

Field Service Procedure

Part Number: SP00150

Rev: L

Date: 20 May 2002

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Narkomed 2C PMC Procedure

6.0 PMC PROCEDURE, NARKOMED 2C

The procedures in this section shall be performed in their entirety each time a component is removed, replaced, calibrated, adjusted and during all scheduled Periodic Manufacturer's Certification (PMC) visits. A PMC Checklist form, P/N S010211, available from the Draeger Medical, Inc. Technical Service Department, shall be completed by the TSR each time a PMC is performed. Steps in the procedure marked with (✓) require a response at the corresponding line on the checklist form.

Space is also provided on the PMC checklist form to record the results of a vapor concentration test.

NOTE: Test equipment listed below with an asterisk (*) requires calibration at a maximum interval of one year. Verify the dates on test equipment calibration labels. DO NOT USE any test equipment having an expired calibration date. Notify your supervisor immediately if any equipment is found to be out of calibration.

In the space provided at the bottom of the PMC checklist form, record the Model and ID number of all calibrated test equipment used. Also record the calibration due dates.

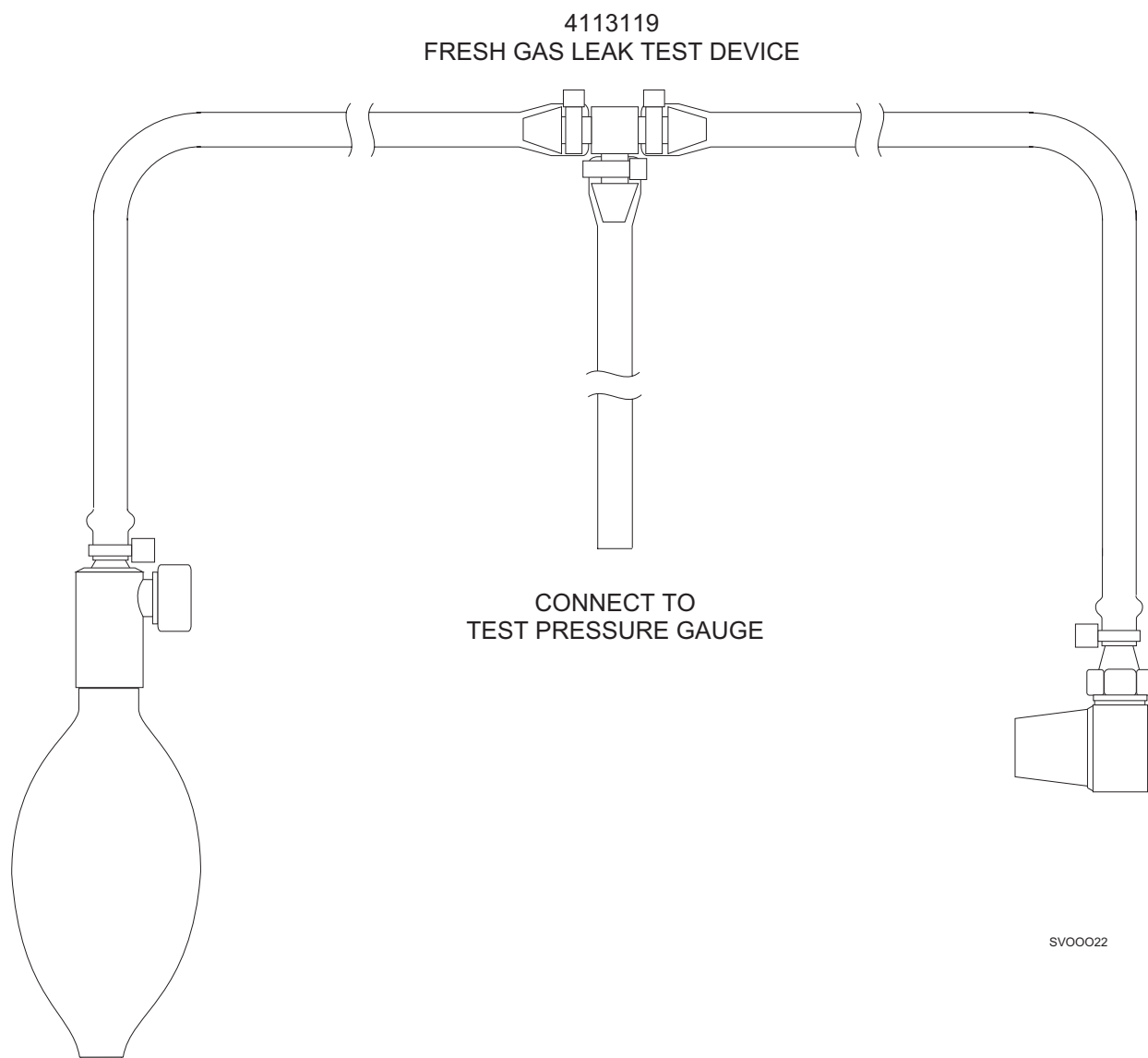
Test Equipment Required:

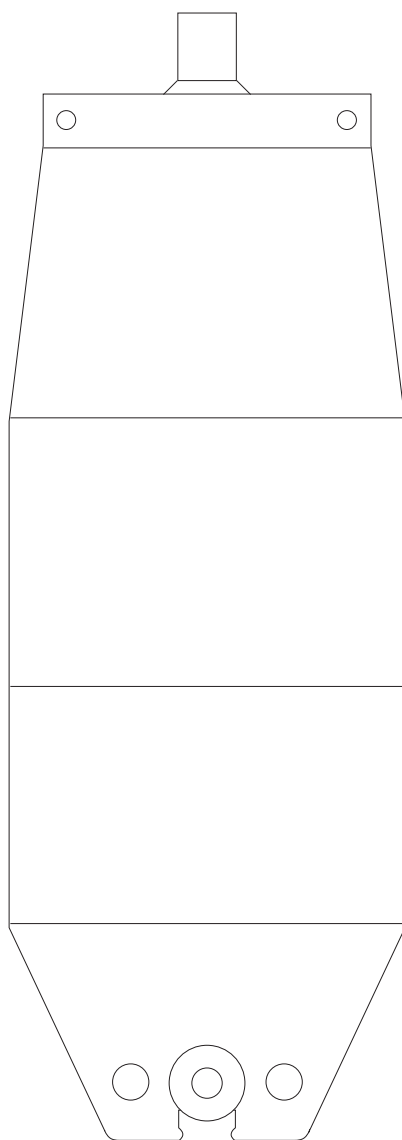
- *-- Multi-Meter (Fluke or equivalent)
- *-- Electrical Safety Analyzer (Biotek 501 Pro or equivalent)
- *-- Regulator Test Pressure Gauge, P/N S000063 or equivalent
 - Fresh Gas Outlet Volume Test Device, P/N S010158 or equivalent
 - Fresh Gas Leak Test Device, P/N 4113119 or equivalent
 - Adapter Assembly, Test Terminal, P/N 4104389 or equivalent: two are required
- *-- Flowmeter Test Stand (Capnomed), P/N S000081 or equivalent
 - Breathing System Leak Test Device, P/N S010159 or equivalent
 - Baromed Pressure Test Fixture or equivalent
- *-- Test Minute Volume Meter, P/N 2212300 or equivalent
- *-- Digital Pressure Manometer (SenSym PDM 200CD or Equivalent)
- *-- Riken Gas Indicator, Model 18H, or 1802D or equivalent
 - Stop Watch
 - Service Test Lung, P/N 4115128

Materials Required:

- Dow Corning High Vacuum Grease, P/N S4105908
- Spiromed Sensor Lubrication Kit, P/N 2218180
- Breathing Bag, 3 liter, P/N 9995330 or equivalent
- Tube, Corrugated, 22 mm x 12 in. long, P/N 9995112

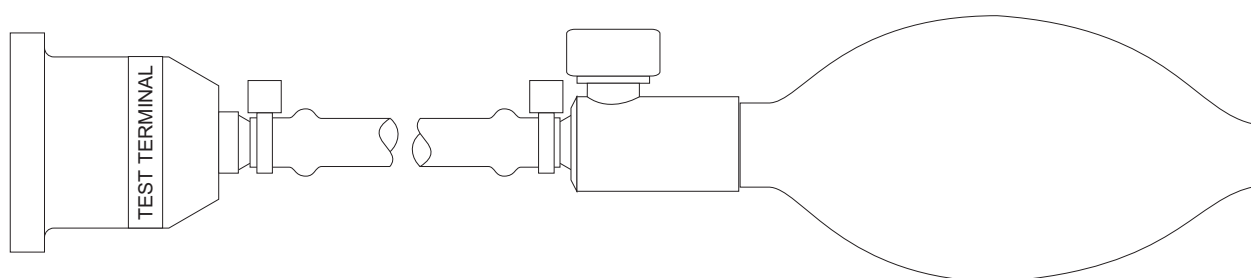
Test equipment illustrations are shown on following pages.



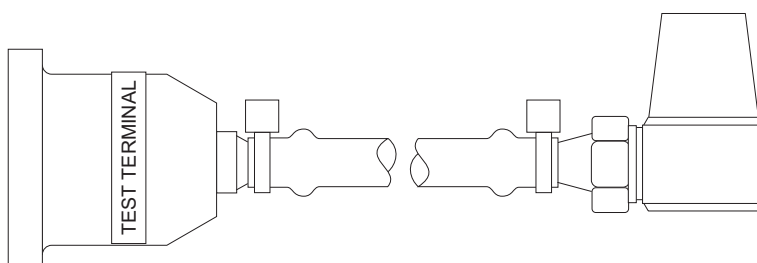


4115128
SIEMENS TEST LUNG

SV00025



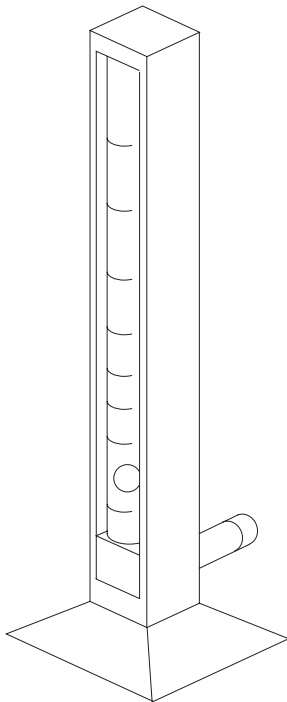
S010159
BREATHING SYSTEM LEAK TEST DEVICE



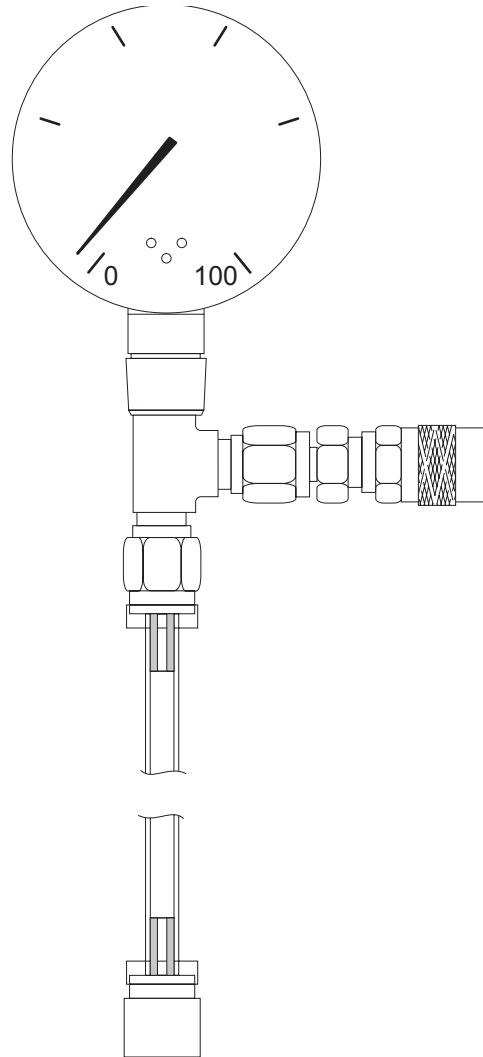
S010158
FRESH GAS OUTLET VOLUME TEST DEVICE

SV00023

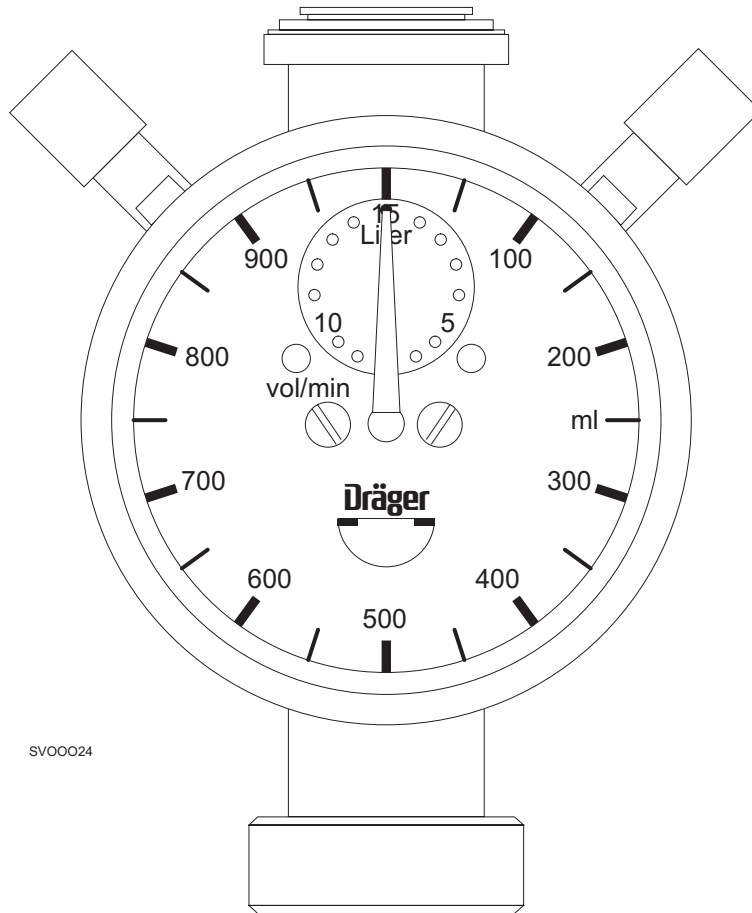
SV00027



S000081
FLOW METER
TEST STAND

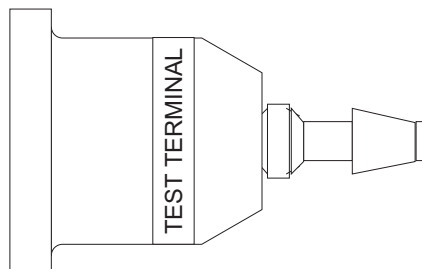


S000063
REGULATOR TEST
PRESSURE GAUGE



2212300
MINUTE
VOLUMETER

SV00024



4104389
TEST TERMINAL
ADAPTER

Periodic Manufacturer's Certification General Instructions

The purpose of these procedures is to provide detailed instructions for performing a Periodic Manufacturer's Certification (PMC) inspection on the Narkomed 2C anesthesia machine.

A PMC consists of a complete Periodic Manufacturer's Service procedure and a certification level inspection based on Draeger Medical, Inc. Recommendations and equipment performance. Additional inspections are also performed to insure proper product labeling.

Several additional documents have been created to ensure the success of this new program. Following is a brief description of the purpose of each document.

Field Service Procedure:

Periodic Manufacturer's Certification Forms - Part Number SP00175.

This procedure illustrates sample checklists with typical periodic maintenance items filled in, including vapor concentrations verification tests, parts replaced, general comments and certification levels. Also included are sample PMC labels marked to show several levels of certifications. An excerpt from Draeger Medical, Inc.'s *Anesthesia System Risk Analysis and Risk Reduction* is included, and also a sample of an Executive Summary to be furnished to the hospital's Risk Manager or Chief of Anesthesia.

Field Service Procedure:

DMI Recommendations Guidelines Index Anesthesia Systems - Part Number S010250.

This Guideline was created to provide an assessment of each machine's certification. It contains various comprehensive overviews of possible equipment conditions and their associated certification levels.

The first list in the Recommendation Guidelines is a reference chart for machine certification based on equipment status. The second is an abbreviated summary of all DMI Recommendations and Failure Codes including the Condition Number, Equipment Condition, Recommended Corrections, Certification Code, and Tests Affected when applicable.

There is also a matrix classified as "Failure Codes" which identifies the correct manner in which to document equipment tests that fail, or were unable to be performed due to circumstances beyond the control of the service technician performing the inspection. (Ex: Air cylinder supply is unavailable to perform Air High Pressure Leak test.) The Failure Codes section also indicates suggested resolution of the situation. Failure Code numbers begin at 34 and use the same certification levels strategy, and carry the same weight as DMI Recommendation equipment condition codes.

The final matrix is the most comprehensive index sorted by machine model and includes Equipment Condition, Certification Code, and DMI Recommendations. It also specifies any suggested upgrade path including ordering information that should be taken such as installing a Bellows with Pressure Limit Control 4109664-S01 Kit, after market modification kit to a machine not equipped with pressure limit control.

The letters A, B, C, D and the Roman Numerals I, II are used as codes in the individual matrix for each model of anesthesia machine. The letters A, B, C, and D are used in descending order to indicate the certification level of the equipment. They are as follows:

- A = Certified
- B = Certified with Recommendations
- C = Conditionally Certified
- D = No Certification

Roman Numerals I and II do not affect the certification level but rather are provided to give further instructions to the end user as follows:

- I = The system in its present configuration shall only be used with a CO₂ monitor incorporating an apnea warning. The operator of the system is advised to frequently scan the CO₂ readings and alarm thresholds.
- II = The present configuration of equipment requires that the unit operate at all times with an oxygen analyzer that includes a low oxygen warning. The operator of the system is advised to frequently scan the oxygen readings and alarm limits.

Following is an explanation of machine certification levels:

Certified- No recommendations apply to machine being inspected. (Only item number 33 - "No Recommendations" shall apply for this certification level.)

Certified with Recommendations- A numbered recommendation with a code of B applies to the machine being examined.

Conditionally Certified- A numbered recommendation with a code of BCI or BCII applies to the machine being examined.

No Certification- A numbered recommendation with a code of D applies to the machine being examined.

When multiple recommendations apply, "No Certification" would take precedence over "Conditionally Certified" and "Certified with Recommendations". "Conditionally Certified" would take precedence over "Certified with Recommendations".

For example:

A **Narkomed 3** could have recommendation number 21 and failure code 61.1 apply.

21 - No ventilator pressure limit control. Code is B.

61.1 - Enflurane agent is unavailable to test. Code is BC.

Correct certification for this machine is BC, which means **CONDITIONALLY CERTIFIED WITH RECOMMENDATIONS**.

A **Narkomed 4** could have recommendation numbers 14 and 21 apply.

14 - CO₂/Agent monitor exhaust port is not properly connected to the waste gas scavenger.

Code B.

21 - No ventilator pressure limit control. Code B.

The correct certification for this machine is B, which means **CERTIFIED WITH RECOMMENDATIONS**.

A **Narkomed 2B, 2C** or **GS** could have recommendation 30 apply.

30 - Anesthesia machine is equipped with inhalation anesthesia vaporizers without an agent analyzer in the breathing system. Code B.

The correct certification for this machine is B, which means **CERTIFIED WITH RECOMMENDATIONS**.

A **Narkomed 6000** could have no DMI recommendations or failure codes apply. The correct certification level for this machine is Code A, **CERTIFIED**.

Code D, which means NO CERTIFICATION, also means the machine shall not receive a Periodic Manufacturer's Certification label. The machine shall also receive a 'WARNING - This System is Not Certified' label, P/N 4114857. This label shall be placed at a prominent location on the right side of the machine after all other previous PM and 'Vigilance Audit® Validation' labels have been removed.

PM Certification Procedure for Narkomed 2C Anesthesia System

1. Use the PM Certification form for Narkomed 2B/ 2C/ GS Anesthesia Systems (P/N S010211).
2. Completely fill in the header information.
3. All Narkomed 2Cs are equipped with Humphrey valves. Indicate so with a (H) next to the "MJV-2 LUBRICATION" line on the Periodic Manufacturer's Certification form.
4. Replace the VENTILATOR RELIEF VALVE DIAPHRAGM in accordance with SP00075. Place a check mark and the replacement date at "VENT RELIEF VALVE REPLACEMENT" line on the Periodic Manufacturer's Certification form.
5. If a TEC 6 DESFLURANE vaporizer is mounted to the machine, a label stating: "WARNING THE ADMINISTRATION OF DESFLURANE ANESTHESIA MAY REQUIRE FRESH GAS CONCENTRATIONS HIGHER THAN COMMONLY USED WITH OTHER VOLATILE ANESTHETIC AGENTS. O2 FRESH GAS CONCENTRATION OF LESS THAN 21% MAY BE OBTAINED WITH HIGH VAPORIZER SETTINGS. CONTINUOUS MONITORING OF THE O2 CONCENTRATION IN THE BREATHING SYSTEM IS THEREFORE REQUIRED. DRAEGER MEDICAL, INC. RECOMMENDS THE CONTINUOUS MONITORING OF THE CONCENTRATION OF ANESTHETIC VAPORS IN THE BREATHING SYSTEM DURING THE ADMINISTRATION OF INHALATION ANESTHESIA."(part # 4112737-001) Shall be attached to the vapor box immediately above the TEC 6 vaporizer.
6. Check all vapor 19 and 19.1 vaporizers for correct labeling. All vaporizers must have a label stating "THE CONCENTRATION OUTPUT OF THIS VAPORIZER SHALL BE VERIFIED AFTER IT HAS BEEN ATTACHED TO THE ANESTHESIA MACHINE" (part # S010015). This label shall be attached to the rear of the vaporizer directly below the mount.
7. All Key Index Safety Systems vaporizers, (K.I.S.S.) must have a label stating "CAUTION: AFTER FILLING HAS BEEN COMPLETED, REINSERT PLUG INTO UPPER FILLER PORT AND TIGHTEN LOCKING SCREW" (part # 4112520-001). This label shall be attached to the vaporizer directly above the keyed filler. Place a check mark at "K.I.S.S. LABEL" on the PM Certification form.
8. If machine is equipped with a HALOTHANE Dräger Vapor 19 or 19.1 vaporizer, determine if vaporizer must be inspected for soil condition one. Check the serial number plate located on the rear of the vaporizer for a plus (+) preceding the serial number. A HALOTHANE vaporizer serial number not preceded with a (+) must be tested for soil in accordance with SP00073. If vaporizer does not need to be inspected, indicate so with a plus (+) next to the "Vapor Inspection (H)" line on the Vigilance Audit form. If vaporizer is soil condition 0, indicate so with "SOIL 0" written next to the "Vapor Inspection (H)" line on the Vigilance Audit form. If vaporizer is soil one, indicate so with "SOIL 1" written next to the "Vapor Inspection (H)" line on the Vigilance Audit form. Place a "CAUTION DO NOT USE" label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the equipment operator to remove the failed vaporizer from the machine and apply a replacement vaporizer or an adapter block onto the mount. All "SOIL 1" vaporizers must be removed from service for machine to receive certification.

PM Certification Procedure for Narkomed 2C Anesthesia System

9. Perform the vapor concentration test on all Dräger vapor vaporizers in accordance with SP00073 at a six month maximum interval. Perform the vaporizer concentration test on all Desflurane vaporizers in accordance with SP00091 for fixed mount vaporizers and SP00189 for user removable D-tec vaporizers at a six month maximum interval. For every vaporizer tested, fill out a "VAPOR VAPORIZER CALIBRATION CHECK" label (part # S010016). Information on this label shall include your signature, type of agent, date tested, test results @ 1%, 2.5%, 4% for H, E, I, or S vaporizers, or @ 4%, 10%, 12%, 16% for Desflurane vaporizers, and a PASS or FAIL indication. This label shall be attached to the upper right side of the vaporizer. If vaporizer fails the concentration verification, internal leak, or exclusion system tests, check "NO" in the "RECOMMENDED FOR USE" section on the PM Certification form.

Place a "CAUTION DO NOT USE" label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the equipment operator to remove the failed vaporizer from the machine and install a replacement vaporizer or an adapter block onto the mount. All nonfunctional Dräger vapor vaporizers must be removed from service for machine to receive certification.

10. Proceed with PM Certification procedure. If any tests fail refer to the "Failure Codes" listing in NAD Recommendations Guidelines Index (P/N S010250) to determine correct certification level starting point. Failure codes shall be documented on the "RECOMMENDATIONS / GENERAL COMMENTS" section of the PM Certification form and on the Executive Summary. If a test fails that has not been identified by the "Failure Codes" list, consult with Draeger Medical, Inc. to assess the proper certification level.
11. Based on the "EQUIPMENT CONDITION" inspect the machine for any "DMI RECOMMENDATIONS" that would apply. Use the Narkomed 2C section of the "RECOMMENDATION GUIDELINES INDEX" (P/N S010250). Note all applicable DMI recommendations on the Executive Summary. NOTE: If using a carbon form, indicate the Equipment Condition number and to see reverse side under the "RECOMMENDATIONS / GENERAL COMMENTS" section of the form.
12. Determine the correct certification level of the machine based on the combined lowest common denominator of "Equipment Conditions" and "Failure Codes". If the machine is at least conditionally certified fill out the "PM CERTIFICATION" label. Check the box(s) on the validation label where appropriate. Write the month and year, (three months from date of PM Certification) next to "NEXT VISIT DUE:" If certification level is "D", machine shall not receive a "PM CERTIFICATION" label. Any machine not receiving a PM Certification label shall receive a "WARNING NOT CERTIFIED" label. This label shall be placed at a prominent location on the left side of the machine after all other previous PMC and Vigilance Audit Validation labels have been removed.
13. In the "CERTIFICATION LEVEL" section of the PM Certification form, record the last visit certification level, the current certification level and the next visit due month and year, (three months from date of PM Certification) in the spaces provided.
14. If applicable, remove the previous PM CERTIFICATION VALIDATION label and attach the new label (P/N S010006 w/phone #, or P/N S010007 w/o phone #) in a prominent location on the rear of the anesthesia machine.
15. Check the appropriate boxes on the "PM CERTIFICATION NOTICE" label, (part # S010011). If the machine is not certified, the last box of this notice label shall be marked. Attach this notice to the flow shield of the anesthesia machine.
16. Have the customer sign each PM Certification form or the Executive Summary, and review the equipment conditions and the recommendations with the customer.
17. Return top copy to Draeger Medical, Inc. Service Department, keep middle copy for service organization records, give bottom copy to customer.

6.1 ELECTRICAL SAFETY

(✓) 6.1.1 Ground Continuity

6.1.1.1 Turn the System Power switch to STANDBY.

NOTE: Do not plug the safety analyzer power cord into a line isolation monitor, as inaccurate readings may occur.

Plug the unit into the safety analyzer, and plug the power cord of the safety analyzer into an AC receptacle.

NOTE: The BIOTECH 501 PRO will automatically test the source outlet for open ground (or ground resistance of $31\ \Omega$ or higher), reverse polarity, open neutral and open line. (The latter two conditions will prevent the analyzer from powering up.)

6.1.1.2 Set the safety analyzer function switch to the GROUND WIRE RESISTANCE position. Attach the test lead to the SINGLE LEAD connector of the analyzer. Connect the other end of the red test lead to the ground socket of the front panel outlet on the safety analyzer. Verify a displayed resistance of $0.000\ \Omega$ or, if necessary, press the CALIBRATE key on the front panel of the analyzer to zero the device.

6.1.1.3 Set the safety analyzer GROUND switch to NORMAL. Set the POLARITY switch to OFF.

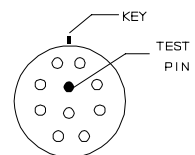
6.1.1.4 The safety analyzer shall indicate $0.1\ \Omega$ or less with its test lead applied to the following points:

- Cylinder yoke
- Power supply assembly chassis
- Each convenience outlet ground socket
- Each Auxiliary Outlet Strip ground socket

(✓) 6.1.2 Circuit Isolation

6.1.2.1 Disconnect the respiratory volume sensor cord from the interface panel.

6.1.2.2 With a multimeter set to its highest resistance range, check for continuity between the power supply chassis and the circuit common at the sensor interface connector keyway pin (use the 12 o'clock position for the Spiromed connector or the position indicated in the illustration for the ultrasonic flow sensor connector). There shall be no continuity between these points.



(✓) 6.1.3 Convenience Outlet and Auxiliary Outlet Strip

NOTE: This test will check the convenience outlets and the auxiliary strip outlets for fault conditions such as open ground ($>31\ \Omega$), reverse polarity, open line and open neutral. This is done each time the BIOTECH 501 PRO is powered up and allowed to cycle through its self test.

6.1.3.1 Shut off and unplug the safety analyzer. Remove the anesthesia machine plug from the analyzer, and plug it into the same outlet that was being used by the analyzer.

6.1.3.2 Plug the safety analyzer into the first convenience outlet to be tested, and turn the analyzer power switch ON. Allow the analyzer to cycle through its Auto Test sequence. If no wiring fault is indicated, shut off the analyzer and move its plug to the next convenience outlet. Test this outlet in the same manner, and continue until all convenience outlets and auxiliary strip outlets are tested.

6.1.4 Chassis Leakage Current

6.1.4.1 Turn the anesthesia machine System Power switch to ON and set the safety analyzer to the CHASSIS LEAKAGE CURRENT position.

6.1.4.2 Attach the safety analyzer test lead to a cylinder yoke.

(✓) 6.1.4.3 Record the total leakage current with the Polarity and Ground switches set as follows:

<u>Ground</u>	<u>Polarity</u>
Open	Normal
Normal	Normal
Open	Reversed
Normal	Reversed

Verify that the leakage current is 75* microamps or less in each of the switch positions (110 microamps or less for the 220/240 volt power supply option).

* 100 microamps if external monitors are plugged into convenience outlets.

(✓) 6.2 SELF-DIAGNOSTICS

6.2.1 Connect the pipeline supply or open the cylinders.

6.2.2 Turn the System Power switch to ON.

6.2.3 Verify that the following is displayed on the alarm CRT:

VIDEO	PASS	NARKOMED 2C
FIRMWARE	PASS	COPYRIGHT 1993, NAD, INC.
STATIC RAM	PASS	VERSION X.XX NM2C SW
TIMER	PASS	SOFTWARE ID. XXXX
A/D CONVERTER	PASS	
AUDIO - PRIMARY	PASS	
- BACKUP	PASS	
SERIAL I/O	PASS	
CLOCK	PASS	
NON-VOLATILE MEMORY	PASS	
FUNCTIONAL		

(✓) 6.2.4 Record the machine software version on the header of the checklist form.

(✓) 6.3 BATTERY CIRCUIT

- 6.3.1 Is "ON" LED lighted? __ (Y)
- 6.3.2 With the System Power switch ON, unplug the AC power cord.
- 6.3.3 Is yellow "AC PWR FAIL" LED lighted as long as the power cord is unplugged?
__ (Y)
- 6.3.4 Does the "AC PWR FAIL" message appear in the Advisory display? __ (Y)
- 6.3.5 Press and hold the "BATTERY TEST" button.
- 6.3.6 Is green Battery Test LED lighted as long as "BATTERY TEST" button is
depressed? __ (Y)
- 6.3.7 Release the "BATTERY TEST" button.
- 6.3.8 Restore AC power to the machine.
- 6.3.9 Does the "AC PWR FAIL" message disappear and the LED extinguish?

(✓) 6.4 CONFIGURATION

- 6.4.1 Press the Datagrip trigger, select SET and enter the SYSTEM CONFIGURE
screen.
- 6.4.2 The remote display shall display the Configuration Screen.
- 6.4.3 Verify the correct Time and Date.
- 6.4.4 Adjust the Volume to the highest setting.

6.5 SERVICE DATA

- 6.5.1 On the display key panel, press and hold the Speaker Disable and LOG DATA or VENT ALARMS OFF keys (simultaneously), and then press the Datagrip trigger (while still holding the keys).
- 6.5.2 The remote display shall display the Main Service Screen.
- (✓) 6.5.3 Record the Last Service Date on the PMS form.
- (✓) 6.5.4 Record the Hours Run Since Last Service on the PMS form.
- (✓) 6.5.5 Record the Total Hours Run on the PMS form.
- 6.5.6 Select and enter the Service Log.
- 6.5.7 Verify any pertinent information from the Service Log. Contact the Draeger Medical, Inc. Technical Service Department if necessary.
- 6.5.8 Set the cursor to EXIT and press the trigger to return to the Main Service Screen.
- 6.5.9 Select the PMS Service Code and press the Datagrip trigger.
- 6.5.10 Select and enter your Technical Service Rep. I.D. number.
- (✓) 6.5.11 Set the cursor to RESET and press the trigger. This resets the last service date to the current date and resets the hours run since last service to zero.
- 6.5.12 Set the cursor to PMS CRITERIA and press the trigger.
- (✓) 6.5.13 Select and enter the month of the next service due date. The internal clock of the machine limits the amount of date advance to a maximum of six months from the current service date.

6.6 CALIBRATIONS

- 6.6.1 Set the cursor to MONITORS and press the trigger to bring up the Oxygen Monitor Service Screen.
- 6.6.2 Remove the oxygen sensor from the valve dome adapter, and remove the oxygen sensor capsule from the oxygen sensor housing.
- (✓) 6.6.3 When the CURRENT CELL A and CURRENT CELL B readings have stabilized, set the cursor to STORE ZERO and press the trigger to store the values.

NOTE: The higher the offset, the higher the calculated oxygen concentration appears at high concentrations.
- 6.6.4 Put the oxygen sensor capsule into the oxygen sensor housing.
- 6.6.5 Set the cursor to PRESSURE MONITOR and press the trigger to enter the pressure monitor service screen.
- 6.6.6 Disconnect the Baromed breathing pressure sensor line from the absorber and expose it to air.
- 6.6.7 Let the Current Pressure Value stabilize, set the cursor to STORE ZERO and press the trigger.
- 6.6.8 Connect a test fixture and calibrated digital pressure manometer to the breathing pressure sensor line.
- 6.6.9 Pressurize the circuit to 50 cm H₂O and allow the Current Value to stabilize.
- (✓) 6.6.10 Set the cursor to STORE SPAN; press the trigger and verify that new span values are stored.
- 6.6.11 Release the pressure, disconnect the manometer and test fixture, and reconnect the breathing pressure sensor line to the absorber.
- 6.6.12 Set the cursor to EXIT and press the trigger to return to the Main Service screen.
- 6.6.13 Set the cursor to EXIT and press the trigger to return to normal operation.

(✓) 6.7A SCAVENGER, A/C - if applicable

6.7A.1 Scavenger, A/C Cleaning

- 6.7A.1.1 Remove all scavenger hoses one at a time, and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace any worn hoses.
- 6.7A.1.2 Remove the safety relief valve housing by unscrewing it in a counter-clockwise direction.
- 6.7A.1.3 Inspect the rubber O-ring and replace if worn.
- 6.7A.1.4 Remove the safety relief valve from its housing by twisting it out in a counter-clockwise direction. The tips of needle-nose pliers can be used to turn the valve. Be careful not to damage the valve disk.
- 6.7A.1.5 Remove any accumulated lint or dust from the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen. The scavenger body can be cleaned with a moist cloth.
- 6.7A.1.6 Reinstall the valve into the housing, making sure that it is threaded all the way into the housing and that the plastic washer is properly seated on its upper surface.
- 6.7A.1.7 Make sure that the interior of the valve body is completely dry. Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.7A.2 Scavenger, A/C Positive Pressure Relief

- 6.7A.2.1 Connect a 19 mm scavenger hose between the bottom of the absorber pole and the right-hand port on the scavenger. Connect a short 19 mm scavenger hose between the APL valve and the port on the rear of the absorber pole. Connect a 19 mm scavenger hose between the ventilator relief valve and the left-hand port on the scavenger.
- 6.7A.2.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber or the expiratory hose terminal on the ultrasonic flow sensor, if applicable.
- 6.7A.2.3 Set the Man/Auto valve to the AUTO position.

- 6.7A.2.4 If the absorber system or ventilator bellows are equipped with a PEEP valve, turn the PEEP valve control knob fully counter-clockwise.
- 6.7A.2.5 Set the oxygen flow to 10 l/min. and occlude the 19 mm scavenger terminal labeled EXHAUST.
- 6.7A.2.6 After the ventilator bellows inflates, the flow of oxygen will exit the system through the positive pressure safety relief valve. At this point, the absorber system breathing pressure gauge shall indicate a pressure of 10.0 cm H₂O or less.

(✓) 6.7B SCAVENGER, OPEN RESERVOIR - if applicable

6.7B.1 Scavenger, Open Reservoir Cleaning

- 6.7B.1.1 Remove all scavenger hoses one at a time and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace any worn hoses.
- 6.7B.1.2 Disconnect the hospital vacuum source from the scavenger.
- 6.7B.1.3 If applicable, remove the scavenger flow control needle valve assembly. Inspect the needle valve and seat for lint or dust accumulation. Clean with compressed air if necessary, and reinstall the needle valve assembly.
- 6.7B.1.4 Remove the scavenger mounting screws.
- 6.7B.1.5 Remove the two screws securing the access panel at the bottom of the scavenger canister.
- 6.7B.1.6 Remove and inspect the silencer; replace if needed.
- 6.7B.1.7 Remove the reservoir canister from the scavenger body by unscrewing the four socket head cap screws located at the top of the canister.
- 6.7B.1.8 Remove the flowmeter from its housing by turning it counter-clockwise. Inspect the tube and clean with compressed air if needed.
- 6.7B.1.9 Reassemble the scavenger assembly, and reactivate the vacuum source.

6.7B.2 Scavenger, Open Reservoir Negative Pressure Relief

- 6.7B.2.1 Connect a 19 mm scavenger hose between the bottom of the absorber pole and the right-hand port on the scavenger. Connect a 19 mm scavenger hose between the APL valve and the rear port on the absorber pole. The left-hand scavenger port may be capped for this test, or may be connected to the ventilator relief valve. Connect a DISS vacuum hose to the threaded terminal on the left side of the scavenger. Alternatively, an adapter can be used to attach a wall suction hose to the hose barb fitting on the adapter.
- 6.7B.2.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber or the expiratory hose terminal on the ultrasonic flow sensor, if applicable. Set the Man/Auto selector valve to the BAG position. Turn the APL valve control knob fully counter-clockwise.
- 6.7B.2.3 Verify that the suction waste gas disposal system is active.
- 6.7B.2.4 Adjust the scavenger needle valve until the flowmeter indicates between the white lines. Close all flow control valves on the anesthesia machine. Occlude the absorber breathing bag terminal.
- 6.7B.2.5 Install a scavenger adapter with a hose barb (P/N 4108114) between the 19 mm hose terminal of the scavenger, and the scavenger hose. Connect a calibrated test pressure monitor to the hose barb on the adapter and observe the pressure reading on the test gauge. The gauge shall indicate a pressure of 0 to -0.5 cm H₂O.

6.7B.3 Scavenger, Open Reservoir Positive Pressure Relief

- 6.7B.3.1 Turn the scavenger needle valve fully clockwise (closed).
- 6.7B.3.2 Open the oxygen flow control valve on the anesthesia machine to a flow of 10 l/min. and occlude the absorber breathing bag terminal.
- 6.7B.3.3 The flow of oxygen shall now exit the system through the relief ports around the top of the canister. The test pressure gauge shall indicate a pressure less than 1.0 cm H₂O.
- 6.7B.3.4 After the test, adjust the scavenger needle valve for a flowmeter indication halfway between the two white lines.

(✓) 6.7C **SCAVENGER INTERFACE - if applicable**

6.7C.1 Scavenger Inspection

6.7C.1.1 Check all scavenger hoses and reservoir bag for deterioration. Replace all worn components.

6.7C.2 Primary Negative Relief Valve Cleaning:

6.7C.2.1 Remove the plastic valve cover on the front surface of the scavenger body by turning it in a counter-clockwise direction.

6.7C.2.2 Remove the valve and washer from the scavenger body by turning it counter-clockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.

6.7C.2.3 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen.

6.7C.2.4 Reinstall the plastic washer and valve into the scavenger body. Replace the valve cover.

6.7C.3 Secondary Negative Relief Valve Cleaning:

6.7C.3.1 Unscrew the chrome plated valve housing on the left side of the scavenger body by turning its fitting counter-clockwise with a wrench.

6.7C.3.2 Unscrew the valve from the housing by turning it in a counter-clockwise direction.

6.7C.3.3 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen.

6.7C.3.4 Reinstall the valve in the housing, and then reinstall the housing into the scavenger body. Note: This valve does not require washers or O-rings.

6.7C.4 Positive Relief Valve Cleaning:

6.7C.4.1 Remove the valve housing on the right side of the scavenger body by turning it counter-clockwise.

6.7C.4.2 Inspect the rubber O-ring and replace if worn.

- 6.7C.4.3 Remove the valve from the housing by turning it counter-clockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.
 - 6.7C.4.4 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen.
 - 6.7C.4.5 Reinstall the valve and plastic washer into the housing.
 - 6.7C.4.6 Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.
- 6.7C.5 Negative Pressure:
- 6.7C.5.1 Connect a 22mm breathing hose between the absorber's inspiratory and expiratory valves. Set the Man/Auto valve to the BAG position. Turn the APL valve fully counter-clockwise. Occlude the bag mount connector.
 - 6.7C.5.2 Verify that the suction waste gas disposal system is active.
 - 6.7C.5.3 Close all flow control valves on the machine. Adjust the scavenger needle valve to allow typical suction through the scavenger.
 - 6.7C.5.4 Install a scavenger adapter (P/N 4108114) with a hose barb between the 19mm hose terminal of the scavenger and the scavenger hose. Connect a test monitor to the hose barb adapter and observe the pressure reading on the test gauge. The gauge shall indicate a pressure of <-1.0 cmH₂O.
- 6.7C.6 Positive Pressure:
- 6.7C.6.1 Close the scavenger needle valve by turning it fully clockwise.
 - 6.7C.6.2 Push the O₂ Flush button to inflate the scavenger reservoir bag. Open the oxygen flow control valve to 10 l/min.
 - 6.7C.6.3 Observe the pressure reading on the test gauge. The gauge shall indicate a pressure of <10.0 cmH₂O.
 - 6.7C.6.4 Remove the test equipment. Readjust the scavenger needle valve to allow typical suction through the scavenger.

6.7D SUCTION REGULATOR

- 6.7D.1 Verify that the suction bottle is attached to the suction regulator.
- 6.7D.2 Verify that vacuum is attached to the ¾ in. DISS vacuum connection.
- 6.7D.3 Set the vacuum on/off valve to the OFF (vertical) position.
- 6.7D.4 Connect a digital pressure meter to the collecting inlet stem of the suction bottle.
- 6.7D.5 Set the digital pressure meter to the mmHg scale.
- 6.7D.6 Turn the vacuum control knob fully counter-clockwise.
- (✓) 6.7D.7 What is the vacuum indicated on the digital pressure meter? (0)
- 6.7D.8 Turn the vacuum control knob fully clockwise and verify that the vacuum control knob stops.
- 6.7D.9 Set the vacuum on/off valve to the ON position.
- 6.7D.10 Set the regulator to indicate 250 mmHg.
- (✓) 6.7D.11 What is the vacuum indicated on the digital pressure meter? (200-300 mmHg)
- 6.7D.12 Return all controls to their original positions.

6.8 BREATHING SYSTEM**(✓) 6.8.1 Absorber System Inspection**

- 6.8.1.1 Remove the inspiratory and the expiratory valve domes.
- 6.8.1.2 Is there a broken or bent pin on the valve assembly?
Inspiratory ____ (N) Expiratory ____ (N)
- 6.8.1.3 Is there a broken pin on the valve domes?
Inspiratory ____ (N) Expiratory ____ (N)
- 6.8.1.4 Is the valve disc in good condition?
Inspiratory ____ (Y) Expiratory ____ (Y)
- 6.8.1.5 Are the valve dome washers in good condition? ____ (Y)
- 6.8.1.6 Reinstall the inspiratory and expiratory valve domes.
- 6.8.1.6A Remove the ultrasonic flow sensor connector hose - if applicable.
- 6.8.1.6B Is the connector hose, connector, and O-ring in good condition? ____ (Y) - if applicable.
- 6.8.1.6C Remove the ultrasonic flow sensor from the mounting bracket - if applicable.
- 6.8.1.6D Remove the flow housing/transducer assembly from the electronics housing - if applicable.
- 6.8.1.6E Remove both transducers from the flow housing; examine each O-ring and condition of all components, then reassemble - if applicable.
- 6.8.1.7 Remove the inspiratory and expiratory valve assemblies.
- 6.8.1.8 Remove the Spiromed sensor.
- 6.8.1.9 Are all three washers in good condition? ____ (Y)
- 6.8.1.10 Reinstall the inspiratory valve.
- 6.8.1.10A Reinstall the expiratory valve and the connector hose between the expiratory valve and the ultrasonic flow sensor - if applicable.
- 6.8.1.11 Are the two (2) spring clips on the absorber rods?
____ (Y)

- 6.8.1.12 Inspect the following: canisters and gaskets, dust cup and O-ring, condition of soda lime.
- 6.8.1.13 Are the absorber canisters and dust cup in good condition? ____ (Y)
- 6.8.1.14 Is the cm H₂O gauge at zero (0)? ____ (Y)
- 6.8.1.15 Remove the O₂Med sensor plug from the inspiratory valve dome adapter and examine the two O-rings at the bottom of the plug.

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6.8.1.16 Reinstall the O₂Med sensor plug into the inspiratory valve dome adapter.

6.8.1.17 Examine the two O-rings at the bottom of the sensor.

(✓) 6.8.2 Repack MAN/AUTO Selector Valve

[Does not apply to machines with later design selector valve.]

6.8.2.1 Remove the four screws securing the stick shift block to the selector valve body and remove the block.

6.8.2.2 Remove the spring and valve channel from the valve body.

6.8.2.3 Remove all residual lubricant from the valve channel.

6.8.2.4 Remove all residual lubricant from the valve body.

6.8.2.5 Apply a minimal amount of "stop cock" lubricant (Dow Corning High Vacuum Grease, P/N S4105908) to the tapered surface of the valve channel, and ensure complete coverage of lubricant.

6.8.2.6 Insert the valve channel into the valve body.

6.8.2.7 Insert the spring into the stick shift block.

6.8.2.8 Align the index pins on the stick shift block to the holes in the valve channel.

6.8.2.9 Secure the stick shift block to the selector valve body with the four screws that were previously removed.

6.8.2.10 Operate the selector valve handle and verify smooth movement.

(✓) 6.8.3 Lubrication, Spiromed Sensor - if applicable

- 6.8.3.1 Locate the four lateral holes at the sides of the Spiromed sensor marked by printed arrows.

CAUTION: Use only Sensor Lubrication Kit P/N 2218180 for the following procedure.

- 6.8.3.2 Remove the protective cover from the pipette and open the lubricant bottle.
- 6.8.3.3 Dip the tip of the pipette into the lubricant and draw one drop of lubricant into the pipette by pulling the pin upwards.
- 6.8.3.4 Insert the pipette into one of the four holes as far as it will go. Push the pin forward to its stop to inject lubricant into the hole.
- 6.8.3.5 Repeat the procedure on the three remaining holes.
- 6.8.3.6 Wipe any lubricant residue from the exterior of the sensor.
- 6.8.3.7 Reattach the sensor to the absorber top dome.
- 6.8.3.8 Reattach the expiratory valve to the sensor.

6.8.4 Freshgas Leak

- 6.8.4.1 Turn the System Power switch to STANDBY.
- 6.8.4.2 Remove the 15 mm connector from the FRESHGAS OUTLET.
- 6.8.4.3 Is the common gas outlet assembly in good condition? ____ (Y)
- 6.8.4.4 Connect a digital pressure manometer and Fresh Gas Leak Test Device to the freshgas outlet.
- 6.8.4.5 Apply 50 cm H₂O of pressure to the system.
- (✓) 6.8.4.6 After thirty (30) seconds, what is the pressure on the manometer? ____ (>40 cm H₂O)
- 6.8.4.7 Turn on the left mounted vaporizer to the first graduated marking.
- 6.8.4.8 Apply 50 cm H₂O of pressure to the system.
- (✓) 6.8.4.9 After thirty (30) seconds, what is the pressure on the manometer? ____ (>40 cm H₂O)
- 6.8.4.10 Turn off the vaporizer.
- 6.8.4.11 Remove the test equipment from the Fresh Gas Outlet.
- 6.8.4.12 Turn the System Power switch to ON.
- 6.8.4.13 Open the O₂ flow control valve to 5 l/min., purge the system for 5 seconds, then close the O₂ flow control valve.
- 6.8.4.14 Turn the System Power switch to STANDBY.
- (✓) 6.8.4.15 Turn on the center mounted vaporizer to the first graduated marking, repeat Steps 6.8.4.4 and 6.8.4.8 thru 6.8.4.14. ____ (>40 cm H₂O)
- (✓) 6.8.4.16 Turn on the right mounted vaporizer to the first graduated marking, repeat Steps 6.8.4.4 and 6.8.4.8 thru 6.8.4.14. ____ (>40 cm H₂O)
- 6.8.4.17 Reconnect the 15 mm connector from the absorber system to the FRESHGAS OUTLET.
- 6.8.4.18 Is the FRESHGAS OUTLET label on the freshgas outlet? ____ (Y)

6.8.5 Breathing System Leak

- 6.8.5.1 Verify the System Power switch is at STANDBY.
- 6.8.5.2 Close all flow control valves.
- 6.8.5.3 Interconnect the inspiratory and expiratory valves with a 12-inch hose.
- 6.8.5.4 Attach a test terminal with a cuff inflation bulb (P/N S010159) to the bag mount.
- 6.8.5.5 Set the Man/Auto selector valve to BAG.
- 6.8.5.6 Close the APL valve.
- 6.8.5.7 Apply 50 cm H₂O pressure to the absorber system.
- (✓) 6.8.5.8 After 30 seconds, what is the pressure in the absorber system? ____ cm H₂O (≥ 30)

6.8.6 APL Valve

- 6.8.6.1 Open the APL valve to its stop.
- 6.8.6.2 Turn the SYSTEM POWER switch to ON.
- 6.8.6.3 Set the oxygen flow to 8 l/min.
- (✓) 6.8.6.4 What is the pressure on the absorber pressure gauge? ____ cm H₂O (≤ 3)
- 6.8.6.5 Close the oxygen flow control valve, turn the System Power switch to STANDBY, and remove the test terminal from the bag mount.

6.8.7 Absorber Flow Direction and Leak

6.8.7.1 Expiration Valve Leak

- 6.8.7.1.1 Close the APL valve.
- 6.8.7.1.2 Connect a 22mm hose between the inspiration valve and the bag mount.
- 6.8.7.1.3 Connect a test terminal to the expiration valve or the expiratory hose terminal on the ultrasonic flow sensor, if applicable.
- 6.8.7.1.4 Connect a Capnomed flowmeter to the test terminal.

- 6.8.7.1.5 Turn the System Power switch to ON, turn up the oxygen flow until the system pressurizes to 30 cmH₂O.
- (✓) 6.8.7.1.6 What is the value indicated on the flowmeter? ____ (≤60ml/min).
- 6.8.7.1.7 Remove all test equipment, and turn the System Power switch to STANDBY.
- 6.8.7.2 Inspiration Valve Leak
 - 6.8.7.2.1 Connect a test terminal to the inspiratory valve.
 - 6.8.7.2.2 Connect a tee fitting (P/N 4109292) and calibrated pressure meter to the test terminal.
 - 6.8.7.2.3 Connect a pressure bulb to the open port of the tee adapter.
 - 6.8.7.2.4 Connect another test terminal to the bag connector.
 - 6.8.7.2.5 Connect a Capnomed flowmeter to the test terminal on the bag mount.
 - 6.8.7.2.6 Pressurize the system to 30 cmH₂O.
 - (✓) 6.8.7.2.7 What is the value indicated on the flow meter? ____ (≤60 ml/min).
 - 6.8.7.2.8 Remove all test equipment.
- 6.8.7.3 Flow Direction
 - 6.8.7.3.1 Attach a breathing circuit with a 3-liter bag at the Y-piece to the inspiration valve and expiration valve or the expiratory hose terminal on the ultrasonic flow sensor, if applicable.
 - 6.8.7.3.2 Attach a 3-liter bag to the swivel bag mount.
 - 6.8.7.3.3 Turn the System Power switch to ON.
 - 6.8.7.3.4 Set the O₂ flow to 4 l/min.
 - 6.8.7.3.5 Inflate the simulated lung by briefly using the O₂ Flush.
 - 6.8.7.3.6 Partially open the APL valve.

- 6.8.7.3.7 Squeeze the breathing bag attached to the bag mount at a rate of approximately 10 BPM. Readjust the APL valve if required to properly ventilate the simulated lung.
- (✓) 6.8.7.3.8 Observe the operation of each unidirectional valve disc at eye level and make sure the inspiratory valve disc raises only during the inspiration phase, and the expiratory valve raises only during the exhalation phase. Watch the valves until satisfied that both valves operate correctly, and move freely without sticking.
- 6.8.7.3.9 Remove the breathing circuit.
- 6.8.7.3.10 Open the APL valve.
- (✓) 6.8.8 Absorber PEEP Valve w/By-Pass - if applicable
 - 6.8.8.1 Connect a 12 in. hose between the inspiratory and expiratory valves, and set the O₂ flow to 5 l/min.
 - * 6.8.8.2 Place the PEEP bypass in the ON position.
 - 6.8.8.3 Adjust the absorber PEEP valve clockwise to the maximum position.
 - 6.8.8.4 Does the PEEP valve adjust smoothly? ____ (Y)
 - 6.8.8.5 What is the maximum PEEP? ____ cm H₂O (15-22)
 - * 6.8.8.6 Place the PEEP bypass in the OFF position.
 - 6.8.8.7 Does the PEEP return to ≤3 cm H₂O? ____ (Y)
 - 6.8.8.8 Adjust the absorber PEEP valve counterclockwise to its minimum position.
 - 6.8.8.9 Close the O₂ flow control valve.
 - * These items apply only to machines with a PEEP by-pass.

6.8.9 Bain Circuit Adapter - if applicable

- 6.8.9.1 Close the APL valve by turning the knob fully clockwise.
- 6.8.9.2 Insert the O₂ sensor plug into the O₂ sensor inlet on the Bain Circuit.
- 6.8.9.3 Attach a test terminal with a cuff inflation bulb (P/N S010159) to the Breathing Bag port on the Bain Circuit.
- 6.8.9.4 Attach a cmH₂O digital pressure meter to the female quick connect connection on the Bain Circuit.
- 6.8.9.5 Occlude the expiration port on the Bain Circuit.
- 6.8.9.6 Apply 50cmH₂O to the Bain Circuit via test terminal and inflation bulb.
- (✓) 6.8.9.7 After 30 seconds, what is the pressure on the cmH₂O digital pressure meter? (45 to 50 cmH₂O)
- 6.8.9.8 Verify that the pressure indicated on the cmH₂O gauge is within 3 cmH₂O of the digital pressure meter reading.
- 6.8.9.9 Open the APL valve by turning the knob fully counter-clockwise.
- 6.8.9.10 Connect a test hose from the fresh gas outlet to the Expiration port of the Bain Circuit.
- 6.8.9.11 Set the O₂ flow to 10 L/min.
- (✓) 6.8.9.12 What is the pressure on the cmH₂O digital pressure meter? (≤ 3 cmH₂O)
- 6.8.9.13 Verify that the pressure indicated on the cmH₂O gauge is within 3 cmH₂O of the digital pressure meter reading.
- 6.8.9.14 Remove the test terminal and inflation bulb from the Breathing Bag port.
- 6.8.9.15 Return all controls to their original positions.

(✓) 6.9 MANUAL SPHYGMOMANOMETER - if applicable

- 6.9.1 Insert the male Luer fitting of the Sphygmomanometer squeeze bulb-hose assembly into the female Luer fitting labeled BP BULB on the front of the machine.
- 6.9.2 Wrap the blood pressure cuff around an "E" cylinder.
- 6.9.3 Hand-pump the squeeze bulb until pressure of 200 mm Hg is indicated on the Sphygmomanometer gauge on the machine. Pinch the hose adjacent to the Luer fitting to assure that the hose-bulb is not the source of any leak.
- 6.9.4 After thirty (30) seconds, what is the pressure on the Sphygmomanometer gauge? ____ mm Hg (190-200)
- 6.9.5 Bleed the pressure.
- 6.9.6 The Sphygmomanometer should indicate within the band.
- 6.9.7 Attach a test gauge in series with the sphygmomanometer gauge being tested.
- 6.9.8 Hand-pump the squeeze bulb until the machine gauge indicates 100 mm Hg.
- 6.9.9 What does the test gauge indicate? ____ mm Hg (90-110).
- 6.9.10 Hand-pump the squeeze bulb until the machine gauge indicates 200 mm Hg.
- 6.9.11 What does the test gauge indicate? ____ mm Hg (180-220).
- 6.9.12 Hand-pump the squeeze bulb until the machine gauge indicates 300 mm Hg.
- 6.9.13 What does the test gauge indicate? ____ mm Hg (210-390).
- 6.9.14 Remove the test gauge.
- 6.9.15 Remove the blood pressure cuff from the "E" cylinder.

(✓) 6.10 VAPOR EXCLUSION SYSTEM

- 6.10.1 Set all vapors to zero (0).
- 6.10.2 Adjust the handwheel on the left vapor (viewed from the front of the machine) to any concentration above zero (0).
- 6.10.3 Using the datagrip, select AGT.
- 6.10.4 Verify that the correct abbreviation for the agent selected appears on the display.
- 6.10.5 Is it possible to adjust the center vapor? ____ (N)
- 6.10.6 Is it possible to adjust the right (viewed from the front of the machine) vapor? ____ (N)
- 6.10.7 Adjust the handwheel on the left vapor to zero (0).
- 6.10.8 Adjust the handwheel on the center vapor to any concentration above zero (0).
- 6.10.9 Verify that the correct abbreviation for the agent selected appears on the display.
- 6.10.10 Is it possible to adjust the left vapor? ____ (N)
- 6.10.11 Is it possible to adjust the right vapor? ____ (N).
- 6.10.12 Adjust the handwheel on the center vapor to zero (0).
- 6.10.13 Adjust the handwheel on the right vapor to any concentration above zero (0).
- 6.10.14 Verify that the correct abbreviation for the agent selected appears on the display.
- 6.10.15 Is it possible to adjust the left vapor? ____ (N).
- 6.10.16 Is it possible to adjust the center vapor? ____ (N).
- 6.10.17 Adjust the handwheel on the right vapor to zero (0).

6.11 YOKES & GAUGES

(✓) 6.11.1 Yokes & Check Valves

- 6.11.1.1 Turn the System Power switch to STANDBY.
- 6.11.1.2 Disconnect all pipeline hoses and close all cylinder valves.
- 6.11.1.3 Remove cylinder or yoke plug from each yoke assembly.
- 6.11.1.4 Do all the yoke handles adjust smoothly? ____ (Y)
- 6.11.1.5 Are the two (2) yoke pins installed securely in each yoke? ____ (Y)
- 6.11.1.6 Is there only one (1) cylinder washer on each yoke assembly? ____ (Y)
- 6.11.1.7 Is there a yoke plug attached to each yoke assembly? ____ (Y)
- 6.11.1.8 Is the proper gas I.D. label affixed to each yoke assembly? ____ (Y)
- 6.11.1.9 Attach a cylinder to each yoke assembly, open the cylinder valve, let the pressure stabilize, close the cylinder valve, and remove the cylinder from the yoke assembly.
- 6.11.1.10 Does the yoke check valve assembly prevent the escape of excessive pressure? ____ (Y)
- 6.11.1.11 Attach the cylinders to the yokes.

(✓) 6.11.2 Cylinder Gauges

- 6.11.2.1 Are the pressure gauges correct for the gases indicated by the flowmeters?
___ (Y)
- 6.11.2.2 Is the gauge closest to the table top for cylinder supply pressure? ___ (Y)
- 6.11.2.3 Bleed all pressure from the cylinder circuit.
- 6.11.2.4 Are the cylinder gauges at zero (0) PSI? ___ (Y)
- 6.11.2.5 Open the cylinder valves.
- 6.11.2.6 Do the cylinder pressure gauges respond properly? ___ (Y)

(✓) 6.11.3 Pipeline Gauges

- 6.11.3.1 Are the gauges right below the flowmeters for pipeline supply pressure?
___ (Y)
- 6.11.3.2 Are the pipeline pressure gauges at zero (0) PSI? ___ (Y)
- 6.11.3.3 Connect the pipeline supply.
- 6.11.3.4 Do the pipeline pressure gauges respond properly? ___ (Y)
- 6.11.3.5 Are the correct gas identification labels affixed at each of the pipeline inlets? ___ (Y)
- 6.11.3.6 Does the back panel identify each of the pipeline inlets properly? ___ (Y)
- 6.11.3.7 Disconnect the pipeline hoses.

6.12 HIGH PRESSURE REGULATOR

Minimum cylinder pressures for this test are: N₂O & CO₂: 600 psi

O₂, Air, He, He/O₂, N₂: 1000 psi

- 6.12.1 Verify the System Power switch is ON.
- 6.12.2 Verify all cylinder valves are closed except the O₂ valve.
- 6.12.3 Set the oxygen flow to 4 liters per min.
- 6.12.4 Open the other gas flow control valves to drain pressure from the system.
- 6.12.5 Close the O₂ cylinder valve, and press the O₂ Flush valve to drain oxygen pressure from the system.
- 6.12.6 Turn the System Power switch to STANDBY.
- 6.12.7 Remove the table top from the machine and remove the top cabinet drawer. Refer to replacement procedure 4.2.
- 6.12.8 Locate the TEE fitting in the ¼ in. diameter O₂ regulator output line, and remove the plug from the TEE fitting.
- 6.12.9 Connect a dedicated O₂ test gauge to the TEE fitting.
- NOTE: Two test gauges are required to avoid contamination of the O₂ circuit from the other gases: a dedicated test gauge for O₂, and a second test gauge for the other gases.
- 6.12.10 Open the O₂ cylinder valve. Turn the System Power switch to ON, and turn the gas selector switch to ALL GASES - if applicable.
- 6.12.11 Verify the oxygen flow is 4 liters per min.
- (✓) 6.12.12 On the test gauge, what is the regulator output press.? ___PSI (43-49)
- NOTE: Leave the dedicated O₂ test gauge connected for later use in the Oxygen Supply Pressure Alarm Test.
- 6.12.13 Turn the System Power switch to STANDBY.
- 6.12.14 For the other pressure regulators, locate their corresponding TEE fittings in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting (one at a time).
- 6.12.15 Connect the second test gauge to the TEE fitting.

- 6.12.16 Open the corresponding cylinder valve and set the System Power switch to ON.
- 6.12.17 Set the corresponding flow to 4 l/min.
- (✓) 6.12.18 On the second test gauge, what is the regulator output pressure? ____ PSI (40 - 49 for N₂O), (43 - 49 for Air)
- 6.12.19 Depressurize the gas circuit.
- 6.12.20 Remove the test gauge and replace the plug in the TEE fitting.
- (✓) 6.12.21 Repeat Steps 6.12.13 thru 6.12.20 for all other gases except CO₂ circuits.

6.13 HIGH PRESSURE LEAK**(✓) 6.13.1 Oxygen High Pressure Leak**

6.13.1.1 Verify the System Power switch is at STANDBY.

6.13.1.2 Open one (1) oxygen cylinder valve.

6.13.1.3 Let the pressure stabilize.

6.13.1.4 Close the oxygen cylinder valve and remove the cylinder.

6.13.1.5 Observe the oxygen cylinder pressure gauge.

6.13.1.6 After two (2) minutes, what is the pressure loss? ____ PSI (<50)

6.13.1.7 Attach the cylinder.

(✓) 6.13.2 Nitrous Oxide High Pressure Leak

6.13.2.1 Turn the System Power switch to ON.

6.13.2.2 Open one (1) oxygen cylinder valve and one (1) nitrous oxide cylinder valve.

6.13.2.3 Adjust the oxygen flow to 4 l/min.

6.13.2.4 Let the pressure stabilize.

6.13.2.5 Close the nitrous oxide cylinder valve and remove the cylinder.

6.13.2.6 Observe the nitrous oxide cylinder pressure gauge.

6.13.2.7 After two (2) minutes, what is the pressure loss? ____ PSI (<50)

6.13.2.8 Attach the cylinder.

6.13.2.9 Close the oxygen flow control valve.

(✓) 6.13.3 Air High Pressure Leak - if applicable

- * 6.13.3.1 Set the gas selector switch to ALL GASES.
- 6.13.3.2 Open the air cylinder valve.
- 6.13.3.3 Let the pressure stabilize.
- 6.13.3.4 Close the air cylinder valve and remove the cylinder.
- 6.13.3.5 Observe the air cylinder pressure gauge.
- 6.13.3.6 After two (2) minutes, what is the pressure loss? ____ PSI (<50)
- 6.13.3.7 Attach the air cylinder.

(✓) 6.13.4 Oxygen-Helium High Pressure Leak - if applicable

- * 6.13.4.1 Set the gas selector switch to ALL GASES.
- 6.13.4.2 Open the oxygen-helium cylinder valve.
- 6.13.4.3 Let the pressure stabilize.
- 6.13.4.4 Close the oxygen-helium cylinder valve and remove the cylinder.
- 6.13.4.5 Observe the oxygen-helium cylinder pressure gauge.
- 6.13.4.6 After two (2) minutes, what is the pressure loss? ____ PSI (<50)
- 6.13.4.7 Attach the oxygen-helium cylinder.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

(✓) 6.13.5 Carbon Dioxide High Pressure Leak - if applicable

- * 6.13.5.1 Set the gas selector switch to ALL GASES.
- 6.13.5.2 Open the carbon dioxide cylinder valve.
- 6.13.5.3 Let the pressure stabilize.
- 6.13.5.4 Close the carbon dioxide cylinder valve and remove the cylinder.
- 6.13.5.5 Observe the carbon dioxide cylinder pressure gauge.
- 6.13.5.6 After two (2) minutes, what is the pressure loss? ____ PSI (<50)
- 6.13.5.7 Attach the carbon dioxide cylinder.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.14 OXYGEN SUPPLY FAILURE PROTECTION

6.14.1 Nitrous Oxide O.F.P.D.

- 6.14.1.1 Open and close the oxygen cylinder valve.
- 6.14.1.2 Open the nitrous oxide cylinder valve.
- 6.14.1.3 Set the O₂ and N₂O flows to 4 l/min.
- (✓) 6.14.1.4 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ____ (Y)
- 6.14.1.5 Connect the O₂ pipeline supply.
- 6.14.1.6 Close the nitrous oxide cylinder valve and bleed the pressure from the circuit.
- 6.14.1.7 Connect the N₂O pipeline supply.
- 6.14.1.8 Disconnect the O₂ pipeline supply.
- (✓) 6.14.1.9 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ____ (Y)
- 6.14.1.10 Close the nitrous oxide flow control valve.
- 6.14.1.11 Disconnect the N₂O pipeline supply.

6.14.2 Air O.F.P.D. - if applicable

- * 6.14.2.1 Set the gas selector switch to ALL GASES.
- 6.14.2.2 Open the air cylinder valve - if applicable.
- 6.14.2.3 Connect the air pipeline hose - if applicable.
- 6.14.2.4 Open one (1) oxygen cylinder valve.
- 6.14.2.5 Set the air flow to 4 l/min; set the oxygen flow to 4 l/min.
- 6.14.2.6 Close the oxygen cylinder valve.
- (✓) 6.14.2.7 Does the flow of air cease when the oxygen pressure is depleted? ____ (Y)
- 6.14.2.8 Close the air flow control valve.
- 6.14.2.9 Disconnect the air pipeline hose - if applicable.

6.14.3 Oxygen-Helium O.F.P.D. - if applicable

- * 6.14.3.1 Set the gas selector switch to ALL GASES.
- 6.14.3.2 Open the oxygen-helium cylinder valve.
- 6.14.3.3 Open one (1) oxygen cylinder valve.
- 6.14.3.4 Set the oxygen-helium flow to 4 l/min; set the oxygen flow to 4 l/min.
- 6.14.3.5 Close the oxygen cylinder valve.
- (✓) 6.14.3.6 Does the flow of oxygen-helium cease when the oxygen pressure is depleted? ____ (Y)
- 6.14.3.7 Close the oxygen-helium flow control valve.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.14.4 Carbon Dioxide O.F.P.D. - if applicable

* 6.14.4.1 Set the gas selector switch to ALL GASES.

6.14.4.2 Open the cylinder of carbon dioxide.

6.14.4.3 Open one (1) oxygen cylinder valve.

6.14.4.4 Set the carbon dioxide flow to 500 ml; set the oxygen flow to 4 l/min.

6.14.4.5 Close the oxygen cylinder valve.

(✓) 6.14.4.6 Does the flow of carbon dioxide cease when the oxygen pressure is depleted? ____ (Y)

6.14.4.7 Close the carbon dioxide flow control valve.

* 6.14.4.8 Set the gas selector switch to O_2+N_2O .

6.14.5 (Deleted)

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.14.6 (Deleted)

6.14.7 Oxygen Supply Pressure Alarm

- 6.14.7.1 If not already connected, connect a dedicated O₂ test gauge to the TEE fitting in the O₂ regulator output line.
- 6.14.7.2 Open and close an oxygen cylinder.
- 6.14.7.3 Set the oxygen flow to 2 l/min.
- (✓) 6.14.7.4 What is the pressure on the dedicated O₂ test gauge when the "O₂ SUPPLY PRESSURE" LED turns on? ____ PSI (34 - 40)
- 6.14.7.5 Does the O₂ SUPPLY LOW message appear in the Caution display? ____ (Y)
- 6.14.7.6 Bleed the remaining O₂ pressure from the system, then close the flow control valve.
- 6.14.7.7 Remove the test gauge from the TEE fitting in the O₂ regulator output line and replace the plug.

6.15 FLOWMETERS

(✓) 6.15.1 Oxygen Flowmeter

6.15.1.1 Open the O₂ cylinder valve.

6.15.1.2 Is it possible to adjust the flow of oxygen over the full range of the flowmeters? ____ (Y)

6.15.1.3 Close the O₂ cylinder valve and bleed the pressure.6.15.1.4 Connect the O₂ pipeline supply, and verify the operation of the oxygen flowmeter.

6.15.1.5 Is the correct flow control knob and label attached to the oxygen flow control valve? ____ (Y)

6.15.1.6 Close the oxygen flow control valve.

* 6.15.1.7 Set the Gas Selector switch to the O₂ + N₂O position.(✓) 6.15.1.8 What is the minimum flow of oxygen? ____ ml (100-200 ml/min); (0 ml for 4107615A (Minimum O₂ Flow Elimination))

(✓) 6.15.2 Nitrous Oxide Flowmeter

6.15.2.1 Set the oxygen flow to 4 l/min.

6.15.2.2 Open the nitrous oxide cylinder valve.

6.15.2.3 Is it possible to adjust the flow of nitrous oxide over the full range of the flowmeter? ____ (Y)

6.15.2.4 Close the nitrous oxide cylinder valve and bleed the pressure.

6.15.2.5 Connect the N₂O pipeline supply, and verify the proper operation of the N₂O flowmeter.6.15.2.6 Is the correct flow control knob and label attached to the N₂O flow control valve? ____ (Y)

6.15.2.7 Close the oxygen and nitrous oxide flow control valves.

* These items do not apply to 2-gas machines or later design (P/N 4113329-001) ORC.

(✓) 6.15.3 Air Flowmeter - if applicable

- * 6.15.3.1 Set the gas selector switch to ALL GASES.
- ** 6.15.3.2 Open the air cylinder valve.
- ** 6.15.3.3 Is it possible to adjust the flow of the air over the full range of the flowmeter? ____ (Y)
- ** 6.15.3.4 Close the air cylinder valve and bleed the pressure.
- 6.15.3.5 Close the air flow control valve.
- 6.15.3.6 Connect the Air pipeline supply and verify the proper operation of the air flowmeter. Close the air flow control valve.
- 6.15.3.7 Is the correct flow control knob and label attached to the air flow control valve? ____ (Y)
- * 6.15.3.8 What is the minimum flow of oxygen? ____ ml (0)

(✓) 6.15.4 Oxygen-Helium Flowmeter - if applicable

- * 6.15.4.1 Set the gas selector switch to ALL GASES.
- 6.15.4.2 Open the oxygen-helium gas cylinder valve.
- 6.15.4.3 Is it possible to adjust the flow of the oxygen-helium over the full range of the flowmeter? ____ (Y)
- 6.15.4.4 Close the oxygen-helium flow control valve.
- 6.15.4.5 Is the correct flow control knob and label attached to the oxygen-helium flow control valve? ____ (Y)

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

**these items do not apply to 4-gas machines.

(✓) 6.15.5 Carbon Dioxide Flowmeter - if applicable

* 6.15.5.1 Set the gas selector switch to ALL GASES.

6.15.5.2 Open the carbon dioxide gas cylinder valve.

6.15.5.3 Is it possible to adjust the flow of the carbon dioxide over its range of 600 ml/min.? ____ (Y)

6.15.5.4 Close the carbon dioxide flow control valve.

6.15.5.5 Is the correct flow control knob and label attached to the carbon dioxide flow control valve? ____ (Y)

*These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.16 O2 MED

- 6.16.1 Disconnect the oxygen sensor cable from the Oxygen Sensor interface.
- 6.16.2 The following message shall appear on the remote display: O2 SENS DISC.
- 6.16.3 Reconnect the O₂ Med sensor.
- 6.16.4 The following message shall appear on the remote display: CAL O2 SENSOR.
- 6.16.5 Press the Datagrip trigger, select SET UP and perform an O₂ calibration.
- NOTE: Make sure that the sensor has been stabilized in ambient air for several minutes.
- (✓) 6.16.6 After calibration is completed, what is the oxygen concentration? ____ % (21)
- 6.16.7 Select TEMPLATE and press the trigger, select GET TEMPLATE and enter the factory defaults.
- 6.16.8 The warning INSP O2 LOW shall appear on the remote display and the warning heading shall be flashing. There shall be a continuous audible alarm.
- 6.16.9 What is the low oxygen alarm default? ____ % (30)
- 6.16.10 Exit the Default screen and re-enter the SET UP screen.
- 6.16.11 Select the OXYGEN LOW alarm limit. Does a box appear around the low alarm limit? ____ (Y)
- 6.16.12 Verify that the low alarm limit has a range from 18 to 99%.
- 6.16.13 Place the oxygen sensor into the inspiratory valve dome adapter, set the Man/Auto selector BAG, close the APL valve. Attach a 12-inch hose to the inspiratory valve and occlude the bag mount.
- 6.16.14 Set the oxygen flow to 4 l/min.
- 6.16.15 Set the low limit to 18, and verify the INSP O2 LOW message has cleared.

- 6.16.16 Select the OXYGEN HIGH alarm limit. Does a box appear around the high alarm limit? ____ (Y)
- 6.16.17 What is the high oxygen alarm default? ____ % (100)
- 6.16.18 Verify that the high alarm limit has a range from 100 to 19%.
- 6.16.19 Set the high alarm limit to 95.
- 6.16.20 The message INSP O2 HIGH shall appear on the remote display under the Advisory column.
- 6.16.21 Return the high alarm limit to 100.
- 6.16.22 The INSP O2 HIGH message shall disappear.
- (✓) 6.16.23 Within 3 minutes, what is the oxygen concentration? ____ % (97-100)

6.17 OXYGEN CONCENTRATIONS

6.17.1 Oxygen + Nitrous Oxide Concentration

- 6.17.1.1 Verify the oxygen flow is at 4 l/min.
- 6.17.1.2 Depress the O₂ Flush button for 5 seconds.
- 6.17.1.3 Does the O₂Med read 97-100% after the value stabilizes?__ (Y)
- 6.17.1.4 Set the nitrous oxide flow to 2 l/min.
- (✓) 6.17.1.5 After the value stabilizes, what is the oxygen concentration? ____ % (64-70)
- 6.17.1.6 Close the nitrous oxide flow control valve.

6.17.2 Oxygen + Air Concentration - if applicable

- 6.17.2.1 Depress the O₂FLUSH button for 5 seconds.
- 6.17.2.2 Does the O₂Med read 97-100% after the value stabilizes?__ (Y)
- * 6.17.2.3 Set the gas selector switch to ALL GASES.
- 6.17.2.4 Verify the O₂ flow is at 4 l/min; set the air flow to 2 l/min.
- (✓) 6.17.2.5 After the value stabilizes, what is the O₂ concentration? ____%(71-77)
- 6.17.2.6 Close the air cylinder valve and bleed the pressure from the circuit - if applicable.
- 6.17.2.7 Close the air flow control valve.
- * 6.17.2.8 Set the gas selector switch to O₂+N₂O.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.17.3 Oxygen + Helium and Oxygen Concentration - if applicable

- 6.17.3.1 Depress the "O₂ FLUSH" for 15 seconds.
- 6.17.3.2 Does the O₂ Med read 97-100% within 3 minutes? ____ (Y)
- * 6.17.3.3 Set the gas selector switch to ALL GASES.
- 6.17.3.4 Verify the oxygen flow is at 4 l/min.
- 6.17.3.5 Set the oxygen-helium flow to 2 l/min.
- (✓) 6.17.3.6 After the value stabilizes, what is the O₂ concentration? ____%(72-78)
- 6.17.3.7 Close the oxygen-helium cylinder valve and bleed the pressure from the circuit.
- 6.17.3.8 Close the oxygen-helium flow control valve.
- * 6.17.3.9 Set the gas selector switch to O₂+N₂O.

6.17.4 Oxygen + Carbon Dioxide Concentration - if applicable

- 6.17.4.1 Depress the O₂FLUSH button for 15 seconds.
- 6.17.4.2 Set the oxygen flow to 1000 ml.
- 6.17.4.3 Does the O₂MED read 97-100% within 3 min? ____ (Y)
- * 6.17.4.4 Set the gas selector switch to ALL GASES.
- 6.17.4.5 Set the carbon dioxide flow to 500 ml.
- (✓) 6.17.4.6 What is the O₂ concentration after the value stabilizes? ____%(64-70)
- 6.17.4.7 Close the carbon dioxide cylinder valve and bleed the pressure from the circuit.
- 6.17.4.8 Close the carbon dioxide flow control valve.
- * 6.17.4.9 Set the gas selector switch to O₂+N₂O.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

(✓) 6.18 AUXILIARY OXYGEN FLOWMETER - if applicable

- 6.18.1 Close the auxiliary oxygen flowmeter flow control valve.
- 6.18.2 Connect a cm H₂O pressure manometer to the outlet.
- 6.18.3 Is there an increase in pressure? ____ (N)
- 6.18.4 Apply a pressure of 50 cm H₂O to the manometer.
- 6.18.5 After 30 seconds, what is the pressure on the manometer? ____(>40 cm H₂O)
- 6.18.6 Remove the gauge and test fixture.
- 6.18.7 Is it possible to adjust the flow over the full range of the auxiliary oxygen flowmeter? ____ (Y)
- 6.18.8 Set the flow rate to 5 l/min.
- 6.18.9 Hold the sensor from a calibrated O₂Med at the auxiliary oxygen flowmeter outlet.
- 6.18.10 After the value stabilizes, what is the oxygen concentration? ____ % (97-100)
- 6.18.11 Remove the O₂Med sensor from the auxiliary oxygen flowmeter, and insert it into the inspiratory valve dome adapter.
- 6.18.12 Close the flowmeter flow control valve.

6.19A OXYGEN RATIO CONTROLLER

- * 6.19A.1 Set the Gas Selector switch to O₂ + N₂O.
- 6.19A.2 Depress the O₂FLUSH for 5 seconds.
- 6.19A.3 Set the oxygen flow to 1000 ml/min.
- 6.19A.4 Open the nitrous oxide flow control valve to the stop position.
- (✓) 6.19A.5 What is the oxygen concentration after the value stabilizes? ____ % (21-29)
- 6.19A.6 Adjust the oxygen flow to 1.5 l/min.
- (✓) 6.19A.7 What is the oxygen concentration after the value stabilizes? ____ % (21-29)
- 6.19A.8 Adjust the oxygen flow to 2 l/min.
- (✓) 6.19A.9 What is the oxygen concentration after the value stabilizes? ____ % (21-29)
- 6.19A.10 Adjust the oxygen flow to 4 l/min.
- (✓) 6.19A.11 What is the oxygen concentration after the value stabilizes? ____ % (21-29)
- 6.19A.12 Reduce the O₂ flow to 500 ml/min. Verify that the N₂O flow is greater than or equal to 600 ml/min.
- 6.19A.13 Close the oxygen flow control valve.
- (✓) 6.19A.14 What is the flow of nitrous oxide? ____ ml/min. (0) or 375-750 ml/min on machines with later design ORC (P/N 4113329-001)
- 6.19A.15 What is the oxygen concentration with the O₂ flow control valve closed? ____% (>21)
- 6.19A.16 Close the nitrous oxide flow control valve.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.20 BAROMED

- 6.20.1 Disconnect the breathing pressure sensor line from the absorber.
- 6.20.2 Connect a test pressure gauge and syringe to the breathing pressure sensor line.
- 6.20.3 Enter the SET UP screen, and select the THRESHOLD PRES alarm limit. Does a box shall appear around the Threshold Alarm Limit? ____ (Y).
- 6.20.4 What is the threshold alarm default? ____ cm H₂O (12)
- 6.20.5 Verify that the threshold alarm limit has a range from 5 to 30 cm H₂O.
- 6.20.6 Adjust the threshold to 10 cm H₂O.
- 6.20.7 Select the PRESSURE HIGH alarm limit. Does a box shall appear around the High Pressure Alarm Limit? ____ (Y)
- 6.20.8 What is the high alarm limit default? ____ cm H₂O (50)
- 6.20.9 Verify that the high alarm limit has a range from 30 to 120 cm H₂O.
- 6.20.10 Set the high alarm limit to 65 cm H₂O, and exit from the set up menu.
- 6.20.11 Increase the pressure to 25 cm H₂O, then decrease the pressure to 20 cm H₂O.
- 6.20.12 Does the THRESHOLD LOW message appear in the Advisory column? ____ (Y)
- 6.20.13 Set the Man/Auto valve to AUTO, and turn the ventilator ON.
- 6.20.14 Bleed the pressure and start a stopwatch.
- (✓) 6.20.15 What is the time when APNEA-PRESSURE appears in the Caution column? ____ sec (13-17)
- (✓) 6.20.16 What is the time when the APNEA-PRESSURE appears in the Warning column? ____ sec (26-34)
- 6.20.17 After the APNEA-PRESSURE alarm is displayed in the Warning column on remote display, slowly increase the test pressure.
- (✓) 6.20.18 At what pressure does the APNEA-PRESSURE alarm deactivate? ____ cm H₂O (7-13)

- 6.20.19 Adjust the threshold to 18 cm H₂O.
- 6.20.20 Increase the pressure to 20 cm H₂O, maintain the pressure, and start a stopwatch.
- (✓) 6.20.21 What is the time when CONTINUOUS PRES appears in the Warning column? ____ sec (12-18)
- (✓) 6.20.22 Decreasing the pressure slowly, what is the pressure at which the CONTINUOUS PRES alarm deactivates? ____ cm H₂O (15-21)
- 6.20.23 Slowly increase the pressure.
- (✓) 6.20.24 At what pressure does the VENT PRESSURE HI alarm activate? ____ cm H₂O (62-68)
- 6.20.25 Bleed the pressure.
- 6.20.26 Slowly create a sub-atmospheric pressure.
- (✓) 6.20.27 At what pressure does the SUB ATM PRESSURE alarm activate? ____ cm H₂O (-7 to -13)
- 6.20.28 Disconnect the test gauge and syringe; reconnect the breathing pressure sensor line to the absorber.
- 6.20.29 Does the SUB ATM PRESSURE alarm deactivate? ____ (Y)
- 6.20.30 Enter the SET UP screen, select APNEA ALARM and select OFF.
- 6.20.31 Select PRESSURE SCALE and verify selections of 0-20, 0-50 and 0-100.
- 6.20.32 Verify that the APNEA ALARM cannot be selected to OFF when the ventilator switch is ON.

6.21 VENTILATOR

NOTE: Set the Pressure Limit control to MAX, and the PEEP valve to the minimum position, if applicable. Readjustment of INSPIRATORY FLOW to limit the inspiratory plateau may be required to reduce erratic tidal volumes and breath rates caused by artifact volume.

- ** 6.21.1 Set the Man/Auto selector to BAG.
- 6.21.2 Set the FREQUENCY to 10 BPM.
- 6.21.3 Set the I:E RATIO to 1:2.
- 6.21.4 Set the Tidal Volume to 1000 ml.
- 6.21.5 Attach a patient circuit to the absorber system.
- 6.21.6 Adjust the O₂ flow to 3 l/min.
- 6.21.7 Is the APNEA-P ALARM OFF message displayed in the Advisory column? (Y) (if no, press the APNEA ALARMS DISABLE key in the Pressure Alarms section of the main keypad.
- 6.21.8 Is the VOL-ALARMS OFF message displayed in the Advisory column? (Y) (if no, press the VOLUME ALARMS DISABLE key in the Minute Volume Alarms section of the main keypad.
- 6.21.9 Turn the ventilator on.
- ** 6.21.10 Verify the FAULT indicator turns on (Y)
- 6.21.11 Set the Man/Auto selector switch to AUTO.
- ** 6.21.12 Verify the FAULT indicator turns off (Y)
- 6.21.13 Do the APNEA-P ALARM OFF and VOL-ALARMS OFF messages disappear from the Advisory column? (Y)
- 6.21.14 Adjust the INSPIRATORY FLOW to the maximum of the LOW zone.
- 6.21.15 Occlude the Y-piece with your thumb.
- 6.21.16 Inflate the bellows by momentarily pressing the O₂ Flush.
- (✓) 6.21.17 What is the peak inspiratory pressure? ____ cm H₂O (>30 cm H₂O)
- 6.21.18 Attach a test lung to the Y-piece.

** These items only apply to machines with an AV2+ ventilator.

- 6.21.19 Using a stopwatch, time the inspiratory phase.
- (✓) 6.21.20 What is the inspiratory time? ____ seconds (1.8-2.2)
- 6.21.21 Using a stopwatch, time the expiratory phase.
- (✓) 6.21.22 What is the expiratory time? ____ seconds (3.6-4.4)
- ** 6.21.23 Press and hold the EXTENDED RANGE switch and scroll the I:E ratio dial counter-clockwise and verify the extended I:E values increment (2:1, 3:1 and 4:1); return the I:E ratio to 2:1.
- ** 6.21.24 Using a stopwatch, time the inspiratory phase.
- (✓) ** 6.21.25 What is the inspiratory time? ____ seconds (3.6 - 4.4)
- ** 6.21.26 Using a stopwatch, time the expiratory phase.
- (✓) ** 6.21.27 What is the expiratory time? ____ seconds (1.8 - 2.2)
- (✓) 6.21.28 Adjust the FREQUENCY and I:E RATIO through the following settings and verify that the ventilator cycles properly:

<u>FREQ.</u>	<u>I:E RATIO</u>	<u>FREQ.</u>	<u>I:E RATIO</u>	<u>FREQ.</u>	<u>I:E RATIO</u>
11	1:1	44	1:2.5	77	1:4
22	1:1.5	55	1:3	88	1:4.5
33	1:2	66	1:3.5	99	1:4.5

6.22 BELLOWS DRIVE GAS LEAK: ADULT

- 6.22.1 Remove the ventilator hose from the VENTILATOR HOSE terminal.
- 6.22.2 Attach a test terminal to the bellows assembly ventilator hose terminal.
- 6.22.3 Connect a flowmeter test stand (P/N S000081) to the test terminal.
- 6.22.4 Set the FREQUENCY to 1 BPM.
- 6.22.5 Set the I:E RATIO to 1:1.
- 6.22.6 Set the INSPIRATORY FLOW to the maximum.
- (✓) 6.22.7 What is the flow indicated during the inspiratory phase? ____ (<50 ml)
- 6.22.8 Remove the test terminal and flowmeter test stand.
- 6.22.9 Turn the ventilator and all ventilation alarms OFF.

6.23 SPIROMED or Ultrasonic Flow Sensor

- 6.23.1 Enter the SET UP screen and select the MINUTE VOLUME LOW alarm limit. Does a box appear around the Minute Volume Alarm Limit? ____ (Y)
- 6.23.2 What is the low minute volume alarm default? ____ (1.0)
- 6.23.3 Verify that the minute volume has a low alarm limit range from at least 0.5 to 10.0 by increments of 0.1. (0.2 to 10.0 on later versions)
- 6.23.4 Adjust the low minute volume alarm to 2.0 liters.
- 6.23.5 Set VOLUME ALARMS to OFF, and exit the set up menu. Turn on the ventilator and start a stopwatch.
- (✓) 6.23.6 What is the time when APNEA-VOLUME appears in the Caution column? ____ sec (13 - 17)
- (✓) 6.23.7 What is the time when APNEA-VOLUME appears in the Warning column? ____ sec (26 - 34)
- (✓) 6.23.8 Within one (1) minute, does the MINUTE VOLUME LOW message appear in the Caution column? ____ Y
- 6.23.9 Insert a test minute volumeter in between the Spiromed sensor (or absorber, if the system is equipped with the ultrasonic flow sensor) and the exhalation valve.
- 6.23.10 Reconnect the ventilator hose to the Ventilator Hose terminal.
- 6.23.11 Adjust the FREQUENCY to 6 BPM.
- 6.23.12 Adjust the I:E RATIO to 1:2.
- 6.23.13 Adjust the flow to the maximum of the LOW zone.
- 6.23.14 Adjust the oxygen flow to 2 l/min.
- 6.23.15 Adjust the Tidal Volume to 200 ml.

- 6.23.16 After the first breath is detected, does the APNEA-VOLUME in the Warning column and the MINUTE VOLUME LO in the Caution column deactivate? ____ (Y)
- 6.23.17 Adjust the low alarm limit above the indicated minute volume.
- 6.23.18 Does the MINUTE VOLUME LO message appear in the Caution column? ____ (Y)
- 6.23.19 Adjust the low alarm limit below the indicated minute volume.
- 6.23.20 Does the MINUTE VOLUME LO message in the Caution column deactivate? ____ (Y)
- 6.23.21 Increase the tidal volume to 1000 ml and the frequency to 10 BPM.
- 6.23.22 Press the O₂ Flush momentarily to inflate the bellows.
- 6.23.23 Readjust the inspiratory flow as necessary to fully collapse the bellows.
- (✓) 6.23.24 Are the tidal and minute volumes on the Spiromed (or ultrasonic flow sensor) and on the test volumeter within 20% of each other? ____ (Y)
- 6.23.25 Create a reverse flow by loosening the expiratory valve dome. If equipped with an ultrasonic flow sensor, remove the breathing hose from the flow sensor. Connect a test terminal and a Riken aspirator (negative pressure squeeze bulb) to the 22 mm male port of the flow sensor. Disconnect the hose attached to the exhalation valve. Compress and release the aspirator.
- (✓) 6.23.26 Each time a reverse flow greater than 20 ml is detected, does the REVERSE FLOW message appear in the Advisory column? ____ (Y)
- 6.23.27 Tighten the expiratory valve dome. If equipped with an ultrasonic flow sensor, remove the test terminal and aspirator from the flow sensor and reconnect the patient circuit hose. Reconnect the hose between the expiratory valve and the flow sensor.
- 6.23.28 Disconnect the respiratory volume sensor cord from the VOLUME SENSOR interface.
- 6.23.29 Do the VOL SENSOR DISC and VOL ALARMS OFF messages appear in the Advisory column? ____ (Y)
- 6.23.30 Reconnect the respiratory volume sensor cord to the Volume Sensor interface and verify that the alarms clear.
- 6.23.31 Select MINUTE VOL SCALE and verify selections of 0-5, 0-10 and 0-20.

6.24A BELLOWS: ADULT - if applicable

- 6.24A.1 Set the FREQUENCY to 10 BPM.
 - 6.24A.2 Set the I:E RATIO to 1:2.
 - 6.24A.3 Adjust the O₂ flow to 300 ml/min.
 - 6.24A.4 Adjust the INSPIRATORY FLOW to MED.
 - 6.24A.5 Adjust the Tidal Volume to 200 ml.
 - 6.24A.6 Press the O₂ Flush momentarily to inflate the bellows.
 - (✓) 6.24A.7 What is the Tidal Volume on the test volumeter? ____ ml (125-250)
 - 6.24A.8 Adjust the Tidal Volume to 1000 ml, and the fresh gas flow to 3 L/min.
 - 6.24A.9 Press the O₂ Flush momentarily to inflate the bellows.
 - (✓) 6.24A.10 What is the Tidal Volume on the test volumeter? ____ ml (900-1100)
 - 6.24A.11 Adjust the O₂ flow to 5 l/min.
 - 6.24A.12 Adjust the Tidal Volume to maximum.
 - 6.24A.13 Remove the test lung and attach a 3 liter breathing bag. Adjust the INSPIRATORY FLOW to fully compress the bellows.
- NOTE: Bag should be placed on a flat horizontal surface to reduce artifact volume.
- (✓) 6.24A.14 What is the Tidal Volume on the test volumeter? ____ ml (≥1400)

6.24B VENTILATOR RELIEF VALVE: ADULT

- 6.24B.1 Adjust the O₂ flow to 10 l/min.
- 6.24B.2 Adjust the INSPIRATORY FLOW to MED.
- 6.24B.3 Adjust the I:E RATIO to 1:3, and the FREQUENCY to 10.
- 6.24B.4 Adjust the Tidal Volume to 1200 ml.
- (✓) 6.24B.5 What is the PEEP? ____ cm H₂O (≤3)
- 6.24B.6 Adjust the O₂ flow to 500 ml.
- (✓) 6.24B.7 Does the ventilator deliver the full Tidal Volume during 5 consecutive cycles? ____ (Y)
- 6.24B.8 Does the bellows stop adjust smoothly? ____ (Y)

6.25A BELLOWS: PEDIATRIC EXTERNAL - if applicable

- 6.25A.1 Set the ventilator frequency to 10 BPM.
- 6.25A.2 Set the I:E Ratio to 1:2.
- 6.25A.3 Adjust the tidal volume to 300 ml/min.
- 6.25A.4 Turn the ventilator ON.
- 6.25A.5 Adjust the Inspiratory Flow control on the ventilator to Medium.
- 6.25A.6 Adjust the fine flow control of the Ped Bellows attachment fully clockwise.
- 6.25A.7 Set the O₂ to 3 l/min.
- 6.25A.8 Occlude the 15mm patient side of the Y-piece and fill the bellows by pressing the O₂ Flush button.
- 6.25A.9 Observe the absorber breathing pressure gauge as the ventilator cycles.
- 6.25A.10 What is the pressure when the bellows completes its downward travel? ____cmH₂O >30
- 6.25A.11 What is the pressure when the bellows completes its upward travel? ____cmH₂O ≤3
- 6.25A.12 Attach a test lung to the patient circuit Y-piece.
- 6.25A.13 Fill the bellows by pressing the O₂ Flush button.
- 6.25A.14 Verify that with the Pediatric Bellows Fine Flow Control turned fully counter-clockwise the bellows does not collapse during inspiration. Readjust the knob to the fully clockwise position.
- 6.25A.15 Adjust the O₂ flow to 10 l/min.
- (✓) 6.25A.16 What is the PEEP? ____cmH₂O (≤3)
- 6.25A.17 Adjust the O₂ flow to 500 ml/min.
- (✓) 6.25A.18 Does the ventilator deliver the full tidal volume during 5 consecutive cycles? ____ (Y)
- 6.25A.19 Set the ventilator frequency to 20 BPM, and the I:E ratio to 1:1.

- 6.25A.20 Adjust the O₂ flow to 3 l/min.
- (✓) 6.25A.21 What is the tidal volume on the test volumeter? ____ml (>250)
- 6.25A.22 Remove the ventilator hose from the ventilator hose terminal.
- 6.25A.23 Attach a test terminal to the bellows assembly ventilator hose terminal.
- 6.25A.24 Connect a flowmeter test stand (P/N S000081) to the test terminal.
- 6.25A.25 Set the frequency to 1 BPM.
- 6.25A.26 Set the I:E RATIO to 1:1.
- (✓) 6.25A.27 What is the flow indicated during the inspiratory phase? ____(<50 ml)
- 6.25A.28 Remove the test terminal and flowmeter test stand.
- 6.25A.29 Return all controls to their original position.

6.25B BELLOWS: PEDIATRIC INTERNAL - if applicable

- 6.25B.1 Set the ventilator frequency to 10 BPM.
- 6.25B.2 Set the I:E Ratio to 1:2.
- 6.25B.3 Turn the ventilator ON.
- 6.25B.4 Adjust the Inspiratory Flow control on the ventilator to Medium.
- 6.25B.5 Set the O₂ to 3 l/min.
- 6.25B.6 Occlude the 15mm patient side of the Y-piece and fill the bellows by pressing the O₂ Flush button.
- 6.25B.7 Observe the absorber breathing pressure gauge as the ventilator cycles.
- 6.25B.8 What is the pressure when the bellows completes its downward travel? ____cmH₂O >30
- 6.25B.9 What is the pressure when the bellows completes its upward travel? ____cmH₂O ≤3
- 6.25B.10 Install a 3 L breathing bag onto the patient circuit Y-piece.
- 6.25B.11 Fill the bellows by pressing the O₂ Flush button.
- 6.25B.12 Adjust the O₂ flow to 10 l/min.
- (✓) 6.25B.13 What is the PEEP? ____cmH₂O (≤3)
- 6.25B.14 Adjust the O₂ flow to 500 ml/min.
- 6.25B.15 Adjust the inspiratory flow control until the bellows collapses entirely.
- (✓) 6.25B.16 Does the ventilator deliver the full tidal volume during 5 consecutive cycles? ____ (Y)
- 6.25B.17 Set the ventilator frequency to 20 BPM, and the I:E ratio to 1:1.
- 6.25B.18 Adjust the O₂ flow to 3 l/min.
- 6.25B.19 Adjust the inspiratory flow control until the bellows collapses to the 100 ml mark on the pediatric bellows assembly.

- (✓) 6.25B.20 What is the tidal volume on the test volumeter? ____ml (65-135)
- 6.25B.21 Adjust the inspiratory flow control until the bellows collapses entirely.
- (✓) 6.25B.22 What is the tidal volume on the test volumeter? ____ml (>240)
- 6.25B.23 Close the O₂ flow control valve.
- 6.25B.24 Remove the ventilator hose from the ventilator hose terminal.
- 6.25B.25 Attach a test terminal to the bellows assembly ventilator hose terminal.
- 6.25B.26 Connect a flowmeter test stand (P/N S000081) to the test terminal.
- 6.25B.27 Set the frequency to 1 BPM.
- 6.25B.28 Adjust the INSPIRATORY FLOW to maximum.
- (✓) 6.25B.29 What is the flow indicated during the inspiratory phase? ____(<50 ml)
- 6.25B.30 Remove the test terminal and flowmeter test stand.
- 6.25B.31 Return all controls to their original position.

6.26 TRACE & TREND

- (✓) 6.26.1 Trace: Verify that the display tracks the Breathing Pressure and Volume waveforms.
- (✓) 6.26.2 Trend: Select VENT, and select SCROLL TREND, roll selection dial to the right and verify that Breathing Pressure, Volume and O₂ concentration trend information is available.

6.26.2.1 Turn the ventilator OFF.

6.27 PRESSURE LIMIT CONTROLLER (AV-2, AV-2+, or optional PLC, if applicable)

- 6.27.1 Turn the ventilator ON.
- 6.27.2 Set the Inspiratory Flow to the bottom of the low range.
- 6.27.3 Set the oxygen flow rate to 4 l/min.
- 6.27.4 Set the Pressure Limit Control to the MAX position.
- 6.27.5 Occlude the Y-piece with your thumb.
- (✓) 6.27.6 Slowly increase the Inspiratory Flow setting until a peak pressure of 80 cm H₂O is achieved.
- 6.27.7 Set the Pressure Limit Control to 30.
- (✓) 6.27.8 What is the peak pressure? ____ cm H₂O (27-33)
- 6.27.9 Set the Pressure Limit Control to the Min position.
- (✓) 6.27.10 What is the peak pressure? ____ cm H₂O (<15)
- 6.27.11 Remove your thumb from the Y-piece.
- 6.27.12 Set the Inspiratory Flow to the maximum of the LOW zone.
- 6.27.13 Close the oxygen flow control valve.
- 6.27.14 Turn the ventilator OFF.

6.28 This section intentionally left blank

(✓) 6.29 AUDIO SILENCE

- 6.29.1 Turn the System Power switch to STANDBY, then turn it ON.
- 6.29.2 Verify the 120-sec. delay at power-up and allow a full countdown.
- 6.29.3 Create any warning alarm.
- 6.29.4 Press the key labeled with a crossed-out speaker.
- 6.29.5 Does the "SILENCE 120" message appear on the display? Is the audio alarm silenced during the count down? ____ (Y)
- 6.29.6 Does the "SILENCE" count down to 0 and then disappear? ____ (Y)

6.30 OXYGEN FLUSH VALVE

- 6.30.1 Press and release the O₂FLUSH button.
- 6.30.2 Does the flow of oxygen stop immediately? __ (Y)
- 6.30.3 Close the APL valve.
- 6.30.4 Connect a 12-inch hose to the inspiratory valve.
- 6.30.5 Set the Man/Auto selector to BAG.
- 6.30.6 Occlude the bag mount.
- 6.30.7 Insert the sensor from a calibrated O₂ Med into the valve dome adapter on the inspiratory valve.
- 6.30.8 Close all flow control valves.
- 6.30.9 Press the O₂FLUSH button.
- (✓) 6.30.10 What is the O₂ concentration after the value stabilizes? ____%O₂ (97-100)
- 6.30.11 Remove the O₂ Med sensor and install the plug.
- 6.30.12 Remove the test minute volumeter (P/N 2212300) from the absorber and connect it to the common gas outlet, using Fresh Gas Outlet Volume Test Device (P/N S010158).
- 6.30.13 Press and hold the O₂ FLUSH button for 15 seconds; multiply the value by 4.
- (✓) 6.30.14 What is the oxygen flush flow rate? ____l/min. (45-65)
- 6.30.15 Remove the test minute volumeter and test fixture, and reconnect the fresh gas hose.
- 6.30.16 Turn the System Power switch to ON.

6.31 FINAL TESTS**(✓) 6.31.1 Operator's Instruction Manual**

6.31.1.1 Verify that the availability/location of the machine's Operator's Instruction Manual is in close proximity of the machine.

(✓) 6.31.2 Auxillary Lamp - if applicable

6.31.2.1 Verify that the lamp head (shroud) can move approximately 90°.

6.31.2.2 Verify that the lamp head (shroud) can be positioned at any point within the 90° range and holds fast.

6.31.2.3 Verify that the lamp can rotate 360° and hits a stop located within 45° on either side of the top center point.

6.31.2.4 Verify that the lamp is plugged into a live AC receptacle.

6.31.2.5 Turn the lamp ON.

6.31.2.6 Adjust the dimmer control and verify that the light varies with the adjustment of the knob.

6.31.2.7 Turn the lamp OFF.

(✓) 6.31.3 Final Check

6.31.3.1 Verify that all cylinder pressure gauges indicate zero.

6.31.3.2 Verify that the pipeline hoses are connected to the hospital pipeline.

6.31.3.3 Verify that the APL valve knob is turned completely counter-clockwise (fully open).

6.31.3.4 Place the Auto/Man selector in the BAG position.

6.31.3.5 Verify that the O₂Med sensor is removed from the valve dome adapter.

6.31.3.6 Verify that the valve dome is plugged.

6.31.3.7 Verify that the machine is plugged into a live outlet.

6.31.3.8 Return all machine controls and settings to their original state.

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