to observe the status of machine and nurses the patients.
1.1.4 The connection of Ventilator and anaesthetic system and gas scavenging transfer and receiving system, see the last Clause for details.
1.1.5 Because of this machine don’t use Ethyl and Cyclopropane etc as flammable anesthetic agent, don’t need antistatic respiratory pipelines and face masks.
1.1.6 When using high frequency electrical surgical equipment, antistatic or conductive respiratory pipelines will likely burn, so it isn’t suggested to use that unit.
1.1.7 The measured value of this System is achieved under STPD(standard temperature pressure dry).
1.1.8 The foldable airbag and reusable parts which contacted with patients, before use them on new patient, must sterilize or disinfect them.
1.1.9 When using this System, wasted gas will arouse, there is exhaust port beside bellows, then connect exhaust port to outdoor so as to avoid room pollution.
1.1.10 When anesthetic gas delivery system stops delivering gas, medical gas pipelines pressure is ≤0.3kpa.
1.1.11 Central supply gas system malfunction will possibly lead to one and more units that work together with it stop working at same time.
1.1.12 Before use this System each time, should check the airtightness, soda lime performance, ventilator, sterilization, etc.
1.1.13 It is the responsibility of user to provide the in-service condition to our company or distribution agency.
1.1.14 Disposal parts should be dealt according to relative regulations of local environment protection, so as to minimize the pollution risk.

1.2 Responsibilities of Manufacturer
Manufacturer provides for clients the qualified ventilator according to standard ISO 8835-5 (Inhalation anesthetic system - Part 5: Anaesthetic Ventilator) of {Medical electrical equipement-Part 2: Particular requirements for the safety and essential performance of anaesthetic systems} which is published by State Food and Drug Administration in July 25, 2007.

Manufacturer /local agent should guarantee the maintenance service of Ventilator within warranty period according to the requirements in contract.

Warning: The ventilator should use our company’s original equipment parts for repair or replacement.
1.3 Product registration informations

Manufacturer Permit Number: BJYJX 20030084

Product Registration No.: GSYJX (S) 3540265, 2007

Product Standard No.: GB-9706.29-2006 ISO 8835-5

1.4 Symbols meaning on this Manual or System

Warning and Cautions means possible accidents will arouse if operation don’t meet this Manual. Please strictly follow this Manual.

**“Warning”**: means it may harm operator or patient.

**“Cautions”**: means it may damage equipments.

**“Note”**: Additional informations, or suggestions, etc.

Other symbols are including as below:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
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<tbody>
<tr>
<td>ON (power)</td>
<td>Earthing</td>
</tr>
<tr>
<td>OFF (power)</td>
<td>Frame Grounding</td>
</tr>
<tr>
<td>STANDBY</td>
<td>Protective Earthing</td>
</tr>
<tr>
<td>STANDBY for some parts</td>
<td>Equal Voltage</td>
</tr>
<tr>
<td>Increase</td>
<td>Decreasing</td>
</tr>
<tr>
<td>DC Current</td>
<td>Increasing</td>
</tr>
<tr>
<td>AC Current</td>
<td>B Type Machine</td>
</tr>
<tr>
<td>Alarm Silence</td>
<td>BF Type Machine</td>
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<tr>
<td>Note, Refer to Manual</td>
<td>CF Type Machine</td>
</tr>
<tr>
<td>Input</td>
<td>Machine Control</td>
</tr>
<tr>
<td>Output</td>
<td>Inspiration Flow</td>
</tr>
<tr>
<td>Serial Number</td>
<td>Expiration Flow</td>
</tr>
<tr>
<td>Manual airbag</td>
<td>Audio alarm silenced</td>
</tr>
<tr>
<td>Single way movement</td>
<td>Rechargeable battery</td>
</tr>
<tr>
<td>Both way movement</td>
<td>Fuse</td>
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</table>
2. Construction and Principle

2.1 Main components

The Ventilator is a respiratory management system used at general full anesthetic operation. It mainly consists of power, gas supply, bellows, control panel, CPU board, frame etc. See Figure 2-1.

![Diagram of Ventilator Components](image)

**Figure 2-1**

2.2 Electrical controlled parts:

Electrical controlled parts includes: Power, CPU board, control panel, flow sensor, etc. Among it, CPU board could be used to monitor Tidal Volume, Minute Ventilation, and to set parameter- Respiratory Frequency, lE, Tidal volume upper / lower limit alarm, Minute ventilation upper / lower limit alarm. The respiration pattern could be: machine control, manual breathing pattern.

2.3 Bellows:

In inspiration status, driving gas will enter bellow and foldable airbag, and drive the airbag down. At the same time, PEEP valve and driving gas work together make the exhaust port keep close status, so as to let gas flow to bellow output port, and enter into patient lung.

In expiration status, driving gas will stop working, patient will exhale gas inside lung and make it enter into foldable airbag. When pressure within airbag exceed limited value, PEEP valve will automatically open, one part of gas will flow to exhaust port, while when pressure is lower than limited value, PEEP valve will automatically close.
The peak pressure protection valve will keep the airway pressure not exceed limited value 6 Kpa.

2.4 Gas supply pipelines

The driving gas ( Oxygen, Air etc.) enters into ventilator through driving gas input, after pressure reducing ( 0.4 Mpa), enter into supply gas source ( there is a pressure-limiting device in this gas supply unit), then solenoid valve, tidal volume valve, driving gas valve etc. finally reach driving gas output, and cooperated with solenoid valve and tidal volume valve, produce respiratory process.

3. Usage

The Ventilator is newly developed portable unit, suitable for respiratory management of full anesthetic condition. Light, small, movable, for patient of more than 10 kgs, min. tidal volume could be controlled at 100ml or so. It can work together with anesthetistic system and perform tightly closed, semi-tightly closed and open respiratory management.

4. Operation

4.1 Installation of main unit ( see Figure 4-1-1-1 )

4.1.1 Connecting with portable Anesthesia Machine

1) Please well prepare the soft tubes, corrugated pipelines, and flow sensor.
2) Refer to Table 4-1-1 and Figure 4-1-1 for pipelines connection.

<table>
<thead>
<tr>
<th>Table 4-1-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting Ends</td>
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<tr>
<td>Driving gas supply pipelines</td>
</tr>
<tr>
<td>Pressure sampling pipelines (PU tube 4x6)</td>
</tr>
<tr>
<td>Corrugated Soft Tube (Φ15X300)</td>
</tr>
<tr>
<td>Corrugated Soft Tube (Φ22X900)</td>
</tr>
<tr>
<td>Flow Sensor</td>
</tr>
</tbody>
</table>
Figure 4-1-1 (g)

Figure 4-1-1 (h)

Figure 4-1-1 (i)

Figure 4-1-1 Gas Pipelines Connection
### 4.1.2 Connecting with Anesthesia Machine Aries 2700

1) Please well prepare the soft tubes, corrugated pipelines, and flow sensor.

2) Refer to Table 4-1-2 and Figure 4-1-2 for pipelines connection.

#### Table 4-1-2

<table>
<thead>
<tr>
<th>Connecting Ends</th>
<th>Gas Supply</th>
<th>Ventilator</th>
<th>Bellows</th>
<th>Anesthesia Machine/Breathing Circuit</th>
<th>Reference Pictures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving gas supply pipelines</td>
<td>Driving gas</td>
<td>Driving gas input</td>
<td></td>
<td></td>
<td>Figure 4-1-2(a)</td>
</tr>
<tr>
<td>Corrugated Soft Tube (Φ 15X300)</td>
<td></td>
<td>Driving gas outlet</td>
<td>Driving gas inlet of bellow</td>
<td></td>
<td>Figure 4-1-2(e)</td>
</tr>
<tr>
<td>Corrugated Soft Tube (Φ 22X900)</td>
<td></td>
<td>Connecting with breathing circuit</td>
<td></td>
<td>Breathing Circuit Machine controlled gas inlet</td>
<td>Figure 4-1-2(c)</td>
</tr>
<tr>
<td>Pressure sampling pipelines</td>
<td></td>
<td>Pressure Sampling Connector</td>
<td></td>
<td>Airway pressure sampling connector</td>
<td>Figure 4-1-2(g)</td>
</tr>
<tr>
<td>(PU tube 4x6)</td>
<td></td>
<td>Flow sensor connector</td>
<td></td>
<td>Respiratory Connector</td>
<td>Figure 4-1-2(h)</td>
</tr>
</tbody>
</table>

![Figure 4-1-2 (a)](image1)

![Figure 4-1-2 (a)](image2)
4.1.3 Installation of Ventilator TH-1 (A)

1) Fix the tray on the block of the frame with 4 pcs M6 x9 bolts, refer to Figure 4-1-3 (a).

2) Take up bellow, push the bottom along with the channel, refer to Figure 4-1-3(b).
3) Fix the bellows with 2 Pcs M4 x 8 bolts, refer to Figure 4-1-3(c).

4) Put the ventilator on the support plate, and fix the ventilator with M8 x 35 bolt, refer to Figure 4-1-3 (b), Figure 4-1-3(e).
4.2 Ventilator Front View (see Figure 4.2)
Please familiar the parts and functions before use.

4-2-1 Front view

1- Ventilator  2- Bellow  3- Control Panel  4- Bellow base  5-foothold
4.2.1 Ventilator: There are 4 bases under it and 2 fixing holes, which will be used to fix the ventilator with the trolley.
4.2.2 Bellows: It could exactly control tidal volume, so as to adjust PEEP because mechanical ventilation mode instead of manual.
4.2.3 Control panel: key part of ventilator, the monitor parameter and alarm parameter could be set on it. Also there is indication light and display.
4.2.4 One key part of ventilator, compounding with PEEP valve, peak pressure protection valve, etc. inside it.
4.2.5 Base cushion: 4 cushions, support the ventilator.

4.3 Ventilator Back View (see Figure 4.3)
Figure 4-3 Ventilator Back View

1- Power  2- Socket  3- Flow Sensor Connector  4- Driving gas input  5- Driving gas output
6- Pressure sampling interface  7- Bellow driving gas input  8- Exhaust port  9- connect with breathing circuit

4.3.1 Power: Turn on / off electricity

4.3.2 Socket: ventilator electricity supply, one wire will be connected with DC, one small device will be used to fix the wire and ventilator, so as to prevent wire drop off from ventilator.

4.3.3 Flow Sensor Connector: flow sensor will be connected with CPU board with this connector, then pass the signals to CPU, the figure will be shown on display.

4.3.4 Driving gas input: connect gas supply (central supply, oxygen cylinder, air compressor, etc. ) with this port through hose, or connect driving gas output of anesthesia machine gas delivery system with this port through hose.

4.3.5 Driving gas output: ventilator will change gas supply to driving gas to drive bellow, then connect with bellow driving gas input, and finish respiratory process.

4.3.6 Pressure sampling interface: The pressure sampling interface connect pressure sampling port of the anesthesia machine respiratory circuit (see Figure 5-3) through an inner diameter $\Phi 6$ (mm) of hose. Acquisition pressure signal transmitted to the pressure sensor.

4.3.7 Bellow driving gas input: connect with ventilator driving gas output, provid driving gas for bellows.

4.3.8 Exhaust port: wasted gas will be drained out through this port. This port could be connected with purifiered device or other pipelines to drain the wasted gas outside operation room.

4.3.9 Connect with breathing circuit: ventilator will be connected with IPPV connector of breathing circuit of anesthesia machine, then finish machine controlled respiratory management.

Note: If connect this port with Portable Anesthesia Machine, then this port could be connected with IPPV connector directly. IPPV input of Portable anesthesia machine and Manual airbag connector is same one.
4.4 Bellows

4.4.1 Bellow refer to Figure 4-4-1

![Figure 4-4-1 Bellows](image)

Figure 4-4-1 Bellows

1-Bellow cover  2-Foldable bag  3-Connector for breathing circuit  
4-Exhaust port  5- Driving gas inlet of bellows 6- Pediatric foldable bag 7- Pediatric cover

1) ![Bellow Cover](image)  Bellow Cover: there is Tidal Volume scale line on it. Clockwise rotate to lock tightly the cover, 
counterclockwisely rotate to open the cover, refer Figure 4-4-1(a), 4-4-1(b).

2) Adult foldable bag: the descended portion each time is the tidal volume of patient at each breath. The tidal volume
can be read by observing the bellow scale. You can also observe the obstruction of airway and the leakage of breathing circuit, such as you should check out if there is air leakage in breathing circuit if it descends too fast or is incapable of ascending. When change the Airbag, need to take the Airbag down with hand, refer to Figure 4-4-1(c).

3) Connecting with breathing circuit: connect 1 piece corrugated pipeline with manual airbag connector, outside diameter: 22mm.

4) Exhaust port: drain out the wasted gas to outside room, outside diameter: 30mm.

5) Driving gas inlet of bellows: by this port, connect 1 piece corrugated pipeline with driving gas outlet at the back of anesthesia machine, outside 15mm, refer to Figure to Figure 4-4-1(e).

6) Pediatric foldable bag: the descended portion each time is the tidal volume of patient at each breath. The tidal volume can be read by observing the bellow scale. The bellow scale can be used base reference value, and compare it with the monitored figure on the display, the base reference figure and monitored figure should be basically same. You can also observe the obstruction of airway and the leakage of breathing circuit, such as you should check out if there is air leakage in breathing circuit if it descends too fast or is incapable of ascending. When change the Airbag, need to take the pediatric Airbag down with hand, refer to Figure 4-4-1(f).

7) Pediatric bellow cover: there is Tidal Volume scale line on it. The range is 0-300ml. Pull the cover vertically with two hands, refer to Figure 4-4-1 (g).

**Note:**

1) Big foldable bag could work together with big cover, small bag with small cover.

   When use big foldable bag and big cover, small bag and small cover has to be get off.

2) When use small foldable bag and cover, the figure is based on what is displayed on small cover.
4.4.2 Bellow Principle and Construction

**Figure 4-4-2(a) Bellow Construction**

1-Various PEEP valve  2-Adult foldable airbag base  3-Bellow Cover  
4-Pediatrics foldable airbag base  5- Pediatric foldable airbag  6- Adult foldable airbag cover  
7- Adult foldable airbag  8-Pediatric foldable airbag cover  9- Peak pressure protection valve

**Figure 4-4-2(b) Bellow Principle**

**Peak Pressure Protection Valve Function:**

When the bellow pressure is larger than regulated figure, the flake inside peak pressure protection valve will open and drain out extra gas, so as to reduce the pressure inside the bellow and protect bellow.
Working principle: (refer to Figure 4-4-2(b))

1) Firstly, charge the Bellow airbag by pressure O₂ flush on the portable machine, and make the bellow airbag to the top.

2) The gas will enter into the ventilator by pipelines, then into the bellow airbag, the gas will press the foldable airbag down. At the same time, the gas will affect peak pressure protection valve and PEEP valve, and perform peak pressure protection and make sure PEEP valve in good seal status.

3) Bellow foldable airbag up and down, repeatedly, and cooperate with anesthesia machine and provide driving gas to breathing circuit.

4.4.3 PEEP Valve

![Figure 4-4-3(a) PEEP Valve Construction](image)

1- Base  2- Top Cover  3- Inside construction  4- Valve flake  5- Base for spring  
6- O Seal Ring  7- Spring Cover  8- Screws for adjustment  9- Gasket  10- Spring

**PEEP Valve Functions:**

When the gas inside the bellow foldable airbag is more, and the inside pressure is larger than regulated figure, the PEEP valve will lower, the extra gas will be drained out by exhausted outlet, and protect the bellow.

![PEEP Valve](image)  ![Inside Construction and O Seal Ring](image)
4.5 Control Panel (refer to Figure 4-5(a))

Figure 4-5 (a) Control Panel

4.5.1 ON/OFF
1. Connect the anesthesia machine with power.
2. Turn the power switch on the back of the anesthesia machine.
3. Press the ventilator power switch to start the machine.
4. Then press the power switch to close the machine.

4.5.2 Setting steps the conventional parameters:
1. Press the "MENU" button on the Control Panel, you will see the triangle cursor remaining the first "BPM" of setting key parameters. (Figure 4-5(b))
2. Press "+" or "-", key to select, will see the cursor move up or down.
3. When the cursor to the pre-set items, press "ENTER" button, see the cursor blinking on pre-set programs then enter the parameter setting condition.

![Figure 4-5 (b)](image_url)

4. Press "+" or "-" button, you will see the parameters increasing or decreasing. Its parameters will be switched in "IPPV / SIMV / MANUL" mode under the respiration.

5. When the parameters satisfy the requirements of the operator, press "ENTER" key to confirm, the setting parameters can take effect, then the cursor will stay automatically the next parameter; If you give up the setting, press "MENU" button, the parameter is invalid, the ventilator continue to maintain the original working state.

4.5.3 Shortcuts button of common functions Description:
1. MANUAL: Shortcuts button for manual respiration mode. Press the button, the display will pop up dialog box (Figure 4-5(c)) and ask the operator whether to enter manual mode, the default is "Y (yes)!", PRESS "+" or "-" key to switch option and the option will be in flashing state, then press "ENTER" key to confirm.
2. IPPV: Shortcuts button for mechanical respiration mode. Press this button, Ventilator will be in the state of machine ventilation.

3. SILENCE: Silence on / off setting button. SILENCE: Silence on / off setting button. Silent settings for pressure alarm, press the button several times, Silent settings in the "open" and "off" switch and show on the display. (Figure 4-5(d)).

4.5.4 Main feature description of different respiration mode:

1. IPPV (Machine control): In this mode, the ventilator will be in the state of setting BPM and I:E ratio, if at the same time open the SIGH function the ventilator will also carry out a sigh for each 100 respiratory cycles. The cycle is twice of the setting parameters. If the pressure exceeds set limits, then the corresponding limit will be flashing, intermittent buzzer alarm. Tidal volume (Vt) and minute ventilation (Ve) at the end of each week will be refresh, pressure (Pre) will appear at the end of each breathing cycle, inspiratory pressure values and the value of end-expiratory pressure.
At the same time, pressure and tidal volume waveform will show real-time.

2. SIMV (Synchronous mode): In this mode, the synchronous trigger pressure and the limited intake pressure parameters will be involved in the work of the ventilator. In the inspiratory phase, if the pressure reach or higher than the inlet pressure limit, stop inspiration and enter into inspiration pause. Expiratory phase, complete the setting expiratory time, if pressure is less than or equal to the synchronous trigger pressure, then the ventilator run to the next inspiratory phase of respiratory cycle. If at the same time open the SIGH function the ventilator will also carry out a sigh for each 100 respiratory cycles. The cycle is twice of the setting parameters. If the pressure exceeds set limits, then the corresponding limit will be flashing, intermittent buzzer alarm. Tidal volume (VT) and minute ventilation (Ve) at the end of each week will be refreshed, pressure (Pep) will appear at the end of each breathing cycle, inspiratory pressure values and the value of end-expiratory pressure. At the same time, pressure and tidal volume waveform will show real-time.

3. Protect of Synchronous mode: synchronous mode of protection: in the inspiratory phase, if the airway pressure has not reached the limited pressure of intake, then the inspiratory time to reach setting and stop to the inspiration. Expiratory phase, after expiratory time completed, if airway pressure is always higher than the synchronous trigger pressure, then continue to maintain tidal ventilator state of hold time for the inspiratory time settings of 1.5 times, and then into The new suction state.

4. Manual mode: In this mode, Ventilator can judge the running state by detecting the flow, gas flow rate by detecting the airway to determine the stage of respiration, in addition to real time display of pressure waveforms, tidal volume waveforms, tidal value, pressure value as well as pressure Limit Alarm outside, when in the first 30 seconds, 30 seconds, the ventilator would be first display respiratory and minite ventilation, then in the second 30 seconds 60 seconds corresponding to the time of respiratory frequency and minute ventilation were second flush, and then a refresh every 20 seconds until the exit the manual mode.

4.5 Use of tidal volume knob
Clockwise or counterclockwise rotating tidal volume tidal volume knob can adjust the volume of TV.

Note: 1. Each start machine, the machine will give a set of default data: BPM "15 bpm / min; input pressure limit: 40cmH₂O;
Pressure upper limit: 40cmH₂O; Pressure lower limit: 0cmH₂O;
2. Regulate a variety of data, only the cursor being in the blinking state, be regulated;
3. Synchronous respiratory mode, tidal volume waveform display and Sigh functions can be showed only after the product upgraded. The option "UPGRADE" is the option to be upgraded.
4. Under Manual mode, does not affect the parameters set of mechanical and synchronous respiratory mode, if change the respiratory parameters under this mode, then the new parameters will be effected in the next

4.6 Battery installation
Considering of the airline limit if the goods shipped by Air, the Lithium battery can`t shipped together with the unit, the battery has to independent with the unit. So, the client have to install the battery when they get the goods. The operation steps are as below:

1) Take off the bellow: Firstly, screw off the the bolts that are used to fix the bellow. With suitable force to pull backwardly the bellow, refer to Figure 4-6(a), (b).
2) Take off the shell, get the 6 pcs bolts down, put the shell aside, refer to Figure 4-6(c), (d).

Figure 4-6 (c)

3) Open the back cover, take off the 2 pcs fixing bolts of pressure regulator, cut off the gas supply connector in the entrance of pressure regulator. Put the pressure regulator outside the machine, refer to Figure 4-6(e), (f), (g).

Figure 4-6 (d)

Figure 4-6 (e)
Figure 4-6 (f)

Cut off tube

Figure 4-6 (g)
4) Forth, cut off the connection pipeline with driving gas valves, and with suitable force to pull it out, refer to Figure 4-6(h), (i).

![Figure 4-6 (h)](image-url)

Cut off tube

![Figure 4-6 (i)](image-url)

Pull the Valves out

5) Fifth, screw off the fixing bolts of battery, forcibly take up the pressing plate, well connect the wires, insert the pressing plate, and screw on the fixing bolts.

**Caution: the wire connection must be correct, refer to Figure (j), (k),(l).**

There is only one connector with battery, the connector end is Black. The connection wires are 1 Yellow color and 1 Black color.
6) After well fixed the battery, back the steps above-mentioned. Then start the machine.

5. Cleaning and sterilization

The cleaning and sterilization should be performed based on sterilization conditions of each hospital and the methods specifically mentioned in this section.

5.1 Surface cleaning and sterilization

Clean the bedplate and surface of ventilator using wiping cloth soaked with water-soluble detergent sanitizer. Note that the detergent sanitizer should be prevented to go inside of the ventilator; never use organic solvent; the preparation of detergent sanitizer should be performed according to the requirements of its manufacturer.

5.2 Flow sensor cleaning

The flow sensor is precise and easily wearable spare part, after fall down or over dirty, please clean with wiping cloth soaked with water-soluble detergent sanitizer.

5.3 Cleaning and sterilization of respiratory pipelines

After each patient use, wash them with soapy water, and put them in 1:2000 or 0.05% iodine solution 30 minutes, then wash with clean water and dry in the air for further use; or steam disinfection in steam sterilization chamber or immerse them into 70% alcohol solution 30 minutes.

5.4 Replace respiratory pipelines

Users can replace the breathing tube according to the actual situation to ensure no leakage.

5.5 Cleaning and sterilizer of rubber threaded pipe and manual airbag

Every used rubber threaded pipe and manual airbag must be firstly washed carefully and then put them in a steam sterilization chamber after being dried in the air or sterilize with the appropriate method for medical rubber products.
Note: Don't sterilize with ultraviolet rays, so as to shorten the service life of rubber products.

5.6 Cleaning and sterilization of spare parts of bellows

5.6.1 Cleaning
Assistant fix the bellows base, then the operator hand grip bellows cover, left or right rotation, bottom lock will be separate. put up light and you can remove bellows cover. Removed the fixed folding bag at the edge of bellows, Removed the fixed folding bag at the edge of bellows. put it into hot water blended with non-enzyme detergent for rubber and plastic. Reuse it using clean hot water and airing. Do not soak it longer than 15 minutes. Then wash it with clean hot water, and dry off.

Note: Please spread foldable airbag fully when dry it off to avoid conglutination

5.6.2 Sterilization
a) Sterilization after being used to ordinary patient
Brush it by soap water, and then use clean water to wash it several times, dry off, and then soak plastic parts and rubber parts in 70-80% alcohol for 30 minutes, take them out with tools of no bacteria, and put them in clean container. Sterilize them again before next time use. Metal parts and glass parts can be sterilized by high pressure steam. For example, at steam pressure of 1.05kg/cm², temperature can be raised to 121°C, and keep it for 15-20 minutes to kill most of the bacteria and germ.

b) Sterilization after being used to infectious patient
After being used to infectious patient, including phthisis, pulmonary abscess, cyanomycosis infection, lockjaw, gas gangrene, infectious, hepatitis, etc, all the parts and components of bellow must be sterilized completely by two steps: initial dispose and complete dispose.

1) Initial dispose
Deal with them according to insulation principles, leave all used parts and components of bellow in operation room, and take below steps after operation is finished:

Soak all bellow parts and components in hydroxybenzene solution of 1-5% for 30 minutes

2) If condition allowed, fumigate parts directly contact with patient with formaldehyde or ethylene epoxide, or by soak sterilization one by one. For parts used by patient of phthisis, soak them 30 minutes in 3% hydroxybenzene solution; for parts used by patient of lockjaw, soak them 30 minutes in 0.2% potassium permanganate; for parts used by patient of gas gangrene, soak them 60 minutes in 0.1% bromo-geramine, for parts used by patient of cyanomycosis infection, soak them 120 minutes in 0.1% bromo-geramine.

--After soaked, all parts and components should be taken out and washed by clean water repeatedly, dry off for future use.

--For part not directly contact with patient, use soap water to wipe, wash repeatedly, and then irradiate with ultraviolet radiation for 30 minutes if necessary.

5.7 Cleaning and maintenance of ventilator

5.7.1 Installation of spare parts being cleaned and sterilized
After spare parts being cleaned and sterilized, eg respiratory pipelines, bellow parts, etc should be correctly installed again, no leakage, test run. Everything is OK, then use it on patient, especially gas-tightness test is very important.

5.7.2 Maintenance of bellows:

Warning: When machine is working on patient, any maintenance will not be allowed.
Check the machine every 30 days, so as to change or repair the broken parts on time. Checking contents are including: gas-tightness, foldable airbag, seal ring, crack on bellow cover, and other physical performance, etc.
Do not bend them. Be careful during cleaning, sterilization, and disassembly. Replace them in time if they are damaged.

6. Performance Parameter
6.1 Power: AC 220V, 50HZ or 110v, 60 Hz
6.2 Rated power: 25W
6.3 Works mode: IPPV, Manual
6.4 Respiration Mode: IPPV (Time control), MANUL, SIMV SIGH, DEMO
6.5 BPM: 3~65 bpm
6.6.l/E Ratio: 8:1,7:1, 6:1, 5:1, 4:1, 3:1, 2:1, 1:5:1, 1:1, 1:1.5, 1:2, 1:3,1:4,1:5,1:6,1:7,1:8
6.7.TV: 50~1600ml
6.8.TV Monitor :50~1600ml
6.9.MV Monitor:0~99.9L
6.10 Alarm Setting: High or low airway pressure alarm, Power failure alarm, Low oxygen alarm
6.11 PEEP:0-15 cmH2O

7. Troubles and Shooting

<table>
<thead>
<tr>
<th>Troubles</th>
<th>Causes</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Foldable Airbag can’t reach the top inside the bellow cover</td>
<td>PEEP valve is adjusted over low</td>
<td>Adjust high</td>
</tr>
<tr>
<td></td>
<td>Corrugated pipelines are broken or loosen in connection</td>
<td>Replace or well connect the pipelines again</td>
</tr>
<tr>
<td></td>
<td>Driving gas valve is stucked together with other device</td>
<td>Take down the valve and clean it with alcohol, then put it back</td>
</tr>
<tr>
<td>2. Foldable airbag incapable of ascending</td>
<td>Corrugated pipelines are broken or loosen in connection</td>
<td>Replace or well connect the pipelines again</td>
</tr>
<tr>
<td></td>
<td>Solenoid valve is broken</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>Driving gas valve is broken</td>
<td>Replace</td>
</tr>
<tr>
<td>3. No display figure of Ventilator</td>
<td>Power cable isn’t connected</td>
<td>Well connect</td>
</tr>
<tr>
<td></td>
<td>CPU board is broken</td>
<td>Replace</td>
</tr>
<tr>
<td>4. Tidal volume figure isn’t exact</td>
<td>Flow sensor isn’t in correct position</td>
<td>Correctly connect</td>
</tr>
<tr>
<td></td>
<td>The sensor hasn’t been calibrated for long time</td>
<td>Calibrate the flow sensor</td>
</tr>
<tr>
<td>5. Tidal volume isn’t being displayed</td>
<td>Flow sensor hasn’t been connected</td>
<td>Well connect flow sensor</td>
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<tr>
<td>--------------------------------------</td>
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</tr>
<tr>
<td></td>
<td>Flow sensor is broken</td>
<td>Replace</td>
</tr>
</tbody>
</table>

**8. Transportation and Storage**

The transportation or storage environment must not exceed below limits:
- Environment Temperature: -9~+35°C
- Relative humidity limits: 20%~60%
- Atmosphere pressure: 700~1060hPa

**9. Appendix**

**9.1 Installation of Trolley**

![Figure 9-1(a) Tray](image1)

![Figure 9-1(b) Fixing Plate](image2)

![Figure 9-1(c) Base](image3)

9.1.1 Tray: there are 4 holes on the tray, and match with the 4 holes on the fixing plate, then fix them with 4 pcs M5X8 bolts, refer to Figure 9-1(d).
9.1.2 Fixing plate: there are 4 holes on the trolley and match with the 4 holes on the fixing plate, then fix them with 4 pcs M8X16 bolts, refer to Figure 9-1(e).

9.1.3 Wheels Installation: the wheels are well fixed.

9.2 Installation of Anesthesia Machine and Ventilator

Figure 9-2 Total Unit Installation

1- Ventilator  2- Anesthesia Machine
9.2.1 Ventilator: on the left of tray. Fix the Ventilator with 1 big M8 bolt.

9.2.2 Anesthesia Machine: on the right of tray. There are fixing corrugated holes under the anesthesia machine, and fix it with the bolts together with the machine.