WATO EX-55/65 Anesthesia Machine

Service Manual

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Revision History

This manual has a revision number. This revision number changes whenever the manual is updated due to software or technical specification change. Contents of this manual are subject to change without prior notice. Revision 1.0 is the initial release of the document.

- Revision number: 1.1
- Release time: 2009-03

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FOR YOUR NOTES

Preface

Manual Purpose

This manual provides detailed information about the assembling, dissembling, testing and troubleshooting of the equipment to support effective troubleshooting and repair. It is not intended to be a comprehensive, in-depth explanation of the product architecture or technical implementation. Observance of the manual is a prerequisite for proper equipment maintenance and prevents equipment damage and personal injury.

This manual is based on the maximum configuration. Therefore, some contents may not apply to your monitor. If you have any question, please contact our Customer Service Department.

Intended Audience

This manual is geared for biomedical engineers, authorized technicians or service representatives responsible for troubleshooting, repairing and maintaining the anesthesia machines.

Password

A password is required to access different modes within the anesthesia machine.

- Factory maintenance: 0611

FOR YOUR NOTES

Contents

FOR YOUR NOTES

1 Safety

1.1 Safety Information

⚠ **DANGER**

- **Indicates an imminent hazard that, if not avoided, will result in death or serious injury.**

⚠ **WARNING**

- **Indicates a potential hazard or unsafe practice that, if not avoided, could result in death or serious injury.**

⚠ **CAUTION**

- **Indicates a potential hazard or unsafe practice that, if not avoided, could result in minor personal injury or product/property damage.**

NOTE

- **Provides application tips or other useful information to ensure that you get the most from your product.**

1.1.1 Dangers

There are no dangers that refer to the product in general. Specific “Danger” statements may be given in the respective sections of this manual.

1.1.2 Warnings

⚠WARNING

- **This equipment must be installed by factory authorized engineers and adequate training of its use should be delivered to its user before it is put into use.**
- **There is high voltage inside the equipment. Never disassemble the equipment before it is disconnected from the AC power source.**
- **This equipment can be disassembled by Mindray trained and authorized personnel only.**
- **Be sure of static discharge before disassembling the equipment. Wear antistatic wrist straps or gloves when disassembling the parts labelled with static-sensitive symbolsto avoid damage to the parts.**
- **The equipment must be connected to a properly installed power outlet with protective earth contacts only. If the installation does not provide for a protective earth conductor, disconnect it from the power line.**
- **Dispose of the packaging materials, observing the applicable waste control regulations and keeping it out of children’s reach.**

1.1.3 Cautions

⚠CAUTION

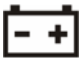
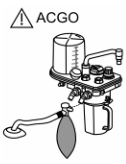
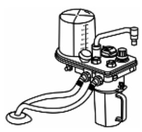
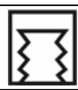
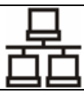
- **Make sure that no electromagnetic radiation interferes with the performance of the equipment when preparing to carry out performance tests. Mobile phone, X-ray equipment or MRI devices are a possible source of interference as they may emit higher levels of electromagnetic radiation.**
- **Before connecting the equipment to the power source, check that the power source conforms to the requirements specified in the Operator’s Manual.**

1.1.4 Notes

NOTE

- **Refer to Operator's Manual for detailed operation and other information.**

1.2 Equipment Symbols

	Attention: Consult accompanying documents (this manual)		Dangerous voltage
	Alternating current		Fuse
	Battery		Equipotential
	Operating state	134°C	Autoclavable
>PPSU<	Material description		Not autoclavable
	Power On		Power Off
	Reset		Standby
	Alarm silence key		MV&TVe alarm key
	Normal screen key	O_2+	O_2 flush button
	ACGO On		ACGO Off
	Bag position/ manual ventilation		Mechanical ventilation
	Lock		Unlock
	Network connector		Flow control

	USB connector	O_2%	O_2 sensor connector
AIR 280-600kPa	Air supply connector	N_2O 280-600kPa	N_2O supply connector
	Upward (Pop-off valve)	A.	Sample gas return port (to the AGSS)
	VGA connector	O_2 280-600kPa	O_2 supply connector
	Table top light	AGSS	AGSS outlet
	Cylinder		PEEP outlet
	Isolation transformer		Vaporizer
APL ≈cmH2O	APL valve		CIS connector
MAX	Maximum level of the sodalime canister		CAUTION HOT
	Gas input direction		Lock or unlock as the arrow shows
	Lock the lifting device		Unlock the lifting device
≈	Approximate		Do Not Crush
11.3kg MAX	Max. weight: 11.3 kg		Please align!
30kg MAX	Max. weight: 30 kg		Type BF applied part. Defibrillation-proof protection against electric shock.
	Pipeline	AIR DRIVE	Driven by air

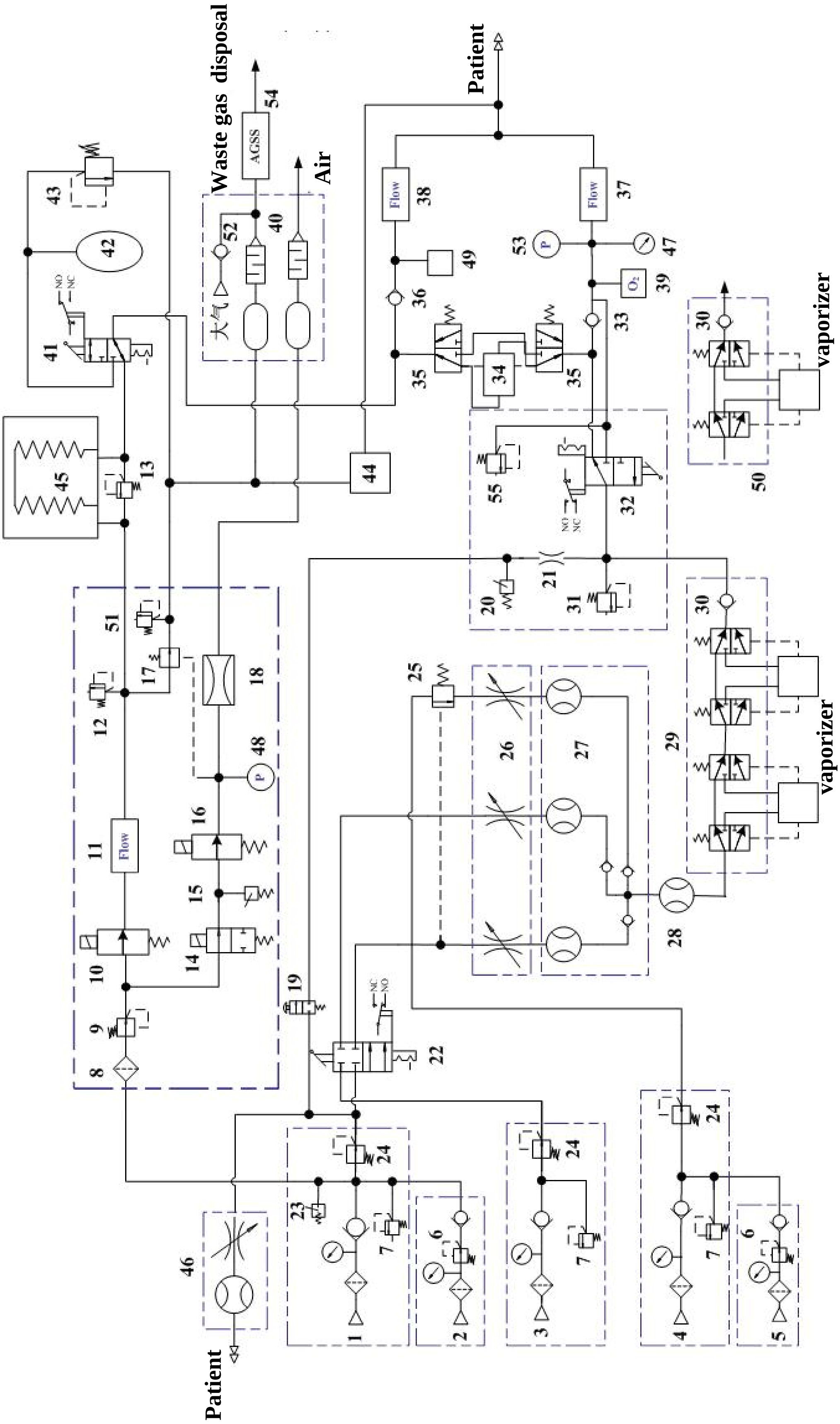
2 Theory of Operation

2.1 Pressure Unit Conversion Table

Pa	hPa	kPa	MPa	mmHg	atm	cmH_2O	mbar	bar	PSI
1	10^{-2}	10^{-3}	10^{-6}	$7.5X10^{-3}$	$9.8X10^{-6}$	$1.02X10^{-2}$	$1X10^{-2}$	$1X10^{-5}$	$1.45X10^{-4}$
$1X10^{2}$	1	$1X10^{-1}$	$1X10^{-4}$	0.75	$9.8X10^{-4}$	1.02	1	$1X10^{-3}$	$1.45X10^{-2}$
$1X10^{-3}$	10	1	$1X10^{-3}$	7.5	$9.8X10^{-3}$	10.2	10	$1X10^{-2}$	0.145
$1X10^{6}$	$1X10^{4}$	$1X10^{3}$	1	$7.5X10^{3}$	9.8	$1.02X10^{4}$	$1X10^{4}$	10	145
$1.33X10^{2}$	1.33	0.133	$1.33X10^{-4}$	1	$1.32X10^{-3}$	1.36	1.33	$1.33X10^{-3}$	$1.93X10^{-2}$
$1.01X10^{5}$	$1.01X10^{3}$	101	0.101	760	1	$1.03 X10^{3}$	$1.01X10^{3}$	1.01	14.7
98.1	0.98	$9.8X10^{-2}$	$9.8X10^{-5}$	0.736	$9.68X10^{-4}$	1	0.98	$9.8X10^{-4}$	$1.42X10^{-2}$
$1X10^{2}$	1	0.1	$1X10^{-4}$	0.75	$9.8X10^{-4}$	1.02	1	$1X10^{-3}$	$1.45X10^{-2}$
$1X10^{5}$	$1X10^{3}$	$1X10^{2}$	0.1	750	0.98	$1.02X10^{3}$	$1X10^{3}$	1	14.5
$6.89X10^{3}$	68.9	6.89	$6.89X10^{-3}$	51.7	$6.8X10^{-2}$	70.3	68.9	$6.89X10^{-2}$	1

2.2 Gas Flow

2.2.1 Pneumatic Circuit Diagram



2.2.2 Parts List

1 O2 P-Line

2 O2 cylinder

3 Air P-Line

4 N2O P-Line

5 N2O cylinder

6 Regulator (0.4 MPa)

7 Safety valve (0.7 MPa)

8 Filter

9 Regulator (0.2 MPa)

10 Inlet gas flow regulator

11 Flow sensor (Venturi)

12 Mechanical overpressure valve (100 cmH2O)

13 Pop-Off valve

14 PEEP safety valve

15 Pressure switch (140 kPa)

16 Proportional PEEP valve

17 Expiratory valve

18 Pneumatic resistor

19 O2 flush valve

20 Pressure switch (37 kPa)

21 Flow restrictor

22 System switch

23 Pressure switch (0.2 MPa)

24 Regulator (0.2 MPa)

25 O2-N2O cut-off valve（0.1 MPa）

26 Flow control assembly (flow regulator）

27 Electronic flowmeter&throttling device

28 Float flowmeter

29 Double-vaporizer manifold

30 Check valve

31 Pressure relief valve (38 kPa)

32 ACGO selector switch

33 Inspiratory valve

34 Sodalime canister

35 BYPASS valve

36 Expiratory valve

37 Inspiratory flow sensor

38 Expiratory flow sensor

39 O2 flow sensor

40 Scavenging reservoir and noise eliminator

41 Bag/mechanical ventilation switch

42 Manual bag

43 APL valve

44 Modular rack (supporting gas module)

45 Bellows assembly

46 Auxiliary O2 supply

47 Airway pressure gauge

48 Pressure sensor

49 Water collection cup

50 Single-vaporizer manifold

51 Pressure relief valve (10 cmH2O)

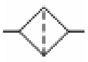
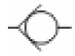
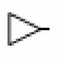
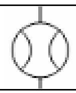
52 Negative pressure valve（1 cmH2O）

53 Pressure sensor

54 AGSS (AGSS transfer and receiving system)

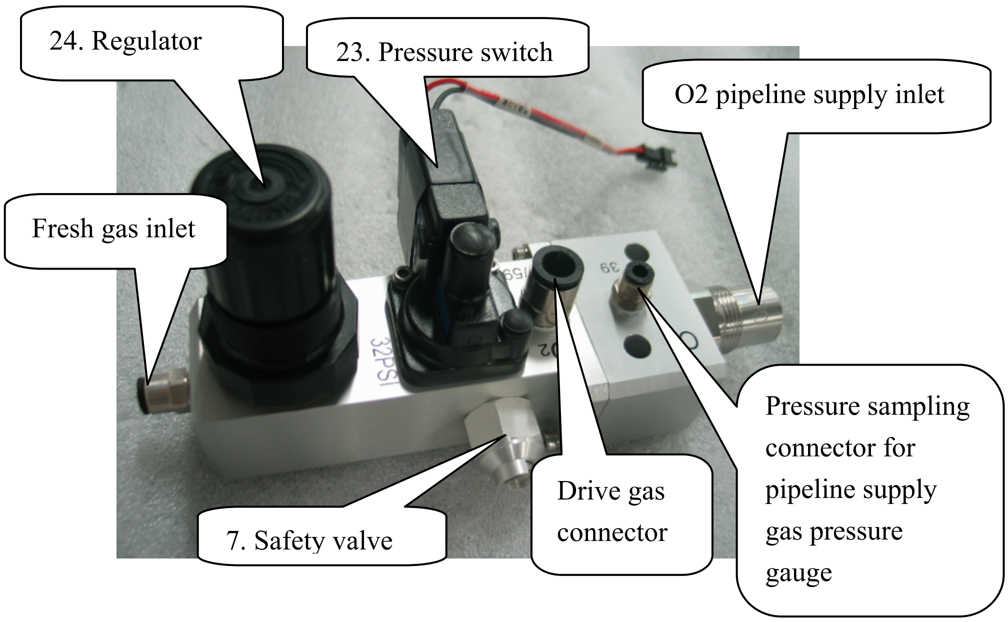
55 Pressure relief valve (11 kPa)

2.2.3 Key to Symbols

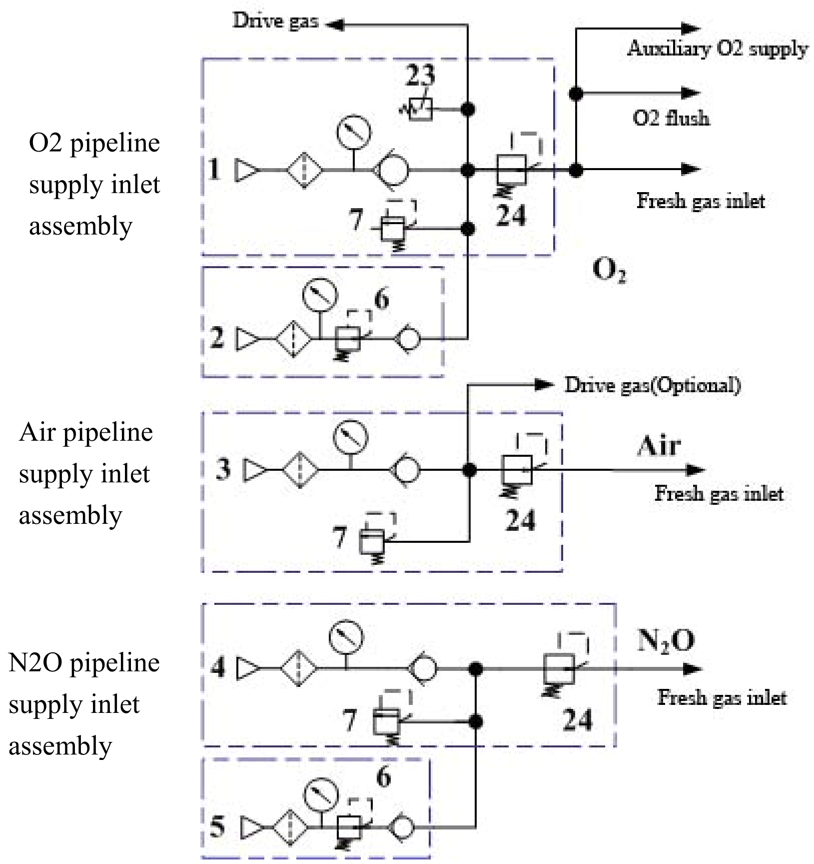
	Filter		Regulator
	Pressure gauge		Check valve
	Gas supply connector		Pressure relief valve
	Flowmeter		Flow control valve
	Pressure switch		Flow restrictor

2.2.4 Description

2.2.4.1 Gas Supplies

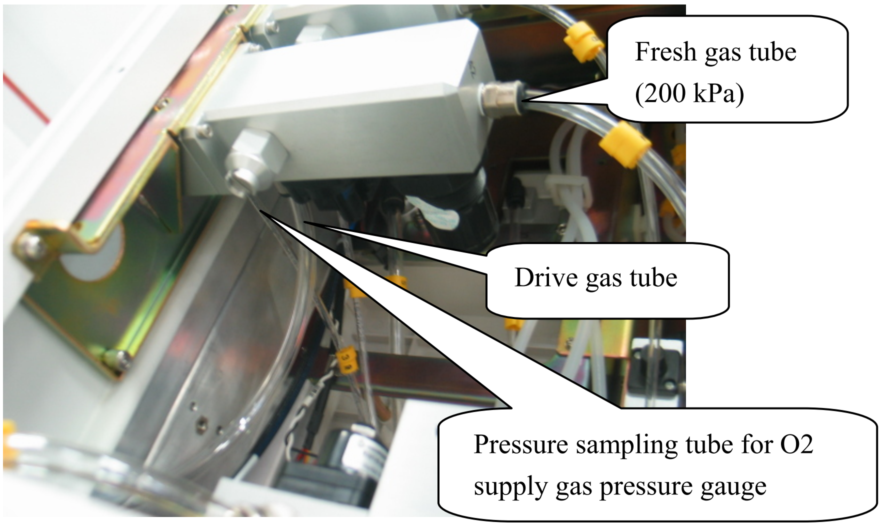


The above picture shows the O2 pipeline supply inlet assembly. The anesthesia machine's pneumatic circuit starts from the gas supplies, which functions to introduce the external pipeline or cylinder gases into the machine. Since the pressure of external gas is very high and the external gas contains foreign substance, pressure reducing valves, filters and pressure relief valves are available in the supply gas circuit. Also, check valves are equipped in the supply gas circuit to prevent gas from flowing back into the pipeline or cylinder. The following figures show the supply gas circuit.



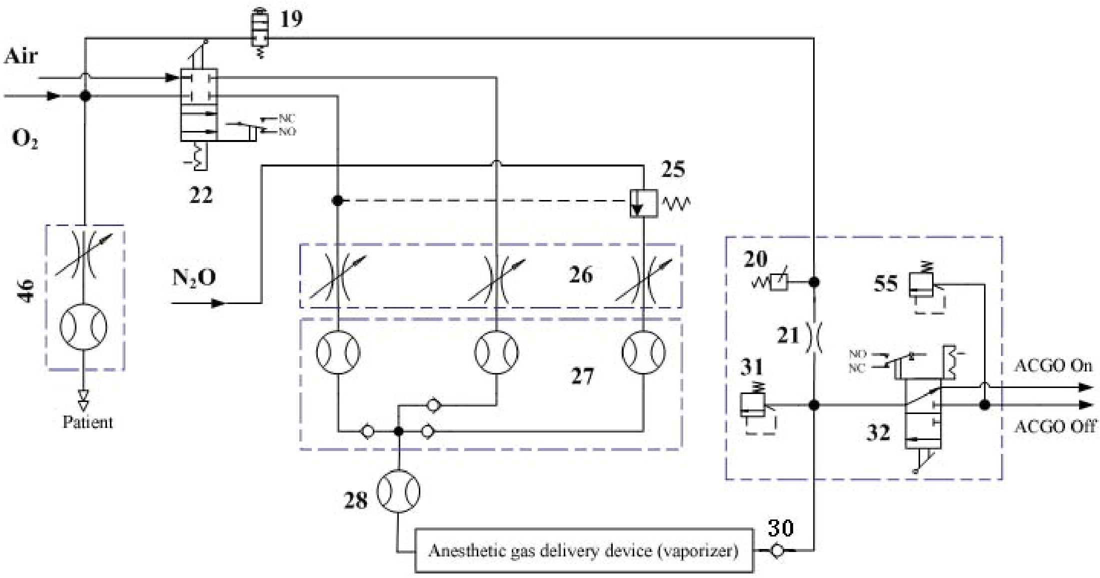
The anesthesia machine has pipeline and cylinder gas supplies available. Pipeline gas supplies, which are O_2, N_2O and Air, go into the pipeline gas supply inlet assemblies through pipeline connectors 1, 3 and 4 respectively. The pipeline pressure ranges between 280 and 600 kPa. Cylinder gas supplies, which are O_2 and N_2O, go into the system through cylinder connectors 2 and 5 respectively. The O2 and N2O cylinder pressures are 6.9 – 15 MPa and 4.2 – 6 MPa respectively, which are decreased to approximately 400 kPa through regulator 6. Each connector is clearly marked and designed to prevent misconnection. All connectors have filters and check valves. Color coded gauges show the pipeline and cylinder pressures. Pressure relief valve 7 functions to prevent the supply gas pressure from being too high. It releases excess gas when gas pressure exceeds 750 kPa. Each supply gas is outputted after gas pressure is decreased below 200 kPa through regulator 24. Pressure switch 23 monitors the O2 supply pressure. When O2 supply pressure is less than approximately 200 kPa, the ventilator gives the alarm of O2 supply failure.

The following picture shows the output connectors of O2 pipeline supply inlet assembly.

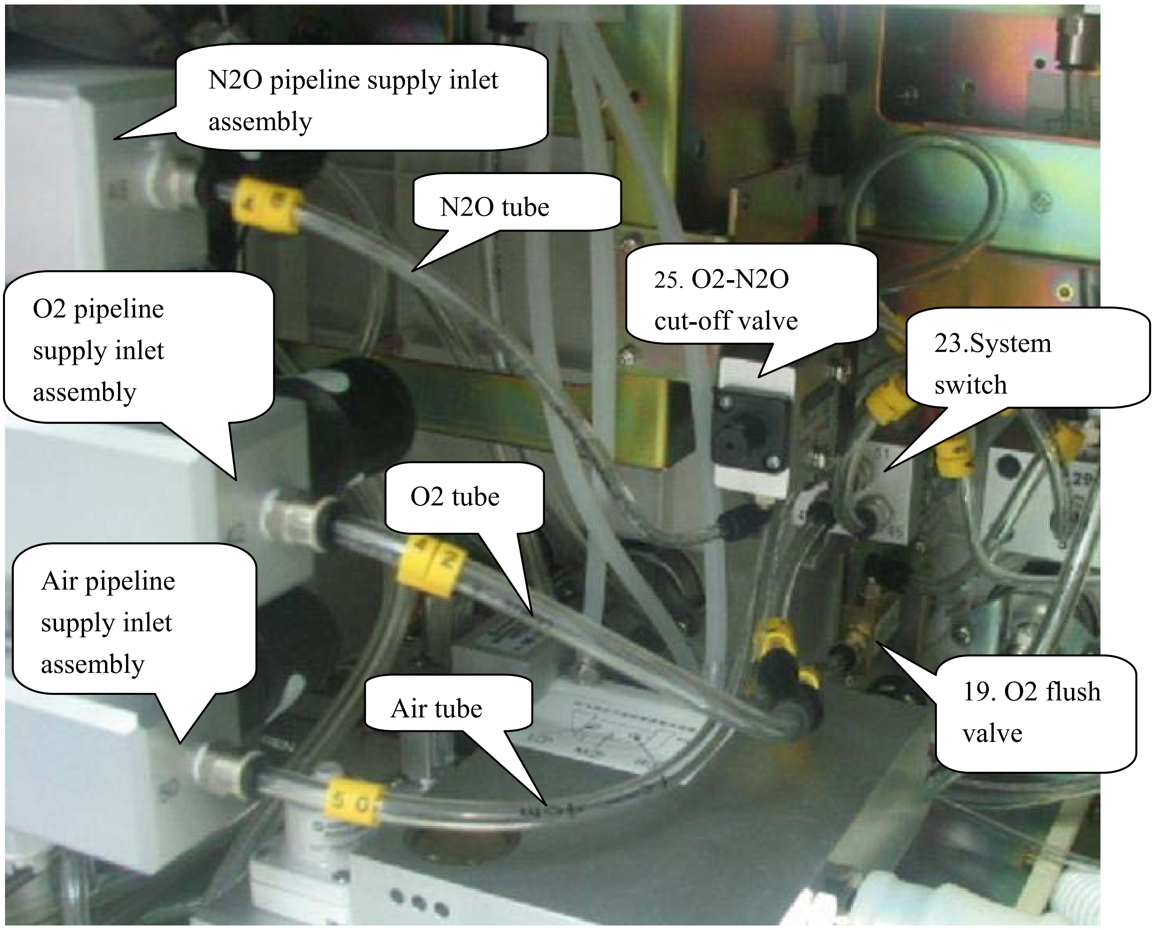


2.2.4.2 Anesthetic Gas Delivery System

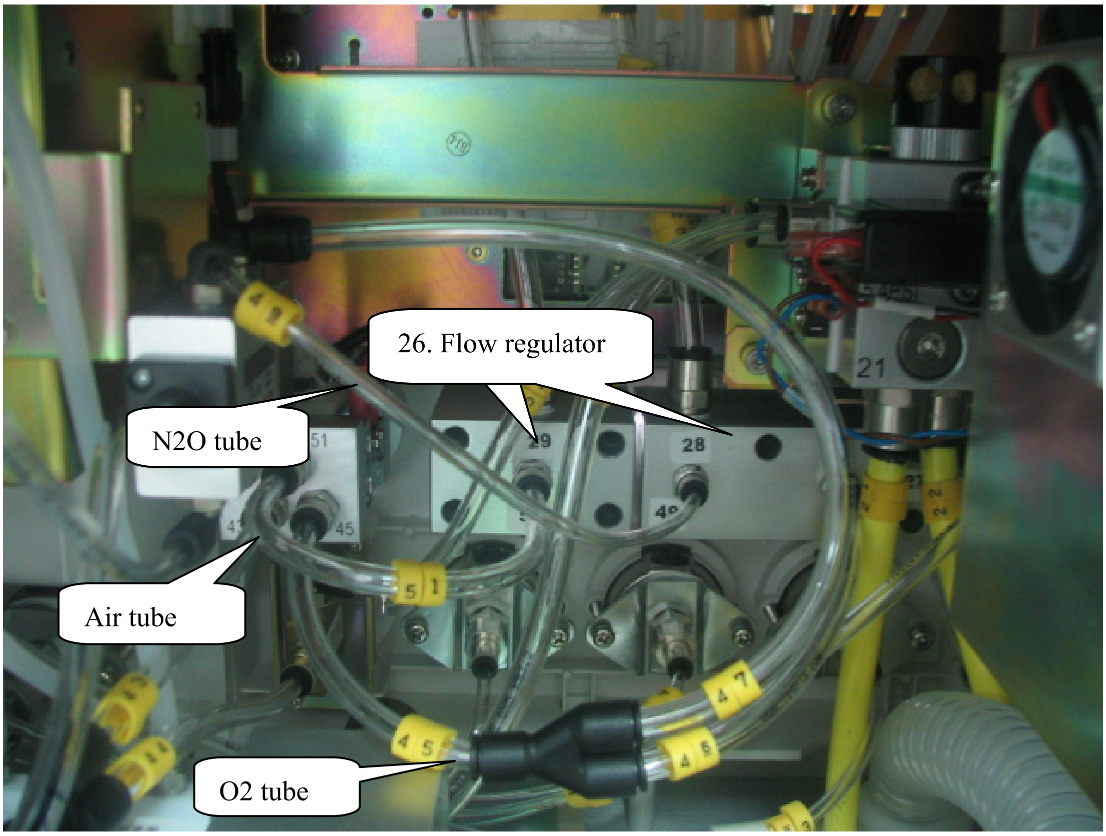
The anesthetic gas delivery system is connected to the gas supplies, anesthetic gas delivery device (vaporizer) and breathing system. N2O, O2 and Air supplies enter the anesthetic gas delivery system and the mixed gas (namely fresh gas) containing these three gases and anesthetic agent and pure O2 (for auxiliary O2 supply and flushing O2) are outputted. The following figure shows the pneumatic circuit of anesthetic gas delivery system.



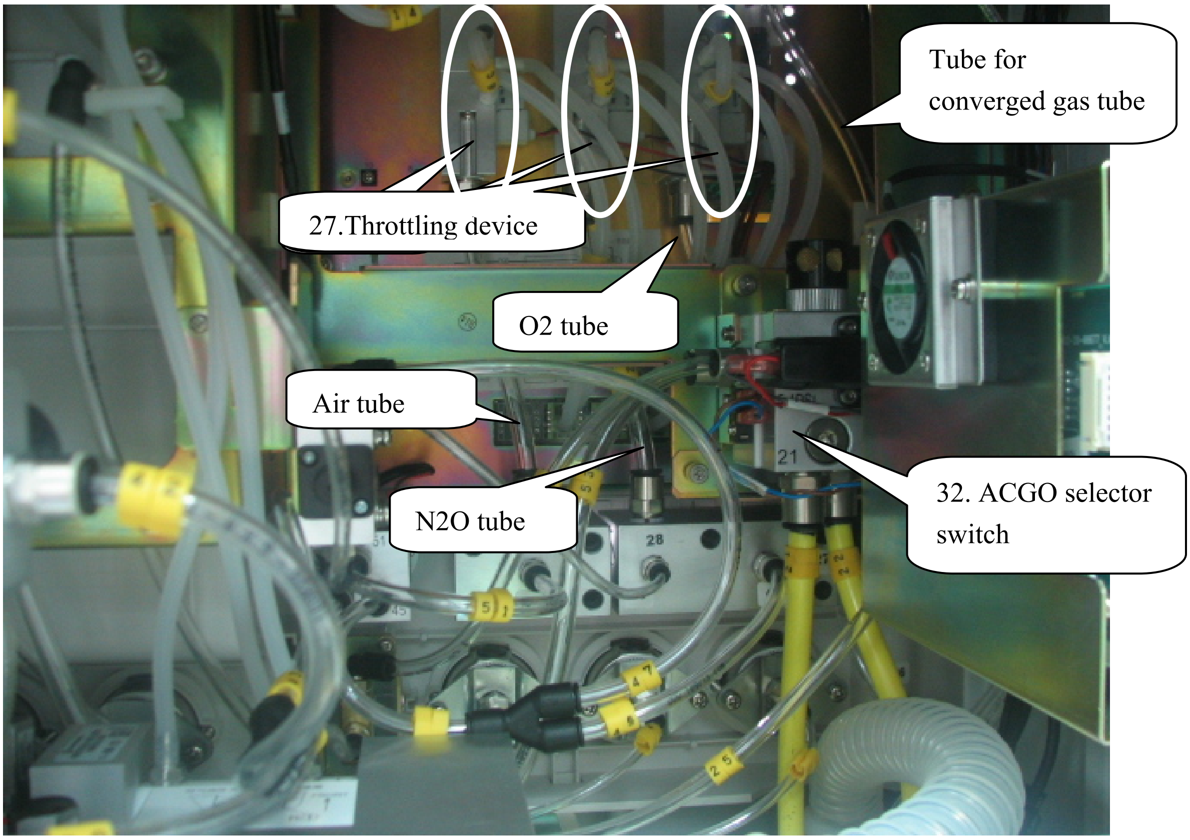
The following picture takes O2+N2O+Air configuration as an example to illustrate how pipeline gas supplies are outputted. O2 is divided into two pathways (into three pathways if auxiliary O2 supply is configured: system switch 23, O2 flush valve 19 and auxiliary O2 supply 46 respectively). One pathway of O2 flows into system switch 23 and the other into O2 flush valve 19. N2O flows into O2-N2O cut-off valve 25 and Air into system switch 23.



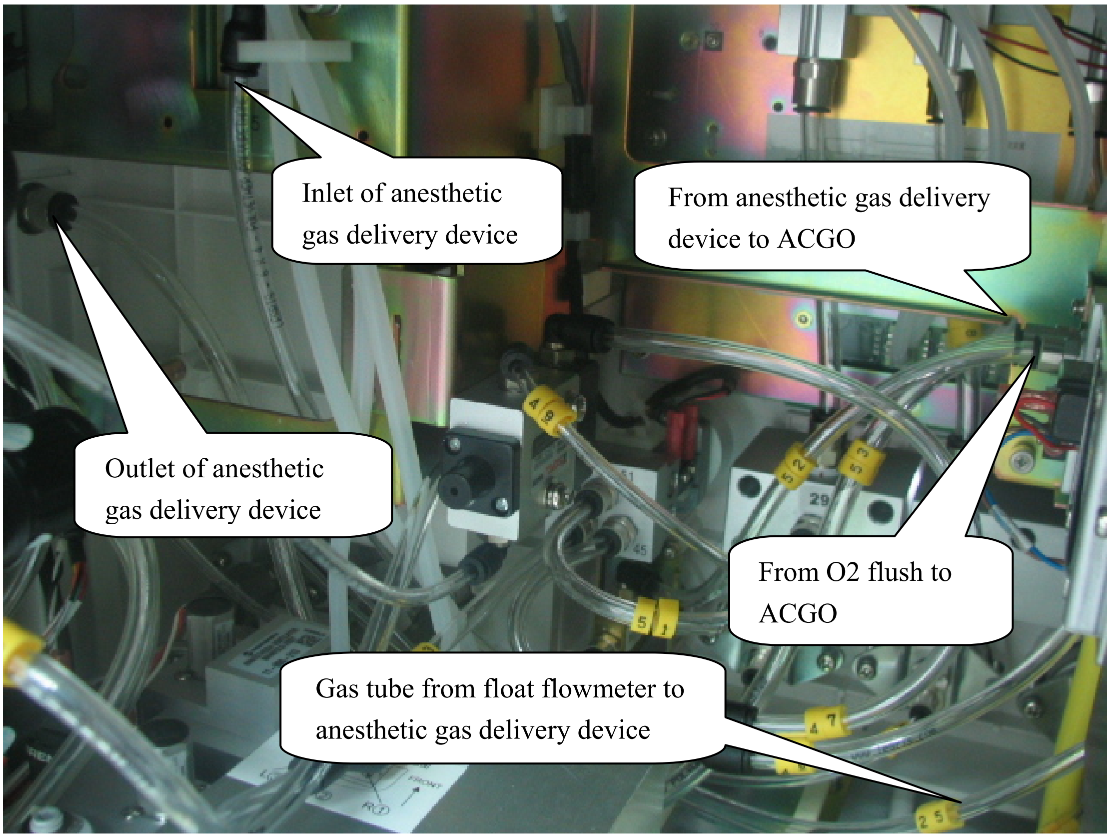
When system switch 22 is turned on, Air enters flow regulator 26. O2 is divided into two pathways. One pathway of O2 flows into flow regulator 26 and the other into O2-N2O cut-off valve 25. If the pressure of O2 vented into O2-N2O cut-off valve 25 is greater than 0.1 MPa, N2O can enter flow regulator 26, as shown below.



Flow regulator 26 controls gas flows. The gases passing through flow regulator 26 enter electronic flowmeter&throttling device 27 and are then converged to enter float flowmeter 28, as shown below.



The converged gas goes from float flowmeter 28 to the anesthetic gas delivery device (vaporizer), forming fresh gas after mixed with anesthetic agent. The fresh gas then goes from check valve 30 through the ACGO assembly to the breathing system. The flushing O2 also enters the breathing system through the ACGO assembly.



When ACGO is turned on, the anesthesia machine stops mechanical ventilation. The fresh gas is directly outputted through the inspiration connector on the breathing circuit. Mechanical pressure relief valve 55 on the ACGO prevents gas pressure at the ACGO port from exceeding 12.5 kPa when ACGO is turned on.

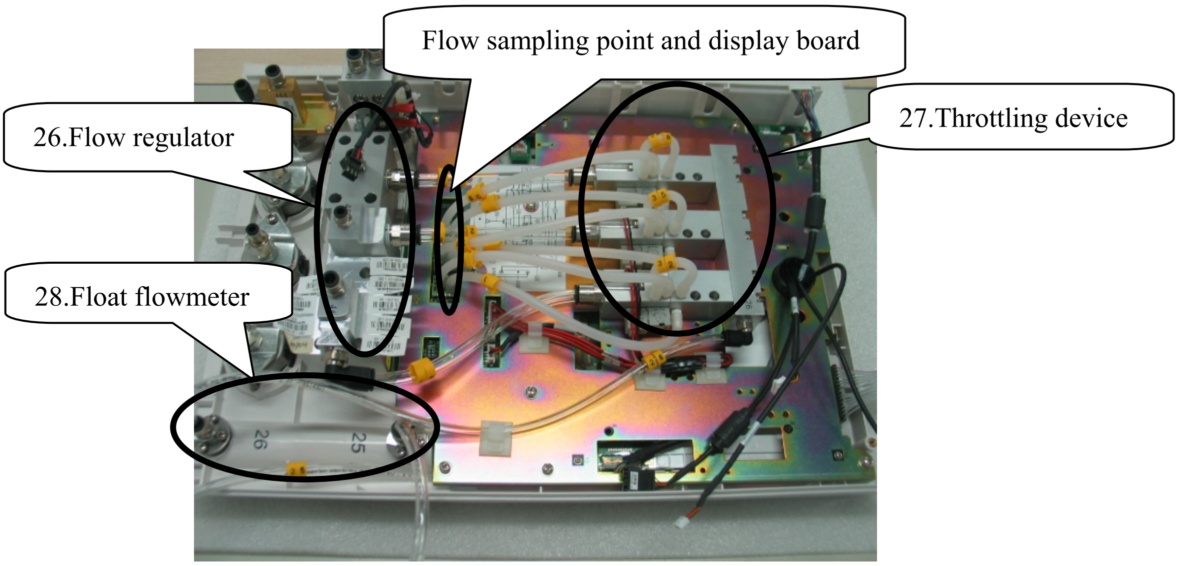
System Switch Assembly

The above picture shows the system switch assembly. Supply gases of Air and O2 go into system switch 22; and Air & O2 flowing into the flowmeter assembly and O2 into the control end of the O2-N2O cut-off valve are outputted. System switch has an electrical outlet which controls the power-on status of the system. When the system switch is turned on, O2 and Air enter the anesthetic gas delivery system and the system is powered on simultaneously. The anesthetic ventilator starts to monitor the status of the system. When the system switch is turned off, O2 and Air cannot enter the anesthetic gas delivery system and the system is powered off.

O2-N2O Cut-off Valve Assembly

The above picture shows the O2-N2O cut-off valve assembly. O2-N2O cut-off valve 25 is a pneumatically controlled three-way valve. O2 is uploaded to the control end of the O2-N2O cut-off valve to conduct on-off control of N2O. When the O2 supply pressure is less than 0.1 MPa (approximate value), N2O supply is cut off. When the O2 supplyp pressure is greater than 0.1 MPa (approximate value), N2O supply is switched on. O2-N2O cut-off valve 25 does not affect Air supply.

Flow Control Assembly

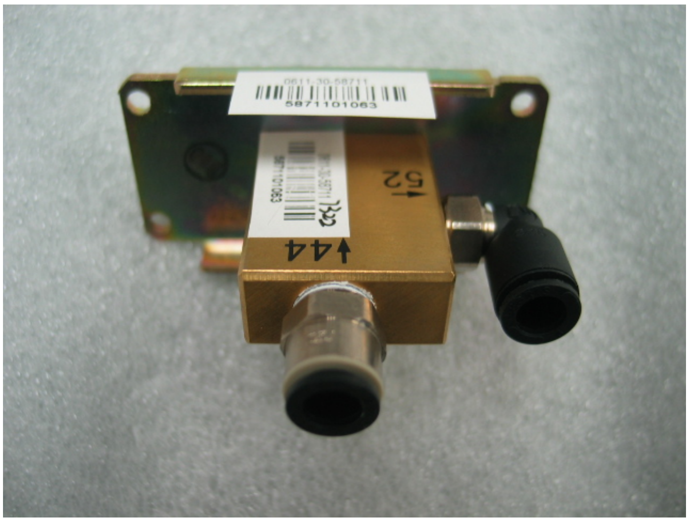


The above picture shows the left front panel where the flow control assembly and flow display assembly are located. Flow control assembly 26 (flow regulator) controls the gas flows and the proportion between O2 and N2O as well to ensure that the gas flows outputted are adjustable within the range of 0 – 15 L/min. O2 concentration is controlled not to be less than 25%. When N2O flow is greater than 1.0 L/min, the minimum O2 concentration is less than 40%. Turning flow controls counterclockwise increases the flow and clockwise decreases the flow.

Flow Display Assembly

Electronic flowmeter&throttling device 27 and float flowmeter 28 constitute the flow display assembly. Gases from the flow regulators enter into the flow display assembly and mixed gas going through the anesthetic gas delivery device (vaporizer) is outputted. Electronic flowmeter&throttling device 27 measures and displays the flow of each gas. Float flowmeter 28 displays the total gas flow. The flow range displayed is from 0.05 to 10 L/min at the resolution of 0.5 L/min. The measurement accuracy is required to be ±10% of the reading. The scale starts from 0.5 L/min and increases by 0.5 L/min when flow is within 0.5 to 2 L/min and by 1 L/min when flow is within 2 to 10 L/min.

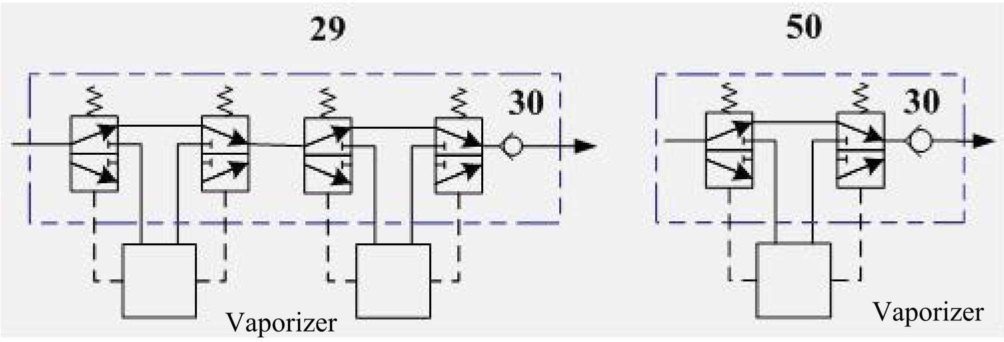
O2 Flush Button Assembly



The above picture shows the O2 flush button assembly. When O2 flush valve 19 is depressed, O2 rushes into the pneumatic circuit which is cut off when this valve is released. The O2 supply gas at 0.2 MPa after regulated goes through the O2 flush valve, the ACGO assembly, and into the breathing system. The O2 flush button assemby is not affected by the system switch. Flushing O2 can be performed as long as O2 supply is normal. The O2 flush valve has a slide valve structure inside which ensures automatic reset each time the valve is depressed and released via the spring.

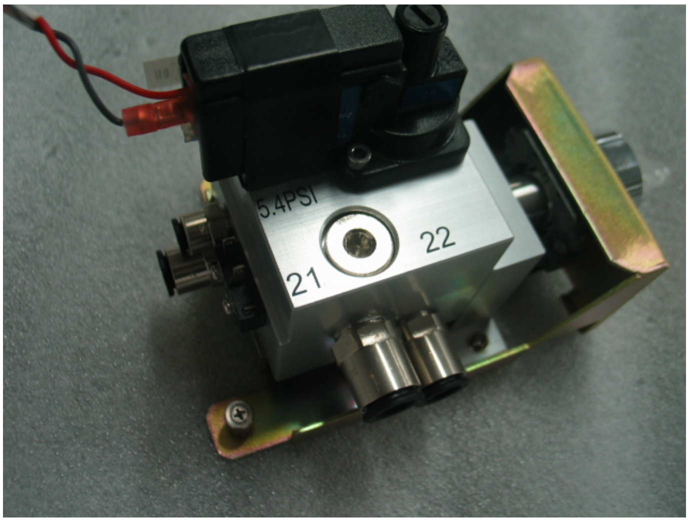
Vaporizer Manifold

The above picture shows the single-vaporizer manifold assembly. The anesthetic gas delivery device (vaporizer) is connected to the anesthetic gas delivery system. The mixed gas of N2O, O2 and Air go into the device and the fresh gas containing these three gases and anesthetic agent is finally outputted to the ACGO assembly. The following figure shows the pneumatic circuit of anesthetic gas delivery device (vaporizer).



Either double-vaporizer manifold 29 or single -vaporizer manifold 50 is used. Both are integrated with check valve 30 which prevents flushing O2 and fresh gas from flowing back to the vaporizer. When a double-vaporizer manifold is used, Selectatec mounting with interlocking function can prevent the user from turning on two vaporizers simultaneously.

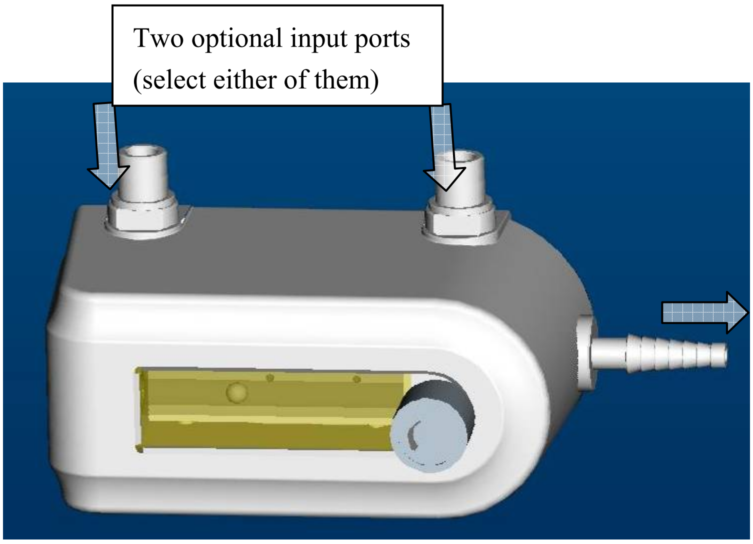
ACGO Assembly



The above picture shows the ACGO assembly. The ACGO assembly includes five parts: pressure switch 20, flow restrictor 21, pressure relief valve 31, ACGO selector switch 32 (three-way valve) and contact switch. Flushing O2 and fresh gas are mixed through the three-way valve and enter the ACGO. The outputs include fresh gas provided for the breathing system (when ACGO is turned off) and that provided for the patient (when ACGO is turned on). Pressure relief valve 31 at the front restricts the pressure of flushing O2 and also that of the fresh gas not to exceed 38 kPa (approximate value). Pressure relief valve 55 at the back ensures that the pressure of the gas outputted to the ACGO does not exceed 12.5 kPa.

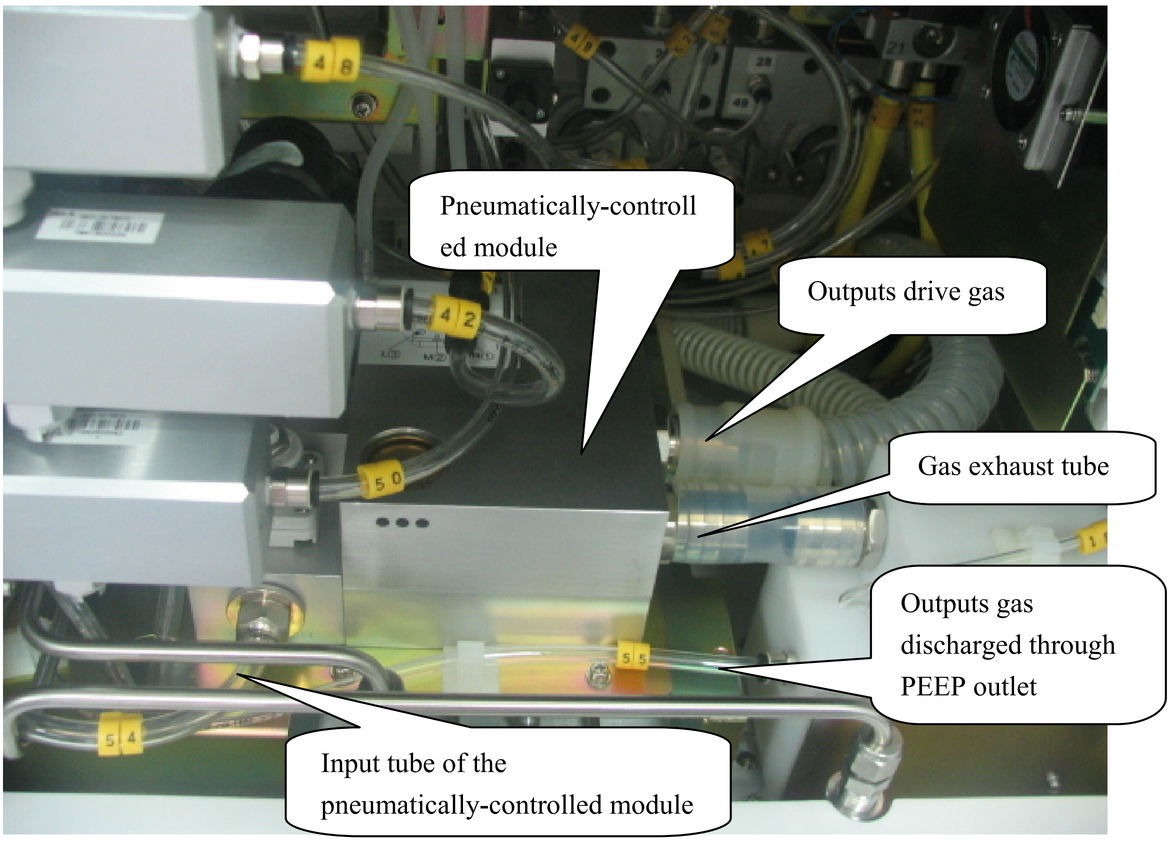
Auxiliary O2 Supply Assembly

Auxiliary O2 supply assembly 46 has two optional input ports (as shown below). O2 goes from O2 supply inlet assembly, with flow controlled by a flow regulator and displayed by a glasstube flowmeter, into the patient. The flow range adjusted is from 0 to 15 L/min and that displayed is from 0 to 10 L/min at the resolution of 1 L/min. Turning the flow control counterclockwise increases the flow and clockwise decreases the flow.

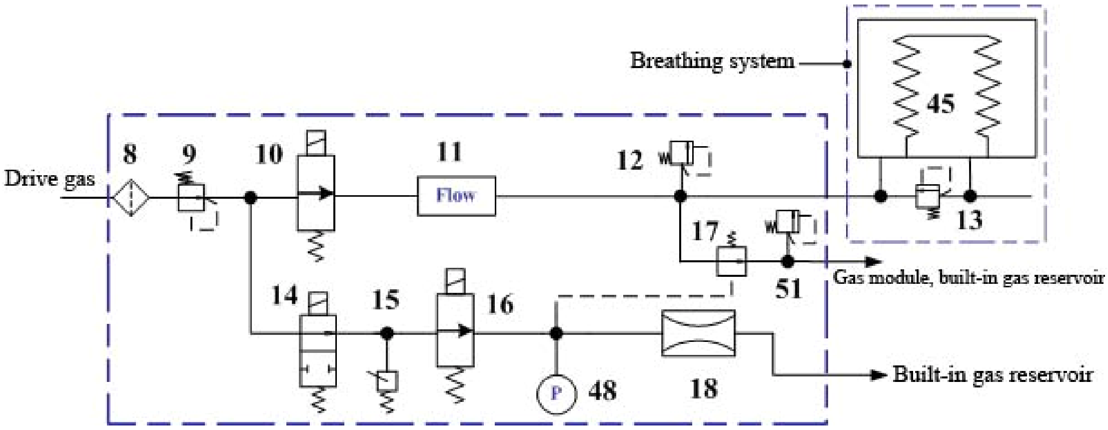


2.2.4.3 Pneumatically-controlled Module of the Anesthetic Ventilator

The pneumatically-controlled module of the anesthetic ventilator provides drive gas for the patient to breathe. O2 (or Air) from the gas supply inlet assembly enters the pneumatically-controlled module and is outputted in three pathways: drive gas entering the breathing system, drive gas discharged through the AGSS outlet and drive gas discharged through the PEEP outlet. The ventilator controls drive gas flow to prevent too high pressure inside the pneumatic circuit from injuring the patient. The following picture shows the gas flow direction and parts concerning the pneumatically-controlled module.



The following is the pneumatic circuit diagram of the pneumatically-controlled module.

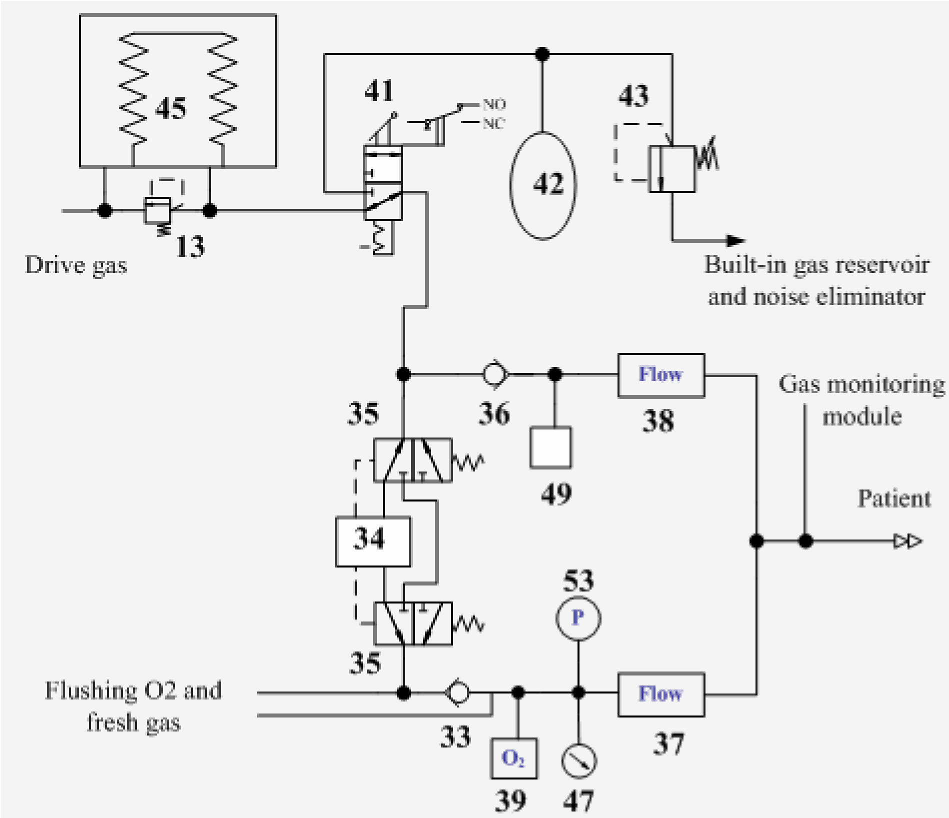


Proportional electromagnetic valve 10 controls inlet gas flow. Filter 8 filters drive gas again. Regulator 9 regulates presssure inside the pneumatic circuit (approximately 0.2 MPa). “11” is a flow sensor of differential pressure type which monitors gas flow in the drive gas circuit. Mechanical overpressure valve 12 ensures that the pressure in the drive gas circuit does not exceed safe pressure. It releases excess gas when gas pressure exceeds 11 kPa.. “17” is expiratory valve. During expiration, gas inside the bellows is discharged from this valve. The PEEP function is performed through expiratory valve. “16” is low-flow proportional electromagnetic valve. When it opens, gas is bled from pneumatic resistor 18, forming relatively stable pressure in the pneumatic circuit between “16” and “18”. Such pressure is exerted on the membrane of expiratory valve 17 to form PEEP.

To prevent too high pressure inside the pneumatic circuit from injuring the patient and damaging the equipment, safety valve 14, which is electromagnetic on-off valve, is placed before the gas pathway of the expiratory valve. “15” is a pressure switch. When drive gas pressure is less than 140 kPa, an alarm is triggered. “48” is a pressure sensor which monitors the pressure at which the expiratory valve is closed. Pressure relief valve 51 ensures the tube pressure after the expiratory valve is less than 10 cmH2O.

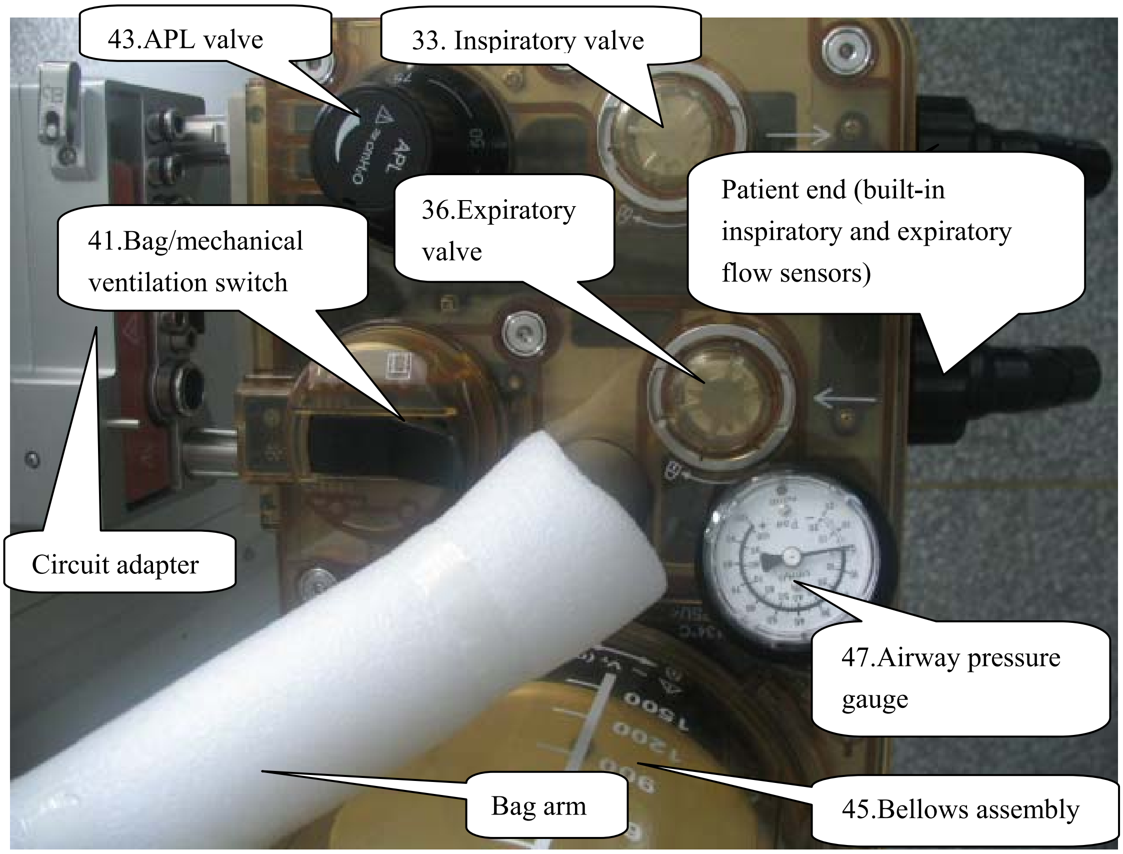
2.2.4.4 Breathing System

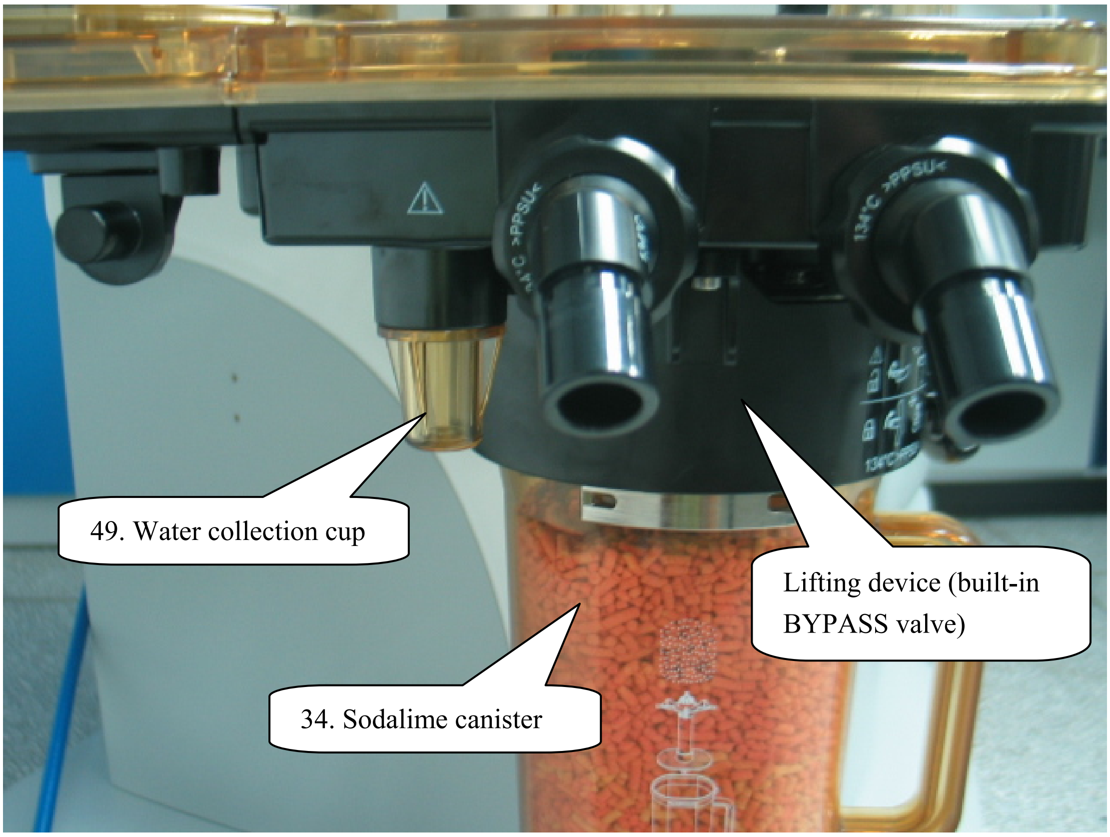
The breathing system provides a closed loop for the anesthetic gas. The CO2 in the patient's expired gas can be inspired in the inspiration phase to maintain the temperature and humidity conditions of the patient's expired gas. During inspiration, the drive gas depresses the bag inside the bellows to force the inside gas to enter the patient's lung. During expiration, the patient's expired gas goes into the bag inside the bellows. Sodalime canister 34 absorbs CO2 the patient expires. The following figure shows the pneumatic circuit of breathing system.



Manual and mechanical ventilation modes are selected through the bag/mechanical ventilation switch. When manual ventilation is selected, the doctor presses manual bag 42 to supply gas for the breathing system. APL valve 43 is used to adjust the pressure inside the pneumatic circuit in case of manual ventilation. When mechanical ventilation is selected, the ventilator starts to work. It controls the drive gas to depress the folding bag inside bellows 45 and supply gas for the breathing system as per the selected ventilation mode.

Connected to the anesthesia machine main unit through the circuit adapter, the breathing system is highly integrated. Its tubes are all built in except the tube connected to the patient and the O2 cell cable, as shown below.



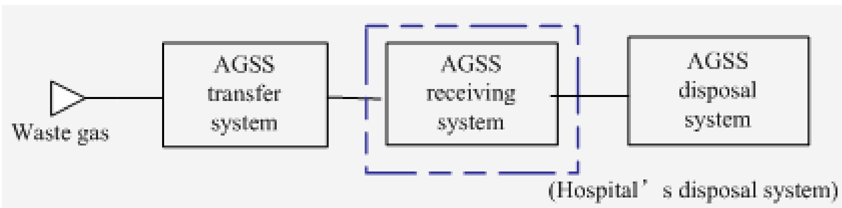


In case of mechanical ventilation, during inspiration, gas flows through bag/mechanical ventilation switch 41, BYPASS valve 35 or sodalime canister 34, inspiratory valve 33, O2 sensor 39, airway pressure gauge 47, and inspiratory flow sensor 37 to the patient. During expiration, gas flows through expiratory flow sensor 38, expiratory valve 36 and bag/mechanical ventilation switch 41 to the folding bag. Airway pressure is monitored by pressure sensor 53.

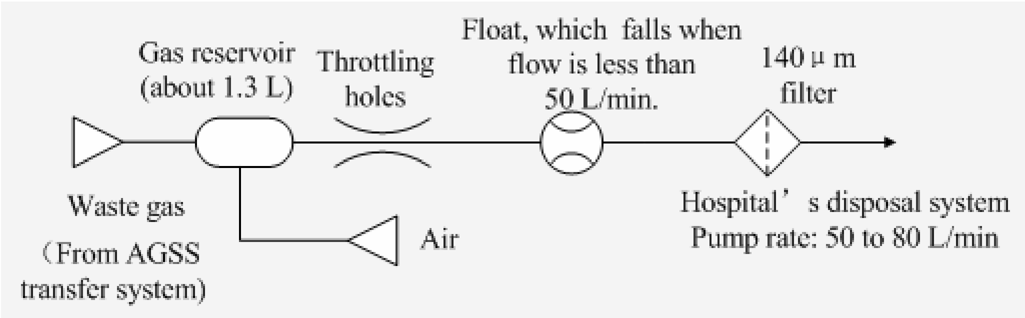
The breathing system is easily disassembled and is autoclavable at 134℃.

2.2.4.5 Anesthetic Gas Scavenging System

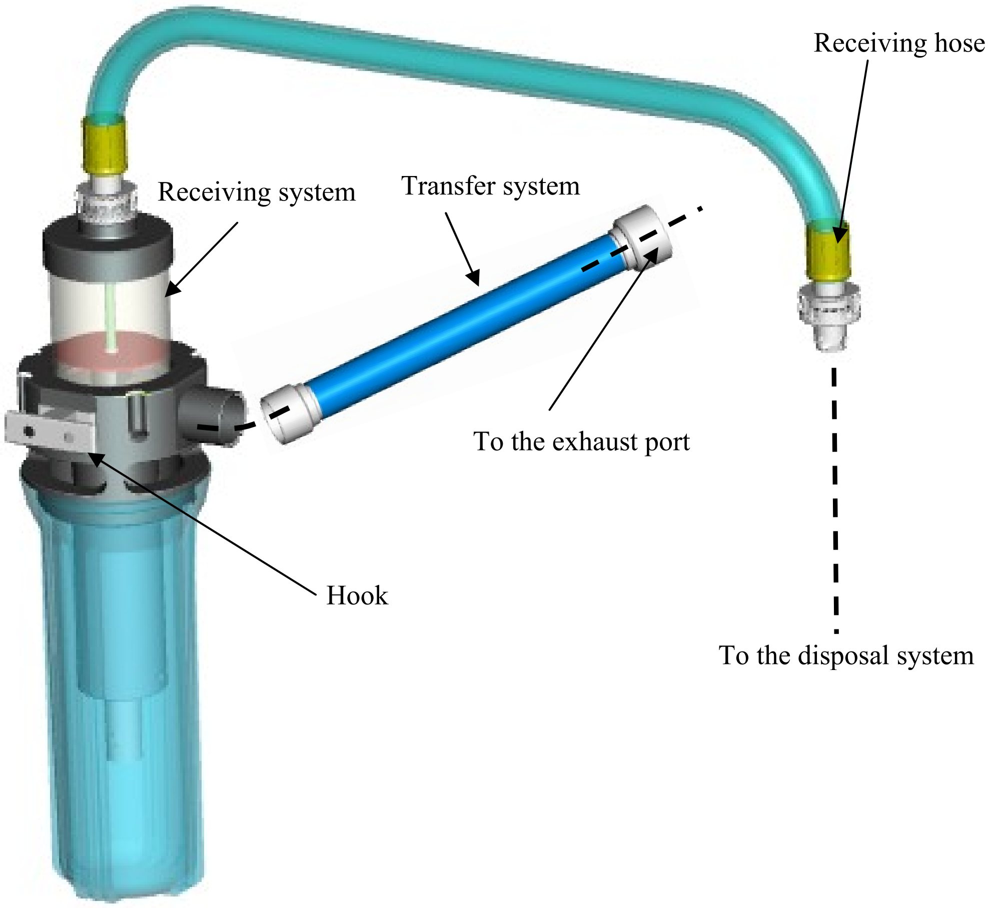
The anesthetic gas scavenging system (AGSS) is composed of AGSS transfer system, AGSS receiving system and AGSS disposal system. Waste gas goes from the exhaust port of the anesthesia machine through the AGSS transfer system and the AGSS receiving system and to the hospital's waste gas disposal system (AGSS disposal system), as shown below.



The following figure shows the operational theory of the AGSS. The throttling holes reduce the effect of negative pressure at the AGSS outlet onto the flow at the entrance. The float helps the user to learn if the disposal system meets the requirement for minimum pump rate. The filter filters foreign substance to prevent the disposal system from being occluded. The gas reservoir is connected to the air through pressure compensation openings. When positive or negative pressure occurs inside the gas reservoir, gas is inputted or outputted to ensure pressure balance inside the system.



The AGSS transfer system is a blue tube with 30 mm conical connectors at both ends. The inlet of the transfer system is a female 30 mm conical connector and the outlet a male 30 mm conical connector. The transfer system is connected to the receiving system through the male 30 mm conical connector. The receiving system is connected to the receiving hose through the proprietary connector. The receiving hose is connected to the hospital's disposal system through BS 6834 connector. The following picture shows the structures of and the connections between the AGSS transfer system, receiving system and disposal system.



3 Checkout and Test

⚠WARNING

- **After servicing the equipment or replacing its components, complete all the tests in this section.**
- **Before doing the tests in this section, completely reassemble the equipment and refer to 4Maintenance and Calibration to do necessary calibrations.**

3.1 System Inspection

NOTE

- **Make sure that the breathing circuit is correctly connected and not damaged.**
- **The top shelf weight limit is 30 kg.**

⚠WARNING

- **Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.**

Make sure that:

1. The equipment is not damaged.
2. All components are correctly attached.
3. The breathing circuit is correctly connected and the breathing tubes are not damaged.
4. The vaporizers are locked in position.
5. The gas supplies are connected and the pressures are correct.
6. Cylinder valves are closed on models with cylinder supplies.
7. The casters are not loose and the brake (s) is set and prevents movement.
8. Make sure the circuit is locked safely (in the position).
9. The power cord is correctly connected. The AC mains indicator and the battery indicator work normally.
10. The anesthesia machine is switched on or off normally.

3.2 Pipeline Tests

⚠WARNING

- **Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.**

1. Disconnect the pipeline supplies and close all cylinder valves. Bleed all the gas inside the machine to let the pressure gauges go to zero. f the gauge fails to go to zero, it indicates that the gauge is faulty.
2. Connect an O2 pipeline supply.
3. Set the system switch to the ⊙ position.
4. Set the flow controls to mid range.
5. Check that the pressure reading on the O2 gauge is within the range of 280 to 600 kPa (if not, adjust the O2 pipeline output pressure). Check that other gauges go to zero.
6. Disconnect the O2 pipeline supply.
7. As O2 pressure decreases, alarms for [**O2 Supply Failure**] and [**Drive Gas Pressure Low**] should occur. The alarm for [**Drive Gas Pressure Low**] occurs only when O2 is the drive gas.
8. Connect other pipeline supplies. Check that the readings on the gauges fall within the range of 280 to 600 kPa.

3.3 Cylinder Tests

NOTE

- **To prevent damage, open the cylinder valves slowly.**
- **After doing the cylinder tests, close all cylinder valves if cylinder supplies are not used.**
- **Turn the flow controls slowly. Do not turn further when the flow indicated through the flowmeter is outside of the range to avoid damaging the control valve.**

This test is not required if cylinders are not configured.

3.3.1 Check the Cylinders are Full

1. Set the system switch to the position and connect the cylinders to be checked.
2. Open each cylinder valve.
3. Make sure that each cylinder has sufficient pressure. If not, close the applicable cylinder valve and install a full cylinder.
4. Close all cylinder valves.

3.3.2 Cylinder High Pressure Leak Test

1. Make sure that the system switch is in the position.
2. Close the auxiliary O2 supply flowmeter if auxiliary O2 supply is configured.
3. Open the cylinder valve.
4. Record the current cylinder pressure.
5. Close the cylinder valve.
6. Record the cylinder pressure after one minute. There is a leak
   - If the cylinder pressure for drive gas decreases more than 5000 kPa (725 psi).
   - If the cylinder pressure for non-drive gas decreases more than 690 kPa (100 psi).
   - In this case, install a new cylinder gasket and repeat steps 1 through 6. If the leak continues, do not use the system.
7. Repeat ***3.3.2Cylinder High Pressure Leak Test*** for each cylinder.

3.4 Flow Control System Tests

3.4.1 Without O2 Sensor

⚠WARNING

- **If N2O is available and flows through the system during this test, use a safe and approved procedure to collect and remove it.**
- **Incorrect gas mixtures can cause patient injury. If the O2-N2O Link system does not supply O2 and N2O in the correct proportions, do not use the system.**

To do the flow control system tests:

1. Connect the pipeline supplies or slowly open the cylinder valves.
2. Turn all flow controls fully clockwise (minimum flow).
3. Set the system switch to the  position.
4. Set the flow controls to mid range. Check that the flowtube float moves smoothly and that the electronic flowmeter displays normally.
5. Test the Link system with N2O flow increasing:

   a.Turn the O2 and N2O flow controls fully clockwise (minimum flow).

   b.Turn the N2O flow control only.

   c.Increase the N2O flow gradually as shown in the table. Make sure that the O2 flow must be greater than the minimum limits.

   d.If the N2O flow is set crossing the limit, before continuing the test, turn the O2 flow control clockwise till the N2O flow decreases to the preset value.

Step	**N2O flow (L/min)**	**O2 flow (L/min)**
1	0.6	⩾0.2
2	1.5	⩾0.5
3	3.0	⩾1.0
4	7.5	⩾2.5

6. Test the Link system with O2 flow decreasing:

   a.Set the N2O flow to 9.0 L/min.

   b.Set the O2 flow to more than 3 L/min.

   c.Slowly turn the O2 flow control clockwise to set the N2O flow to the rates shown in the table. Make sure that the O2 flow must be greater than the minimum limits.

   d.If the O2 flow is set crossing the limit, before continuing the test, turn the N2O flow control counterclockwise till the N2O flow increases to the preset value.

Step	**N2O flow (L/min)**	**O2 flow (L/min)**
1	7.5	⩾2.5
2	3.0	⩾1.0
3	1.5	⩾0.5
4	0.6	⩾0.2

7. Disconnect the O2 pipeline supply or close the O2 cylinder valve.
8. Set the system switch to the  position.

3.4.2 With O2 Sensor

Do as described in ***3.9.2Test the O2 Concentration Monitoring and Alarms*** before testing.To do the flow control system tests:

1. Connect the pipeline supplies or slowly open the cylinder valves.
2. Turn all flow controls fully clockwise (minimum flow).
3. Set the system switch to the ⊙ position.
4. Set the flow controls to mid range. Check that the flowtube float moves smoothly and that the electronic flowmeter displays normally.
5. Test the Link system with N2O flow increasing:

   a.Turn the O2 and N2O flow controls fully clockwise (minimum flow).

   b.Turn the N2O flow control only.

   c.Increase the N2O flow gradually and the O2 flow should increase accordingly. The measured O2 concentration must be ≥25% through the full range.
6. Test the Link system with O2 flow decreasing:

   a.Set the N2O flow to 9.0 L/min.

   b.Set the O2 flow to more than 3 L/min.

   c.Slowly turn the O2 flow control clockwise and the N2O flow should decrease accordingly. The measured O2 concentration must be ≥25% through the full range.
7. Turn all the flow controls fully clockwise (minimum flow).
8. Disconnect the pipeline supply or close the cylinder valve.

3.5 Vaporizer Back Pressure Test

⚠**WARNING**

- **Use only the Selectatec series vaporizers. Make sure that the vaporizers are locked when doing the test.**
- **During the test, the anesthetic agent comes out of the fresh gas outlet. Use a safe and approved procedure to remove and collect the agent.**
- **To prevent damage, turn the flow controls fully clockwise (minimum flow or OFF) before using the system.**

Before the test, make sure that the vaporizers are correctly installed.

1. Connect the O2 pipeline supply or open the O2 cylinder valve.
2. Turn the O2 flow control and set the O2 flow to 6 L/min.
3. Make sure that the O2 flow stays constant.
4. Adjust the vaporizer concentration from 0 to 1%. Make sure that the O2 flow must not decrease more than 1 L/min through the full range. Otherwise, install a different vaporizer and try this step again. If the problem persists, the malfunction is in the anesthesia system. Do not use this system.
5. Test each vaporizer as per the steps above.

NOTE

- **Do not perform test on the vaporizer when the concentration control is between “OFF” and the first graduation above “0” (zero) as the amount of anesthetic drug outputted is very small within this range.**

3.6 O2 Flush Test

3.6.1 In Mechanical Ventilation Mode

1. Connect the O2 pipeline supply or cylinder.
2. Set the bag/mechanical ventilation switch to the mechanical ventilation position.
3. Set the system switch to the position or set the system to Standby.
4. Plug the patient connection using a test plug.
5. Turn off ACGO (if ACGO is configured).
6. Let the folding bag completely collapse.
7. Press and hold the O2 flush button O_2+. Measure the time required for fully inflating the folding bag.
8. Repeat the operation (opening patient connection to collapse the folding bag) at least twice.
9. Check that the folding bag is fully inflated within 1 to 3 seconds.

3.6.2 In Manual Ventilation Mode

1. Set the bag/mechanical ventilation switch to the bag position.
2. Set the system switch to the ⏻ position or set the system to Standby.
3. Plug the patient connection using a test plug.
4. Connect a 3 L or 1 L bag to the bag arm or manual bag port.
5. Turn off ACGO (if ACGO is configured).
6. Let the bag completely collapse.
7. Turn the APL valve to 75 cmH2O.
7. Press and hold the O2 flush button O_2+. Measure the time required for the reading on the pressure gauge to reach 10 cmH2O.
8. Repeat the operation (opening patient connection to collapse the bag) at least twice.
9. Check that
   - ◆ The 3 L bag is fully inflated within 3 to 6 seconds.
   - ◆ The 1 L bag is fully inflated within 1 to 3 seconds.

3.7 Breathing Circuit Tests

⚠**WARNING**

- **Objects in the breathing circuit can stop gas flow to the patient. This can cause injury or death. Make sure that there are no test plugs or other objects in the breathing circuit.Make sure that there are no test plugs or other objects in the breathing circuit.**
- **Do not use a test plug that is small enough to fall into the breathing circuit.**

1. Make sure that the breathing circuit is correctly connected and not damaged.
2. Make sure that the check valves in the breathing circuit work correctly:
   - ◆ The inspiratory check valve opens during inspiration and closes at the start of expiration.
   - ◆ The expiratory check valve opens during expiration and closes at the start of inspiration.

3.7.1 Bellows Test

1. Set the system to Standby.
2. Set the bag/mechanical ventilation switch to the mechanical ventilation position.
3. Set all flow controls to minimum.
4. Close the breathing circuit by plugging the patient connection.
5. Push the O_2 flush button to fill the bellows, folding bag rising to the top.
6. Make sure that the pressure reading on the airway pressure gauge must not increase to more than 15 cmH_2O
7. The folding bag should not fall. If it falls, it indicates that the bellows assembly has a leak. You need to reinstall the bellows or folding bag.

3.7.2 Breathing System Leak Test in Mechanical Ventilation Mode

NOTE

- **Perform leak test again each time after servicing the anesthesia machine, replacing the components, or re-connecting the tubes.**

The test aims to check if the pneumatic circuit has leaks in mechanical ventilation mode. Test items include bellows, drive gas circuit, sodalime canister, patient tubes, flow sensors and their connectors.

3.7.2.1 Test Procedures

NOTE

- **Breathing circuit leak test must be performed when the system is Standby.**
- **Before doing the breathing circuit leak test, make sure that the breathing circuit is correctly connected and the breathing tubes not damaged.**
- **Before doing the breathing system leak test, make sure that the drive gas pressure is sufficient. During the leak test, make sure that the test procedures are strictly followed.**
- **During the leak test, selecting [Stop] will stop the ongoing leak test. To continue the test, you must select [Start] to start the leak test again.**

To do the breathing system leak test in mechanical ventilation mode:

1. Make sure that the system is Standby. If not, press the  key and select [**Ok**] from the pop-up menu to enter Standby.
2. Connect the Y piece on the breathing tube to the leak test plug on the manual bag port.
3. Turn the O_2 flow control to set the O_2 flow to approximately 0.15 – 0.2 L/min.
4. Push the O_2 flush button to fill the bellows, folding bag rising to the top.
5. Make sure that the bag/mechanical ventilation switch is set to the  position.
6. Select the [[**Maintenance**] shortcut key and select [**Breathing System Leak Test** >>]. Select [**Start**] from the [**Breathing System Leak Test**] menu to start the breathing system leak test in mechanical ventilation mode. Typically, the test requires 3 to 5 minutes.
7. When the leak test is completed, the message prompting test passed or failed is displayed. If the leak test is passed, it indicates that the leakage of the breathing system is within 0.15 to 0.2 L/min. The breathing system has good airtightness. If the leak test is failed, it indicates that the leakage of the breathing system exceeds 0.15 to 0.2 L/min. In this case, you need to repair the system.

NOTE

- **In case of leak test failure, check all of the possible leak sources, including bellows, breathing system tubes and sodalime canister. Check that they are correctly connected and their connectors are not damaged.**
- **If there is indeed a leak, check the pneumatic circuit system for leakage and troubleshoot the problems as described in 5.3Pneumatic Circuit System Problems.**
- **After leak failure is troubleshot, do the leak test again and make sure the test is passed.**

3.7.2.2 Commonly-encountered Problems and Recommended Actions

The following table lists the commonly-encountered problems and recommends actions for breathing system leak test in mechanical ventilation mode.

Failure description	Possible cause	Recommended action
Leak test failure is prompted immediately after [**Start**] is selected (typically, the leak test requires at least 3 minutes).	The bag/mechanical ventilation switch is set to the bag position and the message [**Manual Vent.**] is prompted.	Set the bag/mechanical ventilation switch to the mechanical ventilation position.
	The reading on the drive gas (O2) pressure gauge indicates drive gas pressure low (lower than 200 kPa) and the alarm of [**Drive Gas Pressure Low**] is produced.	Replace or connect gas supplies and make sure that the drive gas pressure is at 350 to 450 kPa.
When the system works normally, the machine is not leaky and the bellows folding bag does not collapse but leak test is always failed.	Fresh gas is not provided when leak test is performed.	Make sure that fresh gas is provided.
During leak test, the pressure indicated by the airway pressure gauge fails to reach 30 cmH2O.	1. Before the leak test, the bellows folding bag is not fully inflated. 2. The Y piece on the breathing tube is not connected to the test plug. 3. The bellows housing is not properly installed.	Check the connections of the pneumatic circuit and re-install the pneumatic circuit.
During leak test, the pressure indicated by the airway pressure gauge reaches 30 cmH2O but then falls rapidly.	1. The bellows housing may not be installed properly. 2. The expiratory valve assembly is leaky. 3. The circuit is not tightly connected to the circuit adapter. 4. The connection between the sampling line of the sensor and the board is leaky.	Check the connections of the pneumatic circuit and re-install the pneumatic circuit.

Failure description	Possible cause	Recommended action
During leak test, the alarm of [**Auxi Ctrl Module Error**] occurs.	The auxiliary control board is faulty.	Replace the auxiliary control board.
During leak test, the alarm of [**Ventilator Hardware Error 11**] occurs.	Safety valve control failure by the auxiliary control board.	Restart the machine. Verify if the safety valve is controllable by using the safety valve control command of the monitor board. If the safety valve is damaged, replace the safety valve. If the safety valve is in good condition, it indicates that the auxiliary control board or the main control board is faulty regarding the control path of the safety valve. Check the connecting lines or replace the faulty board.
During leak test, the alarm of [**Ventilator Hardware Error 12**] occurs.	Safety valve control failure by the main control board	

NOTE

- **In case of leak test failure, check the machine for leakage and roughly assess the amount of leakage by using the following methods.**
    - Method 1: In the default VCV mode, stop fresh gas supply. If the folding bag rises to the top each time, it indicates that the machine is not leaky. Otherwise, the machine is leaky. Gradually increase fresh gas. The amount of fresh gas when the bag rises to the top at each expiration can be roughly calculated as the amount of leakage.
    - Method 2: During leak test, observe the airway pressure gauge. A period of time (about 30 s) belongs to pressure holding stage after the airway pressure rises. If the airway pressure gauge shows that airway pressure is gradually falling, it indicates that the machine is leaky. Slowly increase fresh gas until airway pressure stops falling. The amount of the then fresh gas can be calculated as amount of leakage.
- **If there is indeed a leak, check the pneumatic circuit system for leakage and troubleshoot the problems as described in 5.3Pneumatic Circuit System Problems.**
- **After leak failure is troubleshot, do the leak test again and make sure the test is passed.**

3.7.3 Breathing System Leak Test in Manual Ventilation Mode

NOTE

- **Perform leak test again each time after servicing the anesthesia machine, replacing the components, or re-connecting the tubes.**

The test aims to check if the pneumatic circuit has leaks in manual ventilation mode. Test items include APL valve, check valve, sodalime canister, patient tubes, flow sensors and their connectors.

To do the breathing system leak test in manual ventilation mode:

1. Make sure that the system is Standby. If not, press the ⏻ key and select [**Ok**] from the pop-up menu to enter Standby.
2. Set the bag/mechanical ventilation switch to the bag position.
3. Connect the manual bag to the manual bag port.
4. Turn the APL valve control to fully close the APL valve (75 cmH_2O).
5. Turn the O_2 flow control to set the O_2 flow to 0.15 to 0.2 L/min.
6. Close the breathing system at the patient connection.
7. Push the O_2 flush button to let the pressure increase to approximately 30 cmH_2O on the airway pressure gauge.
8. Release the O2 flush button. A pressure decrease on the airway pressure gauge indicates a leak. Look for and repair the breathing system leak.

NOTE

- **If there is indeed a leak, check the pneumatic circuit system for leakage and troubleshoot the problems as described in 5.3Pneumatic Circuit System Problems.**
- **After leak failure is troubleshot, do the leak test again and make sure the test is passed.**

3.7.4 APL Valve Test

1. Make sure that the system is Standby. If not, press the ⏻ key and select [**Ok**] from the pop-up menu to enter Standby.
2. Set the bag/mechanical ventilation switch to the bag position.
3. Connect the manual bag to the manual bag port.
4. Connect the Y piece on the breathing tube to the leak test plug on the manual bag port.
5. Turn the APL valve control to let the pressure of APL valve stay at 30 cmH_2O.
6. Push the O2 flush button to inflate the manual bag.
7. Make sure that the reading on the airway pressure gauge is with the range of 20 to 40 cmH_2O.
8. Turn the APL valve control to the MIN position.
9. Set the O_2 flow to 3 L/min. Turn any other gases off.
10. Make sure that the reading on the airway pressure gauge is less than 5 cmH_2O.
11. Push the O_2 flush button. Make sure that the reading on the airway pressure gauge does not exceed 10 cmH2O.
12. Turn the O_2 flow control to set the O_2 flow to minimum. Make sure that the reading on the airway pressure gauge does not decrease below 0 cmH_2O.

NOTE

- **If the accuracy of the APL valve exceeds the range, refer to 4.6Adjust the APL Valve.**

3.8 Pressure Relief Valve Test

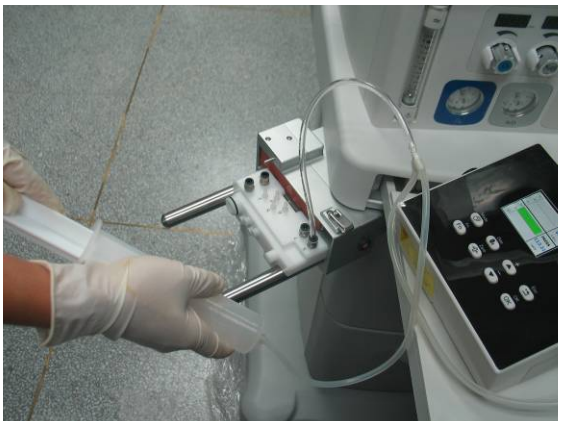
This test can be performed if ACGO is configured.

Perform the pressure relief valve test by using the following tools:

- Anesthesia machine calibration device (quantity:1)
- Circuit adapter test fixture (quantity:1)
- Injector (100 ml) (quantity:1)
- Φ6 silicone tube (quantity:2)
- PU tube (6X300) (quantity:1)
- Y piece (quantity:1)

Test procedures:

1. Turn the system switch off. Close all flow regulators. Turn on ACGO.
2. Pull out the patient circuit. Mount the circuit adapter test fixture onto the circuit adapter.
3. Connect the pressure sensor connector (positive pressure end) on the anesthesia machine calibration device and the injector (before mounting, pull out the push rod of the injector to the graduation of 100 ml) connector to two connectors of the Y piece through two Φ6 silicone tubes. Connect the third connector of the Y piece to No.8 connector on the circuit adapter test fixture through the PU tube (6X300), as shown below.



4. Push in the push rod of the injector to cause the pressure reading on the anesthesia machine calibration device to rise slowly (note to push in the rod at uniform and slow velocity to control the time required for the pressure reading to slowly rise to 100 cmH2O more than 10 s). Continue pushing the push rod at uniform velocity until the rod stops. During the course of pushing in the injector's push rod, the pressure reading on the anesthesia machine calibration device tends to be stable after the tested pressure relief valve is opened. The pressure reading on the anesthesia machine calibration device after the tested pressure relief valve is opened should be within 100 to 125 cmH2O. Otherwise, the test is failed. In this case, you need to replace the pressure relief valve assembly (BOM number: 0621-30-69662).

3.9 Alarm Tests

3.9.1 Prepare for Alarm Tests

1. Connect a test lung or manual bag to the Y piece patient connection.
2. Set the bag/mechanical ventilation switch to the position.
3. Set the system switch to the position.
4. Set the system to Standby.
5. Set the ventilator controls as follows:
   - Ventilation mode: select the [**Vent Mode**] shortcut key and then [**VCV**].
   - [**TV**]: 500 ml.
   - [**Rate**]:12 BPM.
   - [**I:E**]: 1:2.
   - [**Plimit**]: 30 cmH_2O.
   - [**PEEP**]: OFF.
6. Push the O_2 flush button to fill the bellows, folding bag rising to the top.
7. Turn the O_2 flow control to set the O_2 flow to 0.5 to 1 L/min.
8 Press the key and select [**Ok**] from the pop-up menu to exit Standby.
9. Make sure that:
   - The ventilator displays the correct data.
   - The folding bag inside the bellows inflates and deflates normally during mechanical ventilation.

3.9.2 Test the O_2 Concentration Monitoring and Alarms

NOTE

- **This test is not required if O_2 sensor is not configured.**

1. Set the bag/mechanical ventilation switch to the  position.
2. Remove the O_2 sensor and make sure that the sensor measures approximately 21% O_2 in room air.
3. Select the [**Alarm Setup**] shortcut key and then [**Ventilator** >>]. Set the FiO_2 low alarm limit to 50%.
4. Make sure that a low FiO_2 alarm occurs.
5. Set the FiO_2 low alarm limit to a value less than the measured FiO_2 value and make sure that the alarm cancels.
6. Put the O_2 sensor back in the circuit.
7. Select the [**Alarm Setup**] shortcut key and then [**Ventilator** >>]. Set the FiO_2 high alarm limit to 50%.
8. Connect the manual bag to the manual bag port. Push the O_2 flush button to fill the manual bag. After two to three minutes, make sure that the sensor measures approximately 100% O_2.
9. Make sure that a high FiO_2 alarm occurs.
10. Set the FiO_2 high alarm limit to 100% and make sure that the alarm cancels.

3.9.3 Test the Low Minute Volume (MV) Alarm

1. Make sure that MV alarm is turned on.
2. Select the [**Alarm Setup**] shortcut key and then [**Ventilator** >>]. Set the MV low alarm limit to 8.0 L/min.
3. Make sure that a low MV alarm occurs.
4. Select the [**Alarm Setup**] shortcut key and then [**Ventilator** >>]. Set the MV low alarm limit to the default.

3.9.4 Test the Apnea Alarm

1. Connect the manual bag to the manual bag port.
2. Set the bag/mechanical ventilation switch to the  position.
3. Turn the APL valve control to set the APL valve to the minimum position.
4. Inflate the manual bag to make sure that a complete breathing cycle occurs.
5. Stop inflating the manual bag and wait for at least 20 seconds to make sure that the apnea alarm occurs.
6. Inflate the manual bag to make sure that the alarm cancels.

3.9.5 Test the Sustained Airway Pressure Alarm

1. Connect the manual bag to the manual bag port.
2. Turn the O_2 flow control to set the O_2 flow to minimum.
3. Turn the APL valve control to set the APL valve to 30 cmH_2O position.
4. Set the bag/mechanical ventilation switch to the  position.
5. Push the O_2 flush button for approximately 15 seconds. Make sure that the sustained airway pressure alarm occurs.
6. Open the patient connection and make sure that the alarm cancels.

3.9.6 Test the High Paw Alarm

1. Set the bag/mechanical ventilation switch to the  position.
2. Select the [Alarm Setup] shortcut key and then [**Ventilator** >>].
3. Set the Paw low alarm limit to 0 cmH_2O and Paw high alarm limit to 5 cmH_2O.
4. Make sure that a high Paw alarm occurs.
5. Set the Paw high alarm limit to 40 cmH_2O.
6. Make sure the high Paw alarm cancels.

3.9.7 Test the Low Paw Alarm

1. Set the bag/mechanical ventilation switch to the position.
2. Select the [Alarm Setup] shortcut key and then [**Ventilator** >>].
3. Set the Paw low alarm limit to 2 cmH_2O.
4. Disconnect the manual bag from the Y piece patient connection.
5. Wait for 20 seconds. View the alarm area and make sure that a low Paw alarm occurs.
6. Connect the manual bag to the manual bag port.
7. Make sure the low Paw alarm cancels.

3.10 AGSS Inspection

3.10.1 Check the Float

Install the AGSS. Check if the float floats off and exceeds the MIN level. If the float is tacky or damaged, re-install the AGSS or replace the float.

NOTE

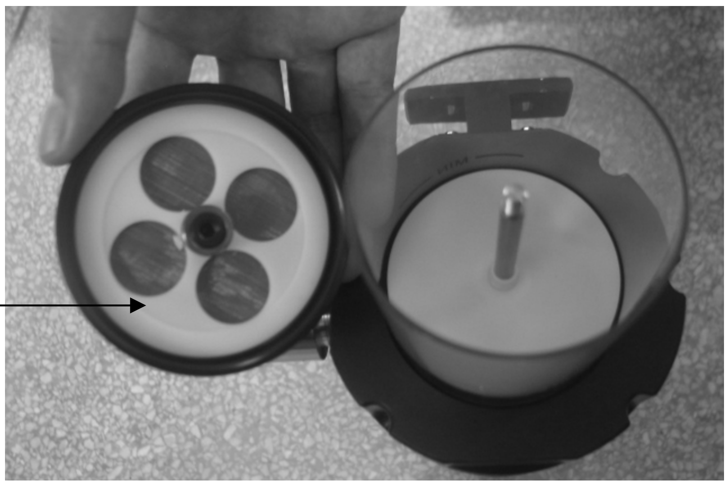
- **Do not block the AGSS pressure compensation openings during the inspection.**

If the float fails to float off, the possible reasons are:

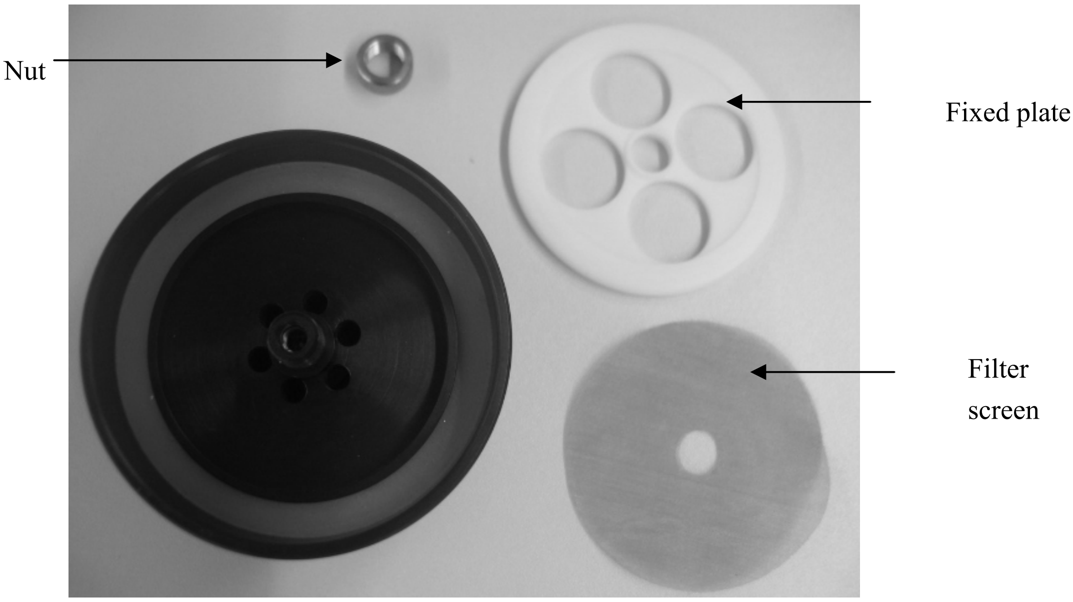
1. The float is tacky or stuck to the guide bar. Invert the AGSS and check if the float moves up and down freely. If not, clean where the float and guide bar meet to remove possible foreign substance. Replace the float or guide bar when necessary.
2. The filter screen inside the top cove may be occluded. Remove the filter screen as described below and check if the filter screen is occluded.

   a.Turn the top cover counterclockwise to separate it from the sight glass.

Top cover



b.Take out the nut, fixed plate and filter screen by turn.

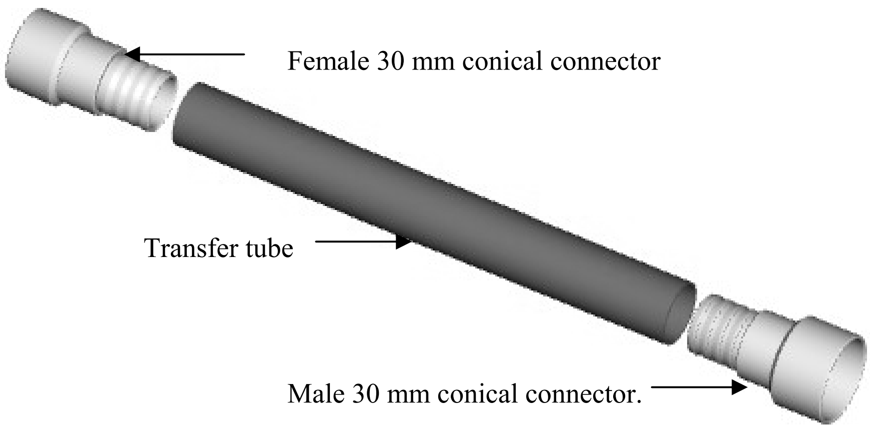


3. The waste gas disposal system is not working or the pump rate is less than 60 L/min at which the AGSS works normally. Check if the waste gas disposal system reaches the pump rate range of 50-80 L/min specified by the AGSS.

3.10.2 Check the Transfer Tube and Active Scavenging Tube

Disconnect the tubes from other components.

1. Check the transfer tube and its connectors for damage. If any damage is detected, replace the tube (four transfer tubes are available in the AGSS accessories for your replacement).



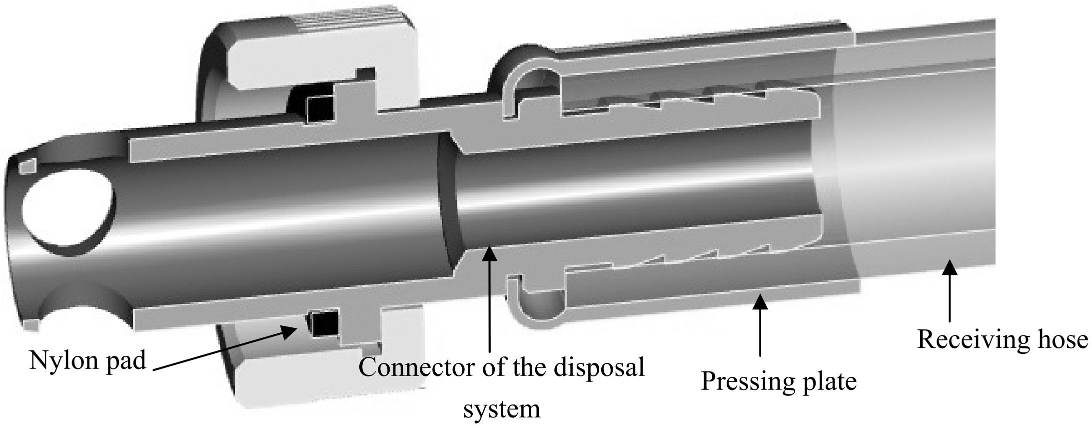
2. Check:

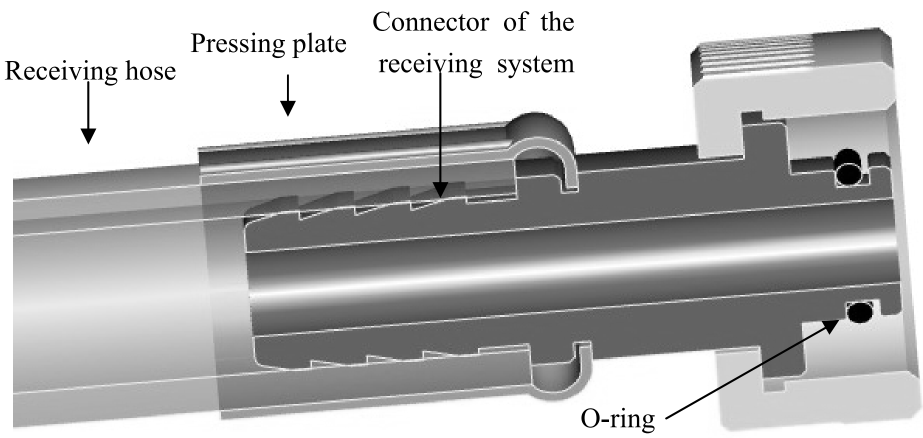
   1).The receiving hose and its connectors for damage.

   2).If the connections between the receiving hose and its connectors are loose.

   3).The nylon pad and seal for damage.

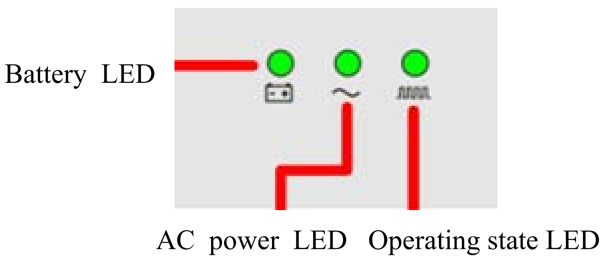
If any damage or loose connection is detected, replace the corresponding component.





3.11 Power Failure Test

1. Connect the anesthesia machine to the AC power source. Both AC power LED and battery LED should come on. If the AC power LED is not lit, check the fuse and power board.



2. Set the system switch to the ⊙ position.

3. Unplug the power cord with the system turned on. The message [**Battery in Use**] is displayed. Meanwhile, the AC power LED is extinguished and the battery LED is flashing.

4. Reconnect the AC power. The prompt message disappears. The AC power LED is illuminated. The battery LED stops flashing and stays ON.

3.12 Electrical Safety Tests

1. Perform leakage current test by using certified (such as UL, CSA or AMAI) test devices. Make sure that the test result is not greater than 500 μA.
2. Make sure that the impedance between the protective grounding terminal of the power cord and any exposed metal enclosure is less than 0.2 Ω.

FOR YOUR NOTES

4 Maintenance and Calibration

WARNING

- **When it comes to test and maintain the equipment, make sure that the patient is disconnected from the equipment.**
- **The equipment may have been used on patients carrying infectious diseases. Before testing or maintaining the equipment, wear sterile rubber gloves to reduce the risk of being infected.**
- **When the equipment to be maintained contains blood or other secretion, clean, disinfect and sterilize the equipment by strictly following the control and safety handling procedures for infectious diseases.**

4.1 Equipment Maintenance

To ensure the long-term reliability and stability of the anesthesia machine, periodical maintenance of the equipment and replacement of its parts must be performed by authorized service personnel. For details about parts replacement, refer to*6Repair* and Disassembly Periodical parts replacement can be carried out every year or every three years. Make records of the parts that have been replaced before the periodical replacement.

NOTE

- **These schedules are the minimum frequency based on typical usage of 2000 hours per year. You should service the equipment more frequently if you use it more than the typical yearly usage.**
- **To avoid equipment damage or personal injury, replace the parts which need to be replaced periodically even if they are not worn or damaged when the due date arrives.**

4.1.1 One-year Replaceable Parts

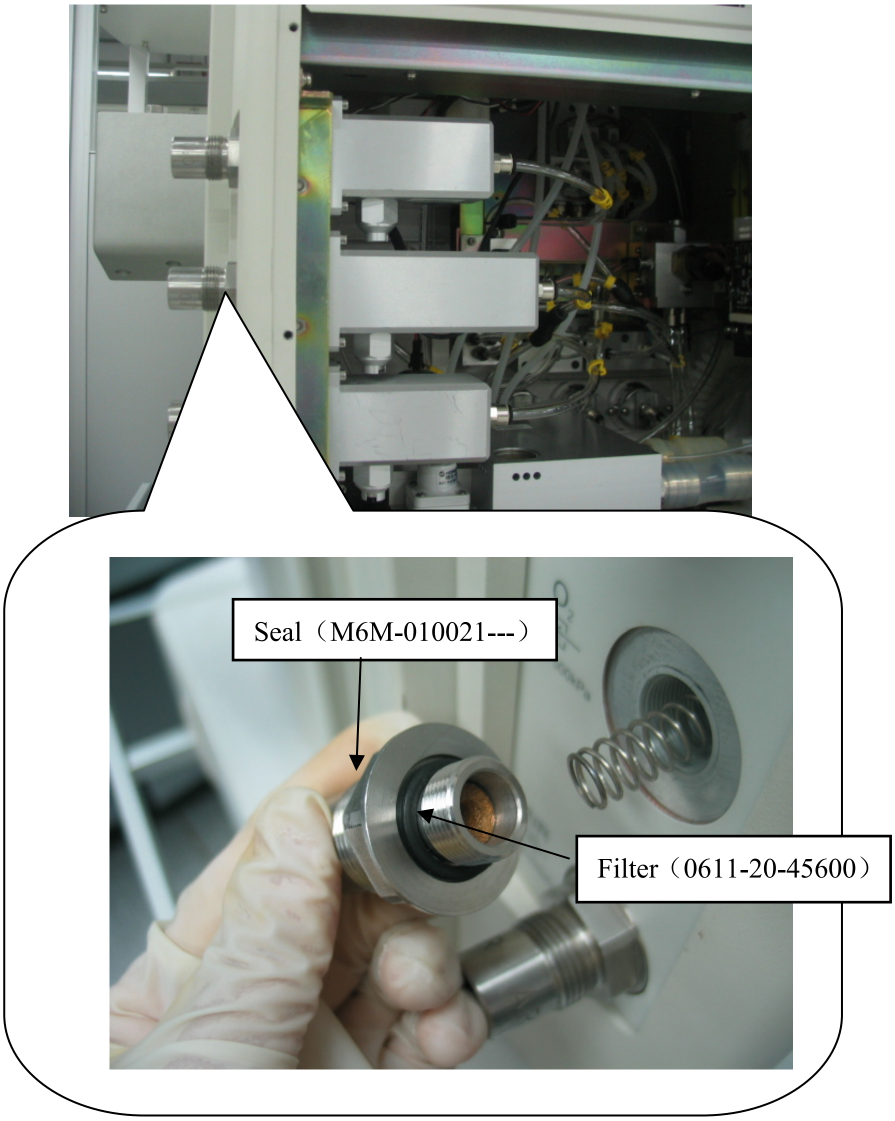
List of one-year service package (0621-30-78479):

SN	P/N	Description	Qty
1	0611-20-45600	Gas supply inlet filter	3
2	M6M-010021---	Seal for gas supply inlet assembly	3

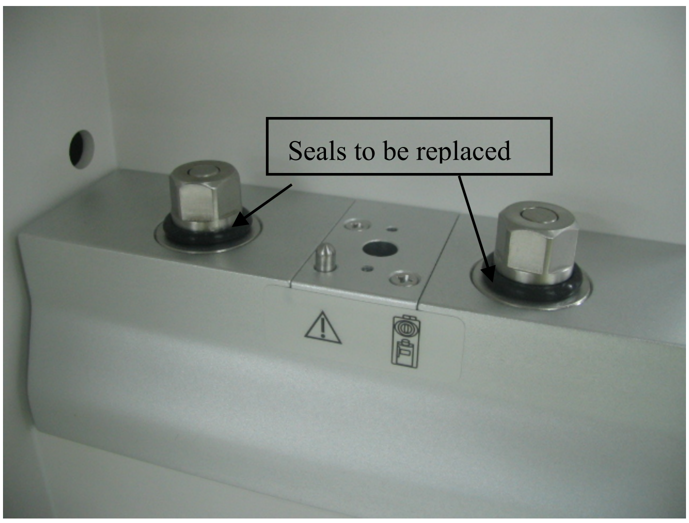
SN	P/N	Description	Qty
3	M6M-010014---	Seal for vaporizer manifold	4
4	M6M-010031---	Seal for valve cover	2
5	M6M-010033---	Valve seal	2
6	M6M-010058---	Seal for bag arm	2
7	M6M-010038---	Seal for water collection cup	1
8	0601-20-78843	Sealing cushion for sodalime canister outlet	1
9	0601-20-78842	Sealing component for sodalime canister	1
10	M6M-010032---	Seal for sodalime canister support	1
11	M6M-010063---	Seal for pressure sampling connector	4
12	M6M-010006---	Seal for fresh gas and ACGO	2
13	M6M-010058---	Seal for drive gas and APL discharge	2
14	0601-20-78848	Seal for bellows housing	1
15	0601-10-69901	Folding bag	1
16	0030-10-13077	Seal for axis of bag/mechanical ventilation switch	2
17	0601-20-78840	BYPASS large sealing cushion	1

4.1.1.1 Parts Replacement

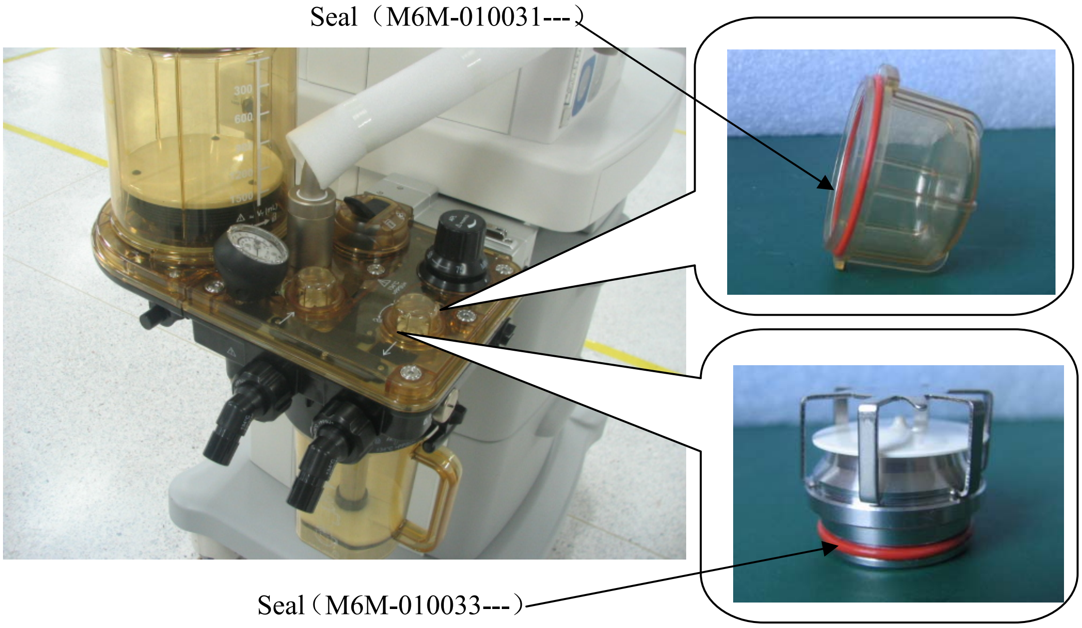
1. As required, replace the gas supply inlet filter (0611-20-45600) and seal for gas supply inlet assembly (M6M-010021---) every 12 months. Unscrew the gas supply inlet counterclockwise using a wrench to disassemble the gas supply inlet assembly as shown below (take O2 supply inlet as an example).



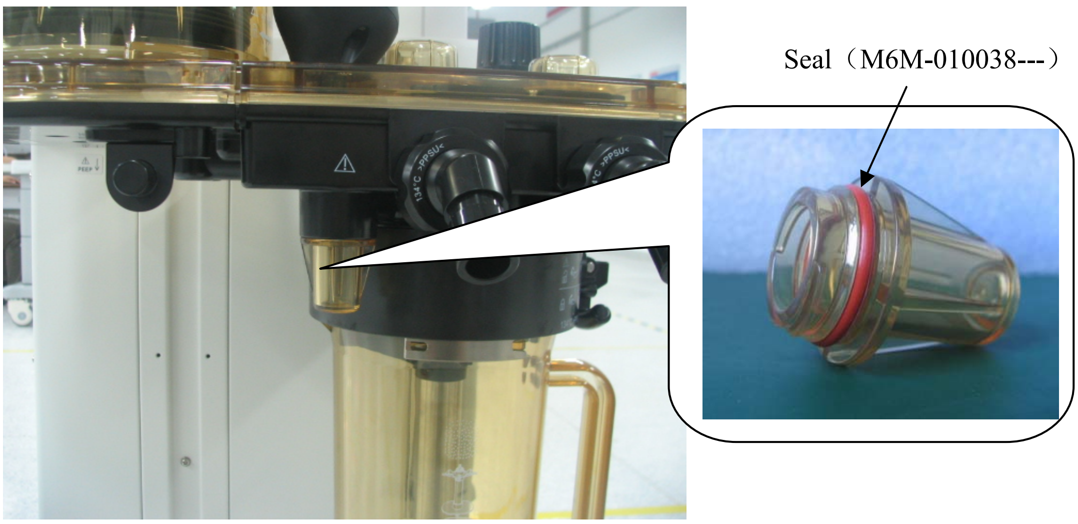
2. As required, replace the seals (M6M-010014---) where vaporizer manifold connectors meet the vaporizers every 12 months



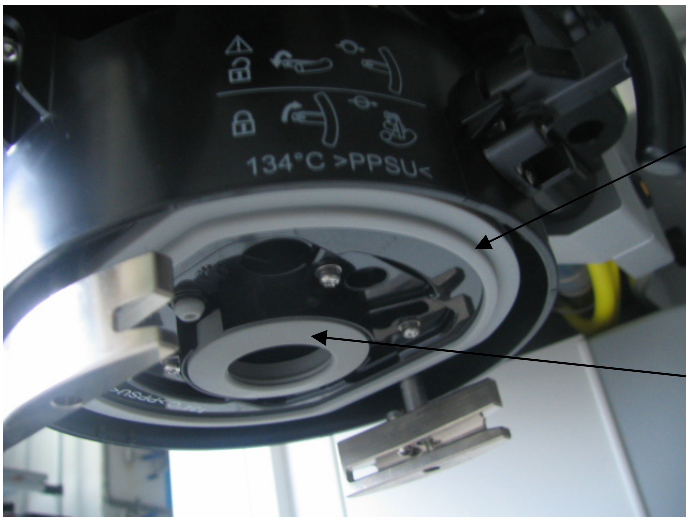
3. As required, replace the seal for valve cover (M6M-010031--) and valve seal (M6M-010033---) every 12 months.



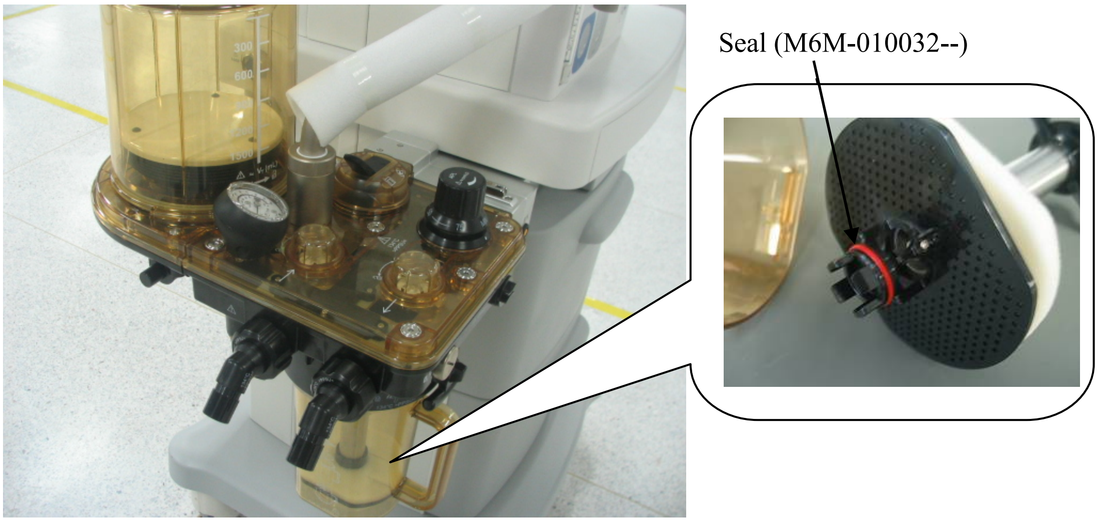
4. As required, replace the seal for water collection cup (M6M-010038---) every 12 months.



5. As required, replace the sealing component for sodalime canister outlet (0601-20-78843) and sealing component for sodalime canister (0601-20-78842) every 12 months.

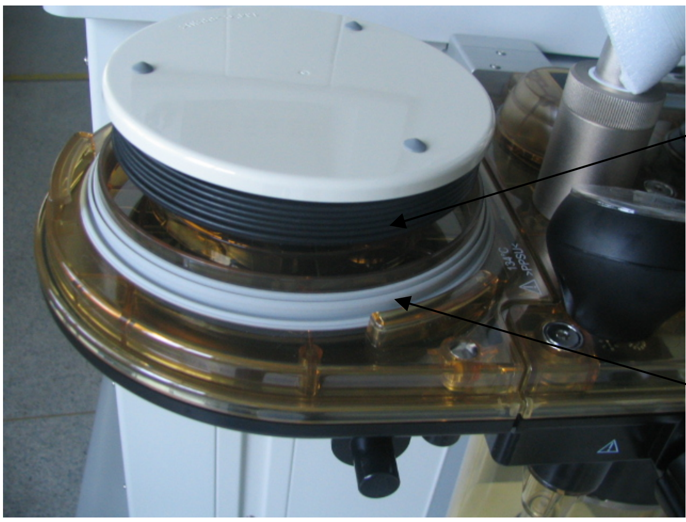


6. As required, replace the seal for sodalime canister support (M6M-010032--) every 12 months.



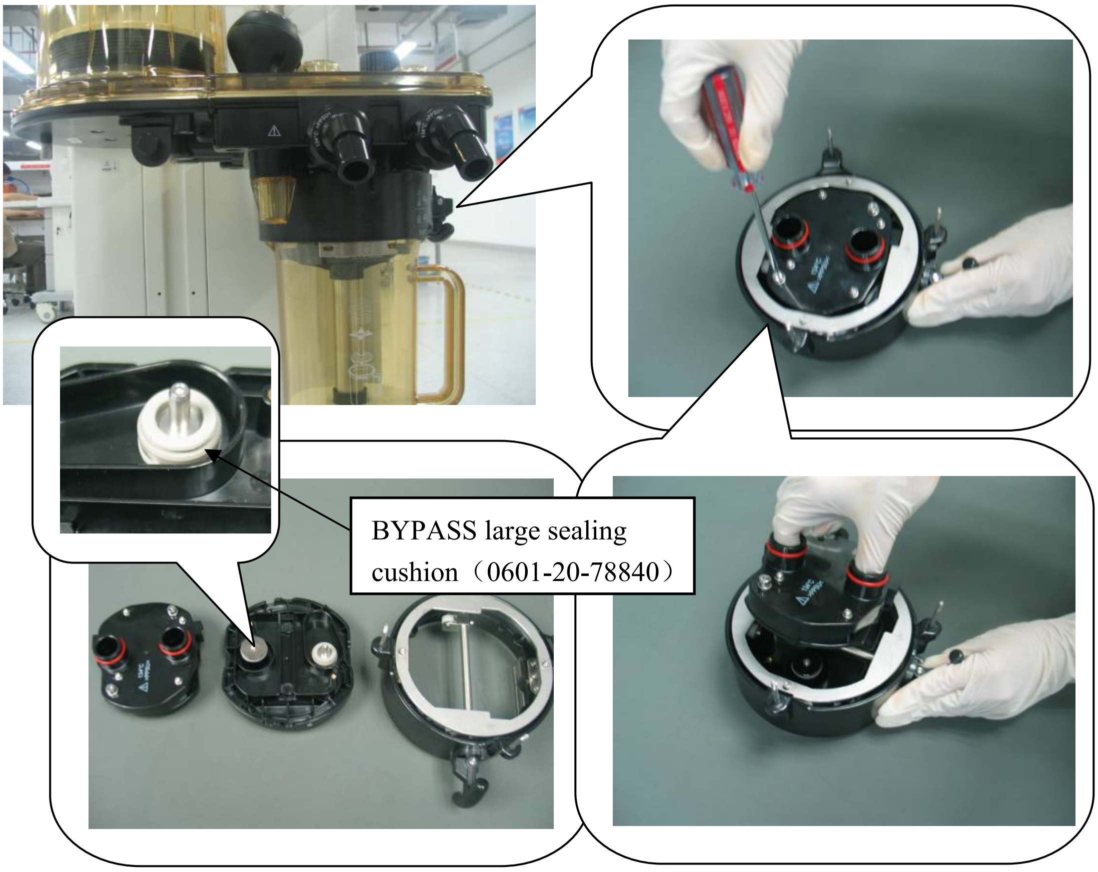
7. As required, replace the seal for pressure sampling connector (M6M-010063---), seal for fresh gas and ACGO (M6M-010006---), seal for drive gas and APL discharge (M6M-010058---) every 12 months.

8. As required, replace the seal for bellows housing (0601-20-78848) and folding bag (0601-10-69901) every 12 months.



9. As required, replace the seal for axis of bag/mechanical ventilation switch (0030-10-13077) every 12 months. For details, refer to *6Repair* and Disassembly**.**

10. As required, replace the BYPASS large sealing cushion (0601-20-78840) every 12 months.



4.1.1.2 Checkout and Test of the Anesthesia Machine

Perform the following maintenance procedures every 12 months:

1. System inspection (refer to 3.1).
2. Pipeline test (refer to 3.2).
3. Cylinder test (refer to 3.3).
4. Flow control system test (refer to 3.4).
5. Vaporizer back pressure test (refer to **3.5**).
6. O2 flush test (refer to 3.6).
7. Breathing circuit test (refer to 3.7).
8. Pressure relief valve test (refer to 3.8).
9. Alarm test (refer to 3.9).
10. AGSS inspection (refer to 3.10).
11. Power failure test (refer to 3.11).
12. Electrical safety test (refer to 3.12).

13. Flow sensor calibration (refer to 4.3.2).
14. O2 sensor calibration (refer to 4.3.7).
15. Airway pressure gauge zeroing (refer to4.5).
16. APL valve accuracy adjustment (refer to 4.6).
17. Low pressure leak test (refer to steps 1 through 8 of “4.Leak test of all pipelines on the circuit adapter” in **5.3.4.2**Leak Test of Low-pressure Pneumatic Circuit System).

4.1.2 Three-year Replaceable Parts

List of three-year service package (0621-30-78480):

SN	P/N	Description	Qty
1	M05-010001-06	Lithium battery Li-ion 11.1V4400mAh LI23S001A	1
2	M05-010R03---	Cell battery Lithium 3V35mAh D12.5*2.0	1

4.2 System Test

Before the anesthesia machine at the client end is maintained, some routine tests are required to check if the current status of the anesthesia machine is normal. The following table lists the routine tests.

SN	Test item	Functional description	Test interval
1	Check the mechanical ventilation mode	1. Check if mechanical ventilation is provided normally and if an alarm occurs. 2. Check if the preset values of pressure and TV are same to the measured values. 3. Check if the pressure measured by the pressure sensor is same to that indicated by the airway pressure gauge and if the TV measured by the flow sensor is same to that indicated by the graduation on the bellows housing. 4. Roughly judge if the breathing system has a significant leak by observing how much fresh gas is compensatedt and observing if the folding bag collapses.	After each service or at the time of return visit
2	Breathing system leak test in mechanical ventilation mode	1. Check the pneumatic circuit in mechanical ventilation mode for leaks, including bellows, drive gas circuit, sodalime canister, patient tubes, flow sensors and their connectors. 2. Check the control effectiveness of main control board and auxiliary control board over PEEP safety valve. 3. Check the monitoring effectiveness of auxiliary control module over airway pressure and PEEP path pressure.	After each service or at the time of return visit

3	Breathing system leak test in manual ventilation mode	Check the pneumatic circuit in manual ventilation mode for leaks, including APL valve, check valve, sodalime canister, patient tubes, flow sensors and their connectors.	After each service or at the time of return visit
4	Check the sensors' zero points	Check if the zero points of all the flow sensors and pressure sensors inside the machine are within the normal range so as to determine when to replace the monitor board.	After each service or at the time of return visit
5	Check the flow sensor accuracy	1. Check if the measurements made by the flow sensors inside the machine are the same. 2. Check if the measurement made by any flow sensor inside the machine is accurate. 3. Check the effectiveness of flow calibration (factory) result.	After each service or at the time of return visit
6	Check the pressure sensor accuracy	1. Check if the measurements made by the pressure sensors inside the machine are the same. 2. Check if the measurement made by any pressure sensor inside the machine is accurate. 3. Check the effectiveness of pressure calibration (factory) result.	After each service or at the time of return visit
7	Check the electronic flowmeter accuracy	1. Check if the measurement made by the electronic flowmeter is normal. 2. Check the effectiveness of electronic flowmeter calibration result.	After each service or at the time of return visit

4.2.1 Check the Mechanical Ventilation Mode

NOTE

- **The main function of the anesthesia machine is to provide breathing support—mechanical ventilation which complies with the doctor's settings to the patient. The tests in this section are performed aiming to ensure that the machine is able to provide normal mechanical ventilation.**
- **The tests can help to judge if the machine operates normally.**

4.2.1.1 Check Volume Control Ventilation (VCV)

NOTE

- **VCV is the standard ventilation mode of the anesthesia machine and also the most basic mechanical ventilation mode.**

To check VCV:

1. Make sure that the supply pressure is normal and that the tubes in the breathing circuit are correctly connected as required for mechanical ventilation. Connect a 2 L bag, which is used as the test lung, to the Y piece in the patient circuit.
2. Set the bag/mechanical ventilation switch to the mechanical ventilation position.
3. Select VCV as the ventilation mode.
4. Adjust total amount of fresh gas to 0.5 L/min.
5. Set the following combinations of TV and Rate respectively: 300 ml and 15 BPM, 600 ml and 15 BPM, 900 ml and 15 BPM, 1200 ml and 15 BPM. Set others to the defaults. Record the displayed TVe and Ppeak values, and the peak pressure reading on the airway pressure gauge in each setting stabilized status.
6. Judge if the above measured data meet the following conditions:
   - TV control and measurement are normal: the displayed TVe value should be within the range of TV setting X (1±10%) ml.
   - Circuit leak is within the acceptable range: the folding bag can reach the top of the bellows housing each time and the lowest graduation on the bellows housing which the bag falls to each time corresponds to approximately TV setting.
   - Pressure measurement is normal: the Ppeak measured value is close to the peak pressure reading on the airway pressure gauge. The error should not exceed 2 cmH2O.
   - No other ventilation failure occurs: the Paw and flow waveforms are displayed normally and no technical alarms occur.

If the above test requirements are not met, perform subsequent checks and do the test again.

NOTE

- **If any errors are detected during VCV test, perform troubleshooting as per 5Troubleshooting and do the test again until the system is normal.**

4.2.1.2 Check Pressure Control Ventilation (PCV)

NOTE

- **PCV is one of the basic mechanical ventilation modes of the anesthesia machine. PCV is configured depending on the user's selection and machine type. If the anesthesia machine under test is not configured with this mode, this test is not required.**

To check PCV:

1. Make sure that the supply pressure is normal and that the tubes in the breathing circuit are correctly connected as required for mechanical ventilation. Connect a 2 L bag, which is used as the test lung, to the Y piece in the patient circuit.
2. Set the bag/mechanical ventilation switch to the mechanical ventilation position.
3. Select PCV as the ventilation mode.
4. Adjust total amount of fresh gas to 0.5 L/min.
5. Set the following combinations of Pinsp, Rate and PEEP respectively: (10 cmH2O, 15 BPM, OFF), (15 cmH2O, 12 BPM, 5 cmH2O), (20 cmH2O, 10 BPM, 8 cmH2O). Set others to the defaults. Record the displayed Ppeak and PEEP values, and maximum and minimum readings on the airway pressure gauge in each setting stabilized status
6. Judge if the above measured data meet the following conditions:
   - Pressure control and measurement are normal: the displayed Ppeak value should be within the range of Pinsp setting ±2 cmH2O.
   - Circuit leak is within the acceptable range: the folding bag can reach the top of the bellows housing each time.
   - Pressure measurement is normal: in one breathing cycle, the Ppeak measured value should be close to the maximum reading on the airway pressure gauge (with error not exceeding 2 cmH2O) and the displayed PEEP value close to the minimum reading on the airway pressure gauge (with error not exceeding 1 cmH2O).
   - No other ventilation failure occurs: the Paw and flow waveforms are displayed normally and no technical alarms occur.

If the above test requirements are not met, perform subsequent checks and do the test again.

NOTE

- **If any errors are detected during PCV test, perform subsequent checks and do the test again until the errors are corrected.**

4.2.2 Breathing System Leak Test in Mechanical Ventilation Mode

For details, refer to *3.7.2Breathing* System Leak Test in Mechanical Ventilation Mode.

4.2.3 Breathing System Leak Test in Manual Ventilation Mode

For details, refer to *3.7.3Breathing* System Leak Test in Manual Ventilation Mode.

4.2.4 Check the Sensor Zero Point

NOTE

- **The zero point A/D value of the airway pressure sensor and PEEP pressure sensor should fall within the normal range of 400 to 800.**
- **The zero point A/D value of the inspiratory flow sensor, expiratory flow sensor and built-in ventilator flow sensor should fall within the normal range of 200 to 1000.**
- **If the zero point of the pressure sensor has an error, in ventilation status, the baseline of the Paw waveform is not at the zero point and a great deviation occurs between pressure control and measurement.**
- **If the zero point of the inspiratory/expiratory flow sensor has an error, in ventilation status, the baseline of the flow waveform is not at the zero point and a great deviation occurs between TV control and measurement.**
- **If the zero point A/D value of any sensor is outside of the normal range, it cannot be corrected. The monitor board must be replaced.**

To check the sensor zero point:

1. Turn off all fresh gases and position the Y piece connector in the patient circuit to the air.
2. Make sure that the system is Standby. Select the [Maintenance] shortcut key → [Factory Maintenance >>] → [Diagnostic Test >>] → [Display A/D Channels >>] → [Ventilator >>] to access the [Display A/D Channels—Ventilator] menu.
3. Make sure that the actual measured value of each sensor is “0” (zero). Record the zero point A/D value of each sensor and judge if the zero point falls with the normal range. If not, replace the monitor board.

4.2.5 Check the Flow Sensor Accuracy

NOTE

- **If a great deviation of TV measured value occurs, test the measurement accuracy of flow sensors so as to determine whether to perform flow calibration again.**

To check the measurement accuracy of flow sensors:

1. Make sure that the circuit, calibration device (or other flow measurement device) and breathing tubes are connected in serial, similar to tubes connection in flow calibration. For details, refer to ***4.3.2Flow Calibration (factory)***.
2. When the system is Standby, select the [Maintenance] shortcut key → [Factory Maintenance >>] → [Diagnostic Test >>] → [Valves—Test Tool >>] to access the [Valves—Test Tool] menu.
3. Set PEEP safety valve to [ON].
4. Set the D/A value of the PEEP valve to above 1500 and ensure that the pressure at which the expiratory valve closes is above 30 cmH2O.
5. Increase the D/A value of the inspiratory valve, causing the measured flow value of the anesthesia machine calibration device to fall with the following ranges respectively: (3±0.5) L/min, (10±1) L/min, (20±1) L/min, (30±2) L/min, (60±3) L/min. Record the measured flow values of the inspiratory flow sensor, expiratory flow sensor and ventilator flow sensor to which each setting corresponds respectively.
6. Make sure that the deviation between the measured data of the inspiratory flow sensor, expiratory flow sensor and ventilator flow sensor and that of the anesthesia machine calibration device must not exceed 1 L/min or 5% of the measured value of the calibration device, whichever is greater. Otherwise, refer to ***4.3.2Flow Calibration (factory)*** to perform flow calibration again.
7. If anesthesia machine calibration device is unavailable, you can execute steps 1 through 5 to test the accuracy of flow sensors. The deviation between the measured data of the inspiratory flow sensor and expiratory flow sensor and that of the ventilator flow sensor must not exceed 1 L/min or 5% of the measured value of the ventilator flow sensor, whichever is greater. Otherwise, refer to ***4.3.2Flow Calibration (factory)*** to perform flow calibration again.

4.2.6 Check the Pressure Sensor Accuracy

NOTE

- **Generally, measurement deviations do not easily occur to pressure sensors. However, in case of maintaining or replacing the monitor board, three-way valve assembly, or expiratory valve assembly, you need to perform pressure calibration and check the flow sensors accuracy so as to confirm the effectiveness of calibration.**

To check the measurement accuracy of pressure sensors:

1. Make sure that the pressure sampling line and calibration device (or other pressure measurement device) are connected in parallel, similar to tubes connection in pressure calibration. For details, refer to ***4.3.3Pressure Calibration (factory).***
2. When the system is Standby, select the [Maintenance] shortcut key → [Factory Maintenance >>] → [Diagnostic Test >>] → [Valves—Test Tool >>] to access the [Valves—Test Tool] menu.
3. Set PEEP safety valve to [ON].
4. Increase the D/A value of the PEEP valve, causing the measured pressure value of the anesthesia machine calibration device to fall with the following ranges respectively: (5±1) cmH2O, (20±1) cmH2O, (50±1) cmH2O, (70±2) cmH2O, (90±2) cmH2O. Record the measured pressure values of the airway pressure sensor and PEEP pressure sensor to which each setting corresponds respectively.
5. Make sure that the deviation between the measured data of the airway pressure sensor, PEEP pressure sensor and that of the anesthesia machine calibration device must not exceed 1 cmH2O or 2% of the measured value of the calibration device, whichever is greater. Otherwise, refer to ***4.3.3Pressure Calibration (factory)*** to perform pressure calibration again.

4.2.7 Check the Electronic Flowmeter Accuracy

NOTE

- **When a great measurement deviation occurs to the electronic flowmeters, checkthe electronic flowmeter accuracy so as to determine whether to calibrate the electronic flowmeters again.**

4.2.7.1 Check the O2/Air Electronic Flowmeter Accuracy

To check the measurement accuracy of O2 or Air electronic flowmeters:

1. When the flowmeter tubes are correctly configured, if alarms related to flowmeter calibration data error occur, re-calibration is necessary. For details, refer to ***4.3.4Electronic Flowmeter Calibration (factory)***.
2. Adjust the needle valve of the flowmeter of the supply gas under test (O2 or Air). Compare the measured value by the electronic flowmeter and that by the float flowmeter. If a great deviation occurs between the value displayed by electronic flowmter LED and the reading on the float flowmeter, such as more than 1 L/min, you may need to calibrate again. For details, refer to ***4.3.4Electronic Flowmeter Calibration (factory)*** (this method is suitable for comparison of more than 3 L/min flow due to low accuracy).
3. Use the anesthesia machine calibration device to check the accuracy of electronic flowmeter further. Connect the low flow (0 to 15 L/min) inlet of the calibration device to the fresh gas port of the breathing system and position the low flow (0 to 15 L/min) outlet of the calibration device to the air.
4. Select the same gas for the anesthesia machine calibration device to that under test, O2 or Air.
5. Adjust the electronic flowmeter, causing the measured flow value by the calibration device to fall within the setting range, such as (3.0±1) L/min, (5.0±1) L/min, (8.0±2.0) L/min. Record the displayed value by the electronic LED to which each setting corresponds respectively.
6. Make sure that the deviation between the reading on the calibration device and that on the electronic flowmeter must not exceed 10% of the reading on the calibration device. Otherwise, you need to calibrate the electronic flowmeter again. For details, refer to .***4.3.4Electronic Flowmeter Calibration (factory)***.

4.2.7.2 Check the N2O Electronic Flowmeter Accuracy

NOTE

- **When checking the accuracy of N2O electronic flowmeter, first adjust O2 flow to sufficiently large (above 5 L/min), so as to make sure that O2 flow does not increase when the needle valve of N2O supply flowmeter is being adjusted. Otherwise, you need to increase O2 flow further and do the test again.**

Due to the existence of O2-N2O chain linkage and O2-N2O cut-off valve, the method for checking the accuracy of O2 or Air electronic flowmeter cannot be used for N2O electronic flowmeter accuracy checking. When checking the accuracy of N2O electronic flowmeter, eliminate the effect of O2 first.

To check the measurement accuracy of N2O electronic flowmeter:

1. Make sure that checking the O2 electronic flowmeter accuracy is passed.
2. Turn off all the electronic flowmeters.
3. Make sure that the anesthesia machine calibration device is connected to the anesthesia machine in the same way to that for checking the O2 electronic flowmeter accuracy. For details, refer to ***4.2.7.1Check the O2/Air Electronic Flowmeter Accuracy.***
4. Select N2O for the gas under test of the anesthesia machine calibration device.
5. Turn on O2 electronic flowmeter and set O2 flow to approximately 5 L/min. Record the reading measured by the calibration device, which is used as the "initial flow" for N2O measurement.
6. Keep O2 flow control unmoved. Adjust the needle valve of the N2O electronic flowmeter, causing the reading on the calibration device to increase by (3±1) L/min and (6±1) L/min respectively based on the "initial flow". Observe the value displayed by the N2O electronic flowmeter, which should fall within (1+/-10%) of the increased reading (current reading minus initial flow) on the calibration device. Otherwise, refer to ***4.3.4Electronic Flowmeter Calibration (factory)*** to calibrate the N2O electronic flowmeter.

4.3 System Calibration

NOTE

- **Perform the corresponding calibration if any test item of the system test about measurement accuracy is failed.**

The anesthesia machine provides the function of monitoring volume, pressure, FiO2, CO2 concentration, AG concentration etc. When these measured values have great deviations, it is very likely that measurement offset occurs to the relevant measurement parts. In this case, you need to perform calibration again. After equipment service, such as replacing the monitor board, expiratory valve assembly or three-way valve assembly, you need to calibrate the flow sensors or pressure sensors.

The following table lists the possible calibration items and calibration time.

SN	Calibration item	Functional description	Calibration time
1	Flow calibration (user)	Calibrate the flow sensors of the breathing system.	1. The TV measurement deviation is great (more than 10% compared with the setting value) after the flow sensors in the patient circuit have been used for a long time. 2. The flow sensor in the patient circuit is replaced.
2	Flow calibration (factory)	Calibrate the flow sensors and inspiratory valve of the anesthesia machine.	1. The expiratory valve assembly is replaced. 2. The monitor board is replaced. 3. The deviation between the measured value of the ventilator flow sensor and that of the flow measurement device exceeds more than 5% of the reading or 1 L/min, whichever is greater.
3	Pressure calibration (factory)	Calibrate the pressure sensors and PEEP valve of the anesthesia machine.	1. The monitor board is replaced. 2. The expiratory valve assembly is replaced. 3. The deviation between the measured value of the machine's pressure sensor and that of the standard pressure gauge exceeds more than 2% of the reading or 1 cmH2O, whichever is greater.

4	Electronic flowmeter calibration (factory)	Calibrate the electronic flowmeter board.	1. The electronic flowmeter board is replaced. 2. The throttling device of the electronic flowmeter is replaced. 3. The deviation between the measured value of the electronic flowmeter and that of the standard flow measurement device exceeds more than 10% of the reading or 0.5 L/min, whichever is greater.
5	Pressure and flow zeroing (factory)	Calibrate the deviation from zero point of the monitor board and auxiliary monitor board.	Flow or Paw waveforms deviates from the baseline.
6	Electronic flowmeter zeroing (factory)	Calibrate the deviation from zero point of the electronic flowmeter board.	The electronic flowmeter has a zero point error. The electronic flowmeter still displays flow when fresh gases are all turned off.
7	O2 sensor calibration (user)	Calibrate the accuracy of O2 sensor at 21% and 100% O2.	1. The measured value of the O2 sensor has a great deviation. The deviation exceeds 3% both in Air and pure O2. 2. The O2 sensor is replaced. 3. The monitor board is replaced.
8	CO2 calibration (factory)	Calibrate to cause the module to work more accurately.	The measurement deviation of the module exceeds the specified accuracy range.
9	AG calibration (factory)	Calibrate to cause the module to work more accurately.	The measurement deviation of the module exceeds the specified accuracy range.
10	O2 module calibration (factory)	Calibrate to cause the module to work more accurately.	1. The measurement deviation of the module exceeds the specified accuracy range. 2. The O2 module is replaced.

Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>]. Enter the required password to access the [**Factory Maintenance**] menu, where you can perform the following calibrations and settings.

4.3.1 Flow Calibration (user)

NOTE

- **The measurements performed by the flow sensors may be affected by the environment where the sensors are used. After the sensors have been used for a long time, great deviations may occur to the measurement results and tidal volume control as well. This problem can be fixed through flow sensor calibration.**
- **When replacing sensors or after re-calibrating sensors, you need to calibrate flow sensors again.**
- **Before calibration, perform leak test of the breathing system in mechanical ventilation mode first and make sure that the test is passed.**
- **During calibration, make sure that the drive gas pressure is kept above 0.3 MPa. Failure to do so may lead to calibration failure.**

This calibration is only intended for the flow sensors in the breathing circuit. The inspiratory flow sensor and expiratory flow sensor in the breathing system are calibrated through the built-in flow measurement reference.

After the inspiratory flow sensor and expiratory flow sensor have been used for several months, for example, three months after calibration, great deviations (more than 10% compared with the setting value) may occur to tidal volume measurement due to sensor ageing or environmental factors. Or, the user replaces flow sensors. In this case, you need to re-calibrate flow sensors. For details about user flow calibration, refer to the corresponding section in the Operator's Manual.

NOTE

- **If measurement deviations are not corrected after multiple flow sensor calibrations, the user is recommended to replace the flow sensor and then perform calibration. If the problem persists, factory maintenance is necessary. After the problem is fixed, perform calibration and system test.**

4.3.2 Flow Calibration (factory)

NOTE

- **Factory flow calibration is necessary in case of replacing the monitor board, expiratory valve assembly or three-way valve assembly.**
- **When a great deviation is detected between the measured value of the built-in flow sensor and that of the standard flow measurement device, you need to perform factory flow calibration.**

This calibration is intended for the flows sensors in the breathing circuit, ventilator flow sensor, and also inspiratory valve. The standard flow measurement device is used to calibrate the flow sensors and inspiratory valve.

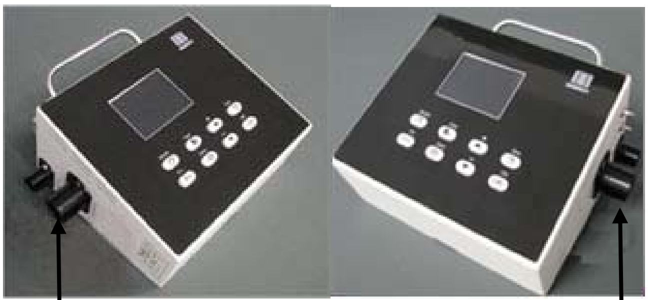
4.3.2.1 Calibration Procedures

NOTE

- **Make sure that the tubes are not leaky when connected.**
- **Do not move or press the tubes during calibration.**
- **When connecting calibration tubes, make sure that gas flows in the correct direction, which is from the inspiration connector of the breathing system, through high flow inlet of the anesthesia machine calibration device, anesthesia machine calibration device, high flow outlet of the anesthesia machine calibration device, and to the expiration connector of the breathing system.**
- **Before calibration, make sure that no sensor or valve related technical alarms occurred.**
- **During calibration, make sure that the drive gas pressure is kept above 0.3 MPa. Failure to do so may lead to calibration failure.**

1. Before calibration, perform leak test of the breathing system in mechanical ventilation mode. Perform calibration after the leak test is passed. For procedures about leak test, refer to *3.7.2Breathing* System Leak Test in Mechanical Ventilation Mode**.**
2. Remove the folding bag from the bellows and reinstall the bellows housing.
3. Remove the water collection cup beside the sodalime canister assembly in the breathing system.

4. Connect the anesthesia machine calibration device to the power source. The following pictures show the connectors on the calibration device.



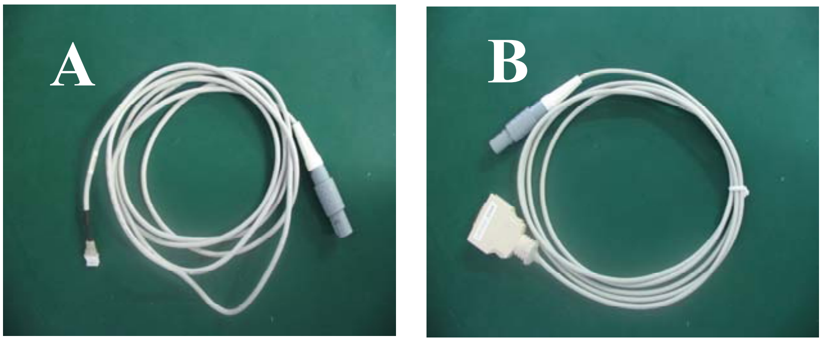
5. Start the calibration device to enter the startup screen followed by sensor heating screen (waiting for approximately 5 minutes as required by the prompt message) and then zeroing screen. Press the "ZERO" key on the panel. After the new screen pops up, press the "OK" key on the panel to complete zeroing.

NOTE

- **When zeroing the anesthesia machine calibration device, make sure that no gas flows through the device, or unplug the tube connected to the gas inlet of the device.**

6. Connect the calibration communication connector of the calibration device to that of the anesthesia machine by using the special communication cable. The calibration device can communicate with the anesthesia machine through two types of connection:

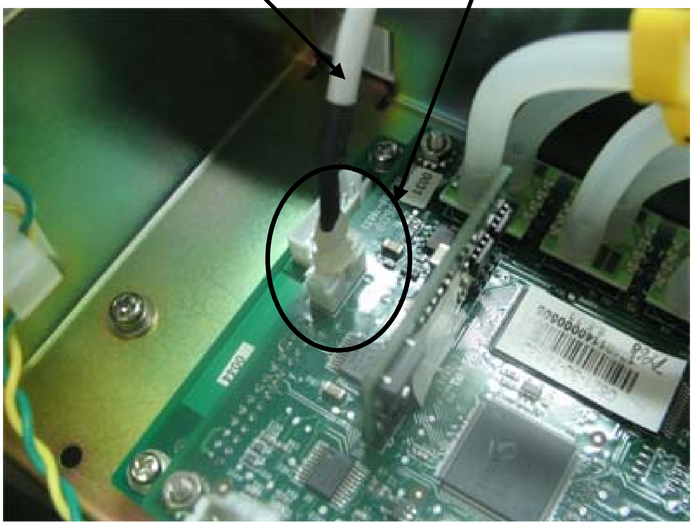
In the following pictures, A and B are two special communication cables for the calibration device.



- Connection 1: Remove the top cover of the anesthesia machine to expose the monitor board. Use communication cable A to connect the calibration communication connector of the calibration device with that of the monitor board, as shown below.

Communication cable A

Calibration communication connector of the monitor board



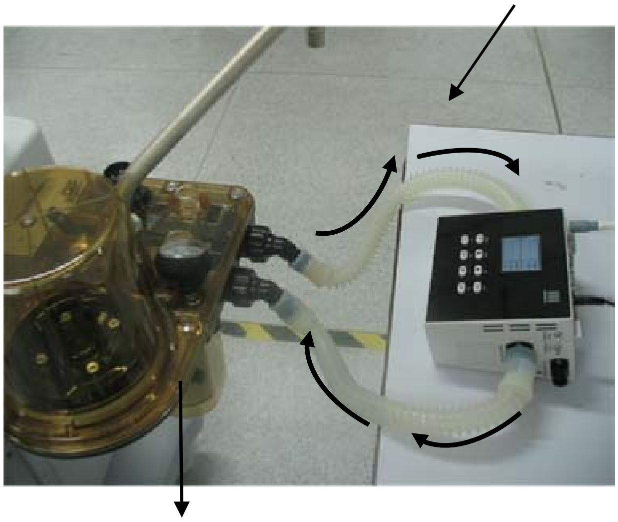
- Connection 2: Use communication cable B to connect the calibration communication connector of the calibration device with that of the anesthesia machine (also the CIS power connector), as shown below.

Calibration communication connector of the anesthesia machine

Communication cable B

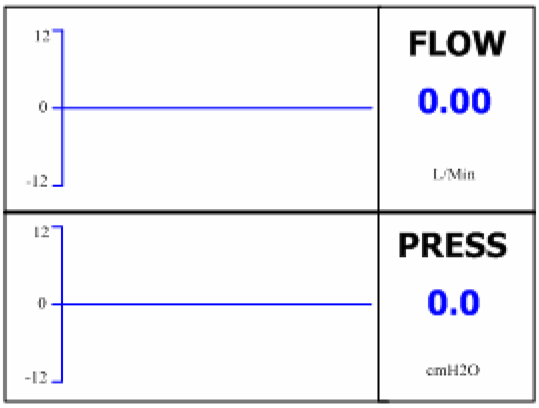
7. sConnect the inspiration connector of the anesthesia machine to the high flow (0 to 120 L/min) inlet of the calibration device and the expiration connector to the high flow (0 to 120 L/min) outlet of the device by using breathing tubes, as shown below (the arrows in the pictures indicate gas flow directions in case of calibration).

Gas flow direction



Connector of water collection cup

8. Press the “MODE” key on the panel of the calibration device. Select “Calibration Mode” from the pop-up menu and then press the “OK” key on the panel to enter calibration screen, as shown below.



9. Before calibration, make sure that the supply gas pressure is sufficient. If cylinder supply is used, turn up the cylinder yoke (not cylinder regulator) enough before calibration so as to ensure that the pressure reading on the O2 pressure gauge is kept above 0.3 MPa. If pressure falls, turn up the cylinder yoke further.

10. Make sure that the anesthesia machine is in standby mode.
11. Turn off all fresh gases.
12. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Factory Cal.** >>] → [**Flow Cal.** >>] → [**Start**].
13. After flow calibration success is prompted, refer to ***4.2.5Check the Flow Sensor Accuracy*** to test the effectiveness of flow calibration. In case of calibration failure, first fix the problem and then perform flow calibration again.

NOTE

- **After flow calibration, check the accuracy of flow sensors by referring to 4.2.5Check the Flow Sensor Accuracy**
- **In case of calibration failure, first fix the problem and then perform flow calibration again.**

4.3.2.2 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
After [**Start**] is selected, no ventilation sound is heard. Very soon, the prompt message of [**Calibration Failure! Please try again.**] is displayed.	[**Manual Vent.**] is prompted. The bag/mechanical ventilation switch is set to the bag position.	Set the bag/mechanical ventilation switch to the mechanical ventilation position.
	[**Drive Gas Pressure Low**] is alarmed. The pressure indicated by the drive gas (O2) pressure gauge is lower than 200 kPa.	Replace or connect the gas supplies to make sure that drive gas pressure is between 350 and 450 kPa.
	Zero point error occurs to the inspiratory/expiratory flow sensor. Refer to ***4.2.4Check the Sensor Zero Point.***	Replace the monitor board.
After [Start] is selected, ventilation sound is heard. Very soon, the prompt message of [Calibration Failure! Please try again.] is displayed.	The sampling line of at least one out of the inspiratory flow sensor, expiratory flow sensor and ventilator flow sensor is not connected or is connected in the reverse order. Refer to ***5.4Troubleshoot*** Sensor and Valve Related Failures by Using the Valves-test Tool.	Re-connect the sensor sampling line.
	The maximum flow to open the inspiratory valve is less than 90 L/min. Refer to ***5.4Troubleshoot*** Sensor and Valve Related Failures by Using the Valves-test Tool.	Replace the expiratory valve assembly.
	1. The pneumatic circuit connection between the anesthesia machine calibration device and the monitor board has an error. 2. The communication connection between the anesthesia machine calibration device and the anesthesia machine has an error. 3. The settings of the anesthesia machine calibration device have an error.	1. Check the pneumatic circuit connection between the anesthesia machine calibration device and the monitor board. Re-connect the pneumatic circuit if necessary. 2. Check the communication connection between the anesthesia machine calibration device and the anesthesia machine. Or re-connect them to ensure normal communication. If the problem persists, replace the communication cable.

		3. Check the settings of the anesthesia machine calibration device. Make settings again if necessary.
About 15 minutes after calibration is started, the prompt message of [Calibration Failure! Please try again.] is displayed.	Calibration data are not correct. Refer to ***4.2.5Check the Flow Sensor Accuracy***.	Replace the inspiratory and expiratory flow sensors and perform calibration again. If calibration still fails, replace the monitor board.
	When flow reaches 90 L/min, the counts value of the inspiratory or expiratory flow sensor is above 4000, which is outside of the normal range. Refer to ***5.4Troubleshoot*** Sensor and Valve Related Failures by Using the Valves-test Tool.	1. Replace the flow sensor in the circuit. 2. Replace the monitor board.

4.3.3 Pressure Calibration (factory)

NOTE

- **Factory pressure calibration is necessary in case of replacing the monitor board, expiratory valve assembly or three-way valve assembly.**
- **When a great deviation is detected between the measured value of the built-in pressure sensor and that of the standard pressure measurement device, you need to perform factory pressure calibration.**

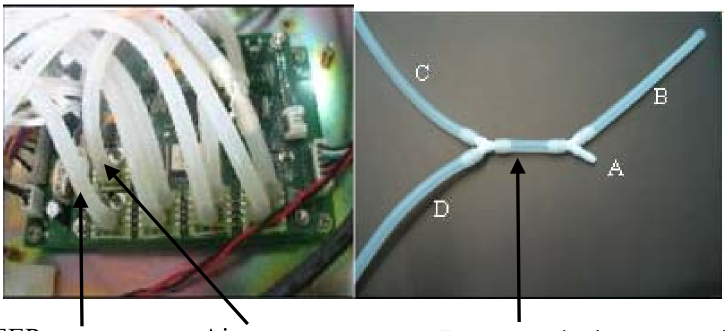
This calibration is intended for the airway pressure sensor in the breathing circuit, PEEP pressure sensorand PEEP proportional valve of the expiratory valve assembly. The standard pressure measurement device is used to calibrate the pressure sensors and PEEP proportional valve.

4.3.3.1 Calibration Procedures

NOTE

- **Before pressure calibration, make sure that the tubes are not leaky when connected.**
- **Do not move or press the tubes during calibration.**

1. Let the anesthesia machine calibration device be powered. Refer to the method described in ***4.3.2Flow Calibration (factory)*** to manually zero the calibration device first. Use the special communication cable to connect the calibration device to the anesthesia machine.
2. A four-way device is required to connect the sampling lines for pressure calibration. The following pictures show the four-way device, connectors on the calibration device and monitor board involved for pressure calibration.



PEEP pressure sampling line

Airway pressure sampling line

Four-way device connecting the sampling lines for pressure calibration

Airway pressure sampling connector (high pressure)

PEEP pressure sampling connector (high pressure)

FPM-65 pressure sampling connector (high pressure)

3. Unplug the PEEP pressure sampling line from the PEEP pressure sampling connector on the monitor board. Then connect it to one connector (Connector A) of the four-way device.
4. Connect the second connector (Connector B) of the four-way device to the PEEP pressure sampling connector (high pressure) on the monitor board.

5. Unplug the airway pressure sampling line from the airway pressure sampling connector (high pressure) on the monitor board.
6. Connect the third connector (Connector C) of the four-way device to the airway pressure sampling connector (high pressure).
7. Connect the fourth connector (Connector D) of the four-way device to pressure sampling connector (high pressure) of the calibration device.

NOTE

- **The sampling lines going through the four-way device must be connected to the high pressure ends of the pressure sampling connectors of the pressure sensors.**
- **It is recommended to connect the sampling lines for pressure calibration to the four-way device following the procedurs to avoid errors.**

8. Make sure that the anesthesia machine is in standby mode.
9. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Factory Cal.** >>] → [**Pressure Cal.** >>] → [**Start**].
10. After pressure calibration success is prompted, refer to ***4.2.6Check the Pressure Sensor Accuracy*** to test the effectiveness of pressure calibration. In case of calibration failure, first fix the problem and then perform pressure calibration again.

NOTE

- **After pressure calibration, test the accuracy of pressure sensors by referring to 4.2.6Check the Pressure Sensor Accuracy.**
- **In case of calibration failure, first fix the problem and then perform pressure calibration again.**

4.3.3.2 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
After [**Start**] is selected, no ventilation sound is heard. Very soon, the prompt message of [**Calibration Failure! Please try again.**] is displayed.	[**Drive Gas Pressure Low**] is alarmed. The pressure indicated by the drive gas (O2) pressure gauge is lower than 200 kPa.	Replace or connect the gas supplies to make sure that drive gas pressure is between 350 and 450 kPa.
	Zero point error occurs to the airway pressure gauge or PEEP pressure sensor. Refer to ***4.2.4Check the Sensor Zero Point***.	Replace the monitor board.

After [**Start**] is selected, ventilation sound is heard. Very soon, the prompt message of [**Calibration Failure! Please try again.**] is displayed.	The sampling line of at least one out of the airway pressure sensor and PEEP pressure sensor is not connected or is connected improperly. Refer to ***5.4Troubleshoot*** Sensor and Valve Related Failures by Using the Valves-test Tool**.**	Re-connect the sensor sampling line.
	The maximum pressure which the PEEP valve produces is less than 95 cmH2O. Refer to ***5.4Troubleshoot*** Sensor and Valve Related Failures by Using the Valves-test Tool**.**	Replace the expiratory valve assembly.
	1. The pneumatic circuit connection between the anesthesia machine calibration device and the monitor board has an error. 2. The communication connection between the anesthesia machine calibration device and the anesthesia machine has an error. 3. The settings of the anesthesia machine calibration device have an error.	1. Check the pneumatic circuit connection between the anesthesia machine calibration device and the monitor board. Re-connect the pneumatic circuit if necessary. 2. Check the communication connection between the anesthesia machine calibration device and the anesthesia machine. Or re-connect them to ensure normal communication. If the problem persists, replace the communication cable. 3. Check the settings of the anesthesia machine calibration device. Make settings again if necessary.
About 15 minutes after calibration is started, the prompt message of [**Calibration Failure! Please try again.**] is displayed.	Calibration data are not correct. Refer to ***4.2.6Check the Pressure Sensor Accuracy.***	Replace the monitor board.

4.3.4 Electronic Flowmeter Calibration (factory)

NOTE

- **Before calibrating the electronic flowmeter, verify if the electronic flowmeter configuration displayed is same to the actual flowmeter configuration of the anesthesia machine at the start-up. Make sure that no technical alarm occurs. If there is, eliminate the technical alarm as per 5Troubleshooting and then perform calibration.**
- **When replacing the electronic flowmeter board or the flow restricting device of the electronic flowmeter, or detecting that the deviation between the measured value of the electronic flowmeter and that of the standard flow measurement device exceeds 10% or 0.1 L/min (whichever is greater), you need to calibrate the electronic flowmeter again.**

4.3.4.1 Calibration Procedures

NOTE

- **Before calibrating the electronic flowmeter, make sure that the breathing system leak test in mechanical ventilation mode is already passed, so as to ensure that all the gases flowing through the electronic flowmeter module pass through the low flow inlet of the anesthesia machine calibration device.**
- **When calibrating the electronic flowmeter of one gas, turn off other gases or disconnect other gas supplies.**

1. Perform leak test of the breathing system in mechanical ventilation mode and make sure that the test is passed.
2. Zero the anesthesia machine calibration device as per the method for factory flow calibration.
3. Use communication cable B to connect the calibration communication connector of the calibration device with that of the anesthesia machine (also the CIS power connector), as shown below.

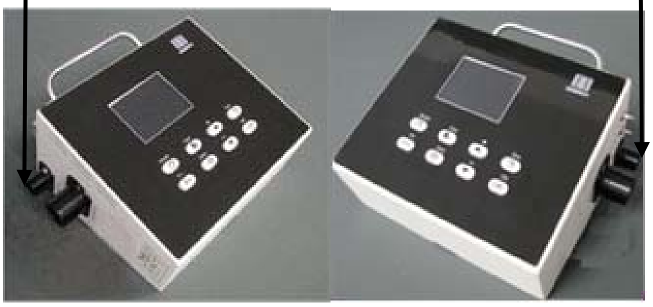
Calibration communication connector of the anesthesia machine

Communication cable B

4. Connect the low flow inlet of the calibration device to the fresh gas port of the anesthesia machine breathing system through breathing tube.

Low flow inlet (0 to 15 L/min)

Low flow outlet (0 to 15 L/min)

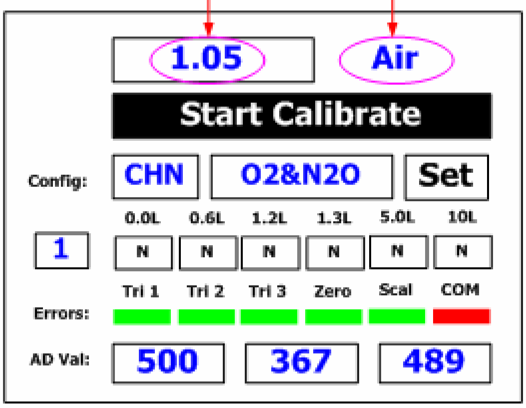


5. In case of calibrating N2O electronic flowmeter, first disconnect O2 from the electronic flowmeter so as to eliminate the effect of O2-N2O cut-off valve and O2-N2O chain linkage onto N2O electronic flowmeter calibration. To do this, remove the rear panel of the anesthesia machine, you can see that O2 is divided into two pathways through the Y piece, one to the O2-N2O cut-off valve and the other to the flowmeter. Unplug the tube leading to the flowmeter and plug the outlet of the Y piece.

6. Press the "MODE" key on the control panel of the calibration device and select "Calibration Flowmeter" to access the electronic flowmeter calibration display, as shown below.

Currently measured flow

Measured gas selected



7. Select gas type through the “GAS” key on the panel to make sure that the gas selected is same to that actually used for calibration.

NOTE

- **The gas type selected on the anesthesia machine calibration device must be same to that actually used for calibration. Failing to comply with this will lead to invalid calibration.**

8 Make that the anesthesia machine is in standby mode. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Factory Cal.** >>] → [**Flowmeter Zero Cal.** >>] to access the [**Flowmeter Zero Cal.**] menu.

9. Turn the flow control to cause the reading on the calibration device to be same to the preset value of calibration point required in the [**Flowmeter Zero Cal.**] menu.

10 After calibration, refer to ***4.2.7Check the Electronic Flowmeter Accuracy*** to test the effectiveness of electronic flowmeter calibration.

4.3.4.2 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
The calibration error alarm occurs during calibration.	During calibration, the A/D value of the sensor crosses the range.	1. Calibrate again. 2. If the alarm is not cancelled after repeated calibrations, replace the flow restricting device of the electronic flowmeter or replace the electronic flowmeter board and then calibrate again.
The electronic flowmeter provides inaccurate measurement after calibration.	1. During calibration, the gas flow is failed to be adjusted to the preset value. 2. The electronic flowmeter is not restarted after calibration. 3. Not calibrations of all gases are completed. 4. During calibration, the needle valve of some gas supply is not fully turned off.	1. Restart the anesthesia machine and electronic flowmeter and then perform measurement again. If the measured value is still inaccurate, calibrate again. 2. Before calibration, turn off the needle valve of the gas supply .

After calibration, the alarm of “Flowmeter Cal. Data Error 01” occurs.	1. The calibration data of some gas is blank. It is possible that complete calibration procedures are not followed for the gas. 2. The tube configuration of electronic flowmeter is changed improperly.	1. Calibrate again. 2. Set tube configuration again. If the alarm still exists after setting, calibrate again.
After calibration, the alarm of “Flowmeter Cal. Data Error 02” occurs.	1. The A/D value of gas calibration data crosses the range. 2. The A/D value of gas calibration data does not increase with the increase of flow.	Calibrate again.

4.3.5 Pressure and Flow Zeroing (factory)

During the operation of the anesthesia machine, pressure and flow are zeroed automatically at a specific interval. You can also zero pressure and flow manually in the factory maintenance menu. Manual zeroing can eliminate the measurement deviations caused by zero offset immediately. This system provides the function of pressure and flow automatic zeroing at a specific interval.

4.3.5.1 Zeroing Procedures

1. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Factory Cal.** >>] → [**Paw and Flow Zero Cal.** >>]. The message [**Zeroing**] is prompted.
2. If pressure and flow zeroing is passed, the message [**Zeroing Completed!**] is displayed. If pressure and flow zeroing is failed, the message [**Zeroing Failure! Please try again**.] is displayed.

NOTE

- **In case of zeroing failure, other faults may exist. You must isolate and eliminate the problem.**

4.3.5.2 Troubleshoot Pressure and Flow Zeroing Failure

In case of zeroing failure, troubleshoot as follows:

1. Set the anesthesia machine to manual ventilation or standby mode. Turn off fresh gas. Unplug the breathing tubes in the breathing system, causing the inspiration and expiration connectors to open to the air. Bleed the residual gas inside the bellows. Make sure that there is no flow or pressure entering the flow or pressure sensors inside the machine.
2. Check if the zero points of the sensors are normal by referring to ***4.2.4Check the Sensor Zero Point.***
3. If a zero point error is detected, unplug the sensor sampling line to eliminate the effects caused by sampling line occlusion or three-way valve. If zero point is still out of the range, the monitor board is faulty. Replace the monitor board.
4. If zero points of the sensors are correct but zeroing is still failed, the three-way valve assembly is faulty. Replace the three-way valve assembly.

4.3.6 Electronic Flowmeter Zeroing (factory)

After the gas supply is disconnected, if the pointer of the pressure gauge returns to zero but the electronic flowmeter still displays flow, it is possible that zero offset occurs to the electronic flowmeter's sensor. Generally, you can zero the flowmeter manually to eliminate the measurement deviation caused by zero offset immediately.

4.3.6.1 Zeroing Procedures

1. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Factory Cal.** >>] → [**Flowmeter Zero Cal.** >>]. The message [**Zeroing**] is prompted.
2. If flowmeter zeroing is passed, the message [**Zeroing Completed!**] is displayed. If flowmeter zeroing is failed, the message [**Zeroing Failure! Please try again.**] is displayed.

NOTE

- **In case of zeroing failure, other faults may exist. You must isolate and eliminate the problem.**

4.3.6.2 Troubleshoot Electronic Flowmeter Zeroing Failure

In case of zeroing failure, troubleshoot as follows:

1. Disconnect the gas supplies. After bleeding the residual gas inside the machine (or after adjusting the flowmeter to cause the pointer of the pressure gauge to go to zero), perform zeroing again.
2. If zeroing is completed, we can conclude that zeroing failure is caused by the three-way valve mechanical fault. Replace the three-way valve assembly.
3. If zeroing is still failed, we can conclude that zeroing is caused by the three-way valve hardware circuit fault or electronic flowmeter board fault. Replace the three-way valve assembly or electronic flowmeter board.

4.3.7 O2 Sensor Calibration (optional)

NOTE

- **Calibrate the O2 sensor again when a great dviation of O2 concentration monitored value occurs or when the O2 senosr or monitor board is replaced.**
- **Before calibration, observe if the O2 sensor displays numerics on the measure screen. If not, confirm that the O2 measure switch is turned on, check the O2 sensor connection line, or replace the O2 sensor unitl measure numerics are displayed.**

4.3.7.1 Calibration Procedures

For details, refer to the section about O2 sensor calibration in the Operator's Manual.

4.3.7.2 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
After [**Start**] is selected, calibration failure is prompted very soon.	If the alarm [**O2 Sensor Unconnecte**d] is displayed, it indicates that O2 sensor is not connected.	Connect the O2 sensor.
	Select the [**Maintenance**] shortcut key → [**User Maintenance** >>] → [**Set O2 Sensor Monitoring** >>]. The O2 sensor is set to OFF.	Set the O2 sensor to ON.

	O2 supply pressure is insufficient (lower than 200 kPa).	Change or connect the gas supply and make sure that O2 supply pressure is sufficient.
	21% O2 calibration is not completed before 100% O2 calibration.	Perform 21% O2 calibration followed by 100% O2 calibration.
Calibration failure is prompted about 3 minutes after calibration is started.	O2% count value is not within the normal range (450 to 2700). Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → [**Diagnostic Test** >>] → [**Display A/D Channels**] → [**Ventilator** >>] to access the [**Display A/D Channels—Ventilator**] menu.	Replace the O2 sensor.

4.3.8 CO2 Calibration (factory)

4.3.8.1 Preparations

Prepare the following before doing the calibration:

- Gas cylinder: one or more cylinders filled with 3% , 4%, 5%, 6% , or 7% CO_2
- T-shape connector
- Samping line

4.3.8.2 Calibration Procedures

NOTE

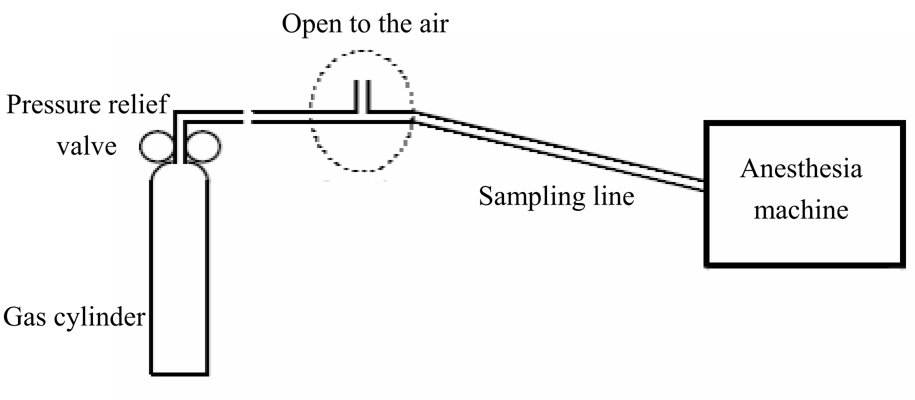
- **During the calibration, selecting [Calibrate] again does not take effect or exit the calibration menu. Other operations than menu options are disabled until the end of calibration.**

Calibrate as follows:

1. Make sure that the CO2 module is already warmed up.
2. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Module Cal.** >>] → [**Gas Module Cal.** >>] → [**CO2 Module Cal.**].
3. Check the airway and make sure that there are no occlusions or leaks.
    - Vent the sampling line to the air and check that the current rate is approximately 150 mL/min.If the deviation is great, it means that the airway is occluded. Check the airway for occlusions.

- Block the gas inlet of the sampling line. The current rate should drop rapidly and the message of airway occlusion should be prompted. Otherwise, it means that the airway leaks. Check the airway for leakage.

4. Wait for the sensor temperature to reach and stay at 35ºC.
5. Select [**Zero**] to start zeroing.
6. Connect the gas cylinder to the sampling line using a T-shape connector, as shown below.



7. Vent the sampling line to CO2 opening the cylinder pressure relief valve.
8. In the [**CO2 Module Cal.**] menu, enter the vented CO2 concentration in the [**CO2**] field.
9. In the [**CO2 Module Cal.**] menu, the measured CO2 concentration, barometric pressure, sensor temperature and current pump rate are displayed. After the measured CO2 concentration becomes stable, select [**CO2 % Cal**.] to calibrate the CO2 module.
10. After a successful calibration, the screen shows [**Calibration Completed!**]. Otherwise, the message [**Calibration Failure! Please try again.**] is displayed. In this case, you need to do the calibration again.

4.3.8.3 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
Calibration is not completed.	1. The module is damaged. 2. The difference between the set AG calibration concentration and the selected standard AG concentration is too great.	1. Return the module to factory for repair. 2. The difference between the standard gas concentration and the set calibration concentration can not exceed 40% of the standard gas concentration.

4.3.9 AG Calibration (factory)

4.3.9.1 Preparations

Prepare the following before doing the calibration:

- Gas cylinder: filled with a certain standard gas or mixed gas. Gas concentration should meet the following requirements: AA>1.5%, CO_2>1.5%, N_2O>40%, O_2>40%, of which AA represents an anesthetic agent.
- T-shape connector
- Sampling line
- Gas bag

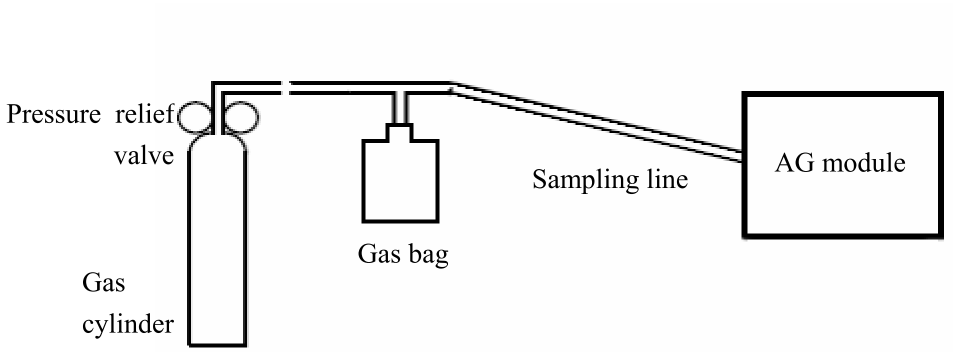
4.3.9.2 Calibration Procedures

Calibrate as follows:

1. Make sure that the system is not Standby and the AG module is in [**Measure**] state.
2. Wait for the AG module to be fully warmed up.
3. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Module Cal.** >>] → [**Gas Module Cal.** >>] → [**AG Module Cal.**].
4. Check the airway and make sure that there are no occlusions or leaks.

   Vent the sampling line to the air and check whether the current rate and set rate are approximately the same. If the deviation is great, it means that the airway is occluded. Check the airway for occlusions.

   Block the gas inlet of the sampling line. The current rate should drop rapidly and the message of airway occlusion is prompted. Otherwise, it means that the airway leaks. Check the airway for leakage.
5. Connect the gas cylinder, gas bag and sampling line using a T-shape connector as shown below.



6. Vent the sampling line to a certain standard gas opening the cylinder pressure relief valve.
7. In the [**AG Module Cal.**] menu, the measured gas concentration and flow are displayed.

   If the difference between the measured gas concentration and the actual one is very small, a calibration is not needed.

   If the difference is great, you should perform a calibration.
8. Enter the vented gas concentrations.
9. Select [**Calibrate**] to start a calibration.
10. After a successful calibration, the screen shows [**Calibration Completed!**]. Otherwise, the message [**Calibration Failure! Please try again.**] is displayed. In this case, you need to do the calibration again.

NOTE

- **If the calibration fails, you can select [Defaults] to restore the factory default calibration values. If the deviation is great, select [Calibrate] again to do a calibration.**
- **If the calibration still fails, replace the AG module.**

4.3.9.3 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
Calibration menu is inaccessible.	The AG module is not fully warmed up or not in measure mode.	Wait for the AG module to be fully warmed up and then access the calibration menu.
Calibration is not completed.	1. The module is damaged. 2. The difference between the set AG calibration concentration and the selected standard AG concentration is too great.	1. Return the module to factory for repair. 2. The difference between the standard gas concentration and the set calibration concentration can not exceed 25% of the standard gas concentration.

4.3.10 O2 Module Calibration (factory)

4.3.10.1 Preparations

Calibrate the O2 module once a year or when the measured value has a great deviation. Prepare the following before doing the calibration:

- Gas cylinder: filled with a certain standard gas or mixed gas. O2 concentration should be greater than 30%.
- T-shape connector
- Sampling line
- Gas bag

4.3.10.2 Calibration Procedures

NOTE

- **Do not press the gas bag during the calibration.**
- **Do not calibrate the O2 module when there are significant leaks in the airway.**
- **Make sure that the gas bag is not empty during the calibration.**
- **In case of calibration failure, select [Calibrate] again to do a calibration.**
- **If the calibration still fails, replace the O2 module.**

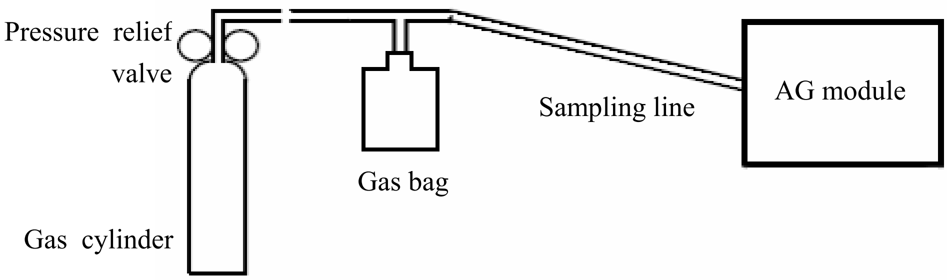
Calibrate as follows:

1. Make sure that the system is not Standby and the AG module is in [**Measure**] state.
2. Wait for the AG module to be fully warmed up.
3. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Factory Cal.** >>] → [**Gas Module Cal.** >>] → [O2 **Module Cal.**].
4. Check the airway and make sure that there are no occlusions or leaks.

   Vent the sampling line to the air and check whether the current rate and set rate are approximately the same. If the deviation is great, it means that the airway is occluded. Check the airway for occlusions.

   Block the gas inlet of the sampling line. The current rate should drop rapidly and the message of airway occlusion is prompted. Otherwise, it means that the airway leaks. Check the airway for leakage.

5. Connect the gas cylinder, gas bag and sampling line using a T-shape connector as shown below.
6. Vent the sampling line to a certain standard gas opening the cylinder pressure relief valve. Set the calibration value to the O2 concentration of the standard gas.



7. Select [**Calibrate**] to start a calibration.
8. After a successful calibration, the screen shows [**Calibration Completed!**]. Otherwise, the message [**Calibration Failure! Please try again.**] is displayed. In this case, you need to do the calibration again.

4.3.10.3 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
Calibration menu is inaccessible.	The AG module is not fully warmed up or not in measure mode.	Wait for the AG module to be fully warmed up and then access the calibration menu.
Calibration is not completed.	1. The module is damaged. 2. The difference between the set O2 calibration concentration and the selected standard O2 concentration is too great.	1. Return the module to factory for repair. 2. The difference between the standard gas concentration and the set calibration concentration can not exceed 25% of the standard gas concentration.

4.4 Software Upgrade and Software Configuration Activation

⚠CAUTION

- **Software upgrade and software configuration activation can be performed by professional service personnel only.**

You can perform program upgrade on the anesthesia machine by downloading the upgrade software through network. You can also perform online upgrade of the software supported configuration through the activation code.

4.4.1 Software Upgrade

You can upgrade the following programs on the anesthesia machine by downloading the upgrade software through network:

- Booting software
- System software
- Multi-lingual library
- General configuration (password)
- Main control board FPGA display drive software
- MO2B module software
- Monitor module software
- Auxiliary control module software
- Electronic flowmeter software
- Power board software

⚠CAUTION

- **Before software upgrade, disconnect the anesthesia machine from the patient and back up the important data.**

NOTE

- **Make sure that the version of the upgrade package is the desired one. To obtain the latest upgrade package, please contact us.**
- **Before upgrading the system software, check the version information of the booting software. If it is not the latest, upgrade the booting software to the latest version first and make sure of software compatibility.**

You can select the following operations to upgrade the corresponding software based on your requirement. You must perform ***4.4.1.1Network Connection*** before upgrading any software.

4.4.1.1 Network Connection

NOTE

- **Before upgrading any software, make sure that the network cable, Hub, and notebook computer are connected correctly and reliably.**
- **The recommended length of the network cable is not greater than 1 m.**

Perform network connection as follows before software upgrade:

1. Connect the anesthesia machine, Hub and notebook computer by using the straight through cable. Connect the Hub to the power source and make sure that the network is connected.
2. Select the [**Maintenance**] shortcut key → [**User Maintenance** >>] → [**Set IP Address** >>] to check the current IP address of the anesthesia machine, which is "192.168.23.250" by default.
3. Set the IP address of the notebook computer. Make sure that the IP address of the anesthesia machine is in the same IP segment with the notebook computer. For example, if the current IP address of the anesthesia machine is the default "192.168.23.250", the IP address of the notebook can be set to "192.168.23.23".

4.4.1.2 Booting Software Upgrade

⚠CAUTION

- **Switching off or powering off the equipment during booting software upgrade can cause system down.**

NOTE

- **When selecting the upgrade package, make sure that the checksum and version are same to that provided by the factory.**

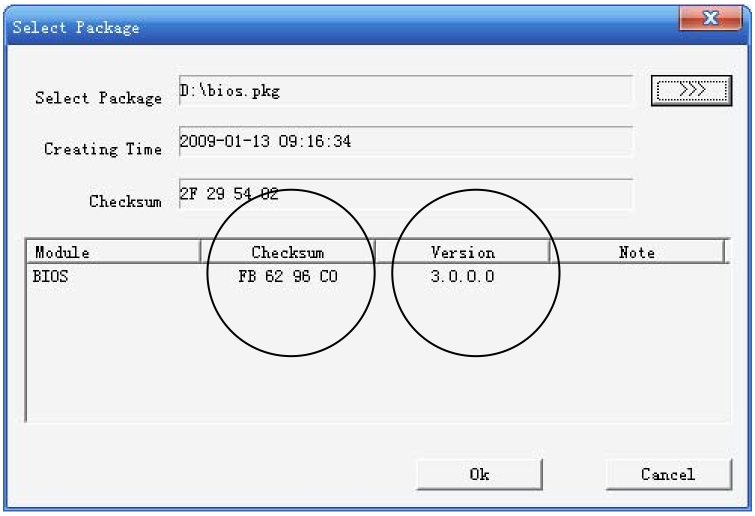
To upgrade the booting software of the anesthesia machine:

1. Run the network upgrade downloading software on the notebook computer to access the software upgrade screen.

2. Click [**Select Package**] to enter the [**Select Package**] menu.

4. Click [>>>]. Select the booting software of the anesthesia machine (Code: BIOS) in the dialog box and then click [**Open**].

5. Check the checksum and version of the booting software as shown below.



6. If the checksum and version are correct, click [**Ok**].

7. Click [**Start (Single)**] on the main screen.

8. Re-start the anesthesia machine to start to upgrade the booting software.

9. Wait for the message prompting upgrade success. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → [**System Information** >>] to check the version information of the booting software.

NOTE

- **After completing booting software upgrade, turn on the anesthesia machine to confirm the correctness of booting software version information.**

4.4.1.3 System Software Upgrade

NOTE

- **Before upgrading the system software, check the version information of the booting software. If it is not the latest, upgrade the booting software to the latest version first and make sure of software compatibility.**
- **Before upgrading the system software, record the current settings of the anesthesia machine so as to restore the pre-upgrade settings after software upgrade.**
- **When selecting the upgrade package, make sure that the checksum and version are same to that provided by the factory. You also need to check the machine code corresponding to the anesthesia machine to be upgraded.**

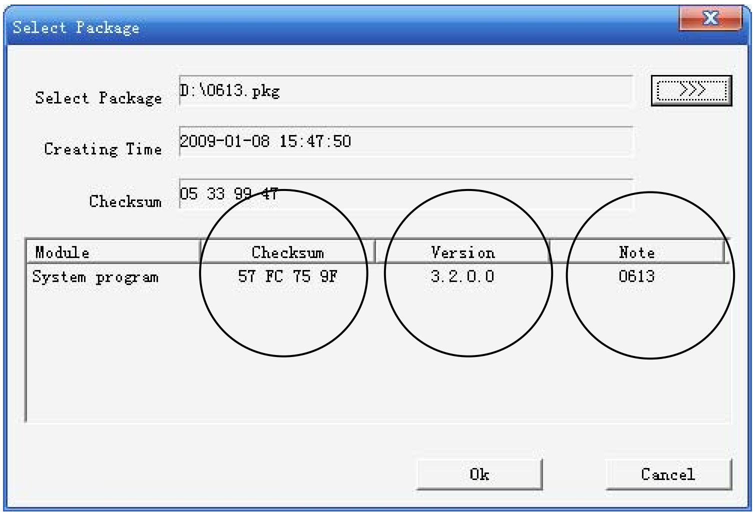
Before upgrading the system software, note the matching between machine name and machine code as listed below.

Machine name	Machine code	Notes
WATO EX-55	0621	/
WATO EX-65	0621	/
WATO EX-50 (2nd generation circuit)	0613	Borrows the breathing circuit of WATO EX-55/65
WATO EX-60 (2nd generation circuit)	0613	Borrows the breathing circuit of WATO EX-55/65
WATO EX-50 (improved circuit)	0611C	Built-in dual-flow sensor circuit after EBU017 engineering change
WATO EX-60 (improved circuit)	0611C	Built-in dual-flow sensor circuit after EBU017 engineering change
WATO EX-50 (1st generation circuit)	0611	External single-flow sensor circuit before EBU017 engineering change
WATO EX-60 (1st generation circuit)	0611	External single-flow sensor circuit before EBU017 engineering change

To upgrade the system software:

1. Check and confirm that the booting software of the anesthesia machine is of the latest version. If not, refer to ***4.4.1.2Booting Software Upgrade*** to upgrade to the latest version.

2. When selecting the system software upgrade package, confirm the correctness of checksum and version. You also need to check the machine code, as shown below.



3. Other operations are similar to those for booting software upgrade. Refer to ***4.4.1.2Booting Software Upgrade*** to finish the upgrade.
4. After upgrading the system software and confirming the version information, select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → [**System Setup** >>] → [**Drive Gas**] to select the applicable drive gas.

NOTE

- **After completing system software upgrade, turn on the anesthesia machine to confirm the correctness of upgrade software version information.**
- **After completing system software upgrade, restore the pre-upgrade settings of the system settings which are saved in case of power failure.**

4.4.1.4 Module Software Upgrade

NOTE

- **When selecting the upgrade package, make sure that the checksum and version are same to those provided by the factory. You also need to check the module code corresponding to the module to be upgraded.**

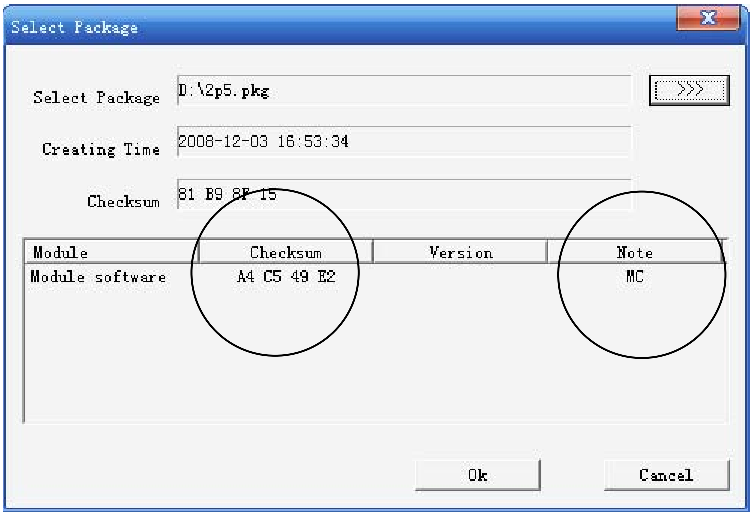
The module software mentioned here includes monitor module software, auxiliary control module software, power board software and electronic flowmeter software. Their upgrade procedures are similar to those for booting software upgrade except that when selecting the upgrade package, apart from making sure of the correctness of checksum and version, you also need to confirm the module code corresponding to the module to be upgraded.

Before upgrading the module software, note the matching between module name and module code as listed below.

Module name	**Module code**
Monitor module	MC
Auxiliary control module	MC2
Power board	POWER
Electronic flowmeter	FLOW
MO2B CO2	0611-MO2B
Main control board FPGA display drive	FPGA

To upgrade the module software:

1. When selecting the module software upgrade package, confirm the correctness of checksum and version. You also need to check the module code, as shown below.



2. Other operations are similar to those for booting software upgrade. Refer to ***4.4.1.2Booting Software Upgrade*** to finish the upgrade.

NOTE

- **After completing module software upgrade, turn on the anesthesia machine to confirm the correctness of upgrade software version information.**

4.4.1.5 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
During upgrade, the buzzer on the main control board buzzes long, resulting in upgrade failure.	The BIOS program of the main control board is damaged due to possible power failure during upgrade or upgrade failure.	Return the main control board to factory for repair.
In case of system software upgrade, the upgrade screen can be accessed but upgrade is always failed.	The version of BIOS program is incompatible with that of system software. The network is not stable.	1. Check the compatibility of software version. Select the appropriate version for upgrade. Refer to the system software-BIOS-upgrade tool compatibility table. 2. Check the network connection between the notebook computer, Hub and anesthesia machine to make sure that the network cable is not loose.
After software upgrade success, only VCV mode is available.	The BIOS program does not match the system software. The main control board does not support system software version greater than V03.01.00.00.	1. Check the version compatibility between BIOS program and system software. 2. Return the main control board to factory for repair.
The upgrade booting screen is inaccessible.	The network is not in good condition.	1. Re-check the network connection between the notebook computer, Hub and anesthesia machine. Check that the network cable is connected correctly and reliably. 2. Make sure that Hub is powered on.
After the system software or XX module software is upgraded, XX module communication stop is alarmed.	The version of system software does not match that of XX module software. Or, the module is damaged.	Re-confirm the version information of XX module software and the module code. If they are correct, return the faulty module to factory for repair.

4.4.2 Software Function Activation

For system software version greater than V03.01.00, online upgrade is supported. The factory can activate all the functions listed in the following table through activation codes. When the user wants to add any function listed in this table, the service engineer can apply to the factory for activation code so as to activate the corresponding function.

Function	**Description**
PCV	Pressure control ventilation mode
PSV	Pressure support ventilation mode
SIMV	Synchronized intermittent mandatory ventilation mode
Spirometry loops	F-V and P-V loops

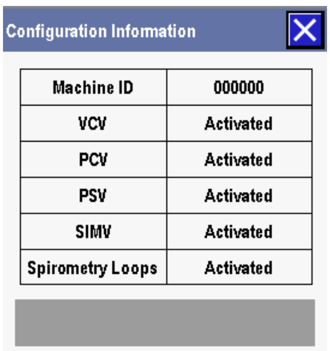
4.4.2.1 Apply for Software Function Activation Code

NOTE

- **To apply for activation code, you must provide the relevant information of the anesthesia machine whose configurations are to be activated, such as machine ID, existing configuration and configuration to be activated.**

When the user wants to add any paid configuration listed in the above table, the service engineer must apply to the Service Department for the software function activation code based on the user's need.

1. Record the serial number of the anesthesia machine (see the label on the left side of the machine) whose configurations are to be activated.
2. Record the machine ID and the current configuration of the anesthesia machine. Select the [**Maintenance**] shortcut key → [**User Maintenance** >>] → [**Configuration Information** >>] to open the configuration information menu as shown below.



3. Record the configuration the user wants to activate.

4. Return the above recorded information to the Service Department to apply for the corresponding activation code.

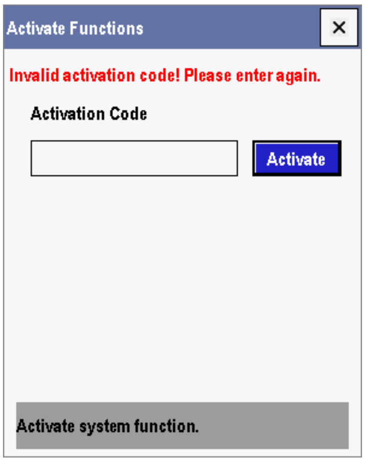
4.4.2.2 How to Activate Software Function

NOTE

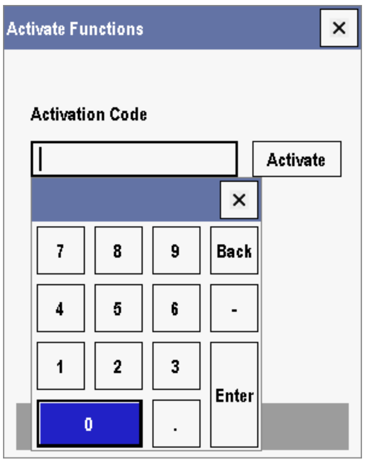
- **Before activation, check and record the user's existing paid configurations and also the paid configurations to be added.**
- **After entering the activation code, make sure that the entered activation code is same to that provided by the factory.**

To activate software functions:

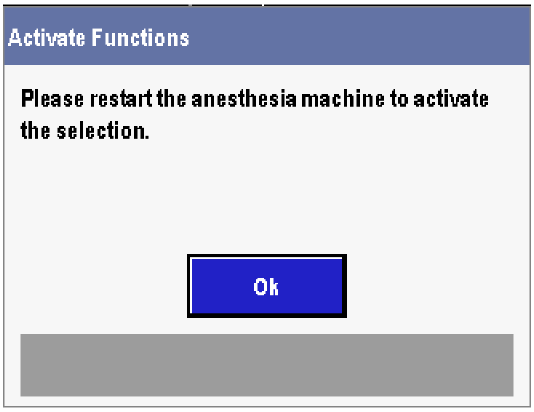
1 Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Function Configuration** >>] → [**Activate Functions** >>] to open the [**Activate Functions**] menu as shown below.



2. Enter the required activation code.



3. Select [**Activate**]. If the entered activation code is correct, a prompt message is displayed as shown below.



4. Select [**Ok**] to restart the anesthesia machine so as to activate the new configuration.

NOTE

- **Powering off the anesthesia machine before the message [Function activation completed! Please restart the anesthesia machine to activate the function.] is prompted can damage the BIOS program on the main control board.**
- **After activation success is promted, restart the anesthesia machine to activate both the existing and new paid configurations after software upgrade.**

4.4.2.3 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
After activation, restart the anesthesia machine. The main control board buzzes long, resulting in restart failure.	During activation, the anesthesia machine is powered off or turned off before activation success is prompted, which damages the BIOS program on the main control board.	Return the main control board to factory for repair.
Invalid activation code is prompted.	The activation code is entered improperly or the activation code itself is wrong.	1. Check that the activation code entered is same to that provided by the factory. 2. If the activation code is entered correctly and invalid activation code is still prompted, send the machine ID, existing configurations and the configurations to be added to the factory for confirmation.

After system activation, the activated functions are not consistent with the user's configurations.	The factory activation code is wrong. Or, the existing configurations and the configurations to be added which are provided for the factory are not complete.	Check the existing configurations and the configurations to be added again. Request the factory to generate activation code again.

4.4.3 Change the Software Configuration of Electronic Flowmeters

The software configuration of electronic flowmeters needs to be reset by the service engineer when:

- The user wants to change the existing electronic flowmeters.
- The user wants to change the existing software configuration of electronic flowmeters.
- The existing software configuration of electronic flowmeters does not meet the user's need.

NOTE

- **Before changing the software configuration of electronic flowmeters, check the number of tubes the user requires and the flowmeter standard complied (tube order).**

4.4.3.1 Check the Software Configuration of Electronic Flowmeters

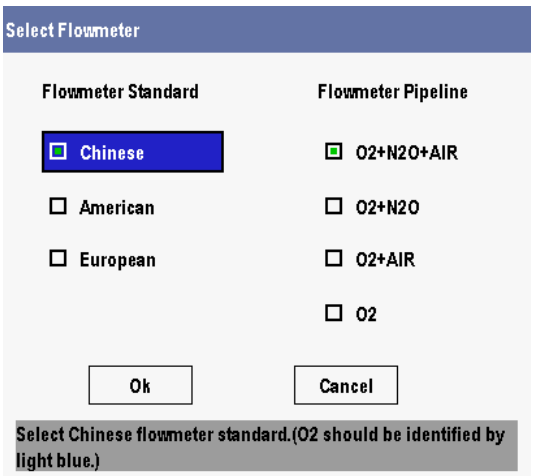
Before resetting the software configuration of electronic flowmeters, check the configuration information of the electronic flowmeters to be changed. The following table lists the configuration information of electronic flowmeters including tube order and color which a specific standard matches with.

Standard	Configuration	Tube order			Color (RGB)		
		Left	Middle	Right	O2	N2O	Air
Chinese	Three tubes	O2	N2O	Air	Baby (phthaleins) blue (73, 216, 230)	Silver grey (192, 192, 192)	Black and white
	Two tubes	O2	/	Air			
	Two tubes	O2	N2O	/			
	One tube	O2	/	/			
European	Three tubes	O2	N2O	Air	White (255, 255, 255)	Blue (0, 0, 255)	Black (0, 0, 0)
	Two tubes	O2	/	Air			
	Two tubes	O2	N2O	/			
	One tube	O2	/	/			
American	Three tubes	Air	N2O	O2	Green (0, 255, 0)	Blue (0, 0, 255)	Yellow (255, 255, 0)
	Two tubes	/	N2O	O2			
	Two tubes	Air	/	O2			
	One tube	/	/	O2			

4.4.3.2 How to Change the Software Configuration of Electronic Flowmeter

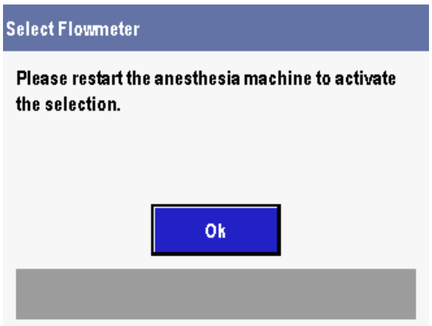
To change the software configuration of electronic flowmeters:

1. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → [**Function Configuration** >>] → [**Select Flowmeter** >>] to open the [**Select Flowmeter**] menu as shown below.



2. Select the required flowmeter standard and pipeline.

3. Select [**Ok**] to confirm the selection. If flowmeter standard or pipeline is changed, the message [**Please restart the anesthesia machine to activate the selection.**] is prompted as shown below.



4. Select [**Ok**] and then restart the anesthesia machine to activate the selected configuration.
5. Check and confirm that the software configuration of electronic flowmeters is changed as expected.

NOTE

- **Powering off or restarting the anesthesia machine before the message [Please restart the anesthesia machine to activate the selection.] is prompted can damage the BIOS program on the main control board.**
- **After the software configuration of electronic flowmeters is changed, restart the anesthesia machine to activate the configuration.**

4.4.3.3 Commonly-encountered Problems and Recommended Actions

Failure description	**Possible cause**	**Recommended action**
After changing the software configuration of electronic flowmeters, restart the anesthesia machine. The main control board buzzes long, resulting in restart failure.	The anesthesia machine is turned off or powered off before software configuration change success is prompted, which damages the BIOS program on the main control board.	Return the main control board to factory for repair.
After changing the software configuration of electronic flowmeters, the electronic flowmeters on the anesthesia machine are inconsistent with those displayed on the screen in terms of color and number of tubes.	The number of tubes and applicable standard are selected improperly.	Select correct number of tubes and applicable standard for electronic flowmeters again.

4.4.4 Load Gas Module or BIS Module

The anesthesia machine provides online upgrade of gas modules and BIS module.

4.4.4.1 Check the Corresponding Relationship between the Loaded Module and its Software Function

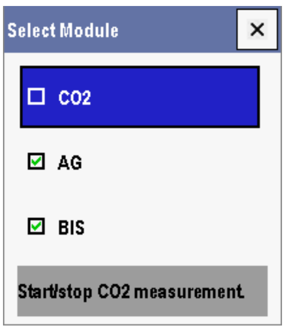
The following table lists the modules which can be loaded and their respective functions.

Module name	**Functional description**	**Loading name of module software function**
AG module	Provides AG and CO2 concentration monitoring and O2 concentration monitoring as well if O2 module is configured.	AG
M02B CO2 module	Provides CO2 concentration monitoring	CO2
Mainstream CO2 module	Provides CO2 concentration monitoring	CO2
Microstream CO2 module	Provides CO2 concentration monitoring	CO2
BIS module	Provides BIS monitoring	BIS

4.4.4.2 How to Load the Software Function of Gas Modules or BIS Module

To load the software function of the gas modules or BIS module:

1. Select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → enter the required password → [**Select Module** >>] to open the module selection menu. Select one or more from [**CO2**], [**AG**] and [**BIS**].



2. After the selection, restart the anesthesia machine or re-plug in the module to activate the added module.

4.4.4.3 Commonly-encountered Problems and Recommended Actions

Failure description	Possible cause	Recommended action
After the module is loaded, the LED indicator on the module is extinguished. The system fails to identify the module.	The module hardware is damaged.	Return the module to factory for repair.
After the module is loaded, the LED indicator on the module is flashing.	1. The loading name of module software function is not selected. 2. The loading name of module software function is selected. But the anesthesia machine is not restarted or the module is not re-plugged in.	1. Select the loading name of the desired module software function in the module selection menu and re-plug in the module. 2. Restart the anesthesia machine or re-plug in the module.
After the module is loaded, the LED indicator on the module is permanently lit and the hardkeys on the module are ineffective.	The hardkey connection line is not connected or the hardkey is damaged.	Return the module to factory for repair.

4.4.5 Load O2 Sensor Monitoring Function

The anesthesia machine provides online upgrade of O2 sensor monitoring function. When the user wants to add the functional configuration of O2 sensor, the service engineer provides the O2 sensor for the user as per the corporate procedures for adding parts configuration after sales. The engineer can go to the site or guide the user on the phone to load the monitoring function of O2 sensor.

1. (Guide the user to) mount the O2 sensor onto the circuit and connect the O2 sensor cable.
2. Select the [**Maintenance**] shortcut key → [**User Maintenance** >>] → [**Set O2 Sensor Monitoring** >>]. Select [**ON**] for [**O2 Sensor Monitoring**].
3. Select the [**User Setup**] shortcut key → [**O2 Monitoring Source** >>]. Select [**O2 Sensor**] in the [**O2 Monitoring Source**] menu to start the monitoring function of O2 sensor.
4. The FiO2 value is displayed on the normal screen.
5. Generally, you need to calibrate a new sensor to ensure its correct measurement. Refer to ***4.3.7O2 Sensor Calibration (optional)*** for calibration.

NOTE

- **After an O2 sensor is configured, if the FiO2 value is displayed as [---], make sure that O2 sensor software function is loaded already. Then check the electrical connection of the O2 sensor. If [O2 Sensor Unconnected] or [Replace O2 sensor] is alarmed, usually, the problem lies in the electrical connection of the O2 sensor. Refer to 5Troubleshooting to troubleshoot the problem.**
- **After adding or replacing an O2 sensor, calibrate the O2 sensor at 21% O2 and 100% O2. For details, refer to the section about O2 sensor calibration.**

4.4.6 Select the Drive Gas

NOTE

- **After upgrading the system software or replacing the main control board, select the applicable drive gas based on the drive gas configuration of the equipment. The default drive gas is O2.**

After the system software is upgraded and the main control board is replaced, the service engineer needs to set up the type of drive gas again based on the drive gas configuration of the anesthesia machine.

To set drive gas:

1. Check the factory configuration table or machine label to confirm the drive gas configuration of the anesthesia machine. If the machine is driven by air, “AIR DRIVE” can be seen above the gas supply inlet assemblies or between the system switch and O2 flush button. If the machine is driven by O2, no such label can be seen.
2. After confirming drive gas, select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → [**System Setup** >>] → [**Drive Gas**] to select the applicable drive gas.

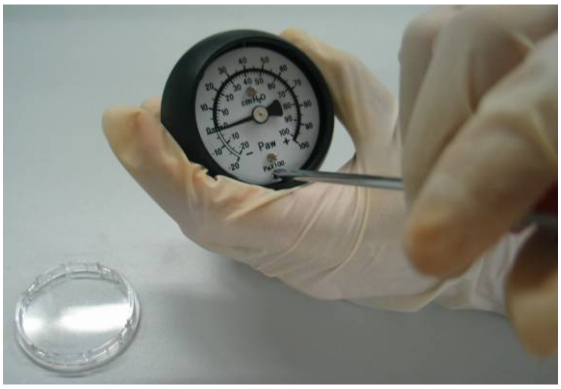
4.5 Zero the Airway Pressure Gauge

Stop manual or mechanical ventilation. Allow the breathing tube patient connection to open to the air. The airway pressure nears zero. If the pointer of airway pressure gauge fails to go to zero, the airway pressure gauge will indicate incorrect pressure. In this case, you need to zero the airway pressure gauge as follows

1. Stop manual or mechanical ventilation. Connect a breathing tube to the breathing circuit and let the breathing tube patient connection open to the air. Make sure that the folding bag fully collapses.

2. Remove the lens by digging out the lens buckle using a flathead screwdriver.

3. Adjust the zeroing screw using a small cross screwdriver to let the pressure gauge pointer go to zero.



4. Set the bag/mechanical ventilation switch to the mechanical ventilation position.

5. Plug the Y piece into the test plug to close the breathing circuit.

6. Push the O2 flush button repeatedly to sweep the pointer across the pressure gauge.

7. Remove the Y piece from the test plug and release the O2 flush button. Check if the pointer goes to zero.

8. Repeat the steps above if the pointer fails to go to zero. If the pointer still fails to go to zero, replace the airway pressure gauge.

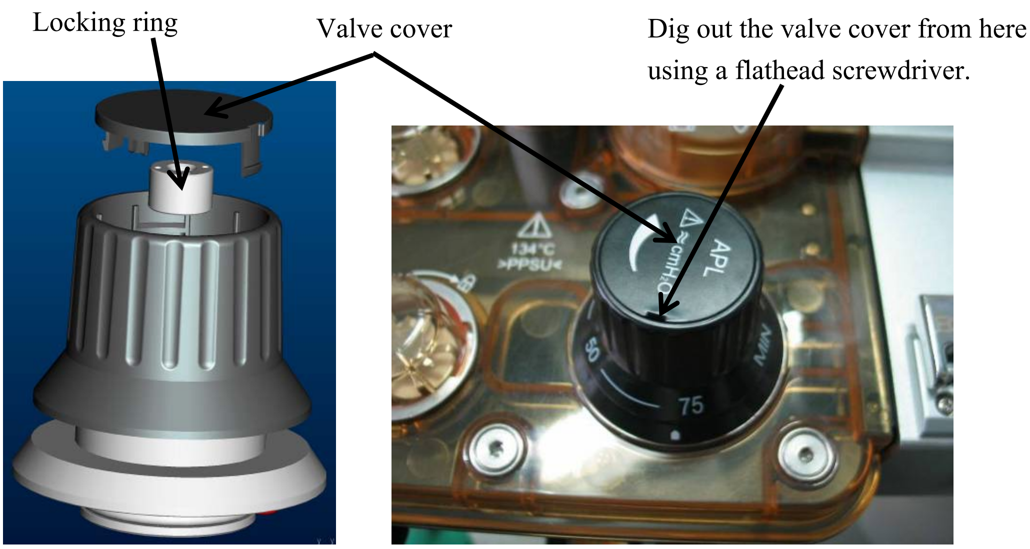
9. If the pointer goes to zero, re-install the lens onto the gauge. If the pointer still fails to go to zero, replace the airway pressure gauge.

4.6 Adjust the APL Valve Accuracy

To calibrate the APL valve:

1. Connect the inspiration connector and bag arm port using a breathing tube, as shown below.

2. Set the bag/mechanical ventilation switch to the bag position.
3. Set the APL valve reading to Min.
4. Push the O2 flush button.
5. The reading on the airway pressure gauge should fall with the range of 0 to 10 cmH2O.
6. Set the APL valve reading to 30 cmH2O.
7 Push the O2 flush button.
8. The reading on the airway pressure gauge should fall with the range of 25 to 35 cmH2O.
9. Set the APL valve reading to 50 cmH2O.
10. Push the O2 flush button.
11. The reading on the airway pressure gauge should fall with the range of 45 to 55 cmH2O.
12. If the reading on the airway pressure gauge fails to fall within the required range during steps 3 through 11, adjust the APL valve until the measurement requirements are met.



To adjust the APL valve:

（1）Remove the valve cover.

（2）Install the locking ring mounting fixture onto the locking ring.

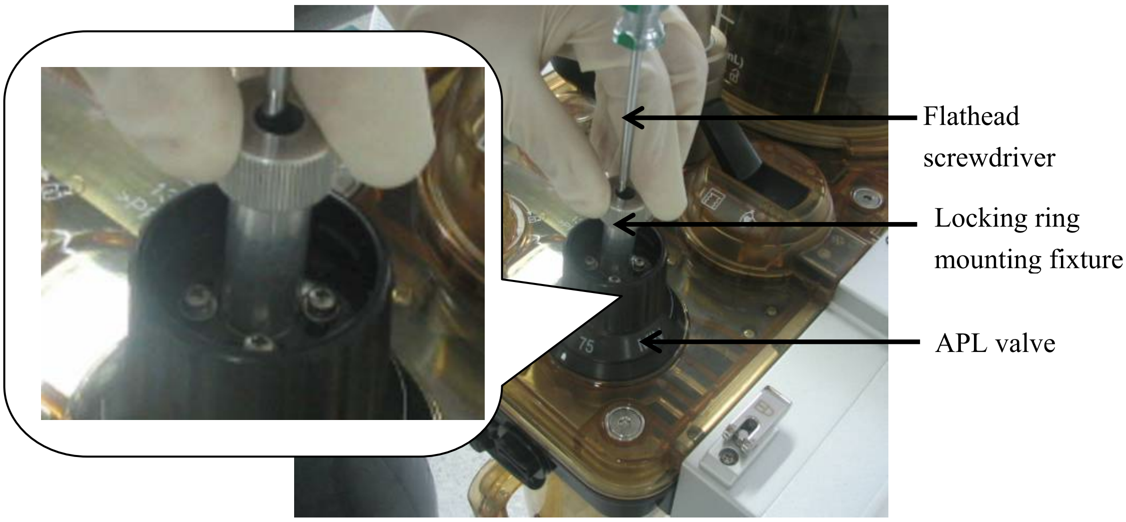
（3）Press the drive axis of the new APL valve using a flathead screwdriver and keep the screwdriver unmoved.

（4）Turn the locking ring mounting fixture counterclockwise to loosen the locking ring.

（5）Keep the locking ring mounting fixture unmoved. Turn the flathead screwdriver clockwise or counterclockwise to adjust the drive axis of the new APL valve, as shown below (turn the drive axis clockwise to increase APL and counterclockwise to decrease).

（6）After completing adjustment, keep the flathead screwdriver unmoved. Turn the locking ring mounting fixture clockwise to lock the locking ring.

（7）Re-install the valve cover.



5 Troubleshooting

5.1 Introduction

In this chapter, anesthesia machine problems are listed along with possible causes and recommended actions. Refer to the tables below to check the anesthesia machine, isolate and eliminate the problems.

Once isolating the part you suspect defective, refer to ***6Repair and Disassembly*** and ***7Parts*** to disassemble the equipment and repair and replace the defective part.

5.2 Technical Alarm Check

Before troubleshooting the anesthesia machine, check for technical alarm message. If an alarm message is presented, eliminate the technical alarm first.

The following sections detail how to troubleshoot technical alarms related to the ventilator and electronic flowmeter. For detailed information on possible causes and actions for technical alarm messages of other modules, refer to the Operator's Manual.

5.2.1 Ventilator Related Alarms

In the "Level" column of the following table, the default alarm level is indicated: H for high, M for medium, L for low and P for prompt message.

Alarm message	**Level**	**Possible cause**	**Recommended action**
RT Clock Need Reset	H	There was no button cell available in the system, or the battery had no capacity.	1. Replace with a new button cell. 2. If the problem persists, replace the main control board.
RT Clock Not Exist	H	RT chip malfunction.	1. Restart the machine. 2. If the problem persists, replace the board.
Low Battery Voltage!	H	The battery voltage was too low.	1. The system is operational. Connect the AC mains immediately. 2. Check if the battery is normal. 3. Check if the charging circuit is normal. If not, replace the power board.

Battery in Use	L	The battery is being used.	1. Check the connection to the AC mains. 2. If the AC mains supply is connected normally and the voltage is normal, check the connection between the AC mains and the power board. Check the AC mains inlet. 3. If the problem persists, replace the power board.
Battery Undetected	H	No battery was installed. Or, the battery was not connected to the power module.	1. Check if the battery voltage is normal. 2. Check if the cable is connected normally. 3. Replace the battery. 4. If the problem persists, replace the power board.
Power System Comm Stop	H	Communication cable error between the power board and the main control board	1. Re-plug the communication cable. 2. Replace with a new communication cable. 3. Check if the power board software is correct. Update the power board software again when necessary. 4. If the problem persists, replace the power board. 5. If the problem persists, replace the main control board.
		Power board software failure	1. Restart the machine. 2. Disconnect the battery from the AC mains. After the power board processor is powered off for 5 minutes, power it on again. 3. Update the power module software.
		Power board hardware failure	1. Refer to ***5.5Hardware and Electrical Problems***to troubleshoot the power board hardware failure. 2. Replace the power board.

Power System Selftest Error	H	Power board software failure	1. Restart the machine. 2. Disconnect the battery from the AC mains. After the power board processor is powered off for 5 minutes, power it on again. 3. Update the power module software.
		Power board hardware failure	1. Refer to ***5.5Hardware and Electrical Problems***to troubleshoot the power board hardware failure. 2. Replace the power board.
Power Supply Voltage Error	H	3.3V/5V/12V error	1. Measure the voltage at the corresponding test point. 2. If the problem persists, replace the power board.
System DOWN for battery depletion!	P	The battery was faulty and could not be recharged. The system software version did not match the current machine type.	1. Connect to the AC mains. Measure the battery voltage. Check if the battery can be recharged. 2. Check if the system software version matches the current machine type. If not, update the system software. 3. If the problem persists, replace the power board.
Power Board High Temp	H	The temperature of the power board exceeded 95 ℃.	1. Check the fan for the power module. 2. Stop using the machine for a period of time. If the problem persists after the machine is restarted, replace the power board.
Breathing Circuit Not Mounted	H	The breathing circuit was not installed. Or, it was not correctly connected to the circuit base.	1. Check that the circuit is installed in place. 2. Test the connection between the connection line and the connector. 3. Replace the power board (for WATO series anesthesia machine, the power board detects whether the circuit is in position).
Keyboard Init Error	H	Keyboard malfunction. Stop using the keyboard.	1. Restart the machine. 2. If the problem persists, replace the keyboard.

Key Error	M	The key was pressed and held for more than five seconds.	1. Check the pop-up status of the key and the keyboard. 2. If the problem persists, replace the keyboard.
Device Fault, Ventilate Manually	H	Both the valve and sensor are faulty.	1. Troubleshoot the valve and sensor respectively. 2. Refer to the alarms related to valve and sensor to eliminate the alarm.
Ventilator Hardware Error 01 to 09	H	Monitor board selftest error	Replace the monitor board.
Ventilator Hardware Error 11	H	Safety valve control failure by the auxiliary control board	1. Perform leak test again. 2. Check if the PEEP valve works normally. Restart the machine. (This fault occurs only when leak test is being carried out).
Ventilator Hardware Error 12	H	Safety valve control failure by the main control board	
Auxi Ctrl Module Error	H	During leak test and zeroing, a failure occurred during the interaction between the auxiliary control board and the monitor board.	1. Restart the machine. 2. Perform leak test. 3. Perform manual zeroing. 4. Replace the monitor board.
Ventilator Comm Error	H	The ventilator module failed to communicate normally with the main system.	1. Re-plug or replace the communication cable between the main control board and the monitor board. 2. If the problem persists, replace the monitor board. 3. If the problem persists, replace the main control board.
Ventilator Comm Stop	H	The ventilator module failed to communicate with the main system.	
Drive Gas Pressure Low	H	The pressure of drive gas was low.	1. Check the status of actual gas supply to confirm if the alarm is in compliance with the actual status. 2. Short circuit the pressure switch and the alarm regarding outputted signals should disappear. Otherwise, it indicates that the pressure switch is faulty. Replace the pressure switch. Otherwise, check the connection between the

			pressure switch and the monitor board and check the socket. 3. If the above two items are normal, replace the monitor board.
O2 Supply Failure	H	The O2 pressure was low.	Use the same method to drive gas pressure low to check the O2 pressure switch.
Sustained Airway Pressure	H	The airway pressure in the breathing circuit was greater than sustained airway pressure alarm limit for 15 seconds.	1. Check if the airway pressure sensor is in correct measurement status. 2. Check if the sampling line of the airway pressure sensor is in normal status. 3. Sensor failure. Replace the monitor board.
Paw<－10cmH2O	H	Less than the barometric pressure for 10 cmH2O.	
ACGO On	M	ACGO was switched on	1. Switch off ACGO. 2. Check if the connection line of ACGO is broken or short circuited. 3. If the ACGO switch is in correct status, and its connection line and connector are normal but the problem persists, replace the monitor board.
PEEP Valve Failure	M	Valve voltage error or valve opening status error	Check if the sensor is normal. Replace the sensor or monitor board when necessary. Replace the expiratory valve assembly.
Insp Valve Failure	M		
PEEP Safety Valve Failure	M		
O2 Flush Failure	M	Oxygen flushing having lasted too long (more than 15 seconds)	1. Check if the O2 flush button fails to pop up. 2. Check if the O2 flush pressure switch is in normal status. 3. Check if the connection line of O2 flush button and its connector are normal. 4. Replace the monitor board.
Replace O2 sensor	M	O2 sensor failure	Replace the O2 sensor.

Patient Circuit Leak	M	A leak was detected in the patient circuit.	1. Check the breathing circuit connections and flow sensor connections. 2. Check the tidal volume measurement accuracy of the sensor. 3. Check for breathing system leakage.
Pressure Monitoring Channel Failure	M	The measured value by the pressure sensor exceeded the range. Or, the zero point of the pressure sensor was outside of the range.	1. Disconnect the gas supply and disconnect connection to the patient airway. Check the counts value of pressure sensor. 2. If there is a great deviation of zero point, check if the pressure sampling line is blocked or pressed. 3. Perform manual zeroing. 4. Restart the machine. If the problem persists, replace the monitor board.
	H	The auxiliary monitor board detected pressure monitoring error.	1 In the A/D channels of the auxiliary monitor board, check the statuses of the airway pressure sensor and the PEEP pressure sensor. 2. Replace the auxiliary monitor board in case that pressure monitoring failure occurs to the auxiliary monitor board.
Volume Monitoring Disabled	M	Flow sensor monitoring was disabled or ACGO was switched on.	1. Fix the flow sensor or ACGO problems. 2. Eliminate the alarm by referring to the corresponding alarm item.
Calibrate Flow Sensor	L	Last calibration of the flow sensor and inspiratory valve failed. Or, great drift occurred to the flow sensor and inspiratory valve.	Perform factory calibration. Refer to ***4Maintenance and Calibration***.
Calibrate PEEP Valve	L	Last calibration of the Paw sensor and PEEP valve failed. Or, great drift occurred to the Paw sensor and PEEP valve.	Perform factory calibration. Refer to ***4Maintenance and Calibration.***

Calibrate O2 Sensor	L	Last calibration of the O2 sensor failed. Or, O2 concentration was measured outside of the range.	1. Calibrate the O2 sensor again. 2. Replace the O2 sensor.
O2 Sensor Unconnected	L	The O2 sensor was not connected to the cable or was not connected properly.	1. Make sure that the O2 sensor is connected to the cable correctly. 2. Replace the O2 sensor.
O2 Sensor Error	M	O2 sensor failure. The measured O2 concentration was less than 5%.	1. Calibrate the O2 sensor again. 2. Replace the O2 sensor.
Flow Sensor Failure	L	The measured value by the flow sensor exceeded the range. Or, the zero point of the pressure sensor was abnormal. Ventilator flow sensor failure or sampling line connection error.	1. Check if the zero point of the flow sensor is normal. 2. Check if the measurement performed by the flow sensor is normal. 3. Replace the flow sensor and perform calibration. 4. Replace the monitor board and perform calibration.
TV Comp Disabled	L	The measured value by the flow sensor had a great deviation in the VCV mode.	1. Eliminate circuit leaks. 2. Judge the sensor measurement status in the valves test tool. 3. Re-calibrate the flow sensor.
Pinsp Not Achieved	L	In the PCV mode, the inspiratory pressure was less than the set inspiratory pressure level for 6 consecutive breathing cycles to some extent.	1. Check for breathing circuit leakage. 2. Check the measurement accuracy of the pressure sensor. 3. Perform calibration in case of measurement failure. 4. Replace the monitor board and perform calibration.
TV Not Achieved	L	TVi was less than the set value for 6 consecutive breathing cycles to some extent.	1. Check for breathing circuit leak. 2. Check the measurement accuracy of the pressure sensor. 3. Perform calibration in case of measurement failure.

Sensor Zero Failed	L	The zero point of the sensor exceeded the range.	1. Disconnect the breathing circuit from gas supplies. Perform zeroing. 2. Disconnect the sampling line of the sensor. Observe the range of the zero point and perform zeroing. If the zero point still exceeds the range, replace the monitor board.
Three-way Valve Failure	L	Error of three-way valve electrical signal control status	1. Check the three-way valve connection line. 2. Replace the three-way valve assembly. 3. Replace the monitor board.
Heating Module Error	L	The voltage of the heating module exceeded 16V.	1. Measure to or in the A/D channels confirm if the heating voltage of the heating module exceeds the standard. 2. If the heating voltage of the heating module exceeds the standard, replace the power board.
		Heating failure (the temperature of two thermistors is less than 35 degrees continuously)	1. Confirm the measurement temperature in the A/D display channels. 2. Check the status of the thermistor. 3. Check the status of the heater. 4. Replace the power board.
		Overtemperature	
IP Address Conflict	M	IP address conflict	1. Set the IP address again. 2. If the problem persists, update the system software code or replace the main control board.
TVe>TVi	L	TVe was greater than TVi for 6 consecutive breathing cycles to some extent.	1. Check if pneumatic connection, leak and fresh gas delivery are normal. 2. Check the measurement accuracy of the sensor. 3. Perform calibration in case of measurement failure.
TV Delivery Too High	L	TVi was greater than the set value for 6 consecutive breathing cycles to some extent.	1. Check the measurement accuracy of the sensor. 2. Perform calibration in case of measurement failure.

Check Flow Sensors	M	The flow sensor detected erroneous gas flow.	1. Check the check valve. 2. Check if the sampling lines of the sensor are connected in correct order. 3. Test the measurement status of the sensor in the valves test tool.
Auxi Ctrl Module Hardware Error 01 to 05	H	Auxiliary control module hardware failure	Replace the auxiliary control board.
Auxi Ctrl Module Comm Error	H	The communication between the auxiliary control board and the main control board failed.	1. Check the communication cable between the auxiliary control board and the main control board. 2. If the LED indicator on the auxiliary control board flashes at 1Hz, it indicates that the auxiliary control board works normally. Otherwise, it is faulty. 3. Restart the machine or update the auxiliary control board software. If the problem persists, replace the board.
Auxi Ctrl Module Comm Stop	H	The communication between the auxiliary control board and the main control board stopped.	

5.2.2 Electronic Flowmeter Related Alarms

In the “Level” column of the following table, the default alarm level is indicated: H for high, M for medium, L for low and P for prompt message.

Alarm message	Level	Possible cause	Recommended action
Flowmeter Hardware Error 01 to 03	H	01_DVCC power failure (5V power supply) 02_AVDD power failure (3.3V power supply) 03_VC power failure (11V)	Replace the electronic flowmeter board.
Flowmeter Hardware Error 04 to 06	H	Processor selftest error	1. Power on the machine again. 2. If the problem persists, replace the board.
Flowmeter Hardware Error 07	H	Watchdog error	1. Check if the watchdog circuit is normal. 2. Power on the machine again. If the problem persists, replace the board.

Flowmeter Cal. Data Error 01	H	Uncalibrated data were empty. Or, the number of calibrated electronic flowmeters was less than that of tubes configured.	1. Confirm and change the electronic flowmeter until it is correctly configured. 2. Calibrate the electronic flowmeter again.
Flowmeter Cal. Data Error 02	H	Calibration data error	Calibrate the electronic flowmeter again.
Flowmeter Comm Error	H	The electronic flowmeter failed to communicate with the main system normally.	1. Replace the communication cable for the electronic flowmeter. 2. Replace the electronic flowmeter board.
Flowmeter Comm Stop	H		
N2O Flow Too High	L	Gas flow exceeded 10 L/min.	1. Turn off other gas flow. Compare the concerned gas flow with the measurement result displayed on the glass tube flowmter. 2. Use test tools. Turn on ACGO. Measure fresh gas flow at the inspiration connector. Measure the measurement error of electronic flowmeter. 3. If the error exceeds the standard, calibrate the electronic flowmeter again.
AIR Flow Too High	L		
O2 Flow Too High	L		
Flowmeter Zero Failed	L	Zero point error or three-way valve failure	1. Switch off fresh gas delivery. Perform zeroing. 2. If the problem persists, check the three-way valve component of the electronic flowmeter module, control circuit and cable. 3. Replace the three-way valve assembly (throttling device). 4. Replace the electronic flowmeter board.

Notes:

1. If special calibration equipment is not available, return the electronic flowmeter to the factory for calibration together with the throttling device of the machine.
2. If the electronic flowmeter board is returned to the factory for replacement, the throttling device of the machine must also be returned for replacement.
3. If special calibration equipment is available, you can just replace the electronic flowmeter board. It can be used normally only after it is calibrated on the machine.

5.3 Pneumatic Circuit System Problems

The pneumatic circuit system is mainly composed of gas supplies, anesthetic gas delivery system, anesthetic gas delivery device (vaporizer), anesthetic ventilator, breathing system and anesthetic gas scavenging system. This chapter details possible failures regarding the pneumatic circuit system and how to troubleshoot them.

5.3.1 Tools for on-site Maintenance

The tools required for troubleshooting are listed below.

Name	Negative pressure ball	Injector （100ml）	Circuit adapter test fixture	Flow sensor pressure sampling pipeline test fixture	Vaporizer manifold test fixture	1 MPa(10 bar) Test pressure gauge	Anesthesia machine calibration device
Quantity	1	1	1	1	1	1	1

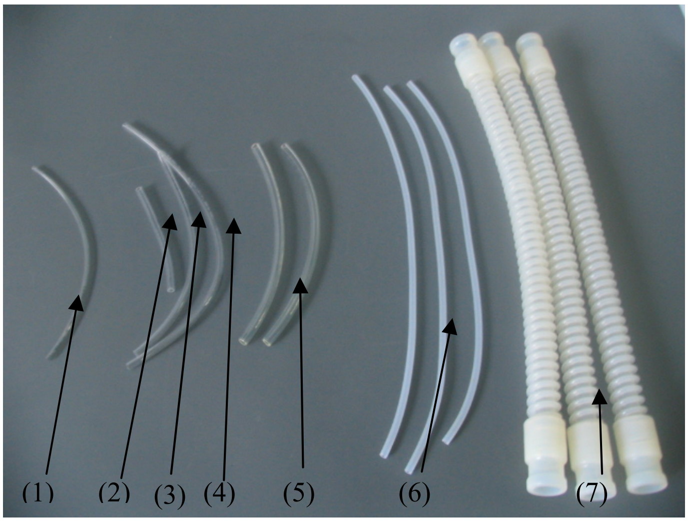
Name	T-shaped Allen wrench
Quantity	1

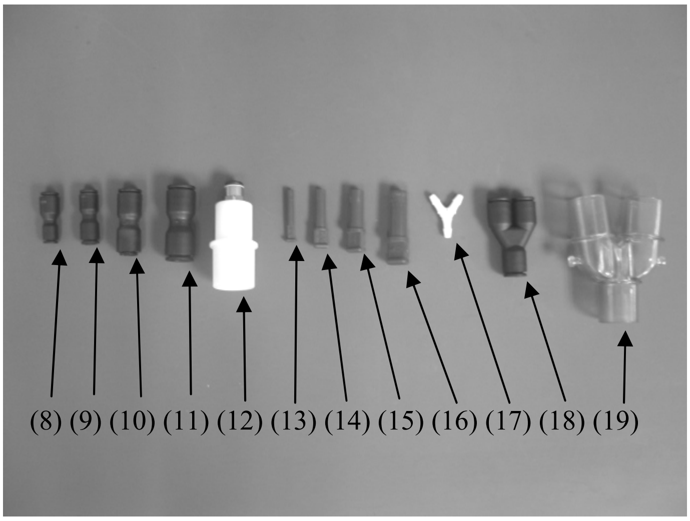
Name	3106-04-06a dapter connector	3106-06-08a dapter connector	3106-10-00a dapter connector	3106-06-00a dapter connector	Breathing tube adapter connector	3126-04 -00 tube plug	3126-06 -00 tube plug
Quantity	1	1	2	1	1	1	2

Name	3126-08-00 tube plug	3126-10-00 tube plug	Y piece	Breathing tube Y piece	3140-08-00 Y piece
Quantity	3	2	2	1	1

Name	PU tube (4X200)	PU tube (6X100)	PU tube (6X200)	PU tube (6X300)	PU tube (8X200)	Breathing tube	Φ6 silicone tube
Quantity	1	1	1	1	2	3	3

The following pictures show the tools listed above.

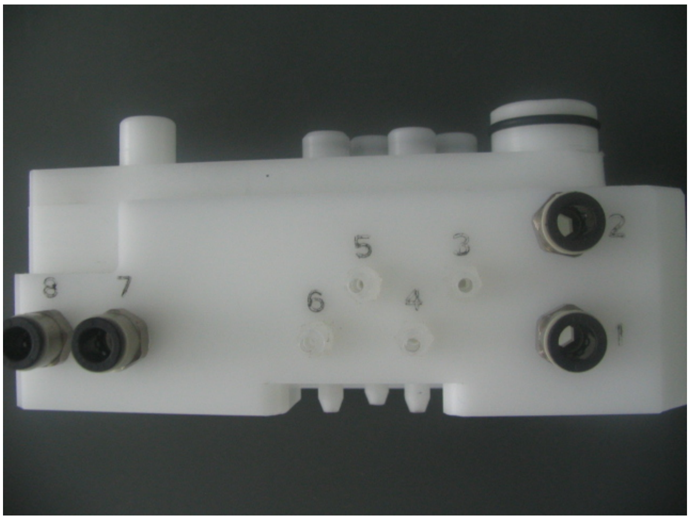




（1）PU tube (4X200)；（2）PU tube (6X100)；（3）PU tube (6X200)；（4）PU tube (6X300)；（5）PU tube (8X200)；（6）Φ6 silicone tube；（7）Breathing tube；（8）3106-04-06 adapter connector；（9）3106-06-00 adapter connector；（10）3106-06-08 adapter connector；（11）3106-10-00 adapter connector；（12） Breathing tube adapter connector；（13）3126-04-00 tube plug；（14）3126-06-00 tube plug；（15）3126-08-00 tube plug；（16）3126-10-00 tube plug；（17） Y piece；（18） 3140-08-00 Y piece；（19） Breathing tube Y piece；

Negative pressure ball:

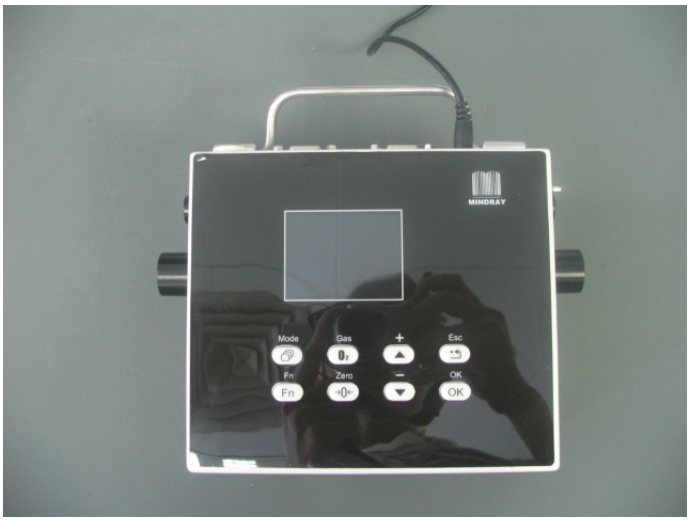
Circuit adapter test fixture:



Flow sensor pressure sampling pipeline test fixture:

Vaporizer manifold test fixture:

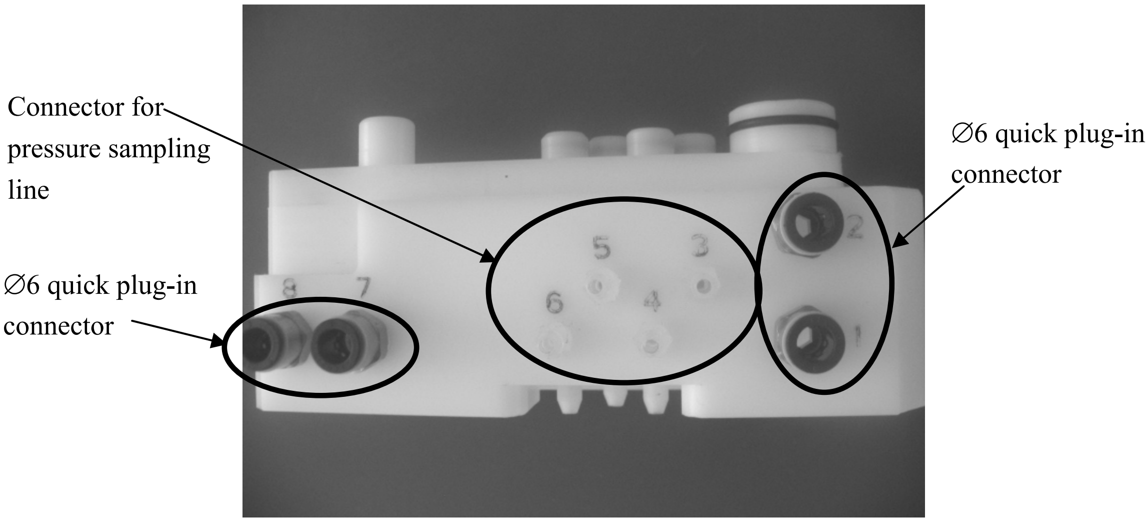
Anesthesia machine calibration device:



1 MPa (10bar) test pressure gauge:

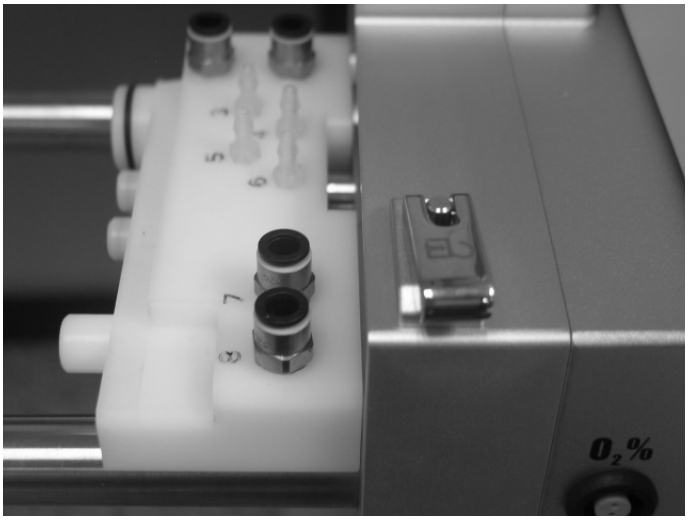
5.3.1.1 Precautions for Use of Circuit Adapter Test Fixture

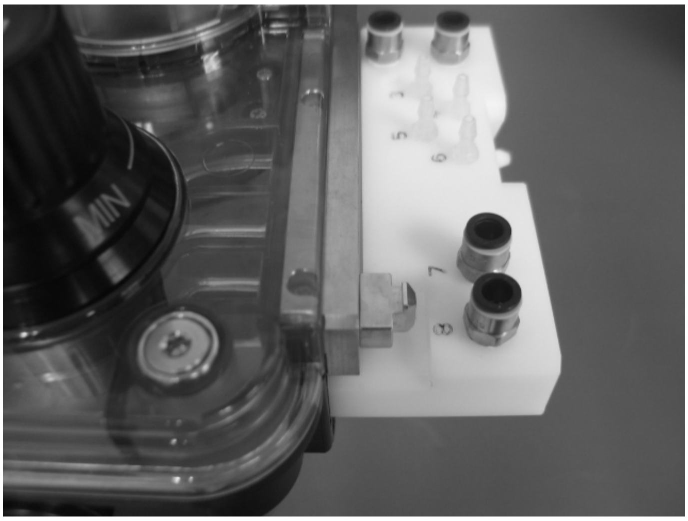
There are four connectors for pressure sampling lines and four ∅6 quick plug-in connectors with number marked on the circuit adapter test fixture, as shown below.



The connectors for pressure sampling lines can be connected with Φ6 silicone tubes and the ∅6 quick plug-in connectors with PU tube (6X100), PU tube (6X200) and PU tube (6X300), as shown below.

The circuit adapter test fixture can be mounted either onto the circuit adapter or onto the removed patient circuit. The following pictures show the test fixture mounted in position.



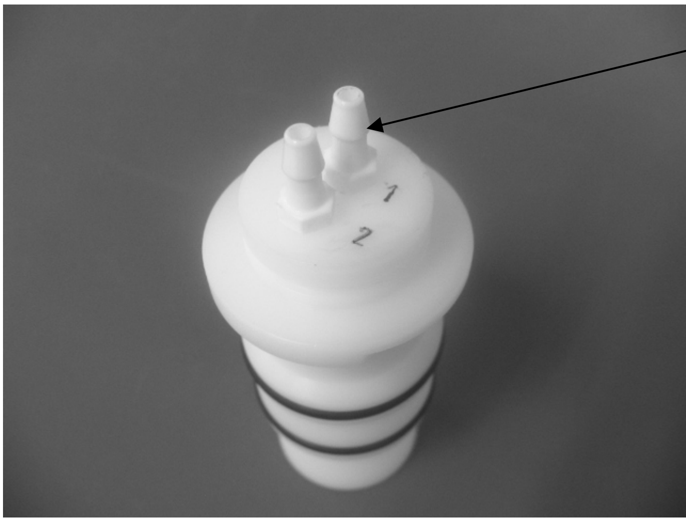


If it is hard to plug in and out the test fixture, apply a layer of KRYTOX lubricant (BOM number: M6F-020003---) to the seals (as shown below).

Seal（M6M-010058---） Seal（M6M-010063---） Seal（M6M-010006---）

5.3.1.2 Precautions for Use of Flow Sensor Pressure Sampling Pipeline Test Fixture

There are two connectors for pressure sampling lines on the flow sensor pressure sampling pipeline test fixture, as shown below.



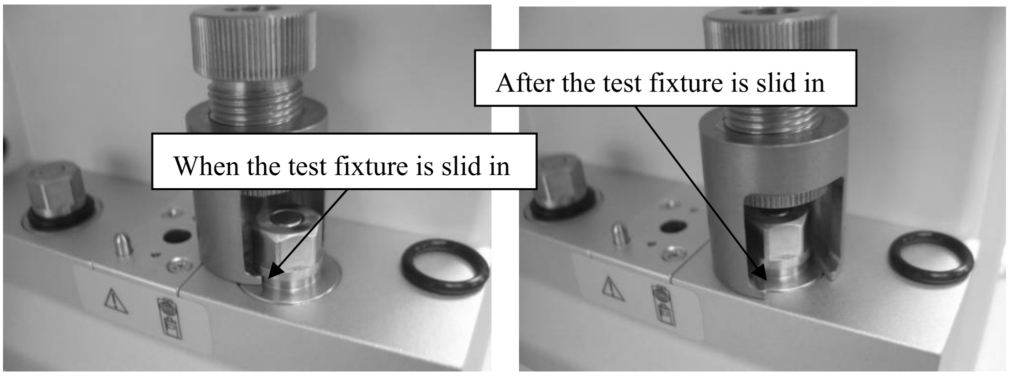
Connector for pressure sampling line

The connector for pressure sampling line can be connected with Φ6 silicone tubes.

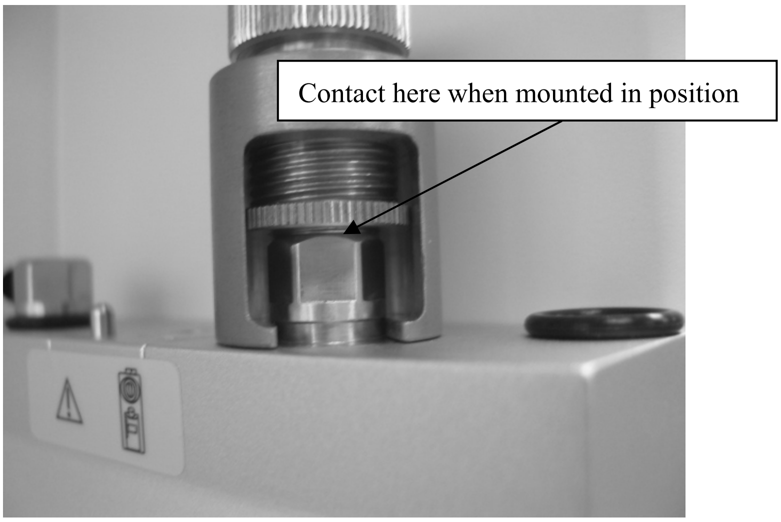
When using the flow sensor pressure sampling pipeline test fixture, remove the expiratory or inspiratory flow sensor from the patient circuit first. Then mount the flow sensor pressure sampling pipeline test fixture onto the position where the expiratory or inspiratory flow sensor was originally mounted and tighten the inspiratory/expiratory connector rotary caps, as shown below. Perform test after connecting the Φ6 silicone tube to the connector for pressure sampling line.

5.3.1.3 Precautions for Use of Vaporizer Manifold Test Fixture

When using the vaporizer manifold test fixture, remove the seal between the connector of vaporizer manifold assembly and the vaporizer first. Then slide the test fixture into the connector, as shown below.

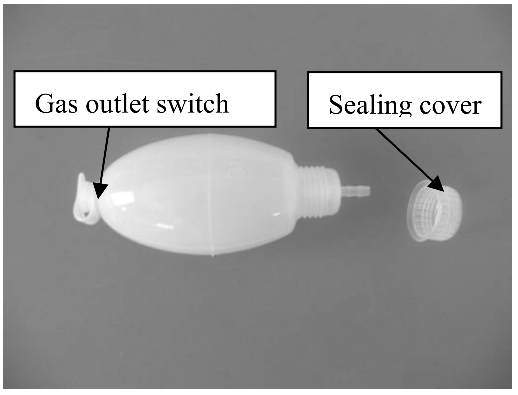


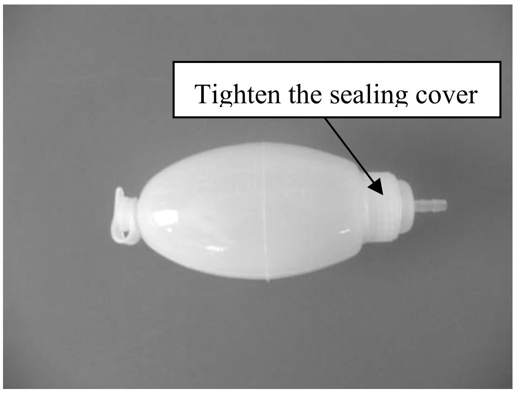
Turn the pressure head of vaporizer manifold test fixture clockwise until the bottom surface of the pressure head is in contact with the top surface of the connector of the vaporizer manifold assembly, as shown below.



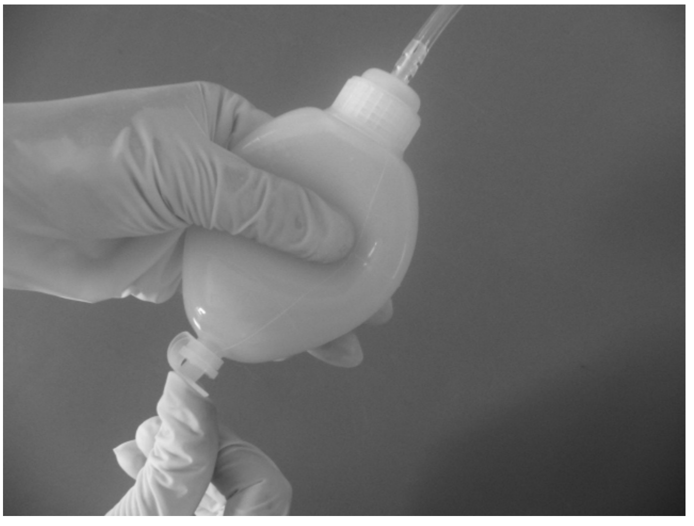
5.3.1.4 Precautions for Use of Negative Pressure Ball

The negative pressure ball has a sealing cover and a built-in one-way valve at its front end and a gas outlet switch at its back end, as shown below. If the front sealing cover is removed or loosened, the sealing performance of the negative pressure ball will compromise. In this case, you need to tighten the sealing cover.





Remove the gas outlet switch to flatten the negative pressure ball. Re-install the gas outlet switch properly when performing the test, as shown below.



Before using the negative pressure ball, make sure that it is not leaky. Check if the front sealing cover is tightened. Then flatten the negative pressure ball to remove the gas inside. Install the gas outlet switch properly. Block the front gas inlet with your hand to release the negative pressure ball main unit. Visiblel expansion of the ball cannot be seen within 30 seconds. Otherwise, replace the ball.

5.3.2 Gas Supplies and Drive Gas

The following table lists gas supplies and drive gas related failures.

Failure description	Possible cause	Recommended action
Leak	The gas supply tube is damaged or the seal at the connection is damaged.	Replace the gas supply tube or the seal at the connection.
	The quick plug-in connector leaks.	Replace the quick plug-in connector or PU tube (when the PU tube is not damaged, if the tube is long enough, cut off a small segment of the tube where the quick plug-in connector is met, and then insert the tube into position).
	The pipeline gas supply inlet assembly leaks.	Check if the one-way valve of the quick plug-in connector of the pipeline gas supplies inlet assembly leaks in the reverse direction. Replace it if necessary. Check and replace the damaged seal of the pipeline gas supplies inlet assembly. If the problem persists, replace the pipeline gas supplies inlet assembly.
	The drive gas pipeline leaks.	Check and repair the expiratory valve assembly as per the procedures described in ***5.3.4.2Leak Test of Low-pressure Pneumatic Circuit System***.
Pipeline pressure gauge shows inaccurate readings or no readings.	The pipeline pressure gauge is damaged.	Replace the pipeline pressure gauge.
The readings on the pipeline pressure gauge fluctuate greatly.	The filter of pipeline gas supply inlet assembly or the PU tube of the pipeline pressure gauge is occluded or the pressure gauge is damaged.	1. After confirming that the pipeline gas pressure is stable, check the PU tube of the pipeline pressure gauge and filter of the pipeline gas supply inlet assembly. If the tube or the filer is occluded, replace it (replaced at least once per year). 2. If the problem persists, replace the pipeline pressure gauge.

No “O2 Supply Failure” alarm occurs when the O2 pressure is low or this alarm occurs when the O2 supply pressure is normal.	The gas pressure switch of the O2 supply inlet assembly is ineffective.	Adjust the pressure switch of the O2 supply inlet assembly to cause O2 supply pressure to approach 0.2 MPa as much as possible within the range of 0.15 to 0.25 MPa when this alarm occurs. If the adjustment fails, replace the pressure switch (refer to ***5.3.2.3Adjust the Pressure Switch***).
No “Drive Gas Pressure Low” alarm occurs when the drive gas pressure is low or this alarm occurs when the drive gas pressure is normal.	The pressure switch on the integrated pneumatic circuit of the expiratory valve assembly or the PEEP safety valve is ineffective. Or, the filter on the integrated pneumatic circuit of the expiratory valve assembly is occluded.	Adjust the pressure switch on the integrated pneumatic circuit of the expiratory valve assembly to cause drive gas pressure to approach 0.14 MPa as much as possible within the range of 0.05 to 0.2 MPa when this alarm occurs. If the adjustment fails, replace the pressure switch. If the problem persists after the pressure switch is replaced, replace the integrated pneumatic circuit of the expiratory valve assembly (refer to ***5.3.2.3Adjust the Pressure Switch***).

5.3.2.1 Test the Pipeline Pressure Gauge and Correct the Regulator

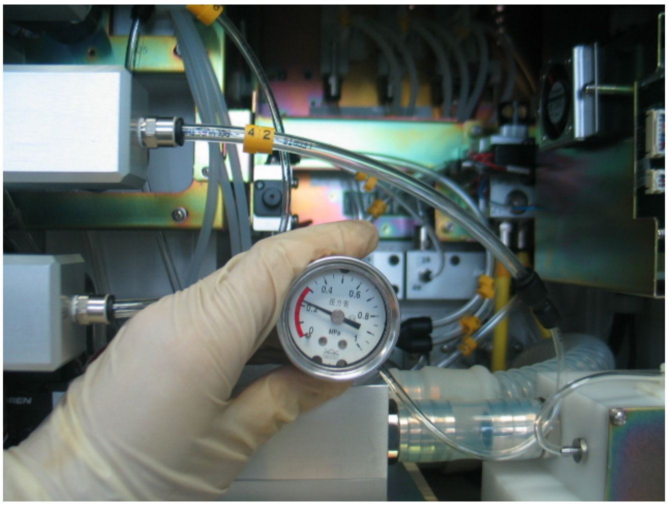
Use the following tools to test the pipeline pressure gauge and regulator of the pipeline gas supply inlet assembly:

- 1 MPa (10bar) test pressure gauge (before the test, make sure that the 1 MPa (10bar) test pressure gauge is in good condition) (quantity: 1)
- 3106-04-06 adapter connector (quantity: 1)
- PU tube (4X200) (quantity: 1)

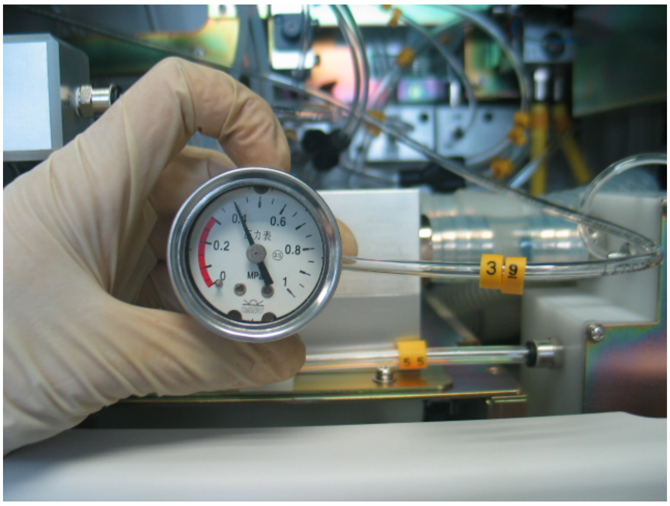
Test procedures:

I O2 supply inlet assembly:

1. Turn off the pipeline gas supply and bleed the residual pressure through O2 flushing.
2. Pull out No.42 PU tube which connects the O2 supply inlet assembly to other assembly (Note 1). The end of the tube which connects the O2 supply inlet assembly is not pulled out but the other end is.
3. Connect the pulled-out tube end to the 1 MPa (10bar) test pressure gauge through 3106-04-06 adapter connector, as shown below.



4. Turn on O2 pipeline supply and record the reading on the O2 pipeline pressure gauge. Observe the test pressure gauge. If the reading on the test pressure gauge is not within the range of 0.15 to 0.25 MPa (namely 1.5 to 2.5bar), adjust the regulator of the O2 supply inlet assembly to cause the reading on the test pressure gauge to reach 0.2 MPa (namely, 2bar). For operations of the regulator, refer to section ***5.3.2.4Adjust the Regulator of the Pipeline Gas Supply Inlet Assembly.***
5. Turn off the pipeline gas supply and bleed the residual pressure through O2 flushing.
6. Insert the pulled-out tube properly.
7. Pull out No.39 PU tube which connects the O2 supply inlet assembly to the O2 pipeline pressure gauge. The end of the tube which connects the O2 supply inlet assembly is not pulled out but the other end is.
8. Connect the pulled-out tube end to the test pressure gauge, as shown below.



9. Turn on the pipeline gas supply and record the reading on the test pressure gauge. If the difference between this reading and the reading on the O2 pipeline pressure gauge is more than 0.1 MPa (1bar), it indicates that the O2 pipeline pressure gauge is damaged. Handle this problem as described in the troubleshooting table.
10. Insert the pulled-out tube properly.

Note 1: The Nos. of the PU tubes described here correspond to the gas tube Nos. when O2, N2O and AIR are all configured. In case of other gas supply configurations, if the PU tube is numbered differently, notes will be given in brackets. For Nos. of all PU tubes, refer to***6.4.2Pneumatic Connections.***

II N2O supply inlet assembly:

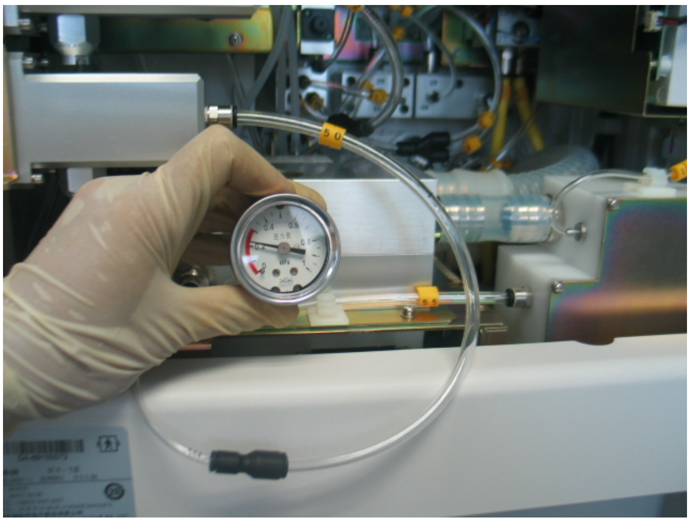
1. Turn off the pipeline gas supply. Pull out No.48 PU tube which connects the N2O supply inlet assembly to other assembly. The end of the tube which connects the N2O supply inlet assembly is not pulled out but the other end is.
2. Connect the pulled-out tube end to the test pressure gauge through 3106-04-06 adapter connector, as shown below.

3. Turn on N2O and O2 pipeline supplies. Adjust the regulator of the N2O supply inlet assembly to cause the reading on the test pressure gauge to be same to that acquired in step 4 of “I O2 supply inlet assembly” (for operations of the regulator, refer to section ***5.3.2.4Adjust the Regulator of the Pipeline Gas Supply Inlet Assembly***). Record the reading on the N2O pipeline pressure gauge.
4. Turn off N2O pipeline supply and bleed the residual pressure by turning on the N2O flow regulator.
5. Insert the pulled-out tube properly.
6. Pull out No.40 PU tube which connects the N2O supply inlet assembly to the N2O pipeline pressure gauge. The end of the tube which connects the N2O supply inlet assembly is not pulled out but the other end is.
7. Connect the pulled-out tube end to the test pressure gauge, as shown below.

8. Turn on the N2O pipeline supply and record the reading on the test pressure gauge. If the difference between this reading and the reading on the N2O pipeline pressure gauge is more than 0.1 MPa (1bar), it indicates that the N2O pipeline pressure gauge is damaged. Handle this problem as described in the troubleshooting table.
9. Insert the pulled-out tube properly.

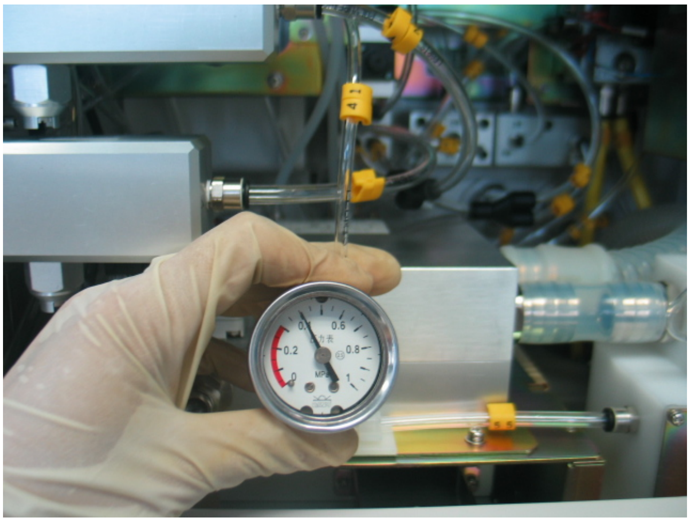
III AIR supply inlet assembly:

1. Turn off the pipeline gas supply. Pull out No.50 PU tube which connects the AIR supply inlet assembly to other assembly. The end of the tube which connects the AIR supply inlet assembly is not pulled out but the other end is.
2. Connect the pulled-out tube end to the test pressure gauge through 3106-04-06 adapter connector, as shown below.



3. Turn on AIR pipeline supply. If the reading on the test pressure gauge is not within the range of 0.2±0.05 MPa (namely 2±0. 5bar), adjust the regulator to cause the reading on the test pressure gauge to reach 0.2 MPa (namely, 2bar). For operations of the regulator, refer to section ***5.3.2.4Adjust the Regulator of the Pipeline Gas Supply Inlet Assembly***. Record the reading on the AIR pipeline pressure gauge.

4. Turn off AIR pipeline supply and bleed the residual pressure by turning on the AIR flow regulator.
5. Insert the pulled-out tube properly.
6. Pull out No.41 PU tube which connects the AIR supply inlet assembly to the AIR pipeline pressure gauge. The end of the tube which connects the AIR supply inlet assembly is not pulled out but the other end is.
7. Connect the pulled-out tube end to the test pressure gauge, as shown below.



8. Turn on the AIR pipeline supply and record the reading on the test pressure gauge. If the difference between this reading and the reading on the AIR pipeline pressure gauge is more than 0.1 MPa (1bar), it indicates that the AIR pipeline pressure gauge is damaged. Handle this problem as described in the troubleshooting table.
9. Insert the pulled-out tube properly.

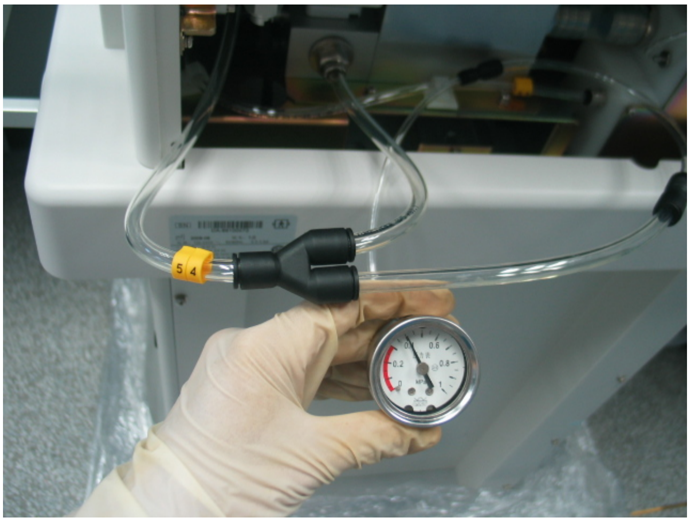
5.3.2.2 Test the Pressure Switch

Use the following tools to test if the pressure switch of the O2 supply inlet assembly and that on the integrated pneumatic circuit of the expiratory valve assembly are normal:

- 1 MPa (1bar) test pressure gauge (before the test, make sure that the 1 MPa (1bar) test pressure gauge is in good condition) (quantity:1)
- 3106-04-06 adapter connector (quantity:1)
- 3106-06-08 adapter connector (quantity:1)
- 3140-08-00 Y piece (quantity:1)
- PU tube (8X200) (quantity:2)
- PU tube (6X200) (quantity:1)
- PU tube (4X200) (quantity:1)

Test procedures:

1. Turn off the pipeline gas supply and bleed the residual pressure through O2 flushing.
2. Pull out No.54 PU tube which connects the O2 supply inlet assembly to the expiratory valve assembly. The end of the tube which connects the O2 supply inlet assembly is not pulled out but the other end is.
3. Connect one PU tube (8X200) to the pulled-out tube end of the expiratory valve assembly. Then connect this PU tube and the pulled-out end of No.54 PU tube to the two connectors of 3140-08-00 Y piece respectively.
4. Connect the test pressure gauge to another connector of 3140-08-00 Y piece through 3106-04-06 and 3106-06-08 adapter connectors, as shown below.



5. Turn on the O2 pipeline supply.
6. Turn on the machine to enter Standby.
7. Turn off all flow regulators.
8. Turn off the pipeline gas supply (if the reading on the test pressure gauge begins to fall dramatically and continuously after the gas supply is turned off, it indicates that one or several leaks occur to the O2 supply inlet assembly, expiratory valve assembly, O2 flush button assembly, system switch assembly, and O2 flow regulator. Perform the subsequent operations after the leaks are serviced. Failures can be located by using the methods described in section ***5.3.3Anesthetic Gas Delivery System*** and ***5.3.4Patient Circuit*** except O2 supply inlet assembly related failures).
9. Manually adjust the O2 flow regulator until O2 flow is approximately 1 L/min, causing the reading on the test pressure gauge to fall gradually to 0.25 MPa (2.5bar).
10. Turn off O2 flow to cause the reading on the test pressure gauge not to fall. If the "O2 Supply Failure" alarm occurs 10 s later, it indicates that the pressure switch of the O2 supply inlet assembly is faulty. Troubleshoot this problem as described in the relevant failure table.

11. Adjust the O2 flow regulator until O2 flow is approximately 0.5 L/min, causing the reading on the test pressure gauge to fall gradually to 0.2 MPa (2bar).
12. Turn off O2 flow to cause the reading on the test pressure gauge not to fall. If the “Drive Gas Pressure Low” alarm occurs 10 s later, it indicates that the pressure switch on the integrated pneumatic circuit of the expiratory valve assembly is faulty. Troubleshoot this problem as described in the relevant failure table.
13. Adjust the O2 flow regulator until O2 flow is approximately 0.3 L/min, causing the reading on the test pressure gauge to fall gradually to 0.15 MPa (1.5bar).
14. Turn off O2 flow to cause the reading on the test pressure gauge not to fall. If the “O2 Supply Failure” alarm does not occur 10 s later, it indicates that the pressure switch of the O2 supply inlet assembly is faulty. Troubleshoot this problem as described in the relevant failure table.
15. Adjust the O2 flow regulator until O2 flow is approximately 0.3 L/min, causing the reading on the test pressure gauge to fall gradually to 0.05 MPa (0.5bar).
16. Turn off O2 flow to cause the reading on the test pressure gauge not to fall. If the “Drive Gas Pressure Low” alarm does not occur 10 s later, it indicates that the pressure switch on the integrated pneumatic circuit of the expiratory valve assembly is faulty. Troubleshoot this problem as described in the relevant failure table.

5.3.2.3 Adjust the Pressure Switch

Adjust the O2 supply pressure switch and drive gas pressure switch as described below. For the convenience of operations, disassemble the corresponding assembly. Take the O2 supply pressure switch as an example. Use a flathead screwdriver to adjust the O2 supply pressure switch as shown below. Turn for small degrees each time such as 30 degrees. Note that turning the pressure switch clockwise will decrease its alarm limits and counterclockwise increase its alarm limits. Assemble the assembly after each pressure adjustment is made and perform a test. Repeat the operations until the pressure at the time moment when the alarm occurs meets the requirement.

5.3.2.4 Adjust the Regulator of the Pipeline Gas Supply Inlet Assembly

Pull up the knob cover of the regulator. Turn the cover clockwise to increase pressure or counterclockwise to decrease pressure, as shown below. Bleed the inside pressure of the pipeline gas supply inlet assembly after each pressure adjustment is made. Then, turn on the pipeline gas supply again. Observe the adjusted pressure through the test pressure gauge.

5.3.3 Anesthetic Gas Delivery System

The following table lists anesthetic gas delivery system related failures.

Failure description	Possible cause	Recommended action
Leak	The O2 flush button assembly leaks.	Replace the seal on the O2 flush button assembly or replace the O2 flush button assembly.
	The system switch assembly leaks.	Replace the seal on the system switch assembly or replace the systems switch assembly.
	The vaporizer is installed improperly, which results in leak.	Re-install the vaporizer.
	The seal between the vaporizer manifold assembly and the vaporizer is damaged.	Clean or replace the seal. The seal should be replaced at least once per year as required.
	The seal between the vaporizer manifold inside and the connection or the rubber plain washer between the vaporizer manifold inside and the spring is damaged or dirty.	Clean the sealing part or replace the faulty seal and rubber plain washer.

	The vaporizer manifold assembly is damaged.	Replace the vaporizer manifold assembly.
	The float flowmeter leaks.	Replace the float flowmeter.
	The O2-N2O cut-off valve assembly leaks.	Replace the O2-N2O cut-off valve.
	The flow regulator leaks.	Replace the flow regulator.
	The throttling device leaks.	Re-calibrate after the throttling device is replaced (for calibration, refer to “Instructions of Use for FPM-65 Flow and Pressure Detection Device”
	The type II pressure relief valve of the ACGO assembly or the pressure relief valve at the breathing connection leaks.	Check and replace the faulty pressure relief valve after locating the problem as described in section ***5.3.4.2Leak Test of Low-pressure Pneumatic Circuit System***.
	The ACGO assembly leaks.	Replace the ACGO assembly after locating the problem as described in section ***5.3.4.2Leak Test of Low-pressure Pneumatic Circuit System***.
	The two fresh gas connections (one is connected to fresh gas and the other to ACGO) of the circuit adapter assembly leak.	Check the seals and tubes at the two fresh gas connections after locating the problem as described in section ***5.3.4.2Leak Test of Low-pressure Pneumatic Circuit System***. Replace the faulty parts and re-install the parts.
The gas supplies cannot be turned off after the machine is turned off.	The seal inside the system switch assembly is damaged.	Replace the system switch.
The machine cannot be powered on after turned on.	The contact switch is ineffective.	Replace the contact switch of the system switch assembly.
The O2 flushing status cannot be detected correctly.	The pressure switch on the ACGO assembly which detects the O2 flushing status is ineffective.	Replace the pressure switch on the ACGO assembly which detects the O2 flushing status.
O2-N2O cut-off is ineffective.	The O2-N2O cut-off valve assembly is damaged.	Replace the O2-N2O cut-off valve assembly.

The flowmeter float indicates inaccurate value or remains unmoved.	The float flowmeter is damaged.	Replace the float flowmeter.
The knob of the flow regulator gets loose.	The flow regulator is damaged.	Replace the flow regulator.
The O2-NO link system is ineffective.	The O2-N2O chain linkage of the flow regulator is damaged.	Replace the flow regulator.
N2O supply cannot be cut off in case of O2 supply failure.	The O2-N2O cut-off valve is damaged.	Replace the O2-N2O cut-off valve assembly.

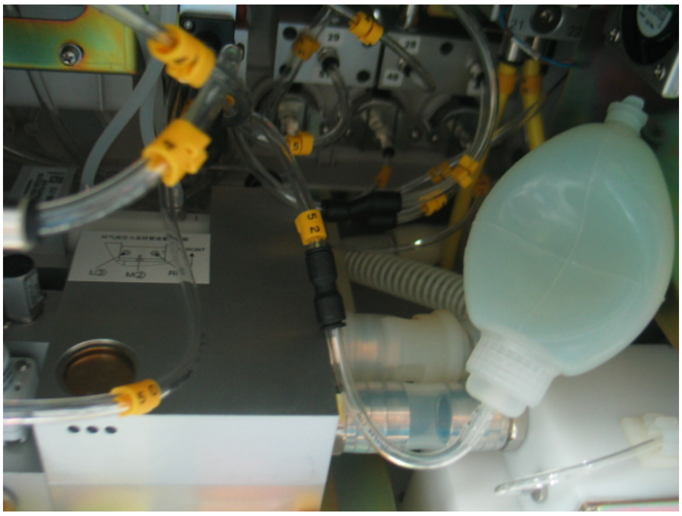
5.3.3.1 Leak Test of the O2 Flush Button Assembly

Perform a leak test of the O2 flush button assembly by using the following tools:

- Negative pressure ball (quantity:1)
- 3106-06-00 adapter connector (quantity:1)
- PU tube (6X100) (quantity:1)

Test procedures:

1. Turn off the pipeline gas supplies and bleed the residual pressure through O2 flushing.
2. Pull out No.52 PU tube which connects the O2 flush button assembly to the ACGO assembly. The end of the tube which connects the O2 flush button assembly is not pulled out but the other end is.
3. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out tube through 3106-06-00 adapter connector.
4. Release the negative pressure ball as shown below. If the negative pressure ball is fully expanded within 30 s, it indicates that the O2 flush button assembly is damaged. Handle this problem as described in the troubleshooting table.



5.3.3.2 Leak Test of the Flowmeter Related Assembly

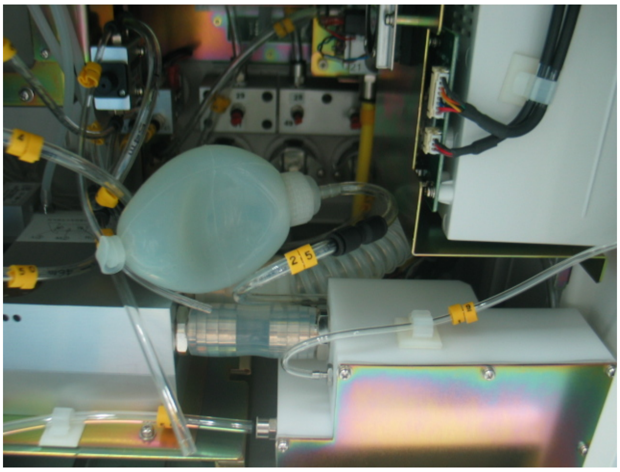
Perform a leak test of the flowmeter related assembly (from flow regulator to float flowmeter) by using the following tools:

- Negative pressure ball (quantity:1)
- 3106-06-00 adapter connector (quantity:1)
- 3106-06-08 adapter connector (quantity:1)
- 3126-04-00 tube plug (quantity:1)
- 3126-06-00 tube plug (quantity:2)
- 3126-08-00 tube plug (quantity:3)
- PU tube (6X100) (quantity:1)
- Cross screwdriver (quantity:1)

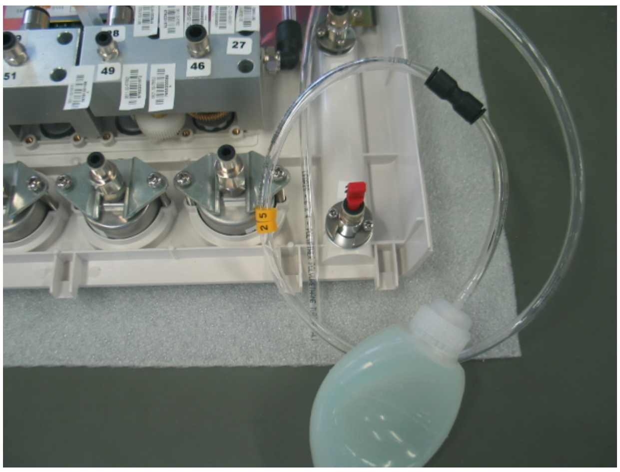
Test procedures:

1. Turn off the pipeline gas supplies and turn on the system switch. Bleed the residual pressure by turning on the flow regulators.
2. Turn off the system switch. Turn on the flow regulators and turn them counterclockwise for more than half a circle.
3. Pull out No.25 PU tube which connects the float flowmeter to the vaporizer manifold assembly. The end of the tube which connects the float flowmeter is not pulled out but the other end is.
4. Pull out No.46, 49 and 51 PU tubes (No.46 and 49 tubes in case of O2+N2O configuration, No.45 and 51 tubes in case of O2+AIR configuration, and No.45 tube in case of single O2 configuration) which connect the system switch assembly and O2-N2O cut-off valve assembly to the flow regulator. The ends of the tubes which connect the flow regulator are pulled out but the other ends are not.
5. Occlude the pulled-out tube end on the flow regulator by using 3126-04-00 or 3126-06-00 tube plug.

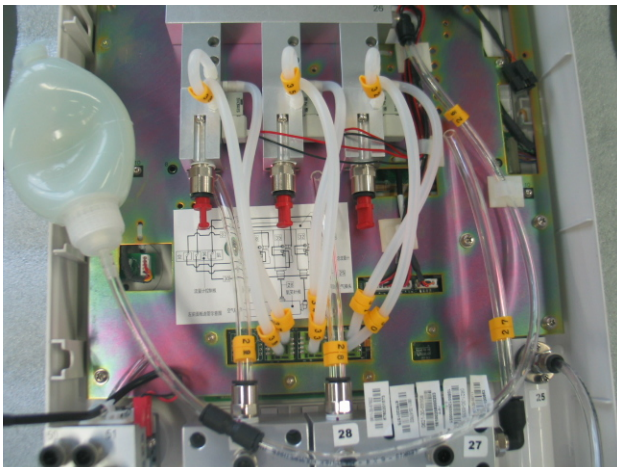
6. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out end of No.25 PU tube through 3106-06-00 adapter connector, as shown below.



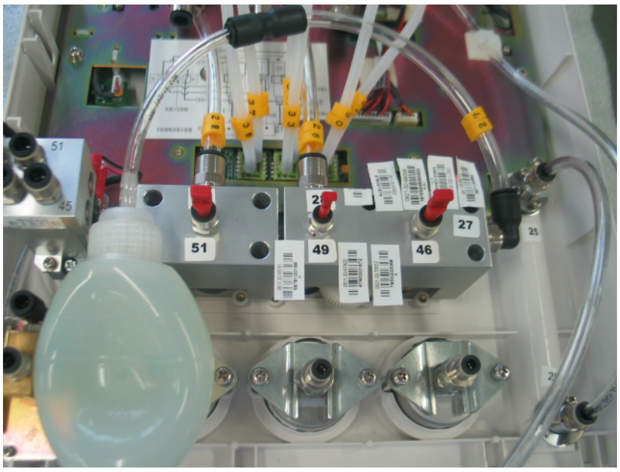
7. Release the negative pressure ball. If the negative pressure ball is fully expanded within 30s, it indicates that the float flowmeter related assembly is damaged. In this case, perform the following operations.
8. Remove the left front panel.
9. Pull out No.26 PU tube which connects the throttling device to the float flowmeter. The end of the tube which connects the float flowmeter is pulled out but the other end is not.
10. Occlude the pulled-out tube end on the float flowmeter by using 3126-06-00 tube plug.
11. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out end of No.25 PU tube through 3106-06-00 adapter connector, as shown below.

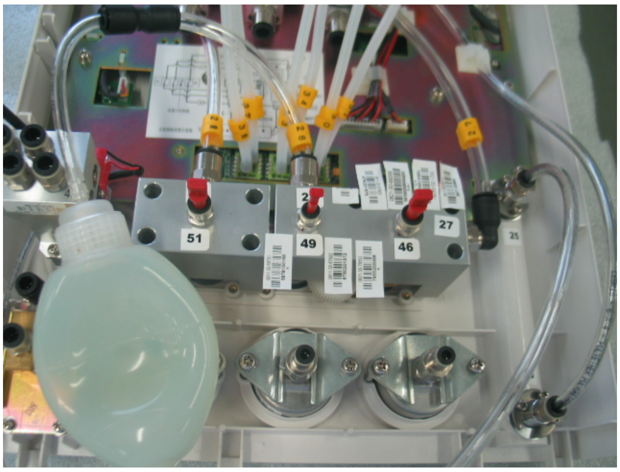


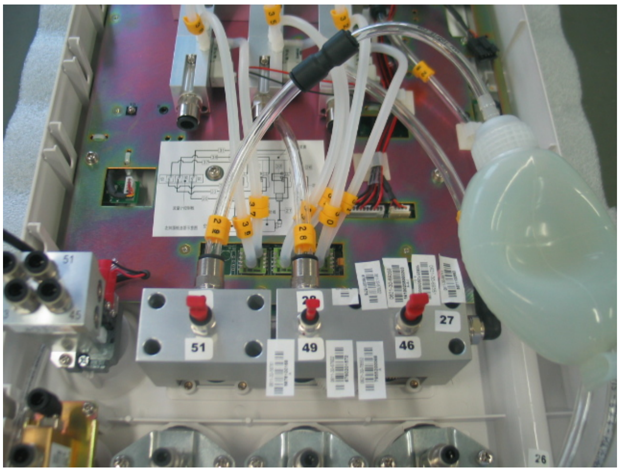
12. Release the negative pressure ball. If the negative pressure ball is fully expanded within 30s, it indicates that the float flowmeter leaks. Handle this problem as described in the troubleshooting table.
13. Pull out No.27, 28 and 29 PU tubes (No.27 and 28 tubes in case of O2+N2O configuration, No.27 and 29 tubes in case of O2+AIR configuration, and No.27 tube in case of single O2 configuration) which connect the flow regulator to the throttling device. The ends of the tubes which connect the throttling device are pulled out but the other ends are not.
14. Occlude the pulled-out tube end on the throttling device by using 3126-08-00 tube plug.
15. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out end of No.26 PU tube through 3106-06-00 adapter connector, as shown below.



16. Release the negative pressure ball. If the negative pressure ball is fully expanded within 30s, it indicates that the throttling device leaks. Handle this problem as described in the troubleshooting table.
17. Pull out No.46, 49 and 51 PU tube (No.46 and 49 tubes in case of O2+N2O configuration, No.45 and 51 tubes in case of O2+AIR configuration, and No.45 tube in case of single O2 configuration) which enter the flow regulator. The ends of the tubes which connect the flow regulator are pulled out but the other ends are not.
18. Occlude the pulled-out tube end on the flow regulator by using 3126-06-00 or 3126-04-00 tube plug.
19. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out end of No.27,28 or 29 PU tube in turn (No.27 and 28 tubes in case of O2+N2O configuration, No.27 and 29 tubes in case of O2+AIR configuration, and No.27 tube in case of single O2 configuration) through 3106-06-00 adapter connector, as shown below.







20. Release the negative pressure ball. If the negative pressure ball is fully expanded within 30s, it indicates that the flow regulator leaks. Handle this problem as described in the troubleshooting table.

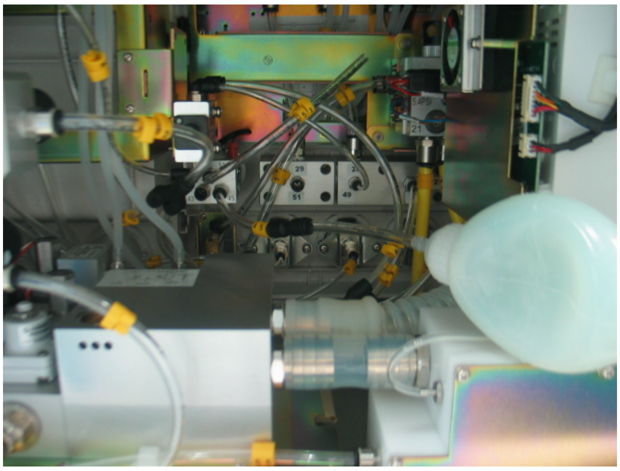
5.3.3.3 Leak Test of the System Switch Assembly

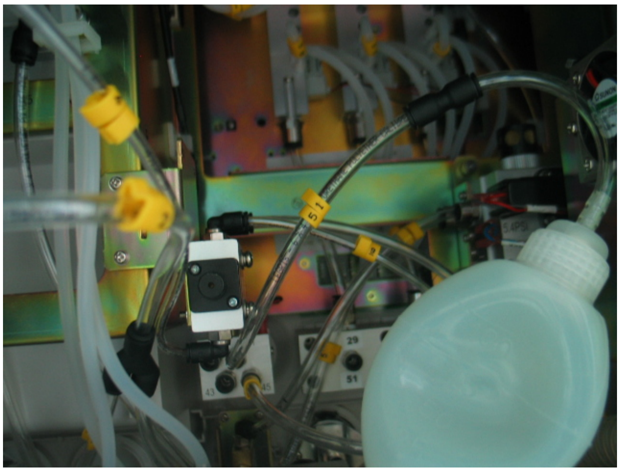
Perform a leak test of the system switch assembly by using the following tools:

- Negative pressure ball (quantity:1)
- 3106-06-00 adapter connector (quantity:1)
- 3126-06-00 tube plug (quantity:2)
- PU tube (6X100) (quantity:1)

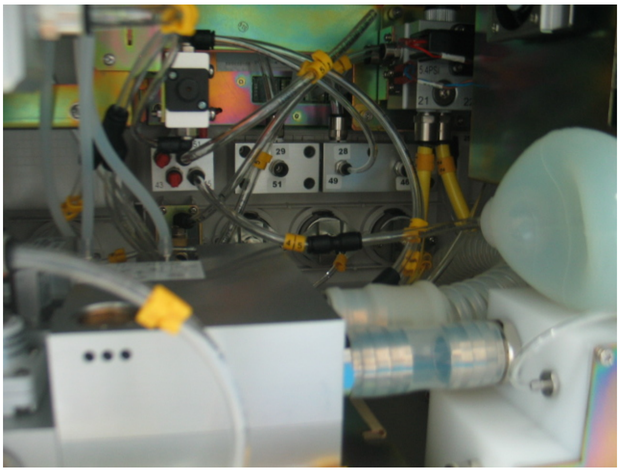
Test procedures:

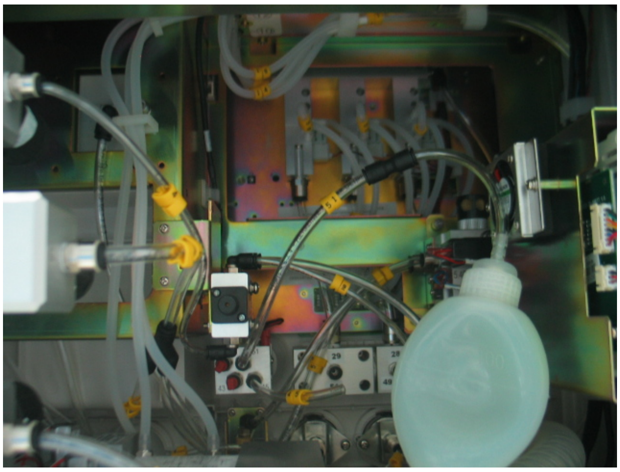
1. Turn off the pipeline gas supplies and turn on the system switch. Bleed the residual pressure by turning on the flow regulators.
2. Turn off the system switch.
3. Pull out No.45 or 51 PU tube (No.45 tube in case of O2+N2O configuration, No.45 and 51 tubes in case of O2+AIR configuration, and No.45 tube in case of single O2 configuration) which connects the system switch assembly to the flow regulator. The end of the tube which connects the system switch assembly is not pulled out but the other end is.
4. Pull out No.43 or 50 PU tube (No.43 tube in case of O2+N2O configuration, No.43 and 50 tubes in case of O2+AIR configuration, and No.43 tube in case of single O2 configuration) which connects the pipeline gas supply inlet assembly to the system switch assembly. The end of the tube which connects the system switch assembly is pulled out but the other end is not.
5. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out end of No.45 or 51 PU tube in turn through 3106-06-00 adapter connector, as shown below.





6. Release the negative pressure ball. If the negative pressure ball is fully expanded within 30s during one of the two tests, it indicates that the system switch assembly is damaged. Handle this problem as described in the troubleshooting table.
7. Turn on the system switch.
8. Occlude the pulled-out tube end on the system switch assembly by using 3126-06-00 tube plug.
9. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out end of No.45 or 51 PU tube in turn through 3106-06-00 adapter connector, as shown below.





10. Release the negative pressure ball. If the negative pressure ball is fully expanded within 30 s during one of the two tests, it indicates that the system switch assembly is damaged. Handle this problem as described in the troubleshooting table.

5.3.3.4 Leak Test of the O2-N2O Cut-off Valve Assembly

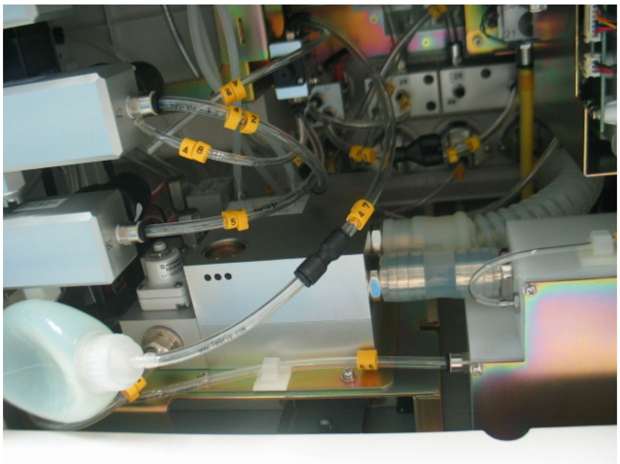
Perform a leak test of the O-N2O cut-off valve assembly by using the following tools:

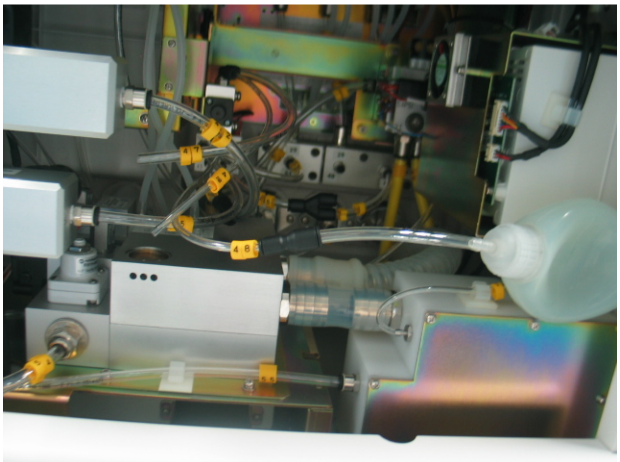
- Negative pressure ball (quantity:1)
- 3106-06-00 adapter connector (quantity:1)
- 3106-04-06 adapter connector (quantity:1)
- PU tube (6X100) (quantity:1)

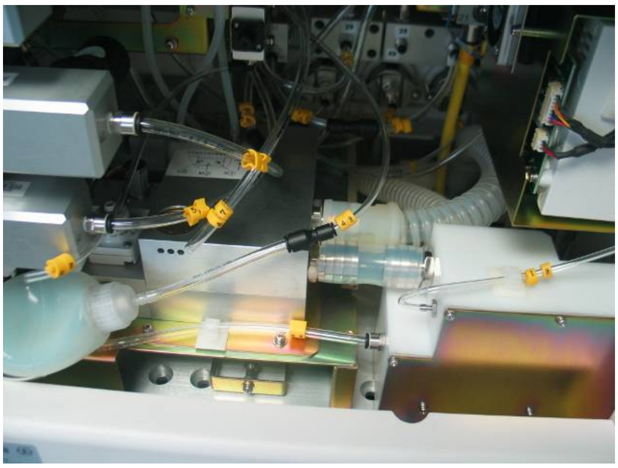
Test procedures:

1. Turn off the pipeline gas supplies and turn on the system switch. Bleed the residual pressure by turning on the flow regulators. Then turn off the system switch.
2. Pull out No.49 PU tube which connects the O2-N2O cut-off valve assembly to the N2O flow regulator (this test is not required in case of O2+AIR configuration or single O2 configuration). The end of the tube which connects the O2-N2O cut-off valve assembly is not pulled out but the other end is.
3. Pull out No.47 PU tube which connects the system switch assembly to the O2-N2O cut-off valve assembly. The end of the tube which connects the O2-N2O cut-off valve assembly is not pulled out but the other end is.
4. Pull out No.48 PU tube which connects the N2O supply inlet assembly to the O2-N2O cut-off valve assembly. The end of the tube which connects the O2-N2O cut-off valve assembly is not pulled out but the other end is.

5. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out tube through 3106-06-00 or 3106-04-06 adapter connector in turn, as shown below.







6. Release the negative pressure ball. If the negative pressure ball is fully expanded within 30s during one of the three tests, it indicates that the O2-N2O cut-off valve assembly is damaged. Handle this problem as described in the troubleshooting table.

5.3.3.5 Leak Test of the Vaporizer Manifold Assembly

Perform a leak test of the vaporizer manifold assembly by using the following tools:

- Negative pressure ball (quantity:1)
- 3106-06-08 adapter connector (quantity:1)
- 3126-06-00 tube plug (quantity:1)
- PU tube (6X100) (quantity:1)
- Vaporizer manifold test fixture (quantity:1)

Test procedures:

I

1. Turn off the system switch.
2. Mount the vaporizer but do not turn it on, as shown below.

3. Pull out No.25 PU tube which connects the float flowmeter to the vaporizer manifold assembly. The end of the tube which connects the vaporizer manifold assembly is pulled out but the other end is not.
4. Occlude the pulled-out tube end on the vaporizer manifold assembly by using 3126-06-00 tube plug.
5. Pull out No.53 PU tube which connects the vaporizer manifold assembly to the ACGO assembly. The end of the tube which connects the vaporizer manifold assembly is not pulled out but the other end is.

6. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out No.53 tube through 3106-06-08 adapter connector, as shown below.

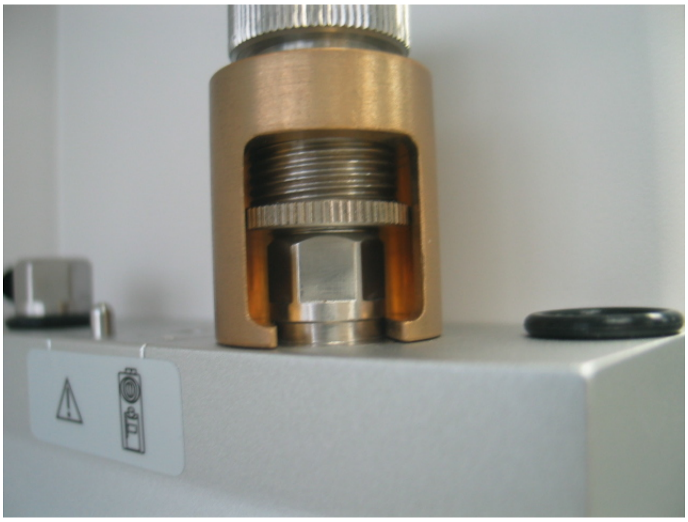
7. Release the negative pressure ball. If the negative pressure ball is not fully expanded within 30s, it indicates that the vaporizer manifold assembly is not leaky. Otherwise, check the seal between the vaporizer manifold assembly and the vaporizer (replace the seal if it is damaged), or re-install the vaporizer. Do the test again until it is passed.

8. Remove the vaporizer as shown below.

9. Repeat steps 3 through 5 as shown below. If the vaporizer manifold assembly is leaky, one or several rubber plain washers and seal of the vaporizer manifold assembly or its contacted mechanical surface are damaged. Handle this problem as described in the troubleshooting table.

II Ensure that the vaporizer manifold assembly with vaporizer mounted (mentioned in "I") is not leaky and perform the following operations.

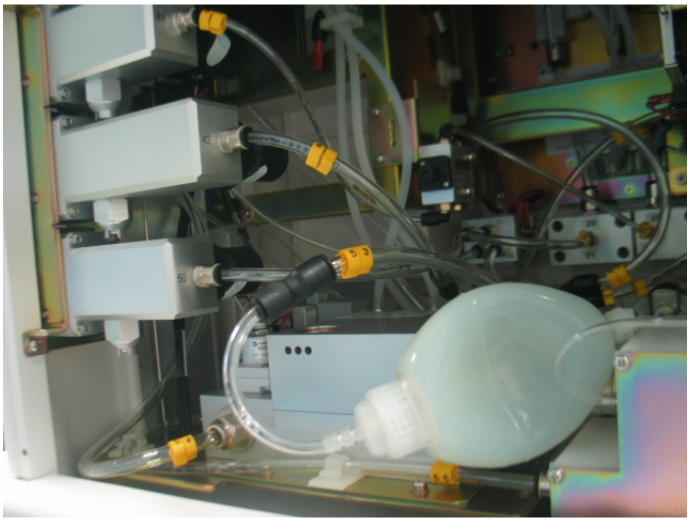
1. Remove the vaporizer and mount the vaporizer manifold test fixture onto the connector of the vaporizer manifold assembly (remove the seal between the connector and the vaporizer when mounting the test fixture), as shown below.



2. Pull out No.25 PU tube which connects the float flowmeter to the vaporizer manifold assembly. The end of the tube which connects the vaporizer manifold assembly is pulled out but the other end is not.

3. Occlude the pulled-out tube end on the vaporizer manifold assembly by using 3126-06-00 tube plug.

4. Pull out No.53 PU tube which connects the vaporizer manifold assembly to the ACGO assembly. The end of the tube which connects the vaporizer manifold assembly is not pulled out but the other end is.
5. Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to the pulled-out No.53 tube through 3106-06-08 adapter connector and occlude the pulled-out tube end on the flowmeter as shown below.



6. Release the negative pressure ball. If the negative pressure ball is fully expanded within 30s, it indicates that the rubber plain washers and seal of the tested pipeline or its contacted mechanical surface are damaged. Handle this problem as described in the troubleshooting table.
7. Test each connector on the vaporizer manifold assembly by following the above steps 1 through 6.

5.3.4 Patient Circuit

The following table lists patient circuit related failures.

Failure description	Possible cause	Recommended action
Leak	The sodalime canister is not installed properly.	Re-install the sodalime canister. Remove the sodalime at the sealing connection. Ensure the correct installation of sadalime canister.
	The sealing components of the sodalime canister assembly are damaged, which refer to the seal for the lifting device (0601-20-78843) and the sealing component of the sodalime canister (0601-20-78842).	Replace the sealing component of the sodalime canister assembly. It is required to replace the seal once a year.

	The seal for the bag arm is damaged.	Replace the seal for the bag arm. It is required to replace the seal once a year.
	The water collection cup gets loose.	Check and tighten the water collection cup.
	The seal for the water collection cup assembly is damaged.	Replace the seal for the water collection cup assembly. It is required to replace the seal once a year.
	The patient circuit is separated from the circuit adapter.	Reinstall the patient circuit. Ensure that the circuit block is in the (locked) position.
	The seal for the circuit adapter assembly is damaged.	Replace the seal, which is required to be replaced once a year.
	The bellows housing or folding bag is not installed properly.	Re-install the bellows housing or folding bag. Ensure their correct installation.
	The bellows sealing cushion falls off or is damaged.	Replace the bellows sealing cushion, which is required to be replaced once a year.
	The valve cover of the breathing valve assembly is not installed properly.	Re-install the valve cover and ensure its correct installation.
	The seal for the valve cover of the breathing valve assembly is damaged.	Replace the seal.
	The O2 sensor is not installed properly.	Re-install the O2 sensor and ensure its correct installation.
	The seal for the O2 sensor or the seal for the O2 sensor plug is damaged.	Replace the seal.
	The seal underneath the sodalime canister support is damaged.	Replace the seal underneath the sodalime canister support. It is required to replace the seal once a year.
	The breathing tube connecting the patient is damaged.	Replace the breathing tube.
	The folding bag is damaged.	Replace the folding bag, which is required to be replaced once a year.

	The sealing connection of other parts of the patient circuit is damaged.	Repair or replace the sealing connection as per the procedures described in section ***5.3.2.4Adjust the Regulator of the Pipeline Gas Supply Inlet Assembly***.
O2 concentration measurement fails or has great deviations.	There is water built up on the measurement surface of O2 sensor.	Remove the built-up water and allow the O2 sensor to air dry.
	The O2 sensor is not calibrated.	Calibrate the O2 senser as per section ***4.3.7O2 Sensor Calibration (optional)*** .
	The O2 sensor is damaged.	Replace the O2 sensor.
The airway pressure gauge shows inaccurate reading or its pointer cannot move.	The airway pressure gauge is damaged.	Replace the airway pressure gauge.
The airway pressure gauge does not return to zero point.	The zero point of the airway pressure gauge is abnormal.	Adjust the zero point of the airway pressure gauge as per section ***4.5Zero the Airway Pressure Gauge*** .
The flow wave is displayed abnormal.	The flow sensor assembly is not installed properly.	Re-install the flow sensor assembly.
	There is water built up inside the flow sensor assembly.	Remove the flow sensor assembly and clear its inside water build-up.
	The membrane of the flow sensor assembly is distorted, dirty or its inside resistance changes. Zero drift occurs to the pressure sensor of the electronic flowmeter board.	Enter the user maintenance mode and calibrate the flow sensor as per section ***4.3.2Flow Calibration (factory)***.
	The flow sensor is damaged.	Replace the flow sensor assembly.
	The pressure sensor on the electronic flowmeter board is faulty.	Replace the electronic flowmeter board.
	The flow sensor pressure sampling pipeline leaks.	Repair the flow sensor pressure sampling pipeline after checking as per the procedures described in section ***5.3.4.1Leak Test of Flow Sensor Pressure Sampling Pipeline***.

5.3.4.1 Leak Test of Flow Sensor Pressure Sampling Pipeline

If the flow waveform is displayed abnormal, the flow sensor pressure sampling pipeline may be leaky. Perform the leak test by using the following tools:

- Anesthesia machine calibration device (quantity:1)
- Flow sensor pressure sampling pipeline test fixture (quantity:1)
- Circuit adapter test fixture (quantity:1)
- Injector (quantity:1)
- Φ6 silicone tube (quantity:3)
- Y piece (quantity:1)

Test procedures:

I Leak test of the flow sensor pressure sampling pipeline (the four sampling pipelines of the expiratory and inspiratory flow sensors are all tested)

1. Turn off the system switch.
2. Install the patient circuit properly.
3. Remove the flow sensor assembly.
4. Mount the flow sensor pressure sampling pipeline test fixture onto the position where the flow sensor assembly was originally mounted. Tighten the breathing connector rotary cap.
5. Connect the Φ6 silicone tubes to the pressure sensor connector (positive pressure end) on the anesthesia machine calibration device), injector (before mounting, pull out the push rod of the injector) connector and the connector for the flow sensor pressure sampling pipeline test fixture by using a Y piece, as shown below.

6. Push in the push rod of the injector to let the pressure reading on the anesthesia machine calibration device rise to 70 to 90 cmH_2O and then stop pushing. Keep the relative position between the push rod and the injector unchanged. If the pressure reading on the anesthesia machine calibration device does not fall more than 5cmH_2O within 15 s, this test is passed.

II Leak test of the flow sensor pressure sampling pipeline inside the main unit (perform this test if test “I” fails)

1. Mount the circuit adapter test fixture onto the circuit adapter assembly.
2. Connect the Φ6 silicone tubes to the pressure sensor connector (positive pressure end) on the anesthesia machine calibration device), injector (before mounting, pull out the push rod of the injector) connector and the connector (one connector out of No.3 through 6 connectors on the test fixture) for the circuit adapter test fixture by using a Y piece, as shown below.

3. Push in the push rod of the injector to let the pressure reading on the anesthesia machine calibration device rise to 70 to 90 cmH_2O and then stop pushing. Keep the relative position between the push rod and the injector unchanged. If the pressure reading on the anesthesia machine calibration device does not fall more than 5cmH_2O within 15s, this test is passed.

If test “I” is failed and “II” passed, it indicates that the flow sensor pressure sampling pipeline on the patient circuit is damaged. In this case, replace the patient circuit. If both tests “I” and “II” are failed, check the sampling lines and connectors inside the main unit, seals and three-way valves of the circuit adapter assembly until test “II” is passed. Then perform test “I”. If test “I” is still failed, it indicates the flow sensor pressure sampling pipeline on the patient circuit is damaged. In this case, replace the patient circuit.

5.3.4.2 Leak Test of Low-pressure Pneumatic Circuit System

After making sure that the flow sensor pressure sampling pipeline is not leaky, perform leak tests of the low-pressure pneumatic circuit system as shown in the following figures (figures a through d).

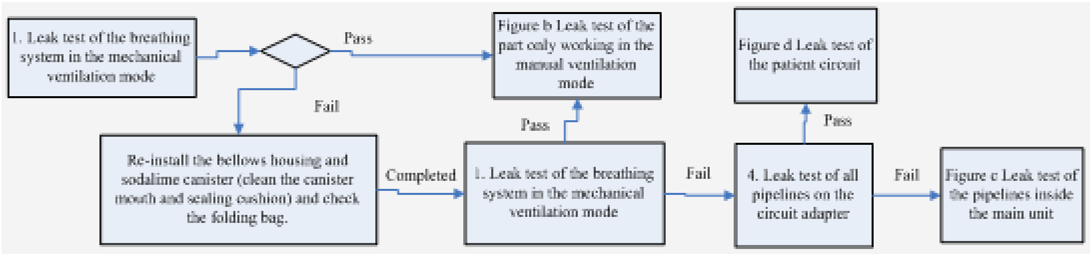


Figure a System leak test

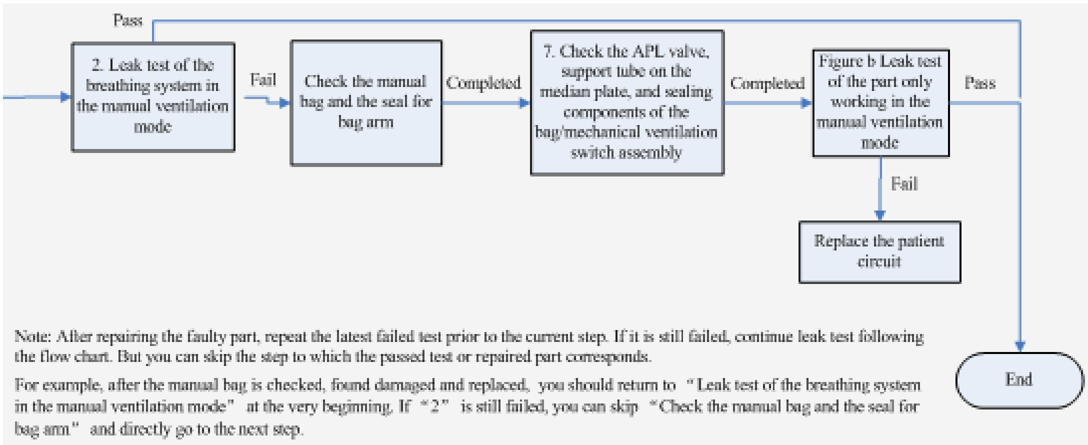


Figure b Leak test of the part only working in the manual ventilation mode

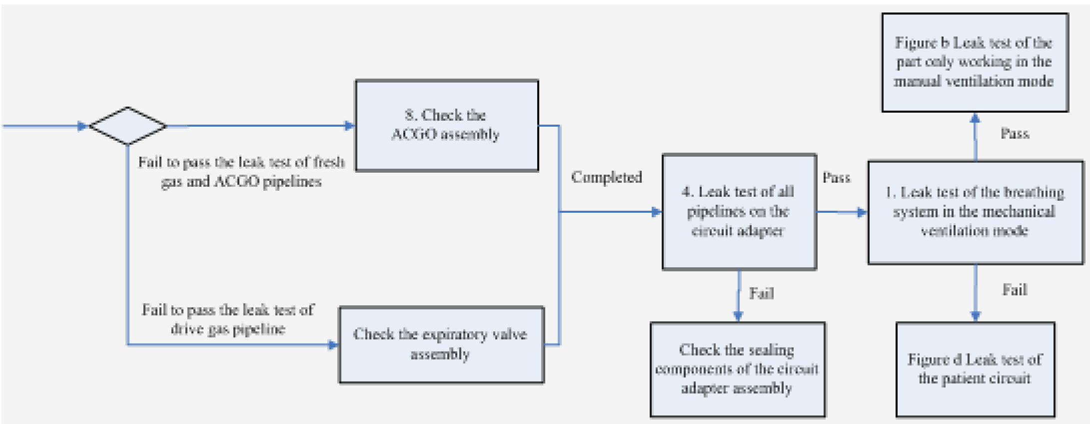


Figure c Leak test of the pipelines inside the main unit

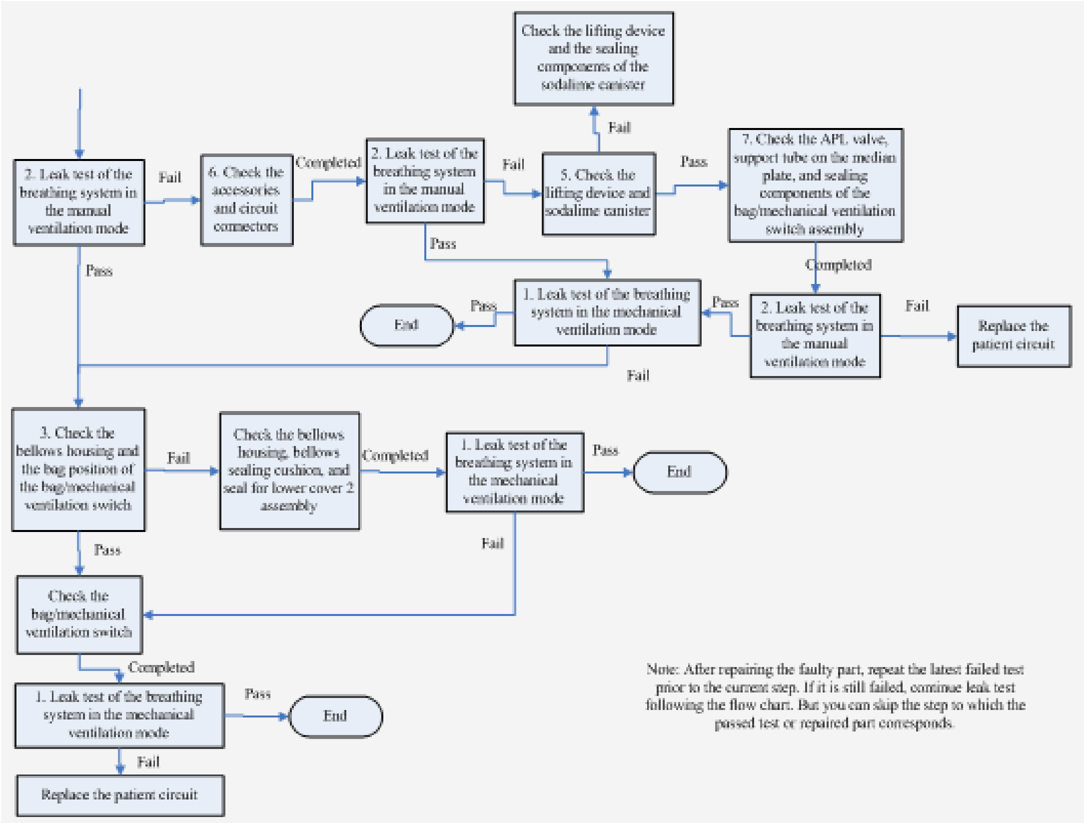


Figure d Leak test of the patient circuit

1. Leak test of the breathing system in the mechanical ventilation mode

   Perform the test as descried in section ***4.2.2Breathing System Leak Test in Mechanical Ventilation Mode***.

2. Leak test of the breathing system in the manual ventilation mode

Tools required:

- Breathing tube (quantity: 3)
- Breathing tube Y piece (quantity: 1)

Test procedures:

（1） Let the system enter Standby.

（2） Mount the patient circuit properly.

（3） Set the bag/mechanical ventilation switch to the bag position.

（4） Set the pressure of the APL valve to maximum.

(5) Occlude the inspiratory&expiratory ports and bag arm port by using three breathing tubes and one breathing tube Y piece as shown below.

(6) Turn on the O2 flow regulator and adjust O2 flow to 0.2L/min,

(7) Push the O2 flush button to let the reading on the Paw pressure gauge rise to 3 kPa.

(8) Stop O2 flushing. If the reading on the Paw pressure gauge falls under 3 kPa, this test is failed.

(9) If the reading on the Paw pressure gauge rises rapidly, to prevent defective APL valve from damaging the Paw pressure gauge, note to turn off the O2 flow regulator timely to prevent the overrange of the Paw pressure gauge (The test which involves O2 flow regulator turned off due to this reason is considered to be passed).

3. Check the bellows housing and the bag position of the bag/mechanical ventilation switch

Tools required:

- Anesthesia machine calibration device (quantity: 1)
- Circuit adapter test fixture (quantity: 1)
- Injector (quantity: 1)
- Φ6 silicone tube (quantity: 2)
- PU tube (6X300) (quantity: 1)
- Y piece (quantity: 1)

Test procedures:

(1) Remove the folding bag.

(2) Mount the bellows housing properly.

(3) Set the bag/mechanical ventilation switch to the bag position

(4) Remove the patient circuit.

（5） Mount the circuit adapter test fixture onto the patient circuit.

（6） Connect the Φ6 silicone tubes and PU tube (6X300) to the injector connector, pressure sensor (of the anesthesia machine calibration device) connector (positive pressure end), and No.2 connector to which drive gas corresponds on the circuit adapter test fixture by using a Y piece, as shown below.

（7） Push in the push rod of the injector to let the pressure reading on the anesthesia machine calibration device rise to 30 to 35 cmH_2O and then stop pushing. Keep the relative position between the push rod and the injector unchanged. If the pressure reading on the anesthesia machine calibration device falls more than $10cmH_2O$ within 30s, this test is failed. It indicates that the bellows housing or the bag position of the bag//mechanical ventilation switch is leaky.

4. Leak test of all pipelines on the circuit adapter

Tools required:

- Negative pressure ball (quantity: 1)
- Circuit adapter test fixture (quantity: 1)
- PU tube (6X100) (quantity: 1)

Test procedures:

（1） Turn off the system switch.

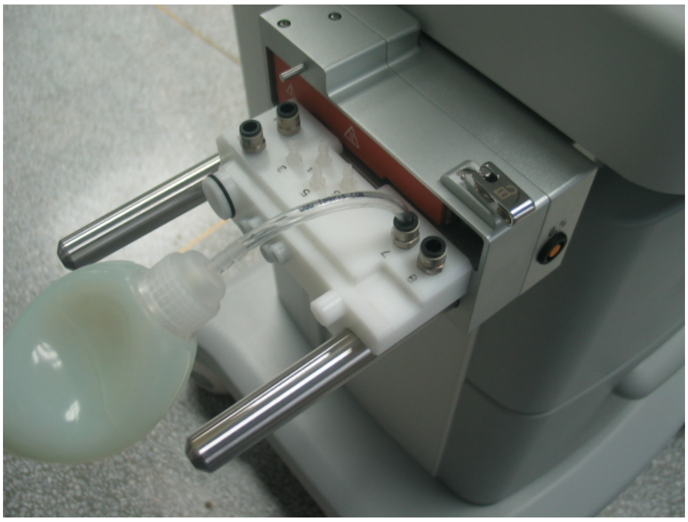
（2） Turn off the flow regulators.

（3） Turn off ACGO.

（4） Remove the patient circuit.

（5） Mount the circuit adapter test fixture onto the circuit adapter.

(6) Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to No.7 (number is marked on the circuit adapter test fixture) connector to which fresh gas pipeline of the circuit adapter test fixture corresponds, as shown below.

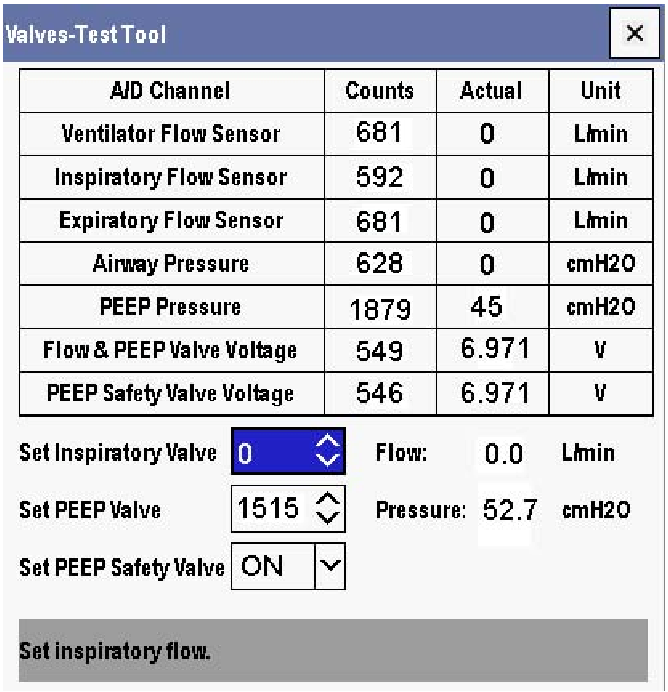


(7) Release the negative pressure ball. If the negative pressure ball is fully expanded within 30 s, it indicates that the test of fresh gas pipeline is failed. Locate the leaking point inside the main unit as per the method described in section ***5.3.3Anesthetic Gas Delivery System***.

(8) Turn on ACGO. Test the ACGO pipeline in the similar way (the connector to which the circuit adapter test fixture corresponds is No.8 connector), as shown below.

(9) Turn on the system switch and let the systems enter Standby.

(10) Select [**Maintenance**] → [**Factory Maintenance**] → [**Diagnostic Test** >>] → [**Valves-Test Tool** >>] to set the A/D value of the PEEP valve to make PEEP exceed 50 cmH2O. Set the A/D value of the inspiratory valve to "0" to produce 0 L/min of flow. Set PEEP safety valve to ON, as shown below.



(11) Flatten the negative pressure ball to remove the gas inside. Then re-install the gas outlet switch of the negative pressure ball properly. Connect the other end of the negative pressure ball to No.1 connector to which drive gas pipeline of the circuit adapter test fixture corresponds, as shown below.

(12) Release the negative pressure ball. If the negative pressure ball is fully expanded within 30 s, it indicates that the test of drive gas pipeline is failed. Check the expiratory valve assembly and the drive gas related pipeline inside the main unit.

5. Check the lifting device and sodalime canister

Tools required:

- Anesthesia machine calibration device (quantity: 1)
- Injector (quantity: 1)
- Φ6 silicone tube (quantity: 2)
- PU tube (6X300) (quantity: 1)
- Breathing tube (quantity: 3)
- Y piece (quantity: 1)
- Breathing tube Y piece (quantity: 1)
- Breathing tube adapter connector (quantity: 1)
- T-shaped Allen wrench (quantity: 1)

Test procedures:

（1） Turn off the system switch.

（2） Mount the sodalime canister onto the lifting device properly.

（3） Remove the lifting device from the patient circuit.

（4） Connect the two connectors of the lifting device by using two breathing tubes and one breathing tube Y piece. The other end of the breathing tube Y piece is connected to the breathing tube adapter connector through another breathing tube. Connect the injector connector, pressure sensor (of the anesthesia machine calibration device) connector (positive pressure end), and the breathing tube adapter connector to a Y piece, as shown below.

（5） Push in the push rod of the injector to let the pressure reading on the anesthesia machine calibration device rise to 30 to 35 cmH_2O and then stop pushing. Keep the relative position between the push rod and the injector unchanged. If the pressure reading on the anesthesia machine calibration device falls more than 10cmH_2O within 30s, it indicates that the lifting device and the sodalime canister are leaky. The test is failed.

（6） Check the seals on the two connections of the lifting device. It they are damaged, the test is failed. Replace the seal and then re-mount the lifting device onto the patient circuit.

6. Check the accessories and circuit in & out parts

Test procedures:

（1） Turn off the system switch.

（2） Check the manual bag and replace it if it is found damaged.

（3） Check the breathing tube and replace it if it is found damaged.

（4） Remove the Paw pressure gauge. Check the seal and replace it if it is found damaged.

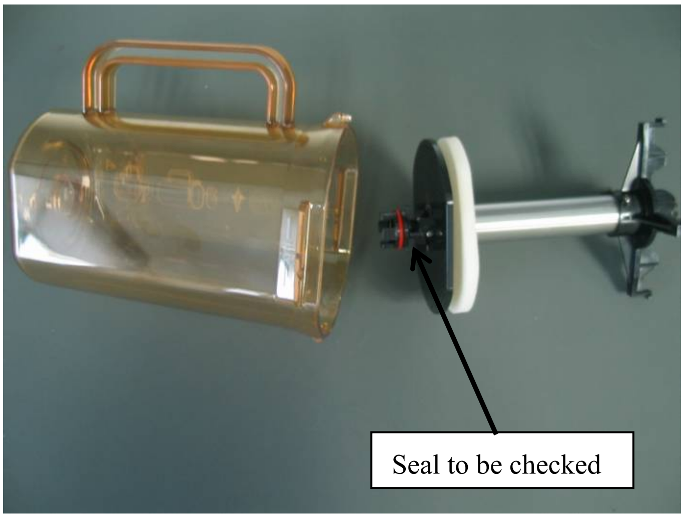
（5） Remove the water collection cup. Check the seal and replace it if it is found damaged.

（6） Remove the O2 sensor (if there is no O2 sensor, remove the plug where the O2 sensor should be installed). Check the seal and replace it if it is found damaged.

（7） Remove the valve cover o the breathing valve assembly. Check the seal and replace it if it is found damaged.

（8） Remove the bag arm. Check the seal and replace it if it is found damaged.

（9） Remove the sodalime canister support as shown below. Check the seal and replace it if it is found damaged.



7. Check the APL valve, support tube on the median plate, and sealing components of the bag/mechanical ventilation switch assembly

The test requires a T-shaped Allen wrench.

Test procedures:

（1） Turn off the system switch.

（2） Remove the APL valve. Check all seals and replace the defective ones.

（3） Remove the support tube on the median plate. Check the seals and replace the defective one.

（4） Remove the bag/mechanical ventilation switch. Check the seals and replace the defective one.

8. Check the ACGO assembly

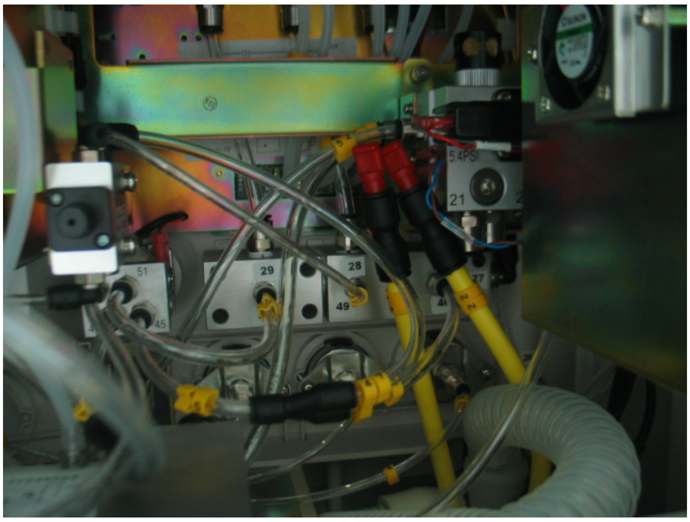
Tools required:

- Negative pressure ball (quantity: 1)
- Circuit adapter test fixture (quantity: 1)
- PU tube (6X100) (quantity: 1)
- 3106-08-10 adapter connector (quantity: 2)
- 3126-06-00 tube plug (quantity: 1)
- 3126-08-00 tube plug (quantity: 1)
- 3126-10-00 tube plug (quantity: 2)

Test procedures:

（1） Turn off the system switch.

（2） Pull out No.21 and 22 PU tubes which connect the ACGO assembly to the circuit adapter assembly. The ends of the tubes which connect the ACGO assembly are pulled out but the other ends are not, as shown below.

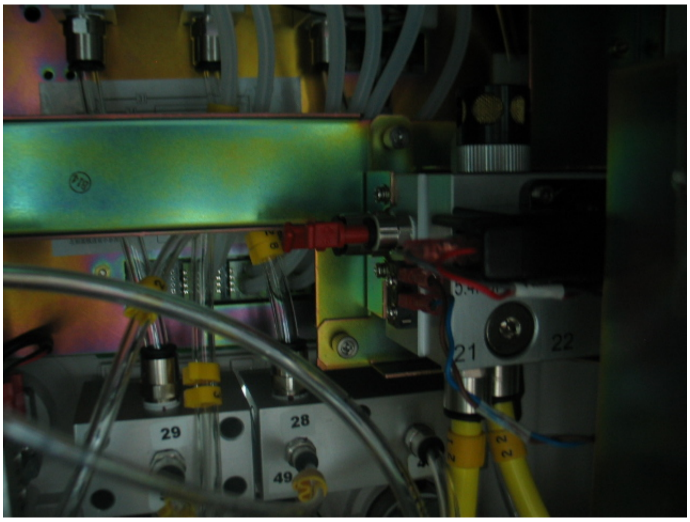


（3） Occlude the pulled-out tube ends by using two 3106-10-00 adapter connectors and two 3126-10-00 tube plugs.

（4） Repeat steps 3 through 7 in “4 Leak test of all pipelines on the circuit adapter”. If the test is failed, it indicates that the connectors of the circuit adapter or seals are damaged. If there is no leak, insert the pulled-out tubes into the ACGO assembly. Note that the relative position of the black wires on the No.21 and 22 yellow PU tubes should be same to that before pulled out.

（5） Pull out No.52 and 53 PU tubes which connect the O2 flush button assembly and the vaporizer manifold assembly to the ACGO assembly. The ends of the tubes which connect the ACGO assembly are pulled out but the other ends are not.

（6） Occlude the pulled-out tube ends by using 3126-06-00 and 3126-08-00 tube plugs, as shown below.



（7） Repeat steps 3 through 7 in “4 Leak test of all pipelines on the circuit adapter”. If the test is failed, it indicates the ACGO assembly is damaged. Check the seals in the ACGO assembly and replace the damaged seals.

5.3.5 Tidal Volume

The following table lists tidal volume inaccuracy related failures.

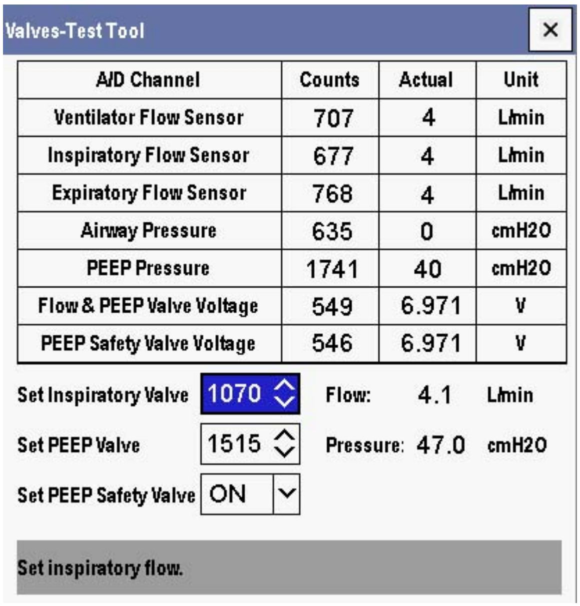
Failure description	Possible cause	Recommended action
Inaccurate tidal volume	The flow sensor is not installed properly.	Re-install the flow sensor.
	The setting of fresh gas flow is inappropriate.	Adjust the fresh gas flow.
	There are significant leaks in the breathing system and the fresh gas flow is too low.	Repair the leaking points after checking as per the procedures described in sections ***5.3.3Anesthetic Gas Delivery System*** and ***5.3.4Patient Circuit***.
	* There is water build-up inside the flow sensor.	Remove the flow sensor and clear its inside water build-up.
	*The membrane of the flow sensor assembly is distorted, dirty or its inside resistance changes. Zero drift occurs to the pressure sensor on the monitor board.	Enter the user maintenance mode and calibrate the flow sensor as per section ***4.3.2Flow Calibration (factory)***.
	*The flow sensor pressure sampling pipeline is leaky.	Repair the leaking points after checking as per the procedures described in section ***5.3.4.1Leak Test of Flow Sensor Pressure Sampling Pipeline***.
	*The flow sensor is damaged.	Replace the flow sensor.
	*The pressure sensor on the monitor board is faulty.	Replace the monitor board.
	The inlet gas flow regulator on the integrated pneumatic circuit of the expiratory valve assembly is faulty.	Replace the integrated pneumatic circuit of the expiratory valve assembly or replace the expiratory valve assembly.
	The current Plimit is set too low, which causes expiration to start in advance.	Set Plimit to a higher value to cause Paw not to exceed the limit.

	The displayed TVe and TVi are not the same.	Enter factory maintenance and switch on TVi review. Observe the value of TVi. In the valves test tool, compare the measurement error made by three sensors and judge whether to perform calibration as per ***4.3.2Flow Calibration (factory)***.

In the above table, possible causes marked "*" are related to inaccurate measured values by flow sensors. Do the following to detect if tidal volume inaccuracy results from "*" marked causes.

1. Turn off the flow regulators.
2. Make sure that the patient is disconnected from the system and that the bag/mechanical ventilation switch is set to the mechanical ventilation position.
3. Remove the folding bag and install the bellows housing properly.
4. Remove the water collection cup.
5. Connect the inspiration and expiration connectors by using a breathing tube, as shown below.

6. Turn on gas supplies and enter Standby.
7. Select [**Maintenance**] → [**Factory Maintenance**] → [**Diagnostic Test** >>] → [**Valves-Test Tool** >>] to set the A/D value of the PEEP valve to make PEEP exceed 40cmH2O. Set PEEP safety valve to ON, as shown below.



Set the A/D value of the inspiratory valve to cause the flow of inspiratory valve to reach a certain value. In this case, the flows measured by the ventilator flow sensor, inspiratory flow sensor, and expiratory flow sensor should be the same. Test multiple points by setting the A/D value of the inspiratory valve. For each point, the flows measured by the three sensors should be the same. If not, the measured value by the flow sensor is inaccurate. Troubleshoot the possible causes marked "*" in the above table.

5.4 Troubleshoot Sensor and Valve Related Failures by Using the Valves-test Tool

5.4.1 Preparations before Using the Valves-test Tool

Make the following preparations before using the valves-test tool to locate the valves or sensors related failures:

1 Connect the pneumatic circuit according to the type of sensor or valve to be checked.

- ◆ Constant-flow connection method: Connect the tubes of the anesthesia machine following the constant-flow connection method to check the flow sensors and inspiratory valve. For details, refer to ***4.3.2Flow Calibration (factory)***.
- ◆ Constant-pressure connection method: Connect the tubes of the anesthesia machine following the constant-pressure connection method to check the pressure sensors and PEEP proportional valve. For details, refer to ***4.3.3Pressure Calibration (factory)***.

2. Make sure that the supply gas pressure is normal.

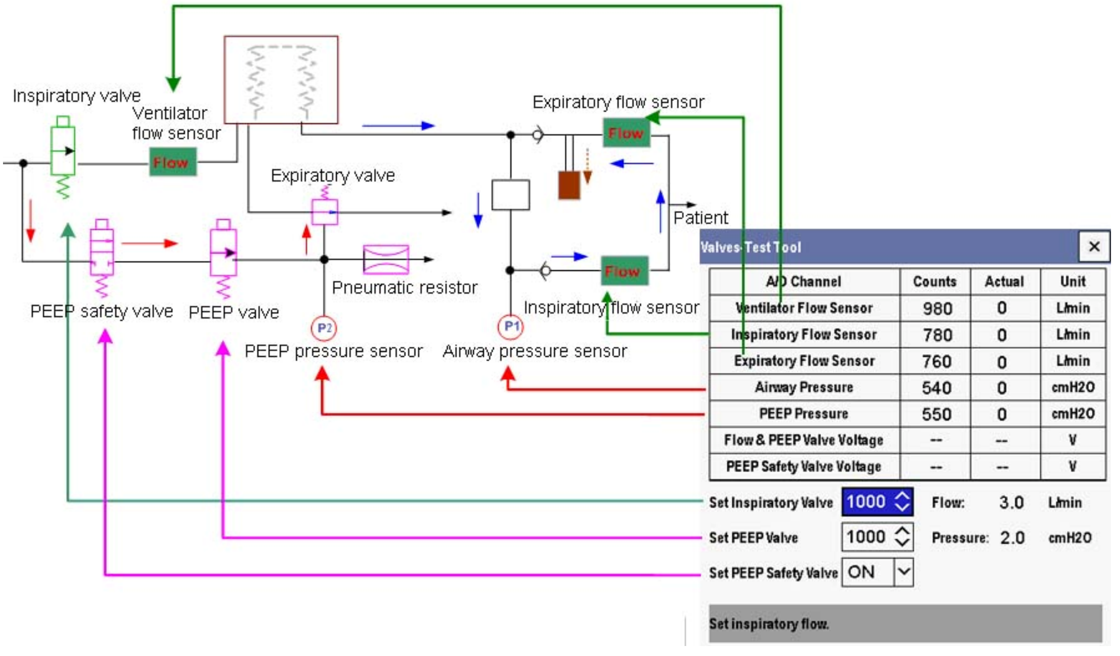
3. When the system is Standby, select the [**Maintenance**] shortcut key → [**Factory Maintenance** >>] → [**Diagnostic Test** >>] → [**Valves-Test Tool** >>] to access the [**Valves-Test Tool**] menu.

5.4.2 One-to-one Correspondence between the Sensors & Valves on the Valves-test Tool Screen and the Components

To use the valves-test tool to troubleshoot the sensors or valves related failures, you must be familiar with the one-to-one correspondence between the menu options on the valves-test tool screen and the actual pneumatic circuit and hardware components.

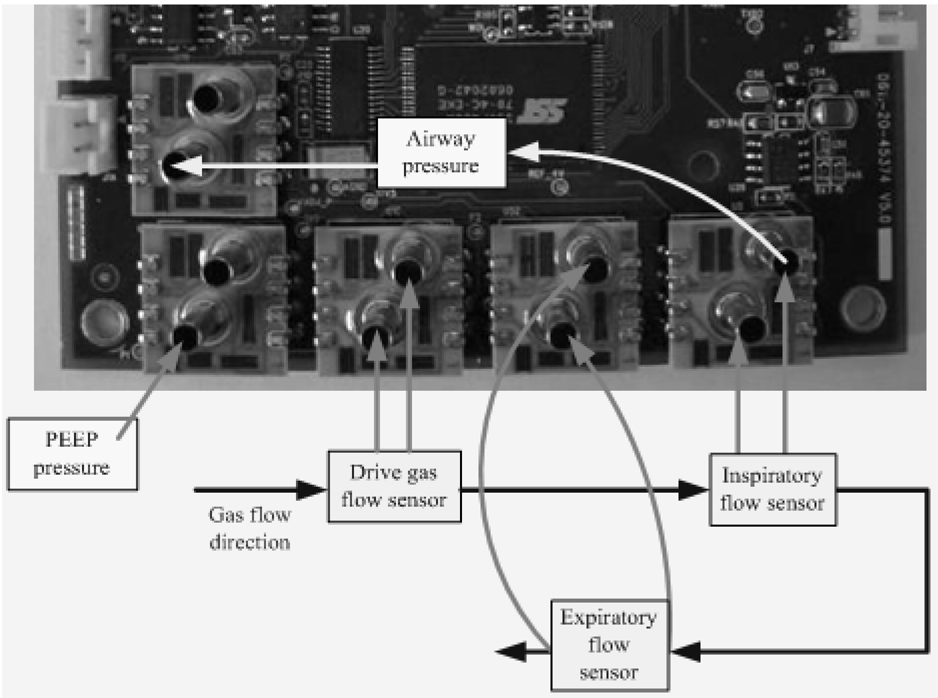
5.4.2.1 Correspondence with Pneumatic Circuit Components

The following figure shows the one-to-one correspondence between the sensors & valves on the valves-test tool screen and the actual components in the pneumatic circuit diagram.



5.4.2.2 Correspondence with Hardware Components

The following figure shows how the sampling lines of the sensors are actually connected on the monitor board.



5.4.3 Description

By using the valves-test tool, you can troubleshoot the problems related to:

- Zero points of the sensors
- Sampling line connection of the sensors
- Calibration data of the sensors
- Opening state of the inspiratory valve
- Opening states of the PEEP safety valve and PEEP proportional valve

5.4.3.1 Problems Related to Zero Points of the Sensors

By using the valves-test tool, you can easily detect if the zero points of all the pressure and flow sensors are normal.

To diagnose the zero points of the sensors:

1. Disconnect all gas supplies and make sure that the actual values of the sensors are “0”.
2. Check the A/D counts of the sensors in the valve-test tool menu, which are the zero points of the sensors.
3. If the zero point of one sensor is outside of the normal range, it indicates that the monitor board is faulty. You need to replace the board.

You can also detect the zero points of the sensors by referring to ***4.2.4Check the Sensor Zero Point.***

NOTE

- **For the normal range of sensors' zero points, refer to 4.2.4Check the Sensor Zero Point.**

5.4.3.2 Problems Related to Sampling Line Connections of the Sensors

The flow sensor has two sampling lines. Connection errors include:

- The two sampling lines are connected reversely.
- One sampling line is not connected.
- Two sampling lines are not connected.

The pressure sensor has one sampling line. Connection errors include:

- The sampling line is not connected.
- The sampling line is connected incorrectly.

By using the valves-test tool, you can detect if the sampling lines are connected normally.

- To diagnose the sampling line connection of the flow sensor:

1. Connect the tubes of the anesthesia machine following the constant-flow connection method. Refer to ***5.4.1Preparations before Using the Valves-test Tool.***
2. Make sure that gas supplies are normal. In the [**Valves-Test Tool**] menu, set the PEEP safety valve to ON and the D/A value of the PEEP valve to more than "1500", making sure that the PEEP valve closes at 30 cmH2O above.
3. Increase the D/A value of the inspiratory valve gradually and the A/D value of the flow sensor should also increase. With the gradual increase of gas supplied,
   - If the A/D value of one sensor decreases gradually, it is possible that the two sampling lines of the sensor are connected reversely.
   - If the A/D value of one sensor keeps unchanged, it is possible that the two sampling lines of the sensor are broken or not connected.
   - If the A/D value of one sensor nears saturation (above "4000") quickly, it is possible that the sampling line at the low pressure end (gas outlet end) of the sensor is not connected.
4. If sampling line connection errors are detected, re-connect the sampling lines and check their connection correctness.

- To diagnose the sampling line connection of the pressure sensor:

  During normal ventilation, if a sampling line connection error occurs, it is easily detected through the Paw waveform and technical alarms.

  - If with the increase of actual pressure, pressure waveform data decreases and the alarm of “Paw Too Low” or “Patient Circuit Leak” occurs simultaneously, it is possible that the sampling line of the airway pressure sensor is connected incorrectly.
  - If from system standy to mechanical ventilation, continuous clicks are heard and the alarm of “Pressure Monitoring Channel Failure” occurs, it is possible that the sampling line of the PEEP pressure sensor is connected incorrectly. You can enter the [**Valves-Test Tool**] menu to set the PEEP safety valve to ON. Gradullay increase the D/A value of the PEEP valve and observe if the A/D value of the PEEP pressure sensor also increases gradually. If not, it further indicates that the PEEP pressure sensor may be connected incorrectly.

  To diagnose the sampling line connection of the pressure sensor in case of pressure calibration failure:

1. Connect the tubes of the anesthesia machine following the constant-pressure connection method. Refer to ***5.4.1Preparations before Using the Valves-test Tool.***
2. Make sure that gas supplies are normal. In the [**Valves-Test Tool**] menu, set the PEEP safety valve to ON.
3. Increase the D/A value of the PEEP valve gradually and the A/D value of the pressure sensor should also increase. With the gradual increase of actual pressure,
   - If the A/D value of one sensor decreases gradually, it is possible that the sampling line of the sensor is connected incorrectly.
   - If the A/D value of one sensor keeps unchanged, it is possible that the sampling line of the sensor is not connected.
4. If sampling line connection errors are detected, re-connect the sampling lines and check their connection correctness.

5.4.3.3 Problems Related to Calibration Data of the Sensors

After confirming that both the zero points of the sensors and the sampling line connections of the sensors are normal, you can detect if the calibration data of the sensors are accurate by using the valves-test tool.

- To diagnose the calibration data of the flow sensors:
  - With the gradual increase of actual flow, the measured value of the flow sensor should also increase. Otherwise, the calibration data have errors. You need to calibrate the flow sensor again.
  - Compared with the measured value of the standard flow measurement device (anesthesia machine calibration device), the measured value of the flow sensor should be accurate. Otherwise, the calibration data have great deviations. You need to calibrate the flow sensor again.

  For details, refer to ***Check the Flow Sensor AccuracyCheck the Flow Sensor Accuracy.***
- To diagnose the calibration data of the pressure sensors:
  - With the gradual increase of actual pressure, the measured value of the pressure sensor should also increase. Otherwise, the calibration data have errors. You need to calibrate the pressure sensor again.
  - Compared with the measured value of the standard pressure measurement device (anesthesia machine calibration device), the measured value of the pressure sensor should be accurate. Otherwise, the calibration data have great deviations. You need to calibrate the pressure sensor again.

  For details, refer to ***4.2.6Check the Pressure Sensor Accuracy.***

5.4.3.4 Problems Related to Opening State of the Inspiratory Valve

By using the valves-test tool, you can detect if the opening state of the inspiratory valve is normal.

1. The methods for tube connections and settings of the anesthesia machine are same to those of sampling line connections of the flow sensors. For details, refer to ***5.4.3.2Problems Related to Sampling Line Connections of the Sensors.***
2. In the [**Valves-Test Tool**] menu, gradually increase the D/A value of the inspiratory valve. If the measured values of the ventilator flow sensor, inspiratory flow sensor, and expiratory flow sensor change very little and low gas flow is felt at the connector of water collection cup, it indicates that the inspiratory valve or the D/A on the monitor board is faulty.
3. Normally, when the D/A value of the inspiratory valve is set to “2500”, the flow measured by the standard flow measurement device can reach 90 L/min.

4. If when the D/A value of the inspiratory valve is set to more than "4000", the flow measured by the standard flow measurement device fails to reach 90 L/min, flow calibration will be failed. In this case, you need to replace the expiratory valve assembly or the monitor board.
5. To locate if the DA on the monitor board is faulty, you can use a multimeter to measure the output of DA on the monitor board corresponding to the inspiratory valve. If voltage also increases with the increase of D/A value, and voltage nears 6V when D/A value is set to more than "4000", it indicates that the DA on the monitor board corresponding to the inspiratory valve may be normal.
6. After the expiratory valve assembly or monitor board is replaced, you can use the similar method to check if the problem is fixed.

5.4.3.5 Problems Related to Opening States of the PEEP Safety Valve and PEEP Valve

When the PEEP safety valve is permanently OFF and the gas supplies are normal, the [**Drive Gas Pressure Low**] is alarmed. When the PEEP valve is faulty, pressure related alarms occur in mechanical ventilation state.

By using the valves-test tool, you can detect if the opening states of the PEEP safety valve and PEEP valve are normal.

■ To diagnose the opening state of the PEEP safety valve:

1. Make sure that gas supplies are normal.
2. In the [**Valves-Test Tool**] menu, when the PEEP safety valve is switched on, a subtle click is heard.
3. Adjust the D/A value of the PEEP valve to cause the pressure measured by the PEEP pressure sensor to exceed 0 cmH2O.
4. Switch off the PEEP safety valve. The pressure measured by the PEEP pressure sensor should drop to 0 cmH2O immediately. Switch on the PEEP safety valve again. The measured value of the PEEP pressure sensor rapidly restores almost the same value to that before PEEP safety valve is switched off. During this period, gas flow and also change of gas flow when the PEEP safety valve is switched on or off can be felt at the PEEP outlet, which helps to judge if the PEEP safety valve can be switched on or off normally.
5. If an error is detected, it is possible that the PEEP safety valve or the safety valve drive voltage on the monitor board is faulty. You can use a multimeter to measure the drive signals on the monitor board corresponding to the PEEP safety valve (measurement can be performed at the corresponding socket). When the PEEP safety valve is turned on, the drive voltage should near 6V. When the PEEP safety valve is turned off, the drive voltage should near 0V. If these two conditions are met simultaneously, the monitor board is normal.

6. If the PEEP safety valve is faulty, replace the expiratory valve assembly. After replacement, you can use the similar method to check if the problem is fixed.

■ To diagnose the opening state of the PEEP valve:

1. Make sure that gas supplies are normal. In the [**Valves-Test Tool**] menu, set the PEEP safety valve to ON.
2. With the increase of D/A value of the PEEP valve, the measured value of the PEEP pressure sensor (or the anesthesia machine calibration device) should also rise. Note that there is a non-response area for the PEEP valve when the D/A value is relatively small. When the D/A value is less than this area, the PEEP valve cannot be opened and the output is “0” continuously. When the D/A value is greater than this area, the pressure output will increase with the increase of D/A value. This phenomenon also exists for the inspiratory valve.
3. For subsequent diagnosis rules, refer to ***5.4.3.4Problems Related to Opening State of the Inspiratory Valve.***

5.5 Hardware and Electrical Problems

Failure description	**Possible cause**	**Recommended action**
During the operation of the anesthesia machine, the display and AC indicator lamp are extinguished all of a sudden and the ventilator cannot be started.	The AC power supply is not connected properly and the capacity of the built-in battery is insufficient.	Check and make sure that the AC power supply is connected properly.
	The fuse of the mains inlet is damaged.	Replace the fuse. If the fuse is burned repeatedly, it indicates that the machine internal power is short-circuited.
The auxiliary electrical outlet has no output voltage.	The fuse of the auxiliary electrical outlet is damaged.	Replace the fuse.
	The isolation transformer is damaged.	Replace the isolation transformer.
During the operation of the anesthesia machine, the display is extinguished all of a sudden and ventilation remains normal.	The connection line of the internal inverter gets loose.	Properly insert the connection line of the inverter.
When started up, the screen is immediately lit and dazzling. The screen	The power board software is damaged.	1. Disconnect the AC power supply and battery. Wait for 5 minutes to cause the power board to fully

becomes normal scores of seconds later. The alarm of power board communication failure occurs.		discharge and reset. Then update the power board software again. 2. If the problem persists, replace the power board.
During the operation of the anesthesia machine, ventilation stops all of a sudden but the display and buttons work normally.	The monitor board or valve is damaged.	Enter [**Maintenance**] → [**Factory Maintenance** >>] . Enter the required password to access the [**Factory Maintenance**] menu. Enter [**Diagnostic Test** >>] → [**Valves-Test Tool**>>] Test the status of each valve and reference power supply in the valves-test tool window. If valve malfunction or reference power supply error is detected, return the valve or monitor board to factory for repair.
The heater malfunctions.	The power board is damaged.	Repair the power board.
	The heater is burned.	Replace the heater.
	The thermistor inside the heater is damaged.	Replace the heater.
	The cable gets loose.	Properly insert the heater-related cable.
The anesthesia machine cannot be started up.	The system switch cable falls off or other cable gets loose.	Properly insert the system switch cable or the loose cable.
	The fuse of the mains inlet is damaged.	Replace the fuse.
	The power board software is damaged.	Disconnect the AC power supply and battery. Wait for 5 minutes to cause the power board to fully discharge and reset. Restart the machine. If the machine works normally, it indicates that the software failure is fixed. If not, the problem is caused by hardware failure.
	The power board hardware is faulty.	Return the power board to factory for repair.
	The system switch is ineffective or the screws on the system switch get loose.	Repair the system switch or tighten the screws on the system switch.

Exiting Standby fails.	The cable between the monitor board and the main control board gets loose.	Properly insert the cable between the monitor board and the main control board.
	The monitor board hardware selftest is failed.	Return the monitor board to factory for repair.
The buttons malfunction.	The buttons are ineffective.	Replace the keyboard.
	The cable gets loose.	Properly insert the cable between the keyboard and button board.
The isolation transformer buzzes.	The anesthesia machine is powered by 220V AC.	Resort to 110 V power supply
Alarm messages are displayed on the screen but without alarm sound.	The button board or speaker is damaged.	Return the button board to factory for repair or replace the speaker.
Operating the control knob is not responded.	The control knob is ineffective.	Replace the control knob.
	The button board is damaged.	Return the button board to factory for repair.
Network connection is failed.	The cables connected to the network connection board get loose.	Properly insert the cables.
	The network cable is too long.	Shorten the network cable. Recommended cable length is approximately 1.5 m.
	The network cable is used incorrectly.	The network cable has two linear orderings which should be differentiated.
No gas is outputted through the valve in mechanical ventilation mode.	The bag/mechanical ventilation switch is faulty or the ACGO switch is turned on.	Check the screen to see if the anesthesia machine is in mechanical ventilation mode and if there is an alarm triggered.
	The valve cannot be opened.	1. Set tidal volume to maximum. 2. Switch between standby and mechanical statuses or between manual and mechanical statuses repeatedly. 3. Replace the pneumatic circuit block.

6 Repair and Disassembly

⚠WARNING

- **To help prevent fires, only use lubricants approved for anesthesia or O_2 equipment.**
- **Do not use lubricants that contain oil or grease. They burn or explode in high O_2 concentrations.**
- **Obey infection control and safety procedures. Used equipment may contain blood and body fluids.**
- **Movable part and removable components may present a pinch or a crush hazard. Use care when moving or replacing system parts and components.**
- **Use care when disassembling the parts with sharp edges to avoid cuts.**
- **Pay attention to the screws during the disassembly to prevent screws from falling into the inside of the equipment. Failure to do so may cause short circuit.**
- **Make sure to bleed gas pressure before disassembling pneumatic fittings to avoid personal injury caused by high pressure gas.**

NOTE

- **When re-assembling, inspect all parts for deterioration. Replace them if necessary. Use appropriate screws and parts.**
- **After repairs are completed or parts replaced, perform the checkout procedure. Refer to3Checkout and Test.**

6.1 Prepare for Disassembly

6.1.1 Tools

During parts disassembling and replacing, the following tools may be required:

- Metric Allen wrench (2.5#, 3#, 4#, 5#, 8#)
- Phillips screwdriver
- Diagonal pliers
- Flathead screwdriver
- Metric M3 and M4 socket screwdriver
- Flowmeter calibration fixture
- Adjustable wrench
- Tweezers
- M16 nut mounting fixture (0621-J26-1)

6.1.2 Preparations

Before disassembly,

- Make sure that the anesthesia machine is turned off and disconnected from the AC power source.
- Bleed the gas pressure inside the anesthesia machine as described below.
- Disconnect all pipeline and cylinder gas supplies.
- Prepare the tools required for disassembly.
- Maneuver the anesthesia machine to an appropriate location and then step down the four caster brakes to fix the machine.

⚠CAUTION

- **The internal parts may be contaminated during long-term use of the equipment. Wear special gloves during disassembling and inspecting.**

6.1.3 Bleed Gas Pressure

Make sure to bleed the gas pressure inside the anesthesia machine before disassembling pneumatic fittings to avoid personal injury or equipment damage. To bleed gas pressure:

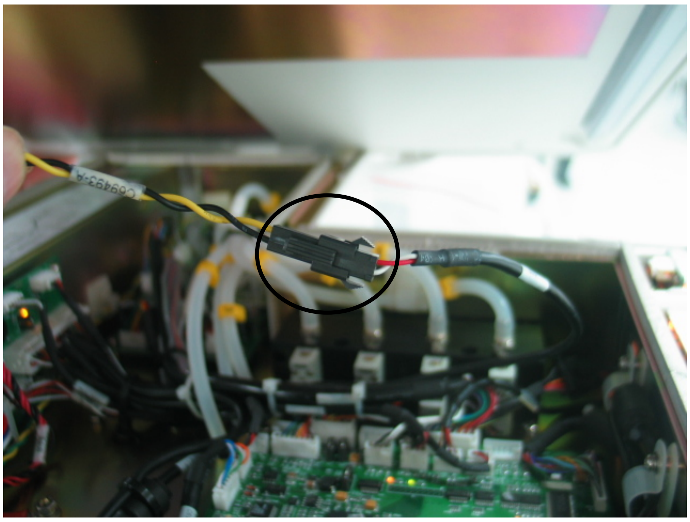
1. Close other cylinder valves and disconnect pipeline gas supplies. Do not disconnect the O2 pipeline. If O2 pipeline is not available, connect O2 cylinder and open the O2 cylinder valve.
2. Set the system switch to ON.
3. Turn on all the flow controls (except O2).
4. Make sure that N2O and AIR pipeline pressure gauges read zero.
5. Disconnect the O2 pipeline supply (or close the O2 cylinder valve). Push the O2 flush button to bleed O2 from the system.
6. Set the system switch to OFF.

6.2 Disassemble the Assemblies

6.2.1 Remove the Top Panel

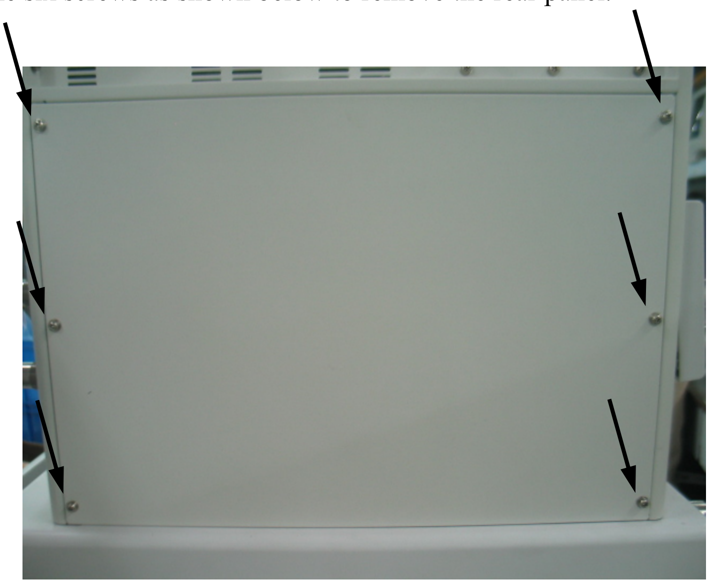
1. Pry up the screw plugs and unscrew the eight screws as shown below.

2. Lift off the top panel and disconnect the air connector between the table toplight power cord and the power signal transfer cable.



6.2.2 Remove the Rear Panel

Unscrew the six screws as shown below to remove the rear panel.



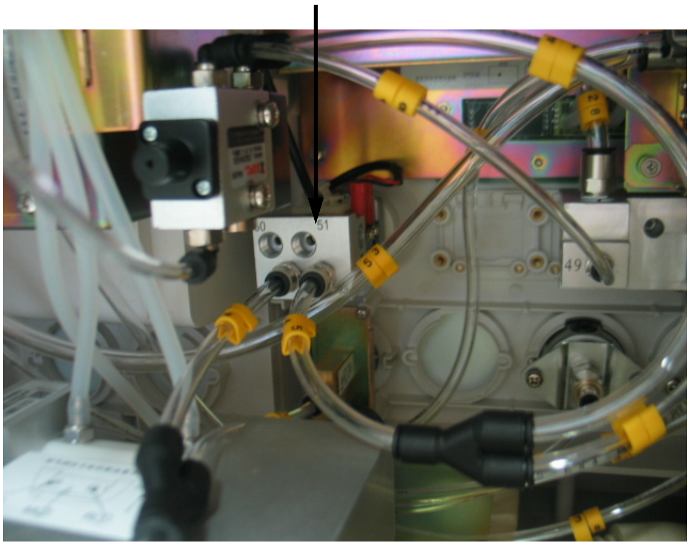
6.2.3 Remove the Trolly Rear Panel Assembly

Unscrew the eight screws as shown below to remove the trolly rear panel.

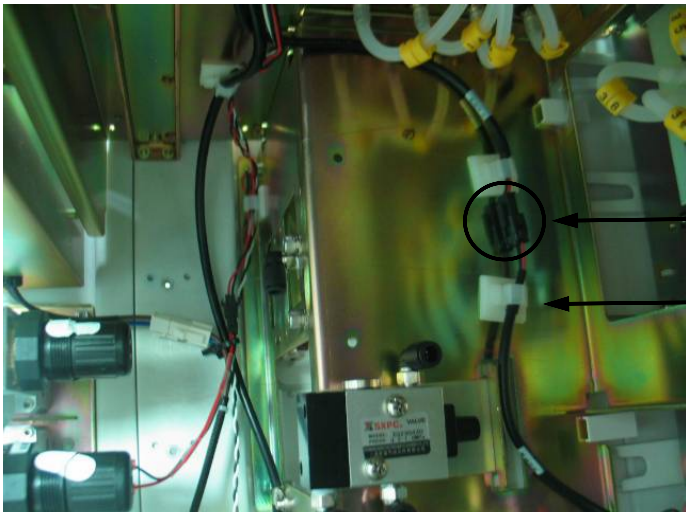
6.2.4 Replace the System Switch

1. Disconnect all the connected tubes.

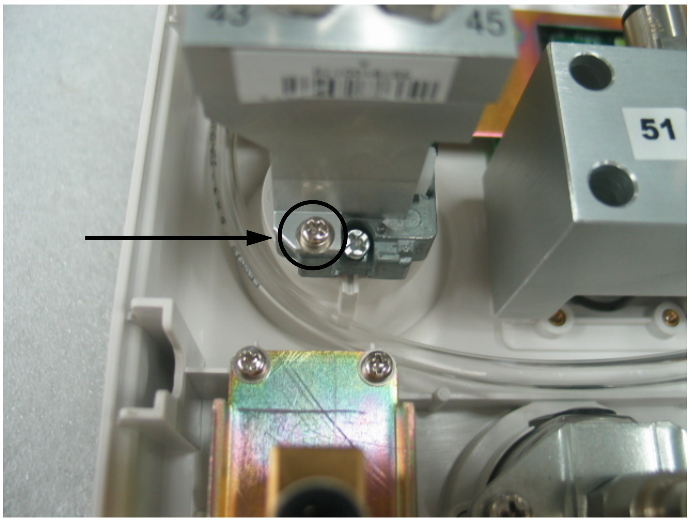
System switch



2. Disconnect the air connectors.

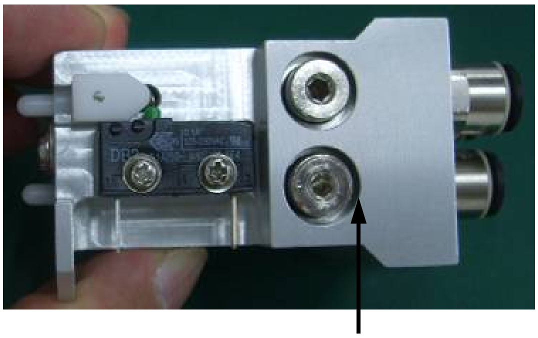


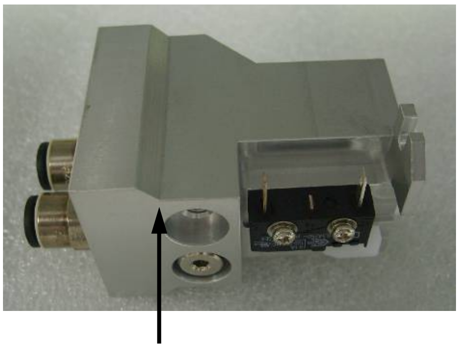
3. Unscrew the screw as shown below.



4. Unscrew the screw on the other side to remove the system switch assembly.

The following pictures show the appearance of system switch.

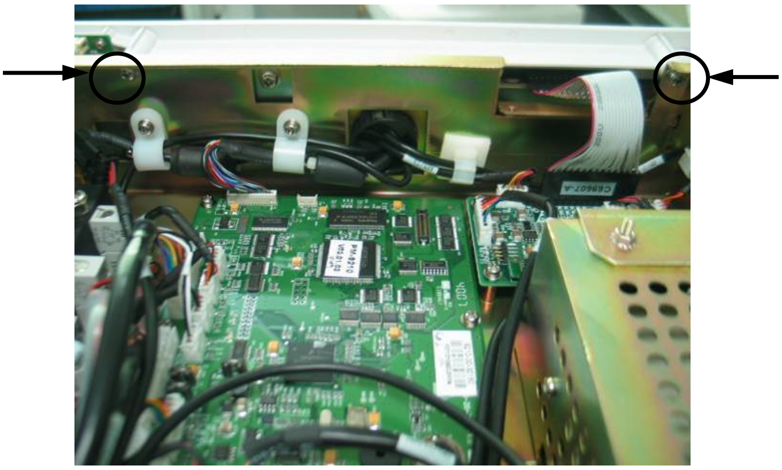




O2+AIR system switch O2 system switch

6.2.5 Remove the Left Front Panel Assembly

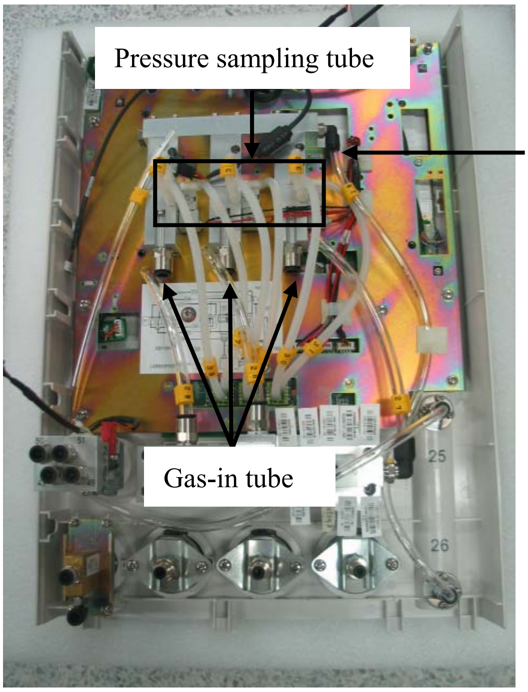
1. Unscrew the two screws and disconnect the related lines as shown below.



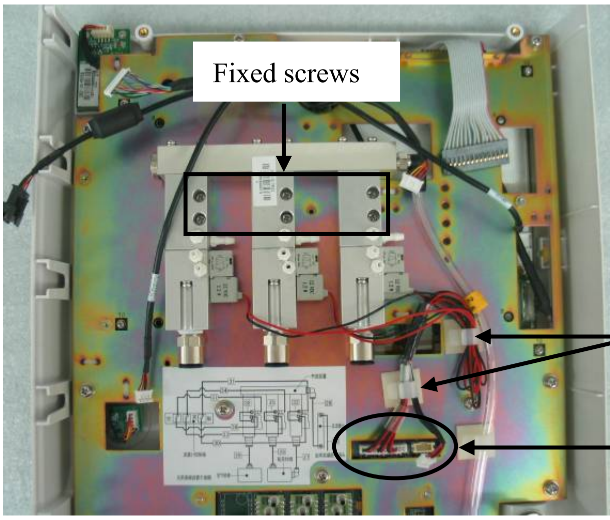
2. Disconnect all the tubes connected to the system switch, O2 flush button, needle valve, pressure gauge, total flowmeter and main unit and remove the left front panel from the main unit.

6.2.6 Remove the Throttling Device

1. Follow the steps described in ***6.2.5Remove the Left Front Panel Assembly.***
2. Disconnect the gas-in tube, gas-out tube and pressure sampling tube.

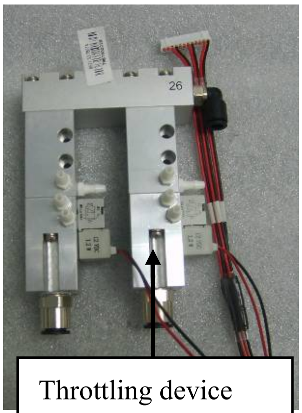


3. Open the cable ties and disconnect the connection lines from the flowmeter control board. Unscrew the fixed screws.

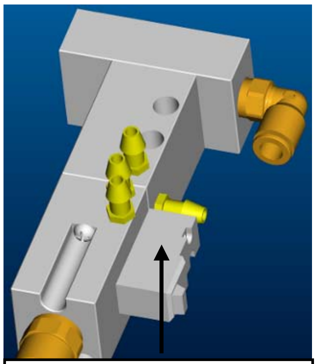


The following pictures show the appearance of throttling device.

Throttling device (O2+N2O+AIR)



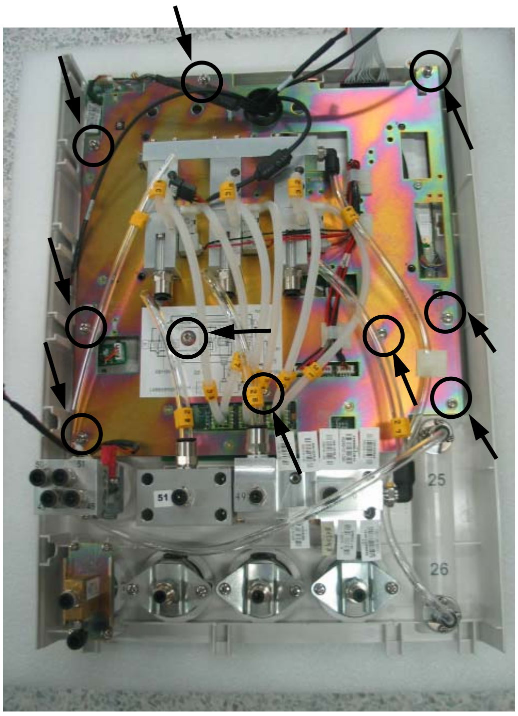
Throttling device (O2+N2O/O2+AIR)



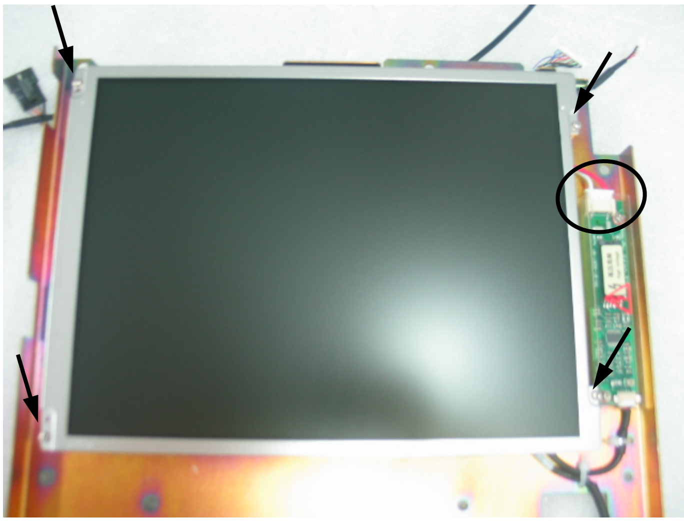
Throttling device (O2)

6.2.7 Disassemble the Display Assembly

1. Follow the steps described in ***6.2.5Remove the Left Front Panel Assembly.***
2. Disconnect the connection lines and tubes from the throttling device. Unscrew the 10 screws to remove the display assembly, as shown below.



3. Turn over the assembly. Disconnect the connection lines to the inverter and unscrew the four screws to remove the display, as shown below.



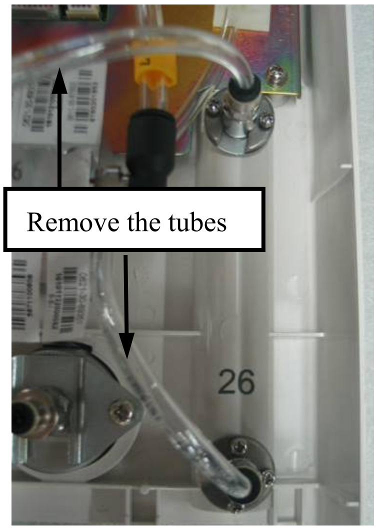
6.2.8 Remove the Flowmeter Control Board

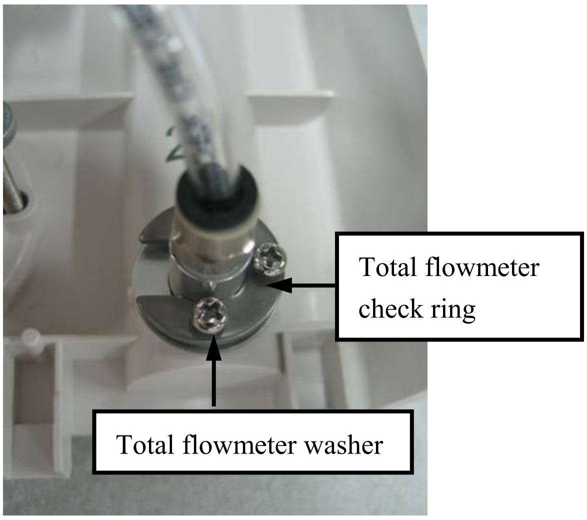
1. Follow the steps described in ***6.2.7Disassemble the Display Assembly***
2. Unscrew the four screws to remove the electronic flowmeter control board, as shown below.

6.2.9 Remove the Total Flowmeter

1. Follow the steps described in ***6.2.5Remove the Left Front Panel Assembly.***

2. Disconnect the two tubes from the total flowmeter. Unscrew the six screws. Take out the check ring and washer for the total flowmeter to remove the flowmeter, as shown below.

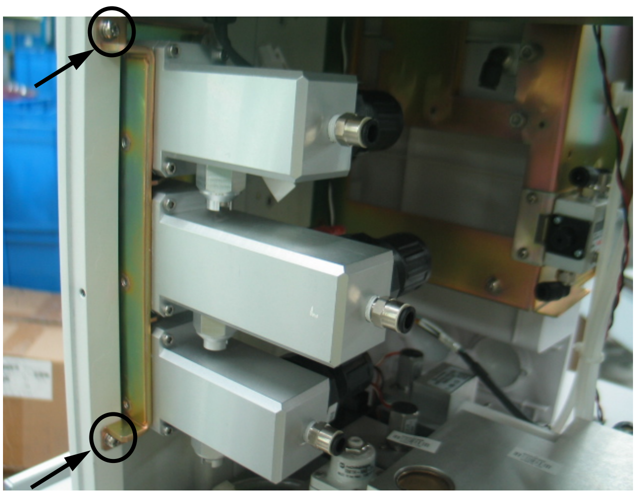


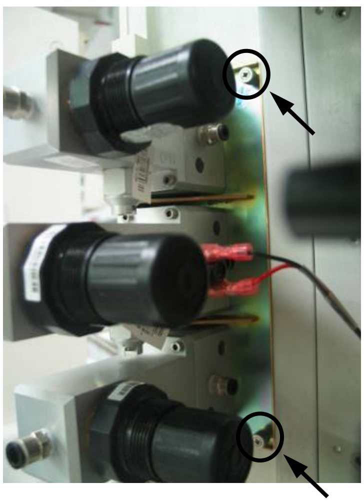


The following picture shows the appearance of total flowmeter.

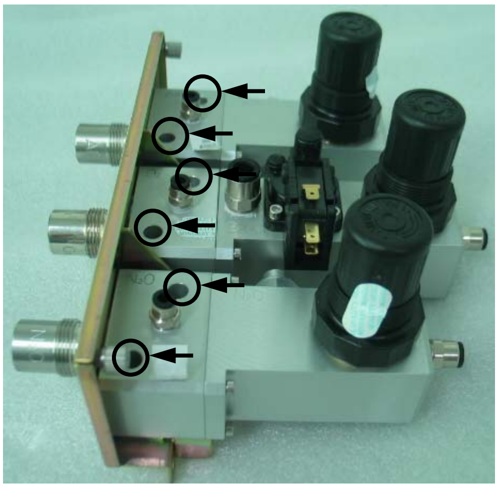
6.2.10 Disassemble the Gas Supply Inlet Assembly

1. Disconnect the gas tubes from the gas supply inlet assembly. Disconnect the connection line from the pressure switch. Unscrew the four screws to remove the gas supply inlet assembly, as shown below.





2. Unscrew the six screws to remove the O2, N2O and AIR supply inlet assemblies respectively, as shown below.



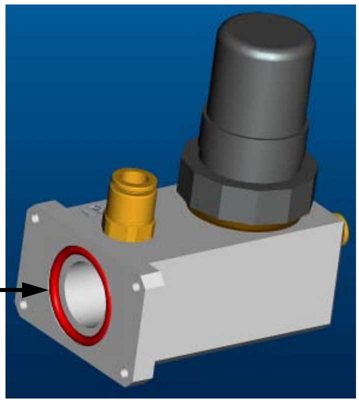
3. Unscrew the four screws on the gas supply inlet assembly to remove the assembly (take AIR supply inlet assembly for an example).

O2 supply inlet assembly

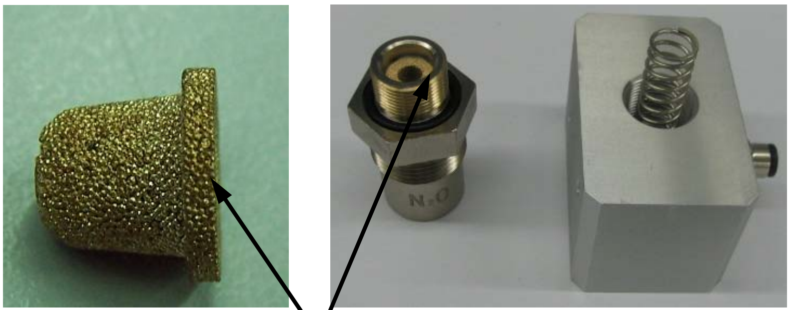
N2O supply inlet assembly

AIR supply inlet assembly

4. Replace the seal and filter on the gas supply inlet assembly.



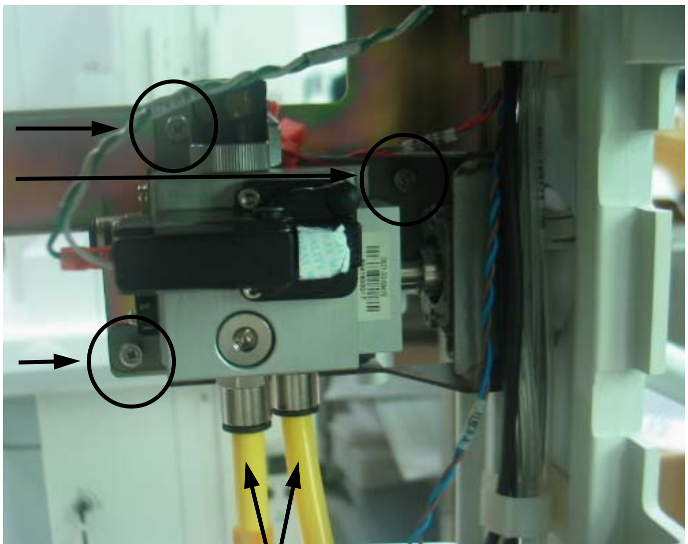
Seal



Filter

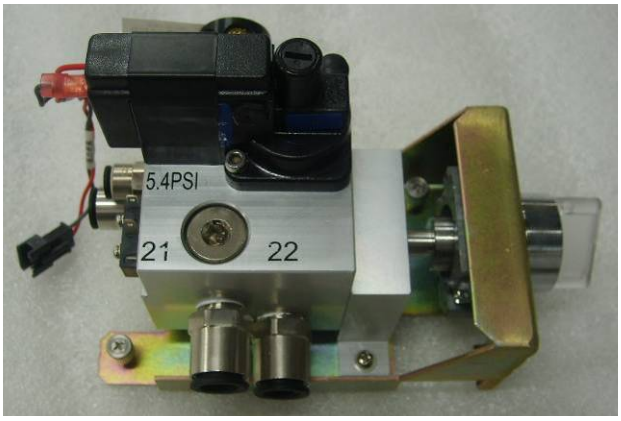
6.2.11 Remove the ACGO Switch Assembly

Disconnect the gas tubes and connection lines from the ACGO switch assembly. Then unscrew the three screws to remove the ACGO switch assembly, as shown below.



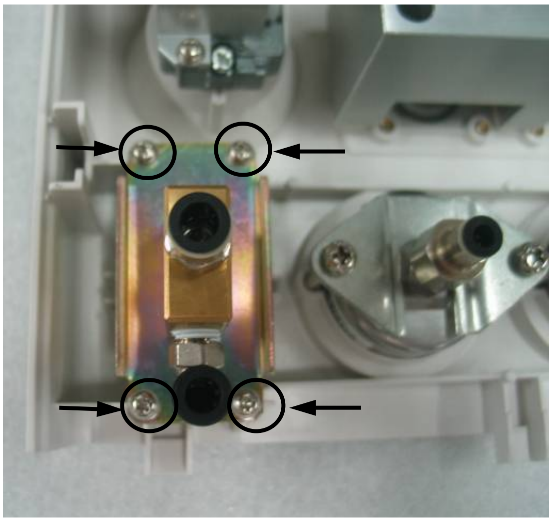
Gas tube

The following picture shows the appearance of ACGO switch assembly.



6.2.12 Remove the O2 Flush Button Assembly

Disconnect the gas tubes from the O2 flush button assembly. Then unscrew the four screws to remove the O2 flush button assembly, as shown below.



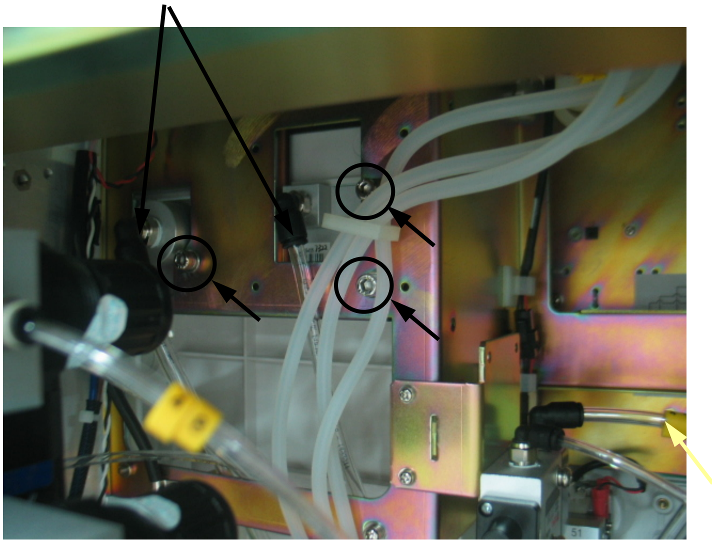
The following picture shows the appearance of O2 flush button assembly.

6.2.13 Remove the Vaporizer Manifold Assembly

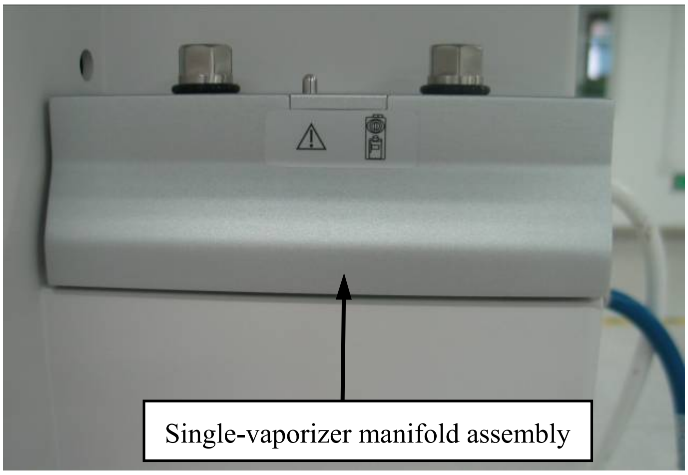
Single-vaporizer Manifold Assembly

1. Disconnect the gas tubes from the vaporizer manifold and then unscrew the four screws as shown below.

Remove the gas tubes



2. Pull out the manifold assembly.

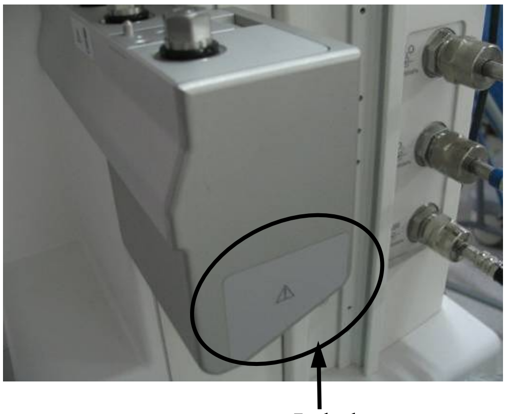


The following picture shows the appearance of single-vaporizer manifold assembly.

Double-vaporizer Manifold Assembly

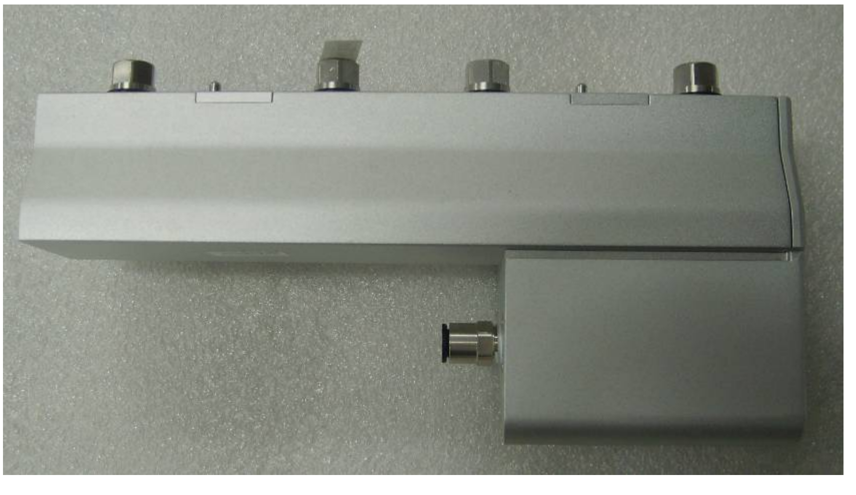
1. Disconnect the gas tubes from the vaporizer manifold and then unscrew the two screws as shown below.

2. Remove the label and unscrew the two screws as shown below. Then pull out the manifold.



Label

The following picture shows the appearance of double-vaporizer manifold assembly.

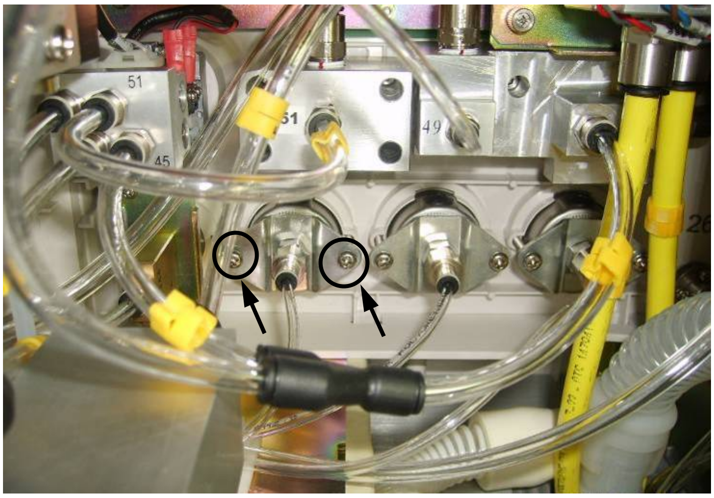


6.2.14 Disassemble the Pipeline Pressure Gauges

Each pipeline pressure gauge can be disassembled separately in the same way. The following takes AIR cylinder pressure gauge for an example.

1. Find the AIR cylinder pressure gauge by referring to the gauge label on the left front panel of the anesthesia machine.

2. Pry up and remove the gauge overlay by using the tweezers.
3. Disconnect the gas tubes and unscrew the two screws as shown below to take out the pressure gauge.



The following pictures show the appearance of AIR cylinder pressure gauge.

6.2.15 Disassemble the Expiratory Valve Assembly

1. Unscrew the screws fixing the connection line to the pneumatic block. Disconnect the connection line between the monitor board and the pressure switch.

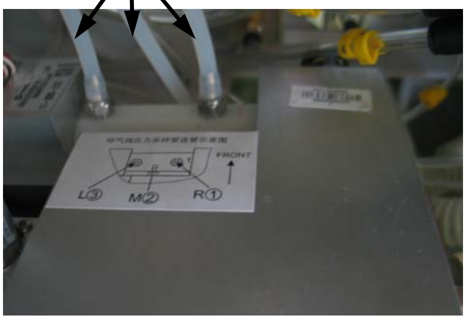
Disconnect the connection line from the monitor board

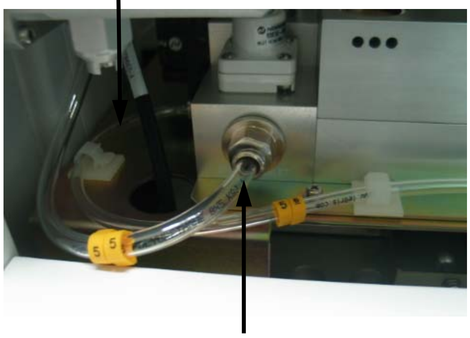
Disconnect the connection line from the pressure switch

2. Disconnect the tubes.

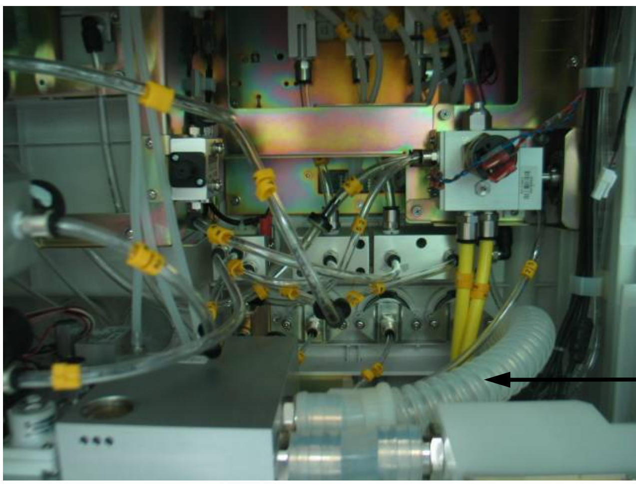
Disconnect three pressure sampling tubes

Disconnect the tube from gas reservoir



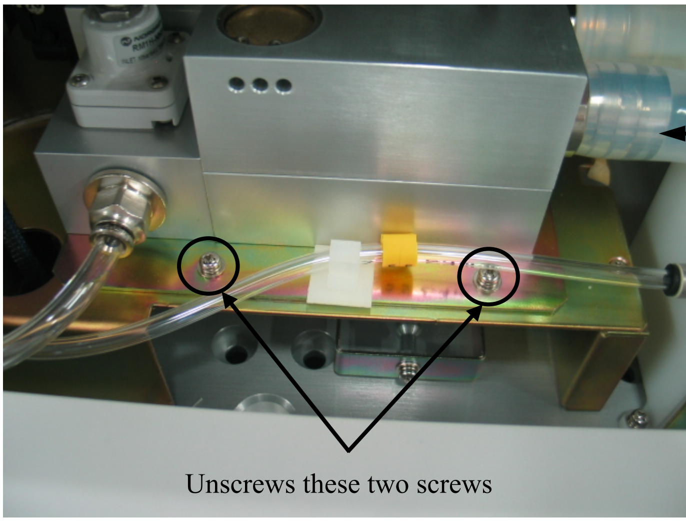


Remove the drive gas tube



Remove the drive gas tube

3. Unscrew the screws to remove the expiratory valve.



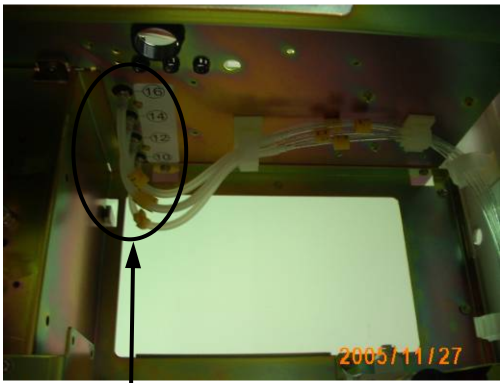
Disconnect the tube from the gas reservoir simultaneously

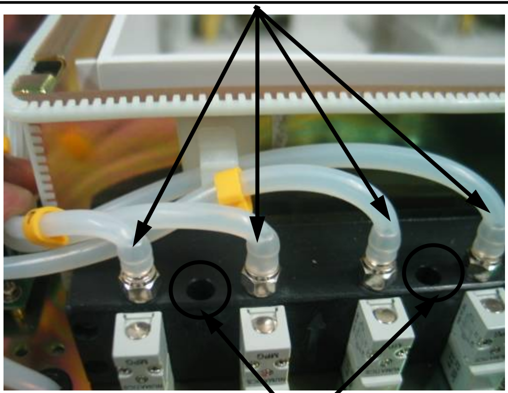
The following picture shows the appearance of expiratory valve.

6.2.16 Remove the Three-way Valve

Disconnect the connection line between the three-way valve and the monitor board. Disconnect the four pressure sampling tubes between the patient circuit and the three-way valve and unscrew the two screws as shown below to remove the three-way valve.

Disconnect the pressure sampling tubes between the patient circuit and the three-way valve



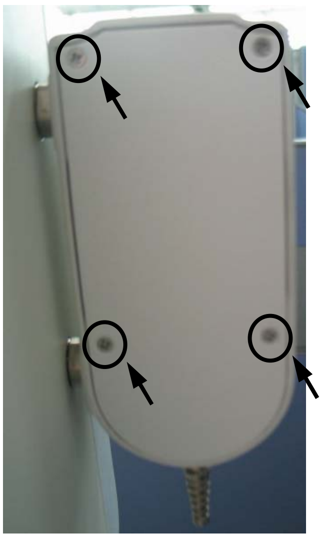


Disconnect the pressure sampling tubes between the patient circuit and the three-way valve

Unscrew these two screws

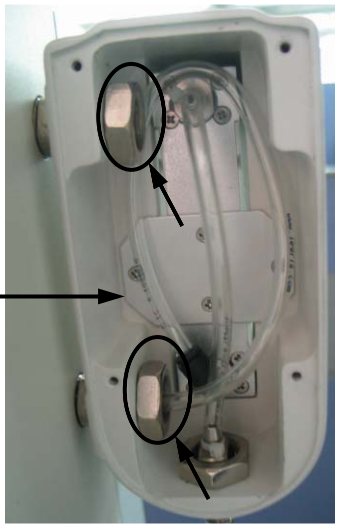
6.2.17 Remove the Auxiliary O2 Supply Assembly

1. Unscrew the four screws on the rear panel of auxiliary O2 supply assembly, as shown below.



2. Disconnect the tubes from the main unit. Unscrew the two nuts using M16 nut mounting fixture (0621-J26-1) to remove the assembly.

Disconnect the tube from
Φ 6 bent connector

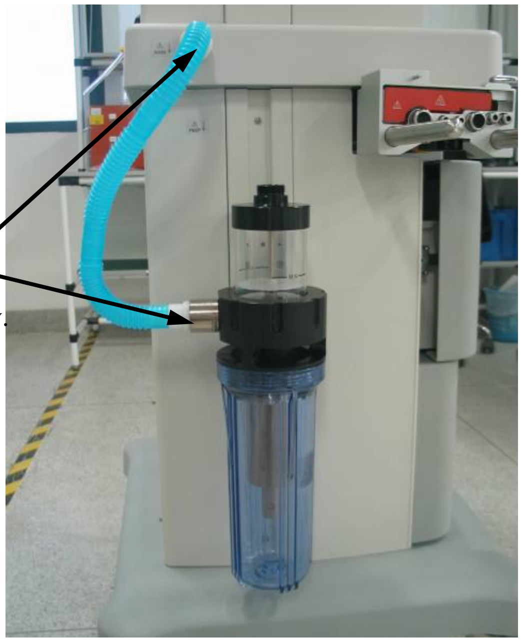


The following picture shows the appearance of auxiliary O2 supply assembly.

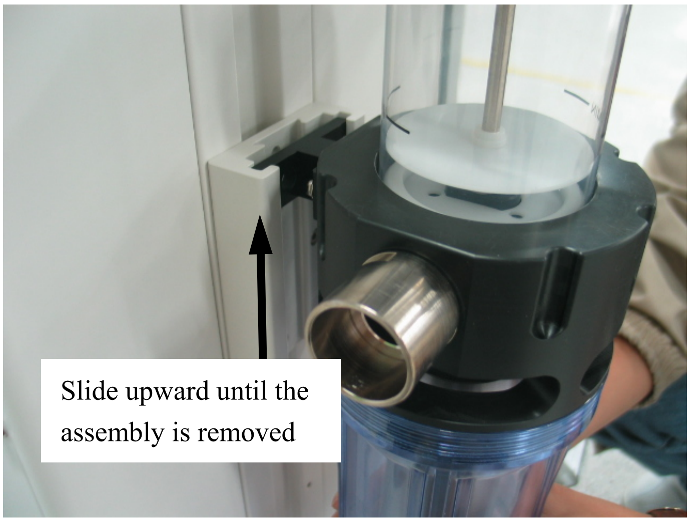
6.2.18 Remove the AGSS Assembly

1. Remove the transfer tube assembly.

Remove the two
connectors on the
transfer tube assembly.



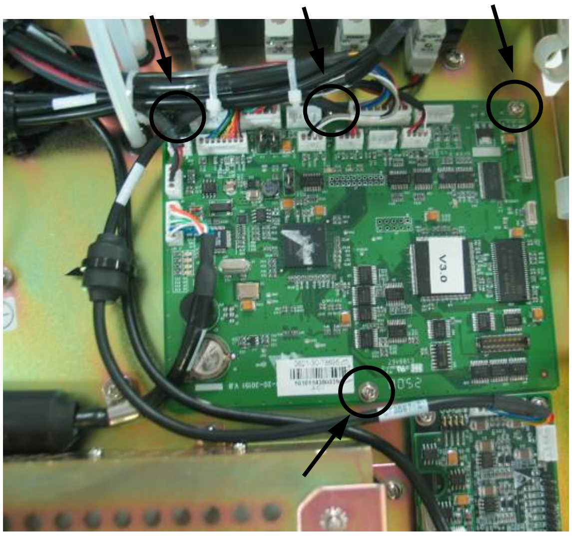
2. Hold and slide the AGSS main unit upward along the bracket to remove the AGSS assembly, as shown below.



The following picture shows the appearance of AGSS assembly.

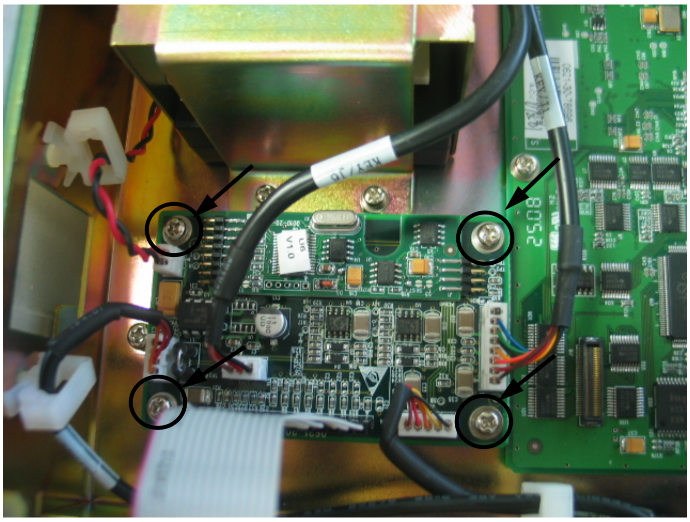
6.2.19 Remove the Main Control Board

Disconnect the connection lines from the main control board. Unscrew the 4 screws as shown below to remove the main control board.



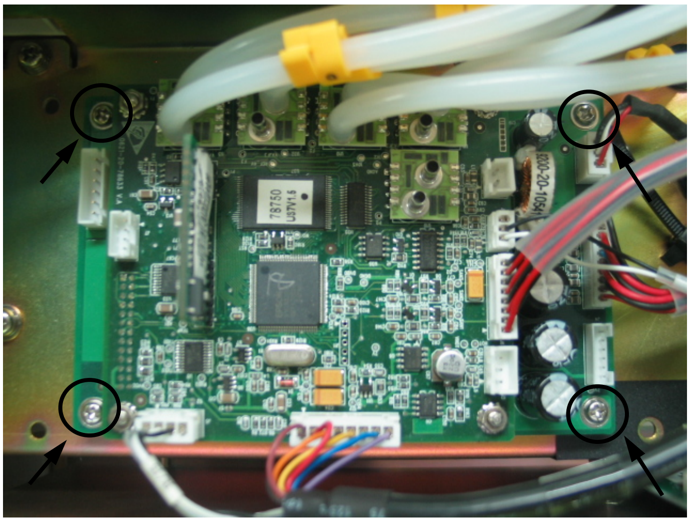
6.2.20 Remove the Button Board

The button board is located beside the battery box and main control board. Disconnect the connection lines from the button board. Unscrew the four screws as shown below to remove the button board.

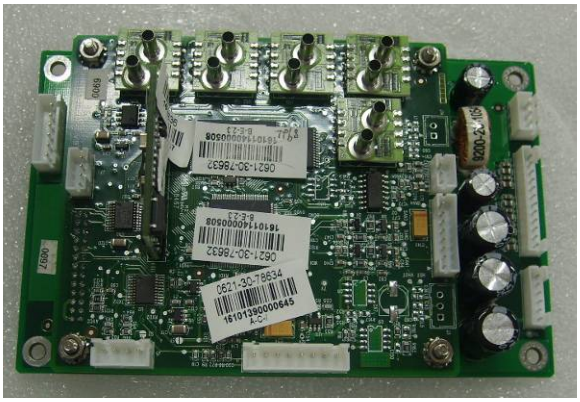


6.2.21 Remove the Monitor Board

The monitor board is located beside the power box. Disconnect the connection lines and tubes from the monitor board. Then unscrew the four screws as shown below to remove the monitor board.

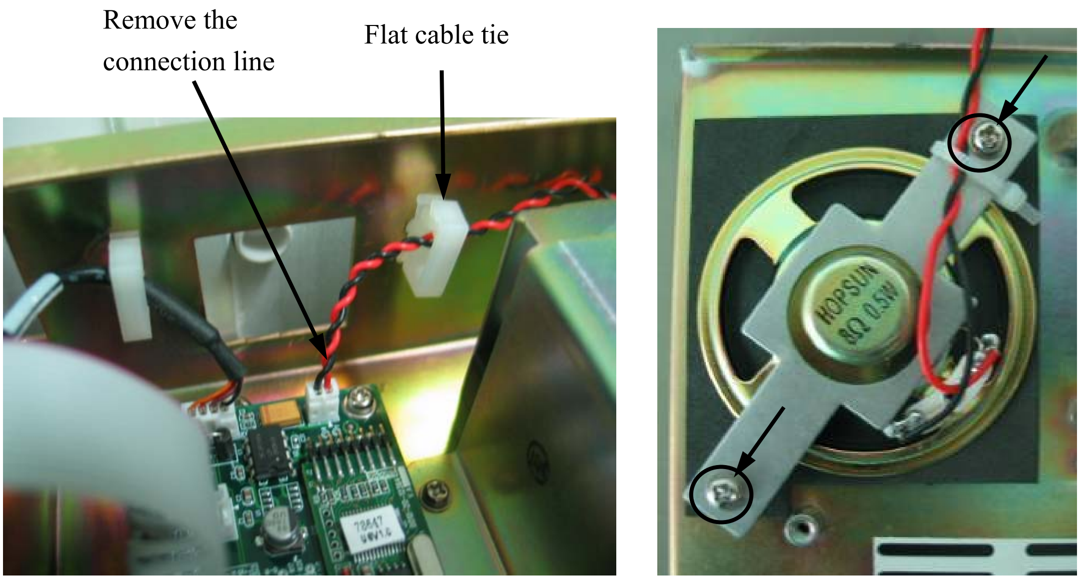


The following picture shows the appearance of monitor board.



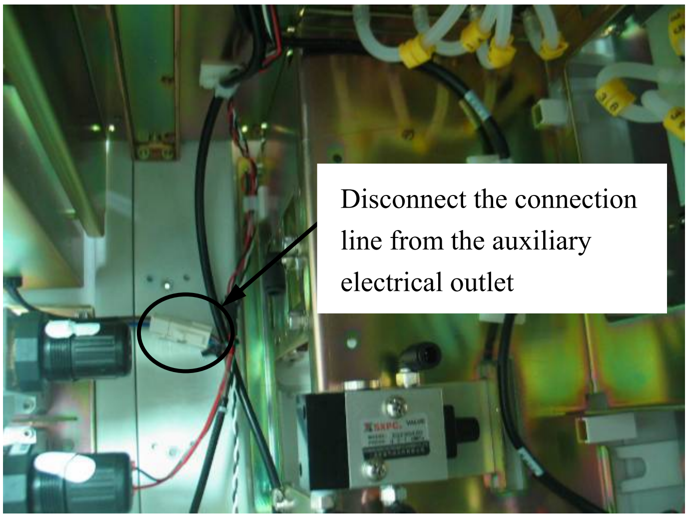
6.2.22 Remove the Speaker

Disconnect the connection lines from the button board. Open the flat cable tie. Unscrew the two screws to remove the speaker, as shown below.

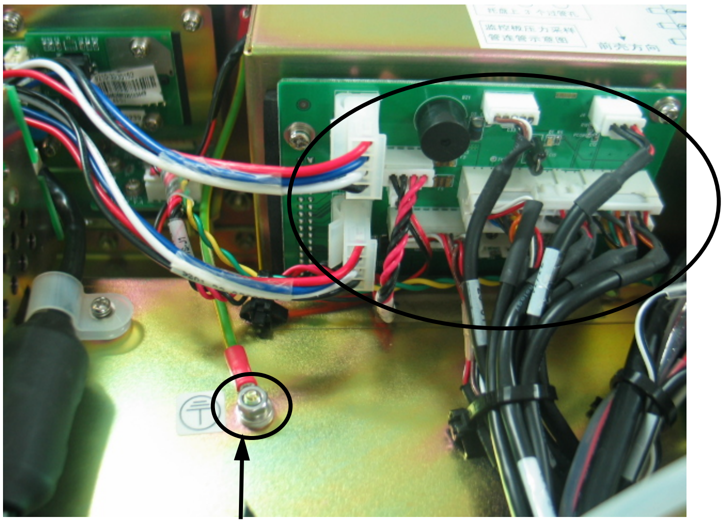


6.2.23 Remove the Power Box

1. Remove the rear panel and disconnect the connection line from the auxiliary electrical outlet.

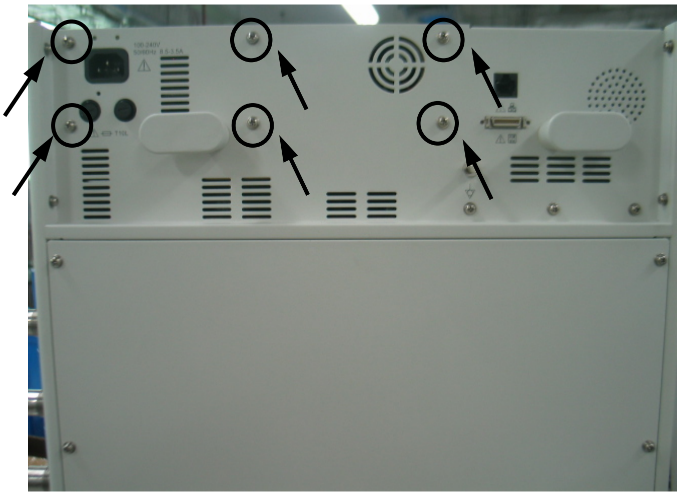


2. Disconnect the connection line from the power conversion board and remove the grounding cable.



Remove the grounding cable

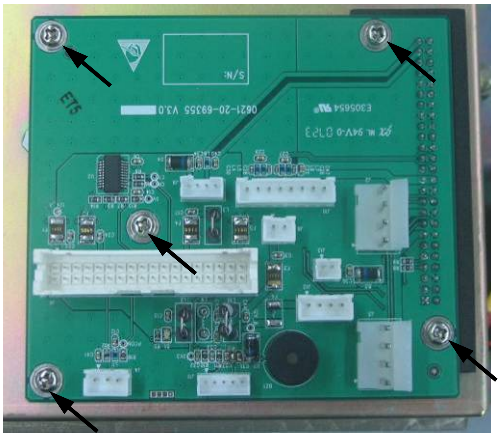
3. Unscrew the six screws as shown below to take out the power box.



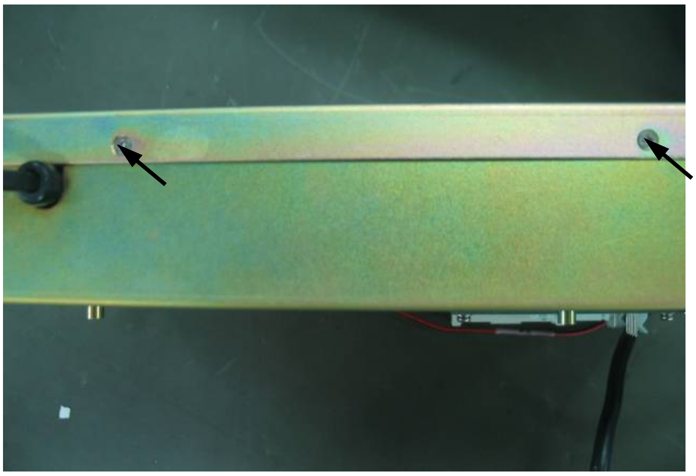
The following picture shows the appearance of power box..

6.2.24 Replace the Power Board

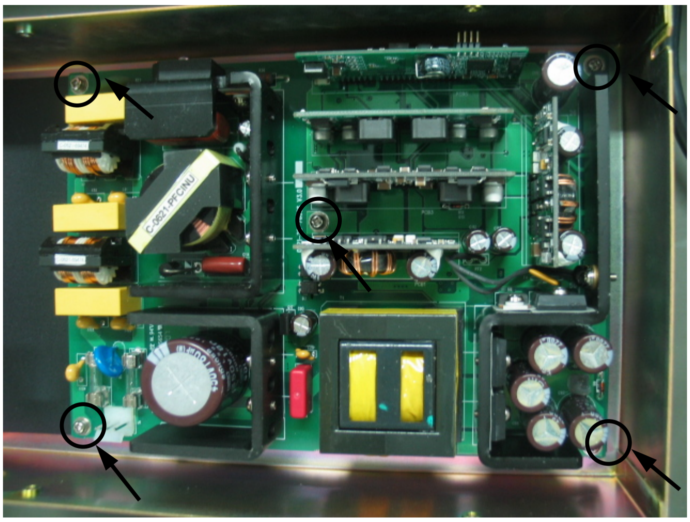
1. Follow the steps described in ***6.2.23Remove the Power Box.***
2. Unscrew the five screws on the power conversion board as shown below.



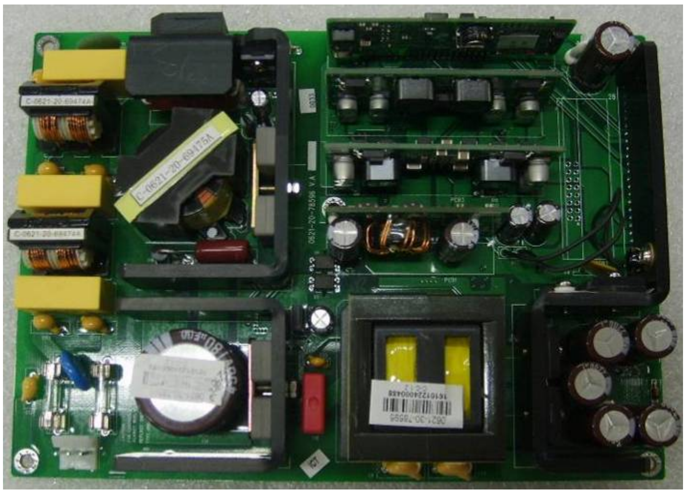
3. Unscrew the four screws on both sides of the power box to open the power box.



4. Unscrew the five screws as shown below to remove the board.



The following picture shows the appearance of power board.

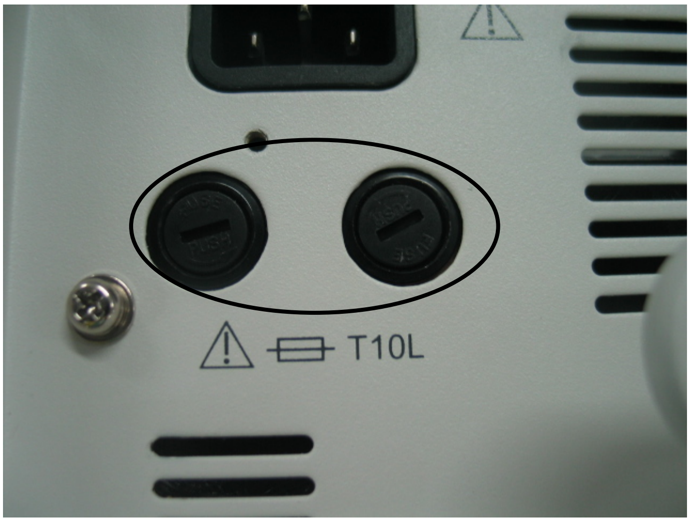


⚠**WARNING**

- **Before replacing the power board, be sure to turn off the system switch and unplug the power cord to prevent electric shock.**

6.2.25 Replace the Fuse

1. Screw out the fuse by using the flathead screwdriver as per the direction marked on the fuse holder.



2. Insert a new fuse and tighten the fuse cover by using the flathead screwdriver.

⚠**WARNING**

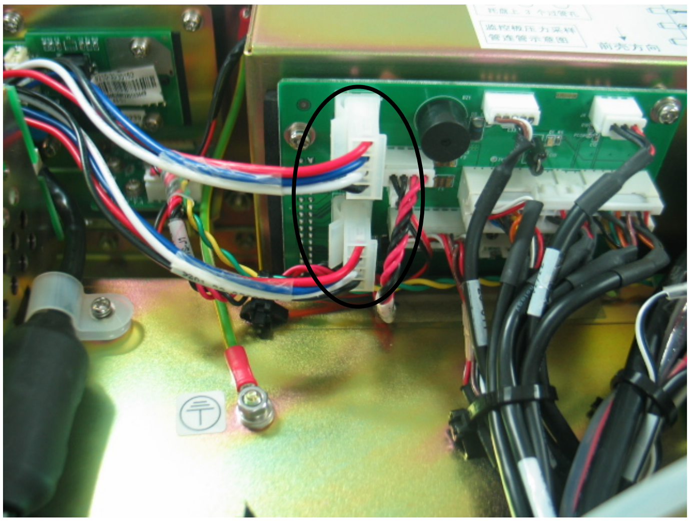
- **Before replacing the fuse, be sure to turn off the system switch and unplug the power cord to prevent electric shock.**

⚠WARNING

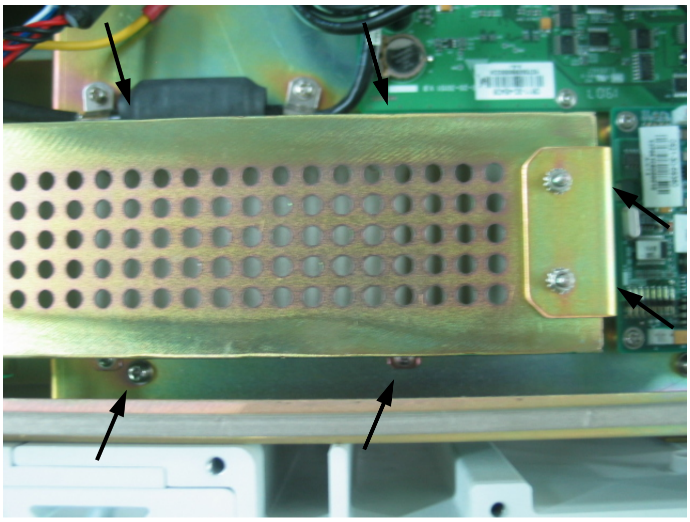
- **Make sure that the new fuse meets the requirements specified in the Operator's Manual.**

6.2.26 Replace the Built-in Battery

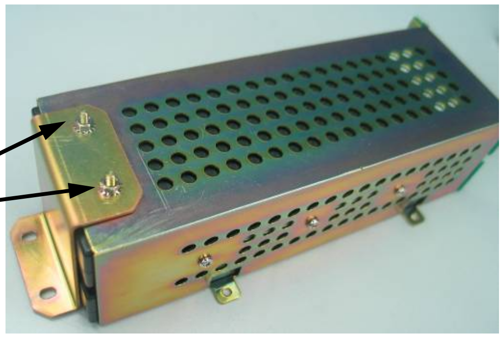
1. Disconnect the connection lines between the battery box and the power conversion board.



2. Unscrew the six screws as shown below to take out the battery box assembly.



3. Unscrew the two M3 nuts and remove the battery block plate to replace the battery, as shown below.



6.2.27 Remove the Power Cord

Unscrew the three screws as shown below to remove the power cord.

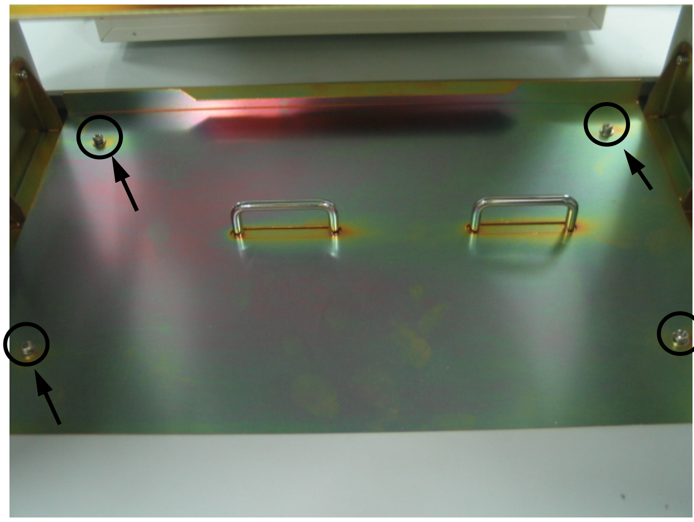
⚠WARNING

- **Before replacing the power cord, be sure to disconnect the power supply to prevent electric shock.**

6.2.28 Remove the Isolation Transformer

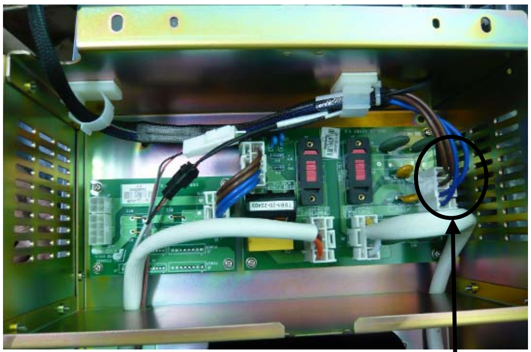
1. Remove the two drawer assemblies.
2. Remove the trolly rear panel assembly.

3. Unscrew the four screws as shown below to remove the cover plate of the isolation transformer mounting box.



4. Disconnect the power cables from the auxiliary electrical outlet and from the isolation transformer to take out the isolation transformer assembly.

Disconnect the power cable from the auxiliary electrical outlet



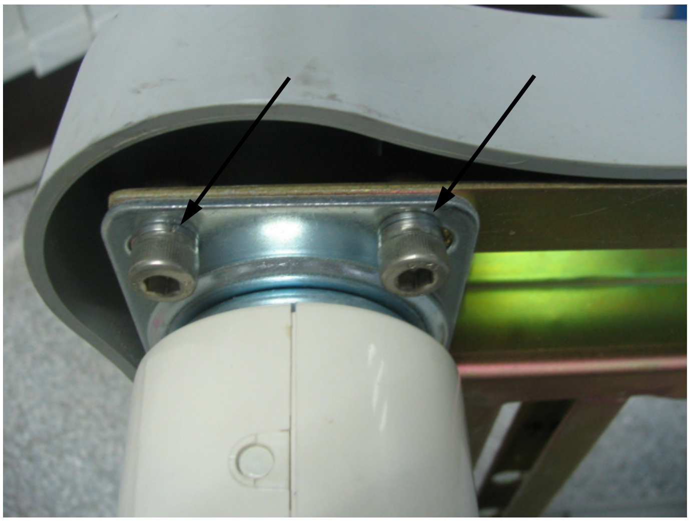
Disconnect the power cable from the isolation transformer

5. Unscrew the four screws fixing the handle to remove the handle, as shown below.

6. Unscrew the four screws fixing the partition plate to remove the partition plate. Disconnect the connectors from the isolation transformer. Unscrew the four screws to remove the isolation transformer.

6.2.29 Replace the Caster

Remove the caster and replace with a new one with one person tipping the anesthesia machine and another person unscrewing the four screws, as shown below.



⚠**WARNING**

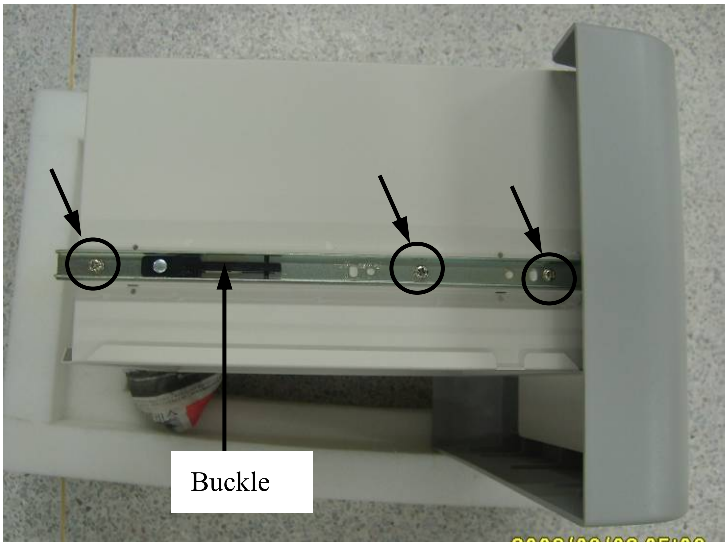
- **Replacing a caster requires at least two people. Personal injury and/or machine damage is possible if one person attempts this procedure alone.**

NOTE

- **Remove the vaporizer before tipping the anesthesia machine. If a vaporizer is inverted, it must be set to 5% and purged for 30 minutes with a 5 L/min flow.**
- **Before tipping the anesthesia machine, maneuver it to coarse floor. Then step down the two brakes to fix the machine. Do not over tip the anesthesia machine to avoid personal injury or machine damage.**

6.2.30 Replace the Drawer

Fully pull out the drawer. Hold the drawer sides by both hands. Depress the buckles inward on both sides of the drawer to remove the drawer. Unscrew the three screws on the rail to remove the rail. Remove the other rail similarly.

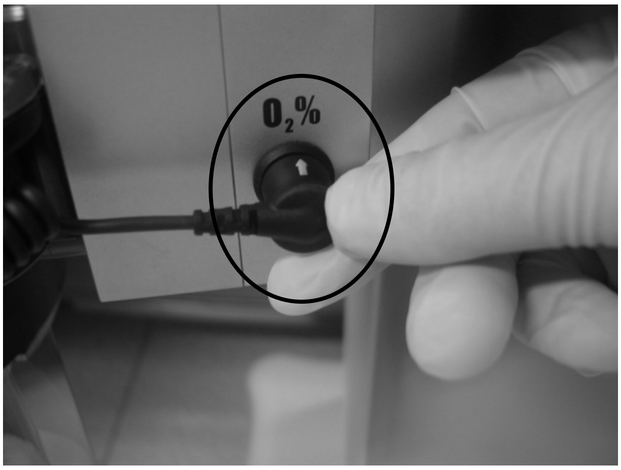


The following picture shows the appearance of drawer.

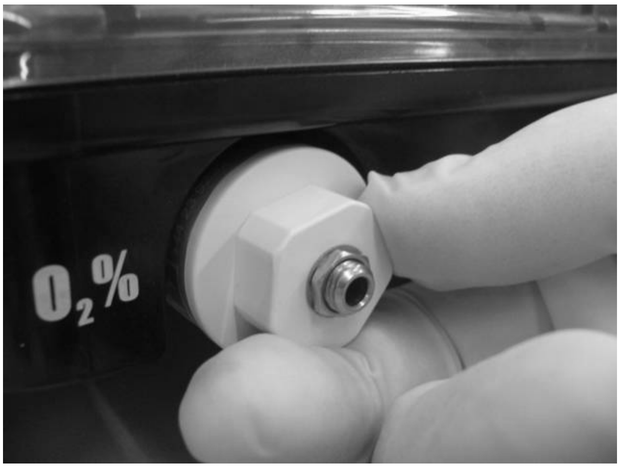
6.3 Disassemble the Breathing System

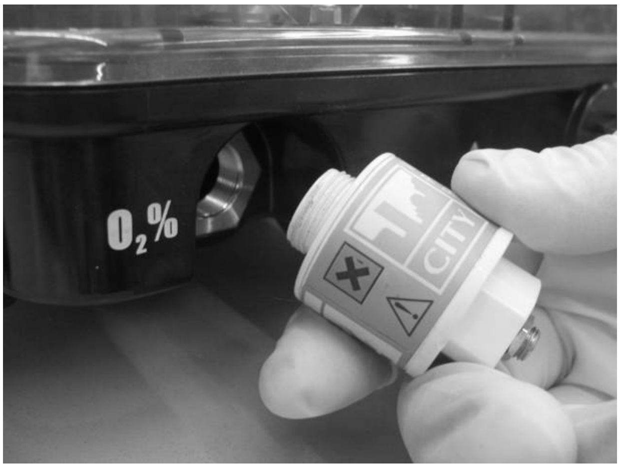
6.3.1 Remove the O2 Sensor

1. Remove one end of the O_2 sensor cable from the O_2% connector on the anesthesia machine. Unplug the other end of the cable from the O_2 sensor.



2. Turn the O_2 sensor counterclockwise to take it out.





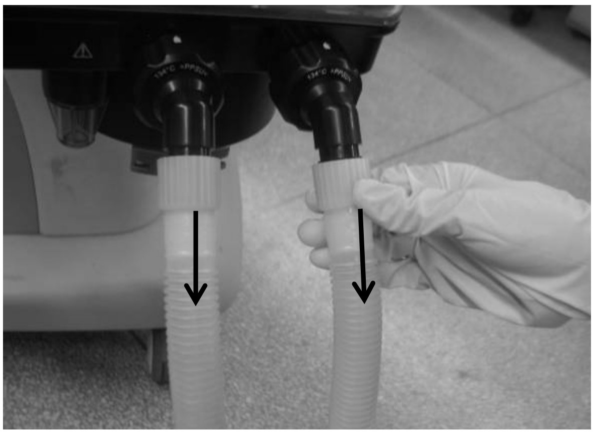
6.3.2 Remove the Breathing Tubes

NOTE

- **When disassembling the breathing tube, hold the tube connectors at both ends of the tube to prevent damage to the tube.**

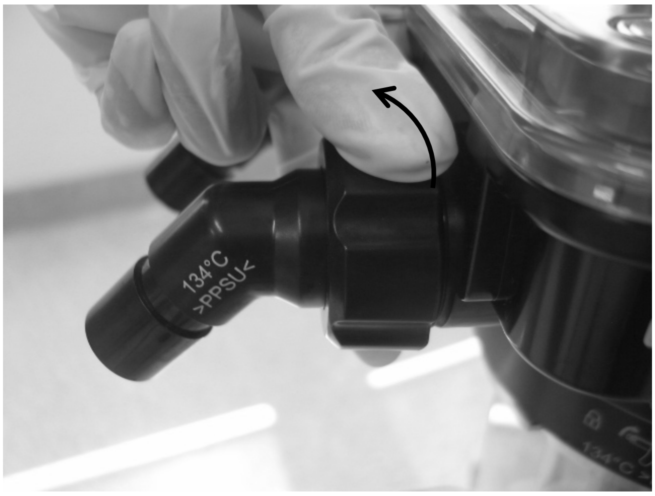
1. Remove the filter from the Y piece.

2. Disconnect the breathing tubes from the inspiration/expiration connectors on the circuit.



6.3.3 Remove the Flow Sensor

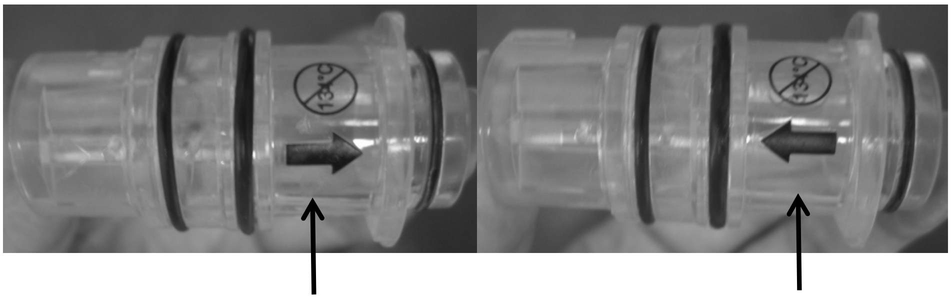
1. Turn the locking nuts counterclockwise.



2. Pull out the inspiration and expiration connectors together with their locking nuts.

3. Pull out the flow sensors horizontally.

The following pictures show the appearance of inspiratory and expiratory flow sensor assemblies.



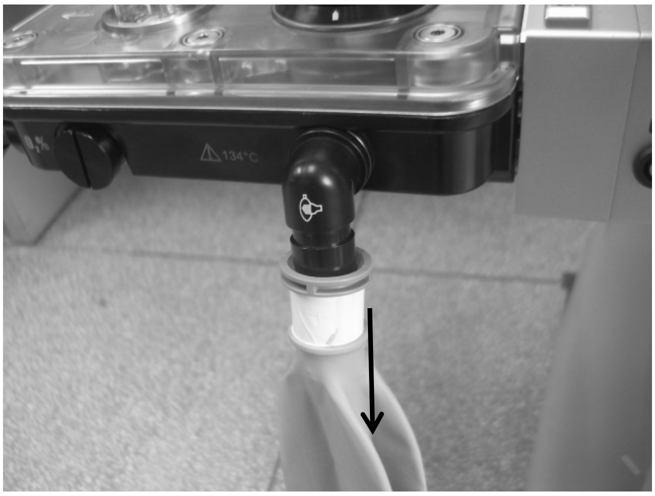
Inspiratory flow sensor assembly Expiratory flow sensor assembly

6.3.4 Remove the Manual Bag

Remove the manual bag from the connector on the breathing system as shown below.

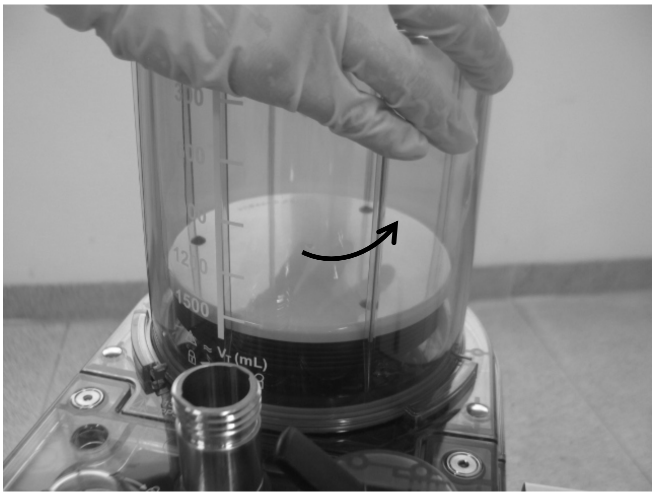
- When a bag arm is configured

- When no bag arm is configured

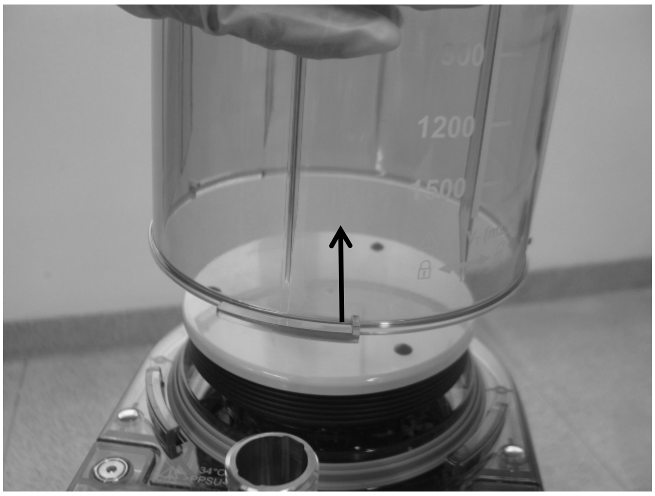


6.3.5 Disassemble the Bellows Assembly

1. Turn the bellows housing counterclockwise.



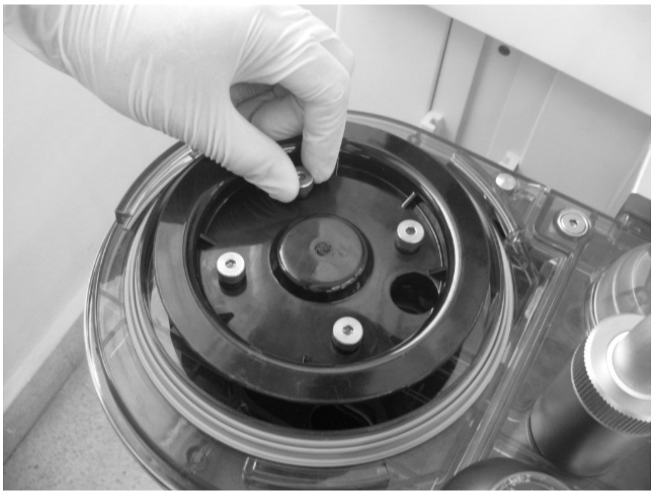
2. Lift off and remove the housing.



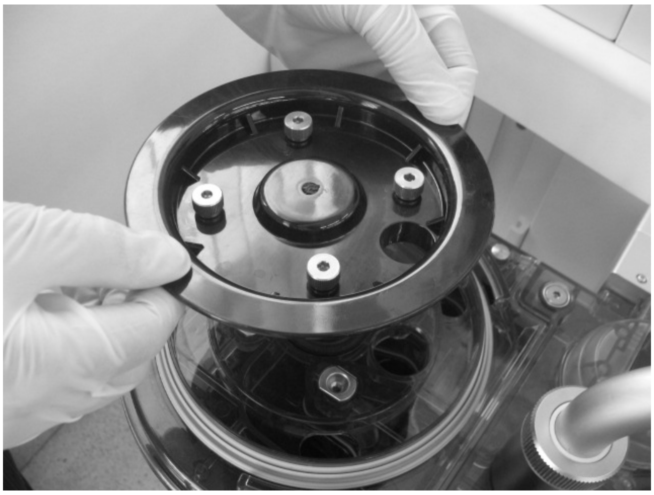
3. Remove the folding bag from the bellows base.

6.3.6 Disassemble the PoP-Off Valve Assembly

1. Unscrew the locking screws.



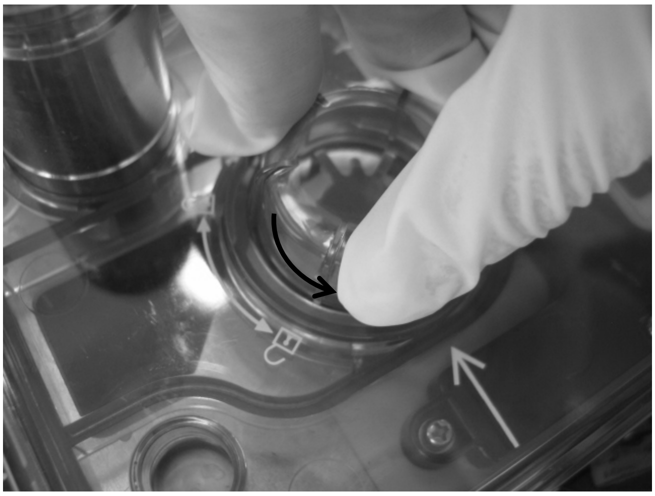
2. Hold and pull up the PoP-Off valve cover to remove it.



3. Take out the PoP-Off valve rubber gasket and metal component.

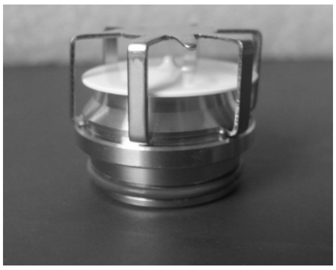
6.3.7 Disassemble the Expiratory Check Valve Assembly

1. Turn the check valve cover counterclockwise to remove it.



2. Pull out the check valve.

The following picture shows the appearance of expiratory check valve assembly.



6.3.8 Disassemble the Inspiratory Check Valve Assembly

For details about how to disassemble the inspiratory check valve assembly, refer to ***6.3.7Disassemble the Expiratory Check Valve Assembly*** 。

6.3.9 Remove the Sodalime Canister

1. Hold and pull up the rotary handle for 90 degrees.

2. Turn the rotary handle for 90 degrees counterclockwise.

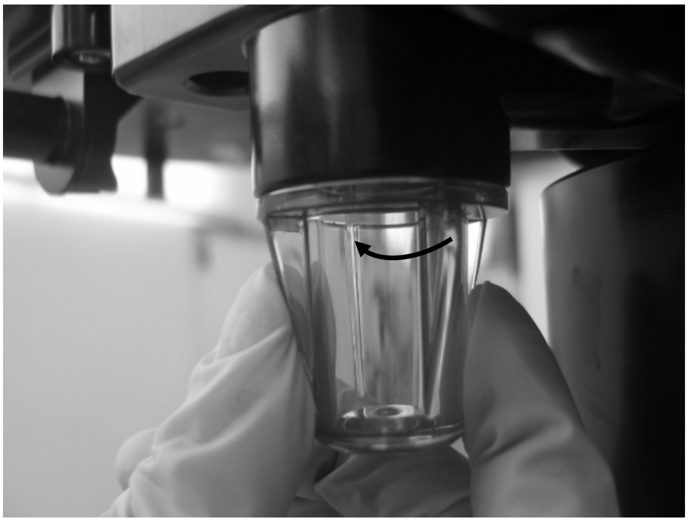
3. Pull off the sodalime canister from the lifting device.

⚠WARNING

- **Sodalime is a caustic substance and is a strong irritant to eyes, skin and respiratory system. Affected parts should be flushed with water. If irritation continues after flushed by water, seek medical assistance immediately.**

6.3.10 Remove the Water Collection Cup

1. Hold the water collection cup and turn it clockwise.

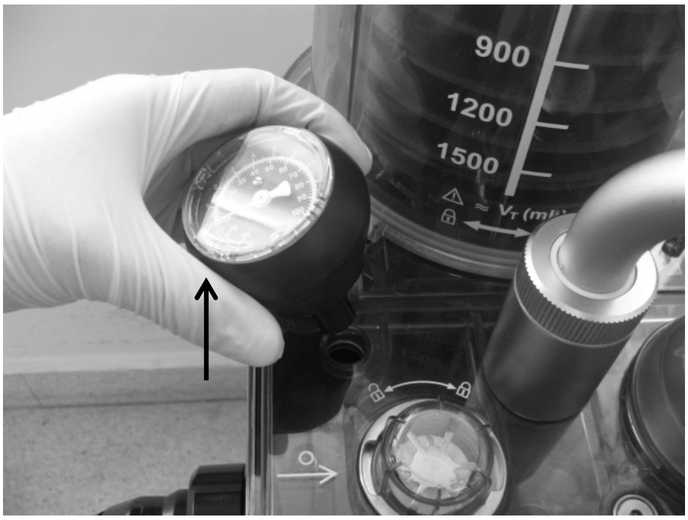


2. Remove the water collection cup.

The following picture shows the appearance of water collection cup.

6.3.11 Remove the Airway Pressure Gauge

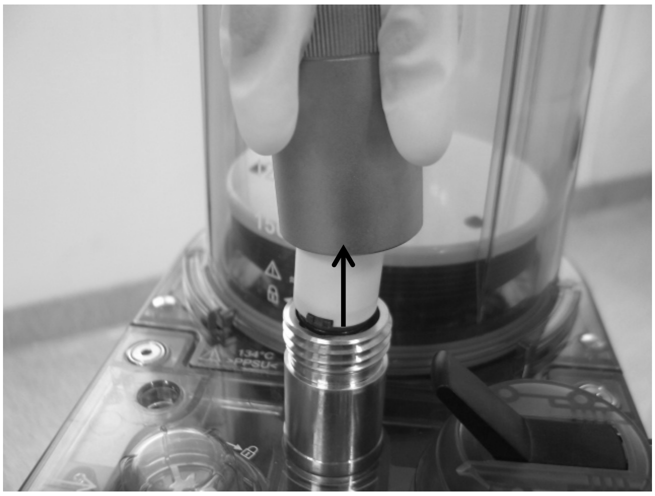
Pull off the airway pressure gauge as shown below.



6.3.12 Remove the Bag Arm

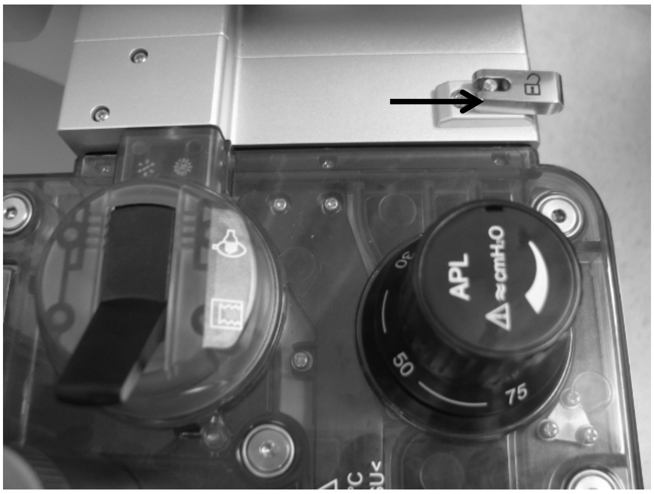
1. Unscrew the locking nut counterclockwise.

2. Remove the bag arm from the circuit.



6.3.13 Remove the Circuit

1. Hold the circuit with one hand. Pull up the locking catches on the circuit adapter with the other hand to unlock it.



2. Remove the circuit from the circuit adapter with both hands.

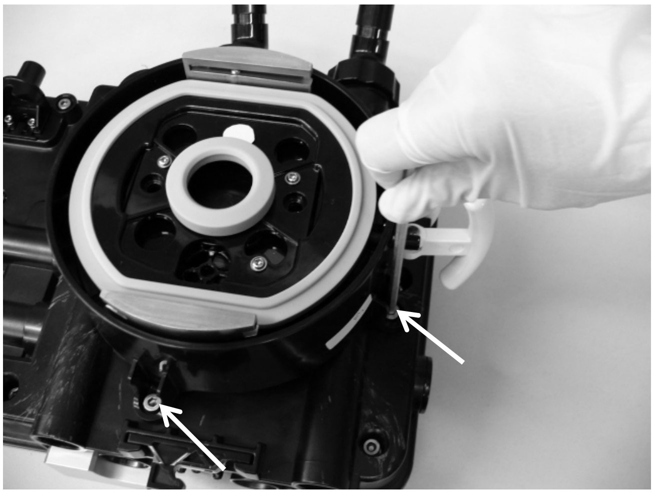
NOTE

- **If it is hard to push the circuit into or out of the circuit adapter, you need to apply some lubricant to the seal on the pneumatic connector to reduce friction.**

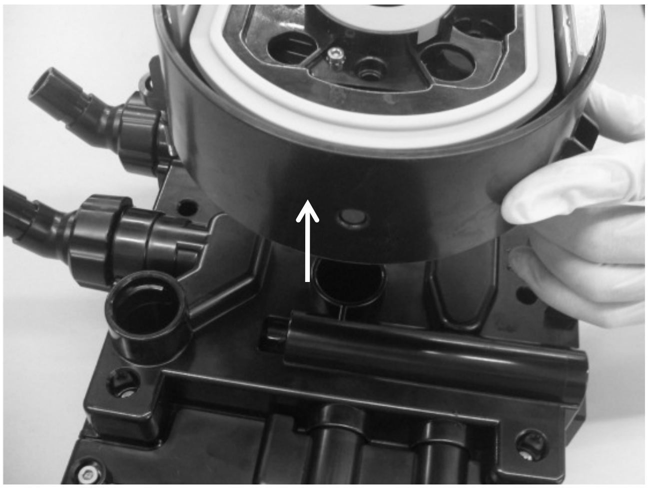
6.3.14 Remove the Sodalime Canister Connection Block Assembly

1. Turn over the circuit.

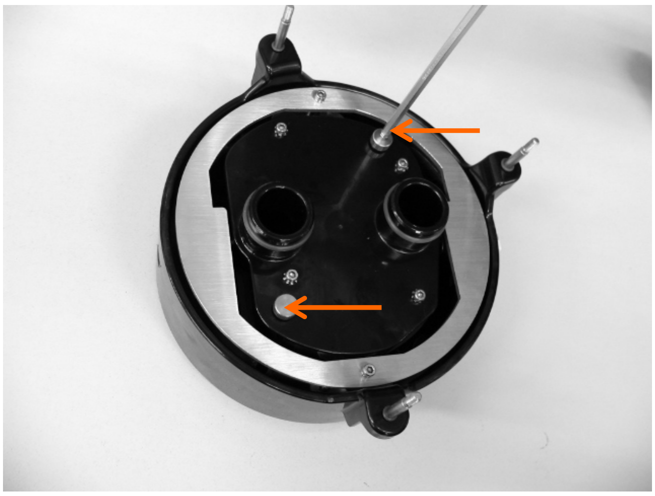
2. Loosen the three screws (as shown in the picture) using an Allen wrench.



3. Remove the sodalime canister connection block assembly from the circuit.

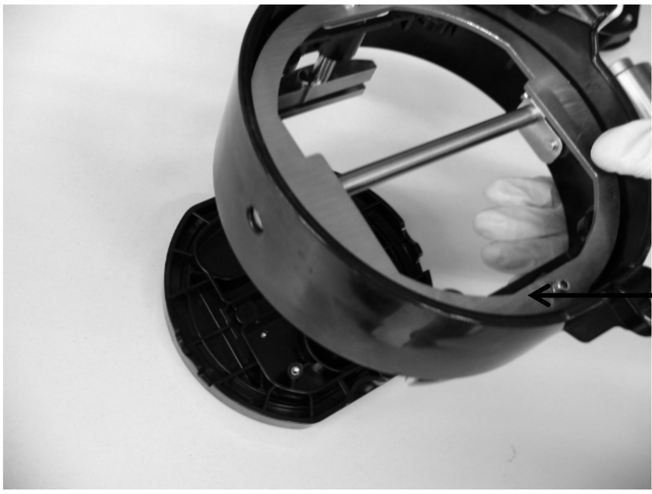


4. Turn over the connection block assembly and loosen the two screws (as shown in the picture) using an Allen wrench.



5. Pull up forcibly to remove the connection block assembly.

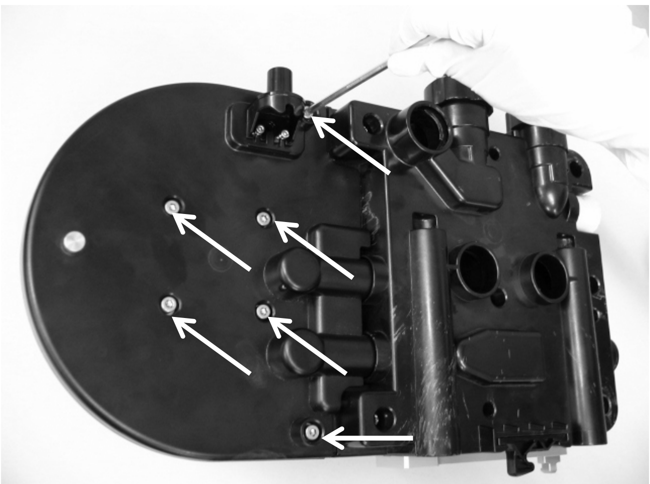
6. Pull off the lifting device.



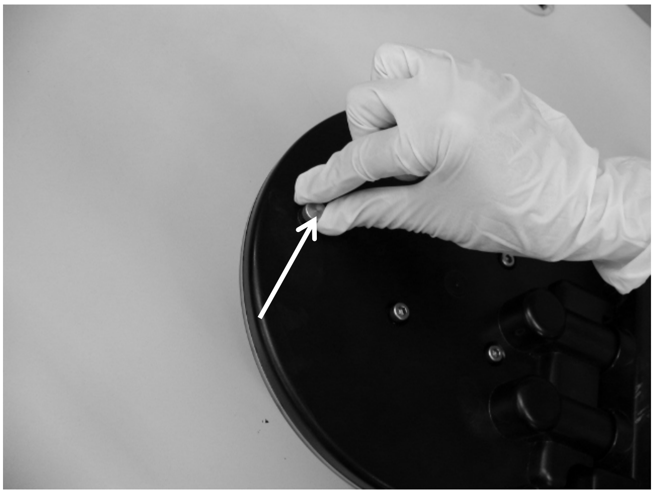
Lifting device

6.3.15 Remove the Upper Cover 2 and Lower Cover 2 Assemblies

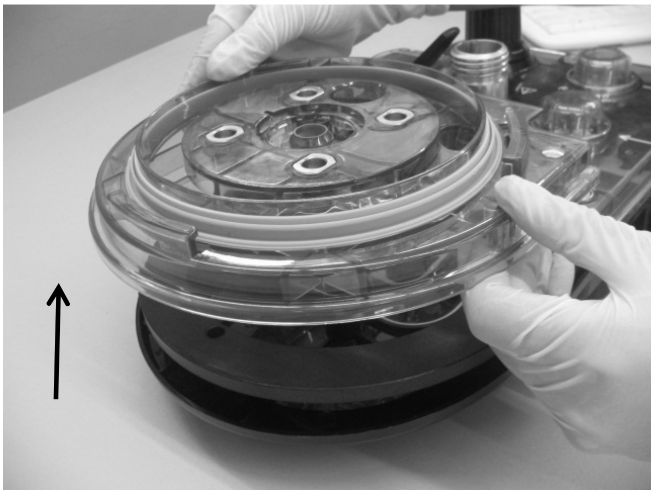
1. Loosen the six screws (as shown in the picture) using an Allen wrench.



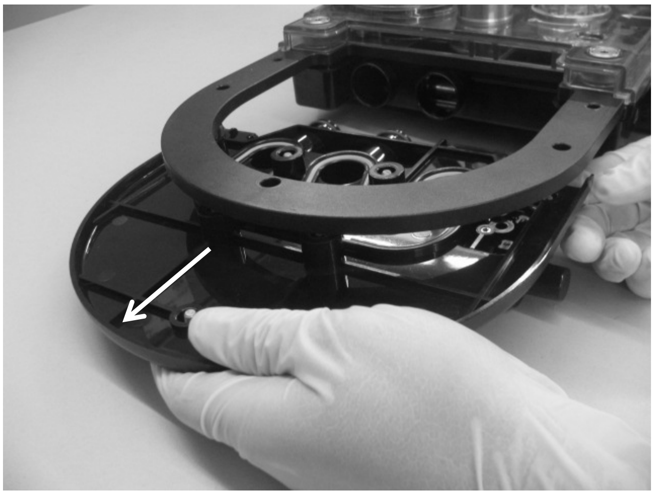
2. Loosen the nut counterclockwise as shown below.



3. Turn over the circuit. Pull up to take out the upper cover 2 assembly

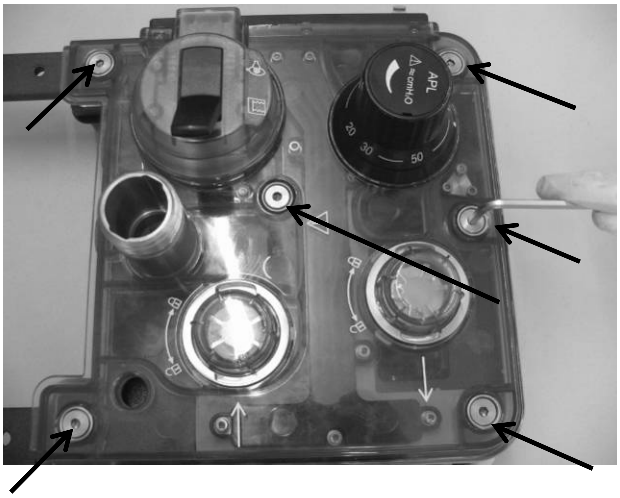


4. Pull leftwards to take out the lower cover 2 assembly.

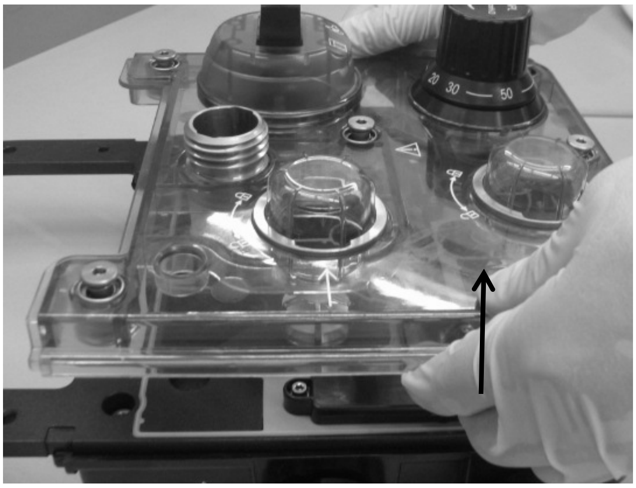


6.3.16 Remove the Upper Cover Assembly

1. Unscrew the six screws as shown below using an Allen wrench.

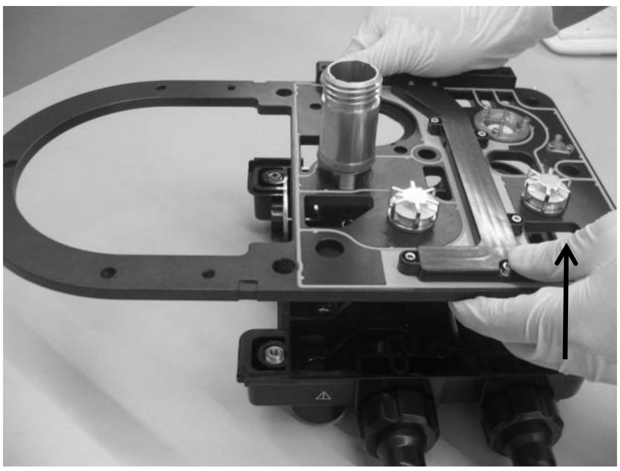


2. Hold the upper cover assembly tightly and pull it up forcibly to remove it.



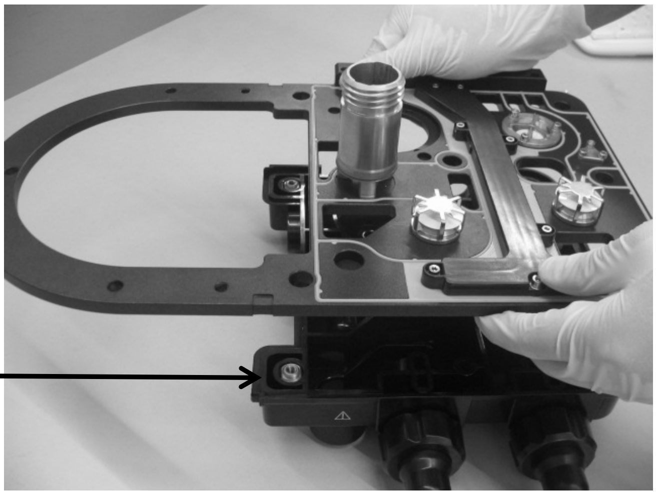
6.3.17 Remove the Median Plate Assembly

Pull up the median plate assembly forcibly to remove it.



6.3.18 Remove the Lower Cover Assembly

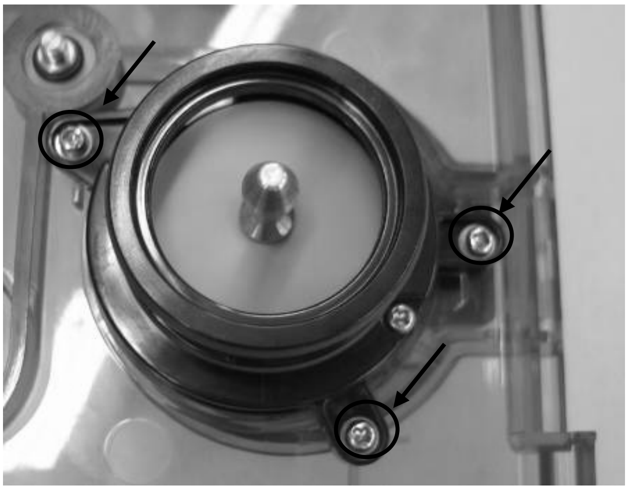
The following picture shows the lower cover assembly.



Lower cover assembly

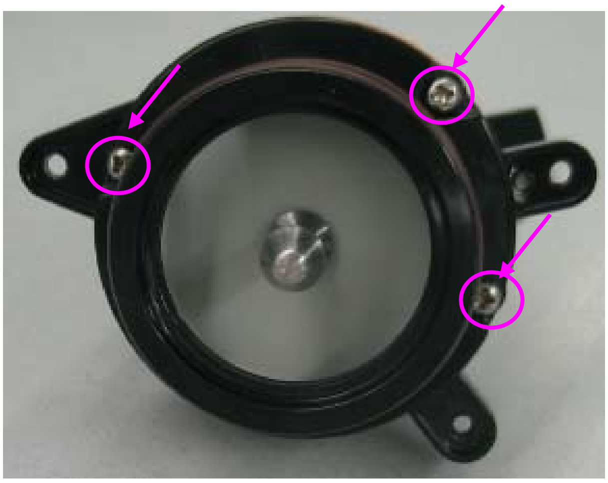
6.3.19 Disassemble the Bag/mechanical Ventilation Switch Assembly

1. Remove the upper cover assembly as per ***6.3.16Remove the Upper Cover Assembly***.
2. Turn over the upper cover assembly and unscrew the three screws as shown in the picture.

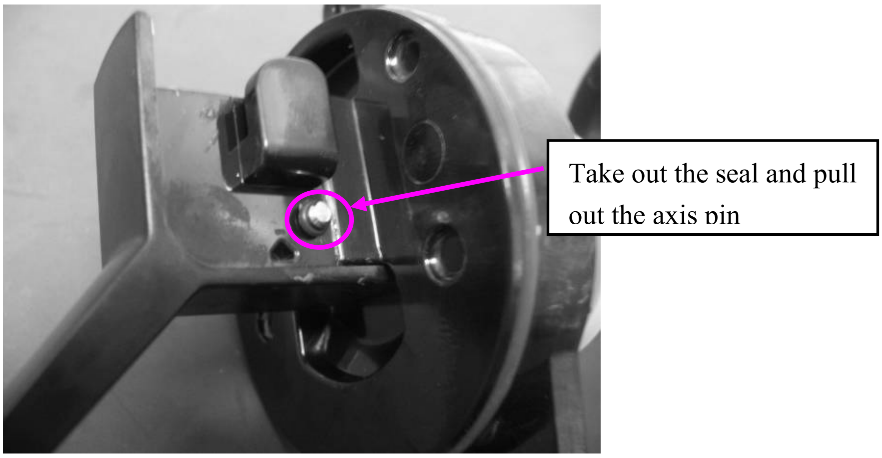


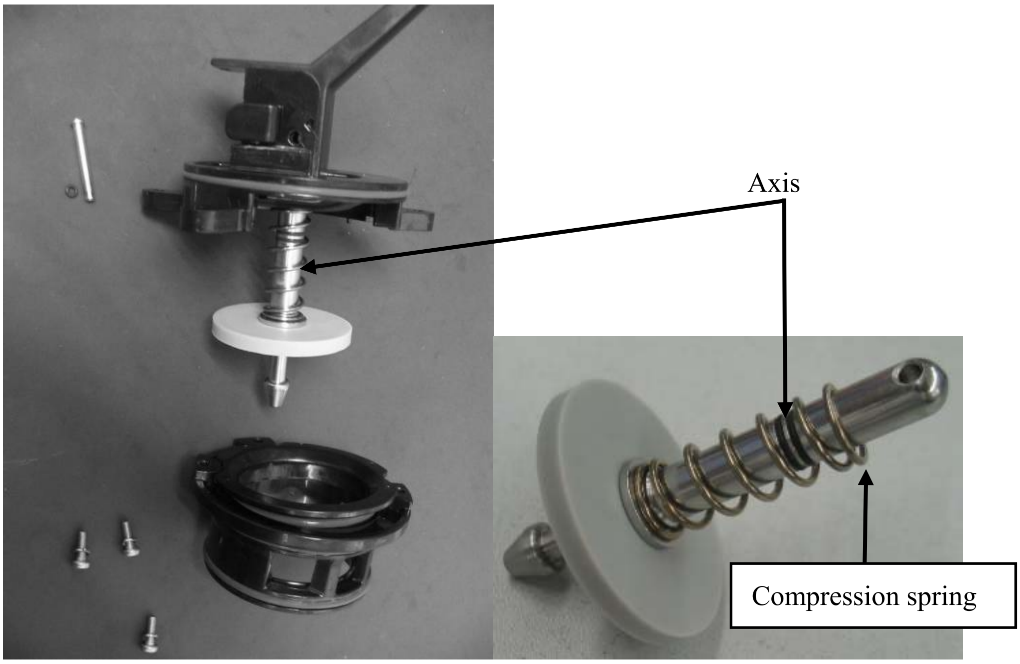
The following picture shows the appearance of bag/mechanical ventilation switch assembly.

3. Unscrew the three screws as show in the picture.

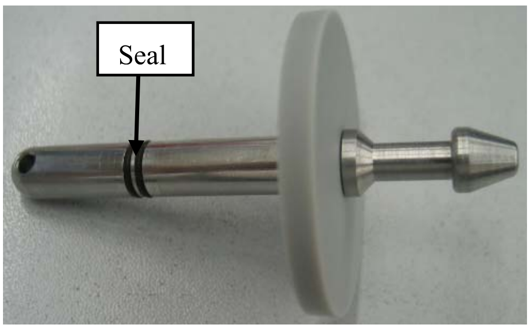


4 Take out the seal and pull out the axis pin to remove the axis.



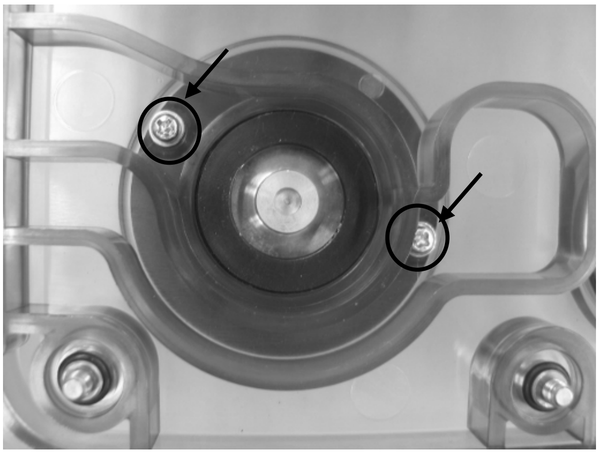


6. Remove the compression spring and replace the two seals (0030-10-13077)



6.3.20 Remove the APL Valve Assembly

1. Remove the lower cover assembly as per ***6.3.18Remove the Lower Cover Assembly***.
2. Unscrew the two screws as shown in the picture to pull out the APL valve assembly.



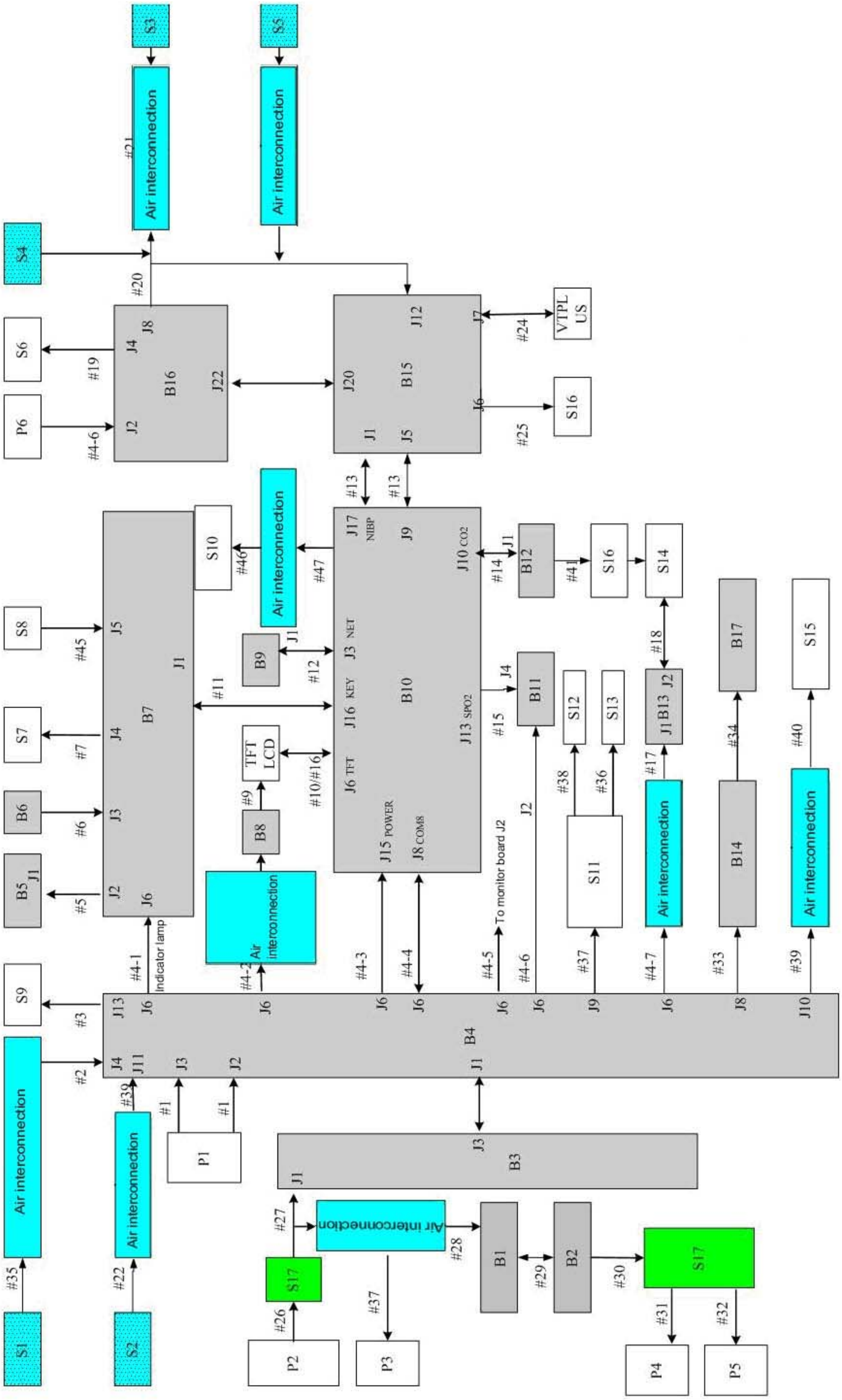
The following picture shows the appearance of APL valve assembly.

6.4 Electrical and Pneumatic Connections

After parts disassembling and replacing, refer to the following to re-install and re–connect the parts.

6.4.1 Electrical Connections

Electrical Circuit Diagram



Wiring

S/N	Description	P/N
1	Battery board connection line	9201-20-35933
2	System switch connection line	0621-20-69478
3	Fan (KDE1204PKV3)	9201-20-53650
4	Power signal transfer cable	0621-20-69481
5	Alarm lamp connection line	0621-20-69479
6	Encoder connection line	0621-20-69480
7	2.25" speaker and connection line	9200-21-10633
8	Inverter connection line	0621-20-69495
9	Connection line for TFT display backlight board	8000-21-10239
10	10.4" AU display data line	0621-20-69483
11	Button board connection line	0621-20-78587
12	Network cable	0621-20-69502
13	Connection line between the monitor board and main control board	0621-20-69488
14	Communication cable for electronic flowmeter board	0621-20-69484
15	Connection line between the infrared backplane and main control board	0621-20-69491
16	8.4" NEC display data line	0621-20-69636
17	Table toplight power cord	0621-20-69493
18	Connection line for table toplight switch	0621-20-69492
19	Connection line for NORGREN breathing circuit	0621-20-69485
20	Signal cable for monitor board switch	0621-20-69486
21	Connection line for flowmeter inlet pressure switch	0621-20-69588
22	Connection line for circuit inside switch	0621-20-78593
23	Grounding cable for power box	0621-20-69569
24	VTPLUS connection line	8000-21-10146
25	Connection line for three-way valve assembly	0611-21-45616
26	Connection line between the AC filter and fuse	0621-20-69489
27	Connection line between the power board and fuse	0621-20-69490
28	Power cord for isolation transformer	0621-20-69604
29	AC mains transfer cable	0621-20-69605
30	Power cord for auxiliary electrical outlet	0621-20-69606
31	Socket connection line (GB)	0621-20-69608
32	Socket connection line (Euro standard)	0621-20-69609
33	CIS power cord	0621-20-69610
34	CIS box connection line—long line(BizLink)	M12A-20-75121
35	System switch connection line B	0621-20-69494
36	Fan and connection line for transformer	0611-20-58667

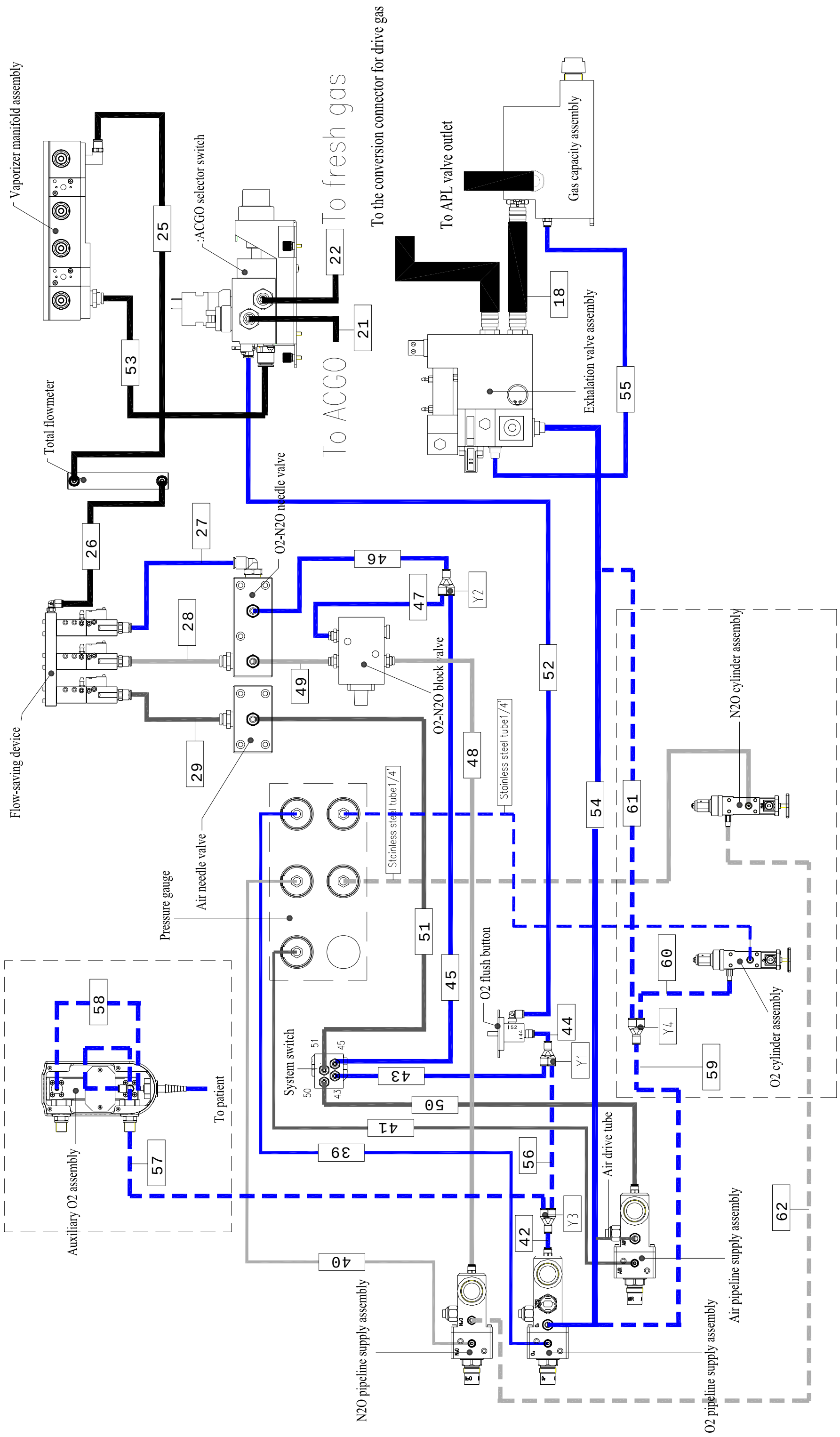
S/N	Description	P/N
37	Connection line between the power board and auxiliary electrical outlet	0621-20-78665
38	Connection line for isolation transformer temperature sensor	0621-20-78594
39	Circuit heating and circuit switch connection line	0621-20-78591
40	Circuit inside heating connection line	0621-21-78641
41	Connection line for flowmter three-way valve assembly	0621-20-78648
42	CIS fan and connection line	0621-20-78572
43	CIS fan transfer cable	0621-20-78573
44	Harddisk data line	0621-20-78642
45	Button scanning connection line	0621-20-69607
46	Modular rack fan	0621-20-69412
47	Connection line for modular rack fan	0621-20-69413
B1	Isolation transformer board	0611-30-45463
B2	AC conversion board	0611-30-45408
B3	Power board	0621-30-78595
B4	Power conversion board	0621-30-69354
B5	Alarm lamp board	0621-30-69358
B6	Encoder board	9200-30-10470
B7	Button control board	0621-30-69360
B8	Inverter	0000-10-11020
B9	Network conversion board	9210-30-30152
B10	Main control board	0611-30-45406
B11	Infrared backplane	0621-30-69353
B11	General NiosII module	6800-30-50075
B12	Flowmeter control board (three flowtubes configured)	0621-30-69351
B12	Flowmeter control board (two flowtubes configured)	0621-30-78639
B12	Flowmeter control board (one flowtube configured)	0621-30-78638
B13	Table toplight board	0621-30-69356
B14	CIS power conversion board	0621-30-69585
B15	Monitor signal detection board	0621-30-78632
B16	Monitor valve drive board	0621-30-78634
B17	CIS backplane	0621-30-69362
P1	Connector for battery power supply	/
P2	AC mains filter	/
P3	Auxiliary electrical outlet	/
P4	Auxiliary electrical outlet (GB)	/
P5	Auxiliary electrical outlet (Euro standard)	/
P6	To power conversion board J6	/
S1	System switch	/
S2	Circuit switch	/
S3	Flowmeter inlet pressure switch	/

S/N	**Description**	**P/N**
S4	Switch status detection	/
S5	O2 sensor for bag/mechanical ventilation switch	/
S6	PEEP valve, inspiratory valve, PEEP safety valve	/
S7	Speaker	/
S8	Membrane keyboard	/
S9	Fan	/
S10	Modular rack fan	/
S11	Isolation transformer	/
S12	Temperature switch	/
S13	Fan	/
S14	Ship-shaped switch	/
S15	Heater	/
S16	Three-way valve	/
S17	Fuse	/

6.4.2 Pneumatic Connections

6.4.2.1 Pneumatic Connection A (configured with O2, N2O and AIR supplies, high-pressure cylinders and auxiliary O2 supply)

Pneumatic Circuit Diagram



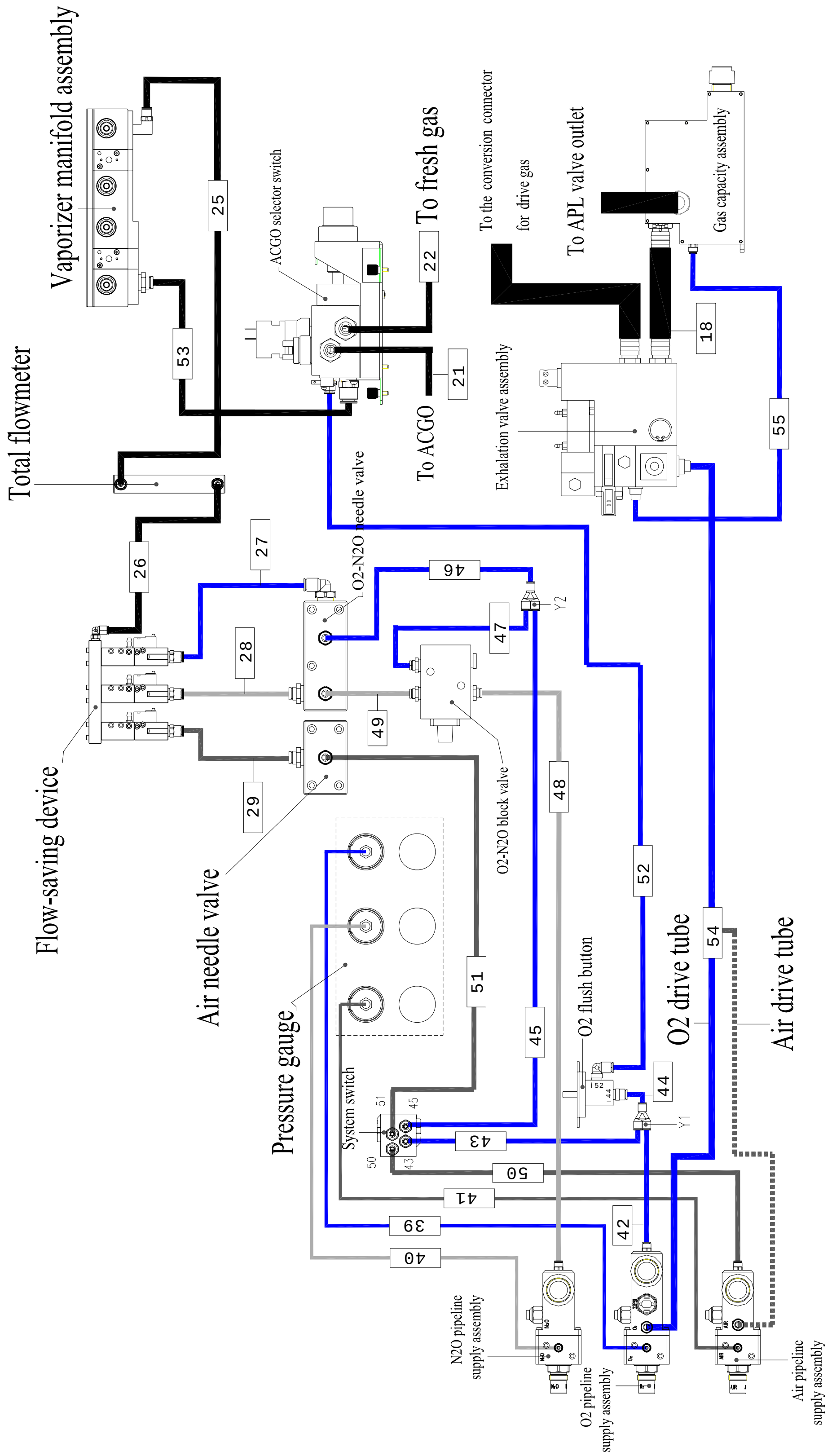
Tubing

S/N	From	To	P/N
18	Gas-out connector of expiratory valve	Gas-in connector of gas reservoir	M6G-020018---
25	Gas-out connector of total flowmeter	Gas-in connector of vaporizer	M6G-020026---
26	Gas-out connector of throttling device	Gas-in connector of total flowmeter	
27	O2-out connector of needle valve	O2-in connector of throttling device	M6G-020014---
28	N2O-out connector of needle valve	N2O-in connector of throttling device	
29	AIR-out connector of needle valve	AIR-in connector of throttling device	
39	O2 supply inlet assembly	O2 pressure gauge	M6G-020046---
40	N2O supply inlet assembly	N2O pressure gauge	
41	AIR supply inlet assembly	AIR pressure gauge	
42	O2 supply inlet assembly	Y3-1	M6G-020026---
43	Y1-2	O2-in connector of system switch	
44	Y1-3	Gas-in connector of O2 flush button	
45	O2-out connector of system switch	Y2-1	
46	Y2-2	O2 needle valve	
47	Y2-3	O2-in connector of O2-N2O cut-off valve	
48	N2O supply inlet assembly	N2O-in connector of O2-N2O cut-off valve	M6G-020046---
49	N2O-out connector of O2-N2O cut-off valve	N2O needle valve	
50	AIR supply inlet assembly	AIR-in connector of system switch	M6G-020026---
51	AIR-out connector of system switch	Air needle valve	
52	Gas-out connector of O2 flush button	Gas-in connector of ACGO assembly	
53	Gas-out connector of vaporizer	Gas-in connector of check valve	M6G-020014---
54	O2 supply inlet assembly	Rear gas-in connector of expiratory valve assembly	
	AIR supply inlet assembly	Rear gas-in connector of expiratory valve assembly	

55	Side gas-out connector of expiratory valve	Gas-in connector of gas reservoir assembly	M6G-020026---
56	Y3-2	Y1-2	M6G-020026---
57	Y3-3	Gas-in connector of auxiliary O2 supply flowmeter	
58	Gas-out connector of auxiliary O2 supply flowmeter	To nozzle for auxiliary O2 supply	
59	Drive gas connector of O2 supply inlet assembly	Y4-1	M6G-020014---
60	Check valve of O2 cylinder bracket	Y4-2	
61	Y4-3	Rear gas-in connector of expiratory valve assembly	
62	Check valve of N2O cylinder bracket	N2O supply inlet assembly	M6G-020026---
Y1, Y2 and Y3 refer to Y piece.			M6Q-030024---
Y4 refers to Y piece.			M6Q-030025---

6.4.2.2 Pneumatic Connection B (configured with O2, N2O and AIR supplies, without high-pressure cylinders and auxiliary O2 supply)

Pneumatic Circuit Diagram



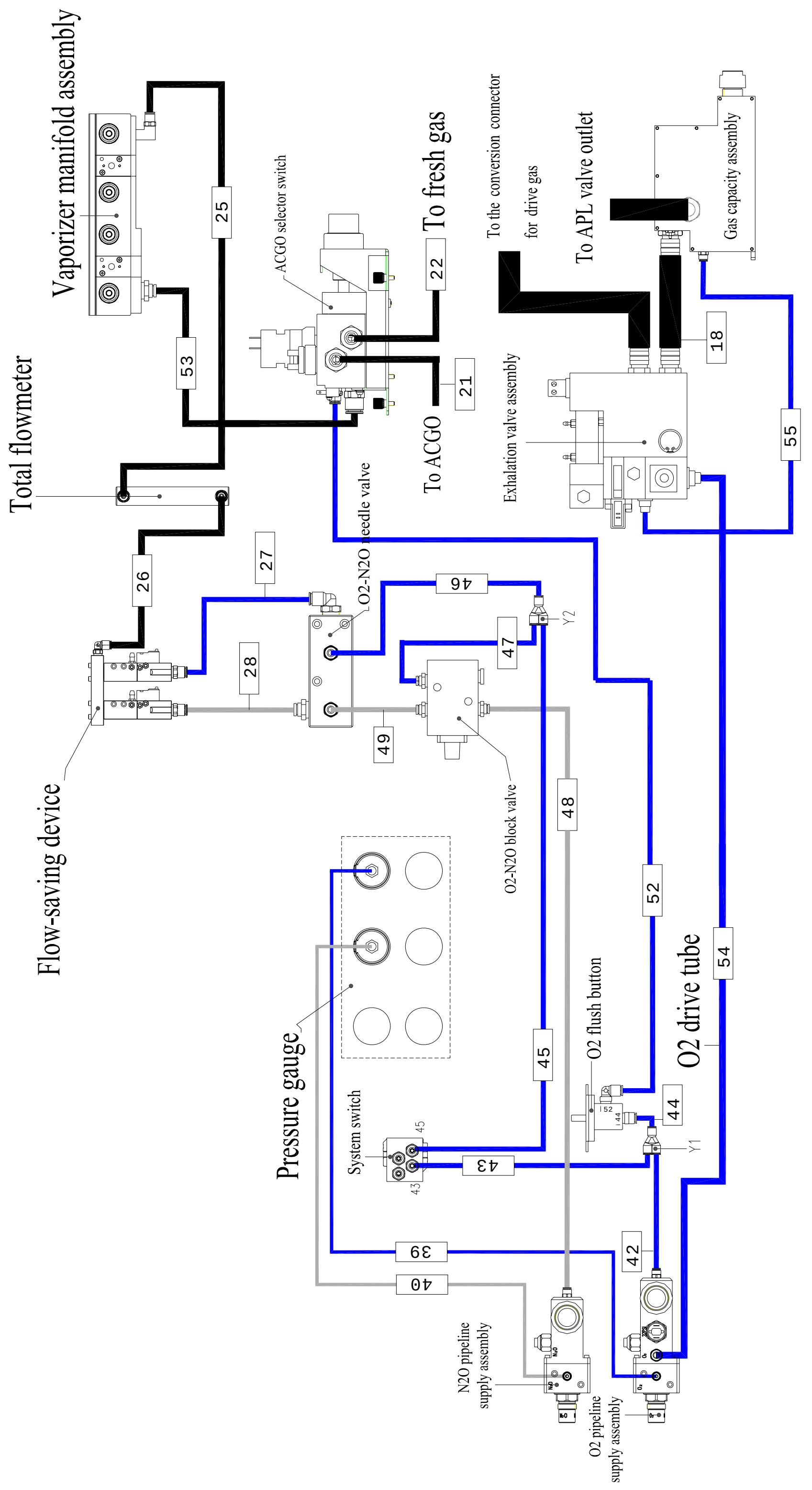
Tubing

S/N	From	To	P/N
18	Gas-out connector of expiratory valve	Gas-in connector of gas reservoir	M6G-020018---
25	Gas-out connector of total flowmeter	Gas-in connector of vaporizer	M6G-020026---
26	Gas-out connector of throttling device	Gas-in connector of total flowmeter	
27	O2-out connector of needle valve	O2-in connector of throttling device	M6G-020014---
28	N2O-out connector of needle valve	N2O-in connector of throttling device	
29	AIR-out connector of needle valve	AIR-in connector of throttling device	
39	O2 supply inlet assembly	O2 pressure gauge	M6G-020046---
40	N2O supply inlet assembly	N2O pressure gauge	
41	AIR supply inlet assembly	AIR pressure gauge	
42	O2 supply inlet assembly	Y1-1	M6G-020026---
43	Y1-2	O2-in connector of system switch	
44	Y1-3	Gas-in connector of O2 flush button	
45	O2-out connector of system switch	Y2-1	
46	Y2-2	O2 needle valve	
47	Y2-3	O2-in connector of O2-N2O cut-off valve	
48	N2O supply inlet assembly	N2O-in connector of O2-N2O cut-off valve	M6G-020046---
49	N2O-out connector of O2-N2O cut-off valve	N2O needle valve	
50	AIR supply inlet assembly	AIR-in connector of system switch	M6G-020026---
51	AIR-out connector of system switch	AIR needle valve	
52	Gas-out connector of O2 flush button	Gas-in connector of ACGO assembly	

53	Gas-out connector of vaporizer	Gas-in connector of ACGO assembly	M6G-020014---
54	O2 supply inlet assembly	Rear gas-in connector of expiratory valve assembly	
	AIR supply inlet assembly	Rear gas-in connector of expiratory valve assembly	
55	Side gas-out connector of expiratory valve	Gas-in connector of gas reservoir assembly	M6G-020026---
Y1 and Y2 refer to Y piece.			M6Q-030024---

6.4.2.3 Pneumatic Connection C (configured with O2 and N2O supplies, without high-pressure cylinders and auxiliary O2 supply)

Pneumatic Circuit Diagram

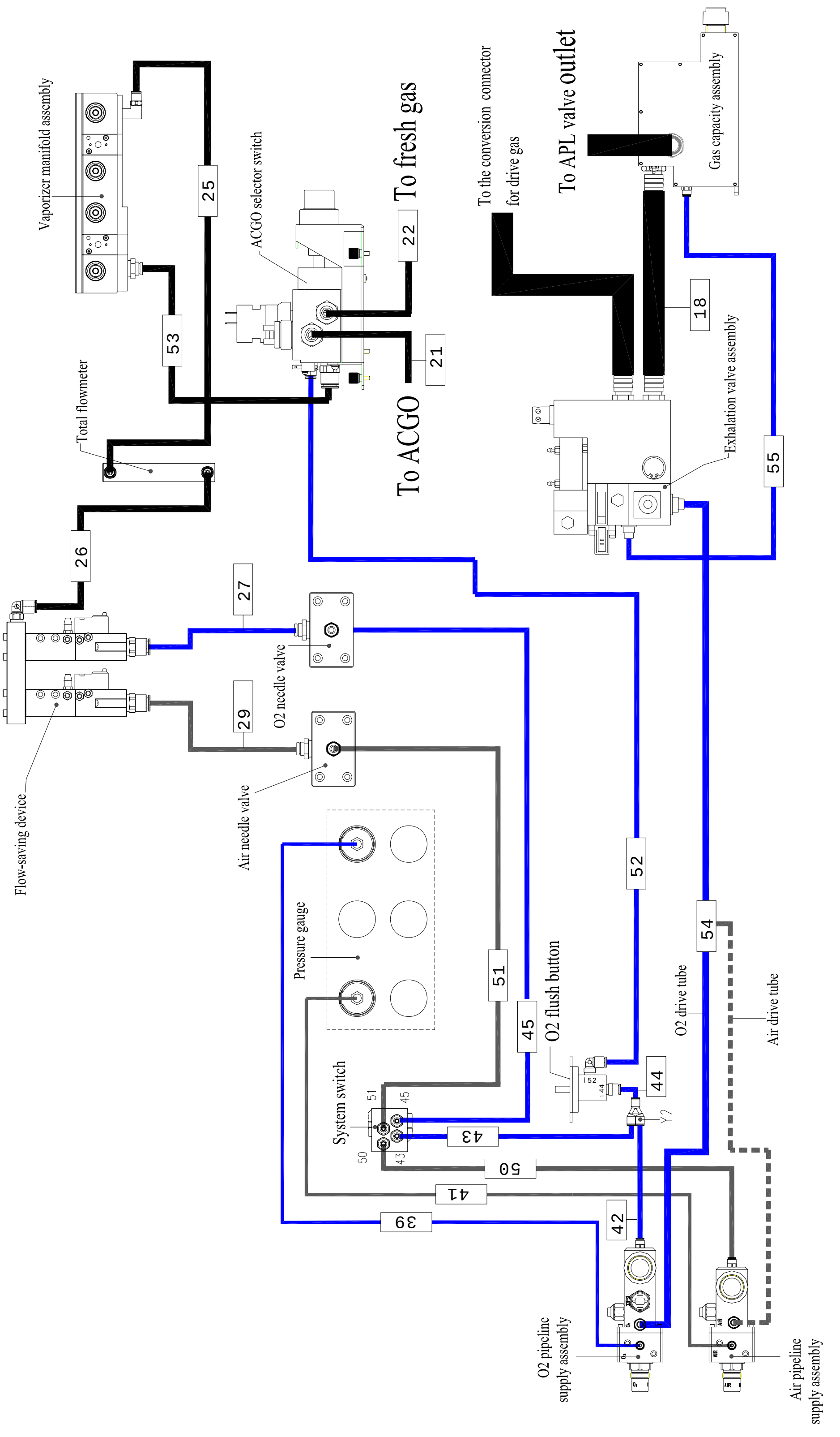


Tubing

S/N	From	To	P/N
18	Gas-out connector of expiratory valve	Gas-in connector of gas reservoir	M6G-020018---
25	Gas-out connector of total flowmeter	Gas-in connector of vaporizer	M6G-020026---
26	Gas-out connector of throttling device	Gas-in connector of total flowmeter	
27	O2-out connector of needle valve	O2-in connector of throttling device	M6G-020014---
28	N2O-out connector of needle valve	N2O-in connector of throttling device	
39	O2 supply inlet assembly	O2 pressure gauge	M6G-020046----
40	N2O supply inlet assembly	N2O pressure gauge	
42	O2 supply inlet assembly	Y1-1	M6G-020026---
43	Y1-2	O2-in connector of system switch	
44	Y1-3	Gas-in connector of O2 flush button	
45	O2-out connector of system switch	Y2-1	
46	Y2-2	O2 needle valve	
47	Y2-3	O2-in connector of O2-N2O cut-off valve	
48	N2O supply inlet assembly	N2O -in connector of O2-N2O cut-off valve	M6G-020046----
49	N2O-out connector of O2-N2O cut-off valve	N2O needle valve	
52	Gas-out connector of O2 flush button	Gas-in connector of ACGO assembly	
53	Gas-out connector of vaporizer	Gas-in connector of ACGO assembly	M6G-020014---
54	O2 supply inlet assembly	Rear gas-in connector of expiratory valve assembly	
55	Side gas-out connector of expiratory valve	Gas-in connector of gas reservoir assembly	M6G-020026---
Y1 and Y2 refer to Y piece.			M6Q-030024---

6.4.2.4 Pneumatic Connection D (configured with O2 and AIR supplies, without high-pressure cylinders and auxiliary O2 supply)

Pneumatic Circuit Diagram

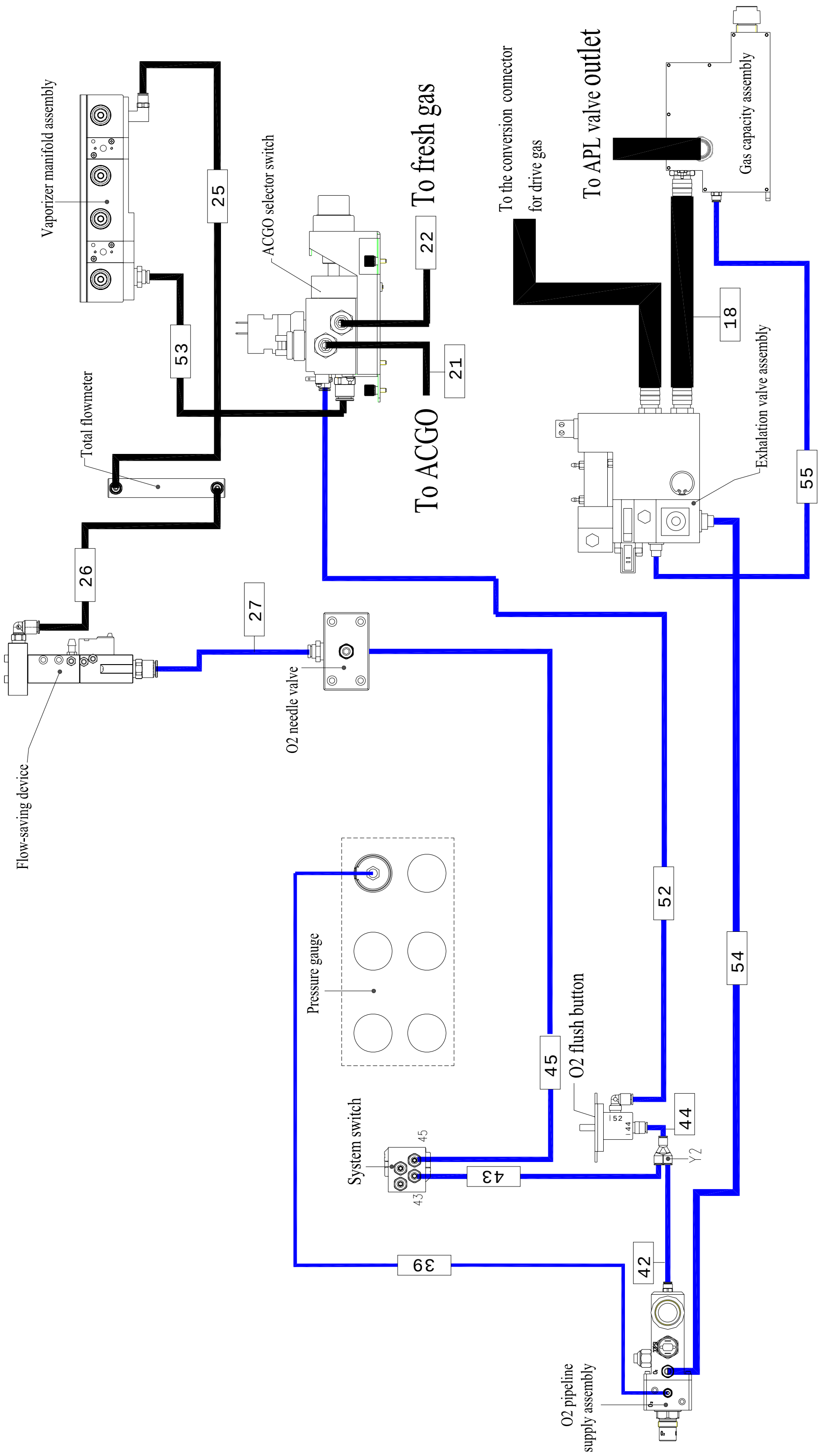


Tubing

S/N	From	To	P/N
18	Gas-out connector of expiratory valve	Gas-in connector of gas reservoir	M6G-020018---
25	Gas-out connector of total flowmeter	Gas-in connector of vaporizer	M6G-020026---
26	Gas-out connector of throttling device	Gas-in connector of total flowmeter	
27	O2-out connector of needle valve	O2-in connector of throttling device	M6G-020014---
29	AIR-out connector of needle valve	AIR-in connector of throttling device	
39	O2 supply inlet assembly	O2 pressure gauge	M6G-020046----
41	AIR supply inlet assembly	AIR pressure gauge	
42	O2 supply inlet assembly	Y2-1	M6G-020026---
43	Y2-2	O2-in connector of system switch	
44	Y2-3	Gas-in connector of O2 flush button	
45	O2-out connector of system switch	O2 needle valve	
50	AIR supply inlet assembly	AIR-in connector of system switch	
51	AIR-out connector of system switch	AIR needle valve	
52	Gas-out connector of O2 flush button	Gas-in connector of ACGO assembly	
53	Gas-out connector of vaporizer	Gas-in connector of ACGO assembly	M6G-020014---
54	O2 supply inlet assembly	Rear gas-in connector of expiratory valve assembly	
	AIR supply inlet assembly	Rear gas-in connector of expiratory valve assembly	
55	Side gas-out connector of expiratory valve	Gas-in connector of gas reservoir assembly	M6G-020026---
Y2	Y piece		M6Q-030024---

6.4.2.5 Pneumatic Connection E (configured with O2 supply only, without high-pressure cylinders and auxiliary O2 supply)

Pneumatic Circuit Diagram

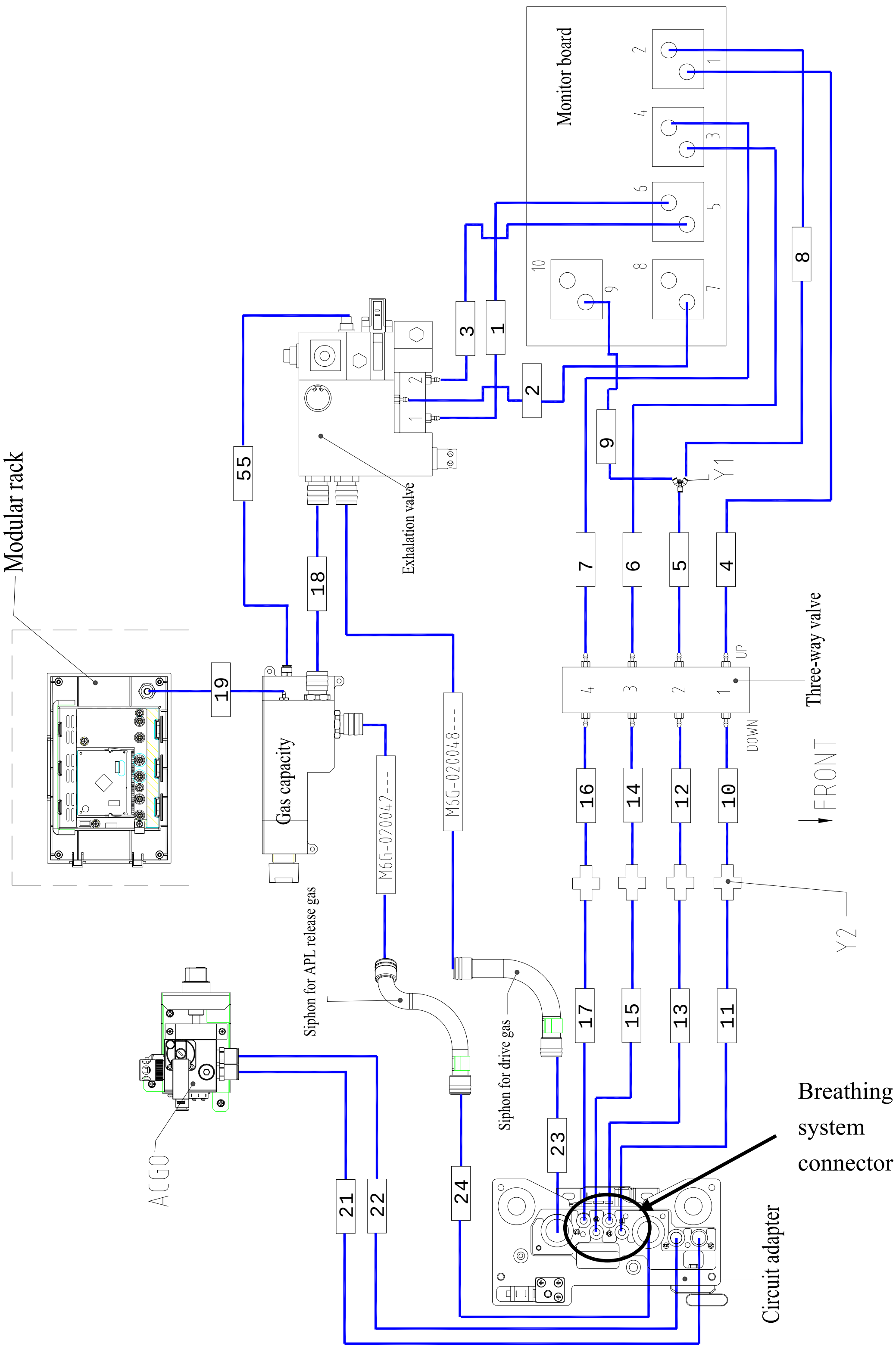


Tubing

S/N	From	To	P/N
18	Gas-out connector of expiratory valve	Gas-in connector of gas reservoir	M6G-020018---
25	Gas-out connector of total flowmeter	Gas-in connector of vaporizer	M6G-020026---
26	Gas-out connector of throttling device	Gas-in connector of total flowmeter	
27	O2-out connector of needle valve	O2-in connector of throttling device	M6G-020014---
39	O2 supply inlet assembly	O2 pressure gauge	M6G-020046---
42	O2 supply inlet assembly	Y-1	M6G-020026---
43	Y-2	O2-in connector of system switch	
44	Y-3	Gas-in connector of O2 flush button	
45	O2-out connector of system switch	O2 needle valve	
52	Gas-out connector of O2 flush button	Gas-in connector of ACGO assembly	
53	Gas-out connector of vaporizer	Gas-in connector of ACGO assembly	M6G-020014---
54	O2 supply inlet assembly	Rear gas-in connector of expiratory valve assembly	
55	Side gas-out connector of expiratory valve	Gas-in connector of gas reservoir assembly	M6G-020026---
Y1	Y piece		M6Q-030024---

6.4.3 Connections between Pneumatic Circuit, Breathing System and Monitor Board

Connection Diagram



Tubing

<table>
<tr><th>S/N</th><th>From</th><th>To</th><th>P/N</th></tr>
<tr><td>1</td><td>Differential pressure gauge connector 1</td><td>Monitor board 6</td><td rowspan="10">A21-000007---</td></tr>
<tr><td>2</td><td>Differential pressure gauge connector2</td><td>Monitor board 7</td></tr>
<tr><td>3</td><td>Differential pressure gauge connector 3</td><td>Monitor board 5</td></tr>
<tr><td>4</td><td>Three-way valve upper connector 1</td><td>Monitor board 1</td></tr>
<tr><td>5</td><td>Three-way valve upper connector 2</td><td>Y1-1</td></tr>
<tr><td>6</td><td>Three-way valve upper connector 3</td><td>Monitor board 3</td></tr>
<tr><td>7</td><td>Three-way valve upper connector 4</td><td>Monitor board 4</td></tr>
<tr><td>8</td><td>Y1-2</td><td>Monitor board 2</td></tr>
<tr><td>9</td><td>Y1-3</td><td>Monitor board 9</td></tr>
<tr><td>10</td><td>Three-way valve lower connector 1</td><td>Y2-1</td></tr>
<tr><td>11</td><td>Y2-2</td><td>Pressure sampling connector</td><td>M6G-020046---</td></tr>
<tr><td>12</td><td>Three-way valve lower connector 2</td><td>Y2-1</td><td>A21-000007---</td></tr>
<tr><td>13</td><td>Y2-2</td><td>Pressure sampling connector</td><td>M6G-020046---</td></tr>
<tr><td>14</td><td>Three-way valve lower connector 3</td><td>Y2-1</td><td>A21-000007---</td></tr>
<tr><td>15</td><td>Y2-2</td><td>Pressure sampling connector</td><td>M6G-020046---</td></tr>
<tr><td>16</td><td>Three-way valve lower connector 4</td><td>Y2-1</td><td>A21-000007---</td></tr>
<tr><td>17</td><td>Y2-2</td><td>Pressure sampling connector</td><td>M6G-020046---</td></tr>
<tr><td>18</td><td>Gas-out connector of expiratory valve</td><td>Gas-in connector of gas reservoir</td><td>M6G-020018---</td></tr>
<tr><td>19</td><td>Gas reservoir</td><td>Modular rack connector</td><td>M90-000049---</td></tr>
<tr><td>21</td><td>Gas-out connector of ACGO assembly</td><td>Circuit adapter</td><td rowspan="2">M6G-020038---</td></tr>
<tr><td>22</td><td>Gas-out connector of ACGO assembly</td><td>Fresh gas</td></tr>
<tr><td>23</td><td>Drive gas connector</td><td>Drive gas bent pipe</td><td rowspan="2">M6G-020018---</td></tr>
<tr><td>24</td><td>APL gas release connector</td><td>APL gas release bent pipe</td></tr>
<tr><td>Y1</td><td colspan="2">Three-way connector</td><td>M90-100030---</td></tr>
<tr><td>Y2</td><td colspan="2">Two-way connector</td><td>M02A-10-25942</td></tr>
</table>

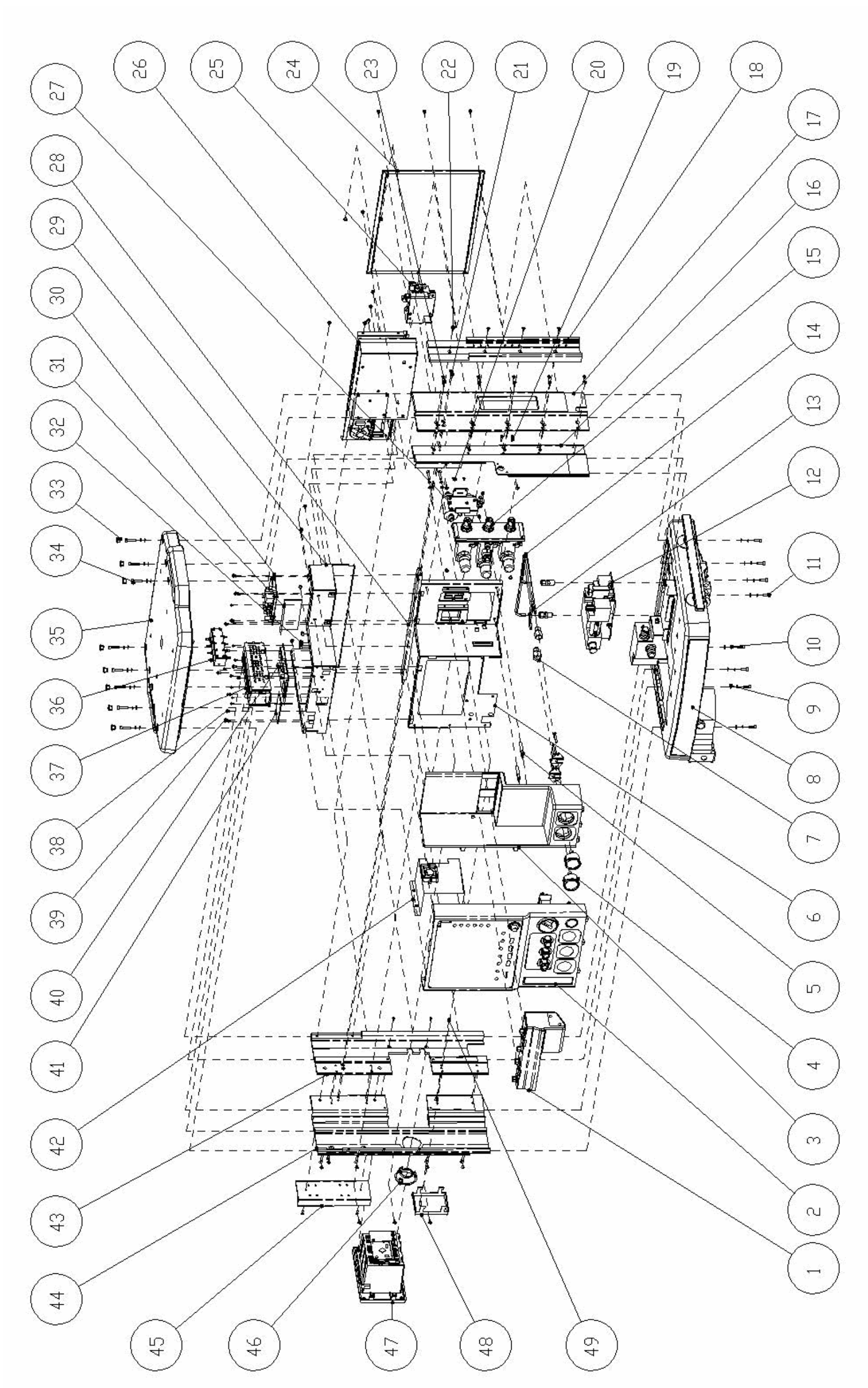
FOR YOUR NOTES

7 Parts

7.1 Main Unit

7.1.1 Main Unit

7.1.1.1 Exploded View



7.1.1.2 Parts List

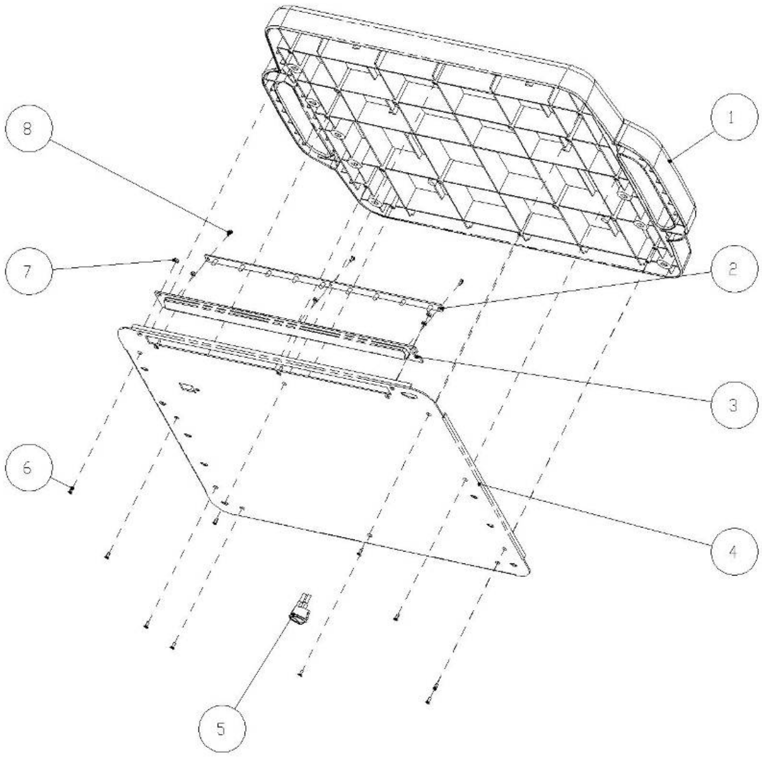
Note: The P/N of this assembly is 0621-30-69401.

S/N	P/N	Description	Qty
1	0621-30-69558	Double-vaporizer assembly	1
2	0621-30-69402	Left front panel assembly (10″ display)	1
3	0621-20-69446	Right front panel (mold MR69446)	2
4	0611-30-67602	Pipeline pressure gauge assembly	2
5	0621-20-69466	Bolt	2
6	0621-20-69404	Intermediate support	1
7	M6Q-030024---	Connector, Y-piece 3140-06-00	4
8	0621-30-69408	Tabletop assembly (with operation console)	1
9	M04-021011---	Plain washer-product grade A GB/T97.1-20025 rustproof nickel plating	18
10	M04-021007---	Single coil spring lock washer, normal type GB/T93-1987 5 rustproof nickel plating	18
11	M04-051062---	Stainless steel hexagon socket cap head screw GB/T70.1-2000 M5X16 polishing	18
12	0621-30-69625	Expiratory valve assembly	1
13	0621-21-69632	Metal tube (0621 O2)	1
14	0621-21-69633	Metal tube (0621 N2O)	1
15	0621-30-78685	O2, N2O and Air supplies inlet assemblies (with N2O cylinder)	1
16	0621-20-69587-51	Right front decorative plate	1
17	0621-20-69372-51	Right rear decorative plate	1
18	0010-20-42929-55	Right slide	1
19	M04-051065---	Stainless steel hexagon socket cap head screw GB/T70.1-2000 M4X16 polishing	2
20	M04-051140---	Cross recessed small pan head screw assembly GB/T9074.8 M3X8 rustproof nickel plating	2
21	M04-051139---	Cross recessed small pan head screw assembly GB/T9074.8 M4X12 rustproof plating	9
22	M04-051053---	Stainless steel cross recessed countersunk head screw GB/T819.2-1997 M4X12	6
23	M04-000205---	Stainless steel cross recessed countersunk head screw GB/T819.2-1997 M4X8	18
24	0621-20-69417-51	Rear panel	1
25	0621-30-69416	ACGO assembly	1
26	0621-30-69516	Rear block plate assembly	1
27	0621-30-78676	O2-N2O cut-off valve assembly	1

S/N	P/N	Description	Qty
28	0621-20-69418	Reinforcement bar	1
29	0621-20-69405	Tray	1
30	0621-30-78559	Monitor board assembly	1
31	0621-20-69563	Insulating strip for conversion board	1
32	M90-000032-00	Cable fixer, closed protective ring, SB-2428, black nylon	4
33	2105-20-40172	Screw plug (mold MR40172)	8
34	M04-051066---	Hexagon socket cap head screw GB/T701-2000 M5X25 rustproof nickel plating	10
35	0621-30-69419	Top plate assembly	1
36	0621-20-69393	Connection line for three-way valve assembly	1
37	0611-30-45595	Battery box assembly	1
38	M04-004012---	Cross recessed small pan head screw with washer GB9074.5-88 M3X6 rustproof nickel plating	18
39	M04-051141---	Cross recessed small pan head screw assembly GB/T9074.8 M4X8 rustproof nickel plating	28
40	0621-30-78696	Main control board	1
41	0621-30-69360	Button control board	1
42	0621-30-69590	Ground plate assembly of modular rack	1
43	0621-20-69372-52	Left rear decorative plate	1
44	0621-20-69371-52	Left front decorative plate	1
45	0010-20-42929-56	Left slide	1
46	0621-20-69415	Cover plate for ACGO switch (mold MR69415)	1
47	0621-30-69414	Modular rack assembly	1
48	0621-20-69559-51	Block plate for left upper decorative plate	1
49	M04-004013---	Cross recessed small pan head screw with washer GB9074.5-88 M3X10 rustproof nickel plating	3

7.1.2 Top Panel Assembly

7.1.2.1 Exploded View



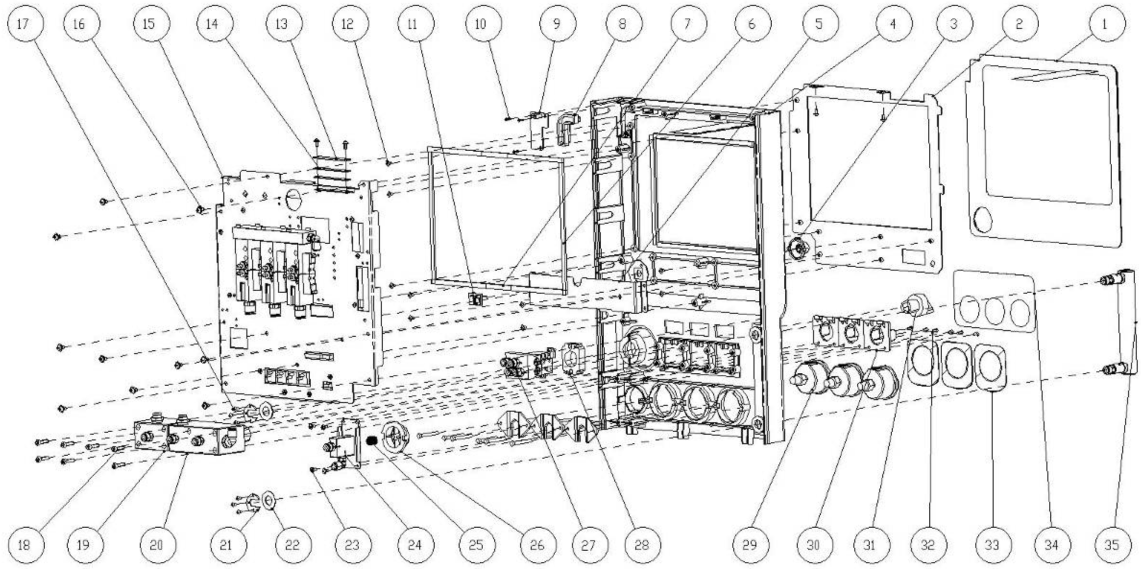
7.1.2.2 Parts List

Note: The P/N of this assembly is 0621-30-69419.

S/N	P/N	Description	Qty
1	0621-20-69451	Top panel (mold MR69451)	1
2	0621-30-69356	Table top light board	1
3	0621-20-69453	Top light shade (mold MR69453)	1
4	0621-20-69452-51	Cover plate	1
5	M07-00105S---	SWITCH ON/OFF 2P Terminal ship-shaped, white	1
6	M04-051145---	Cross recessed countersunk head tapping screw FT3X8 bright nickel plating	10
7	M04-011002---	Hexagon nut conical lock washer assembly M3 rustproof nickel plating	5
8	M04-003905---	Cross recessed pan head tapping screw PT3X6 bright nickel plating	3

7.1.3 Left Front Panel Assembly

7.1.3.1 Exploded View



7.1.3.2 Parts List

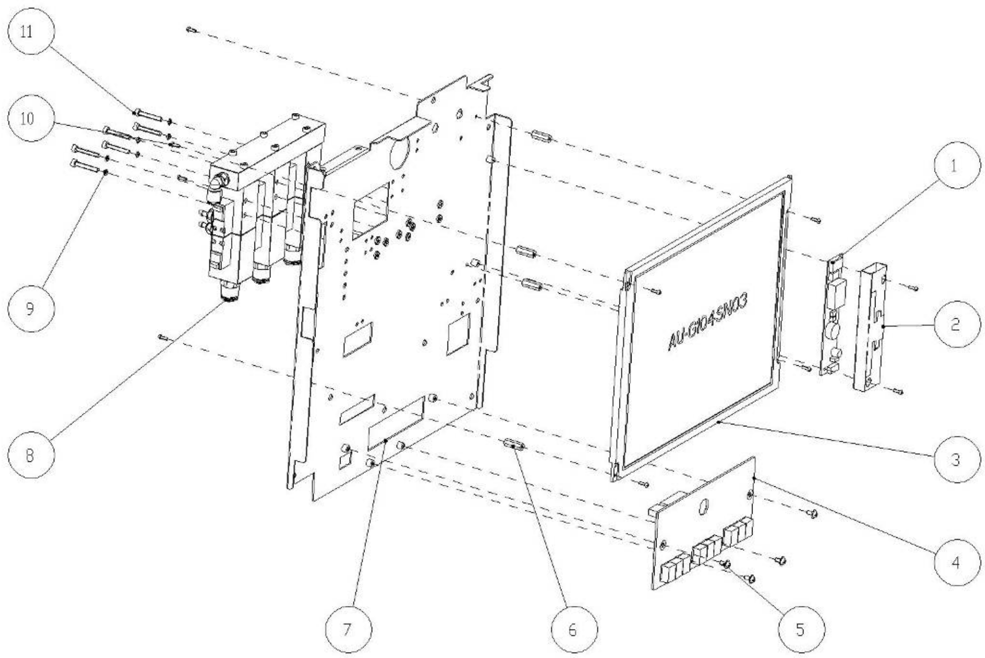
Note: The P/N of this assembly is 0621-30-69402.

S/N	P/N	Description	Qty
1	0621-21-69545	10.4″ membrane keyboard	1
2	0621-20-69535	Membrane keyboard support (10″ display)	1
3	9000-20-07354-51	Encoder knob	1
4	0621-20-69441-51	Left front panel (mold MR69441)	1
5	0621-20-69600	Connecting plate for left front panel	1
6	DA8K-20-14581	Screen dustproof strip 2	2
7	DA8K-20-14580	Screen dustproof strip 1	4
8	0621-20-69443	Alarm lamp shade (mold MR69443)	1
9	0621-30-69358	Alarm lamp board	1
10	M04-051060---	Cross recessed pan head tapping screw PT2X8 bright nickel plating	3
11	0010-30-43089	Encodee board	1
12	M04-004012---	Cross recessed small pan head screw with washer GB9074.5-88 M3X6 rustproof nickel plating	11
13	0621-20-69617	Press bar for membrane button socket	1
14	0621-20-69627	Press bar washer for membrane button socket	2

S/N	P/N	Description	Qty
15	0621-30-69442	Display assembly (AU 10" display)	1
16	M04-051141---	Cross recessed small pan head screw assembly GB/T9074.8 M4X8 rustproof nickel plating	10
17	M04-051031---	Stainless steel cross recessed pan head screw GB/T818-2000 M3X5 polishing	6
18	M04-051065---	Stainless steel hexagon socket cap head screw GB/T70.1-2000 M4X16 polishing	8
19	M6Q-020036---	Flow regulator, AIR	1
20	M6Q-020034---	Flow regulator, O2 and N2O	1
21	0621-20-69568	Check ring for total flowmeter	2
22	0621-20-69567	Washer for total flowmeter	2
23	M04-051140---	Cross recessed small pan head screw assembly GB/T9074.8 M3X8 rustproof nickel plating	19
24	0611-30-58711	O2 flush button assembly	1
25	0621-20-69591	Spring for O2 flush button	1
26	0621-20-69445-51	O2 flush button (mold MR69445)	1
27	0621-20-69494	Connection line B for system switch	1
28	M6Q-120015---	Clip for electrical contact point.ZB2-BZ101	1
29	0611-30-67602	Pipeline pressure gauge assembly	3
30	0621-20-69531	Needle valve knob stopper (mold MR69445)	3
31	M07-00111S---	SWITCH selector switch cam form ZB2-BD2C	1
32	M04-000405---	Cross recessed countersunk head screw GB/T819.1-2000 M3X8 rustproof nickel plating	6
33	0611-20-45647	Overlay for pressure gauge	3
34	0621-20-69444	Overlay for flowmeter	1
35	0621-10-69651	Total flowmeter.0-10L/min	1

7.1.4 Display Assembly

7.1.4.1 Exploded View



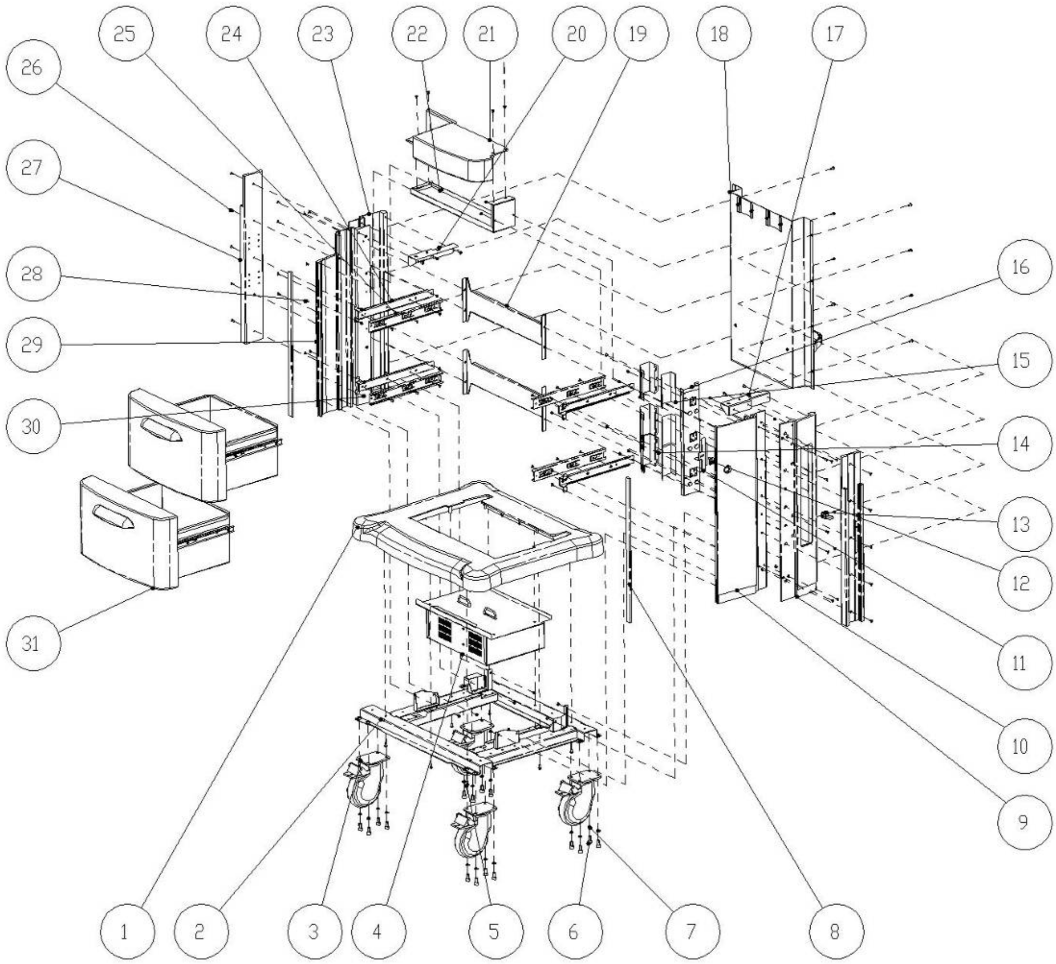
7.1.4.2 Parts List

Note: The P/N of this assembly is 0621-30-69442.

S/N	P/N	Description	Qty
1	0000-10-11020	Inverter DC/AC12VDC/500Vrms 6mA	1
2	7000-20-24417	Insulating strip for backlight board	1
3	0010-10-12357	LCD display TFT 10.4" 800*6003.3V	1
4	0621-30-69351	Flowmeter control board (configured with three flowtubes)	1
5	M04-051140---	Cross recessed small pan head screw assembly GB/T9074.8 M3X8 rustproof nickel plating	4
6	0621-20-69564	M2X15 bolt	4
7	0621-20-69473	Display fixture	1
8	0621-30-78552	Throttling device (O2, N2O and AIR)	1
9	M04-000104---	Single coil spring lock washer, normal type GB/T93-1987 3 rustproof nickel plating	6
10	M04-002405---	Cross recess head screw GB/T818-2000 M2X6 rustproof nickel plating	10
11	M04-000505---	Cross recess head screw GB/T818-2000 M3X20 rustproof nickel plating	6

7.1.5 Trolly Assembly (with Auxiliary Electrical Outlet/Euro Standard/220V)

7.1.5.1 Exploded View



7.1.5.2 Parts List

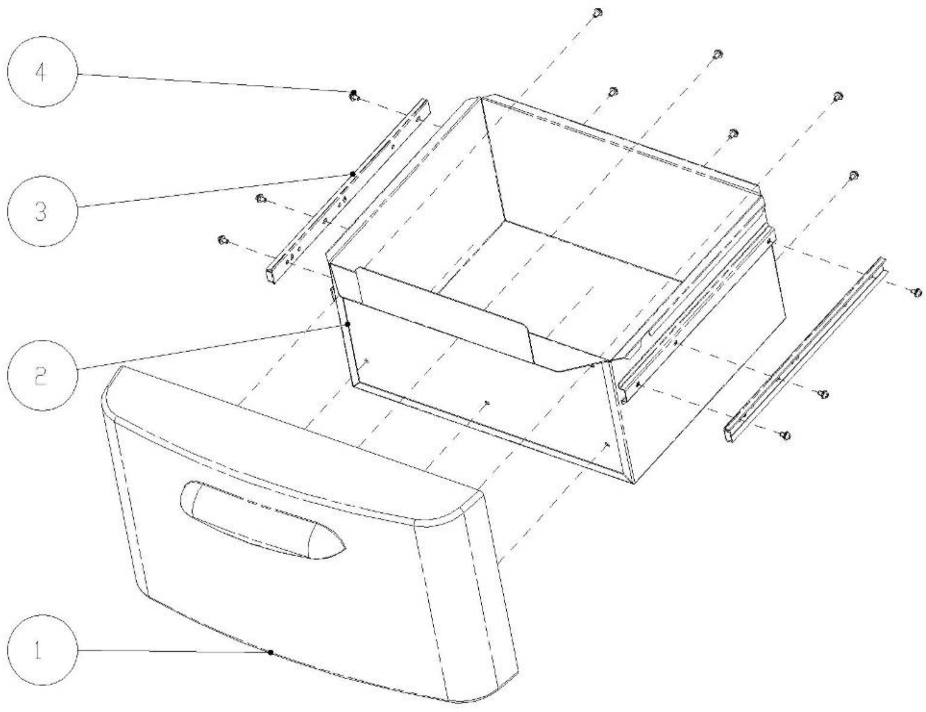
Note: The P/N of this assembly is 0621-30-69394.

S/N	P/N	Description	Qty
1	0621-20-69374	Decorative plate for bottom plate (mold MR69374)	1
2	0621-20-69373	Caster fixture	1
3	M6L-010001---	Caster 125mm white medical use, installation type	4
4	0621-30-69592	Isolation transformer installation box assembly	1
5	M04-051139---	Cross recessed small pan head screw assembly GB/T9074.8 M4X12 rustproof plating	14

S/N	P/N	Description	Qty
6	M04-051119---	Hexagon socket cap head screwGB/T70.1-2000 M8X16 rustproof nickel plating	16
7	M04-021031---	Stainless steel single coil spring lock washer, normal type GB/T93-1987 8 polishing	16
8	0621-20-69647	Drawer silicone washer	2
9	0621-20-69371-53	Trolly right front decorative plate	1
10	0621-20-69372-53	Trolly right rear decorative plate	1
11	0621-20-69621	Lock linkage component	1
12	0621-20-69620	Lockplate	1
13	M90-000151---	Drawer lock.LA-W613 (without plastic washer and lockplate)	1
14	0621-20-69599	Cover plate of auxiliary electrical outlet	3
15	0621-20-69640	Insulating strip for cover plate of auxiliary electrical outlet cover plate	3
16	0621-30-69597	Auxiliary electrical outlet assembly (Euro standard 220V)	1
17	0621-20-69465	Right fixture for tabletop	1
18	0621-30-69584	Trolly rear panel assembly	1
19	0621-20-69388	Rear connecting plate for trolly	2
20	0621-20-69387	Left fixture for tabletop	1
21	0621-20-69381	Drawer decorative plate (mold MR69381)	1
22	0621-20-69385	Front connecting plate for trolly	1
23	0621-20-69372-54	Trolly left rear decorative plate	1
24	0621-20-69390	Rail fixed plate	4
25	M6H-020004---	Rail .3732-12P	4
26	M04-051053---	Stainless steel cross recessed countersunk head screw GB/T819.2-1997 M4X12 polishing	8
27	0010-20-42929-54	Trolly rail	2
28	M04-000205---	Stainless steel cross recessed countersunk head screw GB/T819.2-1997 M4X8 polishing	28
29	0621-20-69371-54	Trolly left front decorative plate	1
30	M04-051134---	Stainless steel cross recess head screw assembly GB9074.4 M4X8 polishing	34
31	0621-30-69391	Trolly drawer assembly	2

7.1.6 Trolly Drawer Assembly

7.1.6.1 Exploded View



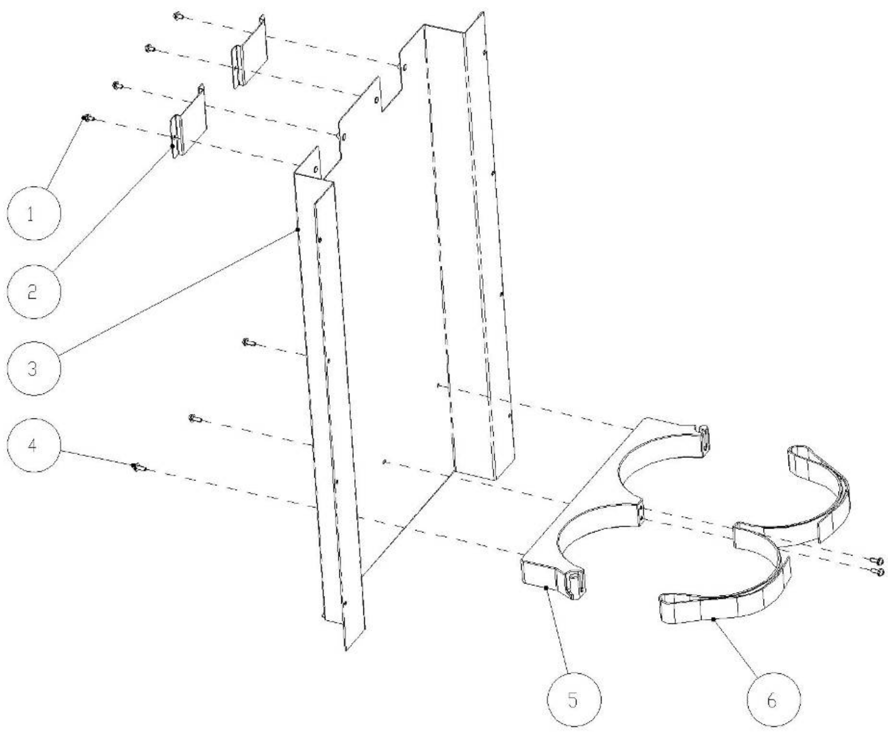
7.1.6.2 Parts List

Note: The P/N of this assembly is 0621-30-69391.。

S/N	P/N	Description	Qty
1	0621-20-69375	Drawer panel (mold MR69375)	1
2	0621-20-69378	Trolly drawer	1
3	M6H-020004---	Rail.3732-12P	2
4	M04-051141---	Cross recessed small pan head screw assembly GB/T9074.8 M4X8 rustproof nickel plating	12

7.1.7 Trolly Rear Panel Assembly

7.1.7.1 Exploded View



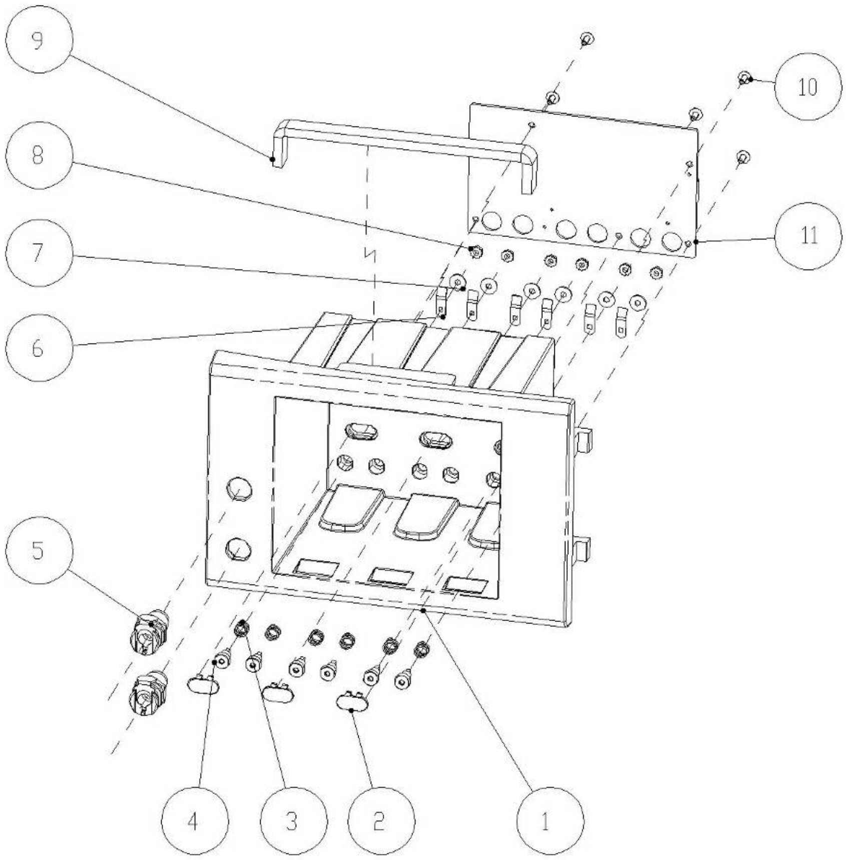
7.1.7.2 Parts List

Note: The P/N of this assembly is 0621-30-69584.

S/N	P/N	Description	Qty
1	M04-051141---	Cross recessed small pan head screw assembly GB/T9074.8 M4X8 rustproof nickel plating	4
2	0621-20-69472-51	Block plate for cylinder connector	2
3	0621-20-69382-51	Trolly rear panel	1
4	M04-051139---	Cross recessed small pan head screw assembly GB/T9074.8 M4X12 rustproof nickel plating	5
5	0621-20-69630-51	Cylinder support	1
6	0621-20-69595	Cylinder strap	1

7.1.8 Modular Rack Assembly

7.1.8.1 Exploded View



7.1.8.2 Parts List

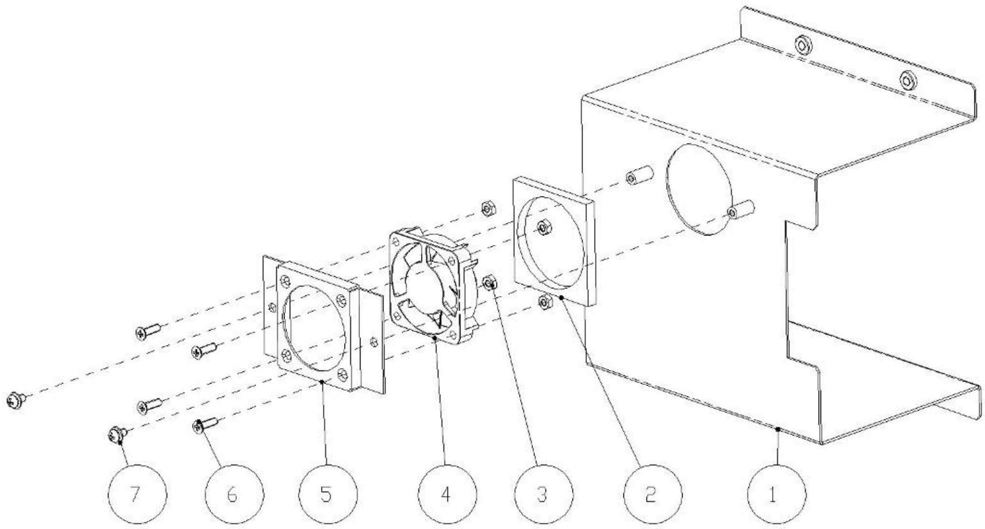
Note: The P/N of this assembly is 0621-30-69414.

S/N	P/N	Description	Qty
1	0621-20-69383-51	Modular rack (mold MR69383)	1
2	6800-20-50279	Infrared eyeglass (mold MR50279)	3
3	6800-20-50261	Contact point spring	6
4	6800-21-51100	Contact point screw	6
5	M6Q-030093---	Connector, easy plug-in and -out, plastic PMCD1601	2
6	6800-20-50388	Shielding finger	6
7	M04-021024---	Plain washer, large series, product grade A GB/T96.1-20023 rustproof nickel plating	6
8	M04-011002---	Hexagon nut conical lock washer assembly M3 rustproof nickel plating	6

S/N	P/N	Description	Qty
9	900E-20-04895	Dustproof cushion 2	1
10	M04-051140---	Cross recessed small pan head screw assembly GB/T9074.8 M3X8 rustproof nickel plating	5
11	0621-30-69353	Infrared backplane	1

7.1.9 Ground Plate Assembly of Modular Rack

7.1.9.1 Exploded View



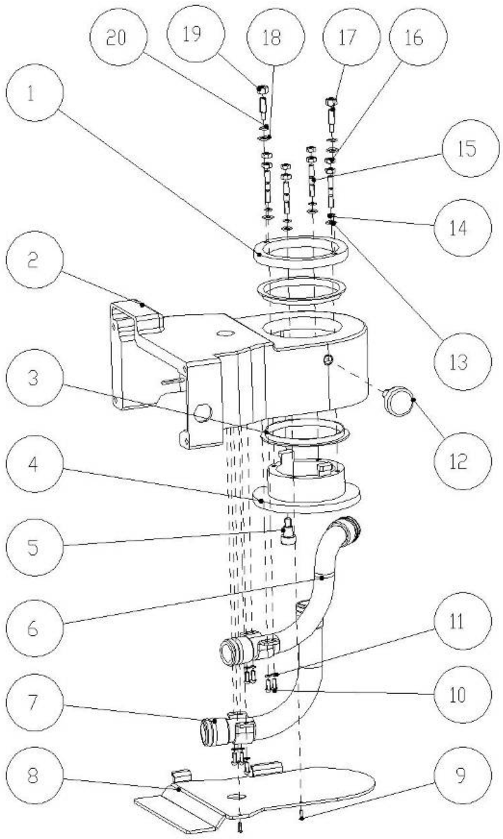
7.1.9.2 Parts List

Note: The P/N of this assembly is 0621-30-69590.

S/N	P/N	Description	Qty
1	0621-20-69454	Ground plate of modular rack	1
2	0611-20-58807	Fan cushion	1
3	M04-000301---	Stainless steel hexagon nut GB/T6170-2000 M3 polishing	4
4	0621-20-69412	Fan	1
5	9201-20-35962	Fan mounting plate	1
6	M04-001705---	Cross recessed countersunk head screw GB/T819.1-2000 M3X10 rustproof nickel plating	4
7	M04-051158---	Cross recessed small pan head screw assembly GB/T9074.8 M3X6 rustproof nickel plating	2

7.1.10 Circuit Bracket Assembly

7.1.10.1 Exploded View



7.1.10.2 Parts List

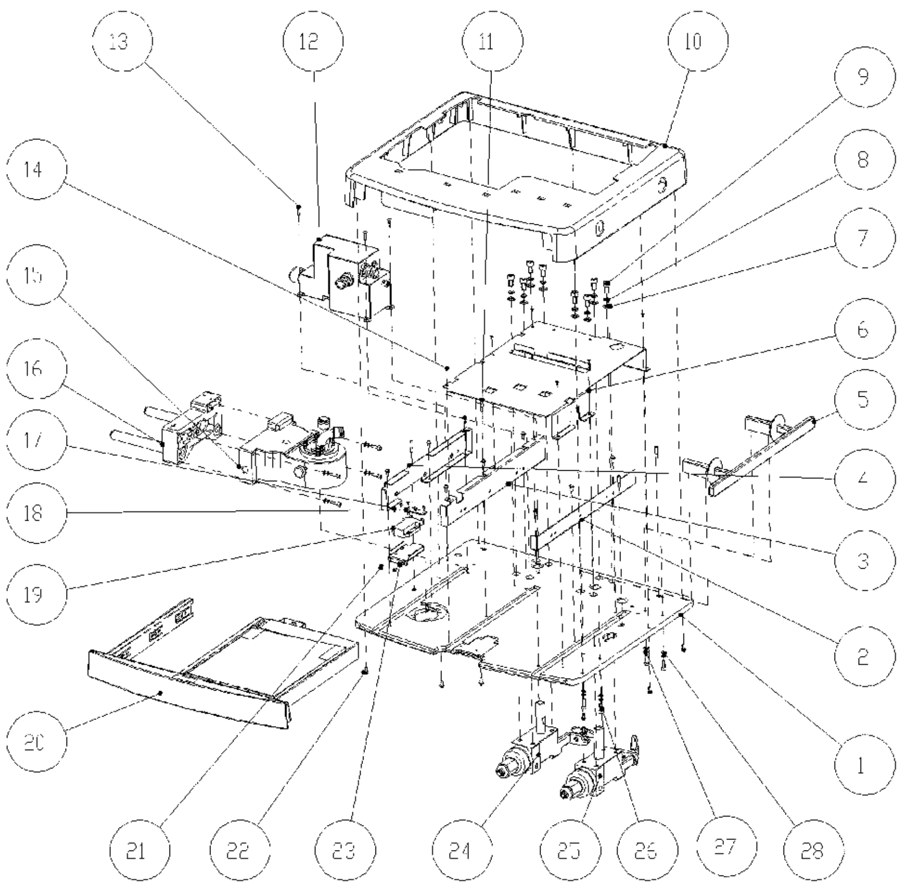
Note: The P/N of this assembly is 0621-30-69624.

S/N	P/N	Description	Qty
1	0621-20-69498	Sleeve for rotation axis	1
2	0621-20-69623-51	Circuit bracket	1
3	0621-20-69376	Friction strip	2
4	0621-20-69497	Rotation axis	1
5	0611-20-58835	Limitation screw	1
6	0601-20-78948	APL release gas bent pipe	1
7	0601-20-78947	Drive gas bent pipe	1
8	0621-20-78560	Cover plate for circuit bracket	1
9	M04-051084---	Cross recessed countersunk head screw GB/T819.1-2000 M2X8 rustproof nickel plating	2
10	M04-000605---	Cross recess head screw GB/T818-2000 M3X8 rustproof nickel plating	8

S/N	P/N	Description	Qty
11	M04-000104---	Single coil spring lock washer,normal type GB/T93-1987 3 rustproof nickel plating	8
12	0611-20-45580	Locking handle	1
13	M04-004702---	Plain washer, normal series, product grade A GB/T97.1-20024 rustproof nickel plating	4
14	M04-021005---	Single coil spring lock washer,normal type GB/T93-1987 4 rustproof nickel plating	4
15	0611-20-58720	Locking bolt	4
16	M04-000401---	Stainless steel hexagon nut GB/T6170-2000 M4 polishing	8
17	0611-20-58836	Locking screw	2
18	M04-021011---	Plain washer, normal series, product grade A GB/T97.1-20025 rustproof nickel plating	2
19	M04-021007---	Single coil spring lock washer,normal type GB/T93-1987 5 rustproof nickel plating	2
20	M04-000501---	Stainless steel hexagon nut GB/T6170-2000 M5 polishing	2

7.1.11 Tabletop Assembly

7.1.11.1 Exploded View



7.1.11.2 Parts List

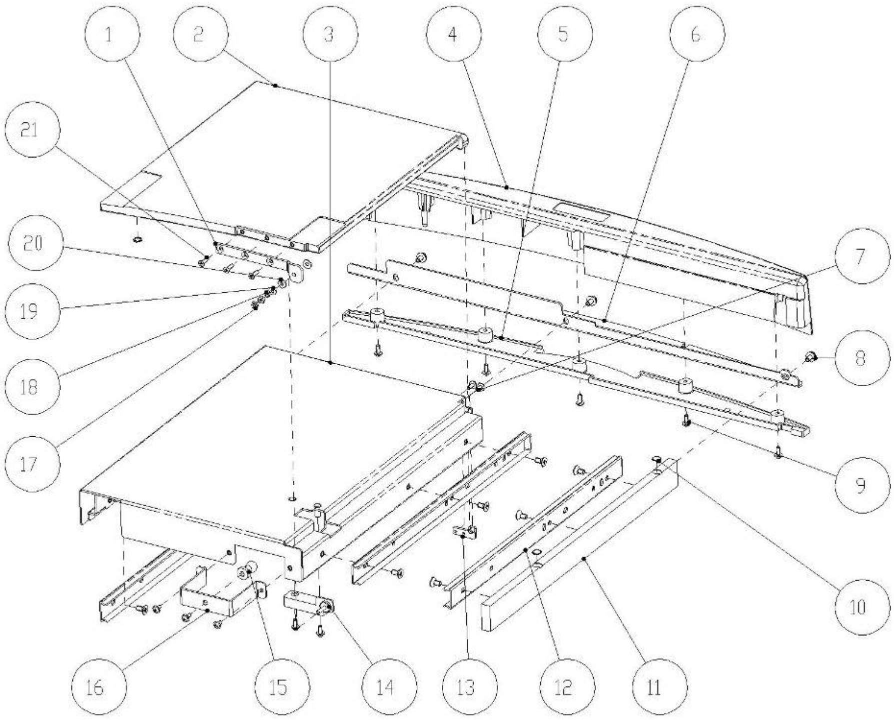
Note: The P/N of this assembly is 0621-30-69408.

S/N	P/N	Description	Qty
1	0621-20-69422	Tabletop base	1
2	0621-20-69424	Right fixing bracket for tabletop rail	1
3	0621-20-69425	Middle fixing bracket for tabletop rail	1
4	0621-20-69555	Left fixing bracket for tabletop rail	1
5	0621-30-69427	Handle asssembly	1
6	0621-20-69467	Tabletop bracket	1
7	M04-000202---	Plain washer, normal series, product grade A GB/T97.1-20028 rustproof nickel plating	8
8	M04-021031---	Stainless steel single coil spring lock washer,normal type GB/T93-1987 8	8
9	M04-051119---	Hexagon socket cap head screw GB/T70.1-2000 M8X16 rustproof nickel plating	8
10	0621-20-69421	Tabletop decorative plate (mold MR69421)	1
11	0621-20-69501	φ5 positioning pin	4
12	0621-30-69468	Capacity assembly	1
13	M04-000205---	Stainless steel cross recessed countersunk head screw GB/T819.2-1997 M4X8 polishing	9
14	M04-005005---	Cross recessed countersunk head screw GB/T819.1-2000 M3X6 rustproof nickel plating	3
15	0621-30-69624	Circuit bracket assembly	1
16	0601-30-69857	Circuit adapter assembly	1
17	M04-002505---	Cross recessed pan head screw GB/T818-2000 M3X6 rustproof nickel plating	4
18	0621-20-69554	Press bar for locking catch base	1
19	M6P-020001---	Locking catch MC-37 white	1
20	0621-30-78580	Tabletop operation console assembly	1
21	M04-051140---	Cross recessed small pan head screw assembly GB/T9074.8 M3X8 rustproof nickel plating	2
22	M04-051139---	Cross recessed small pan head screw assembly GB/T9074.8 M4X12 rustproof plating	16
23	0621-20-69553	Mounting plate for locking catch base	1
24	0621-30-69458	N2O cylinder bracket assembly	1
25	0621-30-69457	O2 cylinder bracket assembly	1
26	M04-051062---	Stainless steel hexagon socket cap head screw GB/T70.1-2000 M5x16 polishing	4

S/N	P/N	Description	Qty
27	M04-021007---	Single coil spring lock washer, normal type GB/T93-1987 5 rustproof nickel plating	4
28	M04-021011---	Plain washer, normal series, product grade A GB/T97.1-20025 rustproof nickel plating	4

7.1.12 Tabletop Operation Console Assembly

7.1.12.1 Exploded View



7.1.12.2 Parts List

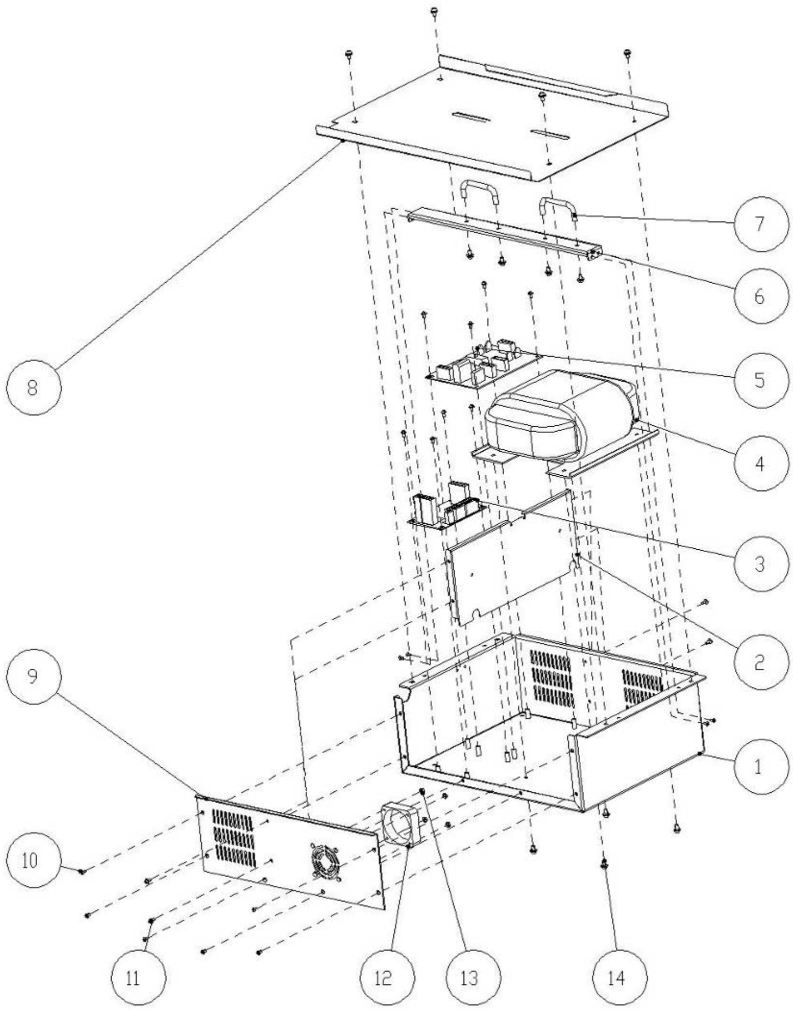
Note: The P/N of this assembly is 0621-30-78580.

S/N	P/N	Description	Qty
1	0621-20-69642-51	Connecting clamp for tabletop rotation axis	1
2	0621-20-69431	Movable operation console	1
3	0621-20-69549-51	Fixed operation console	1
4	0621-20-69428	Operation console panel 1 (mold MR69428)	1
5	0621-20-69429	Operation console panel 2 (mold MR69428)	1
6	0621-20-69551	Connecting bracket for operation console	1

S/N	P/N	Description	Qty
7	M04-051140---	Cross recessed small pan head screw assembly GB/T9074.8 M3X8 rustproof nickel plating	7
8	M04-051134---	Stainless steel cross recessed pan head screw assembly GB9074.4 M4X8 polishing	12
9	M04-004015---	Cross recessed small pan head screw with washer GB9074.5-88 M3X8 rustproof nickel plating	5
10	DA8K-10-14410	Buffer cushion.Bumpon SJ5302 white transparent	4
11	0621-20-69550-51	Bracket for movable operation console	1
12	M6H-020004---	Rail.3732-12P	3
13	0621-20-69644-51	Base for tabletop rotation axis	1
14	0621-20-78581-51	Base for tabletop rear rotation axis	1
15	0621-20-69645	Locker	1
16	0621-20-69552	Mounting plate for locker	1
17	M04-000301---	Stainless steel hexagon nutGB/T6170-2000 M3 polishing	2
18	M04-000104---	Single coil spring lock washer,normal typeGB/T93-1987 3 rustproof nickel plating	1
19	M04-000802---	Plain washer, normal series, product grade A GB/T97.1-20023 rustproof nickel plating	1
20	M90-000122---	WASHER WS-2T inner diameter 3.2 self-colored UL 2000	2
21	M04-001705---	Cross recessed countersunk head screwGB/T819.1-2000 M3X10 rustproof nickel plating	3

7.1.13 Isolation Transformer Mounting Assembly

7.1.13.1 Exploded View



7.1.13.2 Parts List

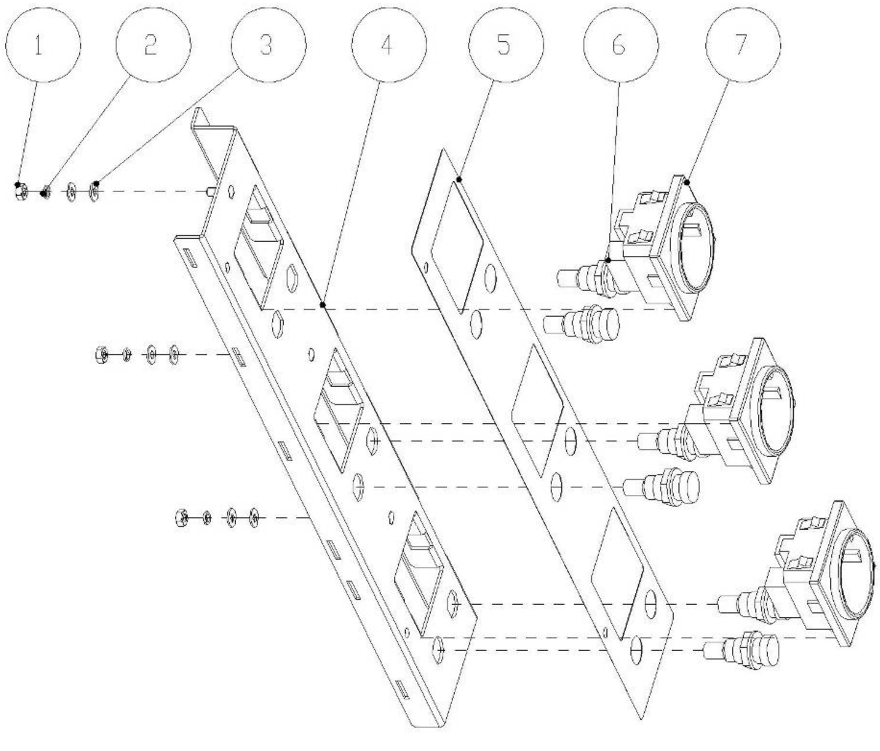
Note: The P/N of this assembly is 0621-30-69592.

S/N	P/N	Description	Qty
1	0621-20-69593	Bottom housing of isolation transformer mounting box	1
2	0621-20-69594	Partition board of isolation transformer mounting box	1
3	0611-30-45408	Power adaptation board (with isolation transformer)	1
4	TSB1-20-20394	Isolation transformer R800 620VA finished goods	1
5	0611-30-45463	Power conversion board (with isolation transformer)	1
6	0621-20-69392	Fixed plate for isolation transformer handle	1
7	2105-20-40482	Handle	2
8	0621-20-69596	Cover plate of isolation transformer mounting box	1

S/N	P/N	Description	Qty
9	0621-20-69628	Rear panel of bottom housing of isolation transformer mounting box	1
10	M04-005005---	Cross recessed countersunk head screw GB/T819.1-2000 M3X6 rustproof nickel plating	10
11	M04-051140---	Cross recessed small pan head screw assembly GB/T9074.8 M3X8 rustproof nickel plating	12
12	0611-20-58667	Fan and cable of isolation transformer	1
13	M04-011002---	Hexagon nut conical lock washer assembly M3 rustproof nickel plating	4
14	M04-051141---	Cross recessed small pan head screw assembly GB/T9074.8 M4X8 rustproof nickel plating	8

7.1.14 Auxiliary Electrical Outlet Assembly (220V)

7.1.14.1 Exploded View



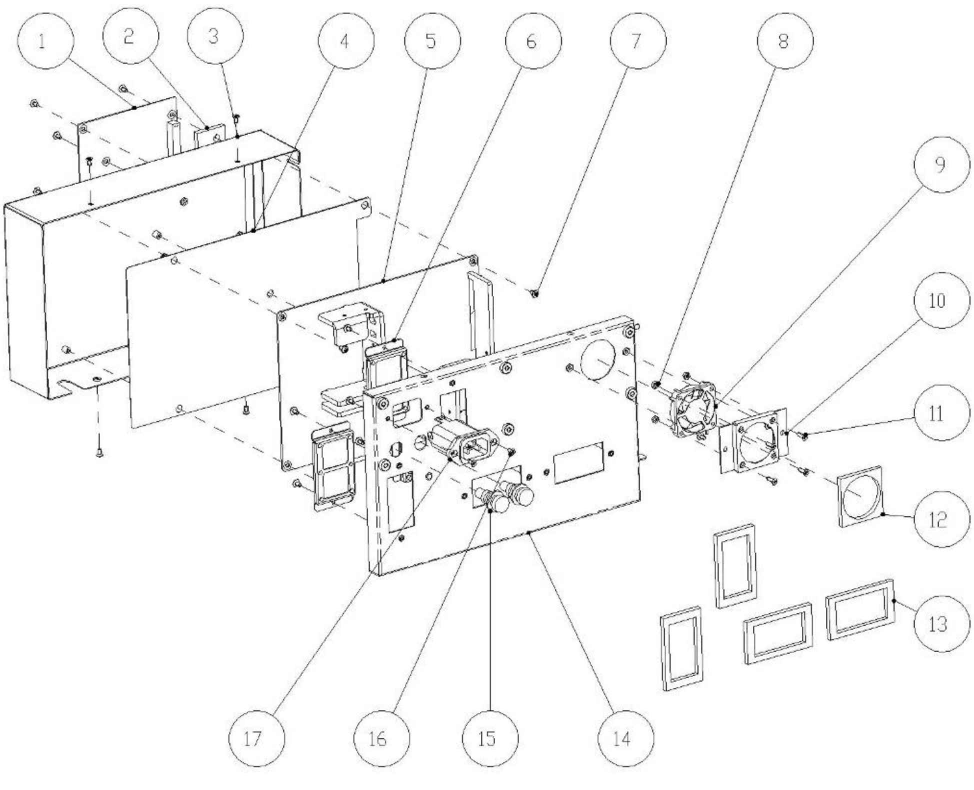
7.1.14.2 Parts List

Note: The P/N of this assembly is 0621-30-69597.

S/N	P/N	Description	Qty
1	M04-000401---	Stainless steel hexagon nut GB/T6170-2000 M4 polishing	3
2	M04-021005---	Single coil spring lock washer, normal type GB/T93-1987 4 rustproof nickel plating	3
3	M04-004702---	Plain washer, normal series, product grade AGB/T97.1-20024 rustproof nickel plating	6
4	0621-20-69598	Bracket for auxiliary electrical outlet (Euro standard)	1
5	0621-20-69603-51	Overlay for auxiliary electrical outlet (Euro standard 220V)	1
6	509B-10-06194	HEADER fuse holder φ5*20	6
7	0621-20-69609	Cable for Euro standard socket	3

7.1.15 Power Box Assembly

7.1.15.1 Exploded View



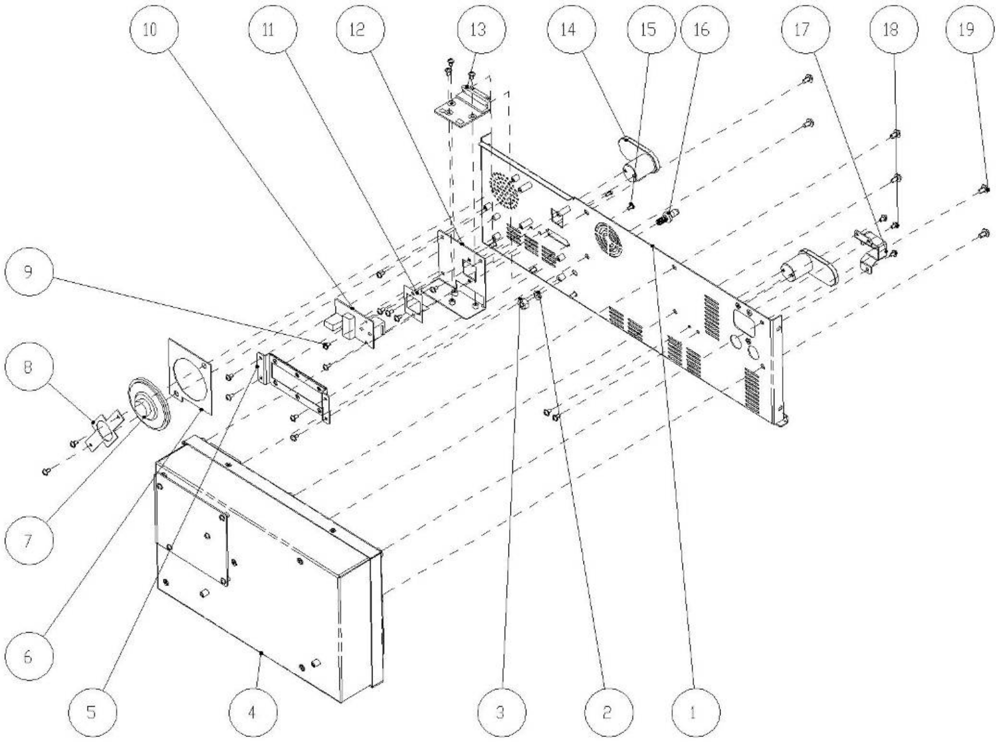
7.1.15.2 Parts List

Note: The P/N of this assembly is 0621-30-69407.。

S/N	P/N	Description	Qty
1	0621-30-69354	Power conversion board	1
2	0621-20-69562	Sealing cushion	1
3	0621-20-69447	Power box	1
4	0621-20-69616	Insulating strip for power board	1
5	0621-30-78595	Power board	1
6	0621-20-78604	Dustproof net	4
7	M04-051140---	Cross recessed small pan head screw assembly GB/T9074.8 M3X8 rustproof nickel plating	20
8	M04-000301---	Stainless steel hexagon nutGB/T6170-2000 M3 polishing	4
9	9200-20-10656	Fan and fan cable (SUNONKDE1204PFV3)	1
10	9201-20-35962	Fan mounting plate	1
11	M04-001705---	Cross recessed countersunk head screw GB/T819.1-2000 M3X10 rustproof nickel plating	4
12	0611-20-58807	Fan cushion	1
13	0621-20-69449	Sealing cushion	4
14	0621-20-69448	Power box cover	1
15	509B-10-06194	HEADER fuse holder φ5*20	2
16	M04-005005---	Cross recessed countersunk head screwGB/T819.1-2000 M3X6 rustproof nickel plating	6
17	0621-21-69489	Cable from AC filter to fuse	1

7.1.16 Rear Plate Assembly

7.1.16.1 Exploded View



7.1.16.2 Parts List

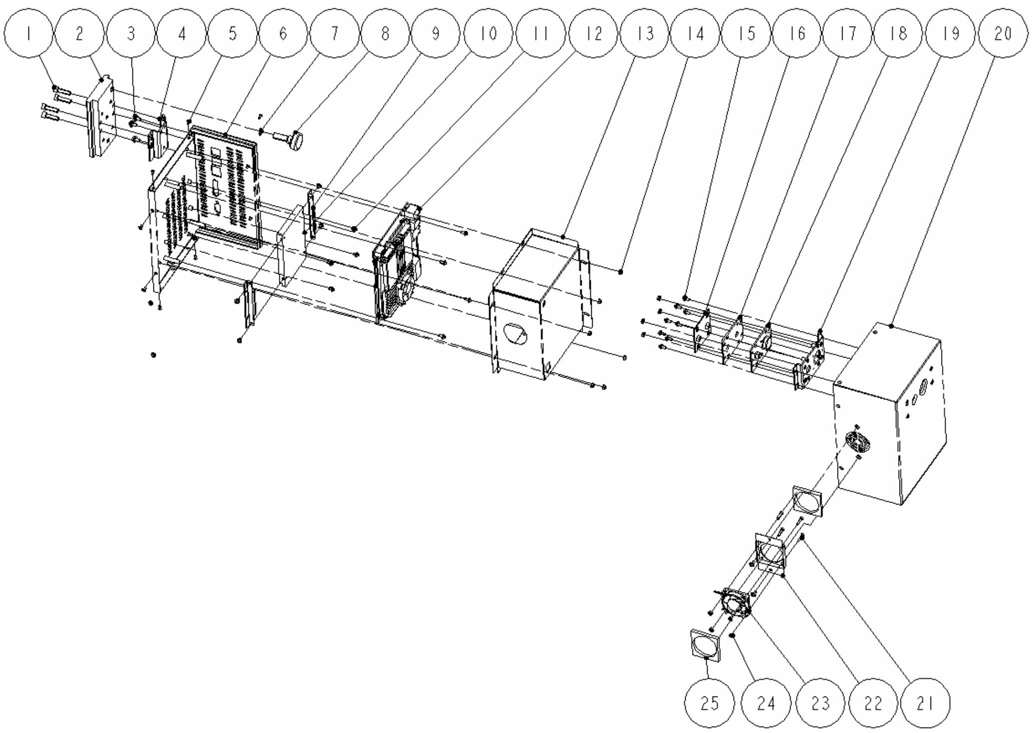
Note: The P/N of this assembly is 0621-30-69516.

S/N	P/N	Description	Qty
1	0621-20-69406-51	Rear plate (100-240V)	1
2	M04-004504---	Single coil spring lock washer, normal type GB/T93-1987 6 rustproof nickel plating	1
3	M04-004401---	Stainless steel hexagon nut GB/T6170-2000 M6 polishing	1
4	0621-30-69407	Power box assembly	1
5	0621-20-69420	Dustproof net	1
6	0621-20-69561	Speaker EVA cushion	1
7	9200-21-10633	2.25" speaker and speaker cable	1
8	9200-20-10620	Press bar for speaker	1
9	M04-051140---	Cross recessed small pan head screw assemblyGB/T9074.8 M3X8 rustproof nickel plating	15

S/N	P/N	Description	Qty
10	9210-30-30152	Network connection board	1
11	9210-20-30175	Insulating strip for socket board	1
12	0621-20-78588	Bracket for network connector	1
13	0621-30-69585	Power conversion board for CIS	1
14	0621-20-69463-51	Hook	2
15	M04-051045---	Cross recessed small pan head screw GB/T823-1988 M2.5X6 rustproof nickel plating	2
16	0509-20-00098	Grounding stud	1
17	0621-20-78748	Mains inlet fixer	1
18	M04-051158---	Cross recessed small pan head screw assembly GB/T9074.8 M3X6 rustproof nickel plating	3
19	M04-006412---	Cross recessed pan head screw with washer GB9074.1-88 M4X8 rustproof nickel plating	6

7.1.17 CIS Assembly

7.1.17.1 Exploded View



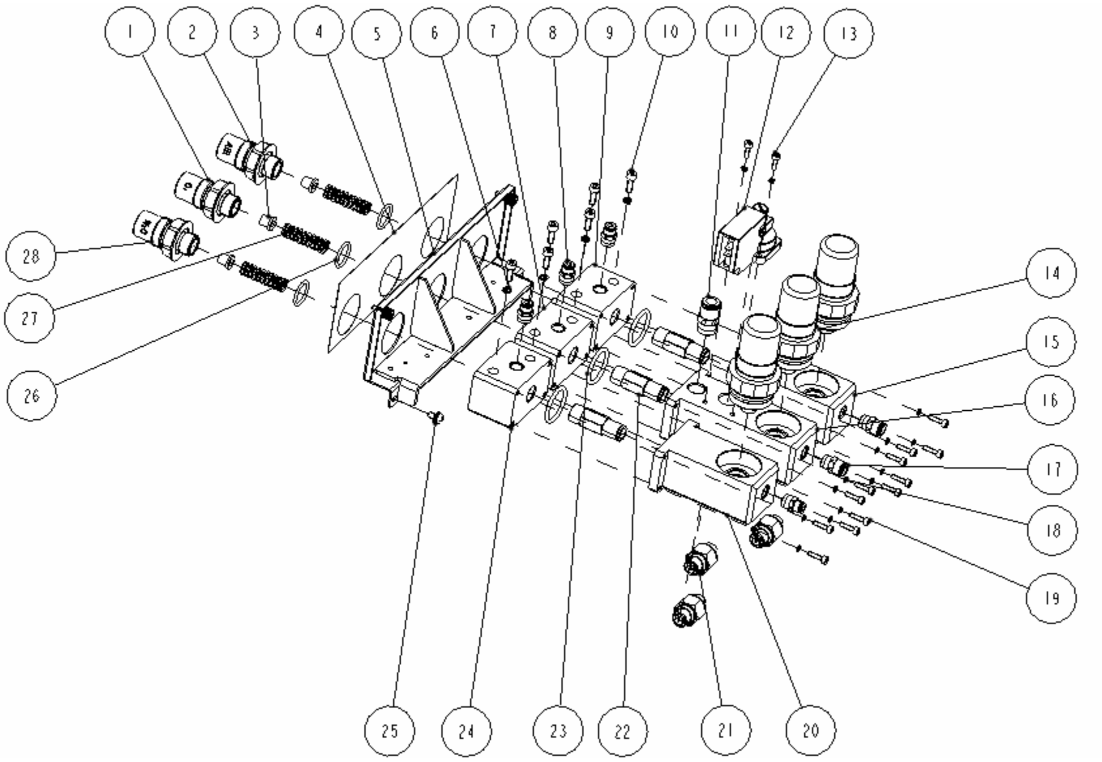
7.1.17.2 Parts List

Note: The P/N of this assembly is 0621-30-78550.

S/N	P/N	Description	Qty
1	M04-051115---	Stainless steel hexagon socket cap head screw GB/T70.1-2000 M5X20	4
2	0010-20-42769	Bracket slide block	1
3	M04-051141---	Cross recessed small pan head screw assembly GB/T9074.8 M4X8 rustproof nickel plating	3
4	0621-20-69581	Mounting plate	1
5	M04-005005---	Cross recessed countersunk head screw GB/T819.1-2000 M3X6 rustproof nickel plating	6
6	0621-20-69577-51	Bottom plate	1
7	M04-051045---	Cross recessed small pan head screw GB/T823-1988 M2.5X6 rustproof nickel plating	4
8	0010-20-42983	Locking knob	1
9	0621-20-69579	Harddisk fixed bar	2
10	0000-10-11065	Harddisk 40GB 5400rpm ATA100 notebook	1
11	M04-051158---	Cross recessed small pan head screw assembly GB/T9074.8 M3X6 rustproof nickel plating	8
12	0621-30-78747	Main control board assembly	1
13	0621-20-69615	Shielding can	1
14	M04-011002---	Hexagon nut conical lock washer assembly M3 rustproof nickel plating	12
15	M04-051140---	Cross recessed small pan head screw assembly GB/T9074.8 M3X8 rustproof nickel plating	14
16	0611-30-58810	Button board	1
17	0611-20-58799	Press bar for silicone button	1
18	0611-20-58798-51	Silicone button-51	1
19	0611-20-58800	Fixed plate for silicone button	1
20	0621-20-69578-51	Cover plate	1
21	M04-051016-00	Cross recessed countersunk head screw GB/T819.1-2000 M3X15 rustproof nickel plating	4
22	9201-20-35962	Mounting plate for fan	1
23	0621-20-78572	CIS fan and fan cable	1
24	M04-000301---	Stainless hexagon nut GB/T6170-2000 M3 polishing	4
25	0611-20-58807	Fan cushion	1

7.1.18 O2, N2O and AIR Supplies Inlet Assemblies

7.1.18.1 Exploded View



7.1.18.2 Parts List

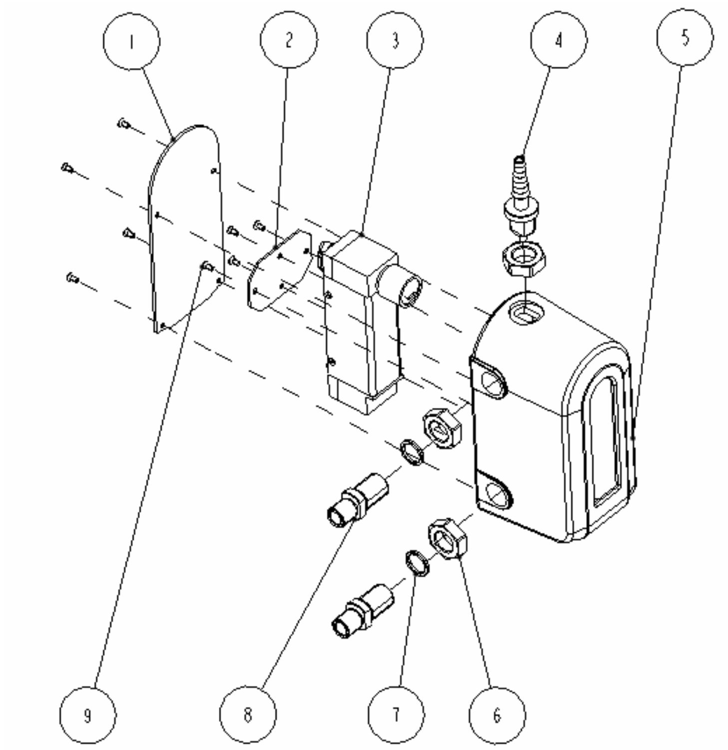
Note: The P/N of this assembly is 0621-30-78685.

S/N	P/N	Description	Qty
1	0611-20-45605	O2 pipe connector	1
2	0611-20-45602	AIR pipe connector	1
3	0611-20-45600	Filter	3
4	0621-20-69510	Gas supply inlet overlay	1
5	0621-20-69411	Gas supply inlet assembly bracket	1
6	M04-021005---	Spring washer GB93 4	6
7	0621-20-78620	O2 pipe support	1
8	M6Q-030014---	Connector, straight connector 3175-04-10	4
9	0621-20-78626	AIR pipe support	1
10	M04-051073---	Hexagon socket cap head screw M4X12	6
11	M6Q-030016---	Straight connector 3175-08-13	1

12	M07-00126S---	Gas pressure switch, which gives an alarm when pressure drops 32 PSI	1
13	M04-051026---	Hexagon socket cap head screw M3X10	2
14	m6q-020030---	Valve, regulator 11-990-196	3
15	0621-20-78627	AIR pipe tail fitting	1
16	0621-20-78621	O2 pipe tail fitting	1
17	M6Q-030015---	Connector, straight connector 3175-06-10	2
18	M04-000104---	Spring washer GB93 3	14
19	M04-051093---	Hexagon socket cap head screw M3X12	12
20	0621-20-78624	N2O pipe tail fitting	1
21	0611-30-67605	Pressure relief valve 37.9	3
22	M6Q-020010---	Valve, check valve AKH08A-02S	3
23	M6M-010016---	Seal, O-ring 23.60X2.65 silicone A70 red	3
24	0621-20-78623	N2O pipe support	1
25	M04-051141---	Small pan head combination screw M4X8	2
26	M6M-010021---	Seal, O-ring16.00X2.00 EPT A70 black	3
27	0611-20-45435	Compression spring	3
28	0611-20-45597	N2O pipe connector	1

7.1.19 Auxiliary O2 Supply Assembly

7.1.19.1 Exploded View



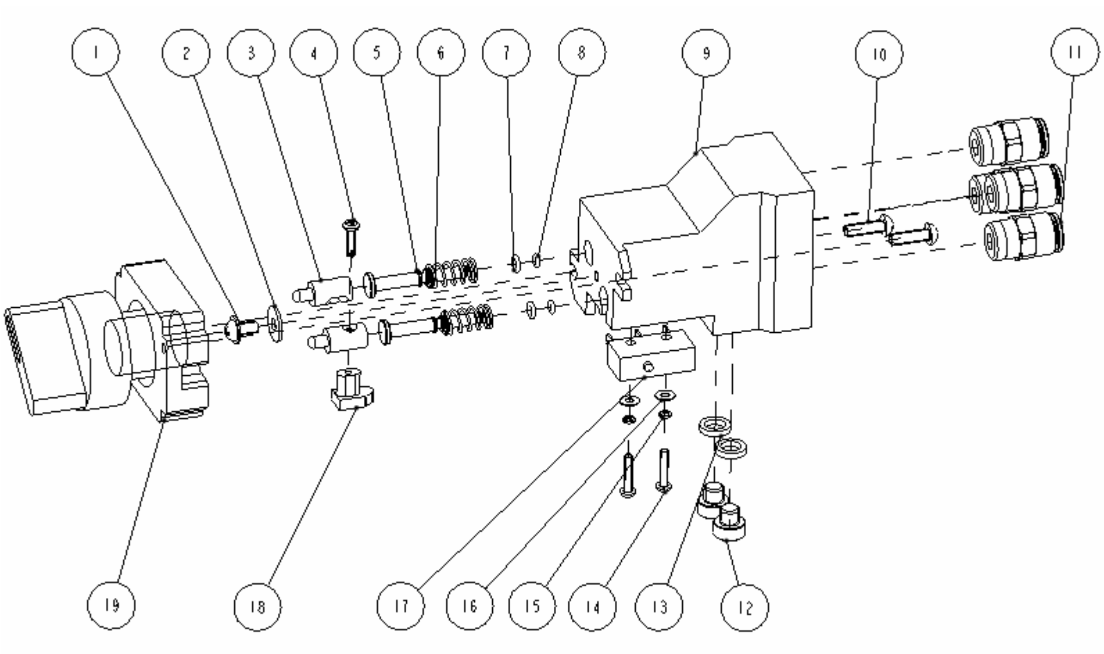
7.1.19.2 Parts List

Note: The P/N of this assembly is 0621-30-78469.

S/N	P/N	Description	Qty
1	0621-20-69504	Rear panel of auxiliary O2 supply assembly	1
2	0621-20-69508	Backboard of auxiliary O2 supply assembly	1
3	0621-10-69652	Auxiliary O2 flowmeter	1
4	0621-20-69505	Nozzle	1
5	0621-20-69503	Housing of auxiliary O2 supply assembly	1
6	M04-011010---	Hex nut GB6173	3
7	0621-20-69515	Plain washer	2
8	0621-20-69506	Bolt	2
9	M04-005005---	Cross recessed countersunk head screw M3X6	8

7.1.20 O2+AIR System Switch

7.1.20.1 Exploded View



7.1.20.2 Parts List

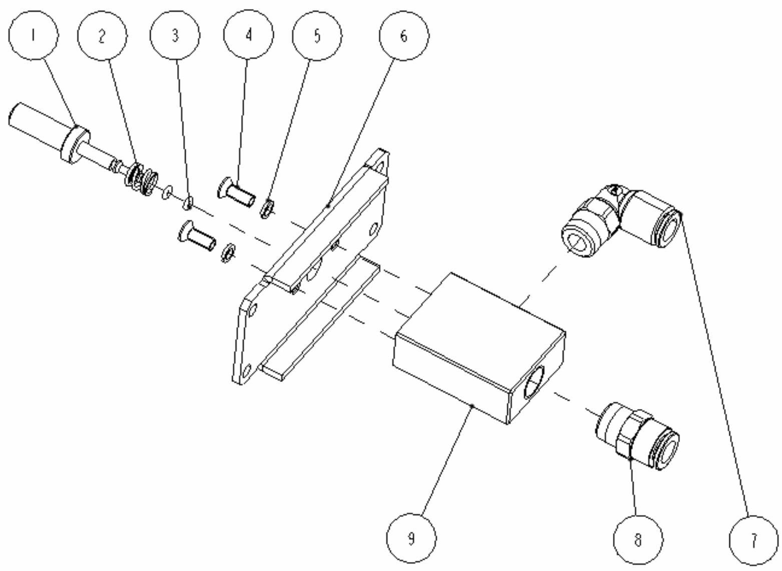
Note: The P/N of this assembly is 0611-30-58781.

S/N	P/N	Description	Qty
1	M04-004012---	Cross recessed pan head screw with washer M3X6	1
2	M04-021024---	Washer GB96-85 3	1

3	0611-20-58785	System switch button A	2
4	M04-051060---	Tapping screw PT2X8	1
5	0611-20-58784	Piston	2
6	0611-20-58783	Spring	2
7	M6M-010045---	Seal, O-ring 2.5X1 EPT A50 black	2
8	0010-10-42556	Seal, O-ring 1.5X1 fluororubber A75 brown	2
9	0611-20-58782	System switch block	1
10	M04-002605---	Cross recessed pan head screw M3X10	2
11	M6Q-030015---	Connector, straight connector 3175-06-10	4
12	M6Q-120044---	M5 hexagon plug 0919-00-19	2
13	M04-021062---	M5 nylon washer	2
14	M04-051020---	Cross recessed pan head screw M2X10	2
15	M04-021012---	Spring washer GB93 2	2
16	M04-000102---	Plain washer GB97.1 2	2
17	M07-00106S---	SWITCH SPDT DIP3 ball end	1
18	0611-20-58786	System switch button B	1
19	M6Q-120015---	Electrical contact clamp.ZB2-BZ101	1

7.1.21 O2 Flush Button Assembly

7.1.21.1 Exploded View



7.1.21.2 Parts List

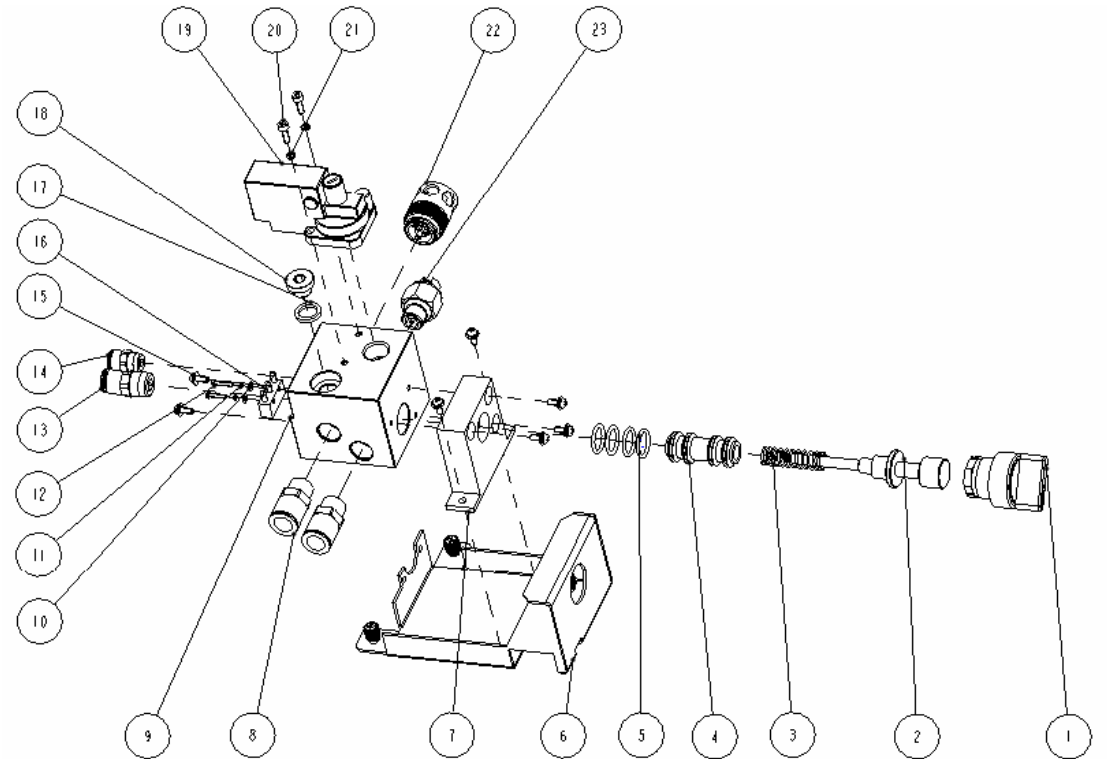
Note: The P/N of this assembly is 0611-30-58711.

S/N	P/N	Description	Qty
1	0611-20-58713	Piston	1
2	0611-20-58715	Spring	1

3	0010-10-42556	Seal, O-ring 1.5X1 fluororubber A75 brown	2
4	M04-000405---	cross recessed countersunk head screw M3X8	2
5	M04-000104---	Spring washer GB93 3	2
6	0611-20-58716	O2 flush bracket	1
7	M6Q-030020---	Connector, L-shaped connector 3109-06-10	1
8	M6Q-030015---	Connector, straight connector 3175-06-10	1
9	0611-20-58712	O2 flush block	1

7.1.22 ACGO Assembly

7.1.22.1 Exploded View



7.1.22.2 Parts List

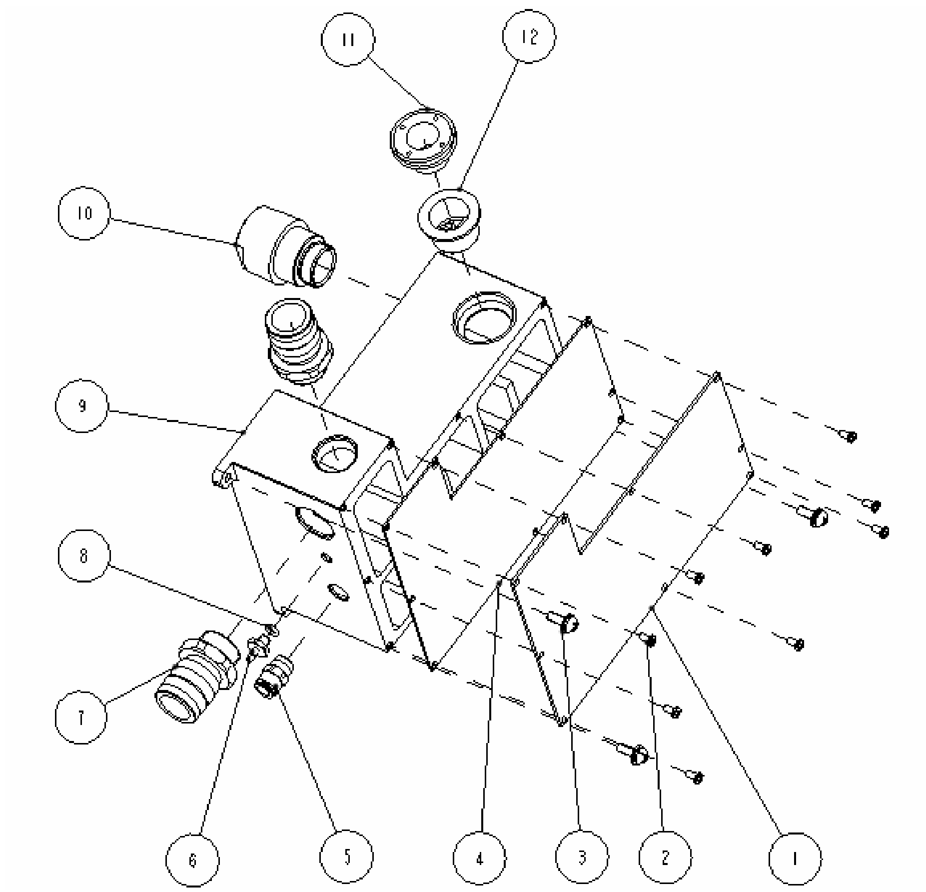
Note: The P/N of this assembly is 0621-30-69416.

S/N	P/N	Description	Qty
1	M6Q-120014---	Rotary switch ZB2-BK127	1
2	C-0621-20-69514	ACGO drive axis	1
3	0611-20-45435	Compression spring	1
4	0611-20-45421	Movable socket	1
5	M6M-010020---	Seal, O-ring 12.42X1.78 EPT A70 black	4
6	0621-20-69512	ACGO base	1
7	0621-20-69513	ACGO positioning block	1

8	M6Q-030100---	Connector, straight connector, inside diameter Φ 10mmR1/4 external thread	2
9	0621-20-69566	ACGO main unit	1
10	M04-000102---	Plain washer GB97.1 2	2
11	M04-021012---	Spring washer GB93 2	2
12	M04-051020---	Cross recessed pan head screw M2X10	2
13	M6Q-030016---	Connector, straight connector 3175-08-13	1
14	M6Q-030015---	Connector, straight connector 3175-06-10	1
15	M04-051140---	Small pan head combination screw M3X8	7
16	M07-00106S---	SWITCH SPDT DIP3 ball end	1
17	M04-021063---	G1/8 nylon washer	1
18	M6Q-120036---	Hexagon plug 0919-00-10	1
19	M07-00126S---	Gas pressure switch, which gives an alarm when pressure drops 32 PSI	1
20	M04-051026---	Hexagon socket cap head screw M3X10	2
21	M04-000104---	Spring washer GB93 3	2
22	0621-30-69662	Pressure relief valve	1
23	0611-30-67606	Type Ⅱ pressure relief valve 37.9	1

7.1.23 Gas Reservoir Assembly

7.1.23.1 Exploded View



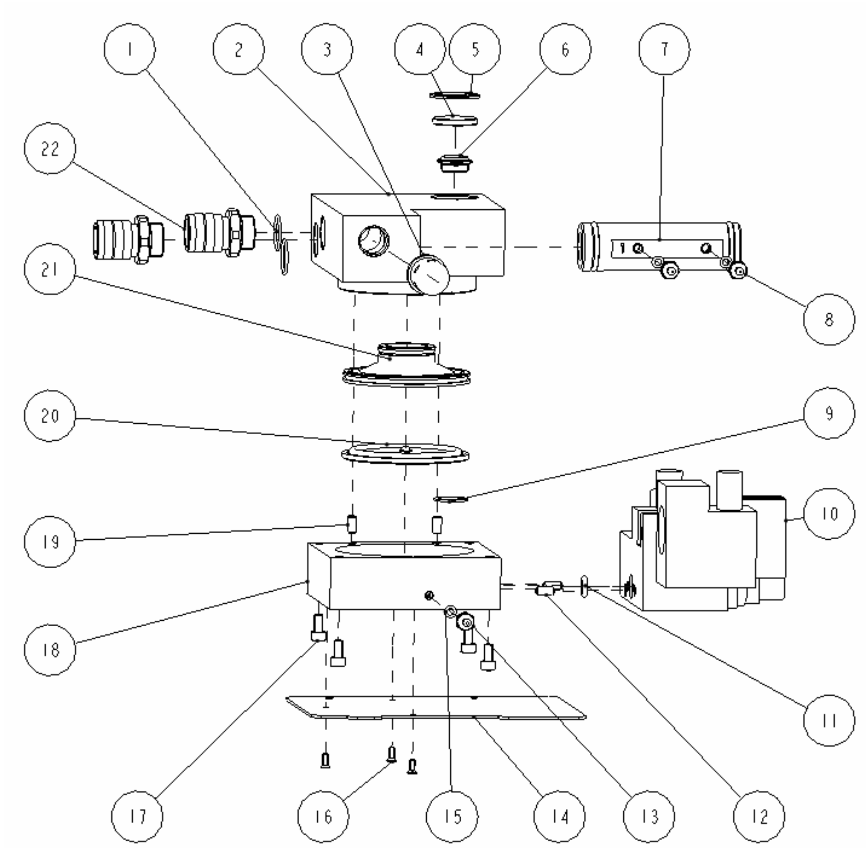
7.1.23.2 Parts List

Note: The P/N of this assembly is 0621-30-78468.

S/N	P/N	Description	Qty
1	0613-20-87567	Cover plate	1
2	M04-002505---	Cross recessed pan head screw GB818-85 M3X6	9
3	M04-051139---	Small pan head assembly M4X12	3
4	0613-20-87568	Sealing cushion	1
5	M6Q-030015---	Connector, straight connector 3175-06-10	1
6	C-0611-20-45642	AGSS connector	1
7	0611-20-45643	Pneumatic circuit connector	2
8	M6M-010013---	Seal, O-ring 4.00X1.50 silicone A70 red	1
9	0613-20-87566	Gas reservoir	1
10	C-0611-20-45641	Waste gas outlet	1
11	0621-20-78605	Nut	1
12	M6Q-020031---	Check valve membrane and check membrane assembly (25X16)	1

7.1.24 Expiratory Valve Assembly

7.1.24.1 Exploded View



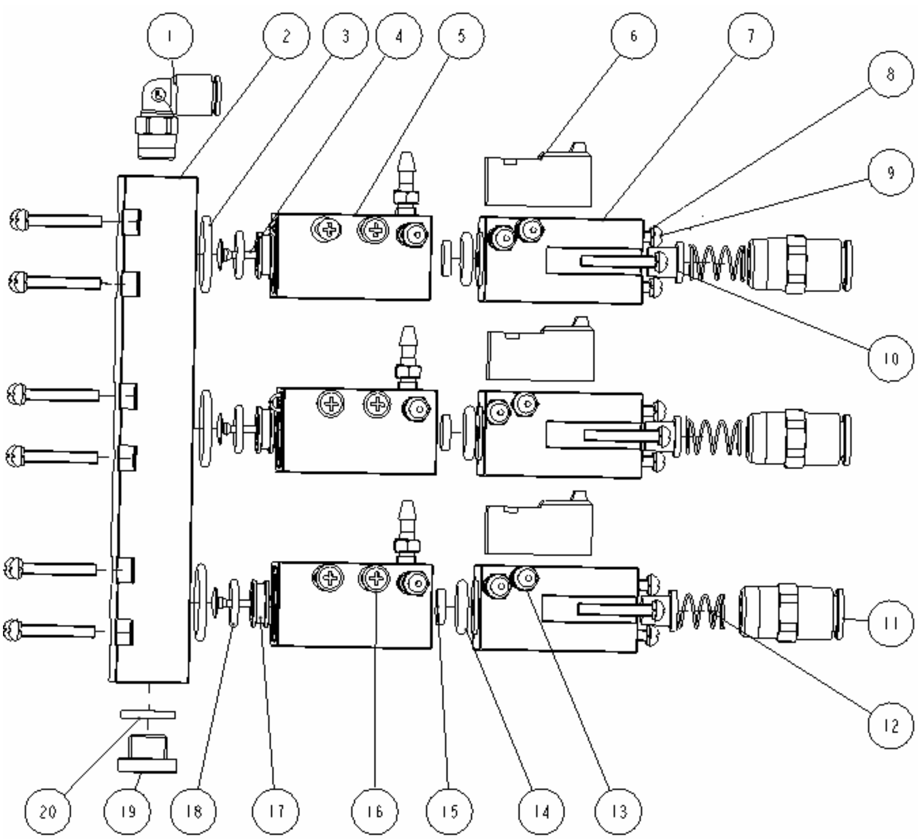
7.1.24.2 Parts List

Note: The P/N of this assembly is 0621-30-69625.

S/N	P/N	Description	Qty
1	M6M-010022---	Seal, O-ring 18.00X1.50 EPT A70 black	1
2	0611-20-45424	Lower cover	1
3	0611-10-58773-01	NORGREN pressure relief valve	1
4	0611-20-45431	Valve slice	1
5	M04-021056---	Spring ring	1
6	0611-20-45430	Valve connector	1
7	0611-30-45428-FLOWSENSOR	Differential pressure gauge assembly	1
8	0611-20-45610	Connector of differential pressure gauge	2
9	0611-20-67598	Plain washer	1
10	0611-10-58773	NORGREN circuit	1
11	0611-10-58773-02	NORGREN seal	1
12	0611-10-58773-03	NORGREN positioning pin	2
13	0611-20-45488	Connector of pressure sampling tube	1
14	0621-20-69626	Mounting plate	1
15	M6M-010013---	Seal, O-ring 4.00X1.50 silicone A70 red	3
16	M04-000405---	Cross recessed countersunk head screw M3X8	3
17	M04-051061---	Hexagon socket cap head screw M5X10	4
18	0611-20-45429	Upper cover	1
19	0611-20-67595	Positioning pin axis	2
20	0611-30-45428-VALVEFLAP	Valve slice assembly	1
21	0611-30-45428-VALVECORE	Valve core assembly	1
22	0611-20-45643	Pneumatic circuit connector	2

7.1.25 Throttling Device (O2+N2O+AIR)

7.1.25.1 Exploded View



7.1.25.2 Parts List

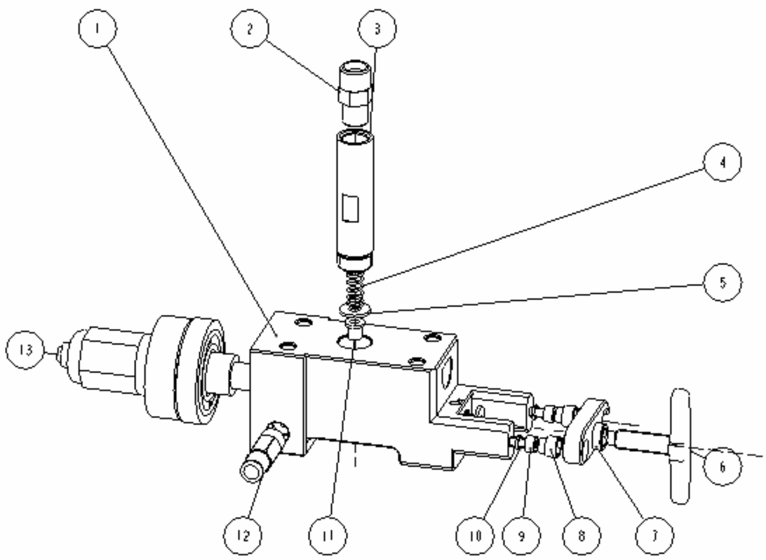
Note: The P/N of this assembly is 0621-30-78552.

S/N	P/N	Description	Qty
1	M6Q-030020---	Connector, L-shaped connector 3109-06-10	1
2	0621-20-69350	Bracket	1
3	M6M-010021---	Seal	3
4	0621-20-69370	Check valve membrane	3
5	0621-20-69364	Throttling pipeline (D)	3
6	M6Q-020038---	Valve.NO 12VDC 1.2W,TM121V12C1 (with M1.7X15 mm)	3
7	0621-20-69365	Throttling pipeline (D/2)	3
8	M04-000104---	Spring washer GB93 3	27
9	M04-000505---	Cross recessed pan head screw M3X20	27
10	0611-20-45600	Filter	3
11	M6Q-030016---	Connector, straight connector 3175-08-13	3

S/N	P/N	Description	Qty
12	0601-20-78930	Spring	3
13	0611-20-45488	Connector of pressure sampling tube	12
14	M6M-010037---	Seal, O-ring 9X2.5 red A50	3
15	0621-20-69363	Port plate	3
16	M04-000802---	Plain washer GB97.1 3	6
17	0621-20-69369	Check valve seat	3
18	M6M-010009---	O-ring 9.5X1.8	3
19	M6Q-120036---	Hexagon plug 0919-00-10	1
20	M04-021063---	G1/8 nylon washer 0602 23 1020	1

7.1.26 O2 Cylinder Bracket Assembly

7.1.26.1 Exploded View



7.1.26.2 Parts List

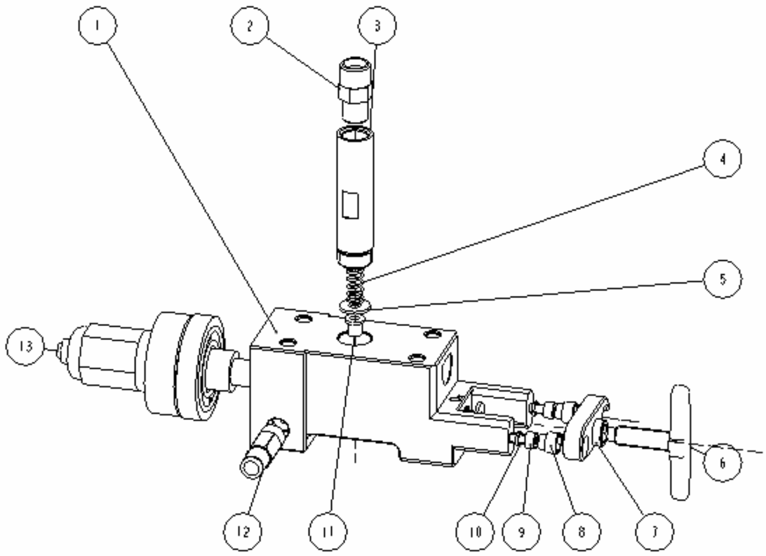
Note: The P/N of this assembly is 0621-30-78466.

S/N	P/N	Description	Qty
1	0621-20-69396	O2 cylinder bracket	1
2	M6Q-030030---	Connector, high voltage withstanding 1/4"NPT male connector SS-400-1-4	1
3	0621-20-69459	Cylinder connector	1
4	0601-20-69711	Compression spring	1
5	0621-20-69618	Sealing cushion	2
6	0611-20-58789	Handle bolt	1
7	0611-20-58788	block	1
8	0611-20-58787	Bolt	2

S/N	P/N	Description	Qty
9	M04-051115---	Hexagon socket cap head screw M5X20	2
10	M04-021007---	Spring washer B93 5	2
11	0611-20-45600	Filter	1
12	M6Q-020010---	Check valve AKH08A-02S	1
13	M6Q-020039---	Pressure reducing valve to decrease pressure from 2 to 15 MPa to 0 to 1 MPa	1

7.1.27 N2O Cylinder Bracket Assembly

7.1.27.1 Exploded View



7.1.27.2 Parts List

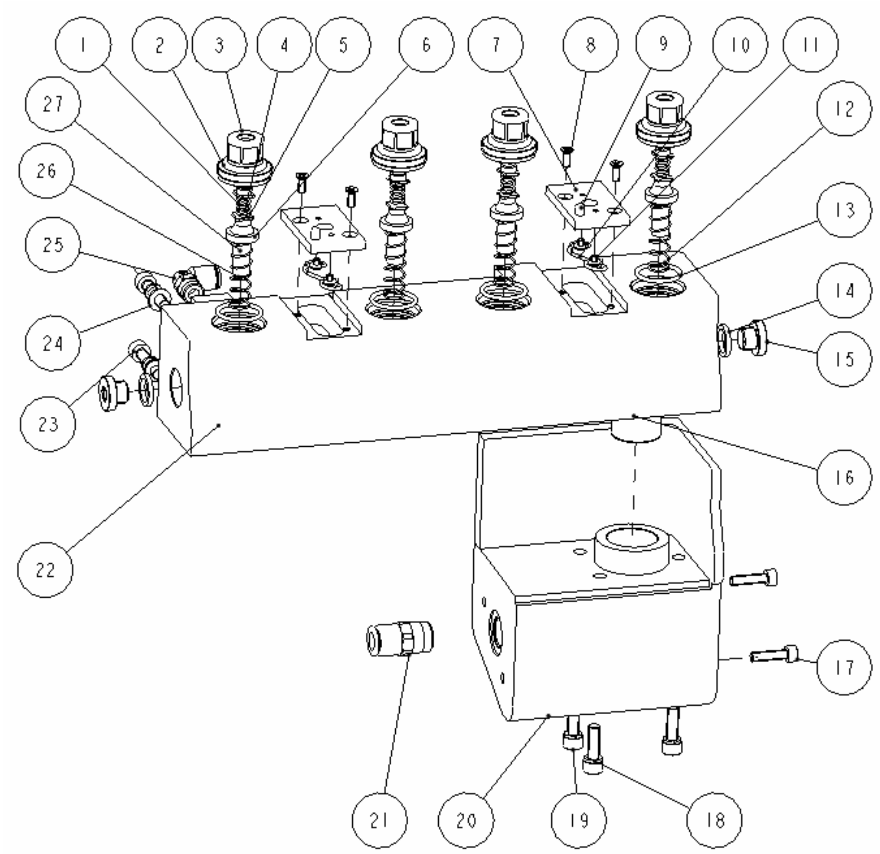
Note: The P/N of this assembly is 0621-30-78467.

S/N	P/N	Description	Qty
1	0621-20-69456	N2O cylinder bracket	1
2	M6Q-030030---	Connector, high voltage withstandin 1/4"NPT male connector SS-400-1-4	1
3	0621-20-69459	Cylinder connector	1
4	0601-20-69711	Compression spring	1
5	0621-20-69618	Sealing cushion	2
6	0611-20-58789	Handle bolt	1
7	0611-20-58788	Block	1
8	0611-20-58787	Bolt	2
9	M04-051115---	Hexagon socket cap head screw M5X20	2
10	M04-021007---	Spring washer GB93 5	2
11	0611-20-45600	Filter	1

S/N	P/N	Description	Qty
12	M6Q-020010---	Check valve AKH08A-02S	1
13	M6Q-020039---	Pressure reducing valve to decrease pressure from 2 to 15 MPa to 0 to 1 MPa	1

7.1.28 Double-vaporizer Manifold Assembly

7.1.28.1 Exploded View



7.1.28.2 Parts List

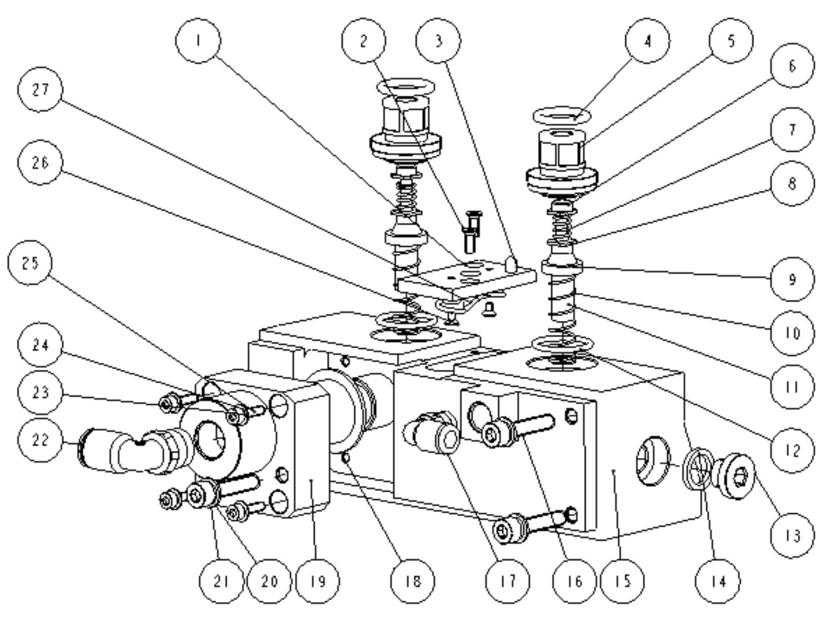
Note: The P/N of this assembly is 0621-30-69558.

S/N	P/N	Description	Qty
1	0611-20-45412	Slide bar	4
2	M6M-010014---	Seal, O-ring 14.00X2.65 silicone A50 black	4
3	0611-20-45413	Connector	4
4	11-20-45403	Spring	4
5	0611-20-45411	Compression slice	4
6	M6M-040001---	Rubber plain washer.6.00X14.00X3.00 silicone A70 red	4
7	0611-20-45416	Locking plate	2
8	M04-051147---	Stainless steel cross recessed countersunk head screw GB/T819.2-1997 M3X8 polishing	4

S/N	P/N	Description	Qty
9	0611-20-45417	Locking pin	2
10	M6T-010009---	Spring, special for vaporizer, S type	2
11	M04-051146---	Stainless steel cross recessed countersunk head screw GB/T819.2-1997 M2.5X4 polishing	4
12	0611-20-45404	Spring	4
13	M6M-010015---	Seal, O-ring 17.17X1.78 silicone A70 black	4
14	M04-021063---	G1/8 nylon washer 0602 23 1020	2
15	M6Q-120036---	Hexagon plug 0919-00-10	2
16	M6Q-020031---	Check valve membrane and check membrane assembly 25X16 silicone	1
17	M04-051065---	Stainless steel hexagon socket cap head screw GB/T70.1-2000 M4X16 polishing	2
18	M04-021007---	Single coil spring lock washer, normal type GB/T93-1987 5 rustproof nickel plating	5
19	M04-051062---	Hexagon socket cap head screw GB/T70.1-2000 M5x16 polishing	3
20	0621-20-69398	Vaporizer external manifold	1
21	M6Q-030016---	Connector, straight connector 3175-08-13	1
22	0621-20-69556	Double-vaporizer manifold	1
23	M04-051066---	Hexagon socket cap head screw GB/T701-2000 M5X25 rustproof nickel plating	2
24	M04-021011---	Plain washer-product grade A GB/T97.1-20025 rustproof nickel plating	2
25	M6Q-030020---	Connector, L-shaped connector 3109-06-10	1
26	0611-20-45404	Spring	4
27	0611-20-45414	Sleeve	4

7.1.29 Single-vaporizer Manifold Assembly

7.1.29.1 Exploded View



7.1.29.2 Parts List

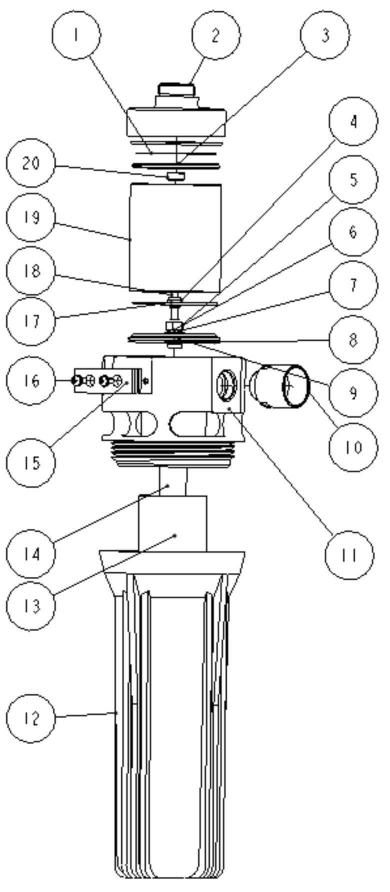
Note: The P/N of this assembly is 0621-30-69455.

S/N	P/N	Description	Qty
1	0611-20-45416	Locking plate	1
2	M04-000405---	Cross recessed countersunk head screw M3X8	2
3	0611-20-45417	Locking pin	1
4	M6M-010014---	Seal, O-ring 14.00X2.65 silicone A50 black	2
5	0611-20-45413	Connector	2
6	0611-20-45412	Slide bar	2
7	0611-20-45403	Spring	2
8	0611-20-45411	Compression slice	2
9	M6M-040001---	Rubber plain washer.6.00X14.00X3.00 silicone A70 black	2
10	0611-20-45404	Spirng	2
11	0611-20-45414	Sleeve	2
12	M6M-010015---	Seal, O-ring 17.17X1.78 silicone A70 black	2
13	M6Q-120036---	Hexagon plug 0919-00-10	1
14	M04-021063---	G1/8 nylon washer 0602 23 1020	1
15	0621-20-69400	Single-vaporizer manifold	1
16	M04-051066---	Hexagon socket cap head screw M5X25	2
17	M6Q-030020---	Connector, L-shaped connector 3109-06-10	1
18	M6Q-020031---	Check valve membrane and check membrane assembly (25X16)	1

S/N	P/N	Description	Qty
19	0621-20-78589	Check valve base	1
20	M04-021007---	Spring washer GB93 5	3
21	M04-021011---	Plain washer GB97.1 5	1
22	M6Q-030021---	Connector, L-shaped connector 3109-08-13	1
23	M04-000104---	Spring washer GB93 3	4
24	M04-000802---	Plain washer GB97.1 3	4
25	M04-051093---	Hexagon socket cap head screw M3X12	4
26	M04-051009---	Cross recessed countersunk head screw M2.5X4	2
27	0611-20-45405	Locking spring	1

7.1.30 AGSS Assembly

7.1.30.1 Exploded View



7.1.30.2 Parts List

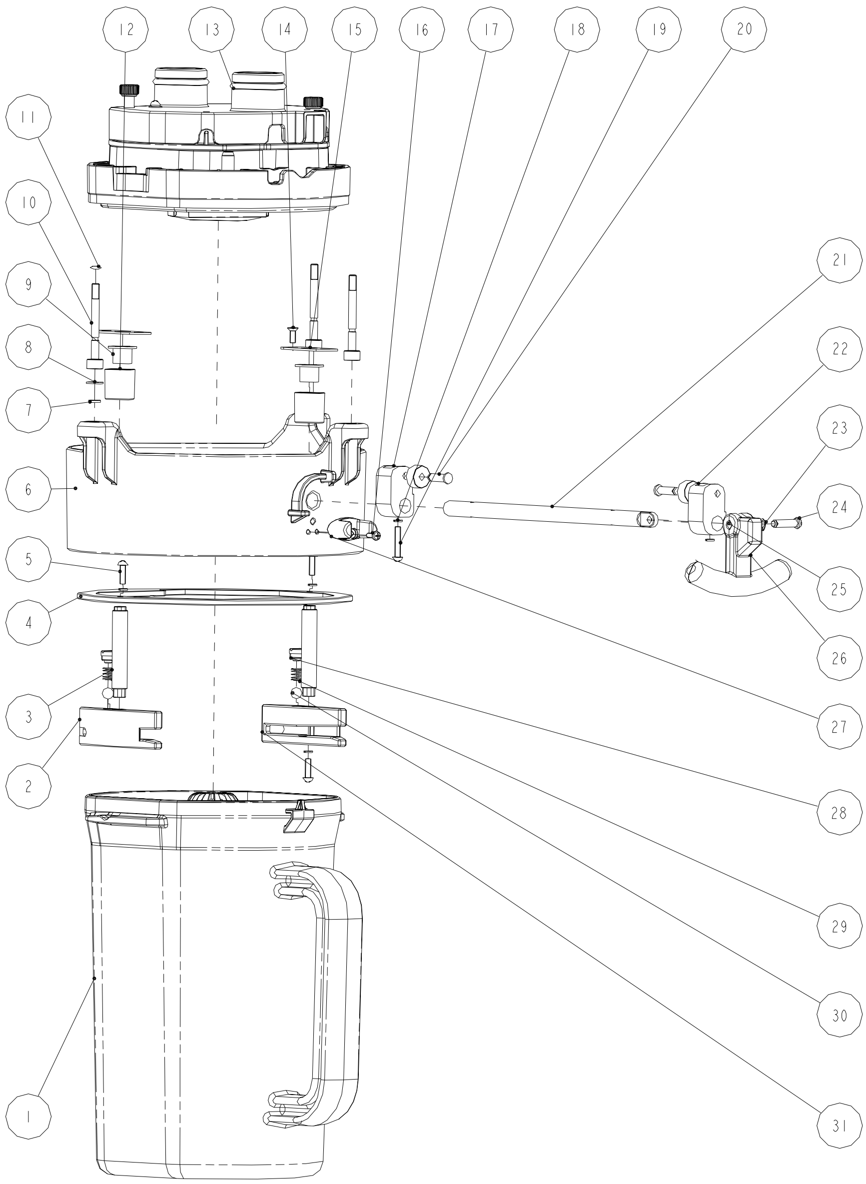
Note: The P/N of this assembly is 0621-30-78685.

S/N	P/N	Description	Qty
1	0611-20-67678	AGSS filtering screen	1
2	0611-20-67633	AGSS top cover	1
3	0611-20-67690	Filter fixter	1
4	0611-20-67632	Ring	1
5	M04-011011---	Stainless steel nut GB6170 M8	1
6	M04-021031---	Spring washer GB93 8	1
7	M04-000202---	Plain washer GB97.1 8	1
8	0611-20-67628	Spoiler	1
9	0611-20-67663	Sealing cushion	2
10	0611-20-67626	Gas inlet	1
11	0611-20-67624	AGSS main unit	1
12	082-000002-00_1	10″ shell	1
13	0611-20-67625	Gas exhaust tube	1
14	0611-20-67627	Ga inlet tube	1
15	0621-20-78650	AGSS hook	1
16	M04-051139---	Small pan head combination screw M4X12	2
17	0611-20-67630	Float	1
18	0611-20-67631	Guide bar	1
19	0611-20-67629	Sight glass	1
20	0611-20-45498	Filter locking nut	1

7.2 Breathing Circuit

7.2.1 Lifting Device Assembly

7.2.1.1 Exploded View



7.2.1.2 Parts List

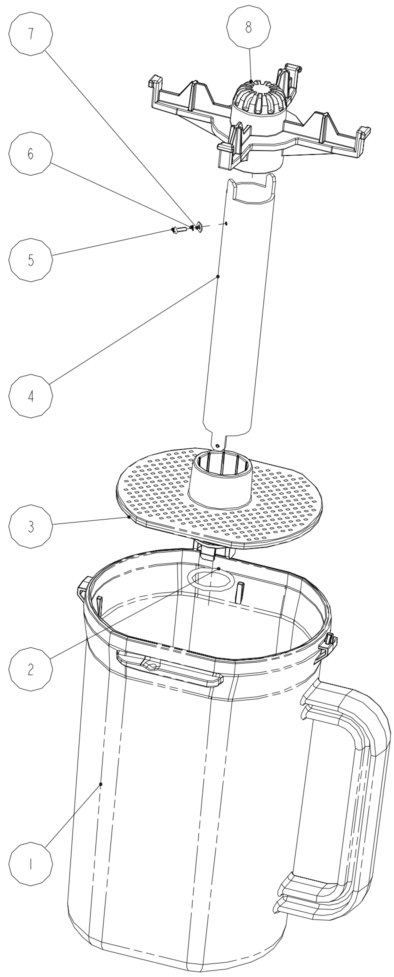
Note: The P/N of this assembly is 0601-30-78806.

S/N	P/N	Description	Qty
1	0601-30-78957	Sodalime canister assembly	1
2	0601-20-78838	Left hook	1
3	0601-20-78836	Hook connecting bar	2

S/N	P/N	Description	Qty
4	0601-20-78827	Tray	1
5	M04-051118---	SUS316 cross recessed pan head screw GB/T818-2000 M3X10	4
6	0601-20-78811-51	Base for lifting device	1
7	M04-021068---	SUS316 single coil spring lock washer, normal typeGB/T93-1987 4	3
8	M04-021073---	SUS316 plain washer,normal series, product grade AGB/T97.1-2002 4	3
9	M6A-010005---	Bearing XFM-0810-09	2
10	0601-20-78857	Fixed screw	3
11	M6M-010068---	Seal, O ring, 3X1.5 nitrile rubber A50 black	3
12	0601-20-78962	Bearing	2
13	0601-30-78945	Connecting block assembly for sodalime canister	1
14	M04-051107---	SUS316 cross recessed countersunk head tapping screw FT3X8	4
15	0601-20-78812	Fixer for linear bearing	2
16	M04-051108---	SUS316 cross recessed pan head tapping screw PT2.6X6	2
17	0601-20-78825	Rear rotation block	1
18	M04-021067---	SUS316 Single coil spring lock washer, normal typeGB/T93-1987 3	6
19	M04-051123---	SUS316 cross recessed pan head screw B/T818-2000 M3X16	2
20	0601-20-78826	Rotation pin	2
21	0601-20-78824	Rotation axis	1
22	0601-20-78815	Wheel	2
23	M04-021029---	Elastic check ring GB/T894.1-1986 4 rustproof nickel plating	3
24	0601-20-78835	Fixed pin	1
25	0601-20-78920	Front rotation block	1
26	0601-20-78814	Rotation handle	1
27	0601-20-78813	Handle fixing base	1
28	0601-20-78917	Screw	2
29	0601-20-78919	Spring	2
30	M6B-010001---	Friction ball, stainless steel Φ6 polishing	2
31	0601-20-78837	Right hook	1

7.2.2 Sodalime Canister Assembly

7.2.2.1 Exploded View



7.2.2.2 Parts List

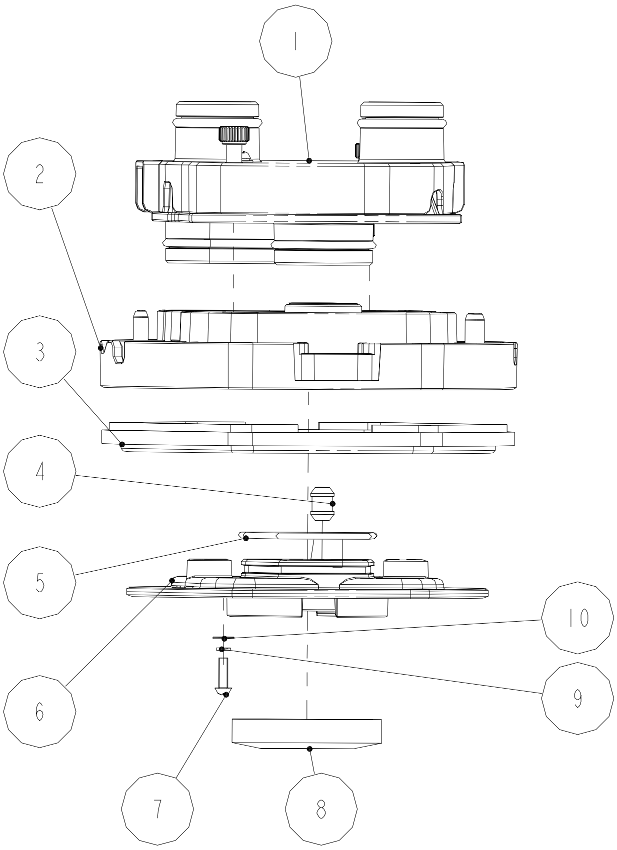
Note: The P/N of this assembly is 0601-30-78957.

S/N	P/N	Description	Qty
1	0601-20-78819-51	Sodalime canister	1
2	M6M-010032---	Seal, O ring 18X2.5 silicone red A50	1
3	0601-20-78816	Sodalime support	1
4	0601-20-78817	Canister support	1
5	M04-051104---	SUS316 cross recessed pan head screw GB/T818-2000 M2X6	4
6	M04-021065---	SUS316 single coil spring lock washer, normal typeGB/T93-1987 2	4
7	M04-021070---	SUS316 plain washer, normal series, product grade AGB/T97.1-2002 2	4

S/N	P/N	Description	Qty
8	0601-20-78818	BYPASS support	1

7.2.3 Canister Connection Block Assembly

7.2.3.1 Exploded View



7.2.3.2 Parts List

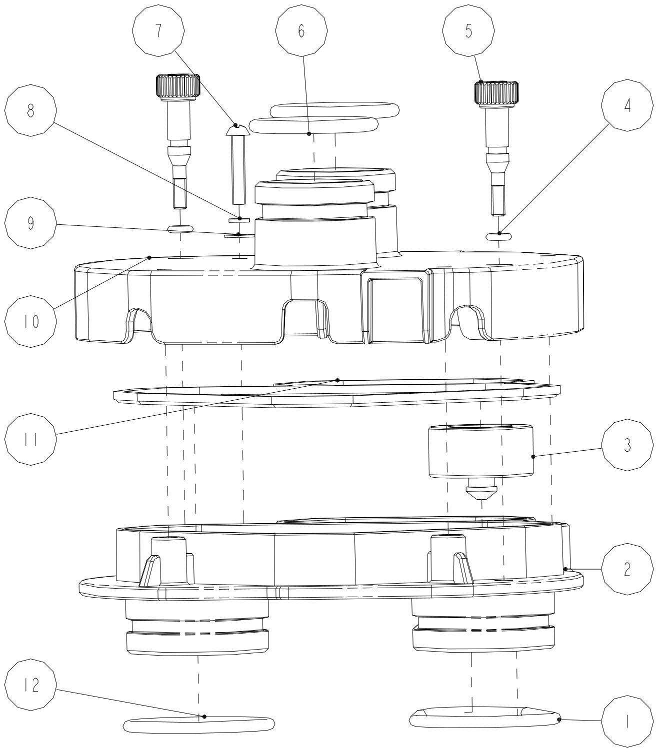
Note: The P/N of this assembly is 0601-30-78957.

S/N	P/N	Description	Qty
1	0601-30-78963	BYPASS upper cover assembly	1
2	0601-20-78809-51	BYPASS lower cover 1	1
3	0601-20-78842	Seal	1
4	0601-20-78949	End plug	1
5	M6M-010042---	Seal, O-ring, 52X2 silicone red A50	1
6	0601-20-78810-51	BYPASS lower cover 2	1
7	M04-051118---	SUS316 cross recessed pan head screw GB/T818-2000 M3X10	3
8	0601-20-78843	Sealing cushion	1
9	M04-021067---	SUS316 single coil spring lock washer, normal typeGB/T93-1987 3	3

S/N	P/N	Description	Qty
10	M04-021072---	SUS316 plain washer, normal series, product grade AGB/T97.1-2002 3	3

7.2.4 BYPASS Upper Cover Assembly

7.2.4.1 Exploded View



7.2.4.2 Parts List

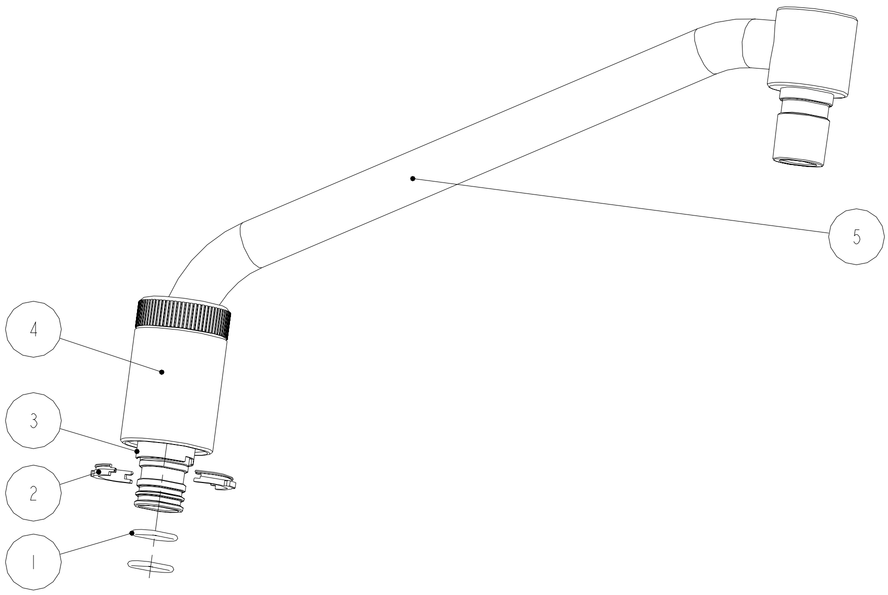
Note: The P/N of this assembly is 0601-30-78963.

S/N	P/N	Description	Qty
1	M6M-010070---	Seal, O-ring 41X2.5 silicone A50 red	1
2	0601-20-78808	BYPASS upper cover 2	1
3	0601-20-78934	BYPASS end plug	1
4	M6M-010013---	Seal, O-ring 4.00X1.50 silicone A70 red	2
5	0601-20-78918	BYPASS screw	2
6	M6M-010038---	Seal, O-ring 23.47X2.95 silicone red A50	2
7	M04-051123---	SUS316 cross recess head screw GB/T818-2000 M3X16	4
8	M04-021067---	SUS316 single coil spring lock washer, normal typeGB/T93-1987 3	4
9	M04-021072---	SUS316 plain washer,normal series, product grade AGB/T97.1-2002 3	4

S/N	P/N	Description	Qty
10	0601-20-78807-51	BYPASS upper cover 1	1
11	0601-20-78839	BYPASS sealing component for upper cover	1
12	M6M-010017---	Seal, O-ring 28.00X2.50 silicone A70 red	1

7.2.5 Bag Arm Assembly

7.2.5.1 Exploded View



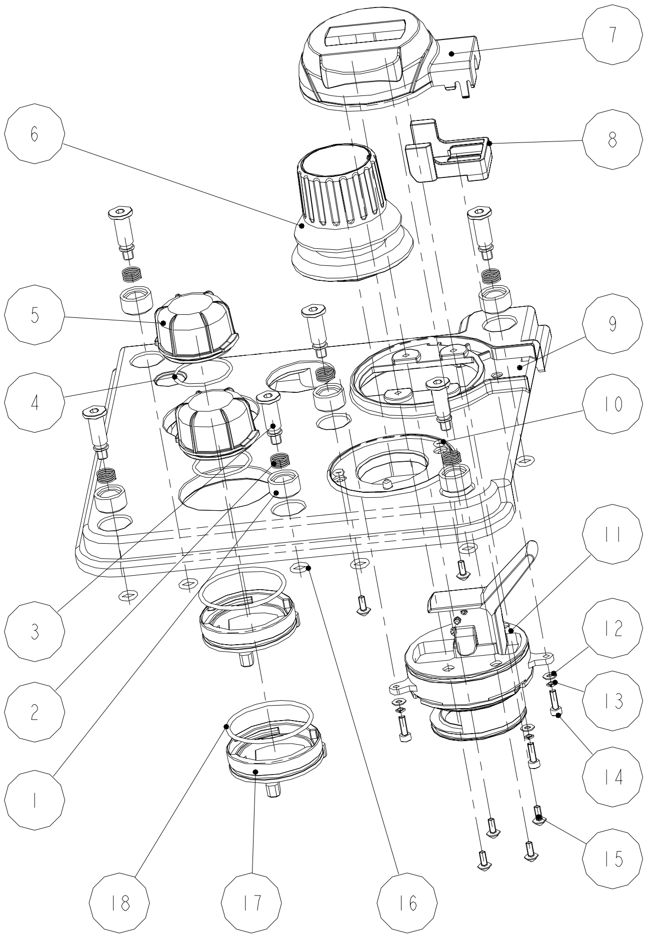
7.2.5.2 Parts List

Note: The P/N of this assembly is 0601-30-78862.

S/N	P/N	Description	Qty
1	M6M-010058---	Seal, O-ring 16X2 fluororubber, A50 black	2
2	0601-20-78866	Rotation connector	2
3	0601-20-78864	Axial sleeve	1
4	0601-20-78863	Locking nut	1
5	0601-20-78884-51	Bag arm bent pipe	1

7.2.6 Upper Cover Assembly

7.2.6.1 Exploded View



7.2.6.2 Parts List

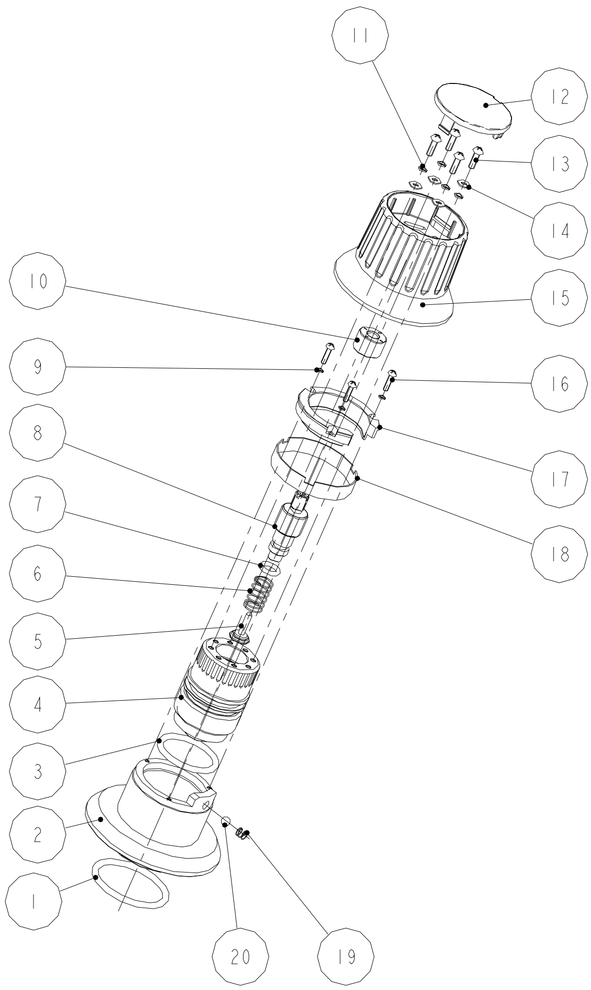
Note: The P/N of this assembly is 0601-30-78869.

S/N	P/N	Description	Qty
1	0601-20-69802	Screw holder	6
2	0601-20-78930	Spring for locking screw	6
3	0601-20-78926	Locking screw 2	6
4	M6M-010031---	Seal, O-ring 27X1.5 silicone red A50	2
5	0601-20-69768	Valve cover (mold MR69768)	2
6	0601-30-78829	New APL valve	1
7	0601-20-78804-51	Cover for bag/mechanical ventilation switch (mold MR78804)	1
8	0601-20-78893	Connecting rod for ag/mechanical ventilation switch (mold MR78893)	1

S/N	P/N	Description	Qty
9	0601-20-69896-51	Upper cover (mold MR69896)	1
10	M6M-010069---	Seal, O-ring 3X1.5 fluororubber, A50 black	2
11	0601-30-78872	Bag/mechanical ventilation switch assembly	1
12	M04-021072---	SUS316 plain washer,normal series, product grade A GB/T97.1-2002 3 polishing	3
13	M04-021067---	SUS316 single coil spring lock washer, normal type GB/T93-1987 3 polishing	3
14	M04-051118---	SUS316 cross recess head screw GB/T818-2000 M3X10 polishing	3
15	M04-051109---	SUS316 cross recess head screw GB/T818-2000 M3X8 polishing	6
16	M6M-010035---	Seal, O-ring 6.07X1.78 ethylene propylene terpolymer (EPT), black A70	6
17	0601-20-69870	Check valve bracket	2
18	M6M-010067---	Seal, O-ring 40X2 silicone red A50	2

7.2.7 APL Valve Assembly

7.2.7.1 Exploded View



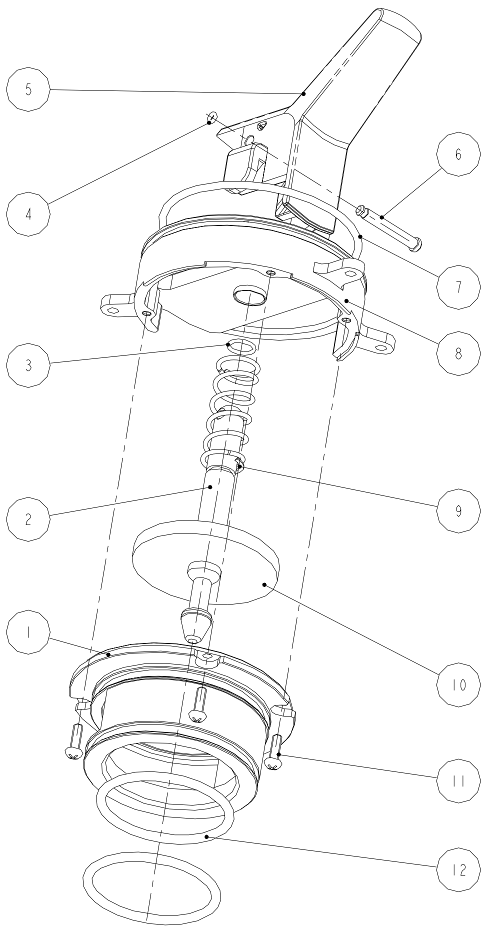
7.2.7.2 Parts List

Note: The P/N of this assembly is 0601-30-78829.

S/N	P/N	Description	Qty
1	M6M-010043---	Seal, O-ring 29.82X2.62 ethylene propylene terpolymer (EPT) black A50	1
2	0601-20-78830-51	Base	1
3	M6M-010065---	Seal, O-ring 23X2.5 fluororubber black A50	1
4	0601-20-78832	Sleeve	1
5	0601-20-69819	Pressure adjustment ring	1
6	0601-20-69820	Pressure adjustment spring	1
7	M6M-010035---	Seal, O-ring 6.07X1.78 ethylene propylene terpolymer (EPT) black A70	1
8	0601-20-78974	New APL valve drive axis	1
9	M04-021065---	SUS316 single coil spring lock washer,normal type GB/T93-1987 2 polishing	3
10	0601-20-78973	Locking ring	1
11	M04-021066---	SUS316 single coil spring lock washer,normal type GB/T93-1987 2.5 polishing	4
12	0601-20-78900-51	Handle cover (mold MR78893)	1
13	M04-051106---	SUS316 cross recessed pan head screw GB/T818-2000 M2.5X8 polishing	4
14	M04-021071---	SUS316 plain washer,normal series,product grade AGB/T97.1-2002 2.5 polishing	4
15	0601-20-78833-51	Handle (mold MR78818)	1
16	M04-051104---	SUS316 cross recessed pan head screw GB/T818-2000 M2X6 polishing	3
17	0601-20-78939	Stop ring	1
18	0601-20-78940	Outer ring	1
19	0601-20-78964	New APL valve compression spring	1
20	M04-140002---	Steel ball.GB308-89 4 stainless steel polishing	1

7.2.8 Bag/mechanical Ventilation Switch Assembly

7.2.8.1 Exploded View



7.2.8.2 Parts List

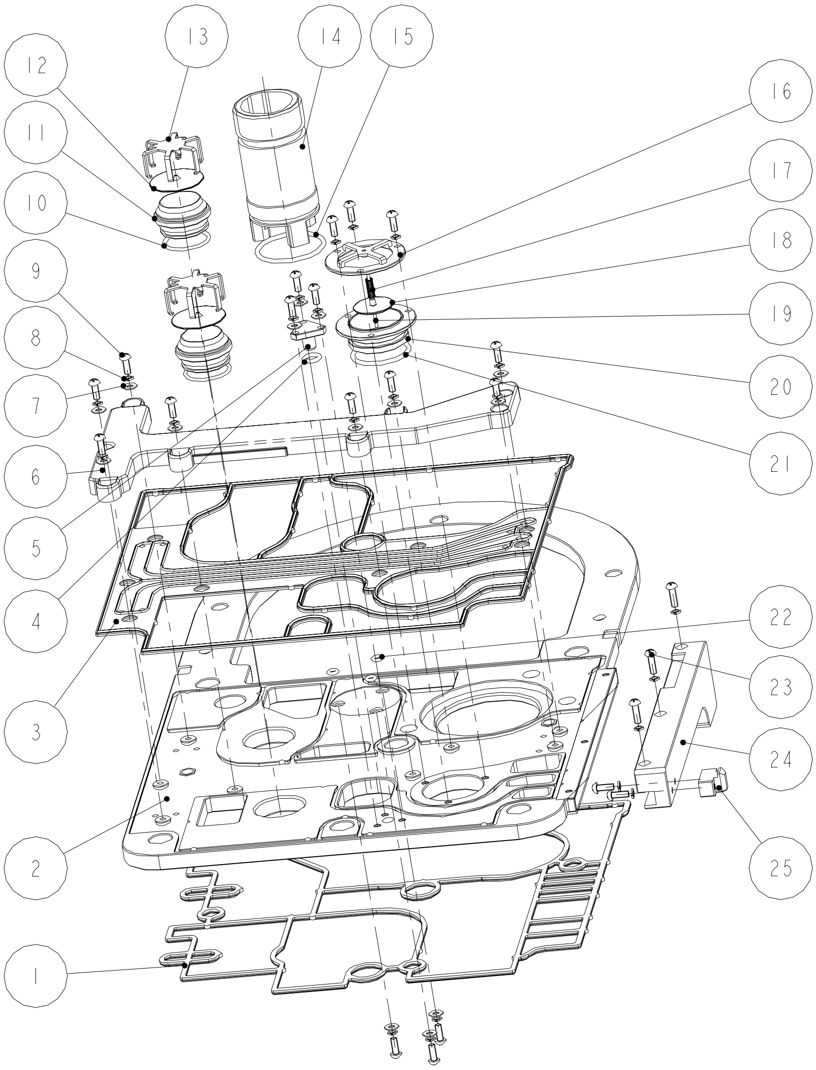
Note: The P/N of this assembly is 0601-30-78872.

S/N	P/N	Description	Qty
1	0601-20-78875	Valve base	1
2	0601-20-78874	Axis	1
3	0030-10-13077	Seal, O-ring 6X1 fluororubber, A75 brown	1
4	0010-10-42556	Seal, O-ring 1.5X1 fluororubber, A75 brown	1
5	0601-20-78873	Handle (mold MR78873)	1
6	0601-20-78878	Connecting axis	1
7	M6M-010042---	Seal, O-ring 52X2 silicone red A50	1
8	0601-20-78877	Valve cover	1
9	0601-20-78880	Compression spring	1
10	0601-20-78879	Valve plate (mold MR78842)	1

S/N	P/N	Description	Qty
11	M04-051106---	SUS316 cross recess head screw GB/T818-2000 M2.5X8 polishing	3
12	M6M-010047---	Seal, O-ring 33.X2.5 silicone A50 red	2

7.2.9 Median Plate Assembly

7.2.9.1 Exploded View



7.2.9.2 Parts List

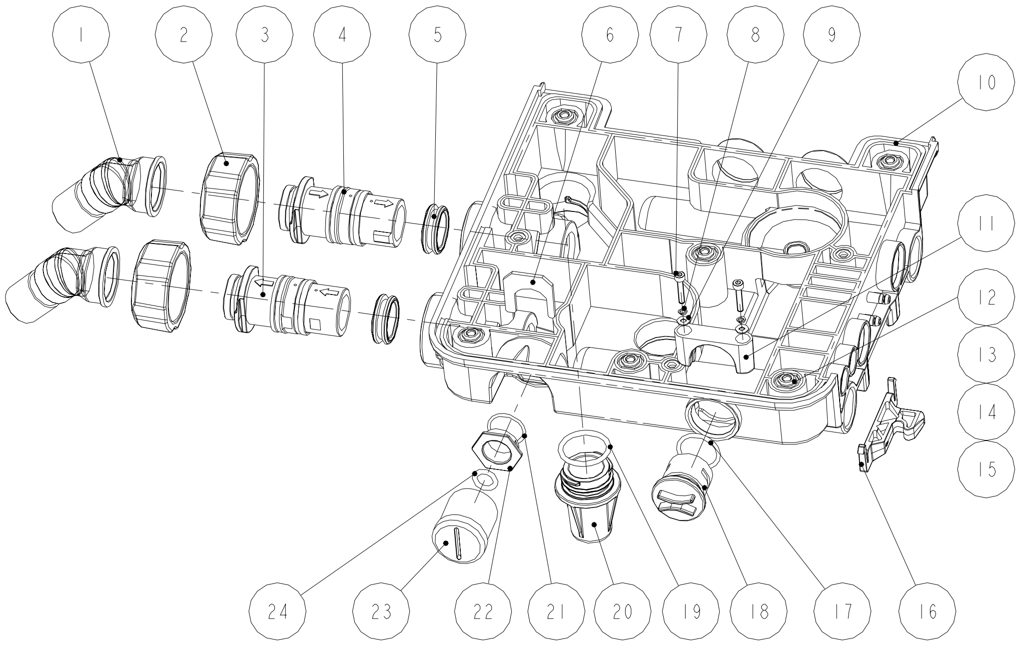
Note: The P/N of this assembly is 0601-30-78870.

S/N	P/N	Description	Qty
1	0601-20-69777	Lower sealing cushion (mold MR78839)	1
2	0601-20-69776	Upper sealing cushion (mold MR78839)	1
3	0601-20-69871	Median plate	1

S/N	P/N	Description	Qty
4	M6M-010035---	Seal, O-ring 6.07X1.78 ethylene propylene terpolymer (EPT) black A70	1
5	0601-20-78931	M4 nut	1
6	0601-20-78889	Pressure sampling component (mold MR7889)	1
7	M04-021072---	SUS316 plain washer,normal series, product grade A GB/T97.1-2002 3 polishing	14
8	M04-021067---	SUS316 single coil spring lock washer, normal type GB/T93-1987 3 polishing	22
9	M04-051109---	SUS316 cross recess head screw GB/T818-2000 M3X8 polishing	19
10	M6M-010033---	Seal, O-ring 20X1.5 silicone red A50	2
11	0601-20-69765	Valve body	2
12	0601-20-69766	Valve (mold MR69716)	2
13	0601-20-69767	Valve cover	2
14	0601-20-78865	Support tube	1
15	M6M-010027---	Seal, O-ring 30X2 silicone red A50	1
16	0601-20-78897	support frame	1
17	0601-20-69828	Compression spring for valve cover	1
18	0601-20-69716	Valve cover (mold MR69716)	1
19	0601-20-69818	Slide bar	1
20	0601-20-78896	Valve port	1
21	M6M-010028---	Seal, O-ring 25X2 silicone red A50	1
22	M6M-010069---	Seal, O-ring 3X1.5 fluororubber A50 black	3
23	M04-051118---	SUS316 cross recess head screw GB/T818-2000 M3X10 polishing	3
24	0601-20-78892	Heat transfer block	1
25	0601-20-78929	Locking hook	1

7.2.10 Lower Cover Assembly

7.2.10.1 Exploded View



7.2.10.2 Parts List

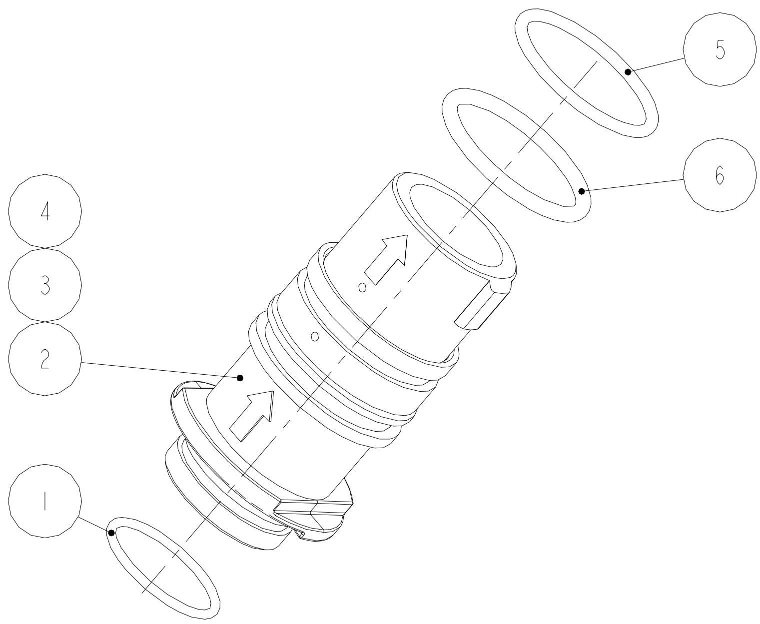
Note: The P/N of this assembly is 0601-30-78871.

S/N	P/N	Description	Qty
1	0601-20-69743-51	Breathing connector (mold MR69743)	2
2	0601-20-69744-51	Cover for breathing connector (mold MR69744)	2
3	0601-30-69700	Inspiratory flow sensor assembly	1
4	0601-30-78894	Expiratory flow sensor assembly	1
5	0601-20-78887	Connector sealing cushion (mold MR78839)	2
6	0601-20-78914	Screw threaded compression slice for O2 sensor	1
7	M04-051123---	SUS316 cross recess head screw GB/T818-2000 M3X16 polishing	2
8	M04-021067---	SUS316 single coil spring lock washer, normal type GB/T93-1987 3 polishing	2
9	M04-021072---	SUS316 plain washer,normal series,product grade A GB/T97.1-2002 3 polishing	2
10	0601-20-69897-51	Bottom shell (mold MR69897)	1
11	0601-20-78882	Fixing piece for bag connector (mold MR69744)	1
12	0601-20-69889	Screw base	6
13	M04-021074---	SUS316 plain washer,normal series,product grade AGB/T97.1-2002 5 polishing	6

S/N	P/N	Description	Qty
14	M04-021069---	SUS316 single coil spring lock washer,normal typeGB/T93-1987 5 polishing	6
15	0601-20-78958	Screw	6
16	0601-20-78883	Retainer for locking catch (mold MR69744)	1
17	M6M-010064---	Seal, O-ring 20X2 fluororubber A50	1
18	0601-20-78899	End plug for bag (mold MR78873)	1
19	M6M-010038---	Seal, O-ring 23.47X2.95 silicone red A50	1
20	0601-20-69746	Water collection cup (mold MR69746)	1
21	M6M-010022---	Seal, O-ring 18.00X1.50 ethylene propylene terpolymer, (EPT), A70 black	1
22	0601-20-78913	Screw threaded transitional piece for O2 sensor	1
23	M6M-010037---	Seal, O-ring 9X2.5 silicone red A50	1
24	0601-20-78961	End plug for O2 sensor	1

7.2.11 Expiratory Flow Sensor Assembly

7.2.11.1 Exploded View



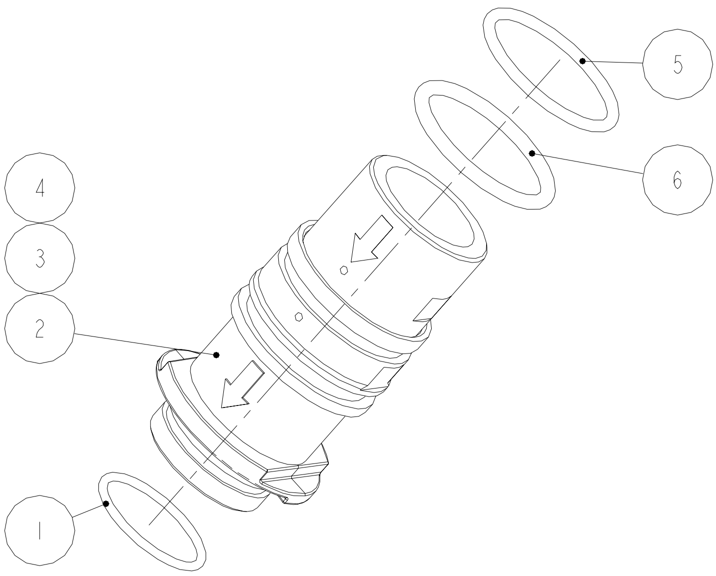
7.2.11.2 Parts List

Note: The P/N of this assembly is 0601-30-78894.

S/N	P/N	Description	Qty
1	M6M-010059---	Seal, O-ring 20X1.5 fluororubber A50 brown	1
2	0601-20-78898-51	Conical tail fitting (mold MR69703)	1
3	0601-20-69702	Flow sensor membrane	1
4	0601-20-78895	Conical connector (mold MR69703)	1
5	M6M-010065---	Seal, O-ring 23X2.5 fluororubber black A50	1
6	M6M-010066---	Seal, O-ring 23X2 fluororubber black A50	1

7.2.12 Inspiratory Flow Sensor Assembly

7.2.12.1 Exploded View



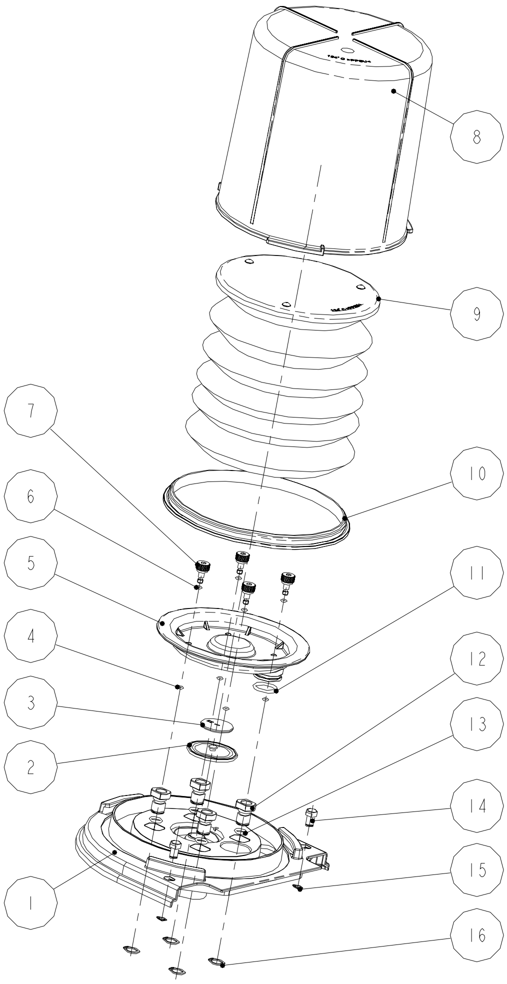
7.2.12.2 Parts List

Note: The P/N of this assembly is 0601-30-69700.

S/N	P/N	Description	Qty
1	M6M-010059---	Seal, O-ring 20X1.5 fluororubber A50 brown	1
2	0601-20-69704-51	Conical tail fitting (mold MR69703)	1
3	0601-20-69702	Flow sensor membrane	1
4	0601-20-69703	Conical connector (mold MR69703)	1
5	M6M-010065---	Seal, O-ring 23X2.5 fluororubber black A50	1
6	M6M-010066---	Seal, O-ring 23X2 fluororubber black A50	1

7.2.13 Upper Cover 2 Assembly

7.2.13.1 Exploded View



7.2.13.2 Parts List

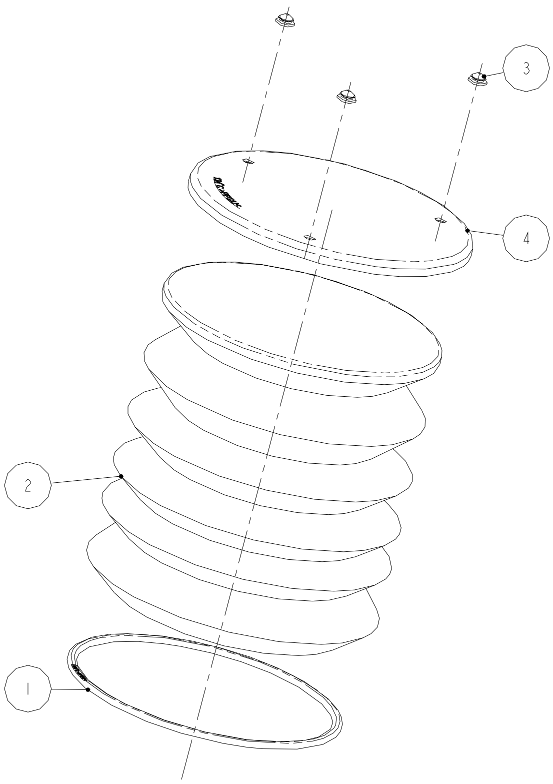
Note: The P/N of this assembly is 0601-30-78891.

S/N	P/N	Description	Qty
1	0601-20-78888-51	Upper cover 2 (mold MR78888)	1
2	0601-20-69771	PoP-off valve rubber pad (mold MR69771）	1
3	0601-20-69772	PoP-off valve metal block	1
4	M6M-010068---	Seal, O-ring 3X1.5 nitrile rubber A50 black	4
5	0601-20-78847-51	PoP-off cover plate(mold MR78847)	1
6	M6M-010013---	Seal, O-ring 4.00X1.50 silicone A70 red	4
7	0601-20-78846	PoP-off hand screw	4
8	0601-20-78972-51	Bellows housing (mold MR69773)	1
9	0601-30-78968	Folding bag assembly	1

S/N	P/N	Description	Qty
10	0601-20-78848	Bellows sealing cushion (mold MR78842)	1
11	M6M-010032---	Seal, O-ring 18X2.5 Silicone red A50	1
12	0601-20-78849	Fixed nut	4
13	M6M-010006---	Seal, O-ring8.5X2.0fluororubber A75 black	4
14	0601-20-78915	Fixed nut	2
15	M04-021023---	Elastic check ring GB/T894.1-1986 7 rustproof nickel plating	2
16	M04-021041---	Elastic check ring GB/T894.1-1986 12 rustproof nickel plating	4

7.2.14 Folding Bag Assembly

7.2.14.1 Exploded View



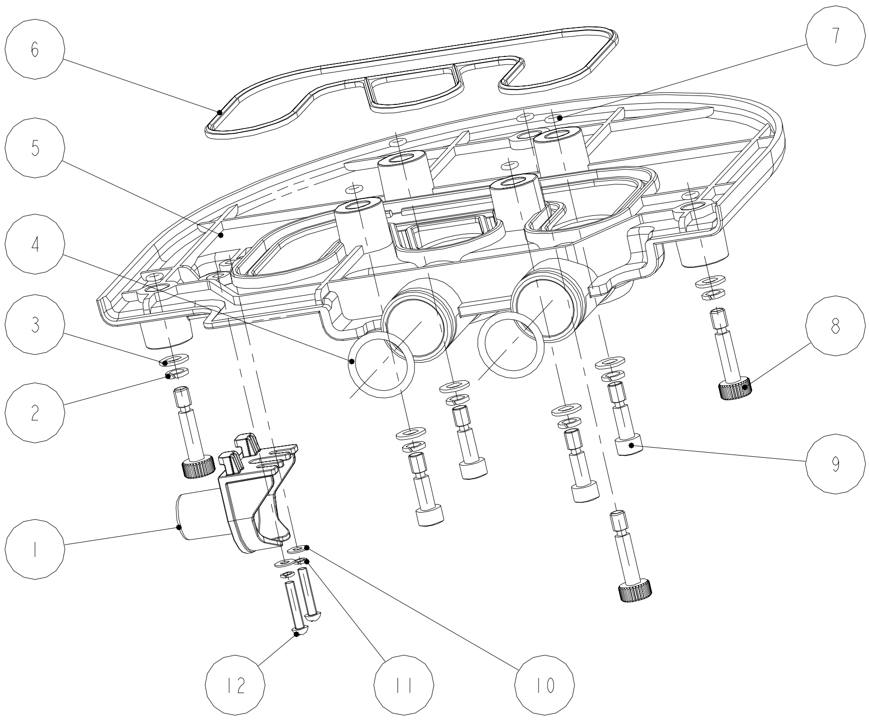
7.2.14.2 Parts List

Note: The P/N of this assembly is 0601-30-78968.

S/N	P/N	Description	Qty
1	0601-20-69780	Top disc ring (mold MR69780)	1
2	0601-10-69901	Folding bag, neoprene, black, 8 folds 145mm	1
3	0601-20-69781	Top disc needle (mold MR69781)	3
4	0601-20-69779	Top disc (mold MR69779)	1

7.2.15 Lower Cover 2 Assembly

7.2.15.1 Exploded View



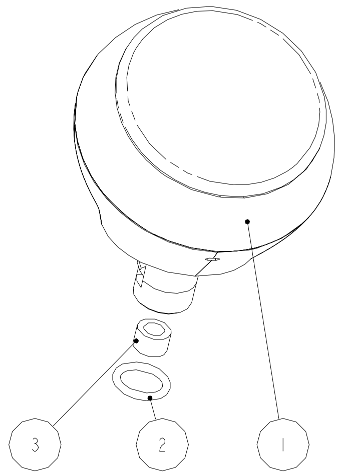
7.2.15.2 Parts List

Note: The P/N of this assembly is 0601-30-78901.

S/N	P/N	Description	Qty
1	0601-20-78890	Test plug (mold MR78893)	1
2	M04-021069---	SUS316 Single coil spring lock washer, normal type GB/T93-1987 5 polishing	6
3	M04-021074---	SUS316 Plain washer, normal series, product grade AGB/T97.1-2002 5 polishing	6
4	M6M-010032---	Seal, O-ring 18X2.5 silicone red A50	2
5	0601-20-78805-51	Lower cover 2 (mold MR78805)	1
6	0601-20-78850	Sealing cushion (mold MR78839)	1
7	M6M-010068---	Seal, O-ring 3X1.5 nitrile rubber A50 black	7
8	0601-20-78928	Hand screw	3
9	0601-20-78927	Fixed screw 3	4
10	M04-021072---	SUS316 plain washer, normal series, product grade AGB/T97.1-2002 3 polishing	2
11	M04-021067---	SUS316 single coil spring lock washer, normal type GB/T93-1987 3 polishing	2
12	M04-051123---	SUS316 cross recess head screw GB/T818-2000 M3X16 polishing	2

7.2.16 Airway Pressure Gauge Assembly

7.2.16.1 Exploded View



7.2.16.2 Parts List

Note: The P/N of this assembly is 0601-30-78967.

S/N	P/N	Description	Qty
1	0601-21-78935	Airway pressure gauge	1
2	M6M-010001---	Seal, O-ring10X1.8 fluororubber A75 black	1
3	m6G-020014---	PU tube 8mmX5mm transparent TU0805C-100	1

P/N：0621-20-78654（1.1）