



Veterinary Anesthesia System



# Contents

User's responsibility	1
Symbols used in this manual or on this equipment	1
Intended use	5
Adaption disease	5
Contraindication	5
EMIC Information	5
Main structure, function and principle of system	10
System	10
Components included	10
Components excluded	10
Structure of the whole machine	11
Working principle	12
Flowmeter	13
Function	13
Structure	13
Anaesthetic vaporizer	
Anaesthetic breathing system	
Function	
Structure	14
Main control parts	
Oxygen liush valve	1/
System unving gas circuit	10 10
Gas supply	10 19
C2 Supply	10
Intaka filtar	10 10
Vontilation and manitar (antional)	10 10
Transfer and reactivity system of an anther the new second system. (antian all)	
Transfer and receiving system of anaestnetic gas scavenging system. (optional)	
Anestnesia ventilator	19
FUNCTION	
Connection port	20 20
Back papel of Ventilator	20 20
Dreparation	20
	Z I
Gas supply connection	21
Power supply	
Main power—AC mains	
stand-by power:	23
Main power supplyBack-up battery transition	
Low voltage of back-up battery	
Dispharae of back up bettery	ZJ
Discindige of the back up battery	
Installation or replace fuse	
Installation and arrangement of $CO_2$ absorbent	
Installation and liquid medicine perfusion of vaporizer	20 26
Installation	
Liquid medicine perfusion	
Connection of reservoir bag	27
Connection of breathing tube and sample tube of tidal volume	29
Installation and connection of anaesthetic gas scavenging system-transfer and receiving	system29

Installation and connection of respirartory gas monitor(optional)	30
Installation and operation of pressure regulator	30
	31
Check interval	
System check	32
Check power failure alarm	32 32
Gas supply check	32
l eakage check	
Oxvgen flush valve check	
Anaesthetic breathing system check	
Inhalation, exhalation flap check	
Leakage check	33
"APL" valve check	34
Breathing bellow check	34
Manual ventilation check	
	35
Apesthesia ventilator check	
Allerm function check	
Operation	
Start-up system	
Manual mode	
Enter manual mode	
Mechanical ventilation	
Setting of ventilation mode and parameters	40
Reset of alarm parameter	41
Reset of system setting	42
Operation of IPPV mode	44
Operation of A/C mode	45
Operation of SIMV mode	
Operation of apnea function	
Operation of SIGH function	48
Operation of key lock function	
Oxygen concentration (ontional)	
Oxygen flush valve	
Oxygen flow rate adjustment	
V <sub>r</sub> adjustment	
Anesthesia	51
Pressure limit adjustment and discharge of manual ventilation	51
Operation of anaesthetic gas scavenging system-transfer and receiving	
system(optional)	51
I ne end of use	52
Cleaning and disinfection	53
High pressure $O_2$ hose	53
Breathing tube, connection hoses, etc.	53
CO <sub>2</sub> absorber	54
Dismantle CO <sub>2</sub> absorber	54
After use of general animals	54
After use of infectious animals	
Installation of CU <sub>2</sub> absorber	
Initial and exhaustion valve	
Dismantle breathing bellow and buffer pocket	
ü	

Cleaning and disinfection	. 55
Install breathing bellow and buffer pocket	. 55
Equipment surface	. 55
Maintenance	55
Before everyday operation	. 56
After operation of every animal	56
When needed	56
When Assembling after washing and disinfection	56
Operation over 1200 hours or 6 months	. 56
Every year or operation over 2500 hours	56
Every two years or operation over 5000 hours	. 56
Waste disposal	.57
Disposal of battery	. 57
Disposal of electronic and plastic parts	.57
Scrap disposal of medical equipment	. 57
Alarm and disposal	58
Troubleshooting	63
Main technical specification	64
	04
Environment conditions	. 64
	.65
Gas supply	.00
FIOW Tale	.00
Flectromagnetism compatibility	60 . 66
Anaesthetic breathing system	.00
Anaesthetic das discharge port	67
Ventilation mode	67
Ventilation parameters	.67
Specification	. 67
Driven gas	68
Fresh gas compensation	.68
Ventilation parameter Monitoring	69
Monitoring equipment should be equipped in using	. 71
Installation, conveying and moving	.71
Storage and transportation	71
Storage	.71
Transportation	.71
Others	.72
Check list	72

# User's responsibility

- Anesthesia System in the following text is short for Veterinary Anesthesia System.
- Read the operation manual carefully and assemble, operate and maintain in strict accordance with instructions in this manual.
- Performance of safety for the equipment shall be checked before the equipment is started each time so as to ensure that the equipment is in sound operation condition in service. Please refer to "Pre-use check" section in this operation manual.
- The equipment is to be operated by trained and authorized medical personnel only.
- Parts which are damaged, missing, wearing, deformed or polluted, should be replaced immediately. If need to repair or replace, we recommend that you call or write to the recent company's customer service center for help.
- Don't make any change for the equipment unless authorized by our company. If any trouble occurred with the equipment, service shall be made by special technical personnel authorized by our Company or by trained and qualified technical personnel.
- If improper use, wrong maintenance and repairing, damage or changes made by any person not in our company lead to product faults, the responsibility will be taken by users.
- If necessary, please contact our company for further information.
- Keep the ventilator stable and balance during operation, transportation or move. The maximum tilt angle is not more than 10°.

#### **▲** Warning:

- Never use inflammable or explosive drugs with this equipment!
- The vaporizer only shall be filled with specified drugs. Never mix them up !
- Only vaporizers provided or designated by Anesthesia System manufacturer that are in match with the Anesthesia System shall be used. Otherwise, their performance will be degraded.
- Don't use antistatic breathing tube (threaded pipe) and mask with this equipment. If this kind of breathing tube and mask are used adjacent to HF electrical surgical equipment, it will lead to fire.
- The equipment shall not be used in a hazardous environment containing inflammable and explosive gases.
- The equipment shall not be used in the Nuclear Magnetic Resonance environment.
- When any alarm conditions occurred during operation, the equipment shall be checked and trouble be removed immediately.
- If alarm occurs in use, please ensure animal 's safety at first, then carry out fault diagnosis or necessary maintenance.
- If power supply is interrupted, manual vent should be immediately carried out.
- Although full consideration is given to clinic safety in the design of this equipment, its operator still shall not neglect the observation of operation conditions of the equipment and monitoring of animal. Only by so doing, any mistakes or functional abnormal may get corrected right away once occurred.
- Breathing tube shall be placed carefully so as not to enwind or asphyxiate the animal during operation.
- Moving or covering the equipment is not allowed during operation; nor is servicing of the equipment allowed. Do not maintain the machine during operation.

# Symbols used in this manual or on this equipment

" indicates "Follow instructions for use".

"  $\triangle$  **Warning**" and "  $\triangle$  **Caution**" indicate that dangerous conditions can occur if operation is not carried out as instructed in this operator's manual. Please read the manual carefully and pay attention to all warnings and cautions.

**Warning**: indicates that if operation is not carried out as instructed, injury to you or your animal and/or damage to the equipment can occur.

Caution: means there is a possibility of damage to the equipment or other property.

**Note**: indicates points of particular interest for more efficient and convenient operation.

Other symbols are used in this manual or on the equipment in order to replace words expressions. These symbols are included in the following Table A1.

#### Table A1 – Explanation for symbols used in this manual or on the equipment

Graphs & Symbols	Instructions	
8	Follow instructions for use	
~	Alternating current	
€	Gas inlet	
$\Box$	Gas outlet	
¢-	Reservoir bag	
	Ventilator	
•	Read the top point of the float.	
O <sub>2</sub> +	Oxygen flush valve	
Ò	Off	
$\odot$	On	
$\langle \langle \rangle$	Exhaust port	
Â	Audio Paused	
	Backup battery indicator	
4	Main power supply indication	
-	Backup battery supply indication	
	indicatin for low voltage of battery	
	Battery charging (main power is suppling) indication	
(L),	Protective earth	
$\bigtriangledown$	Equipotential terminal	
Ċ	Standby	

Graphs & Symbols	Instructions	
Q	Parameters setting	
	System setting	
A	Alarm setting	
!!!	High priority alarm	
!!	Medium priority alarm	

Terms and abbreviation in this manual or on this equipment:

Terms and Abbreviation	Explanation
IPPV	Intermittent positive pressure ventilation
A/C	Assistant/control ventilation

Terms and Abbreviation	Explanation			
SIMV	Synchronized intermittent mandatory ventilation			
Standby	Standby mode			
FiO <sub>2</sub>	O <sub>2</sub> concentration of inhalation			
MV	Minute Volume			
VT	Tidal Volume			
Freq	Frequency			
Ppeak	Airway peak pressure			
PEEP	Positive end-expiratory pressure			
С	Dynamic lung compliance			
l:E	Inhalation/exhalation ratio			
TiP	Holding time (Platform time and Inhalation platform)			
Sigh	Sigh frequency			
PTr	Pressure trigger			
FTr	Flow trigger			
Flow	Flow			
Pcon	Continuous airway pressure alarm			
Tapnea	Apnea time			
Paw—t	Waveform of airway pressure and time			
Flow—t	Waveform of flow and time			
O <sub>2</sub>	Oxygen			
BTPS	Body temperature and pressure-saturated			
bpm	Beat per minute (unit for frequency)			
S	Second (Unit for time)			
L	Liter (Unit for capability)			
L/min	Liter per minute (Unit for volume)			
DC	Direct current			
hPa	Hpa (Unit for pressure)			
kPa	kPa (Unit for pressure)			
MPa	MPa (Unit for pressure)			
cmH2O	Centimeter water column(Unit for pressure)			
V	Voltage (Unit for voltage)			
A	Ampere (Unit for current)			

Terms and Abbreviation	Explanation
Hz	HZ (Unit for frequency)
VA	VA (Unit for power)
db(A)	Decibel (Unit for noise)
°C	Celsius (Unit for temperature)

# Intended use

Anesthesia system is intended to provide general anesthesia to the animals as well as control animal's breathing or assist breathing, monitor and display ventilation parameters of animals in medical department.

# Adaption disease

All kinds of animals in need of anesthesia surgery.

# Contraindication

As to the anesthesia system there is no absolute contraindication. But the operator should pay attention to the relevant contraindication of mechanical ventilation and give appropriate dosage for animals with different diseases.

# **EMC** Information

## ▲ Important Notice

- BAM-8 Veterinary Anesthesia System meets the requirement of electromagnetic compatibility in IEC60601-1-2.
- The user needs to install and use according to electromagnetism compatibility information which is attached with it.
- Portable and mobile RF communication devices may influence BAM-8 performance, so BAM-8 should be kept away from them during using.
- Guidance and manufacturer's declaration stated in the appendix.

## **▲** Warning:

- BAM-8 Veterinary Anesthesia System should not be used adjacent to or stacked with other equipment and that if adjacent or stacked use is necessary, BAM-8 should be observed to verify normal operation in the configuration in which it will be used.
- Class A equipment is intended for use in an industrial environment. BAM-8 may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

#### Table 1

Guidance and manufacturer's declaration –electromagnetic emissions				
The BAM-8 Veterinary specified below. The or environment.	The BAM-8 Veterinary Anesthesia System is intended for use in the electromagnetic environment specified below. The customer or the user of the SECP-II should assure that it is used in such an environment			
Emissions test	Compliance Electromagnetic environment - guidance			
DE emissione		The DAM 9 years DE energy only for its internal		

Emissions lest	Compliance	Electromagnetic environment - guidance		
RF emissions CISPR 11	Group 1	The BAM-8 uses RF energy only for its inter function. Therefore, its RF emissions are very low are not likely to cause any interference in ner electronic equipment.		
RF emissions CISPR 11	Class B	The BAM-8 is suitable for use in all establishmer other than domestic and those directly connected to the suitable of the suit		
Harmonic emissions IEC 61000-3-2	Class B	public low-voltage power supply network that supplies buildings used for domestic purposes.		
Voltage fluctuations / flicker emissions IEC 61000-3-3	Complies			

Guidance and manufacturer's declaration – electromagnetic immunity			
The BAM-8 Veterinary Anesthesia System is intended for use in the electromagnetic environment			
specified below. The customer or the user of the BAM-8 should assure that it is used in such an environment			
Immunity test	IEC 60601 test	Compliance level	Electromagnetic environment –
			guidance
discharge (ESD)	±6 KV contact ±8 kV air	$\pm$ 6 kV contact $\pm$ 8 kV air	ceramic tile. If floors are covered with
			synthetic material, the relative humidity
IEC 61000-4-2			should be at least 30 %.
Electrical fast	±2 kV for power	±2 kV for power	Mains power quality should be that of a
transient/burst	supply lines	supply lines	typical commercial or hospital
Surge	± 1 kV line(s) to	± 1 kV line(s) to	Mains power quality should be that of a
	line(s) $(1 + 2) + (1 + 2$	line(s)	typical commercial or hospital
IEC 01000-4-5	$\pm 2$ kV line(s) to earth	$\pm 2 \text{ kV}$ ine(s) to earth	environment.
Voltage dips, short	<5 % <i>U</i> T	<5 % <i>U</i> T	Mains power quality should be that of a
interruptions and	(>95 % dip in <i>U</i> T)	(>95 % dip in <i>U</i> T)	typical commercial or hospital
on power supply	40 % <i>U</i> T	40 % <i>U</i> T	requires continued operation during
input lines	(60 % dip in <i>U</i> T)	(60 % dip in <i>U</i> T)	power mains interruptions, it is
IFC 61000-4-11	for 5 cycles	for 5 cycles	recommended that the BAM-8 be
	(30 % dip in <i>U</i> T)	(30 % dip in <i>U</i> T)	supply or a battery.
	for 25 cycles	for 25 cycles	
	<5 % U1 (>95 % dip in UT)	<5 % U1 (>95 % dip in <i>U</i> T)	
	for 5 s	for 5 s	
Power frequency	0.0/0	0.4/	Power frequency magnetic fields
	3 A/M	3 A/M	should be at levels characteristic of a
(50/60 Hz)			typical location in a typical commercial
magnetic field			or nospital environment.
NOTE OT is the a.c. mains voltage prior to application of the test level.			

## Table 2

#### Table 3

Guidance and manufacture's declaration – electromagnetic immunity				
The BAM-8 Veterinary Anesthesia System is intended for use in the electromagnetic environment				
specified below. The customer or the user of BAM-8 should assure that it is used in such an				
environment.		Compliance		
Immunity test	IEC 60601 test level	e level	Electromagnetic environment - guidance	
Conducted RF IEC 61000-4-6	3 V <sub>ms</sub> 150 kHz to 80 MHz outside ISM bands <sup>a</sup>	3 V	Portable and mobile RF communications equipment should be used no closer to any part of the BAM-8,, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. <b>Recommended separation distance</b> $d = 1.2\sqrt{P}$	
	10 V <sub>rms</sub> 150 kHz to 80MHz in ISM band <sup>a</sup>	3V	$d = 1.2\sqrt{P}$	
Radiated RF IEC 61000-4-3	If is w band a10 V/m10 V/m $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz4-310 V/m10 V/m $d = 1.2\sqrt{P}$ 80 MHz to 2.5 GHzWhere P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m). b10 V/mField strengths from fixed RF transmitters, as determined by an electromagnetic site survey,° should be less than the compliance level in each frequency range.d Interference may occur in the vicinity of equipment marked with the following symbol:			
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.				
NOTE These guidelines may not apply in all situations. Electromagnetic propagation is affected				
by absorption and reflection from structures, objects and people.				
<sup>a</sup> The ISM (industrial, scientific and medical) bands between 150kHz and 80MHz are 6.765 MHz to 6.795 MHz; 13.553MHz to 13.567MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz.				
<ul> <li><sup>o</sup> The compliance levels in the ISM frequency bands between 150 kHz and 80MHz and in the frequency range 80MHz to 2.5GHz are intended to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into animal areas. For this reason, an additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in these frequency ranges.</li> <li><sup>c</sup> Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast</li> </ul>				

telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the BAM-8 is used exceeds the applicable RF compliance level above, the BAM-8 Veterinary Anesthesia System should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the BAM-8.

<sup>d</sup> Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

## Table 4

#### Recommended separation distances between

## portable and mobile RF communications equipment and the BAM-8 Anesthesia System

The BAM-8 Veterinary Anesthesia System is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the BAM-8 Veterinary Anesthesia System can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the BAM-8 Veterinary Anesthesia System as recommended below, according to the maximum output power of the communications equipment.

	Separation distance according to frequency of transmitter (m)			
Rated maximum output power of transmitter				
	150 kHz to 80 MHz	150 kHz to 80 MHz	80 MHz to 800 MHz	800 MHz to 2 .5 GHz
(W)	outside ISM	in ISM band	$d = 1.2\sqrt{P}$	$d = 2.3\sqrt{P}$
	bands $d = 1.2\sqrt{P}$	$a = 1.2\sqrt{P}$		
0.01	0.12	0.12	0.12	0.23
0.1	0.37	0.37	0.37	0.73
1	1.20	1.20	1.20	2.30
10	3.69	3.69	3.69	7.27
100	12.00	12.00	12.00	23.00

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 The ISM (industrial, scientific and medical) bands between 150 kHz and 80MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66MHz to 40.70MHz.

NOTE 3 An additional factor of 10/3 is used in calculating the recommended separation distance for transmitters in the ISM frequency bands between 150kHz and 80MHz and in the frequency range 80MHz to 2.5GHz to decrease the likelihood that mobile/portable communications equipment could cause interference if it is inadvertently brought into animal areas.

NOTE 4 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

# *Main structure, function and principle of system* System

## **Components included**

- BAM-8 anesthesia system includes the following monitoring devices ,alarm devices and protection devices:
  - -----monitoring for exhaling gas volume;
  - -----monitoring for airway pressure;
  - ----airway pressure limit;
  - -----continuous pressure alarm for ventilation system;
  - -----alarm for airway pressure high;
  - ----alarm for MV high;
  - ----apnea alarm;
  - -----alarm for ventilation system integrity;
  - -----oxygen fault protection;
  - -----alarm for power supply fault;
  - -----O2 monitor;
  - ------ anaesthetic ventilator;
  - anaesthetic breathing system.
- The devices or components should all comply with the following relevant standards:

IEC 60601-1 Medical electrical equipment –Part 1: General requirements for basic safety and essential performance

IEC 60601-2-13 Medical electrical equipment—Part 2-13: Particular requirements for the safety and essential performance of anaesthetic systems

ISO 21647 Medical electrical equipment—Particular requirements for the basic safety and essential performance of respiratory gas monitors

ISO 8835-2 Inhalational Anesthesia Systems - Part 2: Anaesthetic breathing systems

ISO 8835-4 Inhalational Anesthesia Systems - Part 4: Anaesthetic vapour delivery devices

ISO 8835-5 Inhalational Anesthesia Systems - Part 5: Anaesthesia ventilators

IEC 60601-1-8 Medical electrical equipment - Part 1-8: General requirements for basic safety and essential performance- Collateral standard: General requirements, tests and guidance for alarm systems in medical electrical equipment and medical electrical systems

## **Components excluded**

• The following components are not equipped on BAM-8 anesthesia system, but they can be used with BAM-8.

——Ventilation gas monitor;

-----Transfer and receiving systems of active anaesthetic gas scavenging systems.

• These components shall comply with the following international standards:

ISO 21647 Medical electrical equipment—Particular requirements for the basic safety and essential performance of respiratory gas monitors

ISO 8835-3 Inhalational Veterinary Anesthesia Systems - Part 3: Transfer and receiving systems of active anaesthetic gas scavenging systems

- When connect these components, the following aspects shall be paid attention to:
  - ——Ventilation gas monitor should be connected with the inhalation port of the breathing system. After assembling, leakage test shall be carried out.
  - -----Transfer and receiving system of active anaesthetic gas scavenging system should be connected with exhaust port of the breathing system. After assembling, leakage test shall be carried out.

#### ▲ Warning:

According to requirements of standard IEC 60601-2-13, when using anesthesia system:

- It shall be used with the following monitors:
  - -----CO2 monitor;
  - ----O<sub>2</sub> monitor;
  - ------ exhalation gas volume monitor;
  - ------ anaesthetic gas monitor (when using vaporizer).
- It shall also be used with transfer and receiving system of active anaesthetic gas scavenging system.
- Breathing circuit equipped with this system should comply with the ISO 5367 standard.

#### ▲ caution:

When users connect the above equipments to the anesthesia system, the correspondent installation operation instructions provided by the equipment manufacture must be complied with. Whoever connect the single equipment to the anesthesia system, the guidance or instructions for the normal operation of the separate equipment, which is requested by anesthesia system and standard shall all be provided.

## Structure of the whole machine

Anesthesia system comprises anaesthetic gas delivery system (include anaesthetic gas delivery

piping, flowmeter, oxygen fault alarm and protective device),anaesthetic breathing system, anaesthetic gas scavenging system-transfer and receiving system(optional), anaesthetic vaporizer(with some functions of pressure compensation, temperature compensation and flow compensation, two models SE6A and SE6B, anaesthetic agents can be used have Enfluran, Halothane, Isoflurane, Sevoflurane), anaesthetic ventilator, SJ- I respiratory gas monitor(optional) and main frame.

See figure 1 for the outline of whole machine.



Fig.1 Outline of the whole machine

# Working principle

Gas supply entered into the equipment shall be regulated to the required flow and proportion by flow control valve of the flowmeter, then flow through drug vaporizer and be sent to anaesthetic breathing

system. Anaesthetic agent concentration is controlled by vaporizer. When concentration knob of the vaporizer is adjusted to "0", there will be no anaesthetic agent in the fresh gas output.

Part of O<sub>2</sub> entered into the equipment is branched to oxygen flush valve, high flow oxygen coming from oxygen flush outlet enters into anaesthetic breathing system.

When O<sub>2</sub> pressure is lower than 0.18 MPa, the equipment will give auditory alarm signals a.

If choose the manual control, fresh gas will be stored in the reservoir bag, and the breathing circuit for animal is achieved by manual way. This time, the breathing of the animal is manually controlled by squeezing the reservoir bag with a hand.

For inhalation, the gas and fresh gas outputted from reservoir bag will be sent into animal 's lung via CO<sub>2</sub> absorber, inhalation valve, inhalation gas connector, thread pipe and Y connector.

For exhalation, loosen the reservoir bag, expired gas will go through Y connector, thread pipe, expiratory gas connector and expiratory valve and come back into the reservoir bag. The excessive gas will be discharged through APL valve.

If choose the mechanical control, fresh gas will be stored in the bellow, the breathing circuit for animal is achieved by anesthesia system.

For inhalation, the flow control valve and exhalation control valve open,  $O_2$  flow out of the bellow via breathing control valve, squeeze the bellow so that fresh gas in the bellow will be sent into animal 's lung via  $CO_2$  absorber, inhalation valve, inhalation gas connector, thread pipe and Y connector.

For exhalation, the flow control valve and exhalation control valve close, expired gas will go through Y connector, thread pipe, expiratory gas connector and expiratory valve and come back into the bellow, squeeze the bellow to make the gas out of breathing valve(the circuit is complete). The excessive gas will be discharged through the overflow valves via the breathing valve. When the airway pressure reaches the set pressure of relief valve (not more than 12.5 kPa), pressure relief valve opens automatically so as to prevent airway pressure being too high to hurt the animal 's airway.

The excessive gas coming from the breathing valve is discharged to outdoor atmosphere via gas transfer and receiving system.

Anesthesia breathing control panel will work under the ventilation mode and parameters set on th e operation panel, and process airway pressure and tidal volume sampled from flow and pressure se nsor, then control inhaling time, exhaling time, breathing rate, and tidal volume, and display the moni tored ventilation parameters on the screen.

When the monitored ventilation parameters are beyond the set alarm limit, the anesthesia breathing control panel will activate the sound and visible alarm.

The breathing gas monitor control panel processes the breathing gas collected by the gas sampling module and displays the monitored ventilation parameters on the screen.

When the monitored gas parameters are beyond the set alarm limit, the anesthesia breathing control panel will activate the sound and visible alarm.

## Flowmeter

#### Function

The flowmeter is provided with a flow control valve, which controls and indicates the flowrate of fresh gas provided to the animals.

#### Structure

- The flow meter is a single pipe rotary flow meter for O<sub>2</sub>.
- flow rate is controlled by the flow rate control valve,

-----counterclockwise rotation shall increase flow rate;

-----clockwise rotation shall decrease flow rate.

# Anaesthetic vaporizer

Anaesthetic vaporizer is used for precisely controlling the concentration of anaesthetic gas which is transmitted to the fresh gas.

The equipment may select enflurane or isoflurane or sevoflurane or halothane or desflurane vaporizer with temperature and flow rate compensation function. and can be equipped with one Anaesthetic vaporizer. The vaporizer mating with the anesthesia system nominated by our company shall be used. Otherwise, the performance of them will be decreased.

There is the self-lock device on this vaporizer.

Turn the concentration-regulating-knob to adjust the required concentrations of anaesthetics.

See the manual for the detailed vaporizer instructions.

# Anaesthetic breathing system

## Function

- Transmit the fresh gas (mixed gases) with anesthetic gas to the animals;
- Getter the CO<sub>2</sub> exhaled by the animals;
- To provide path to control the inhalation and exhalation of animals;
- Discharge the surplus gas and waste.

## Structure

• Anaesthetic breathing system mainly consist of inhalation flap, exhalation flap, CO<sub>2</sub> absorber (circle absorber components), "APL" valve (adjustable Pressure limit valve, exhaust valve).

• See figure 2 for the outline of anaesthetic breathing system.



Fig. 2 Anaesthetic breathing system

## Main control parts

• Inhalation valve and exhalation valve

The inhalation valve (1) and exhalation valve (2) are one-way valves which controls the direction of breathing gas flow.

The inhalation valve and exhalation valve respectively consist of:

----valve flap (3) and (4)

With breathing of animals, the flap of inhalation valve (4) and the flap of exhalation valve (3) are opened and closed alternatively,

—When the animal inhales, the inhalation flap is opened, exhalation flap is closed, the gas output by the



anaesthetic breathing system is sent into animal airway through breathing tube;

- —When the animals exhales, the inhalation flap is closed, exhalation flap is opened, the exhaled gas is sent to anaesthetic breathing system through breathing tube .
- CO<sub>2</sub> absorber(circle absorber components)
  - ----CO<sub>2</sub> absorbent is put in the CO<sub>2</sub> absorber. Absorbent can absorb the CO<sub>2</sub> of the exhaled gas of animals thoroughly, the produced O<sub>2</sub> is transferred to animals.
  - ——The CO<sub>2</sub> absorber is installed on the lower part of anaesthetic breathing system, consisting of absorber casing, screen cloth.
  - ——CO<sub>2</sub> absorber has a capacity of about 950ml.

See Fig.3 structure of CO<sub>2</sub> absorber:



1. Flow direction 2. Canister 3. screen cloth

Fig.3 Structure of CO<sub>2</sub> absorber

• "bag /vent" selection knob

Select manual ventilation (reservoir bag) or mechanical ventilation (ventilator).

—— When the "bag /vent" selection knob revolves to " \$ , the breathing of animal is controlled manually;

(Note: When choose manual ventilation, the ventilator shall be changed to standby status, press the standby key for a moment to enter to standby status)

------ When the "bag /vent" selection knob revolves to "

the breathing of animal s is controlled by ventilator.

• "APL" valve

When "APL" valve (adjustable pressure limit valve) is used for manual control ventilation, adjust pressure limits of breathing system. When the pressure of breathing system exceeds the limit, exhausting through the surplus gas outlet.



- Rotate the "APL" valve knob clockwise, increase the pressure of breathing system. Rotate clockwise to the end to close the valve, then the pressure limit is about 70 cmH<sub>2</sub>O;
- ——Rotate the "APL" valve knob counterclockwise,decrease the pressure of breathing system. Rotate counterclockwise to the end to open the valve fully ,then the pressure limit is about 0 cmH<sub>2</sub>O,the gas in breathing system exhaust directly through the surplus gas outlet.



• breathing bellow

During the starting of inhaling, the driving gas get into the folding bag and box cover, overflow valve and exhale valve are closed; the mid-term of inhaling, the driving gas go on getting into, to increase the pressure, then compress the folding bag, make it down, to force the intracapsular gas into the breathing circuit; during the starting of exhaling, the gas (expiratory air and fresh air) of respiratory system flow into the folding bag. then the folding bag begin to rise up,to make the exhalation valve open, the driving gas is discharged into the atmosphere; the final phase of exhaling, gas flow into continuously, the positive pressure arise after the folding bag blugs completely, to make overflow valve open, excess gas in the folding bag discharge into the exhaust system by the overflow valve .

## Oxygen flush valve

Oxygen is used for providing high flow rate O<sub>2</sub> to anaesthetic breathing system through fresh air outlet:

- Press the switch of oxygen flush valve,output high flow rate O<sub>2</sub>;
- Loose the switch of oxygen flush valve, then the air flow will stop.



# System driving gas circuit

## Gas supply

- Gas enters the system through gas source input connector. Gas resource input connector includes a central gas supply connector;
- The central gas supply connector includes an O<sub>2</sub> inlet ;
- All the gas resource input connector have the marked connector ,filter ;
- After gas resource enters the system, a relief valve (about 750kPa) is additionally connected to prevent the system from bearing the over high Pressure;
- Gas resource pressure gauge display the central gas supply pressure entering into the system.

## O<sub>2</sub> supply

After O<sub>2</sub> enter the system, it reaches separately to:

- The O<sub>2</sub> flow control valve of flowmeter: adjust O<sub>2</sub> flow rate of the fresh gas (mixtures );
- Oxygen flush valve: press the oxygen flush valve and supply high flow O<sub>2</sub> for the fresh gas outlet.
- Ventilator: as ventilator's driving gas.

## Fresh gas(common gas)

- Fresh gas from flowmeter outlet to fresh air outlet (inside the machine) through vaporizer, enters anaesthetic breathing system.
- The outlet pressure for fresh gas is limited to 30 ~ 45 kPa by the pressure relief valve.

## Intake filter

• Function

Preventing the dust and sundries with the size of over 100µm from entering equipment duct to affect the normal operation of the equipment.

Structure

Filter (1) is a cup shaped structure which is installed on the back end of the gas input connector (2).



# Ventilation gas monitor (optional)

See the operation manual of ventilation gas monitor.

# Transfer and receiving system of anaesthetic gas scavenging system. (optional)

AGSS is used to transfer and receive exhaust gas which animals expire.



Fig.4 Transfer and receiving system of anaesthetic gas scavenging system

# Anesthesia ventilator

## Function

The anesthesia ventilator provides mechanical ventilation for animals in the operation and monitors and display the breathing parameters of animals.

## Structure

Anesthesia ventilator main consists of breathing parameters adjusting and control part , display window ,sensor,etc.

The front panel of the ventilator sees figure 5.



4 parameters setting key 5 system setting key 6 standby key

7 power supply indicator 8 battery state indicator

9 "adjustment/ confirmation" knob 10 Vt adjustment knob 11 PEEP adjustment knob

Fig.5 The front panel of ventilator

# **Connection port**

## **Back panel of Ventilator**

See figure 6.



9 O<sub>2</sub> supply inlet

Fig.6 Back panel of ventilator

10 starting switch

# **Preparation** Gas supply connection

- The gas resource of the equipment :
  - -----can be central gas supply system;
  - -----can be cylinder high-pressure O<sub>2</sub>.
- The connection of central gas supply system and the equipment:
  - ——In the first using, the connection plugs of the outlet connection of O<sub>2</sub> shall be installed on the corresponding high pressure gas hose of the central gas supply.
  - -----Check the supply pressure of the central gas supply system, it shall be 440 kPa±160 kPa

(280 kPa~600 kPa);

- ---- Connect the high pressure O<sub>2</sub> hose,
- a) Connect the corresponding inlet of gas resource on the back of the equipment with one end;
- b) Connect the corresponding gas resource outlet on the gas supply system with one end;
- ——and connection plug of O<sub>2</sub> is provided by central gas supply system manufacturer. If the users need to be provided by the company, they should put forward when ordering, and shall provide the technical data of the connection plug.
- If O<sub>2</sub> cylinder is used, the pressure regulator must be used. Check and adjust the pressure regulator for output pressure of 440 kPa±160 kPa (280 kPa~600 kPa), then connect it to O<sub>2</sub> port on the back of the machine by high pressure hose.

#### ▲ Warning:

Fault of central gas supply system may lead to that more than one connecting units and even all the connecting units stop working at the same time.

#### ▲ caution:

- 1) The rated work pressure of the system is 440 kPa (4.4 bar) .The pressure range of central gas supply system shall be 440 kPa±160 kPa (280 kPa~600 kPa).
- 2) Gas resource all shall be medical grade.
- 3) When taking central gas supply system as gas resource, the impurity of pipes shall be prevented from entering equipment.
- 4) When using central gas supply system to supply gas, all shall be equipped with reserve gas cylinder which is full of O<sub>2</sub>.
- 5) See the manual for the Installation and operation of pressure regulator.

## **Power supply**

## ▲ Warning:

IEC 60601-1-1 is suitable for all the connections between medical electric equipment and at least one medical electric equipment and one or a plurality of connections of non- medical electric equipment. Even if there is not functional connections between the single parts of equipments, when they are connected to the power supply socket of auxiliary nets, medical electric system is thus formed. The operator must realized that when equipment is connected to the power supply socket of auxiliary net, the risk of leakage current rise exist.

#### **∆**caution:

1.The supply voltage of mains power supply is100-240V  $\,$   $\sim$ ,the frequency is 50/60 Hz.

2. Disconnect from main power by pulling the plug on the wall, and do not position the machine to make it difficult to operate the disconnection from main power.

## Main power—AC mains

- Plug the mains connector of power supply cord into AC power supply inlet socket (2 of Fig. 6) on the back of equipment;
- Plug the mains plug of power supply cord into mains socket-outlet on the wall, then the power indicator light at the panel is on(7 of Fig. 5)

#### stand-by power:

- back-up battery:
  - Model: SF-Y3S-8
  - Capacity: 5200mAh
  - Voltage: DC11.1V
- When the back-up battery is fully charged, the battery will supply power for the equipment about 2 hours.
- If the machine is powered by battery, the power state indication place will display the signal of
   " " " ".
- When the power is changed from AC to back-up battery, the equipment will keep same functions as working under AC.

## Main power supply -----Back-up battery transition

- It will switch over to back-up battery automatically when the main power supply fails during operation
- When the back-up battery power the ventilator, there is sound indication from the machine, and the power state indication place will display the signal of " .

## Low voltage of back-up battery

- At this time, power supply should transit to AC or switch off the power of ventilator, and charge the battery.

## ▲ Warning:

Power supply should transit to AC when the battery is low voltage.

## Charge of back-up battery

- When the equipment is supplied by AC power and starting switch is off, power supply indicator (item 7 of Fig. 5) lights (green for a long time), if battery is charging, battery state indicator (item 8 of Fig. 5) lights (green), if battery is fully charged, battery state indicator (item 8 of Fig.5) do not light.
- Charge can be carried out continually, or intermittently.
- The back-up battery should be charged in time after using, generally it should be charged for more than 3 hours after using for one hour.

## **Discharge of back-up battery**

- It should be discharged in regular time when no using for a long time.
- It should be charged in time after discharging.
- Intervals of discharge do not beyond 3 months.

## Replacing of the back-up battery

- Usually, the battery can be used for 3- 6 years, if it is often used in over voltage state, or often power cut or the environment temperature is excessive high, efficiency will become lower the and life will be shorten.
- The battery should be replaced when the efficiency receded or shattered. Battery replacing should be managed by special technical personal. When in replacing the battery, firstly switch off the AC, and then open the cover to get the battery out. Pay attention to the specification of the battery and do not overturn the polarity.

#### ▲ Warning:

Do not throw the battery into the fire in case of explosive; Do not open or destroy the battery, because it contains injurant which may injure skin and eyes. Please dispose the battery under (by) the local environment law.

#### Installation or replace fuse

• Replacement of AC power supply fuse:

When AC input power supply is normal, power indicator(7 of Fig.5) is not on. After opening the starting switch (10 of Fig.6), the backup battery works, at this time the fuse of AC power supplying put socket / fuse socket (2 of Fig.6) shall be checked. Unpluging the plug of power supply and poking fuse socket with screw driver, the fuse can be taken out .If it has been damaged, the fuse with the same size and model shall be replaced.

• Replace stand-by power supply fuse :

When using standby power supply and the battery is already full, after pressing the starting switch (10 of Fig.6), no display is on the screen, at this time standby power supply fuse shall be checked. screwing off the cover of fuse box with screw driver, take out fuse to check. If it has been damaged, the fuse with the same size and model shall be replaced.

• Size and model of fuse

—— AC power supply	T2AH 250V×2
——internal standby power supply	T4AH 250V

## ▲ Warning:

1) Before installing or replacing fuse, you must pull out the mains plug of power supply cord from the mains-outlet.

2) When replacing fuse, it shall be noticed that the size and model is the same with the original one.

## Installation and arrangement of CO<sub>2</sub> absorbent

- When the color of CO2 absorber gradually changes, it shows that the carbon dioxide is absorbed, the change of absorbent color only roughly display. Please use carbon dioxide monitor to decide whether replacing absorbent or not.
- The replaced absorbent shall be throw away, for absorbent will recover to the original color after placement for a while, instead, the misleading function will occurs.

- The placement of absorbent: (see Fig. 3)
  - ----- clockwise tilt CO2 absorber (2 of Fig. 3);
  - ----- enclose appropriate amount of absorbent;
  - ----- clean out the foreign matter attached on the sealing washer and sealing face;
  - -----put CO2 absorber (2 of Fig. 3) on the fixed seat again;
  - ----- counter clock wisely tilt and press CO2 absorber(2 of Fig. 3).

#### ▲ Warning:

- 1) Do not replace absorbent during ventilation;
- 2) Replace absorbent frequently to prevent the deposit of non metabolic gas when the system does not work;
- After complete each case, the color of absorbent shall be checked, when the system does not work, the color of absorbent may recover to its original color. The detailed about color change sees instructions of absorbent;
- 4) If the absorbent is completely dry, then it will release CO2 after contacting the anaesthetic gas. In view of safety, please replace absorbent. The proper prevention measure shall be adopted to ensure that absorbent can not change to be dry. After using the system, shut off all the air resource is an important measure preventing absorbent from dry;
- 5) After replacing absorbent, air leakage test of anaesthetic breathing system shall be carried out.

#### ▲ caution:

- 1) CO2 absorbent can only use air , oxygen , nitrous oxide , halothane , enflurane , isoflurane and sevoflurane;
- 2) The CO2 absorber shall be placed correctly,foreign matter must not exist between the sealing washer and sealing face so as to avoid air leakage .

## Installation and liquid medicine perfusion of vaporizer

## Installation

- Counter clockwise rotate the lock bar of Anaesthetic vaporizer for 90°
- Anaesthetic vaporizer is put into the vaporizer fixed seat block on the anesthesia system, when placing, pay attention to the fast connection of vaporizer and fixed seat block.
- Clockwise rotate the lock bar of Anaesthetic vaporizer for 90°
- To check if vaporizer and fixed seat block is tightly connected.
- The installation of other model of vaporizer refers to the other instructions.

## Liquid medicine perfusion

Vaporizer liquid medicine perfusion and the check before and after perfusion see the user manual thereof.

#### ▲ Warning:

- 1) The equipment do not use inflammable and explosive anaesthetics!
- 2) Vaporizer can only be added the specified anaesthetics, do not mixed to add!

## Connection of reservoir bag

Connect the anesthesia reservoir bag which comply with the provisions of ISO 5362 (5) to reservoir bag connector (2) on anesthetic ventilation system (1) ,see figure 7.



#### $\triangle$ caution:

The reservoir bag should comply with ISO 5362.

Fig.7 Connection of reservoir bag

## Connection of breathing tube and sample tube of tidal volume

connection of breathing tube and sample tube of tidal volume (Pressure / flow rate) see Fig. 8.



1 pressure/flow sampling input port	2 sampling tube
3 pressure/flow sampling tube	4 "L" connector
5 breathing tube with "Y" connector	6 exhalation gas connector
7 inhalation gas connector	8 exhaust port

Fig.8 Connection of breathing tube and sample tube of tidal volume

#### **▲** caution:

The breathing tubes should comply with the ISO 5367 standard.

- Breathing tube with "Y" connector (5) is respectively connected with exhalation gas connector
   (6) and inhalation gas connector (7);
- Insert the thin end (outer cone end) of sampling tube (3) into breathing tube with "Y" connector (5);
- Insert "L" connector (4) into the inner hole of thick end of sampling tube (3);
- The other end of "L" connector (4) is connected with breathing mask or tracheal tube;
- One end of sampling tube(2) is connected with pressure/flow sampling tube(3), the other end is connected with pressure/flow sampling input port (1).

# Installation and connection of anaesthetic gas scavenging system-transfer and receiving system

Installation and connection of anaesthetic gas scavenging system refers to user's manual;

- Connect the input connection tube of anaesthetic gas scavenging system-transfer and receiving system to exhaust port (8 of Fig.8) on the back of anesthesia system
- $\triangle$  caution:

Anaesthetic gas scavenging system-transfer and receiving system shall comply with ISO 8835-3.

# Installation and connection of respirartory gas monitor(optional)

- Installation and connection of respirartory gas monitor refers to user's manual;
- CO<sub>2</sub> monitor need to be connected with "Y" connector of anaesthetic breathing system. After installation, a gas leakage test shall be performed;
- Respirartory gas monitor need to be connected with "Y" connector of anaesthetic breathing system. After installation, a gas leakage test shall be performed;
- ▲ caution:
- Respirartory gas monitors shall comply with ISO 21647

## Installation and operation of pressure regulator

Installation and operation in accordance with the following steps:

- Place the cylinder upright steadily;
- Stand at the side of cylinder and quickly open and close the cylinder valve so as to clean the valve port;
- Confirm that the pressure regulator is in conformity with the gas in the cylinder;
- Clean up any oil stain and dirt at pressure regulator inlet and cylinder valve port;
- Install the pressure regulator onto the corresponding cylinder and tighten up with a wrench;
- Turn the pressure adjusting knob anti-clockwise to release pressure adjusting spring;
- Connect the corresponding HP hose and tighten with wrench;
- The other end of HP hose is connected to the corresponding gas input port at back of the

equipment;

• Open the cylinder valve slowly and adjust the pressure regulator to 400  $\pm$  50 kPa output pressure.

## ▲ Caution:

1 Before open the cylinder valve, the pressure adjusting knob of pressure regulator should be fully loosened anti-clockwise, if not, the transient pressure may damage the diaphragm and will cause invalidation of the pressure regulator and injury to person in extreme cases.;

 $2\;$  Don't stand facing to or back to the cylinder valve port or the pressure regulator when opening the cylinder valve.

3 Open the cylinder valve quickly, not for a long time, otherwise, the back pressure of discharged gas will turn the cylinder over.

# Check before use

## ▲ Warning:

Do not use the equipment with fault.

#### ▲ caution:

The connection, safety characteristics and alarm characteristics of the equipment must be checked before each use to ensure equipment is in good working condition.

# **Check interval**

The check before use shall be carried out in the following conditions:

- Before the using of the first animal;
- Before the using of the every animal;
- After maintenance, servicing , cleaning disinfection;
- After repairing.
# System check

- Components are installed and connected tightly and correctly;
- Breathing tubes are in good condition and connection connected tightly and correctly;
- Vaporizer is locked to the position and filled with enough and correct vaporizer;
- Gas supply is correctly connected;
- When using central gas supply, the valve of reserve gas cylinder shall be closed;
- Plug the mains plug of power supply cord into mains socket-outlet on the wall tightly. Press starting switch, ventilator screen shall be lighted.

### Check power failure alarm

- Connect to mains power, power supply indicator is lighted ,turn on the starting switch ,the ventilator runs. the power state indication place will display the signal of "-C" or " T ".
- Disconnect power supply cord from mains power,. The ventilator is automatically switched to the mode of operation with back-up battery ,at this time ,there will be a sound alarm and the power state indication place will display the signal of " .
- Reconnect to mains power, sound alarm disappears and the power state indication place will

display the signal of " - ( , or " I . .

### Gas supply check

#### Air source check

- The gas supply pressure of central gas supply system shall be 440 kPa±160 kPa (280 kPa~ 600 kPa);
- Gas cylinder in using and reserve gas cylinder all shall be full state;
- The reserve gas cylinder should be able to supply gas normally;
- Close the valve of reserve gas cylinder.

#### Leakage check

- Rotate the flow rate control knob of flow meter clockwise, close O<sub>2</sub> flow rate;
- Connect and open O<sub>2</sub> supply;
- After the indication value of corresponding O<sub>2</sub> pressure gauge on the Anesthesia System is stabled, close gas resource;
- Observe O<sub>2</sub> pressure gauge, their indication drop value shall be no more than 10 kPa in one minute;
- If their indication drop value in one minute is greater than 10 kPa, it shows that there is gas leakage, gas leakage position shall be checked and renovated;
- There may exist at gas leakage position,
  - -----Connection on the high pressure gas hose and pressure regulator
  - ——Connection of corresponding gas inlet connector on the high pressure gas hose and Anesthesia System;
  - -----pressure regulator
  - ——High pressure gas hose;

-----Flow meter is not closed;

-----Oxygen flush valve is not closed by itself.

#### Oxygen flush valve check

- Press oxygen flush switch, high flow gas shall outflow the fresh gas outlet;
- Loosen oxygen flush switch, the flow shall be stopped.

### Anaesthetic breathing system check

#### Inhalation, exhalation flap check

- Rotate selection knob of "bag/vent" to" i;
- Breathing reservoir bag connection port and animal connection port ("Y" connector) are all connected with breathing reservoir bag;
- Press oxygen flush button to fill breathing reservoir bag;
- Repeatedly manually pinch the breathing reservoir bag to simulate the breathing status of animal s:
  - ----- During exhalation, flap flake of exhalation flap rise, inhalation flap drop;
  - —— During inhalation, flap flake of exhalation flap rise, exhalation flap drop;
- Opening and closing of inhalation and exhalation flap shall be flexible, free.

#### Leakage check

- Rotate selection knob of "bag/vent" to "
- Close "APL" valve ;
- Breathing reservoir bag connection port is connected with reservoir bag;
- Block up the animal connector ("Y" connector );
- Press oxygen flush button, breathing reservoir bag start to inflate;
- When indicated value of airway pressure gauge is 30 cmH<sub>2</sub>O,loosen oxygen flush button;
- Observe airway pressure gauge, the drop of pressure indicated value in one minute shall be no more than 4 cmH<sub>2</sub>O;
- If the drop of pressure indicated value in one minute is greater than 4 cmH<sub>2</sub>O, it shows there is air leakage, air leakage point shall be checked and renovated.

hint:

Air leakage may be at:

- 1) Connection ports of each breathing tube;
- 2) Each connection tube and port;
- 3) Breathing reservoir bag is broken;
- 4) Breathing tube is broken;

- 5) "APL"valve is not closed
- 6) CO<sub>2</sub> absorber is leak.

#### "APL" valve check

- Block up the connection port of breathing reservoir bag;
- Block up animal connector ("Y" connector);
- "APL" valve is closed:
  - -----Adjust gross flow rate of fresh gas to about 3 L/min;
  - -----The indicated value of airway pressure gauge shall be no more than 85 cmH2O (Pressure fluctuation belongs to normal phenomenon);
- "APL" valve is completely opened:
  - -----Adjust gross flow rate of fresh gas to about 3 L/min;
  - -----The indicated value of airway pressure gauge shall be about 0 cmH<sub>2</sub>O;
  - -----Press oxygen flush button;
  - ——The indicated value of airway pressure gauge shall be no more than 5 cmH<sub>2</sub>O.

#### **Breathing bellow check**

- Rotate "bag/vent" selection knob to"
- Block up animal connector ("Y" connector);
- Press oxygen flush button to fully fill breathing bellow;
- The indicated value of airway pressure gauge shall be no more than 2 cmH<sub>2</sub>O;
- Loosen oxygen flush button;
- Adjust gross flow rate of fresh gas to about 0.5 L/min;
- The buffer pocket of breathing bellow shall not drop;
- Any drop of the buffer pocket of breathing bellow shows there is air leakage and the air leakage point shall be checked and renovated .

#### Note:

Air leakage point may be at:

- 1) Connection ports of each breathing tube;
- 2) Each connection tube and port;
- 3) Breathing tube is broken;
- 4) Air leakage of CO<sub>2</sub> absorber;
- 5) The bellows cover is not wrenched tightly;
- 6) Bellow and buffer pocket is broken.

#### Manual ventilation check

- Rotate "bag/vent" selection knob to
- Close "APL" valve;
- The connection port of breathing reservoir bag and animal connection port ("Y" connector) are

respectively connected with reservoir bag;

- Press oxygen flush button to fill breathing reservoir bag;
- Press oxygen flush button to make two breathing reservoir bags inflated to about a half;
- Repeat manually pinch reservoir bag on the breathing reservoir bag connection port;
- The reservoir bag on the animal connector ("Y" connector) shall inflate or shrink.

#### CO<sub>2</sub> absorbent check

- After completing each case, increase and check CO<sub>2</sub> absorbent;
- The volume of discoloring absorbent do not exceed a half of volume.

### Vaporizer check

- Before the perfusion of liquid medicine, check concentration adjust knob, it shall be with free rotatation, self locking and reliable interlocking unit;
- Observe fluid level gauge, perfused liquid medicine shall be between the highest and lowest fluid level;
- Dosing knob, dosing screw shall be tightened without leakage..

### Anesthesia ventilator check

- Rotate "bag/vent" selection knob to"
- animal connector ("Y" connector) is connected with test lung;
- Adjust gross flow rate of fresh gas to 0.5L/min;
- Press oxygen flush button to fully fill breathing bellow;
- Open ventilator power supply;
- The parameters of ventilator ventilation is set as:
  - -----tidal volume : 500 mL
  - -----frequency: 12 /min;
- Start-up ventilator;
- The rise and drop of ventilator bellow shall be normal;
- The monitoring value display of ventilation parameters shall be correct;
- Adjust gross flow rate of fresh gas to 0.5 L/min;
- The monitoring value display of ventilation parameters shall be correct;
- The exhalation end pressure is about 2 cmH2O.

### Alarm function check

- Rotate "air bag-ventilator" selection knob to"
- Animal connector ("Y" connector) is connected with test lung;
- Adjust gross flow rate of fresh gas to 0.5L/min;
- Press oxygen flush button to fully fill breathing bellow;

- Open ventilator power supply;
- Basic ventilation parameters set as:
  - -----tidal volume : 500 mL
  - ----- frequency: 12 /min;
  - ------inspiratory to expiratory time ratio(I:E): 1: 2
- Check the "MV high" alarm:
  - ----- set upper alarm limit value of MV as 8.0 L/min;
  - -----adjust tidal volume and frequency to ensure that the MV is slightly greater than the set upper alarm limit value of MV;
  - ----- "MV high" shall be alarmed ;
- Check the "MV low "alarm:
  - ----- set the lower alarm limit value of MV as 6.0 L/min;
  - —adjust tidal volume and frequency to ensure that the MV is slightly less than the set lower alarm limit value of MV;
  - ——" MV low" shall be alarm;
- Check the "PAW high "alarm:
  - ----- set the upper limit value of airway pressure as  $20 \text{ cmH}_2\text{O}$ .
  - adjust tidal volume and airway resistance to ensure that airway pressure is slightly greater than the set upper limit value of airway pressure;
  - ----- "PAW high" shall be alarmed;
  - ——After the "PAW high" alarm, inhalation state shall be switched to exhalation state and airway pressure shall be no more than 100 cmH<sub>2</sub>O;
- Check the" PAW low" alarm:
  - —— set the lower limit value of airway pressure as 10 cmH<sub>2</sub>O.
  - adjust tidal volume and airway resistance to ensure that the airway pressure is slightly less than the set lower limit value of airway pressure;
  - ----- "PAW low" shall be alarmed;
- Check "Apnea" alarm:
  - ---When beginning to expire, disconnect the breathing pipe and the flow sensor,
  - ---Delay time is about 30s, if it is 120s, "Apnea>120s" alarm occurs.
- Check "NO V<sub>T</sub>" alarm:
  - ----When beginning to expire, disconnect the breathing pipe and the flow sensor,
  - ——Delay time is less than 6 s, "NO  $V_T$ " alarm occurs.
- Alarm shall be sound alarm and alarm hint ;
- Check mute:
  - ——When an alarm occurs, the alarm will resume within 2 minutes by pressing mute key" 🔆 " (item 2 in Fig. 5). ;
  - -----If the alarm fault is not get rid of, then about 2 minutes later, this sound alarm continues;
  - —— When the sound alarm pause, alarm hint still exist unless fault is eliminated.

# Operation

#### ▲ Warning:

- 1) At any time, the equipment shall has independent ventilation method in use (for example, be equipped with simple breather with mask).
- 2) Before use and operation, please carefully read the user's manual and strictly carry out use and operation as specified .
- 3) If alarm occurs in use, it shall be treated . At first, protect the safety of animal , then carry out fault diagnosis or necessary service .
- 4) In use, proper anesthesia , ventilation parameters and alarm parameters shall be set in accordance with the conditions of animal .
- 5) Although the equipment has take full consideration of the clinic security in design, operator still must not neglect the observation for equipment's work state and the monitoring for animal 's psychological function parameters, only by this, once mistake or function abnormity occurs, it can be rapidly correct.
- 6) In use, breathing tube(threaded pipe) shall be placed carefully, prevent duct from falling off , winding or suffocating animal .
- 7) In using anaesthetic gas,dry CO<sub>2</sub> absorbent will be dangerous. Proper prevention measures shall be adopted to ensure that absorbent will not run dry. After using the system,shuting off all the air resource is an important measure of preventing absorbent run dry.
- 8) In use, the stability , equalizing of the equipment shall be paid attention to so as to prevent tilting.
- 9) According to requirements of IEC 60601-2-13 standards, when using anesthesia system, it shall be used with the following monitoring:

----O<sub>2</sub> monitor;

- —— exhalation gas volume monitor;
- ------ anaesthetic gas monitor (when using vaporizer).
- 10)According to requirements of IEC 60601-2-13 standards, when using anesthesia system, it shall be

further used with anaesthetic gas scavenging system-transfer and receiving system.

### Start-up system

- Connect the power and gas source
- Switch on the ventilator switch, then the machine will enter the self-check surface.
- When self-check is finished, the machine will enter "Standby" surface. Refer to Fig.9.

Veterinary Anesthesia System Standby Software Version: 1. 0	

Fig. 9 Standby interface

# Manual mode

#### Enter manual mode

- Enter manual mode;
- turn the "bag/vent" selection knob on the anaesthetic breathing system to position ", the equipment automatically enters manual mode;
- When choose manual ventilation, the ventilator shall be changed to standby status, press the standby key for a moment to enter to standby status;



• See Fig.10 for interface of manual mode.

Fig.10 Manual mode interface

#### **Manual ventilation**

- Turn the "bag/vent" selection knob to position "
- Adjust O<sub>2</sub> flow rate valve for required flow rate;
- Push the oxygen flush valve to ensure that the reservoir bag is moderately inflated;
- Adjust "APL" valve (adjustable pressure limit valve) to proper pressure limit value;
- Manually squeeze the bag frequently to execute manual ventilation for animal .
- ▲ Caution:

In manual ventilation, "bag/vent" selection knob of anaesthetic breathing system must be turned to position " (; when choose manual ventilation, the ventilator shall be changed to standby status, press the standby key for a moment to enter to standby status;

### **Mechanical ventilation**

• When "bag/vent" selection knob is turned to position "

", ventilator automatically enters

mechanical-controlled mode;

- -----If it is the first time to operate the mechanical-controlled mode, then operates in accordance with the default ventilation mode (includes default ventilation parameters);
- -----If it is from standby, it shall also operate according to default IPPV mode;
- ——If is has operated the mechanical-controlled mode and it switched from manual mode, then it shall operate according to the original mode;
- Enter such mechanical ventilation mode as IPPV,A/C, SIMV etc.:
  - -----Ventilation mode can be selected only under the mechanical-controlled mode;
  - ——Enter corresponding mechanical ventilation mode according to the steps of "select ventilation mode" and press the adjustment/confirmation knob to conform.

### Setting of ventilation mode and parameters

- Enter the surface of setting of ventilation mode and parameters
  - -----Switch the ventilator on, press the "adjustment/ confirmation" knob (Item 9 in Fig.5),
  - ——After it runs, press the parameters setting key (Item 4 in Fig.5), you can reset ventilation mode and parameters.

——Fig.11,12,13 are the ventilation mode and parameters setting surfaces under IPPV, A/C, SIMV mode.

• Ventilation mode selection:

——Turn the adjustment/confirmation knob (Item 9 in Fig.5) to the required ventilation mode, and press it for confirmation.

- Setting of parameter:
  - ——Turn the adjustment/confirmation knob (Item 9 in Fig.5) to the required parameter, and press it for confirmation;
  - ——Turn the knob (Item 9 in Fig.5) for setting (Turning clockwise will max the parameter; Turning anticlockwise will minimum the parameter). Press it for confirmation.
  - ——Turn the knob (Item 9 in Fig.5) to " , press the knob to exit the setting surface.
  - -----The machine will work under the set mode and parameters.

Note: The machine will work under the former ventilation mode and parameters when make the settings.



Fig. 11 Setting of mode and parameter under IPPV

IPPV A/C SIMV	$\times$
Freq 12 Tinsp 1.7 Ptr -1 bpm 12 S 1.7 cmH20 -1 Ftr 2	

Fig.12 Setting of mode and parameter under A/C

IPPV A/C SIMV	$\left[\times\right]$
Freq 10 Tinsp 1.7 Ptr -1	
Ftr L/min <b>2</b>	

Fig.13 Setting of mode and parameter under SIMV

### Reset of alarm parameter

- Reset of alarm parameter:
  - ——Press the alarm setting key (Item 3 in Fig.5), the machine will enter reset of alarm parameter surface. Refer to Fig.14
- Change the alarm parameter:
  - -----Turn the knob (Item 9 in Fig.5) to highlight the required parameter;
  - ——Press the knob (Item 9 in Fig.5) to make the parameter setting value in opposite color;
  - ——Turn the knob (Item 9 in Fig.5) to required value (Turn clockwise to max the parameter; Turn anticlockwise to minimum the parameter). Press the knob for confirmation;

-----Repeat the previous step if next alarm value need to be adjusted;

——Turn the knob to"  $\boxtimes$  ", press it to confirm and exit the setting surface, and the machine will work with the set values.

• Alarm information

- ——During running, Press alarm setting key (Item 3 in Fig.5) to enter the alarm setting surface for viewing the alarm information .Refer to Fig. 14.
- ——Turn the knob (Item 9 in Fig.5) to "Info", press the knob (Item 9 in Fig.5) for confirmation and enter the "Info" surface. Refer to Fig.15.
- ——Turn the knob (Item 9 in Fig.5) to " $\boxtimes$ ", press it to exit the setting surface.



Fig.14 Setting of alarm parameter surface (1)

Limits Info	$\times$
1 AC Power loss ! ! 2 Pcon high ! ! !	

Fig. 15 Setting of alarm parameter surface (2)

### Reset of system setting

- Reset of system setting:
  - ——Enter the relevant surface of ventilation mode, if you don't want to use the previous mode or default system setting, you can reset system setting;
  - -----If need to change system setting, press the "system setting" key (Item 5 in Fig. 5 )
  - ——See Fig.16 for "system setting" surface.
- Parameter adjustment:
  - -----Turn the knob (Item 9 in Fig.5) to highlight the required parameter;
  - ----Press the knob (Item 9 in Fig.5) to make the parameter setting value in opposite color;
  - -----Turn the knob (Item 9 in Fig.5) to adjust the parameter;
  - -----Press the knob (Item 9 in Fig.5) for confirmation;
  - -----Repeat the previous step if next parameter need to be adjusted;
  - ——Turn the knob to" 🖄 ", press the knob to exit the setting surface, and the machine will work with the set values.

Graphics Lock O <sub>2</sub> Cal.	X
PAW Flow P/V	
PAW Flow P/V	

Fig.16 System setting surface

### **Operation of IPPV mode**

- Enter IPPV mode:
  - -----Choose IPPV mode in the surface of ventilation mode and parameter setting (Fig.11);
  - ----Press the knob(Item 9 in Fig.5) for confirmation and the machine will enter standby status;
  - ——Turn the knob (Item 9 in Fig.5) to " 🖄 ", press it to confirm and exit, and the machine will work under the mode of IPPV.
- Surface of IPPV mode:

Please refer to Fig. 17.



Fig.17 Surface of IPPV mode

Illustration for the surface of IPPV mode (same for other modes):

- -----(1) is audio paused indication of alarm.
- -----(2) is respectively indication for alarm of PAW High (Low), FiO2 High (Low), High (Low) MV, No tidal volume.
- -----(3) is spontaneous inhalation status.
- -----(4) is respectively indication for waveform.
- (5) is the indication for the monitoring values of O<sub>2</sub> concentration and the presetting values of upper and lower limit for O<sub>2</sub> concentration alarm (optional).
- ----(6) is the indication for the monitoring value of MV and the presetting values of upper and lower limit for MV alarm .
- ----(7) is the indication for the monitoring value of tidal volume.
- -----(8) is the indication for the monitoring value of frequency.
- -----(9) is the indication for the monitoring value of Ppeak and the presetting values of upper and lower limit for Ppeak alarm .
- -----(10) is the indication for the monitoring value of PEEP.
- ----(11) is the monitoring value of lung compliance.
- ----(12)~(15)are respectively indication of the presetting values for frequency, I:E( inspiration and expiration ratio), Sigh time, inhalation platform.
- -----(16) is lock or unlock indication.
- -----(17) is indication for power supply status, including AC, Battery, and low voltage of battery.

#### ▲ Note:

.When the ventilator is working, the "bag/vent" selection knob must be turned to "

### **Operation of A/C mode**

- Enter the mode of A/C
  - -----Choose mode A/C under the surface of ventilation mode and parameter setting (Fig.12);
  - ----Press the knob(Item 9 in Fig.5) for confirmation and machine will enter standby status;
  - ——Turn the knob (Item 9 in Fig.5) to " $\boxtimes$ ", and press it to confirm and exit, and the machine will work under mode of A/C.
- Surface of A/C mode:

Please refer to Fig.18.



Fig.18 Surface of A/C mode

### **Operation of SIMV mode**

- Enter the mode of SIMV:
  - -----Choose mode SIMV under the surface of ventilation mode and parameter setting (Fig.13);
  - ——Press the knob(Item 9 in Fig.5) for confirmation and the machine will enter standby status;
  - ——Turn the knob (Item 9 in Fig.5) to" 🖄 ",and press it to confirm and exit, and the machine will work under mode of SIMV.
- Surface of SIMV mode:

Please refer to Fig19.



Fig. 19 Surface of SIMV mode

### **Operation of apnea function**

#### Note:

Only under the mode of SIMV, apnea time can be set.

- Before Choose of apnea mode, please set the proper ventilation parameters under the mode of A/C.
- Press alarm setting key (item 3 in Fig. 5) to set the apnea time under mode of SIMV.
- If there is no spontaneous or assisted ventilation during Apnea time, the mode will change to AC, and there is alarm indication of Apnea (Red).
- If there are 3 times of Spontaneous ventilation after change mode to A/C, the mode will change to the former ventilation mode, and there is alarm indication of Apnea.

#### Note:

When sigh time is set to OFF, there will be no apnea ventilation or apnea alarm indication.

# **Operation of SIGH function**

• Under the mode of IPPV, choose sigh function and set times of sigh.

## **Operation of Audio paused function**

- When an alarm occurs, the alarm will resume within 2 minutes by pressing mute key" 💭 " (item 2 in Fig.5).after mute time (2 minutes),alarm will remain unless the problem is solved properly.
- When the sound alarm is muted, the alarm indication" () on the screen will remain unless the problem is solved properly.

### **Operation of key lock function**

- ——Under every ventilation mode, press system setting key (item 5 in Fig.5), enter system setting surface ;
- -----Turn the knob (Item 9 in Fig.5) and choose "Lock";
- -----press the knob(Item 9 in Fig.5) to enter "Lock" surface, refer to Fig.20;
- ——Turn the knob (Item 9 in Fig.5) to " (a) " and press it , the indication " (b) " will be on the screen. All the keys will be locked and not be operated except system setting key and manual ventilation key.
- ——Turn the knob (Item 9 in Fig.5) to " $\stackrel{i}{\square}$ " and press it, all the keys will be unlocked.



Fig.20 Surface of key lock

### Oxygen concentration (optional)

- ——In every ventilation mode, press system setting key (item5 in Fig.5), enter system setting surface;
- -----Turn the knob (Item 9 in Fig.5) and choose "O2 Cal.";
- -----Press the knob(Item 9 in Fig.5) to enter "O<sub>2</sub> Cal." surface, refer to Fig.21;

- ——Put the oxygen sensor in air ,turn the knob(Item 9 in Fig.5) to "21%" and press it , until the screen displays "Calibration completing ";
- -----Take out the reservior bag and install the oxygen sensor;
- -----The "bag/vent" selection knob is revolved to " \_\_\_\_\_" position;
- ——Adjust O<sub>2</sub> flow valve to 5 L/min;
- ----- Push the switch of oxygen flush valve about 10s;
- ——Turn the knob (Item 9 in Fig.5) to "100%" and press it , until the screen displays "Calibration completing ".

Graphics Lock O <sub>2</sub> Cal.	$\left  \times \right $
21%	
100%	

Fig. 21 Surface of oxygen calibration

### Oxygen flush valve

- Press the oxygen flush valve (item 7 of Fig.1) to provide high flow rate of O<sub>2</sub> to anaesthetic breathing system;
- Loosen the oxygen flush valve, oxygen flow stops.

#### ▲ caution:

When open the oxygen flush valve, pay attention that airway pressure can not be too high.

### Oxygen flow rate adjustment

- The volume of oxygen flow rate is decided by consumption of animal and leakage volume of whole breathing circuit ,etc.;
- In mechanical ventilation:
  - ——The buffer pocket of breathing bellow shall inflate to the top at the end of each breathing;
  - ——If the buffer pocket of breathing bellow falls at the end of each breathing, then the oxygen flow rate shall be increased.

### $V_{\tau}$ adjustment

- ——Turn the VT adjustment knob (Item 10 in Fig. 5) anticlockwise to increase VT output.
- ----Clockwise to reduce VT output.

- ——Observe VT monitoring display values.
- ——When monitoring display value reach a required value, stop adjusting.
- ——The machine will work with the set value.

#### ∆Note:

- After changing frequency, inspiratory time or PEEP, V<sub>T</sub> will also change. At this time, V<sub>T</sub> should be adjusted to a required value.
- When SIGH occurs, ventilation time is twice as long as the preset time, V<sub>T</sub> will increase 1 to 1.5 times.
- The flow of continuous positive airway can be adjusted under CPAP mode.

### Anesthesia

- In accordance with requirements, adjust flow rate of fresh gas (generally, flow rate is 0.5~1L / min);
- Turn the concentration adjustment knob to required concentration;
- After using, turn the concentration adjustment knob clockwise to position "0".

#### Marning:

Concentration adjustment of the vaporizer shall not be less than 0.2%. If it is less than 0.2%, output concentration of anaesthetics is unstable.

#### ▲ caution:

See user's manual for use of vaporizer.

# Pressure limit adjustment and discharge of manual ventilation

During manual control ventilation,

- When it is needed to adjust pressure limit value of anaesthetic breathing system:
  - -----Observe the airway pressure gauge (Item 8 of Fig.1);
  - —As manually pinches breathing reservoir bag,rotate "APL" valve (adjustable pressure limit valve) knob:
    - a) rotate clockwise to increase pressure limit value of breathing system;
    - b) counter clockwise rotate to reduce pressure limit value of breathing system
    - Until airway pressure reached the needed value, then the equipment start to discharge .
- When the equipment need to completely discharge:
  - counter clockwise rotate "APL" valve (adjustable pressure limit valve) knob to completely open;
  - After completion of discharge,rotate clockwise knob, "adjust APL" value to required pressure limit value or completely close.

# **Operation of anaesthetic gas scavenging**

# system-transfer and receiving system(optional)

#### ∆ Warning:

1)The largest continuous or intermittent flow of ventilation system used with exhaust gas transfer and receiving system shall not be over 60L/min, otherwise it will overflow.

2)The suction flow rate of processing system used with exhaust gas transfer and receiving system shall not be less than 75 l/min.

- Connect the negative pressure air supply properly;
- Adjust the flow adjusting valve(Item 3 of Fig.4), so that the suction flow rate is between the high and low flow signs.

# The end of use

It shall be carried out according to the following procedures after completion of use:

- Rotate vaporizer concentration adjustment knob to "0";
- Close the flowmeter:
- Close power supply of anesthesia ventilator;
- Remove power cord;
- Close O2 supply,remove high pressure gas hose;
- Pressure relief of anesthesia system :
  - -----Revolves" bag/vent" breathing selection knob to "
  - ——When choose manual ventilation, the ventilator shall be changed to standby status, press the standby key for a moment to enter to standby status;
  - counter clockwise rotate "APL" valve (adjustable pressure limit valve) knob to completely open,carry out discharge ( sound alarm is given in discharge process is normal phenomenon );
  - ——After completion of discharge,rotate clockwise knob,"adjust APL" valve to required pressure limit value or completely close .

# **Cleaning and disinfection**

#### ▲ Warning:

- 1) carefully read the scope and use instructions of cleaning agent;
- 2) carefully read user manual of disinfection equipment;
- 3) Do not use steatite , stearic acid , Calcium Carbonate , corn flour or similar materials,these materials may enter the lungs or of animal respiratory passages thereby causing stimulation or damage.

#### ▲ caution:

1) Do not use organic solvent , halogenation or petroleum base solvent , anesthesia agent ,glass cleaning agent , acetone or other stimulative cleaning agent;

- 2) Please do not use abrasive cleaning agent, such as steel wool, silver polish or cleaning agent;
- 3) All the liquid shall be placed at the positions far away from the electric components;
- 4) The liquid mustn't flow into internal of the equipment casing;
- 5) Wild Water or high pressure gas mustn't flush ,blow the inner barrel of flow rate sensor;
- 6) Do not use flow rate sensor to carry out high temperature steam disinfection .

7) After maintenance, servicing, cleaning and disinfection, equipment shall be checked according to steps of "check before use ".

### High pressure O<sub>2</sub> hose

When it is used for the first time, clean with clear water and blow-dry.

### Breathing tube, connection hoses, etc.

Breathing tube, breathing reservoir bag, anesthesia mask, "Y" shaped connector, fresh gas connection tube, pressure sample tube of airway,etc., After each use:

- Dismantle from the equipment;
- Rinse with soap water and flush;
- Flush with clear water and air;
- Place in disinfection fumigating box to fumigate and sterilize; or
- Immerse for 30 minute with 70% alcohol;
- With disinfection regulations to carry out;
- Flush with clear water and air.

# CO<sub>2</sub> absorber

#### Dismantle CO<sub>2</sub> absorber

- Dismantle CO<sub>2</sub> absorber from equipment according to the method of "Installation and setting of CO<sub>2</sub> absorbent";
- Spill CO<sub>2</sub> absorbent.

#### After use of general animals

- Wash with soap water ;
- Wash with clear water and air.

#### After use of infectious animals

- Wash with soap water;
- Wash with clear water and air;
- Place in disinfection fumigating box to fumigate and sterilize;or
- Immerse for 30 minute with 70% alcohol; or
- With disinfection regulations to carry out;
- Flush with clear water and air.

#### Installation of CO<sub>2</sub> absorber

According to the method of "installation and setting of  $CO_2$  absorbent", after enclosing  $CO_2$  absorbent, enclose equipment.

### Inhalation and exhalation valve

- Pull out flap cover up;
- Break flap flake card into halves;
- Take out flap flake;
- Immerse water-solubility disinfection agent with sterile gauze ;
- Scrub away flap cover , flap flake and flap port;
- Air moisture;
- Recover flap flake;
- Press flap cover into flap cover seat.
- ▲ caution:

1) Dismantling and cleaning flap cover and flap flake shall be handled with care, do not smash or scratch flap cover and flap flake .

2) When installing flap cover and flap flake, sealing shall be paid attention to .

### Breathing bellow and buffer pocket

Instructions:

Buffer pocket of Bellow is latex component.

#### Dismantle breathing bellow and buffer pocket

- Counter clockwise rotate bellow casing and raise;
- Take down buffer pocket of bellow;

- Press the latch of buffer pocket seat and take down buffer pocket seat;
- Take down relief valve;
- Take down seal washer.

#### **Cleaning and disinfection**

- Rinse with soap water;
- Wash with clear water and air;
- Place in disinfection fumigating box to fumigate and sterilize;or
- Immerse for 30 minute with 70% alcohol; or
- With disinfection regulations to carry out;
- To rinse with clear water and air.

#### Install breathing bellow and buffer pocket

- Install seal washer;
- Install relief valve;
- Install buffer pocket seat;
- Install buffer pocket of bellow;
- Bellow casing is placed with fixed seat, clockwise rotate and tighten.

### **Equipment surface**

Soak with sterile gauze and scrub away and sterilize with water-solubility disinfection agents.

# Maintenance

#### **M** warning:

- 1) No use-serviceable parts inside, before servicing to authorized representative or manufacturer!2) Do not use the equipment with fault.
- 2) If fault occurs in equipment, then it shall be serviced by authorized professional technicians of our Company .If users need to service by themselves, the service shall be carried out by trained, qualified and competent technicians. If necessary, our company may provide necessary information.
- 3) Calibration of components of equipment shall be carried out by authorized professional technicians of our Company,or by trained, qualified and competent technicians.
- 4) Do not throw away the replaced battery into fire in maintenance and servicing so as to avoid blasting; do not open or destroy battery, since it contain hazard substance and may damage skin and eyes ;nor throw away freely so as to avoid polluting the environment. It shall be sent to manufacturer to recover.
- 5) Do not throw away the replaced electric and plastic parts freely in maintenance and servicing so as to avoid polluting the environment. It shall be handled according to the requirements of local environmental laws and regulations.

6) Please remove primary batteries when machine is not likely to be used for some time.

#### ▲ caution:

After maintenance and servicing, the equipment check shall be carried out according to the steps of "check before use".

### Before everyday operation

Before first operation, clean the surface of the machine everyday.

### After operation of every animal

Do disinfection after operation of every animal .

### When needed

- Drain the water in the fixed seat of the CO2 absorber.
- Detach the cover of the inhalation and exhalation valve and wipe the water vapor.

### When Assembling after washing and disinfection

Check the gasket of exhalation valve and "O" ring and other part when doing assemble after disinfection. If any part is broken, replace it immediately.

### **Operation over 1200 hours or 6 months**

• Every 6 months or over 1200 hours, take out the filter. assemble it after removing the dust and other things.

### Every year or operation over 2500 hours

- Maintain, and check the machine completely;
- Replace the gasket and O type circle;
- Check and calibrate:
  - ----vaporizer;
  - ------ Flow meter;
  - —— Pressure gauge;
  - ------ Exhalation gas volume (tidal volume ,minute MV) monitor;
  - ----- Pressure monitor.

### Every two years or operation over 5000 hours

Every two years or operation over 5000 hours, check and calibrate every pressure limit valves.

# Waste disposal

### **Disposal of battery**

#### **▲** Warning

Do not throw the battery into the fire in case of explosive; Do not open or destroy the them, because it contains injurant which may injure skin and eyes. Please dispose the battery under the local environment law.

- For there is polluting material in battery, please dispose battery according local environment law.
- Please refer to Environmental Protection Agency or government or waste disposal company for relevant environment law.

### Disposal of electronic and plastic parts

#### ▲ Warning

Do not discard the broken electronic and plastic parts ignorantly for environment protection.

• Do not discard the broken electronic and plastic parts ignorantly for environment protection. Please dispose them under the environment law.

### Scrap disposal of medical equipment

When service life is over, do not dispose it as household waste, and dispose it separately.

- Please abide the local environment law for waste disposal.
- Please refer to Environmental Protection Agency or government or waste disposal company for waste disposal.

# Alarm and disposal

#### ▲ Warning:

- 1) If there is alarm during the operation, safeguard the animal firstly, then check immediately to fix the fault.
- 2) If power fails during operation, and the machine stop working, please do manual ventilation to the animal .
- 3) When the alarm for under-voltage of the backup power battery is activated, indicating that the backup power is running out, the system shall be immediately switched to be powered through AC utility power. If it is impossible to switch to supply power through AC utility, turn off the ventilator and conduct manual ventilation for the animal.
- If there is alarm during the operation, safeguard the animal firstly, then check immediately to fix the fault.
  - -----Revolves the "bag/vent" selection knob of anaesthetic breathing system to"

——When choose manual ventilation, the ventilator shall be changed to standby status, press the standby key for a moment to enter to standby status;

- -----Adjust O<sub>2</sub> flow rate valve to the needed flow rate;
- —Push oxygen flush button to ensure that manually controlled breathing reservoir bag is moderately inflated;
- ——Adjust the "APL" valve (adjustable pressure limiting valve) to proper pressure limiting value;
- ----- Manually pinching breathing reservoir bag may conduct manual ventilation to animal s;
- —— Or use the simple breather with mask to directly conduct manual ventilation.
- When the alarm condition occurs, the alarm shoud be actived immediately.
- When there are two or more alarms occur at the same time, the alarm is the high priority alarm.
- The position of the operators:

----- Visual alarm: The operator should be at a distance of 1 m from the display screen (in the cone which is  $30^{\circ}$  against the center of the screen plane level);

—— Auditory alarm: The operator should be at a distance of 1 m from the front of equipment .

- Before and after the interruption of power supply, alarm default values will not change.
- Alarm default values must do with access change or storage change by a special tool.
- The volume of the auditory alarm signal: high priority: 68 db middle priority: 68 db
- The alarm priority is classified by the risk level to the animal .
- The high priority alarm should be disposed immediately.
- Alarm priority:

Priority

Alarm way

Priority	Alarm way
High	Continuous and repeated ten tones and with 7 second interval
Mediu	Continuous and repeated three tones
m	and with 23 second interval
Low	Odd tune

• Alarm information:

Alarm	Priority	Setting range	Default value	Alarming way
High Ppeak alarm	High	$20~\sim~100~\text{cmH}_2\text{O}$	40 cmH₂O	When the monitoring value over the upper limit of Ppeak, there will be a sound alarm and display "PAW high!!!".
Low Ppeak alarm	High	$0\sim~20~cmH_2O$	4 cmH₂O	When the monitoring value under low limit of Ppeak, there will be a sound alarm and display PAW low !!!".
High MV alarm	Medium	1L/min $\sim$ 20 L/min	10 L/min	When the monitoring value over upper limit of MV, there will be a sound alarm and display "MV High!!".
Low MV alarm	Medium	0 L/min $\sim$ 10 L/min	0 L/min	When the monitoring value under low limit of MV, there will sound alarm and display "MV low!!".
No tidal volume alarm	Medium			If there is no tidal volume in 6 seconds, there will be a sound alarm and display "No tidal volume! ! ".
Continuous pressure alarm	High			If the airway pressure (PEEP+1.5Kpa) over or under the set upper or low limit of continuous pressure alarm in 16 seconds, there will be a sound alarm and display "Pcon High!!!".

Alarm	Priority	Setting range	Default value	Alarming way
Apnea alarm	Medium	5s∼60s	OFF	If there is no spontaneous or assisted ventilation during SIGH time, the mode will change to AC mode, and there will be a sound alarm and display " Apnea "(Red color). If there are 5 times of Spontaneous ventilation after change mode to A/C, the mode will change to the former ventilation mode, and there will be a sound alarm and display "Apnea "(Green color).
Power failure alarm	e Medium			Main power disconnection or problem, the machine power supply will be battery, there will be a sound alarm and display of "
Low voltage alarm	Medium			When the voltage of back-up battery is low (10.2V±0.3V), the power state indication place will display the signal of "
Fan failure	Medium			When the fan doesn't work,the screen will display the signal of "Fan failure", and there will be a sound alarm.

• Cause of alarm and solution of the alarm:

Alarm	Cause	Solution of alarm
High Ppeak alarm	<ol> <li>Block of breathing circuit pipe</li> <li>Block of animal airway.</li> <li>Upper limit of alarm is too low.</li> <li>Ventilation parameters are set improperly.</li> </ol>	<ol> <li>Check the breathing circuit pipe</li> <li>Check the animal status</li> <li>Re-set the upper limit of alarm.</li> <li>Reset ventilation parameters.</li> </ol>
Low Ppeak alarm	<ol> <li>Leakage or disconnection of breathing circuit pipe</li> <li>Low limit of alarm is too high.</li> <li>The compliance of animal changes.</li> </ol>	<ol> <li>Check and reconnect the pipe.</li> <li>Reset the low limit of alarm</li> <li>Check the animal status.</li> </ol>
High MV alarm	<ol> <li>Upper limit of MV alarm is too low.</li> <li>High frequency or High tidal volume</li> </ol>	1 Reset the upper limit of MV alarm. 2 Reset frequency or tidal volume
Low MV alarm	<ol> <li>Low limit of MV is too high.</li> <li>Leakage or disconnection of breathing circuit pipe</li> <li>Low frequency or tidal volume</li> <li>No input gas</li> <li>Problem with flow sensor</li> </ol>	<ol> <li>Reset the low limit of MV.</li> <li>Check and reconnect the pipe.</li> <li>Reset frequency or tidal volume</li> <li>Check the input gas supply</li> <li>Check the flow sensor</li> </ol>
oxygen deficiency alarm	<ol> <li>gas supply pressure is too low</li> <li>Oxygen sensor should be calibrated</li> </ol>	<ul> <li>1 Adjust gas supply pressure wthin</li> <li>440 kPa± 160 kPa</li> <li>2 Adjust pressure regulator to make sure</li> <li>that the output pressure is 440 kPa</li> </ul>
Continuous pressure alarm	<ol> <li>Problem with breathing circuit pipe</li> <li>Block of animal airway</li> <li>Alarm limit of is too low</li> <li>Ventilation parameters are set improperly.</li> </ol>	<ol> <li>Check and reconnect the pipe</li> <li>Check the animal status</li> <li>Reset the alarm limit</li> <li>Reset the ventilation parameters</li> </ol>
Power failure alarm	<ol> <li>Main power disconnection or problem</li> <li>Problem with fuse</li> </ol>	1Check the main power supply 2 Replace the fuse
Alarm of low voltage of battery	1 Low voltage of battery	1 Change the power supply to main power

Alarm	Cause	Solution of alarm
Fan failure	1 Fan doesn't work.	1 Change the fan.

# Troubleshooting

Fault	Cause	Solution way
There is no display on screen and ventilator do not work.	<ol> <li>The main power is off</li> <li>Power line disconnection</li> <li>The switch of ventilator is off.</li> <li>Fuse is broken</li> </ol>	<ol> <li>Check the power supply in the working place</li> <li>Connect the power line</li> <li>Switch on the ventilator</li> <li>Change the fuse</li> </ol>
Abnormal display of tidal volume	<ol> <li>Loose connection of flow sensor sampling tube</li> <li>Leakage of breathing circuit pipe</li> <li>Leakage of exhalation valve</li> </ol>	<ol> <li>Re-connect the flow sensor sampling tube</li> <li>Re-connect or change pipe</li> <li>Check exhalation valve</li> </ol>
air leakage of anaesthetic breathing system	<ol> <li>"APL" valve is not closed</li> <li>CO2 absorber is not tightly installed</li> <li>Breathing tube damage or connector is loosened</li> <li>damage of breathing reservoir bag</li> <li>inhalation, exhalation flap cover is damaged or unpressed</li> </ol>	<ol> <li>close "APL" valve</li> <li>reinstall and clean out foreign matter of seal washer of CO2 absorber</li> <li>replace new tube or reinstall</li> <li>replace air bag</li> <li>replace new flap cover or repressed</li> </ol>
At the end of exhalation, breathing buffer pocket of bellow can not expand to top or gradually drop	<ul> <li>1over fast selected breathing rate at the bigger tidal volume</li> <li>2 flow rate control valve is not opened or flow rate is too small</li> <li>3 air leakage of breathing circuit</li> <li>4 buffer pocket of bellow is damaged or detached</li> </ul>	<ol> <li>reset proper breathing rate</li> <li>open flow rate control valve switch or adjust proper flow rate</li> <li>according to the method of "air leakage of anaesthetic breathing system "to check and treat</li> <li>check and replace buffer pocket of bellow</li> </ol>
During inhalation, buffer pocket of breathing bellow is not compressed or compress range is not enough	<ol> <li>"air bag-ventilator" selection knob is still at position "air bag"</li> <li>airway blocking</li> </ol>	<ol> <li>switch the selection knob to "ventilator"</li> <li>check and get rid of</li> </ol>
Difficult drench of	1 Evaporation concentration adjustment knob did not revolve to"0", or drenching is	1 Evaporation concentration adjustment knob revolves to 0 or drenching is carried out 2 minute after drenching

Fault	Cause	Solution way
vaporizer	carried out at once after the knob revolved to "0".	2 The perfusion port's screw is not loosened
	2 The perfusion port's screw is not loosened	
without	out 1 flow rate control valve is not 1 adjus entration opened ,without flow rate output 2 dosin ut of 2 No liquid medicine prizer	1 adjust flow rate control valve
concentration		2 dosing
output of vaporizer		

# *Main technical specification* Environment conditions

• Working environment

Ambient temperature	5 °C $\sim$ 40 °C
Relative humidity	≤80 %
Atmospheric pressure	860 hPa $\sim$ 1060 hPa

• Storage environment

Ambient temperature	$-20~^\circ\mathrm{C}{\sim}+50~^\circ\mathrm{C}$
Relative humidity	≤93%
Atmospheric pressure	500 hPa $\sim$ 1060 hPa

### Classification

Classified according to IEC 60601-1, BAM-8 belong to:

- Common equipment;
- No use flammable anaesthetic;
- Continuous operation;
- please refer to the Chapter "clearance and disinfection"
- Steam and high heat pressure resistant or may be sterilized (please refer to" cleaning and disinfection "of the user's manual).

#### Gas supply

•	Gas source	O2 (For medical use)
•	Rated working pressure	440 kPa
•	Input pressure range	280 kPa $\sim$ 600 kPa
•	Output pressure of regulator	
	(gas cylinder supply)	less than 440 kPa
•	Safety valve	780kPa
•	Negative pressure air source	≥75 L/min

#### Flow rate

• Adjust range of flow meter

O <sub>2</sub>	0.1 L/min $\sim$ 5 L/min
	•••••••••••••••••••••••••••••••••••••••

• precision (20°C 101.3kPa, supply pressure 440 kPa)

The precision from 10 % of full scale to full scale is  $\pm 10$  % of indicated value The precision lower than 10 % of full scale is class 4.

•	Flow rate of oxygen flush valve	25 L/min $\sim$ 75 L/min	
•	Output pressure for fresh valve	30 kPa $\sim$ 45 kPa	
Power supply			
•	Voltage	100-240 V $\sim$	
•	Frequency	50/60 Hz	
•	Input power	40VA	
•	Fuse		
	——Main power ——Internal power	T2AH 250V T4AH 250V	

# Electromagnetism compatibility

#### ▲ Warning:

- 1) Cell phone and other radiation equipment used near the machine will cause unexpected problem to the ventilator. If there is radio frequency radiation source nearby, working status of the equipment should be monitored.
- 2) The other equipment added to ventilator will lead to disturbance to the machine. Before used to the animal , check if the machine work normally under the set values.

#### ▲ caution:

- 1) without our company agreement to change the equipment ,may cause electromagnetism compatibility problem of this equipment or other equipments .
- 2) Design and test of this equipment comply with regulations of electromagnetism compatibility.

### Anaesthetic breathing system

- Volume 2300 mL (includes bellow and CO2 absorber)
- CO2 absorber 950 mL/piece
- System compliance

2.2 mL/cmH₂O

• Impedance

			30 L/min	60 L/min
		inhalation impedance	2 cmH₂O	4 cmH₂O
		exhalation impedance	2.5 cmH <sub>2</sub> O	5 cmH₂O
•	Exhalation flap (damp	check valve) resistance	1 cmH	₂O(60 L/min,35 ℃)
•	Exhalation flap (damp	check valve ) open press	sure 0.8 cmH	₂O(20 mL/min 35 ℃)

### Anaesthetic gas discharge port

Anaesthetic gas discharge port is a 30mm outer cone connector complying with ISO 5356-1 ,which is used to be connected with the anaesthetic gas scavenging system - transfer and receiving system complying with ISO 8835-3.

### Ventilation mode

- ——IPPV
- ——A/C
- ——SIMV

### Ventilation parameters

#### Specification

• Frequency

	——Adjusting range	1 bpm $\sim$ 100 bpm
		(Under SIMV: 1 bpm $\sim~$ 20 bpm
		All mode except SIMV: 4 bpm $\sim$ 100 bpm )
	——Allowable error	± 15 %
•	Inhalation time (I:E) (Tinsp)	
	——Adjusting range	2:1 (1:0.5) ~ 1:6
		(0.2s $\sim$ 6.0s)
	——Allowable error	$\pm$ 15 % or $\pm~$ 0.1 s, whichever is the greater
•	Tidal volume $(V_T)$	
	——Adjusting range	0,20 mL $\sim$ 1500 mL
•	Minute ventilation (MV)	
	——Max MV	≥18 L/min
---	------------------------------------	---
•	PEEP(optional)	
	——Adjusting range	0 kPa $\sim$ 3kPa
	——Allowable error	$\pm$ 15 % or $\pm$ (3cmH_2O+10%setting value) ,
		whichever is the greater
•	Pressure trigger (PTr)	
	——Adjusting range	$-$ 2.0 kPa $\sim$ 0kPa $$ (Under PEEP)
	——Allowable error	± (0.1 kPa+10 %setting value)
•	Flow trigger (FTr)	
	——Adjusting range	0.5 L/min $\sim$ 30 L/min
	——Allowable error	
	>3L/min:	±20%
	≤3L/min:	±0.6 L/min
•	Holding time (Inhalation platform)	(TIP)
	——Adjusting range	0 $\sim$ 3s(Less than 50% of inhalation time)
	——Allowable error	$\pm$ 15 % or $\pm~$ 0.1 s,whichever is the greater
•	Sigh	
	——Adjusting range	0, 1/100 $\sim$ 5/100
•	Apnea ventilation	
	——Adjusting range	OFF,5 s $~\sim~$ 60 s
•	Max set working pressure	
	pressure limit range	2kPa $\sim$ 10kPa
	——Allowable error	$\pm$ 15 % or $\pm$ 1 kPa, whichever is the greater
•	Max pressure	≤12.5 kPa

explanation:

- 1) set pressure limit value to produce maximum working pressure( the upper limit of high airway pressure alarm).
- 2) do not use negative pressure at exhalation.
- 3) maximum limit pressure is pressure of the safety valve.

#### Driven gas

•	Gas source	$O_2 \ (For \ medical \ use)$			
•	Rated working pressure	440 kPa			
•	Input pressure range	280 kPa $\sim$ 600 kPa			
Fr	Fresh gas compensation				
•	Compensation range	0 $\sim$ 15 L/min			
•	gas composition	O <sub>2</sub> and anaesthetic			

## **Ventilation parameter Monitoring**

- The fllowing are monitoring parameters under the environment of body temperature and pressure-saturated.
- Minimum exhalation volume maybe monitored is 50 mL/min.
- display:

Parameter	Range	Resolving power	Accuracy				
Frequency (Freq)	0 bpm $\sim$ 100 bpm	1 bpm	±15 %				
Tidal volume $(V_T)$	0 $\sim~2000~mL$	10 mL	>100 mL, ±20% ≤100 mL, ±0.02 L				
Minute ventilation (MV)	0~100L/min	0.1 L/min	>1L/min, ±20% ≤1L/min, ±0.5 L/min				
(Ppeak)	$0\sim$ 100 cmH <sub>2</sub> O	1 cmH <sub>2</sub> O	± (4%full scale+4%actual reading)				
Compliance	$1\sim$ 1000mL/ cmH <sub>2</sub> O	1mL/ cmH₂O					
<ul> <li>Waveform display:</li> <li>—Time- airway pressure (under all modes)</li> <li>—Time—flow (under all modes)</li> <li>—pressure volume loop (all modes)</li> </ul>							
Remarks: The	machine cannot record	all the adjusting and mon	nitoring values.				
<ul> <li>the purpose and sensor position, type and sampling method of control, measurement and display device</li> </ul>							
the purpose	sensor position	type	sampling method				
Airway pressu	re Exhaling end	pressure- voltage Simulated dat	e and Choose average value from multiple sampling				
PEEP(optional	l) Exhaling end	pressure- voltage Simulated dat	e and from multiple sampling				
Continuous pressure	Exhaling end	pressure- voltage Simulated dat	e and from multiple sampling				

the purpose	sensor position	type	sampling method
freq	built-in	Time and simulated data	Choose average value from multiple sampling
Inhalation time	built-in	Time and simulated data	Choose average value from multiple sampling
Holding time	built-in	Time and simulated data	Choose average value from multiple sampling
tidal volume	Exhaling end	flow- voltage and Simulated data	Choose average value from multiple sampling
flow	Exhaling end and inhaling end	flow-voltage and simulated data	Choose average value from multiple sampling
O2 concentration (optional)	Inhaling end	O <sub>2</sub> concentration-voltage and simulated data	Choose average value from multiple sampling

## Monitoring equipment should be equipped in using

According to international standard, the equipment shall be used with the following monitoring equipments :

- CO2 monitor (comply with requirements of ISO 21647);
- O<sub>2</sub> monitoring device (comply with requirements of ISO 21647);
- Anaesthetic gas monitoring device (when using vaporizer) (comply with requirements of ISO 21647).

## Installation, conveying and moving

- The equipments shall be steady when installing, conveying or moving, in installation, the tilting of the equipment shall not be greater than 5°.
- Before the anesthesia system is conveyed or moved, it shall:
  - ——Dismantle all power wires, cables, pipe etc.
  - ——Drawer shall be pushed to close.
- The mass of anesthesia system including its safe working load is 80kg.

#### ▲ Caution:

- 1) When the anesthesia system is conveyed or moved, it shall:
  - -----pay attention to keep steady to prevent from unbalanced.
- 2) Before the anesthesia system is conveyed or moved, it shall
  - ----- dismantle all power wire, cable, pipe etc.;
  - -----drawer shall be pushed to close.

# Storage and transportation Storage

- The Anesthesia System shall be stored indoors with ambient temperature of −20°C ~ 50°C, relative humidity not exceeding 93% and atmospheric pressure at 500 hPa~1060 hPa, free of corrosive gases and not affected by strong magnetic field, and with good ventilation.
- When the anesthesia system is stored, the anaesthetics of vaporizer shall be drained and the vaporizer shall be purged according to user's manual of vaporizer.

### Transportation

• Anesthesia System to be transported shall be packed in package. Each set of machine shall be

secured in its package and soft material of adequate thickness shall be inserted in between the package and product to protect against movement and rubbing against each other during transportation. The package shall be protected from damp and rain to ensure that the product will not be damaged in natural condition.

- The packed ventilator can be transported by general means. The product shall be protected from rain, damp, corrosion and against strong vibration, turn over at handling is forbidden.
- The Anesthesia System shall be transported at ambient temperature of −20°C ~ 50°C, relative humidity not exceeding 93% and atmospheric pressure at 500 hPa~1060 hPa.

# Others

- If complying with the rules of storage and transport and use, and the equipment can work normally ,our company will repair it freely within one year from leaving factory.
- Please do not dismantle the equipment without authorization If faults occur on the equipment, it shall be repaired by professional technical person authorized by our Company .If users need to repair by yourselves, it shall be carried out by trained, qualified and competent technical. IF necessary, our company can provide necessary data.

# Check list

#### ▲ Warning:

If any check did not pass through, then the equipment shall not be used.

- Every day before use of the first animal and every animal, and after maintenance, service, cleaning, disinfection and repairing, all the items shall be checked by experienced personnel who are familiar with the equipment.
- The list can be copied as records of daily check, each function shall be marked after being checked and passed.

#### System check

- □ The installation and connection of components are well done;
- □ Breathing tube are in good condition, and connection is secure and correct;
- □ Vaporizer is well locked and is provided with enough and correct anaesthetic;
- □ Gas supply connection is correct;

- □ When using central gas supply, the cylinder valve shall be closed;
- □ The plug of power cord is firmly connected with the power socket on the wall.

#### Check of power supply fault alarm

- □ Connect mains power supply, the power indicator lights; switch on the starting switch, start-up the ventilator. The symbol "- (1)" and " (1)" " will display on the screen.
- Pull down the power cord from the socket, the equipment shall automatically switch to work with battery, there will be a sound alarm and the symbol " will display on the screen.

#### Gas supply check

- Gas source check
- □ Pressure of the central gas supply system is 440 kPa±160 kPa (280 kPa~600 kPa);
- □ The reserved cylinder shall be able to well supply gas;

Close the gas cylinder valve.

- Leakage check
- Leakage check
  - ----Close the flow rate of O2;
  - -----Connect gas supply of O2;
  - After the indicated value of pressure gauge of O2 on the anesthesia system is stable, switch
    off the gas supply;
  - -----Observe O2 pressure gauge, the indicated value shall drop not more than 10 kPa in 1 minute;
  - ——If the drop of the indicated value is greater than 10 kPa, it indicates there is gas leakage, gas leakage position shall be checked and restored.
- Check of oxygen flush valve
- □ Press the oxygen flush valve switch, high gas flow shall flow from the fresh gas outlet;
- □ Loosen the oxygen flush valve switch,gas flow shall stop.
- Check of flow rate control
- □ Adjust the flow rate control knob of O<sub>2</sub>, flow rate shall be able to reach full scale, the floater in the flow meter tube shall float freely;

#### Vaporizer check

- □ Check the concentration adjustment knob before perfusion of liquid medicine,the knob shall be rotated freely,self-locking and Interlocking device shall be reliable;
- Observe the fluid level gauge, perfused liquid medicine shall be between the highest and the lowest level;
- Dosing knob and dosing screw shall be tightened, leakage phenomenon shall not exist. .

#### Anaesthetic breathing system check

□ Inhalation and exhalation valve check

----- Rotate "bag/vent" selection knob to "

—When choose manual ventilation, the  $\sqrt{e}$ ntilator shall be changed to standby status, press the standby key for a moment to enter to standby status;

----- Animal connector ("Y" connector ) is connected with the breathing reservoir bag;

—— Press oxygen flush valve to ensure breathing reservoir bag full;

— Repeatedly squeeze the breathing reservoir bag by hand to simulate the breathing state of animal s:

During exhalation, the flap of exhalation valve rises and the flap of inhalation valve drops;

During inhalation, the flap of inhalation valve rises and the flap of exhalation valve drops;

——Rise and drop of inhalation and exhalation flap shall move freely.

Leakage check

----- Rotate "bag/vent" selection knob to "

——When choose manual ventilation, the ventilator shall be changed to standby status, press the standby key for a moment to enter to standby status;

----- Close "APL" valve ;

-----The breathing reservoir bag connection port is connected with the reservoir bag;

----- Block off animal connector ("Y" connector);

Press oxygen flush valve, the breathing reservoir bag starts to inflate;

-----when the indicated value of airway pressure gauge is 30 cmH<sub>2</sub>O, loosen oxygen flush valve;

Observe airway pressure gauge, drop of indicated value shall be no more than 4 cmH<sub>2</sub>O in 1 minute;

——If the drop of indicated value is greater than 4 cmH<sub>2</sub>O, it indicates there is leakage, the leakage position shall be checked and restored.

"APL" valve check

---- Rotate" bag/vent" selection knob to "

——When choose manual ventilation, the ventilator shall be changed to standby status, press the standby key for a moment to enter to standby status;

----Block off the breathing reservoir bag connection port ;

----Block off the animal connector ("Y" connector) ;

----- "APL" valve is closed:

Adjust gross flow rate of fresh gas to about 3 L/min;

The indicated value of airway pressure gauge shall be no more than  $85cmH_2O$  (pressure fluctuation belongs to normal phenomenon );

------ "APL" valve is completely opened:

Adjust gross flow rate of fresh gas to about 3 L/min;

The indicated value of airway pressure gauge shall be about 0 cmH<sub>2</sub>O;

Press oxygen flush valve;

The indicated value of airway pressure gauge shall be no more than 5 cmH<sub>2</sub>O.

□ Breathing bellow check

- -----Rotate "bag/vent" selection knob to " \_\_\_\_\_ ";
- ----Block off the animal connector ("Y"  $\frac{1}{con}$  hector);
- ----- Press oxygen flush valve to ensure that breathing bellow is filled;
- -----The indicated value of airway pressure gauge shall be no more than 2 cmH<sub>2</sub>O;
- ----- Loosen oxygen flush valve;
- ----- Adjust gross flow rate of fresh gas to about 0.5 L/min;
- ----Buffer pocket of breathing bellow shall not drop;
- -----If the buffer pocket of breathing bellow drop, it indicates there is gas leakage, the leakage position shall be checked and restored .

#### Manual ventilation check

----Rotate "bag/vent" selection knob to "  $\phantom{a}_{\mbox{\scriptsize $\sim$}}$  ";

——When choose manual ventilation, the ventilator shall be changed to standby status, press the standby key for a moment to enter to standby status;

- ----- Close "APL" valve ;
- ——The breathing reservoir bag connection port and animal connector ("Y" connector ) are respectively connected with the reservoir bag;
- ----- Press oxygen flush valve, the reservoir bag starts to be inflated;
- Press oxygen flush valve to ensure that the two breathing reservoir bags are inflated to about half;
- -----Repeatedly squeeze the reservoir bag on the reservoir bag connection port by hand;
- -----The reservoir bag on the animal connector ( "Y" connector ) shall inflate or shrink accordingly.

 $\square$  CO<sub>2</sub> absorbent check (After each animal using,do check.)

The volume of discoloring absorbent shall not exceed a half.

#### Anesthesia ventilator check

Anesthesia ventilator check

- -----Rotate "bag/vent" selection knob to " \_\_\_\_\_";
- ----- Animal connector ("Y" connector) is connected with simulating lung;
- -----Adjust gross flow rate of fresh gas to 0.5L/min;
- ----- Press oxygen flush valve to ensure that breathing bellow is filled;
- ----- Open ventilator power supply;
- -----Ventilator ventilation parameters are set as:

Tidal volume: 500 mL

Frequency : 12 /min;

- inspiratory to expiratory time ratio: 1: 2
- —— Start-up ventilator;
- ----- Rise and drop of Ventilator bellow shall be normal ;

- -----Monitoring value of ventilation parameters shall correctly display;
- -----Adjust gross flow rate of fresh gas to 0.5 L/min;
- -----Monitoring value of ventilation parameters shall correctly display;
- -----The pressure at the end of exhalation is about 0 cmH<sub>2</sub>O.

#### Alarm function check

- -----Rotate "bag/vent" selection knob to "
- -----Connect the Y connector with simulating fung;
- -----Adjust gross flow rate of fresh gas to 0.5L/min;
- ----- Press oxygen flush valve to ensure that breathing bellow is filled;
- -----Switch on the ventilator;
- -----Set the ventilation parameters to the following value under mode IPPV (Adult);
  - Tidal volume: 0.50 L
  - Frequency: 12 /min;
  - I:E: 1: 2
- □ Check for high MV alarm:
  - -----Set the upper limit of MV to 8.0 L/min;
  - Reset tidal volume and frequency to make the MV over upper limit of MV;
  - ——When the MV overpass 8.0 L/min, there will be an alarm for High MV alarm.
- □ Check for Low MV alarm:
  - -----Set the lower limit of MV to 6.0 L/min;
  - ——Reset tidal volume and frequency to make MV under the lower limit of MV;
  - ——When the MV is lower than 6.0 L/min, there will be an alarm for low MV alarm.
- □ Check for High Ppeak alarm:
  - -----Set the upper limit of Ppeak to 20 cmH2O;
  - -----Adjust tidal volume and airway resistance to make the Ppeak over the upper limit;
  - ——There will be alarm for High Ppeak alarm.
  - ——When alarm for High Ppeak occurs, inhalation status should be turned to exhalation status and airway pressure should be not more than 100 cmH2O.
- □ Check for low Ppeak alarm:
  - -----Set PEEP to 0 cmH2O;
  - ——Squeeze the flow sampling tube, observe airway pressure and make it more than 15 cmH2O, delay 16s, alarm for continuous pressure should occur.
- □ Apnea alarm
  - ——When start exhalation, disconnect breathing circuit pipe from the flow sensor.
  - ——There will be alarm for apnea lasting for 30 seconds.
- □ Check for continuous pressure alarm:
  - ——When start exhalation, disconnect breathing circuit pipe from the flow sensor.
  - ——After two respiratory cycles, there should be alarm for continuous pressure.

- □ Check for High O<sub>2</sub> concentration alarm(optional):
  - -----Put O2 sensor in air ;
  - -----Set the upper limit of O<sub>2</sub> concentration to 20%;
  - ——There will be an alarm for high O<sub>2</sub> concentration.
- $\Box$  Check for low O<sub>2</sub> concentration alarm(optional):
  - -----Put O2 sensor in air;
  - -----Set lower limit of O2 concentration to 22%;
  - ——There will be an alarm for low O<sub>2</sub> concentration.
- □ Check for no tidal volume
  - ——When start exhalation, disconnect breathing circuit pipe from the flow sensor.
  - -----Delay time is less than 6s. Alarm for no tidal volume shall occur.
- □ Audio alarm and visual alarm shall be available.
- □ Check for audio paused alarm:
  - -----Press the audio paused key (item 2 of Fig.5) when any sound alarm occurs, then the sound alarm will pause about 2 minutes;
  - -----If alarm condition does not disappear, the sound alarm will continue after 2 minutes;
  - -----When sound alarm pauses, indicator alarm still exist, unless fault disappears.



Set R&D, production, sales in one of the medical equipment manufacturers, service providers

BMV Technology Co.Ltd. Tel: +86 755-26564580 Add: 4/F,Yinjin Building,Block 71, Baoan Centre District,Shenzhen,China Email: sales@bmv.cc URL: www.bmv.cc

www.bmv-vet.com