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Technical Service Manual

Part Number: S002011
Rev: Y
Date: 20 May 2002

Narkomed 2B Anesthesia System

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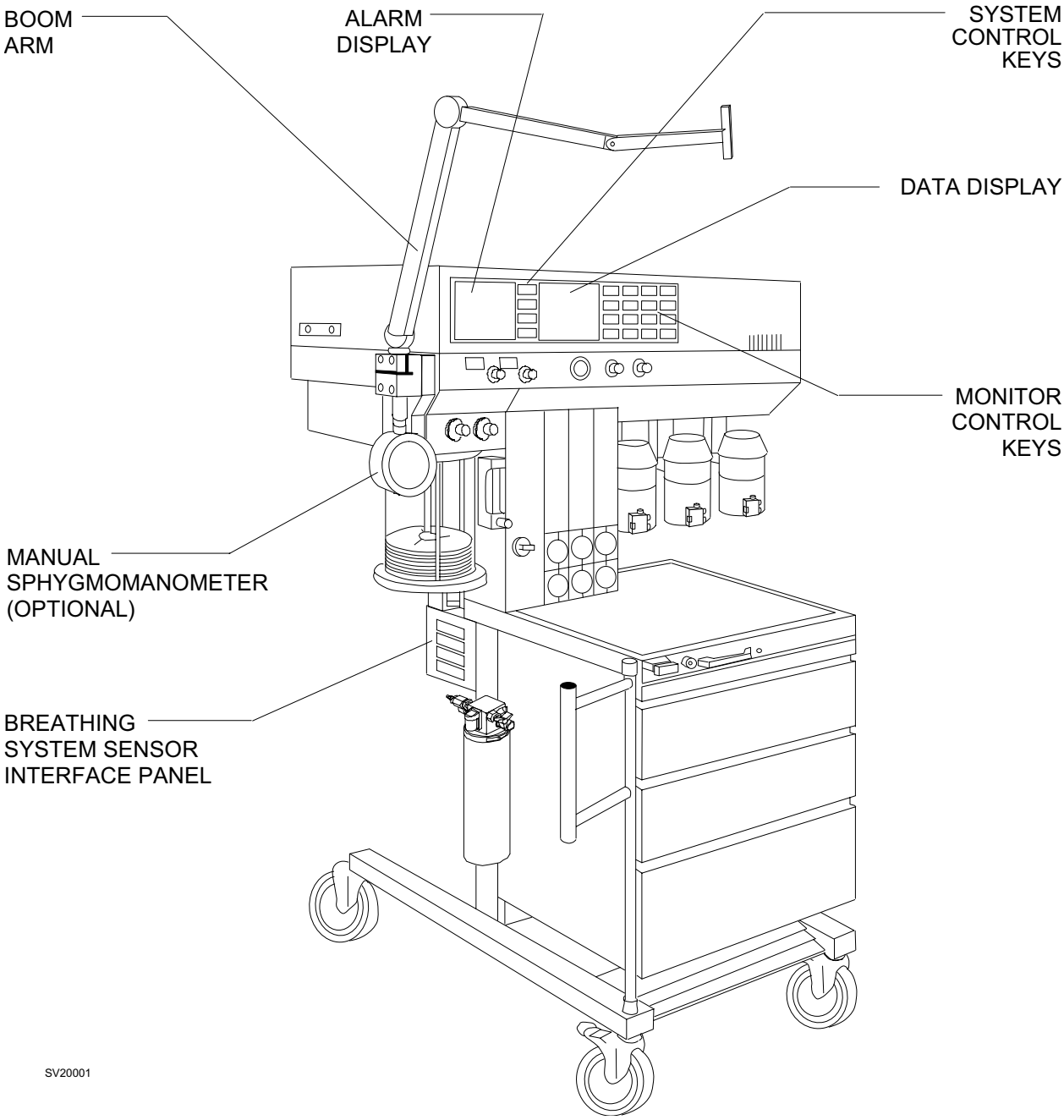
NARKOMED 2B ANESTHESIA SYSTEM



1.0 Recommendations

Because of the sophisticated nature of Draeger Medical, Inc. anesthesia equipment and its critical importance in the operating room setting, it is highly recommended that only appropriately trained and experienced professionals be permitted to service and maintain this equipment. Please contact DrägerService® at (800) 543-5047 for service of this equipment.

Draeger Medical, Inc. also recommends that its anesthesia equipment be serviced at three-month intervals. Periodic Manufacturer's Service Agreements are available for equipment manufactured by Draeger Medical, Inc. For further information concerning these agreements, please contact us at (800) 543-5047.

Draeger Medical, Inc. products/material in need of factory repair shall be sent to:

DrägerService
3124 Commerce Drive
Telford, PA 18969
(Include RMA Number)

HOW TO USE THIS MANUAL

The manual is divided into several sections. The DIAGNOSTICS section describes self-test and service diagnostics for checking the system functions. An understanding of the on-board service capabilities is necessary before any attempt is made to troubleshoot the unit. The TROUBLESHOOTING section lists error codes and provides troubleshooting guides to assist the TSR in locating the source of a problem. The REPLACEMENT PROCEDURES section contains instructions for removal and replacement of the assemblies that are considered field-replaceable. The ADJUSTMENT AND CALIBRATION PROCEDURES section contains the field procedures needed to restore original system specifications. The Periodic Manufacturer's Service (PMS) PROCEDURE section outlines the steps required to verify the electrical, mechanical and pneumatic safety of the unit and also identifies components requiring periodic replacement.

GENERAL TROUBLESHOOTING GUIDELINES

Troubleshooting the Narkomed 2B should always begin by communicating with those who observed or experienced a problem with the unit. This may eliminate unnecessary troubleshooting steps. Once a general problem is identified, refer to the troubleshooting flow charts in Section 3 to determine the proper corrective action to be taken.

After a component has been replaced, verify that the unit is operating properly by running the appropriate diagnostic procedure. The PMS PROCEDURE in Section 6 must also be performed after any component has been replaced.

The general arrangement of the Narkomed 2B Anesthesia System is shown on the opposite page.

WARNINGS are used in this manual before procedures which if not performed correctly could result in personal injury.

CAUTIONS are used in this manual to alert service personnel to the possibility of damage to the equipment if a procedure is not performed correctly.

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2.0 DIAGNOSTICS

The Narkomed 2B contains a diagnostic system that monitors certain system functions and records their operational status. A series of tests is performed when the system is powered up and the results are displayed on the diagnostics screen shown in Figure 2-1. Further diagnostic functions are available through service screens that can be called up by a TSR at the display panel. The following paragraphs provide a description of each service screen that can be accessed through system control keys on the display panel. If no display is present upon system power-up, refer to Section 3 of this manual for troubleshooting assistance.

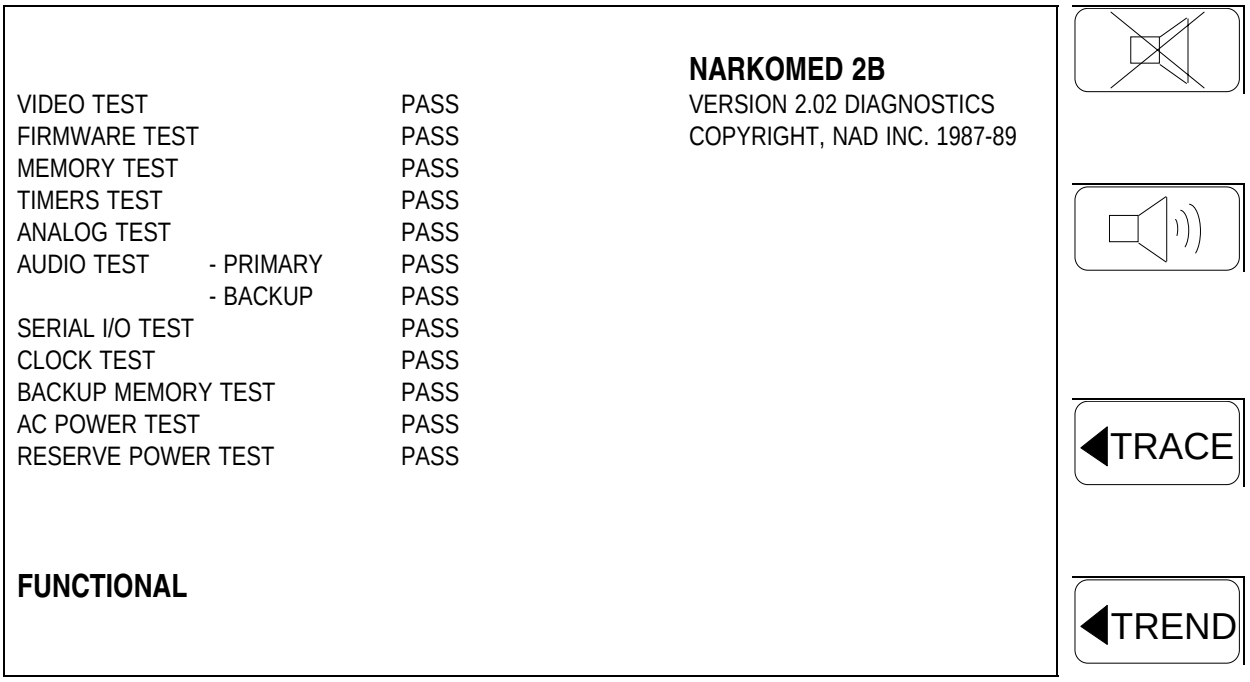

Figure 2-1: POWER-UP DIAGNOSTICS SCREEN

2.1 Service Menu Screen

To access the Service Menu Screen, press and hold the CONFIG key, and (while holding the CONFIG key) simultaneously press the 21% and APNEA ALARM DISABLE keys. These keys are located on the monitor control key panel. The Service Menu Screen appears as shown in Figure 2-2. Access to the other service functions is gained through the keys to the right of the service screen which temporarily function according to their corresponding on-screen labels.

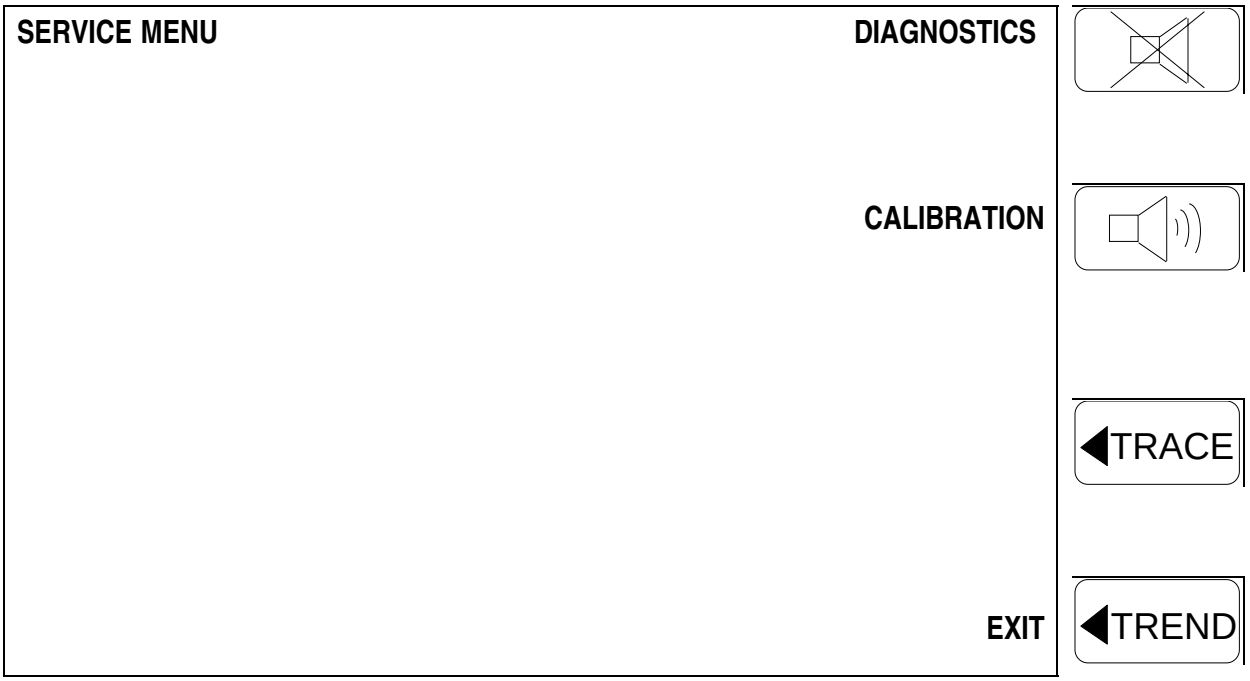

Figure 2-2: SERVICE MENU SCREEN

2.1.1 Diagnostics Menu Screen

Pressing the DIAGNOSTICS key on the Service Menu Screen brings up the Diagnostics Menu Screen. Figure 2-3 shows a typical Diagnostics menu which displays the last service date and an error log. To reset the last service date to the current date, press the RESET DATE key.

NOTE: The RESET DATE key also clears all stored error codes, so the date should not be reset until the indicated problems are resolved. If the processor assembly must be replaced, the original assembly should be returned to the NAD Technical Service Department with all of its stored error codes.

Each line in the Error Log is displayed as three groups of hexadecimal characters, with each group having a left and right character (see Figure 2-3). Tables 2-1, 2-2 and 2-3 on the following pages list the possible errors that correspond to the displayed characters in each group.

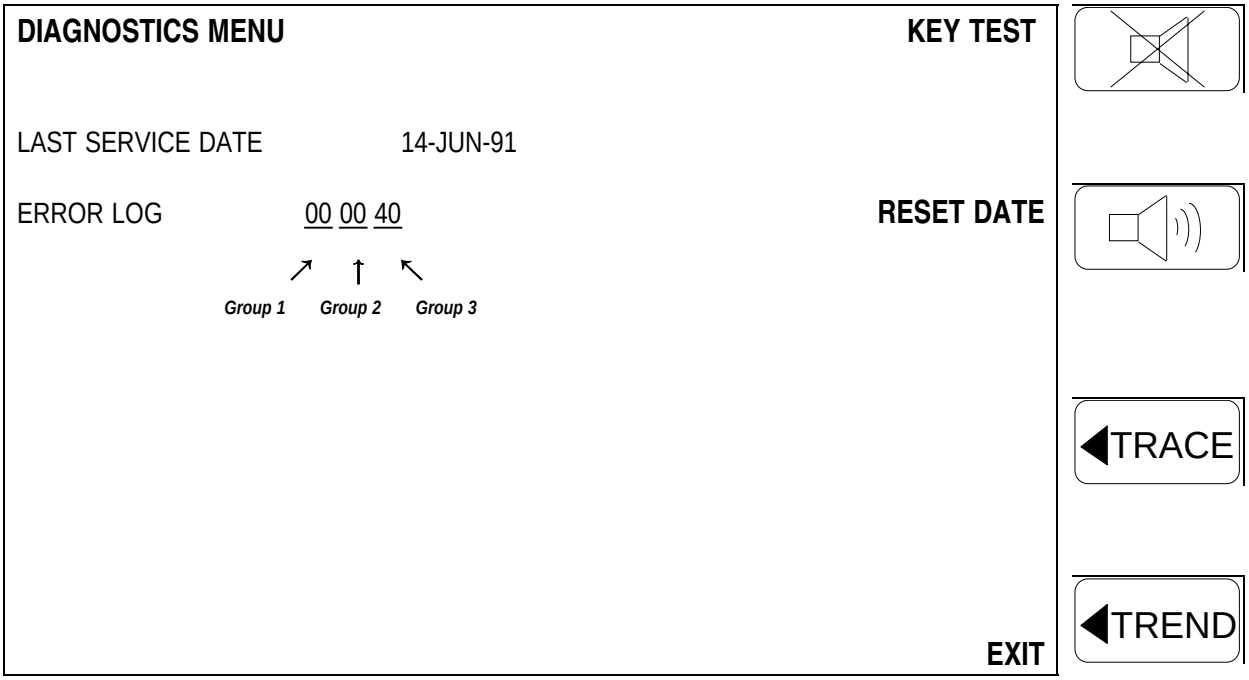

Figure 2-3: DIAGNOSTICS MENU SCREEN

Table 2-1: NARKOMED 2B ERROR CODES, GROUP 1

Left Char.	Error(s)	Right Char.	Error(s)
0	No Error	0	No Error
1	System memory fail (checkerboard test)	1	CRT controller fail (readback test)
2	System memory fail (ROM compare test)	2	CRT memory fail (checkerboard test)
3	System memory fail (checkerboard test) System memory fail (ROM compare test)	3	CRT controller fail (readback test) CRT memory fail (checkerboard test)
4	CTC fail (timer function test)	4	CRT memory fail (ROM compare test)
5	CTC fail (timer function test) System memory fail (checkerboard test)	5	CRT memory fail (ROM compare test) CRT controller fail (readback test)
6	CTC fail (timer function test) System memory fail (ROM compare test)	6	CRT memory fail (ROM compare test) CRT memory fail (checkerboard test)
7	CTC fail (timer function test) System memory fail (ROM compare test) System memory fail (checkerboard test)	7	CRT memory fail (ROM compare test) CRT memory fail (checkerboard test) CRT controller fail (readback test)
8	CTC fail (interrupt logic test)	8	ROM fail (firmware CRT test)
9	CTC fail (interrupt logic test) System memory fail (checkerboard test)	9	ROM fail (firmware CRT test) CRT controller fail (readback test)
A	CTC fail (interrupt logic test) System memory fail (ROM compare test)	A	ROM fail (firmware CRT test) CRT memory fail (checkerboard test)
B	CTC fail (interrupt logic test) System memory fail (ROM compare test) System memory fail (checkerboard test)	B	ROM fail (firmware CRT test) CRT memory fail (checkerboard test) CRT controller fail (readback test)
C	CTC fail (interrupt logic test) CTC fail (timer function test)	C	ROM fail (firmware CRT test) CRT memory fail (ROM compare test)
D	CTC fail (interrupt logic test) CTC fail (timer function test) System memory fail (checkerboard test)	D	ROM fail (firmware CRT test) CRT memory fail (ROM compare test) CRT controller fail (readback test)
E	CTC fail (timer function test) CTC fail (interrupt logic test) System memory fail (ROM compare test)	E	ROM fail (firmware CRT test) CRT memory fail (ROM compare test) CRT memory fail (checkerboard test)
F	CTC fail (interrupt logic test) CTC fail (timer function test) System memory fail (ROM compare test) System memory fail (checkerboard test)	F	ROM fail (firmware CRT test) CRT memory fail (ROM compare test) CRT memory fail (checkerboard test) CRT controller fail (readback test)

Table 2-2: NARKOMED 2B ERROR CODES, GROUP 2

Left Char.	Error(s)	Right Char.	Error(s)
0	No Error	0	No Error
1	Backup audio fail (sound generation test)	1	A/D conv. fail (analog V out of range)
2	Serial port B fail (channel A on UART)	2	Primary audio fail (speaker test)
3	Backup audio fail (sound generation test) Serial port B fail (channel A on UART)	3	A/D conv. fail (analog V out of range) Primary audio fail (speaker test)
4	Serial port A fail (channel B on UART)	4	Primary audio fail (sound gen. test)
5	Serial port A fail (channel B on UART) Backup audio fail (sound generation test)	5	Primary audio fail (sound gen. test) A/D conv. fail (analog V out of range)
6	Serial port A fail (channel B on UART) Serial port B fail (channel A on UART)	6	Primary audio fail (sound gen. test) Primary audio fail (speaker test)
7	Serial port A fail (channel B on UART) Serial port B fail (channel A on UART) Backup audio fail (sound generation test)	7	Primary audio fail (sound gen. test) Primary audio fail (speaker test) A/D conv. fail (analog V out of range)
8	Clock fail (cannot read)	8	Backup audio fail (speaker test)
9	Clock fail (cannot read) Backup audio fail (sound generation test)	9	Backup audio fail (speaker test) A/D conv. fail (analog V out of range)
A	Clock fail (cannot read) Serial port B fail (channel A on UART)	A	Backup audio fail (speaker test) Primary audio fail (speaker test)
B	Clock fail (cannot read) Serial port B fail (channel A on UART) Backup audio fail (sound generation test)	B	Backup audio fail (speaker test) Primary audio fail (speaker test) A/D conv. fail (analog V out of range)
C	Clock fail (cannot read) Serial port A fail (channel B on UART)	C	Backup audio fail (speaker test) Primary audio fail (sound gen. test)
D	Clock fail (cannot read) Serial port A fail (channel B on UART) Backup audio fail (sound generation test)	D	Backup audio fail (speaker test) Primary audio fail (sound gen. test) A/D conv. fail (analog V out of range)
E	Clock fail (cannot read) Serial port A fail (channel B on UART) Serial port B fail (channel A on UART)	E	Backup audio fail (speaker test) Primary audio fail (sound gen. test) Primary audio fail (speaker test)
F	Clock fail (cannot read) Serial port A fail (channel B on UART) Serial port B fail (channel A on UART) Backup audio fail (sound generation test)	F	Backup audio fail (speaker test) Primary audio fail (sound gen. test) Primary audio fail (speaker test) A/D conv. fail (analog V out of range)

Table 2-3: NARKOMED 2B ERROR CODES, GROUP 3

Left Char.	Error(s)	Right Char.	Error(s)
0	No Error	0	No Error
1	Backup memory fail (ROM compare test)	1	Clock fail (write/readback test)
2	Backup memory fail (array recall test)	2	Clock fail (original time test)
3	Backup memory fail (ROM compare test) Backup memory fail (array recall test)	3	Clock fail (write/readback test) Clock fail (original time test)
4	AC power fail	4	Clock fail (seconds not incrementing)
5	AC power fail Backup memory fail (ROM compare test)	5	Clock fail (seconds not incrementing) Clock fail (write/readback test)
6	AC power fail Backup memory fail (array recall test)	6	Clock fail (seconds not incrementing) Clock fail (original time test)
7	AC power fail Backup memory fail (array recall test) Backup memory fail (ROM compare test)	7	Clock fail (seconds not incrementing) Clock fail (original time test) Clock fail (write/readback test)
8	Reserve power fail (batt. low/disconnected)	8	Backup memory fail (checkerboard test)
9	Reserve power fail (batt. low/disconnected) Backup memory fail (ROM compare test)	9	Backup memory fail (checkerboard test) Clock fail (write/readback test)
A	Reserve power fail (batt. low/disconnected) Backup memory fail (array recall test)	A	Backup memory fail (checkerboard test) Clock fail (original time test)
B	Reserve power fail (batt. low/disconnected) Backup memory fail (array recall test) Backup memory fail (ROM compare test)	B	Backup memory fail (checkerboard test) Clock fail (original time test) Clock fail (write/readback test)
C	Reserve power fail (batt. low/disconnected) AC power fail	C	Backup memory fail (checkerboard test) Clock fail (seconds not incrementing)
D	Reserve power fail (batt. low/disconnected) AC power fail Backup memory fail (ROM compare test)	D	Backup memory fail (checkerboard test) Clock fail (seconds not incrementing) Clock fail (write/readback test)
E	Reserve power fail (batt. low/disconnected) AC power fail Backup memory fail (array recall test)	E	Backup memory fail (checkerboard test) Clock fail (seconds not incrementing) Clock fail (original time test)
F	Reserve power fail (batt. low/disconnected) AC power fail Backup memory fail (array recall test) Backup memory fail (ROM compare test)	F	Backup memory fail (checkerboard test) Clock fail (seconds not incrementing) Clock fail (original time test) Clock fail (write/readback test)

With the exception of the error codes corresponding to AC power and battery failure, the codes listed in Tables 2-1 thru 2-3 indicate a possible problem in the NARKOMED 2B processor assembly.

Troubleshooting should begin with a check of the power supply voltages on the processor board (see Section 3) followed by a check of all connections to the processor assembly. Refer to Section 4 for removal and replacement procedures for the field-replaceable assemblies in the NARKOMED 2B.

2.1.1.1 Key Panel Test Screen

Pressing the KEY TEST key in the Diagnostics Menu Screen allows the TSR to check each key on the display panel. As each key on the display panel is pressed, a corresponding key is illuminated on the Key Panel Test Screen as shown in Figure 2-4.

NOTE: The TREND key should be pressed last, because it also exits the Key Panel Test Screen.

If the correct keypanel response is not obtained, refer to Section 3 for the appropriate troubleshooting procedure.

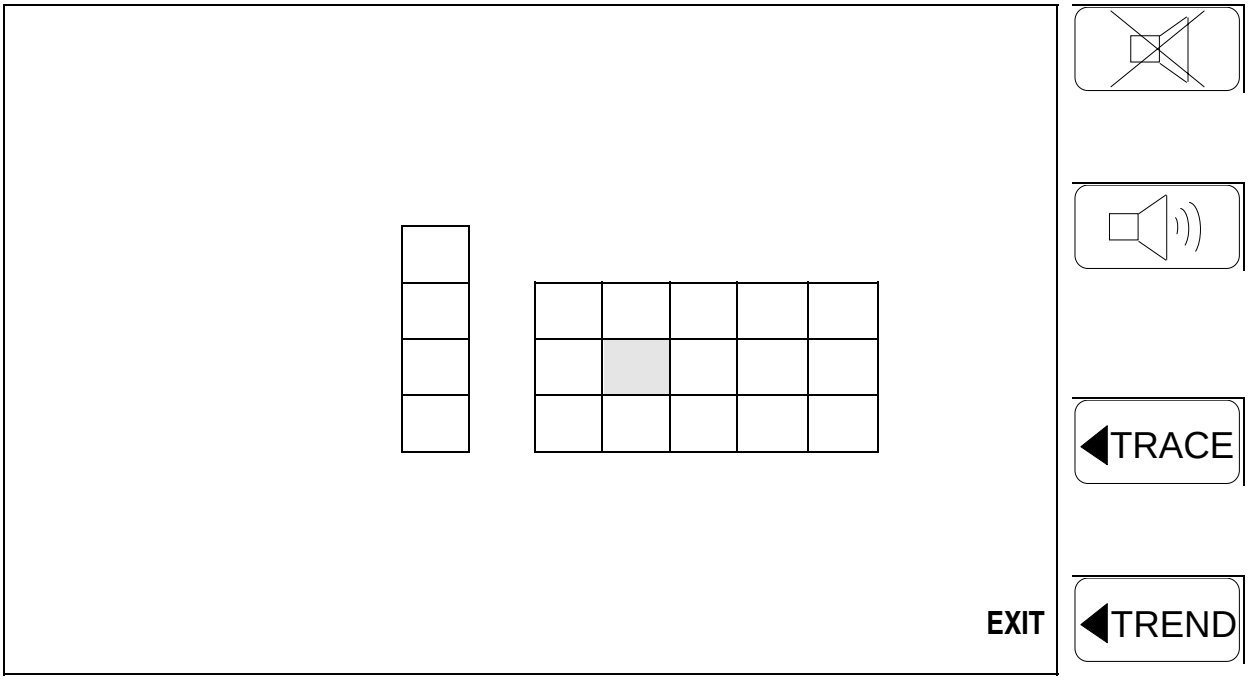

Figure 2-4: KEY PANEL TEST SCREEN

2.1.2 Calibration Menu Screen

Pressing the CALIBRATION key on the Service Menu Screen brings up the Calibration Menu Screen. This menu allows the TSR to perform calibration for the Oxygen Analyzer sensor and the Breathing Pressure Monitor. Figure 2-5 shows a typical Calibration Menu Screen. The four-digit numbers in the left column show the current values, while the numbers in the right column show the values stored from the previous calibration.

For a valid zero calibration of the Oxygen Analyzer sensor, the two offset readings should be between 125 and 145, and the difference between Cell A and Cell B should be no greater than 8. Pressing the O2MED key stores the values, and the message OXYGEN OFFSET READINGS STORED appears on the screen. Refer to Section 5 of this manual for the complete calibration procedure.

For a valid calibration of the Breathing Pressure Monitor, the pressure span reading at 60 cm H_2O should be between 465 and 519. Pressing the BAROMED key stores the value, and the message PRESSURE SPAN READING STORED appears on the screen. Refer to Section 5 of this manual for the complete calibration procedure.

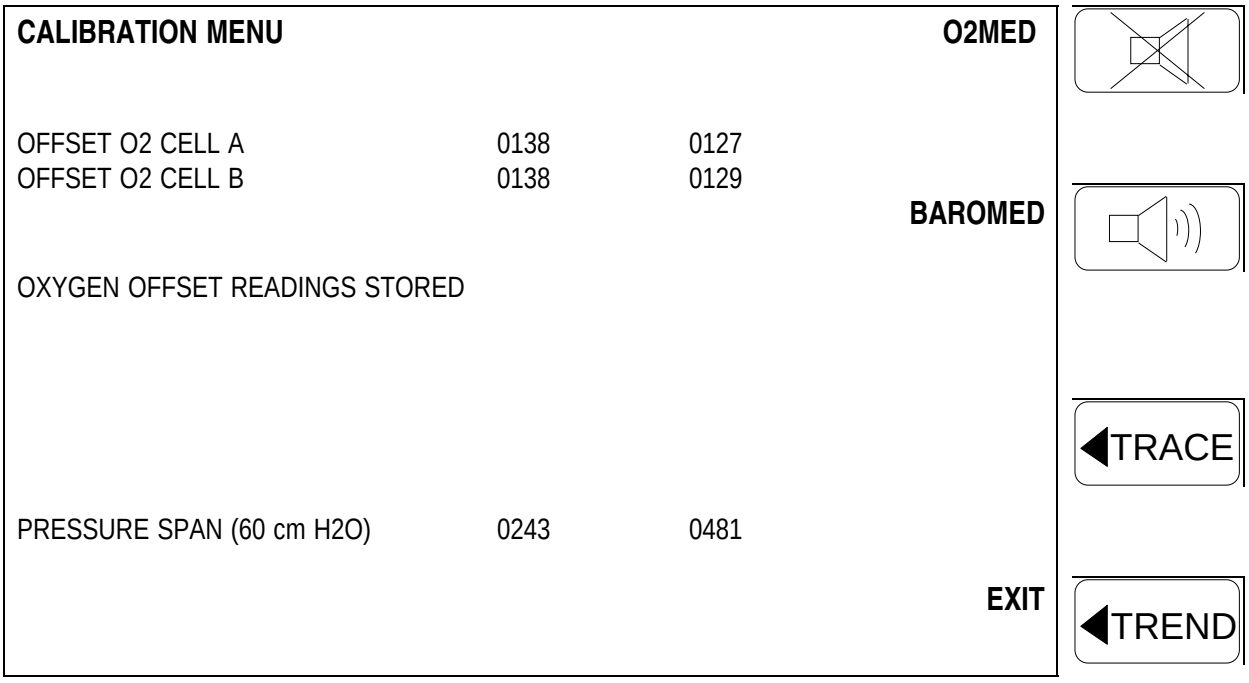

Figure 2-5: CALIBRATION MENU SCREEN

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3.0 TROUBLESHOOTING

This section contains information to assist the Draeger Medical, Inc. qualified Technical Service Representative (TSR) in locating electrical faults affecting the NARKOMED 2B monitoring and display devices. Since most troubleshooting efforts begin with verifying power supply voltages, the following paragraph outlines the voltage distribution scheme within the machine along with test points for each of the voltages.

3.1 Power Supply and Voltage Distribution

In the NARKOMED 2B the power supply outputs at J10 are connected to J5 on the processor board for distribution. The CRTs are powered by 12 VDC; the ventilator controller and the alarm channel are powered by 8 VDC. The processor is powered by 5 VDC along with the other voltages. Under normal load conditions these voltages are measured at the (+) end of capacitors C23, C24 and C31 on the processor board. See Figure 3-1. The voltmeter return should be connected to the (-) end of one of the capacitors. Table 3-1 lists the acceptable range for each voltage.

TABLE 3-1: PROCESSOR BOARD VOLTAGES

LOCATION	VOLTAGE	ACCEPTABLE RANGE
+ End of C23	+ 5 VDC	4.85 to 5.15 VDC
+ End of C24	+ 8 VDC	7.45 to 8.47 VDC
+ End of C31	+ 12 VDC	11.52 to 12.24 VDC

The power supply voltages can also be measured in an unloaded condition.

CAUTION: Before disconnecting the output cable from J10 on the power supply assembly, turn the System Power switch to STANDBY, and disconnect the data cable from J9 on the power supply assembly.

The test points are:

+5V: J10-3,-4
+8V: J10-1,-2
+12V: J10-5,-6
Com: J10-7,-8

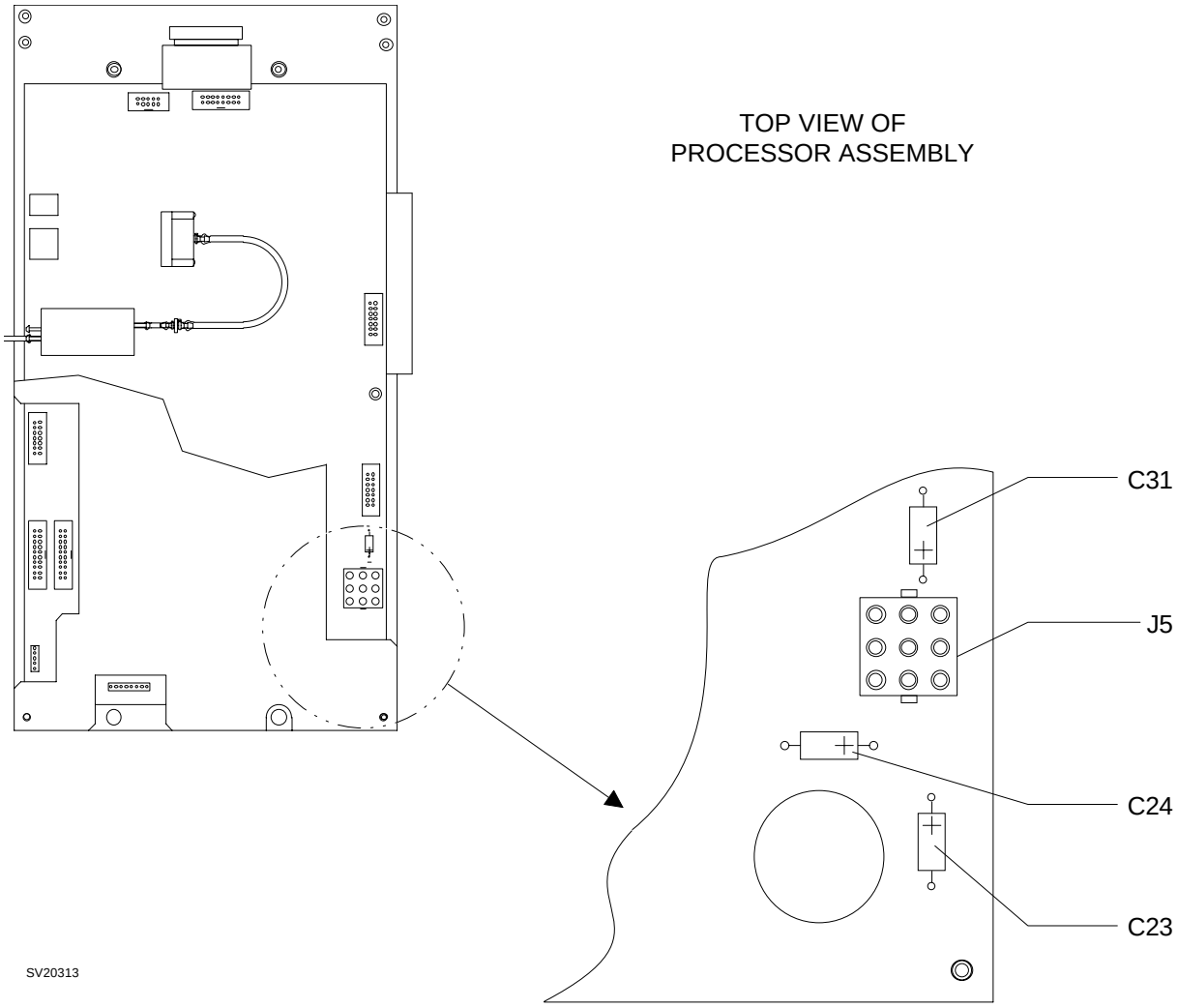


Figure 3-1: PROCESSOR BOARD VOLTAGE TEST POINTS

3.2 Battery

While the machine is operating from an AC line, the battery voltage at full charge should be within the range of 12.83 to 14.18 VDC. Battery voltage can be measured between J7-3(+) and J7-4(-). During battery operation, the low battery cutoff voltage should be within the range of 9.79 to 10.82 VDC.

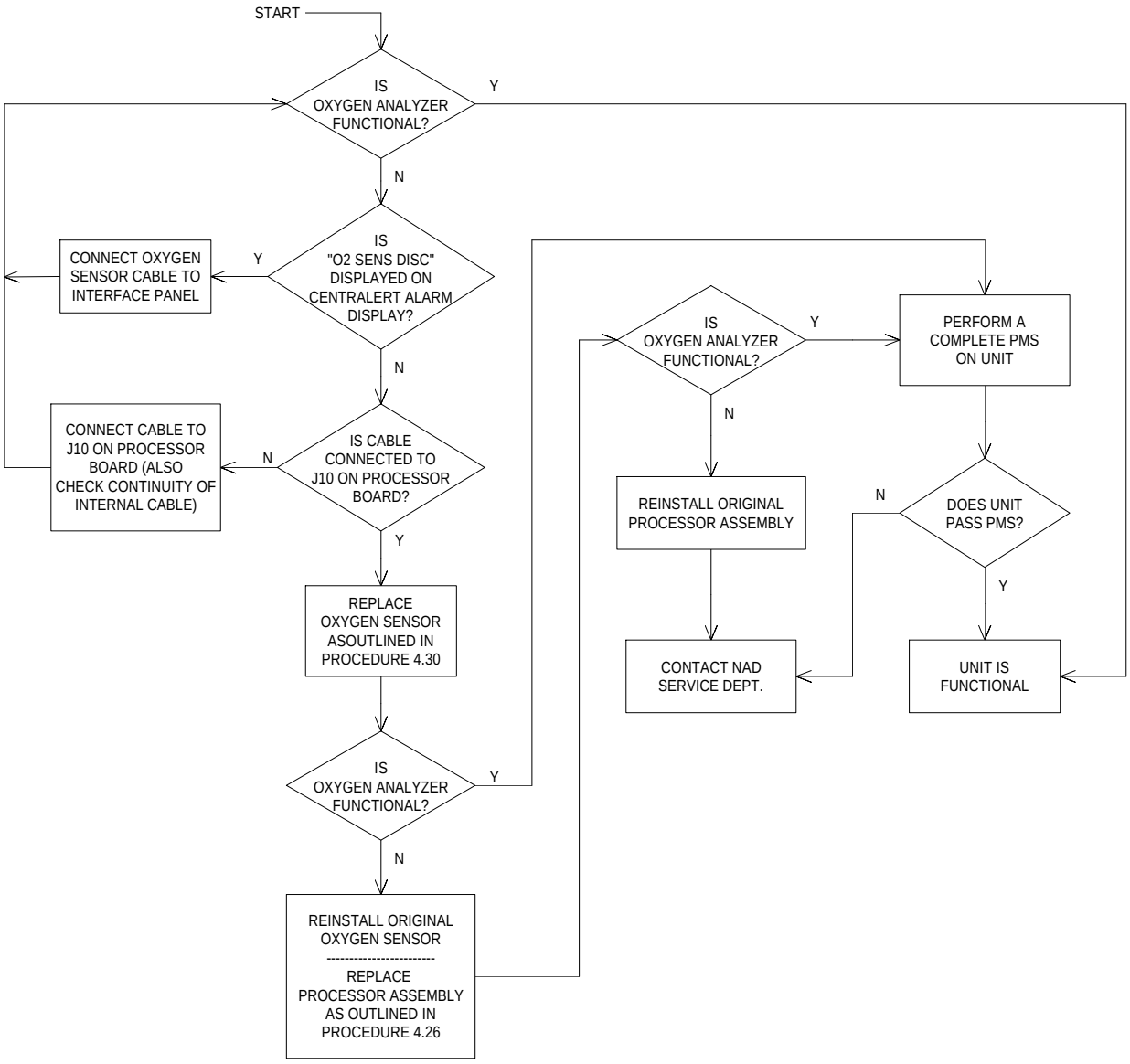
3.3 Troubleshooting Guides

Table 3-2 lists common failure modes and symptoms (excluding simultaneous multiple faults) for the monitoring and display devices in the NARKOMED 2B. Each failure mode or symptom is keyed to a troubleshooting guide flow chart on the following pages to assist in locating a problem. These flow charts assume that the machine is plugged into an AC outlet with the correct voltage, and the machine is not running on its backup battery.

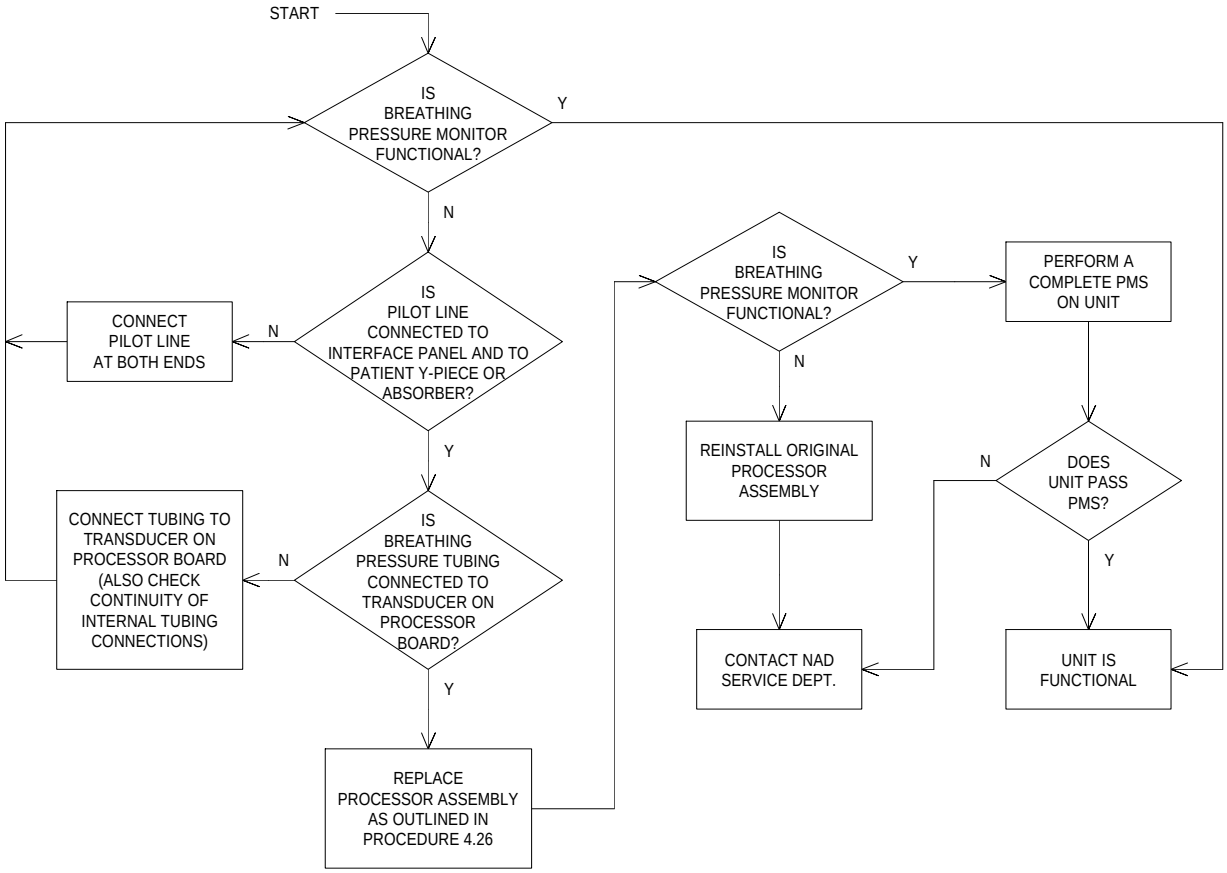
TABLE 3-2: NARKOMED 2B FAILURE MODE AND SYMPTOM LIST

FAILURE MODE / SYMPTOM	CORRECTIVE ACTION
Loss of O_2 Monitor	Guide 1
Loss of Breathing Pressure Monitor	Guide 2
Loss of Respiratory Volume Monitor	Guide 3
No Audio Alarms	Guide 4
Vitalink Failure	Guide 5
Incorrect Display	Guide 6
No Oxygen Ratio Monitor Alarms	Guide 7
No Oxygen Supply Pressure Alarms	Guide 8
Display Screens Blank Upon System Power-up	Guide 9
No Keypanel Response	Guide 10

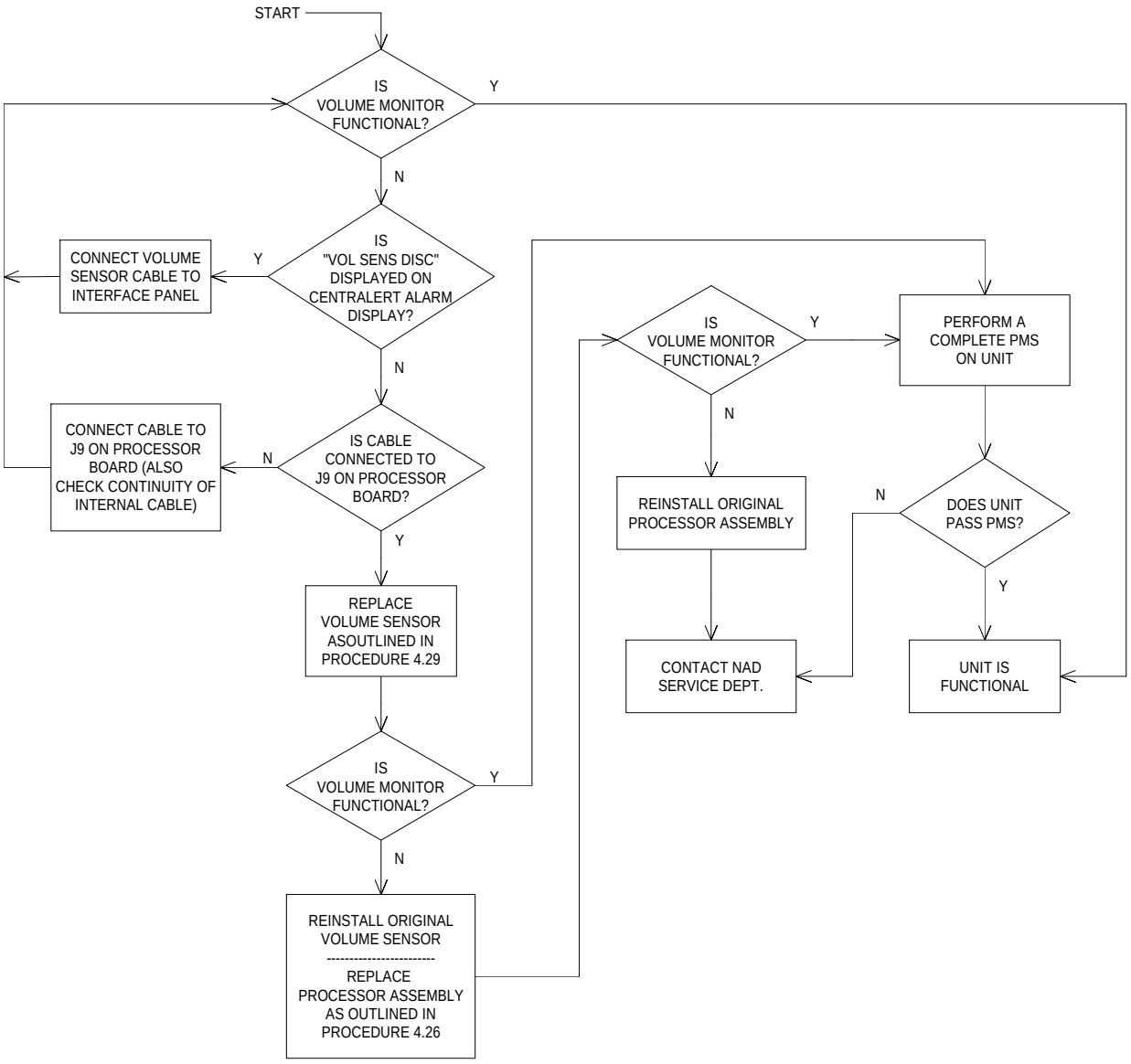
GUIDE 1: Loss of O_2 Monitor



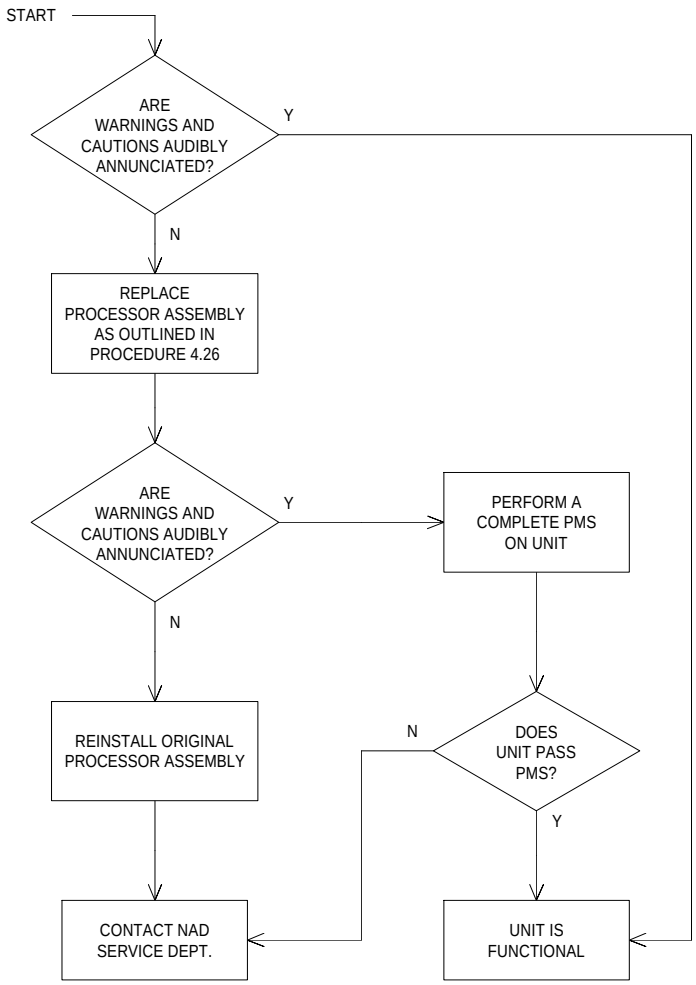
GUIDE 2: Loss of Breathing Pressure Monitor



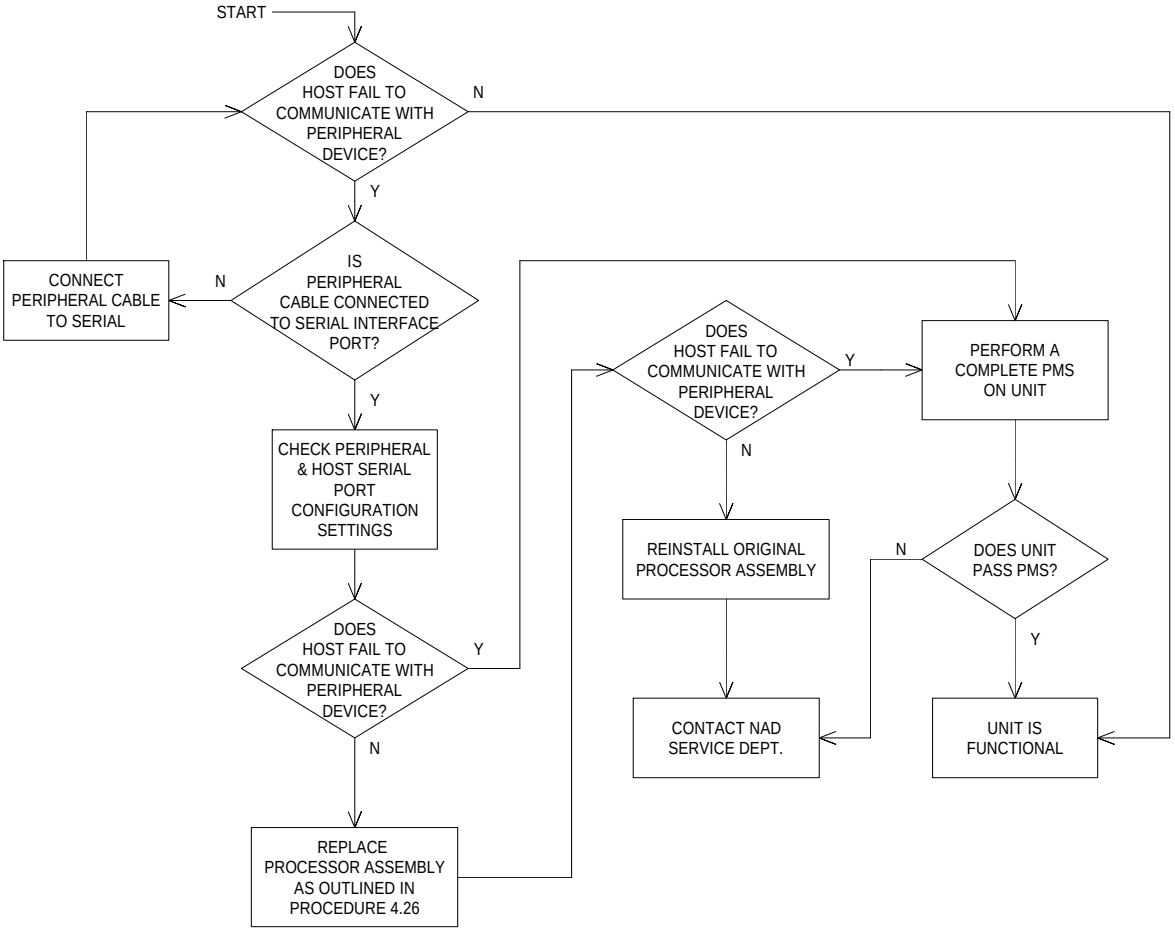
GUIDE 3: Loss of Respiratory Volume Monitor



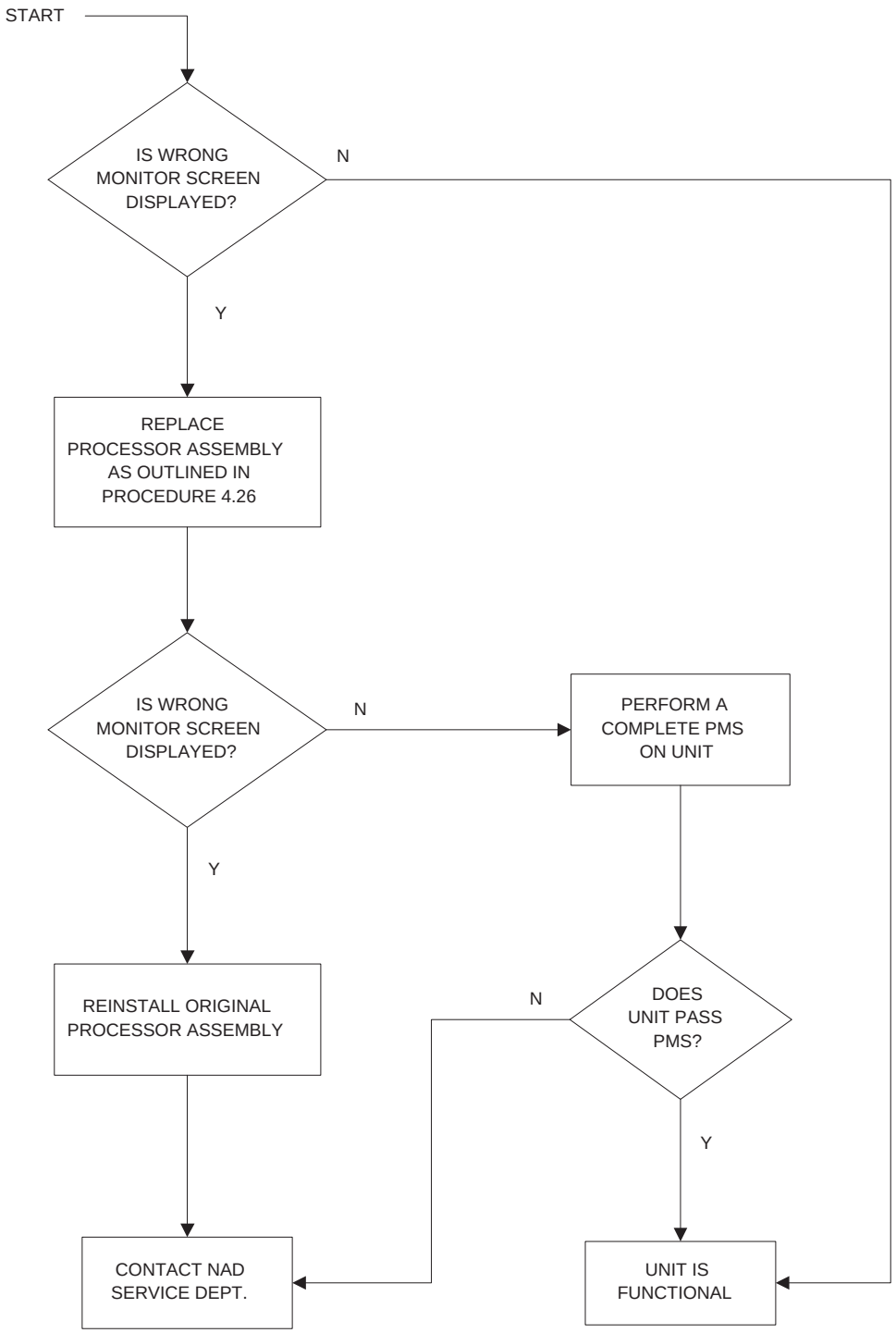
GUIDE 4: No Audio Alarms



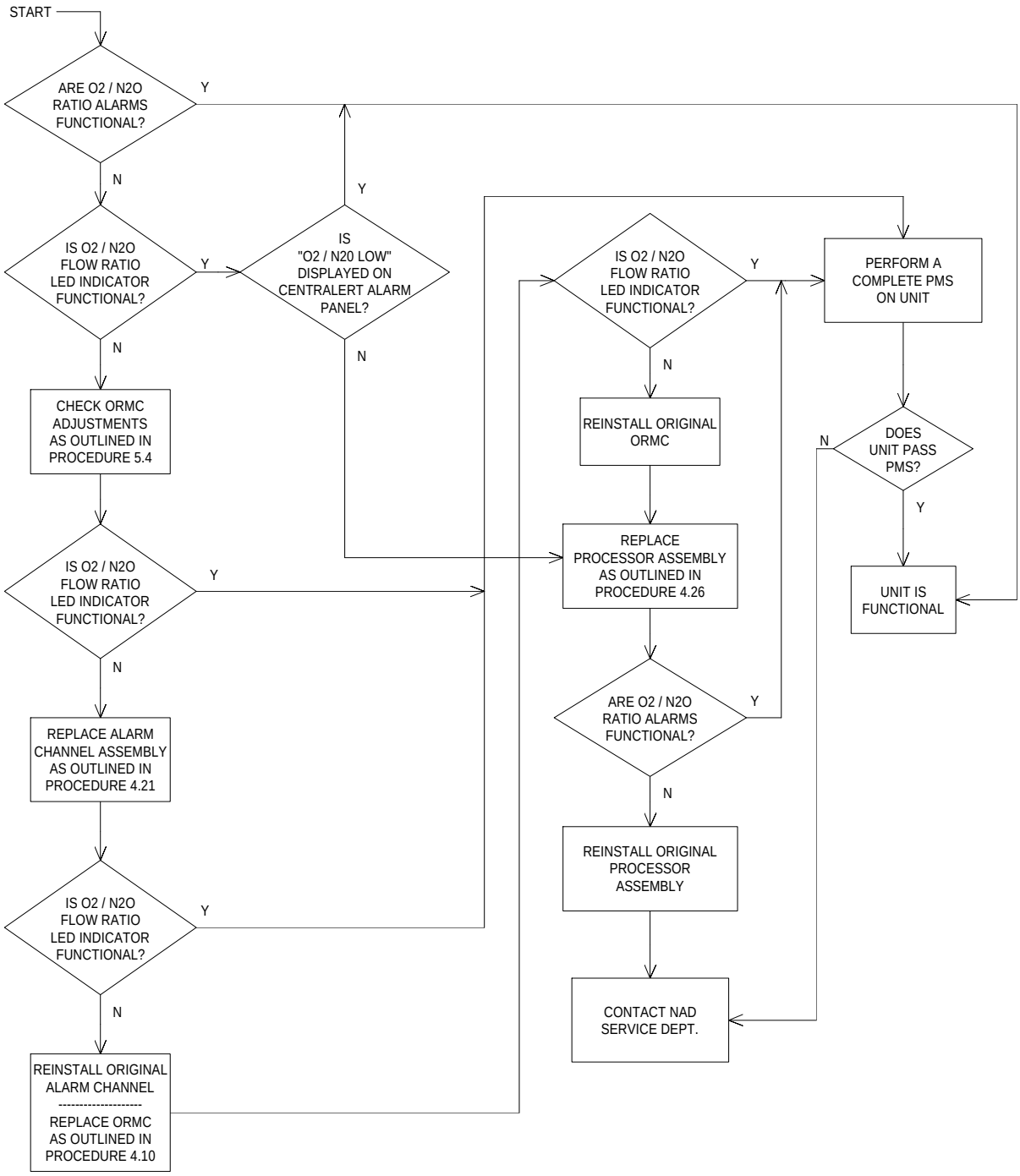
GUIDE 5: Vitalink Failure



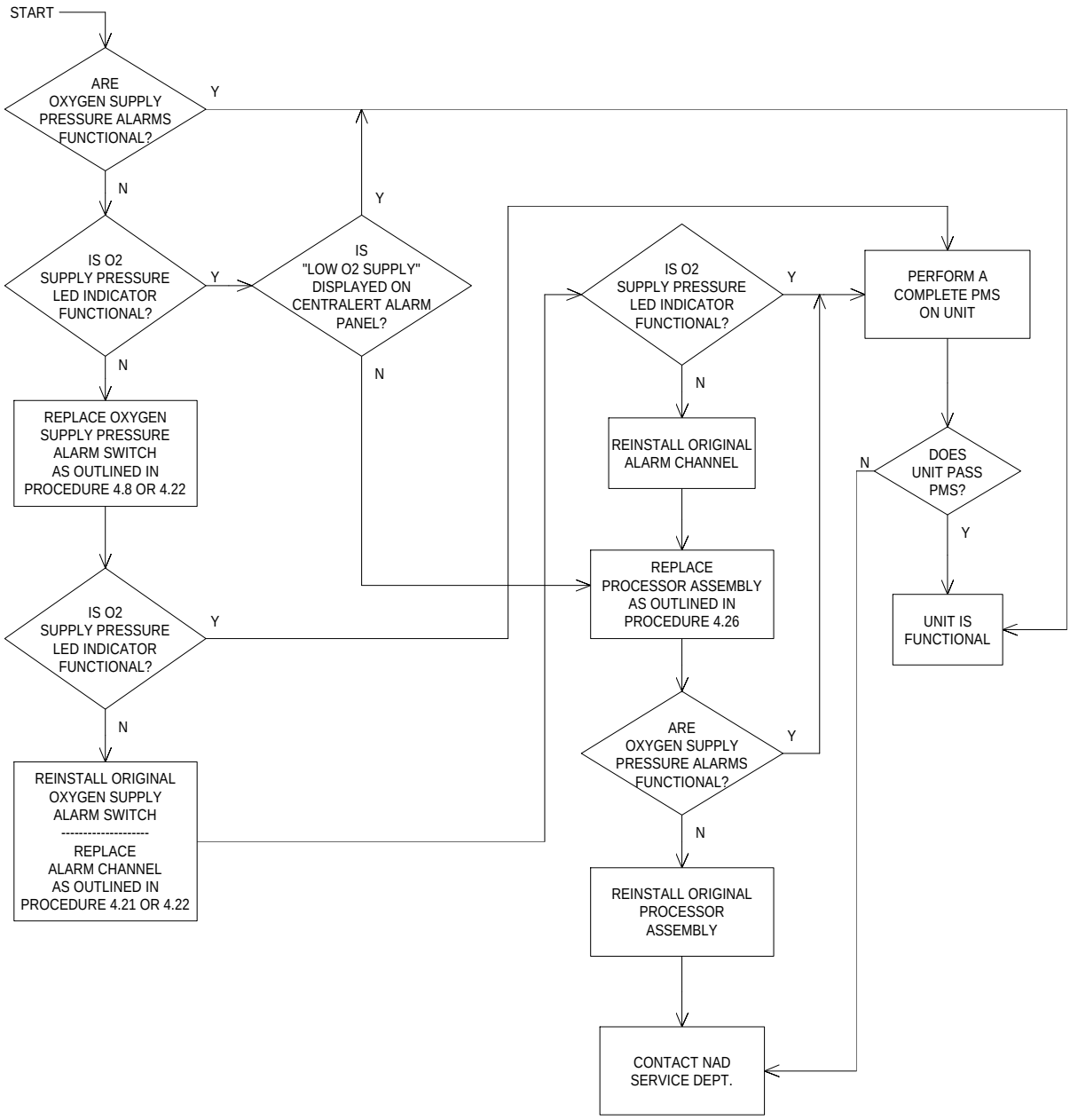
GUIDE 6: Incorrect Display



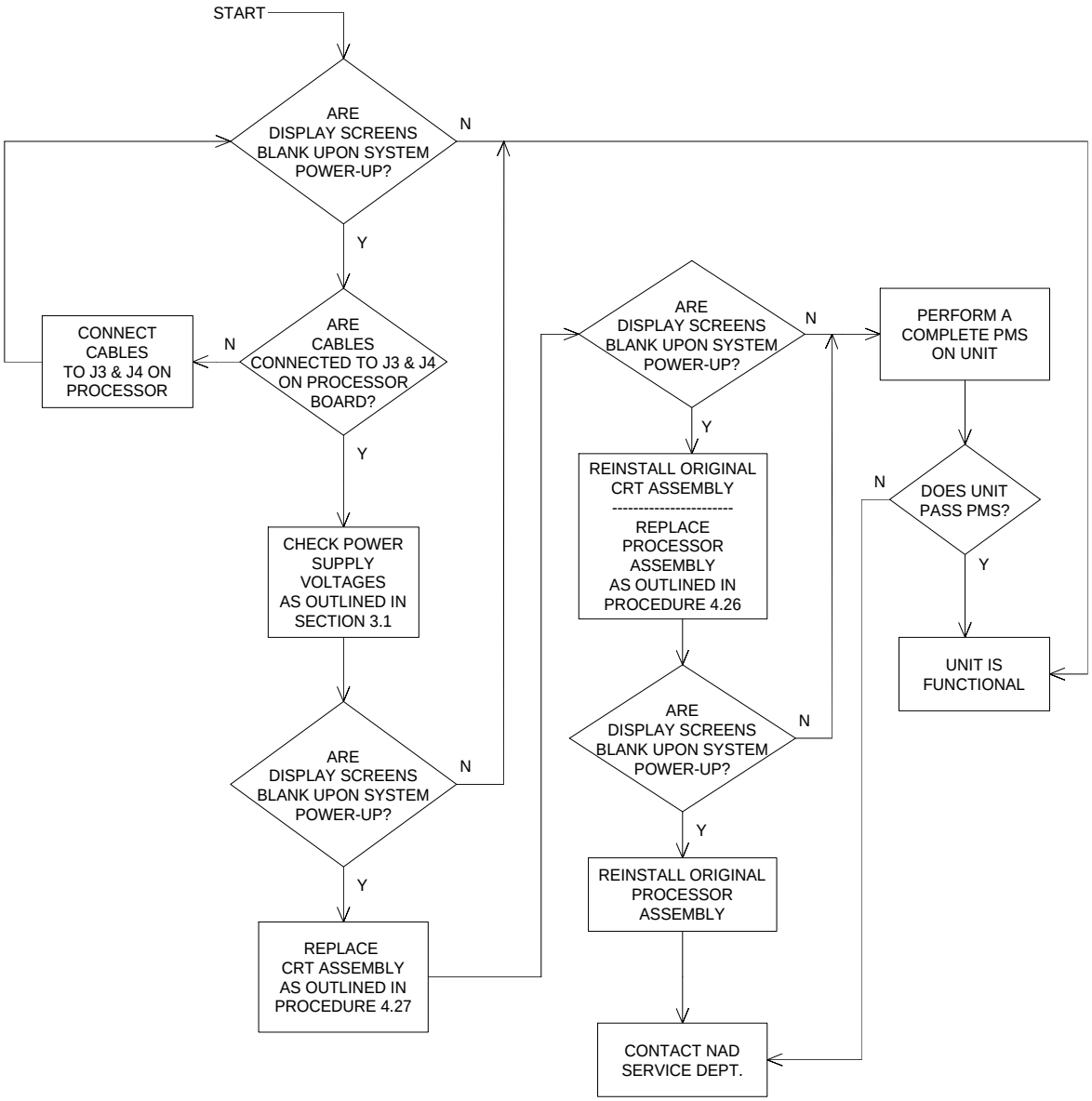
GUIDE 7: No Oxygen Ratio Monitor Alarms



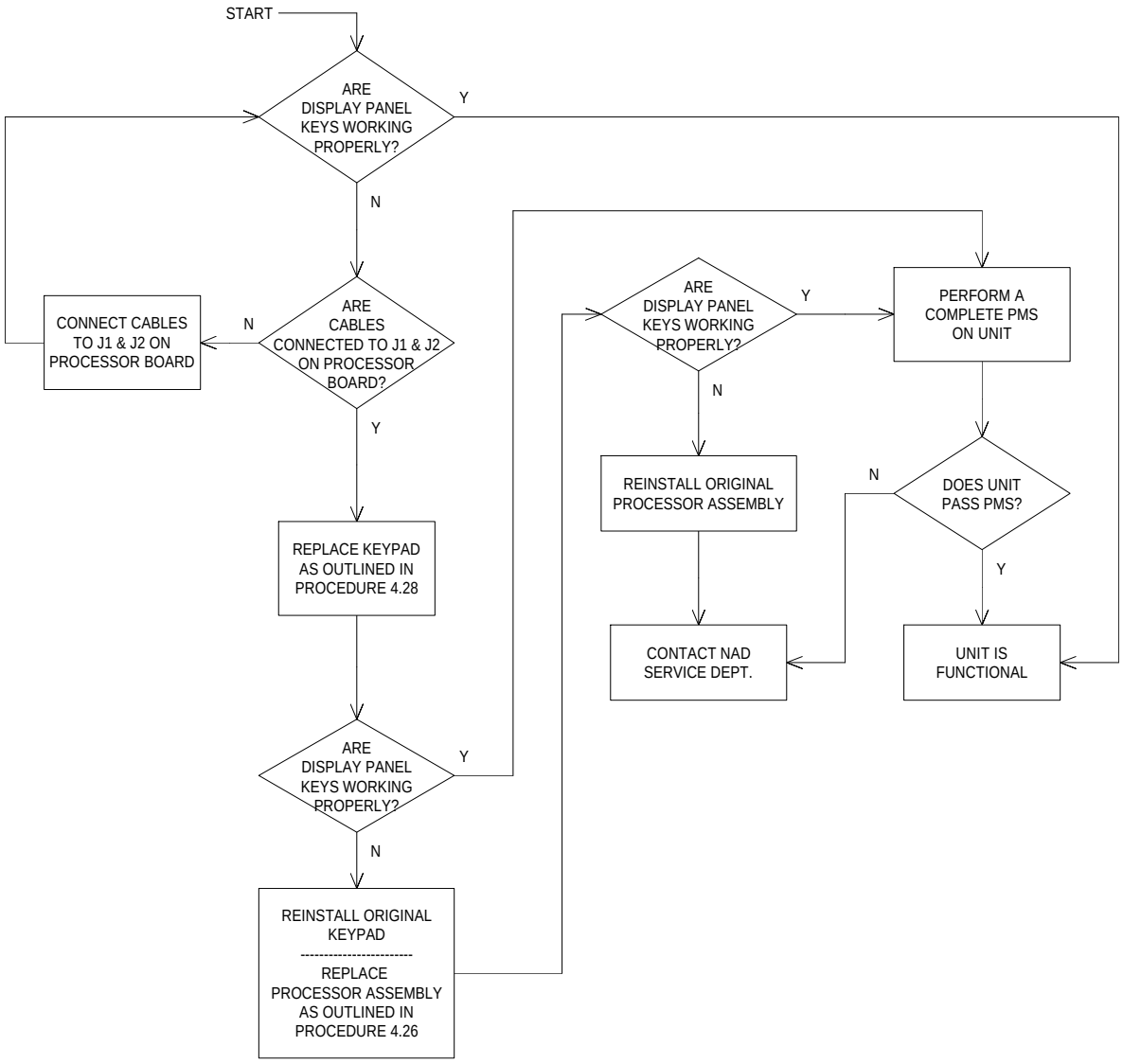
GUIDE 8: No Oxygen Supply Pressure Alarms



GUIDE 9: Display Screens Blank Upon System Power-Up



GUIDE 10: No Keypanel Response



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4.0 REPLACEMENT PROCEDURES

This section outlines removal and replacement procedures for the field-replaceable assemblies of the NARKOMED 2B Anesthesia System.

These procedures are to be performed only by a Draeger Medical, Inc. qualified Technical Service Representative (TSR).

The following are the only procedures authorized by Draeger Medical, Inc. to be performed in the field. All other service procedures shall be referred to NAD's Technical Service Department.

NOTE: The PMS PROCEDURE detailed in Section 6 must be performed after any replacement, removal, calibration or adjustment procedure.

4.1 Cylinder Yoke Assemblies

Each cylinder yoke contains a replaceable filter and check valve assembly. Replacement of this assembly requires that the yoke be removed from the anesthesia machine. Figure 4-1 shows a typical cylinder yoke mounting arrangement. Access to the yoke mounting screws and gas line connection requires that the table top be removed from the machine.

4.1.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.1.2 Close all cylinder valves except the O_2 valve.

4.1.3 Set the oxygen flow to 5 liters per min.

4.1.4 Open the other gas flow control valves to drain pressure from the system.

4.1.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.1.6 Set the System Power switch to STANDBY.

4.1.7 Remove the cylinder where the yoke is to be replaced.

WARNING: Store the cylinder in a safe place and lay it on its side.

4.1.8 Remove the screws holding the table top to the machine and lift out the table top.

4.1.9 Pull the writing or keyboard tray out to its fully extended position.

4.1.10 Disconnect the gas line fitting at the yoke and remove the two yoke mounting screws.

4.1.11 Remove the filter and check valve assembly from the yoke and install a replacement assembly.

NOTE: If the entire yoke assembly is being replaced, ensure that the replacement yoke has the correct label and pin indexing arrangement.

NOTE: If the yoke spacer is removed from the frame rail of the machine, be sure to re-install it in its original position.

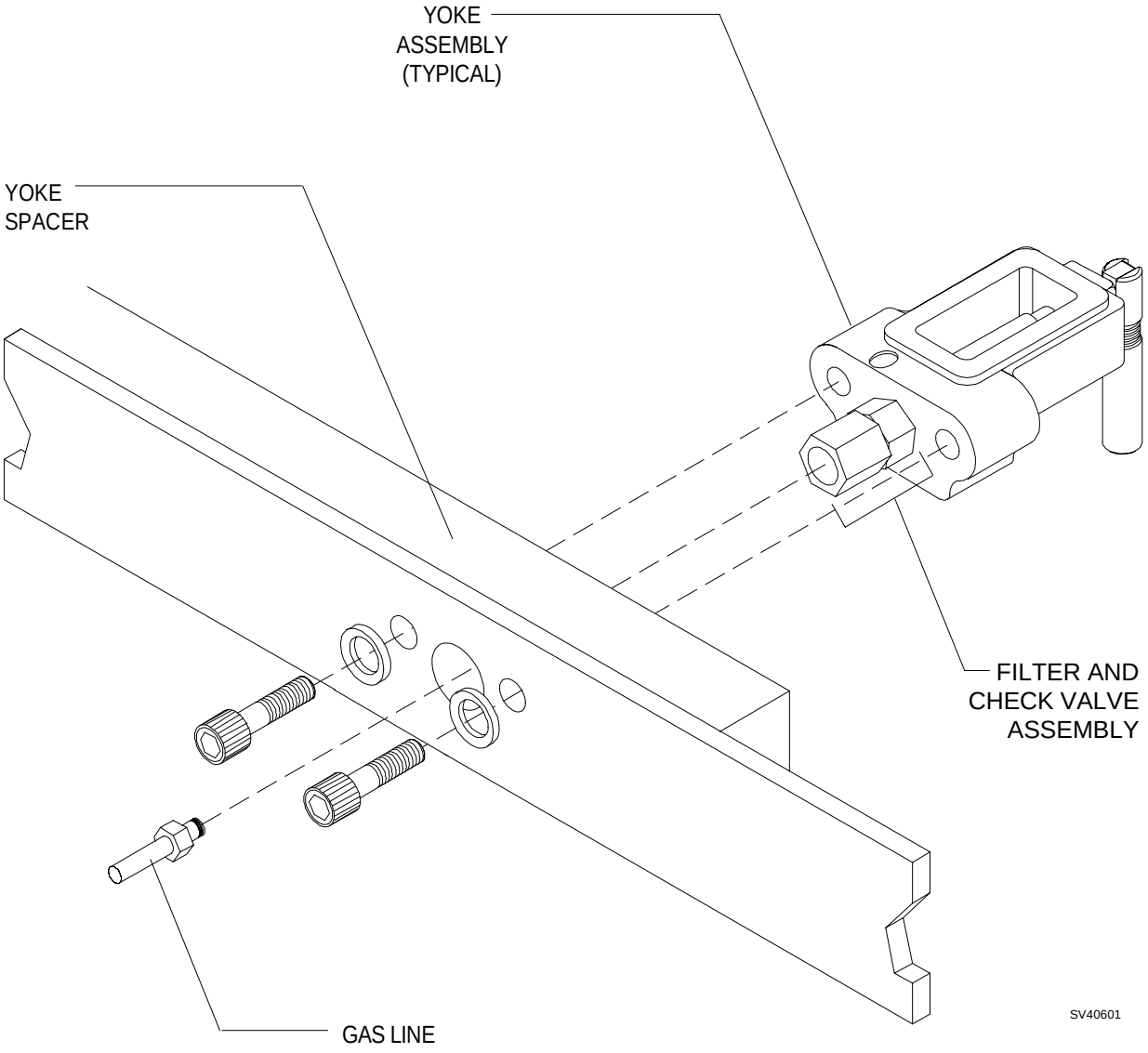


Figure 4-1: CYLINDER YOKE ASSEMBLY

4.1.12 Position the yoke on the spacer, and install the two mounting screws and lockwashers. Tighten the screws securely. Connect the gas line fitting to the yoke.

4.1.13 If a new cylinder is being installed, remove the old sealing washer from the gas inlet of the yoke and install a new washer.

4.1.14 Install the correct cylinder in the yoke, making sure that the index pins are properly engaged before tightening the handle bolt. The cylinder should hang vertically after the handle is tight.

4.1.15 Perform the following leak test on the yoke assembly:

4.1.15.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2	: 1000 PSI
N_2O	: 700 PSI
HE	: 1000 PSI
CO_2	: 800 PSI
AIR	: 1000 PSI
N_2	: 1000 PSI
O_2-He	: 1000 PSI

4.1.15.2 Close the cylinder valve and remove the cylinder from the yoke.

4.1.15.3 For any gas, the pressure should not drop more than 50 PSI in two minutes.

4.1.16 Re-install the cylinder in the yoke.

4.1.17 Replace the table top and its retaining screws.

4.1.18 Replace the pipeline hoses.

4.1.19 Perform the PMS Procedure given in Section 6.

4.2 Cylinder Pressure Regulators

Access to the cylinder pressure regulators requires that the table top be removed from the anesthesia machine. Figure 4-2 shows the mounting arrangement of the regulators and typical connections.

4.2.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.2.2 Close all cylinder valves except the O_2 valve.

4.2.3 Set the oxygen flow to 5 liters per min.

4.2.4 Open the other gas flow control valves to drain pressure from the system.

4.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.2.6 Set the System Power switch to STANDBY.

4.2.7 Remove the cylinder corresponding to the regulator to be replaced.

4.2.8 Remove the screws holding the table top to the machine and lift out the table top.

4.2.9 Remove the top drawer from the cabinet and pull the writing or keyboard tray out to its fully extended position.

4.2.10 Disconnect the three compression fittings at the regulator.

4.2.11 Loosen the two setscrews holding the regulator to its mounting bracket and remove the regulator.

4.2.12 Record the serial number of the regulator that was removed, and record the serial number of the replacement regulator.

NOTE: If fittings must be installed in the replacement regulator, use Loctite #271 (red). Refer to the parts list in Section 8.

NOTE: For Canadian machines, verify that the correct relief valve is installed in the regulator. Refer to the parts list in Section 8 for CSA items.

4.2.13 Position the replacement regulator in its mounting bracket, and connect the three compression fittings. Do not tighten the fittings yet.

TOP VIEW OF NARKOMED 4
WITH TABLE TOP REMOVED

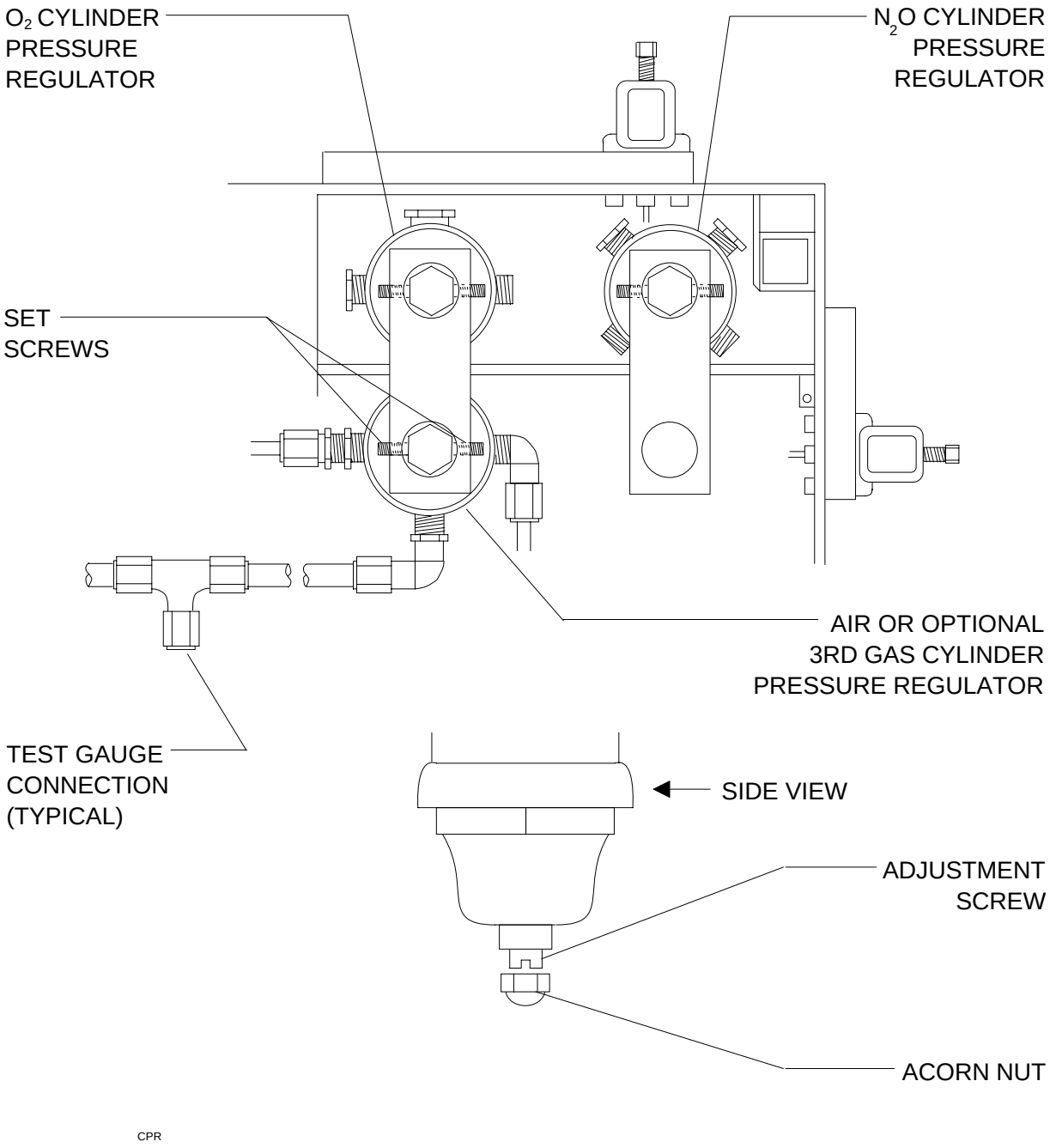


Figure 4-2: CYLINDER PRESSURE REGULATORS

4.2.14 Tighten the regulator mounting setscrews to a torque of 50 to 55 in. lbs.

4.2.15 Tighten the compression fittings.

4.2.16 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

4.2.17 Set the regulator output pressure in accordance with the Cylinder Pressure Regulator Adjustment given in Section 5.

4.2.18 Perform the following leak test on the high pressure side of the regulator:

4.2.18.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2 : 1000 Psi
N_2O : 700 Psi
HE : 1000 Psi
CO_2 : 800 Psi
AIR : 1000 Psi
N_2 : 1000 Psi

4.2.18.2 Close the cylinder valve and remove the cylinder from the yoke.

4.2.18.3 For any gas, the pressure should not drop more than 50 Psi in two minutes.

4.2.19 Re-install the cylinder in the yoke.

4.2.20 Replace the table top and its retaining screws.

4.2.21 Replace the top drawer in the cabinet.

4.2.22 Connect the pipeline hoses.

4.2.23 Perform the PMS Procedure given in Section 6.

4.3 Cylinder Cutoff Valves (Canada)

Access to the cylinder cutoff valves requires removal of the table top from the anesthesia machine. Figure 4-3 shows the locations of the O_2, Air or 3rd gas, and N_2O cutoff valve assemblies. The instructions apply to all three assemblies. On earlier machines the tubing arrangement may be slightly different from that illustrated.

NOTE: Replacement of the O_2 Cutoff Valve Assembly shall be performed every 24 months. Documentation shall be created by the service person and a copy distributed to the owner institution. Testing of the O_2 Cutoff Valve shall be performed at each PMS. (Perform the flow test given at the end of the following procedure)

4.3.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.3.2 Close all cylinder valves except the O_2 valve.

4.3.3 Set the oxygen flow to 5 liters per min.

4.3.4 Open the other gas flow control valves to drain pressure from the system.

4.3.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.3.6 Set the System Power switch to STANDBY.

4.3.7 Remove the screws holding the table top to the machine and lift out the table top.

4.3.8 Remove the top drawer from the cabinet and pull the writing or keyboard tray out to its fully extended position.

4.3.9 Disconnect the compression fittings indicated at points marked C on the illustration.

4.3.10 Cut the tie-wrap clamp and disconnect the flexible tubing from the cutoff valve assembly at the point marked A on the illustration.

NOTE: On later machines with assemblies that have brass fittings instead of nylon, the flex tubing is attached with a press-on hose clamp instead of a tie strap.

4.3.11 Remove the cylinder cutoff assembly.

4.3.12 Connect the flexible tubing to the replacement cutoff valve assembly and secure it with a new tie-wrap clamp.

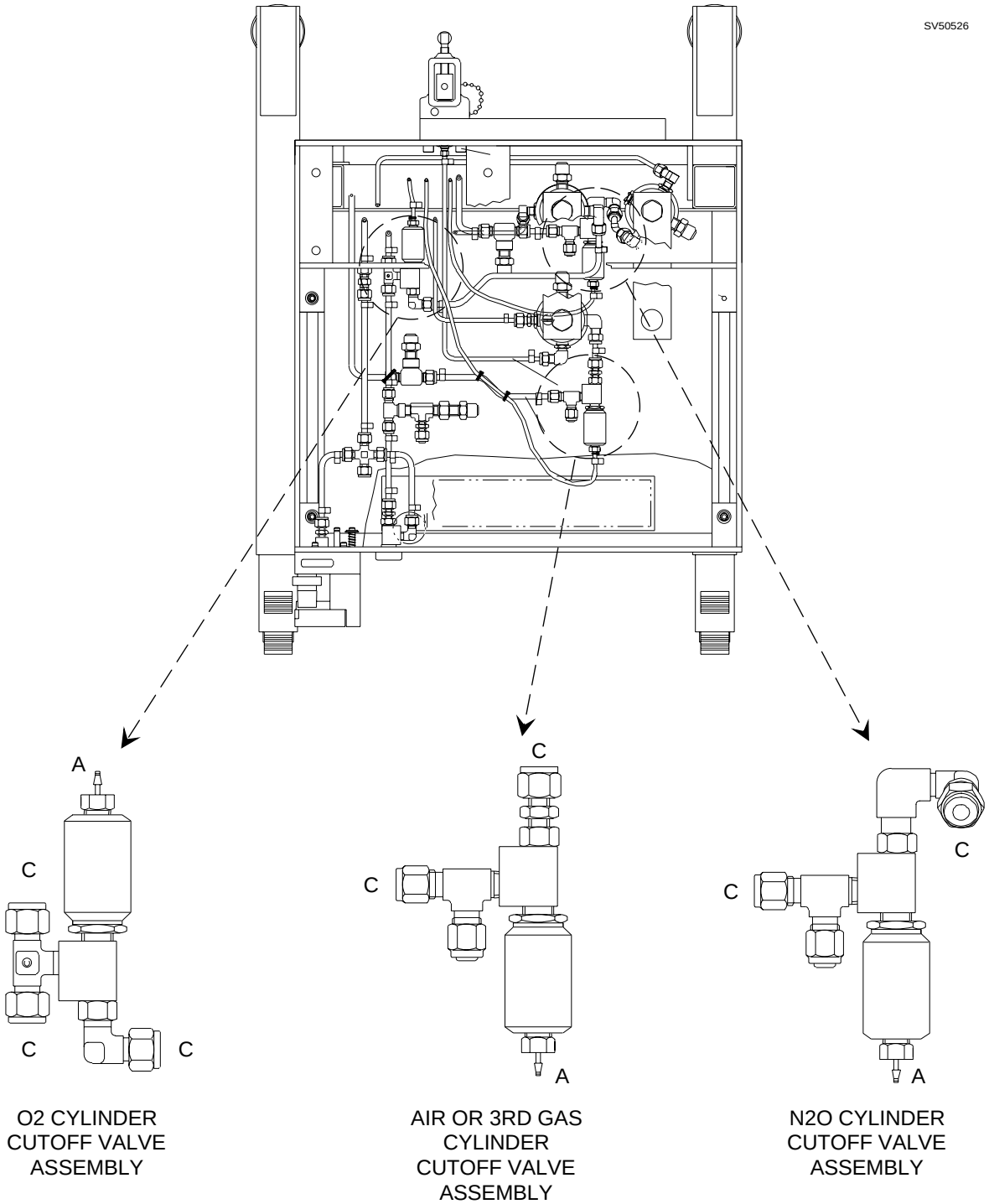


Figure 4-3: CYLINDER CUTOFF VALVES (CANADA)

4.3.13 Connect and tighten the compression fittings at points marked C on the illustration.

4.3.14 Perform the following test: --Remove the plug from the test gauge connection at the Tee fitting in the regulator outlet piping, and install a test gauge.

NOTE: The cylinders used for this test must contain the following minimum pressure: O_2 : 1000 PSI AIR : 1000 PSI
O_2+He : 1000 PSI N_2O : 745 PSI

--Set the System Power switch to ON.
--For the O_2 cutoff valve: open the O_2 cylinder valve and set the oxygen flow to 4 liters per min.
--For the N_2O cutoff valve: open the O_2 cylinder valve and the N_2O cylinder valve. Set each flow to 4 liters per min.
--Verify that regulator outlet pressure is between 43 and 49 PSI.
--Connect the pipeline hoses and pressurize to 50 PSI.
--Turn off the pipeline supply and observe the pipeline pressure gauge.
--The cutoff valve shall open when the pipeline pressure drops through the range of 45 to 40 PSI.
--Close the cylinder valve(s), and close the flow control valve(s).
--Disconnect test pressure gauge and reinstall the plug in the regulator outlet piping.

4.3.15 Replace the table top and its retaining screws.

4.3.16 Replace the top drawer in the cabinet.

4.3.17 Connect the pipeline hoses.

4.3.18 Perform the PMS Procedure given in Section 6.

O_2 Flow Test:

--Disconnect all pipeline supplies.
--Install a full O_2 cylinder on the machine, and open the cylinder valve.
--Turn the System Power switch to ON.
--Set the Inspiratory Flow control to maximum high, and turn the ventilator switch to ON.
--Set the oxygen flow to 10 l/min.
--Verify that the oxygen flow does not drop below 8 l/min. while the ventilator is running.
--Press and hold the O_2 FLUSH button while observing the O_2 flowmeter, and verify that the oxygen flow does not drop below 8 l/min.
--If the oxygen flow in either of the above two steps drops below 8 l/min., replace the O_2 cutoff valve assembly.

4.4 Cylinder and Pipeline Pressure Gauges

Replacement of the cylinder and pipeline pressure gauges requires that the plexiglass front cover be removed from the gas instrumentation panel, and also the rear cover for access to the gauge connections. Figure 4-4 shows disassembly and mounting details.

4.4.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.4.2 Close all cylinder valves except the O_2 valve.

4.4.3 Set the oxygen flow to 5 liters per min.

4.4.4 Open the other gas flow control valves to drain pressure from the system.

4.4.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.4.6 Set the System Power switch to STANDBY.

4.4.7 Remove the screws holding the rear cover, and remove the cover.

4.4.8 Remove the screws holding the table top to the machine and lift out the table top.

4.4.9A Early models: Remove the two screws (from the back) holding the front plate at the top of the plexiglass cover. Hold the front plate as the screws are removed from the back.

4.4.9B Later models (without the O_2/N_2O ratio alarm lamp): Remove the six screws holding the flowmeter shield and vapor box cover panel, and remove the panel.

4.4.10 Remove the O_2 flow control knob. The knob has two setscrews.

NOTE: If the knob must be rotated to allow access to a setscrew, carefully note its position so that it can be re-assembled in the same position with the "Off Stop" properly set.

4.4.11 Remove the two screws holding the knob guard in place, and remove the knob guard. (For earlier machines with the bar-type knob guard, the screws holding the guard assembly are accessible through the back of the flowmeter housing.)

4.4.12 Remove the screws holding the plexiglass cover over the flow tubes and gauges, and carefully remove the cover.

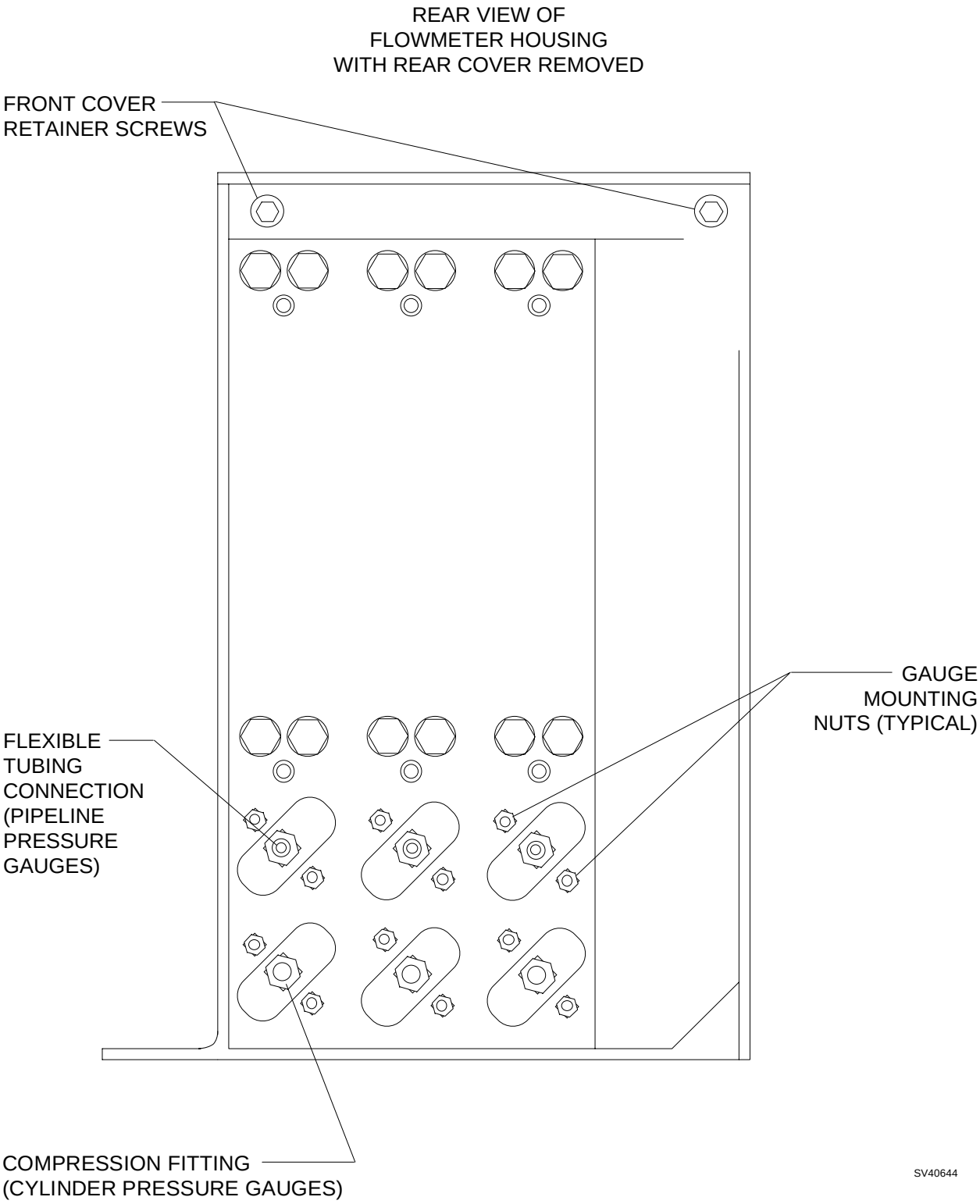


Figure 4-4: CYLINDER AND PIPELINE PRESSURE GAUGES

NOTE: Intermediate assemblies may need to be removed to allow access to the gauge connections and mounting hardware. Be sure to keep a record of the disassembly sequence so that all tubing can be correctly re-assembled.

4.4.13A For the cylinder pressure gauges:

Disconnect the compression fitting at the back of the gauge.

Remove the gauge mounting nuts, and remove the gauge from the front of the panel.

Install the replacement gauge in the panel using the flat washers, lock washers and mounting nuts that were previously removed.

Connect the gas line to the gauge and tighten the compression fitting.

4.3.13B For the pipeline pressure gauges:

Locate the flexible tubing connecting the gauge to the pipeline inlet assembly, cut the tie-wrap tubing clamp at the pipeline inlet and disconnect the tubing.

NOTE: On later machines that have brass fittings instead of nylon, the flex tubing is attached with a press-on hose clamp instead of a tie strap.

Remove the gauge mounting nuts, and remove the gauge from the front of the panel.

Cut the tie-wrap tubing clamp and disconnect the flexible tubing from the gauge.

Connect a new 7-inch length of tubing (8-inch for the air pipeline pressure gauge) to the replacement gauge and secure it with a new tie-wrap clamp.

Place the gauge in the panel and secure it with the flat washers, lock washers and mounting nuts that were previously removed.

Connect the other end of the flexible tubing to the pipeline inlet assembly and secure it with a tie-wrap clamp.

4.4.14 If a cylinder pressure gauge was replaced, perform the following leak test:

4.4.14.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2 : 1000 PSI
N_2O : 700 PSI
HE : 1000 PSI
CO_2 : 800 PSI
AIR : 1000 PSI
N_2 : 1000 PSI
O_2-He : 1000 PSI

4.4.14.2 Close the cylinder valve and remove the cylinder from the yoke.

4.4.14.3 For any gas, the pressure should not drop more than 50 PSI in two minutes.

4.4.15 Reinstall the cylinder in the yoke.

4.4.16 Place the plexiglass cover over the gauges and flow tubes, and reinstall the cover screws. Do not over-tighten these screws as the plexiglass may crack.

4.4.17 Place the knob guard over the flow control valves and install its two retaining screws. (Reinstall the bar-type knob guard on earlier machines.)

4.4.18 Reinstall the O_2 flow control knob and tighten its setscrews. If the knob is installed properly, the O_2 label will be straight when the knob is against its clockwise stop.

4.4.19 Replace the front plate at the top of the plexiglass cover and secure it with the hardware that was previously removed.

4.4.20 Replace the rear cover and its retaining screws.

4.4.21 Replace the table top and its retaining screws.

4.4.22 Connect the pipeline hoses.

4.4.23 Perform the PMS Procedure given in Section 6.

4.5 Flowmeters

The flowmeter tubes are held by compression in gaskets at the top and bottom of each tube. Each upper gasket is seated in an adjustable retainer that allows removal of the tube as shown in Figure 4-5. Access to the flow tubes and their retainers requires removal of the plexiglass cover on the gas instrumentation panel.

4.5.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.5.2 Close all cylinder valves except the O_2 valve.

4.5.3 Set the oxygen flow to 5 liters per min.

4.5.4 Open the other gas flow control valves to drain pressure from the system.

4.5.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.5.6 Set the System Power switch to STANDBY.

4.5.7 Remove the screws holding the table top to the machine and lift out the table top.

4.5.8 Early models: Remove the flowmeter housing rear cover.

4.5.9A Early models: Remove the two screws (from the back) holding the front plate at the top of the plexiglass cover. Hold the front plate as the screws are removed from the back.

4.4.9B Later models (without the O_2/N_2O ratio alarm lamp): Remove the six screws holding the flowmeter shield and vapor box cover panel, and remove the panel.

4.5.10 Remove the O_2 flow control knob. The knob has two setscrews.

NOTE: If the knob must be rotated to allow access to a setscrew, carefully note its position so that it can be re-assembled in the same position with the "Off Stop" properly set.

4.5.11 Remove the two screws holding the knob guard in place, and remove the knob guard. (For earlier machines with the bar-type knob guard, the screws holding the guard assembly are accessible through the back of the flowmeter housing.)

4.5.12 Remove the screws holding the plexiglass cover over the flow tubes and gauges, and carefully remove the cover.

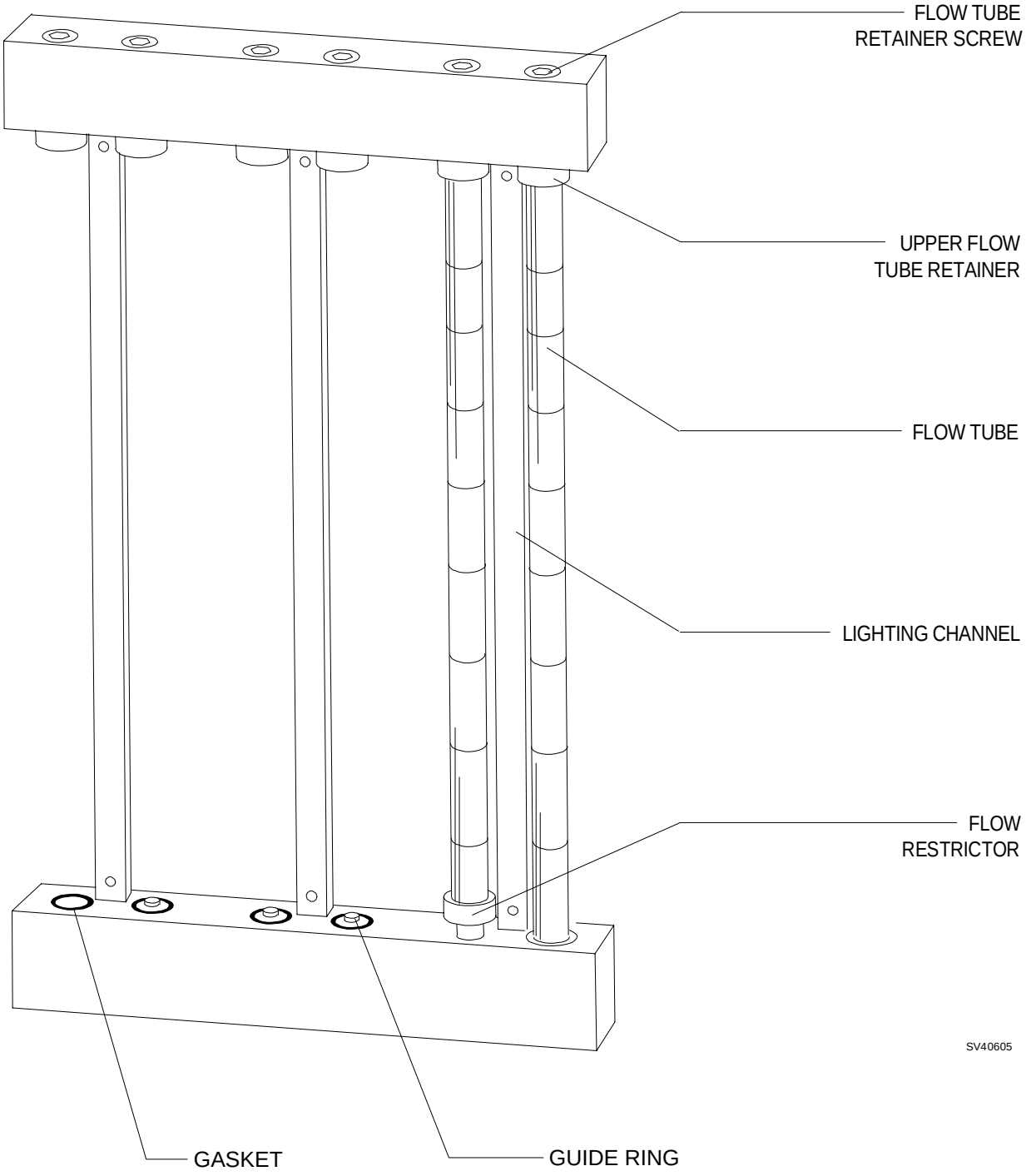


Figure 4-5: FLOWMETERS

4.5.13 Loosen the screw directly above the flowmeter tube to be replaced. Turning the screw counter clockwise will raise the upper flow tube retainer. Raise the retainer far enough to be able to pull the top of the tube outward, and remove the tube.

NOTE: If the bottom of the tube is seated in a flow restrictor, be sure that the arrangement of the restrictor and its gaskets is not disturbed.

4.5.14 Make sure that the replacement flow tube bears the correct markings and has a ball.

4.5.15 Place the bottom of the flowmeter tube into the guide ring of the lower gasket seal, and position the top of the flow tube into the center guide ring of the top gasket seal. It will be easier to hold the tube if the adjacent lighting channel is pulled forward and temporarily removed.

CAUTION: The flowmeter tube must be properly centered over the guide rings or damage to the flowmeter tube may occur.

4.5.16 Ensure that the markings on the flow tube are facing forward, and turn the upper retainer screw clockwise until the flow tube is firmly held in place.

CAUTION: Do not over-tighten the screw as the flowmeter tube may break.

4.5.17 Perform the following leak test on the system:

4.5.17.1 Disconnect the absorber hose from the freshgas outlet.

4.5.17.2 Connect a test gauge and B.P. bulb to the freshgas outlet, and pressurize the system to 50 cm H_2O.

4.5.17.3 The pressure should not drop more than 10 cm H_2O in thirty seconds.

4.5.18 Disconnect the test gauge and re-connect the absorber hose to the freshgas outlet.

4.5.19 Replace any lighting channels that were previously removed.

4.5.20 Place the plexiglass cover over the gauges and flow tubes, and reinstall the cover screws. Do not over-tighten these screws as the plexiglass may crack.

4.5.21 Place the knob guard over the flow control valves and reinstall its two retaining screws. (Reinstall the bar-type knob guard on earlier machines.)

4.5.22 Reinstall the O_2 flow control knob and tighten its setscrews. If the knob is installed properly, the O_2 label will be straight when the knob is against its clockwise stop.

4.5.23 Replace the front cover plate at the top of the plexiglass cover and secure it with the hardware that was previously removed.

4.5.24 If applicable, replace the flowmeter housing rear cover.

4.5.25 Replace the table top and its retaining screws.

4.5.26 Connect the pipeline hoses.

4.5.27 Perform the PMS Procedure given in Section 6.

4.6 Flow Control Valves

The flow control valves have replaceable elements that are removable from the front of the gas instrumentation panel as shown in Figure 4-6. Each flow control knob has a clockwise positive stop arrangement that prevents damage to the valve seat. Whenever a valve cartridge is replaced, the "off stop" must be set as outlined in the following procedure.

4.6.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.6.2 Close all cylinder valves except the O_2 valve.

4.6.3 Set the oxygen flow to 5 liters per min.

4.6.4 Open the other gas flow control valves to drain pressure from the system.

4.6.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.6.6 Set the System Power switch to STANDBY.

4.6.7 Remove the O_2 flow control knob, and the knob on the valve to be replaced.

4.6.8 Remove the two screws holding the knob guard in place, and remove the knob guard. (For earlier machines with the bar-type knob guard, the screws holding the guard assembly are accessible through the back of the flowmeter assembly.)

4.6.9 Remove the stop pin nut.

4.6.10 Remove the flow control valve by holding it at the wrench flats and turning it counter-clockwise.

4.6.11 Install the replacement flow control valve in the valve housing.

CAUTION: Before tightening the cartridge, rotate the valve shaft several turns counter-clockwise to prevent bottoming the valve element into the seat when the cartridge is tightened.

4.6.12 Replace the stop pin nut.

4.6.13 Replace the knob guard and secure it with the two mounting screws. (Replace the bar-type knob guard on earlier machines.)

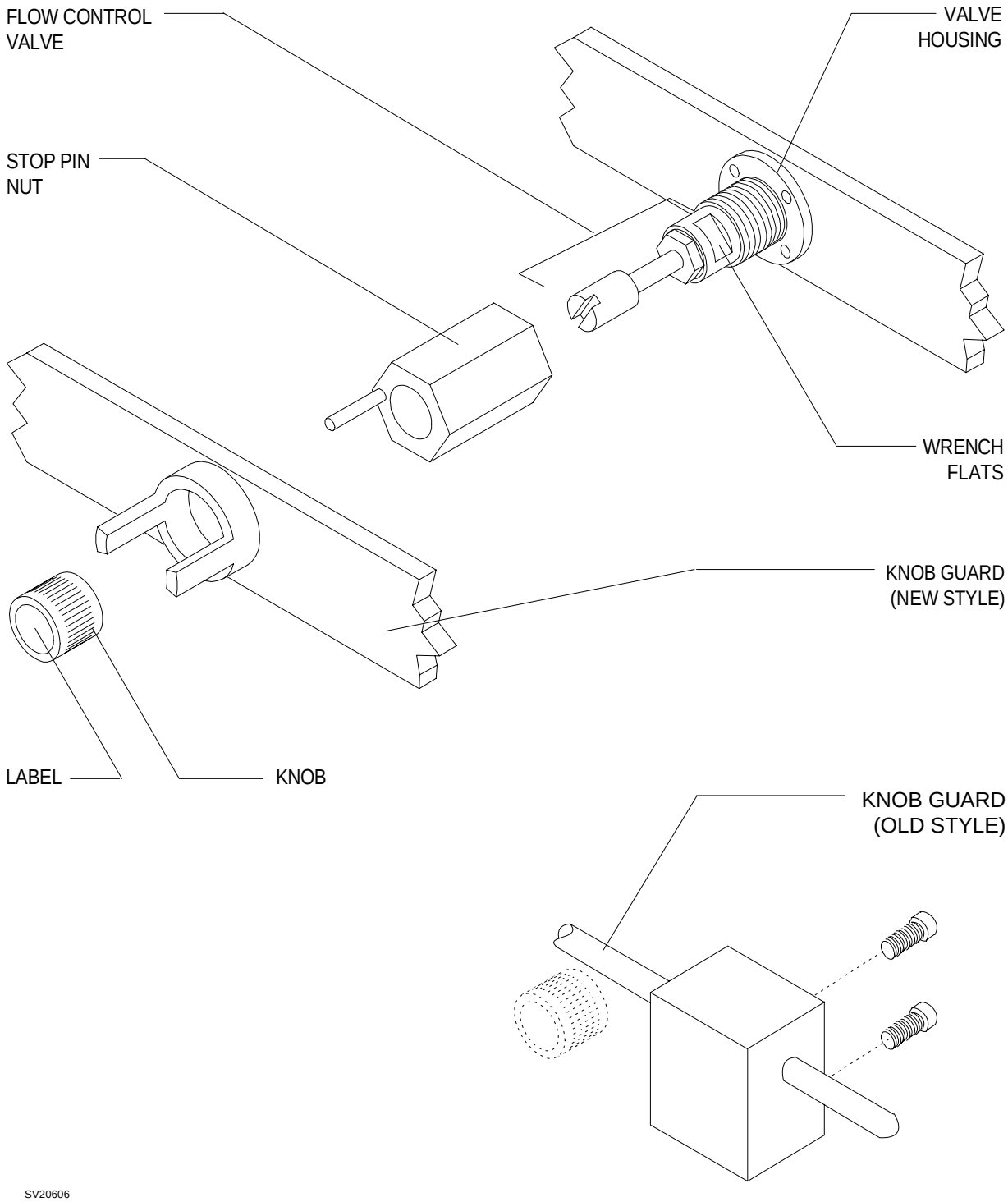


Figure 4-6: FLOW CONTROL VALVES

4.6.14 Set the System Power switch to ON.

4.6.15A For the O_2 flow control valve:

Open the oxygen cylinder valve.

Turn the flow control valve clockwise until the flow rate will not drop any further. (If the machine has been modified to eliminate the minimum flow feature, turn the valve until the flow rate is zero.)

4.6.15B For the other gas flow control valves:

Open the oxygen cylinder valve, and open the cylinder valve corresponding to the flow control valve replacement.

Set the oxygen flow rate to four liters per minute.

Turn the other gas flow control valve clockwise until the flow rate is zero.

4.6.16 Place the knob on the flow control valve shaft and turn it clockwise until it engages the stop pin. Tighten one of the knob setscrews.

4.6.17 Turn the knob in both directions and ensure that the flow can be controlled over its entire range. When the valve is closed, the knob should be against the clockwise stop. Tighten the remaining setscrew.

4.6.18 If the knob label is not horizontal when the valve is closed, remove the label and install a new label in the correct position.

4.6.19 Connect the pipeline hoses.

4.6.20 Perform the PMS Procedure given in Section 6.

4.7 Oxygen Supply Pressure Failure Protection Device

The oxygen supply failure protection devices (failsafe assemblies) are located behind the gas instrumentation panel. Access to these assemblies requires removal of the rear cover. For earlier machines, replacement assemblies are supplied with all hardware out to the first compression fitting in each line.

On later machines with flowmeter assemblies having an Oxygen Ratio Controller (ORC), failsafe assemblies have an additional inlet port that allows both pipeline and cylinder supplies to be connected directly to the failsafe assemblies. Figure 4-7 shows the arrangement for both types of assemblies.

4.7.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.7.2 Close all cylinder valves except the O_2 valve.

4.7.3 Set the oxygen flow to 5 liters per min.

4.7.4 Open the other gas flow control valves to drain pressure from the system.

4.7.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.7.6 Set the System Power switch to STANDBY.

4.7.7 Remove the screws holding the rear cover, and remove the cover.

4.7.8 Cut the tie-wrap clamp on the flexible O_2 control line, and disconnect the flexible tube.

NOTE: On later machines with assemblies that have brass fittings instead of nylon, the flex tubing is attached with a press-on hose clamp instead of a tie strap.

4.7.9 Disconnect the compression fittings at the side ports and at the check valve, and remove the assembly.

NOTE: If fittings must be installed in the replacement block assembly, use Loctite #271 (red). See parts list in Section 8.

4.7.10 Install the replacement failsafe assembly, and tighten all compression fittings.

4.7.11 Connect the flexible tubing to the control port, and install a new tie-wrap clamp.

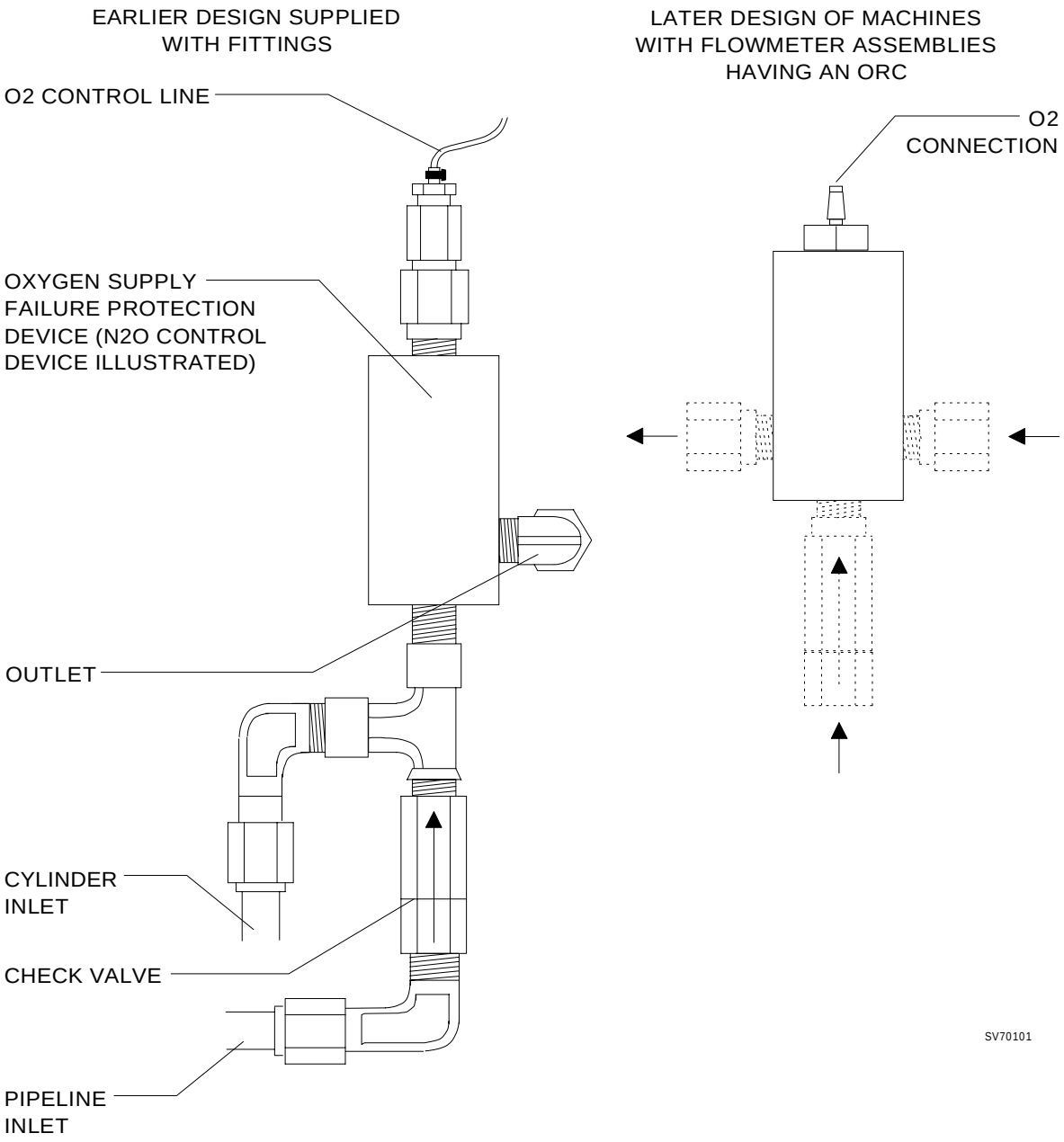


Figure 4-7: OXYGEN SUPPLY FAILURE PROTECTION DEVICE

4.7.12 Perform the following test:

4.7.12.1 Open the cylinder valves.

4.7.12.2 Set the System Power switch to ON.

4.7.12.3 Set the oxygen flow to five liters per minute.

4.7.12.4 Set the other gas flow to five liters per minute.

4.7.12.5 Close the oxygen cylinder valve.

4.7.12.6 As the oxygen flow decreases, the other gas flow should also decrease proportionally.

4.7.12.7 Set the System Power switch to STANDBY.

4.7.13 Replace the rear cover and its retaining screws.

4.7.14 Connect the pipeline hoses.

4.7.15 Perform the PMS Procedure given in Section 6.

4.8 Oxygen Supply Pressure Alarm Switch (earlier machines)

The oxygen supply pressure alarm switch is located behind the gas instrumentation panel. Access to the switch requires removal of the flowmeter housing rear cover. The replacement switch must be tested to ensure that its operating point is set correctly. Figure 4-8 shows the switch assembly on earlier machines where the switch is supported by the O_2 tubing.

On later machines with flowmeter assemblies having an Oxygen Ratio Controller (ORC), the oxygen supply pressure alarm switch is part of the alarm channel assembly. Refer to the procedure titled "Alarm Channel and Oxygen Supply Pressure Alarm Switch" for specific replacement instructions.

4.8.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.8.2 Close all cylinder valves except the O_2 valve.

4.8.3 Set the oxygen flow to 5 liters per min.

4.8.4 Open the other gas flow control valves to drain pressure from the system.

4.8.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.8.6 Set the System Power switch to STANDBY.

4.8.7 Remove the screws holding the rear cover, and remove the cover.

4.8.8 Disconnect the two compression fittings at the TEE.

4.8.9 Note the position of the wires on the switch so that the replacement unit can be connected in the same manner. Disconnect the wires from the switch and remove the assembly.

4.8.10 Connect the wires to the replacement assembly; connect and tighten the compression fittings on the O_2 lines.

4.8.11 Remove the screws holding the table top to the machine and lift out the table top.

4.8.12 Pull the writing or keyboard tray out to its fully extended position.

4.8.13 Locate the TEE fitting in the ¼ in. diameter output line of the O_2 regulator and remove the plug from the TEE fitting.

4.8.14 Connect a dedicated O_2 test gauge to the TEE fitting.

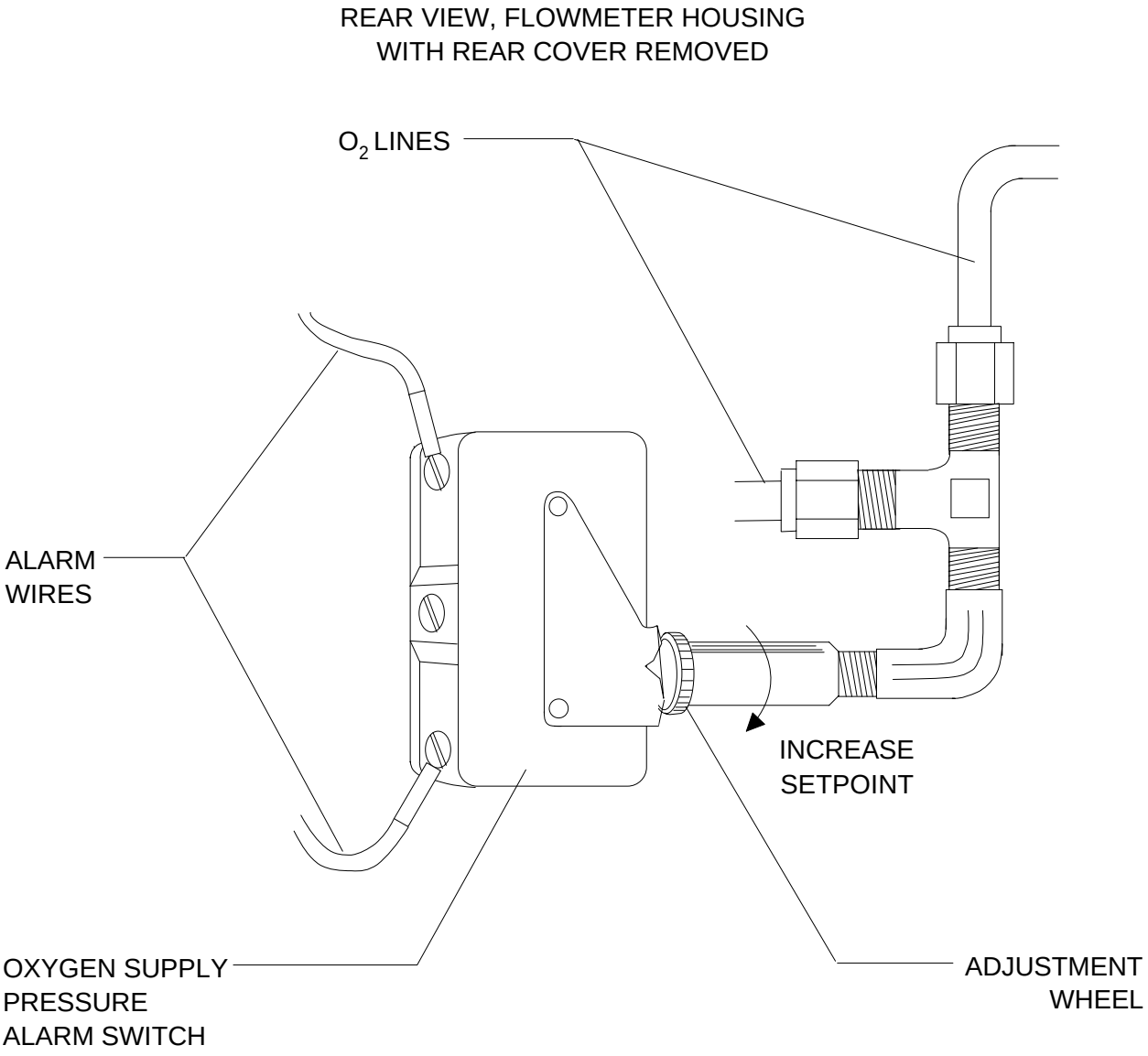


Figure 4-8: OXYGEN SUPPLY PRESSURE ALARM SWITCH

4.8.15 Open the oxygen cylinder valve and set the System Power switch to ON.

4.8.16 Set the oxygen flow to five liters per minute.

4.8.17 Close the oxygen cylinder valve.

4.8.18 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

4.8.19 If the alarm activates when the pressure is below 34 psi, turn the adjustment wheel counter-clockwise, repeat the test and adjust as necessary to bring the set point into the correct range.

If the alarm activates when the pressure is above 40 psi, turn the adjustment wheel clockwise,repeat the test and adjust as necessary to bring the set point into the correct range.

4.8.20 Set the System Power switch to STANDBY.

4.8.21 Disconnect the test gauge and replace the plug in the regulator line TEE fitting.

4.8.22 Replace the table top and its retaining screws.

4.8.23 Replace the rear cover and its retaining screws.

4.8.24 Connect the pipeline hoses.

4.8.25 Perform the PMS Procedure given in Section 6.

4.9 Oxygen Supply Pressure Alarm Whistle (Canada)

The oxygen supply pressure alarm whistle is located inside the flowmeter housing. Access to the whistle assembly requires removal of the flowmeter housing rear cover. Figure 4-9 shows the arrangement of the whistle assembly within the flowmeter housing, and indicates the compression fittings that need to be disconnected in order to remove the assembly.

4.9.1 Set the System Power switch to STANDBY, and remove AC power from the machine.

4.9.2 Close all cylinder valves and disconnect the pipeline hoses.

4.9.3 Press the O_2 FLUSH button to remove pressure from the oxygen circuit.

4.9.4 Remove the screws holding the flowmeter housing rear cover, and remove the cover.

4.9.5 Disconnect the three compression fittings at the locations shown in the illustration, and remove the whistle assembly.

4.9.6 Position the replacement whistle assembly in the flowmeter housing, connect and tighten the three compression fittings.

4.9.7 Replace the flowmeter housing rear cover and its retaining screws.

4.9.8 Connect the pipeline hoses and perform the following test:

-- Set the System Power switch to ON.

-- Set the oxygen flow rate to 1 l/min.

-- Close the pipeline supply valve and observe the pipeline pressure gauge.

-- The alarm whistle shall sound for a minimum of 10 seconds when the pressure drops below the range of 35 to 30 PSI.

4.9.9 Perform the PMS Procedure given in Section 6.

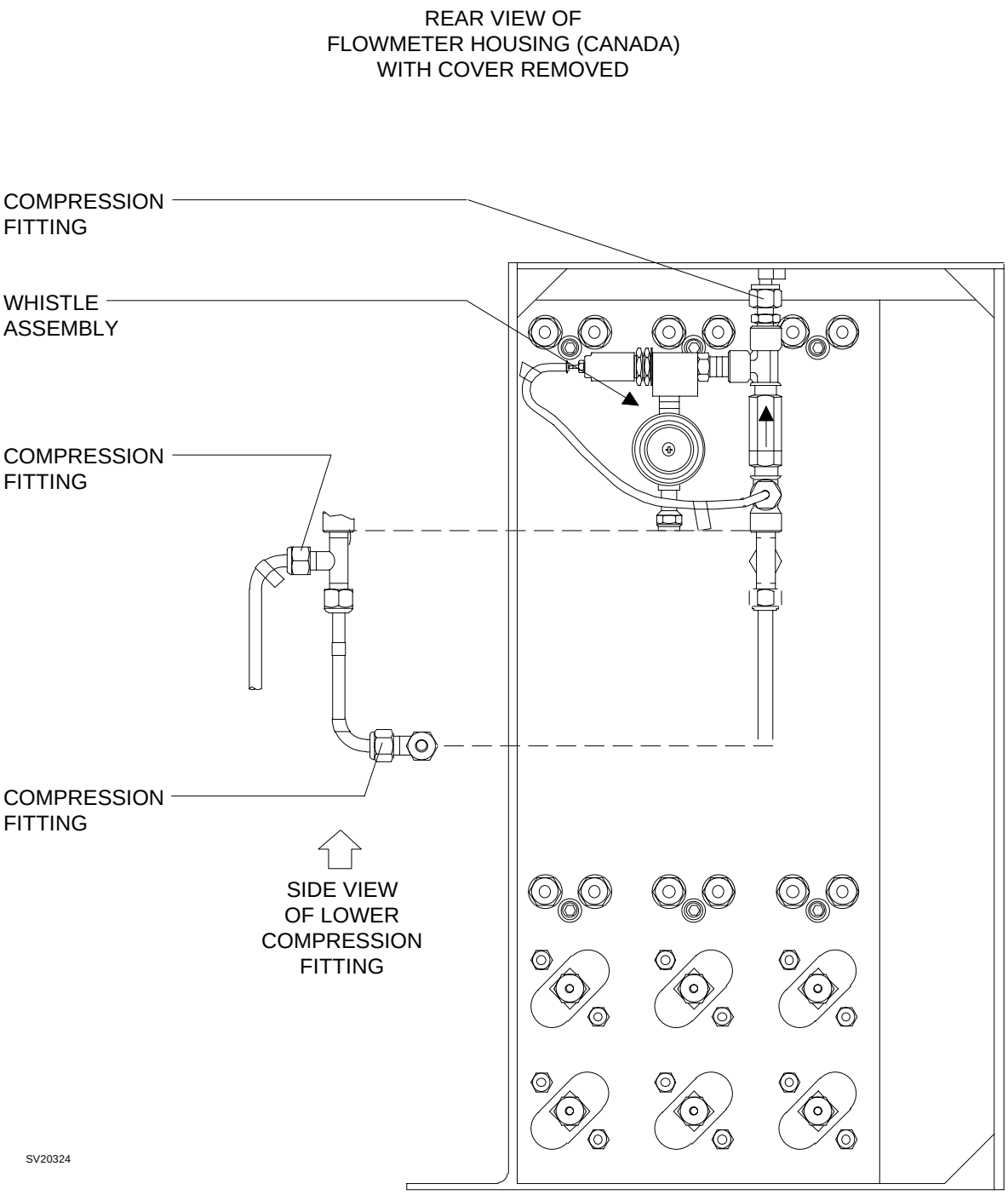


Figure 4-9: OXYGEN SUPPLY PRESSURE ALARM WHISTLE (CANADA)

4.10 Oxygen Ratio Monitor/Controller

The oxygen ratio monitor/controller (ORMC) is located in the vapor box and is accessible by removing the rear cover panel above the vaporizer mounts. Figure 4-10 shows the location of the ORMC mounting screws and connections. Test and adjustment instructions are included in the following procedure.

NOTE: Steps marked with an asterisk (*) do not apply to later model machines that do not have the O_2/N_2O ratio lamp on the alarm channel.

4.10.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.10.2 Close all cylinder valves except the O_2 valve.

4.10.3 Set the oxygen flow to 5 liters per min.

4.10.4 Open the other gas flow control valves to drain pressure from the system.

4.10.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.10.6 Set the System Power switch to STANDBY.

4.10.7 Remove the four screws holding the vapor box rear cover, and remove the cover.

4.10.8 Remove the two screws holding the ORMC to the bottom of the vapor box.

4.10.9 Remove the four screws holding the bottom plate of the vapor box, and remove the plate to gain access to the ORMC connections.

4.10.10 Disconnect the flexible O_2 tubing from the left side of the ORMC, and disconnect the flexible N_2O tubing from the right side of the MPL switch. (Later models do not have the MPL switch.)

* 4.10.11 Cut the tie-wrap clamp on the in-line wiring harness connectors, and separate the two ORMC connections.

4.10.12 While holding the ORMC, carefully disconnect the compression fittings on the N_2O lines.

4.10.13 Disconnect the remaining flexible N_2O tubing from the tee fitting at the front of the ORMC. (Later models do not have the tee fitting.)

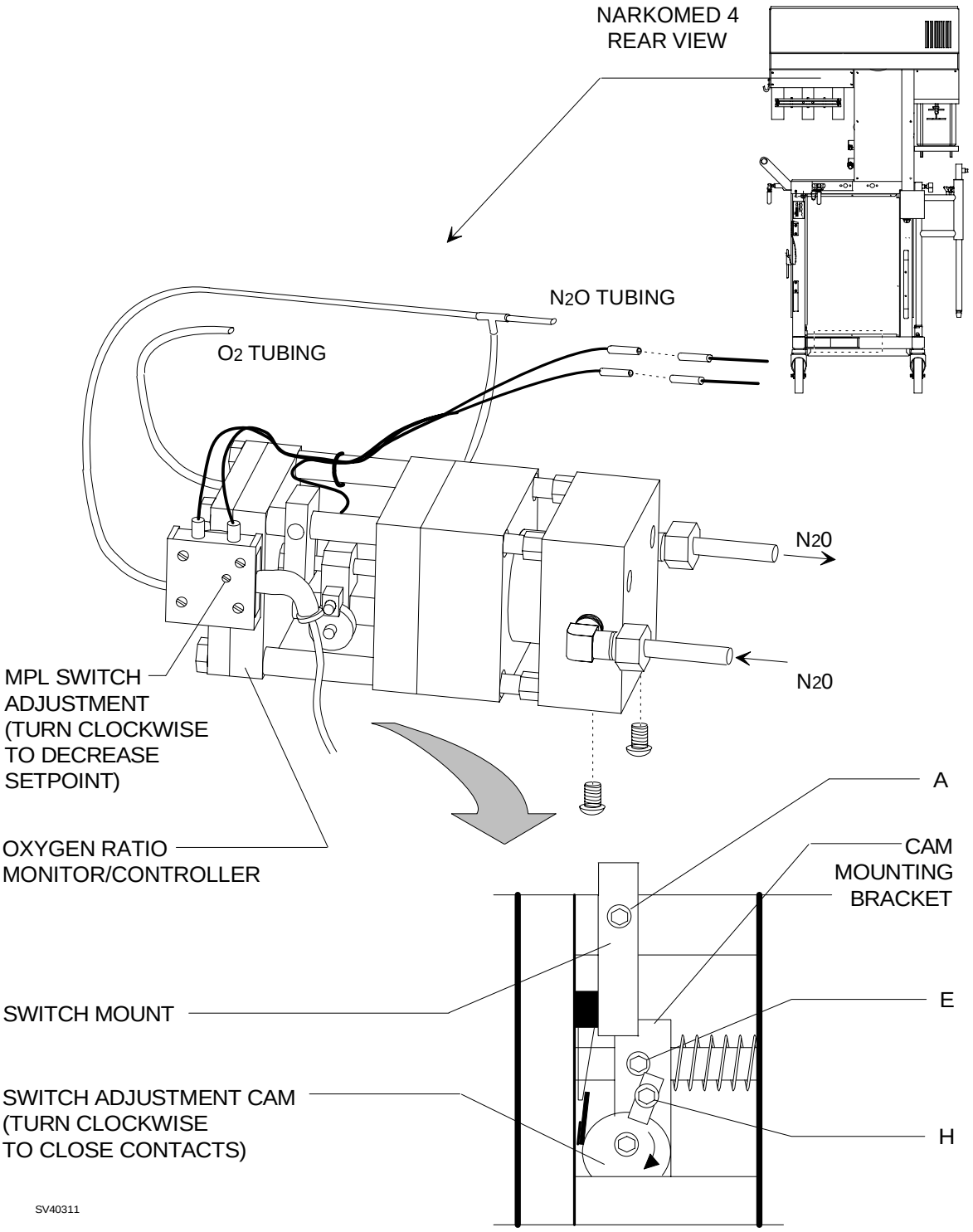


Figure 4-10: OXYGEN RATIO MONITOR/CONTROLLER

4.10.14 Connect the flexible N_2O tubing that was removed in the previous step to the tee fitting at the front of the replacement ORMC, and secure the connection with a new tie strap clamp. (Later models do not have the tee fitting.)

4.10.15 Connect the copper N_2O lines to the replacement ORMC and tighten the compression fittings.

* 4.10.16 Join the in-line wiring harness to the replacement ORMC connectors and install a new tie-wrap cable clamp.

4.10.17 Connect the flexible O_2 tubing to the left side of the ORMC, and connect the flexible N_2O tubing to right side of the MPL switch. Secure each connection with a press-on clamp. (Later models do not have the MPL switch.)

4.10.18 Open the O_2 and N_2O cylinder valves.

4.10.19 Set the System Power switch to ON, and perform the following test:

4.10.19.1 Open the N_2O flow control valve three turns. There should be no nitrous oxide flow.

4.10.19.2 Slowly open the O_2 flow control valve. The nitrous oxide should start to flow when the oxygen flow is between 200 and 300 ml per minute.

4.10.19.3 Connect a calibrated oxygen monitor to the Freshgas Outlet.

4.10.19.4 Adjust the oxygen flow to 1 liter per minute. The oxygen concentration should be between 21% and 29% oxygen.

* 4.10.19.5 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should be lighted.

4.10.19.6 Adjust the oxygen flow to 1.5 liters per minute. The oxygen concentration should be between 21% and 29% oxygen.

* 4.10.19.7 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should be lighted.

4.10.19.8 Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

* 4.10.19.9 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should be lighted.

4.10.19.10 Close the oxygen flow control valve. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

4.10.19.11 The nitrous oxide flow should stop when the flow of oxygen is between 200 and 300 ml per minute.

4.10.19.12 Close the N_2O flow control valve and set the System Power switch to STANDBY.

NOTE: If the ORMC is not working properly, perform the adjustment procedure given in Section 5.

4.10.20 Replace the bottom plate of the vapor box. Be sure it is oriented correctly with the ORMC mounting holes in the correct position.

4.10.21 Secure the ORMC to the bottom of the vapor box with its two mounting screws.

4.10.22 Replace the rear cover of the vapor box.

4.10.23 Perform the PMS Procedure given in Section 6.

4.11 Oxygen Ratio Controller (machines with E-Z Plumb piping)

The Oxygen Ratio Controller (ORC) is part of the N_2O flowmeter sub-assembly and is located within the flowmeter housing. The ORC is accessible by removing the rear flowmeter housing cover. Figure 4-11 shows a typical ORC location and mounting arrangement, with a detail of the O-rings and filter.

The following procedure applies to both ORC designs: P/N 4111800, and Low Flow design P/N 4113229.

4.11.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.11.2 Close all cylinder valves except the O_2 valve.

4.11.3 Set the oxygen flow to 5 liters per min.

4.11.4 Open the other gas flow control valves to drain pressure from the system.

4.11.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.11.6 Set the System, Power switch to STANDBY.

4.11.7 Remove the press-on clamp securing the flexible O_2 line to the ORC, and carefully disconnect the tubing from the hose barb.

4.11.8 Remove the three screws holding the ORC to the flowmeter sub-assembly, and carefully remove the ORC from the flowmeter housing.

4.11.9 For low flow ORC (P/N 4113229) replacement, install the 6 in. length of flexible tubing with a blue N_2O label on the replacement ORC (see detail view in illustration) Secure each connection with a press-on hose clamp.

Position the replacement ORC at the back of the N_2O flowmeter sub-assembly; be sure that its O-rings and filter are in place, and install its three mounting screws.

4.11.10 Connect the flexible O_2 line to the ORC and secure it with the press-on hose clamp.

4.11.11 Open the O_2 and N_2O cylinder valves.

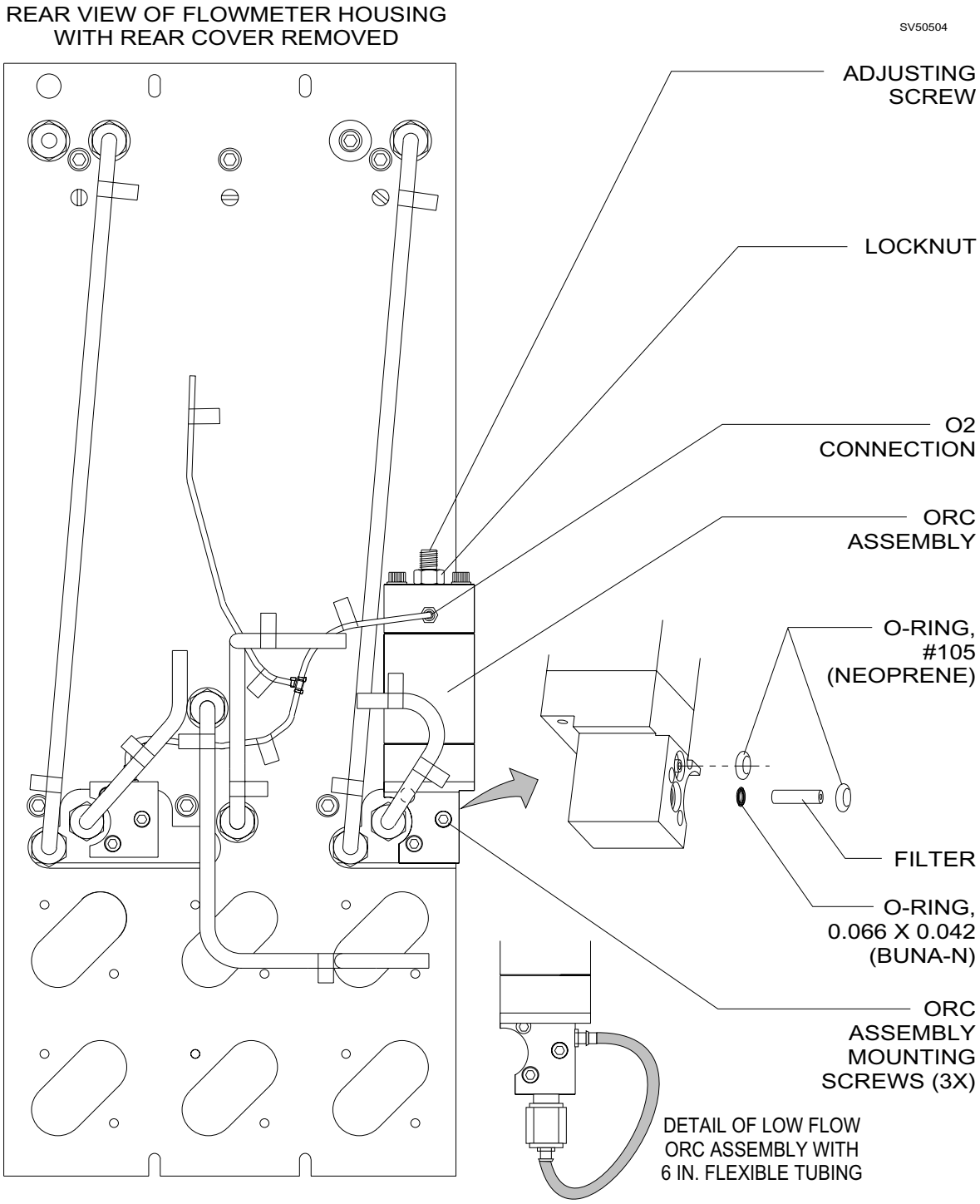


Figure 4-11: OXYGEN RATIO CONTROLLER

4.11.12 Perform the ORC adjustment procedure given in Section 5 of this manual.

NOTE: There are two adjustment procedures - one for ORC P/N 4111800, and one for low flow ORC P/N 4113229. Be sure to follow the correct procedure.

4.11.13 Reinstall the flowmeter housing rear cover.

4.11.14 Perform the PMS Procedure given in Section 6.

4.12 Vaporizers

Each vaporizer is held to the machine by two metric sized hex screws. These screws are accessible at the back of the vaporizer mount, below the interlock mechanism as shown in Figure 4-12. Before removing a vaporizer from the machine, it must be completely drained and dried in accordance with the procedure given below. Be sure to have a suitable packing or storage container available in which to place the vaporizer.

CAUTION: The following steps must be performed in the sequence given.

4.12.1 Set the System Power switch to ON.

4.12.2 Set all vaporizer handwheels to their Zero or OFF position.

WARNING: Do not inhale anesthetic vapors as this could result in personal injury.

4.12.3 Remove the filler and drain plugs, and drain the vaporizer into a suitable container. Dispose of the residual agent in an approved manner.

4.12.4 Turn the vaporizer handwheel to the maximum concentration setting.

4.12.5 Set the oxygen flow to 10 l/min. for at least 20 minutes.

WARNING: This procedure must be performed in a well ventilated area and without personnel present.

4.12.6 Turn the vaporizer handwheel to 0 (zero), and replace the filler and drain plugs.

4.12.7 Turn the oxygen flow off, and set the System Power switch to STANDBY.

4.12.8 While holding the vaporizer, remove the mounting screws and carefully separate the vaporizer from the machine. Note the arrangement of gaskets so that the replacement vaporizer can be installed in the same manner.

4.12.9 Place the vaporizer in a suitable container for transport or storage.

WARNING: Do not tilt a vaporizer that contains anesthetic agent more than 45 degrees. Failure to observe this precaution will render the handwheel calibration invalid.

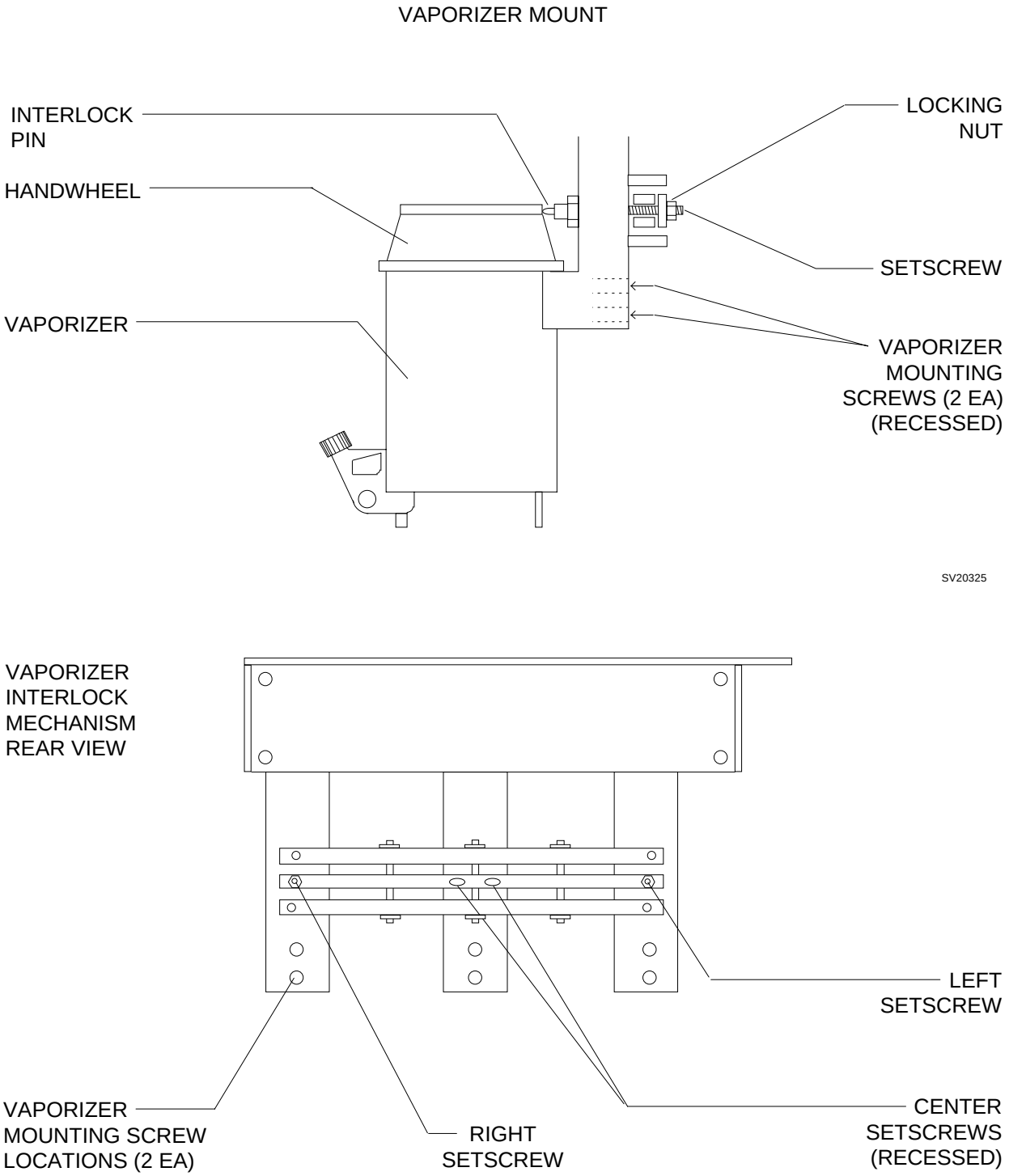


Figure 4-12: VAPORIZER INSTALLATION AND INTERLOCK ADJUSTMENT

NOTE: Should a vaporizer containing anesthetic agent be accidentally tilted more than 45 degrees, it must be drained and flushed in accordance with instructions given in the manual supplied with the vaporizer.

4.12.10 Set the handwheel on the replacement vaporizer to its Zero position.

4.12.11 Install the replacement vaporizer on the machine (be sure the O-rings are in place) and tighten the mounting screws to a torque of 24 to 26.5 inch pounds.

4.12.12 Perform the following test on the interlock mechanism and make any necessary adjustments:

4.12.12.1 Turn the center vaporizer handwheel ON. The left and the right vaporizer handwheels should be locked in their Zero position. If the left or right vaporizer does not lock, tighten the corresponding center set screw until the handwheel locks properly.

4.12.12.2 Turn the center vaporizer OFF and turn the left vaporizer ON. The center and the right vaporizer handwheels should be locked in their Zero position. If the right vaporizer does not lock, loosen the locking nut on the right set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE: Do not over-tighten the set screws. Each vaporizer handwheel must turn easily while the other vaporizers are locked .

4.12.12.3 Turn the left vaporizer OFF and turn the right vaporizer ON. The center and the left vaporizer handwheels should be locked in their Zero position. If the left vaporizer does not lock, loosen the locking nut on the left set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

4.12.13 Perform the PMS Procedure given in Section 6.

4.13 O2 Flush Valve

The O_2 flush valve is located at the front of the machine next to the freshgas outlet. Access to the flush valve requires removal of the table top. Figure 4-13 shows the mounting and assembly details of the flush valve.

4.13.1 Set the System Power switch to STANDBY.

4.13.2 Disconnect all pipeline hoses.

4.13.3 Close the O_2 cylinder valve.

4.13.4 Press the O_2 Flush valve to drain oxygen pressure from the system.

4.13.5 Remove the screws holding the table top to the machine and lift out the table top.

4.13.6 Hold the O_2 Flush button in and rotate it until one of its set screws are visible through the access hole in the guard ring, and loosen the set screw.

4.13.7 Turn the O_2 Flush button 180 degrees, hold it in and loosen the other set screw.

4.13.8 Remove the O_2 Flush button and washer from the valve shaft.

4.13.9 Disconnect the two compression fittings at the valve.

NOTE: Do not lose the flow restrictor located at the right-angle fitting. This restrictor will be transferred to the replacement valve assembly.

4.13.10 The O_2 Flush valve is retained by the guard ring on the front of the machine frame. Hold the body of the Clippard valve with an open end wrench; insert a rod or hex wrench through the holes in the guard ring (or use a spanner wrench), and un-screw the guard ring from the front of the frame rail.

4.13.11 Assemble the replacement O_2 Flush valve, spacer, internal tooth lock washer and guard ring through the frame and tighten the assembly, making sure that the valve is mounted straight.

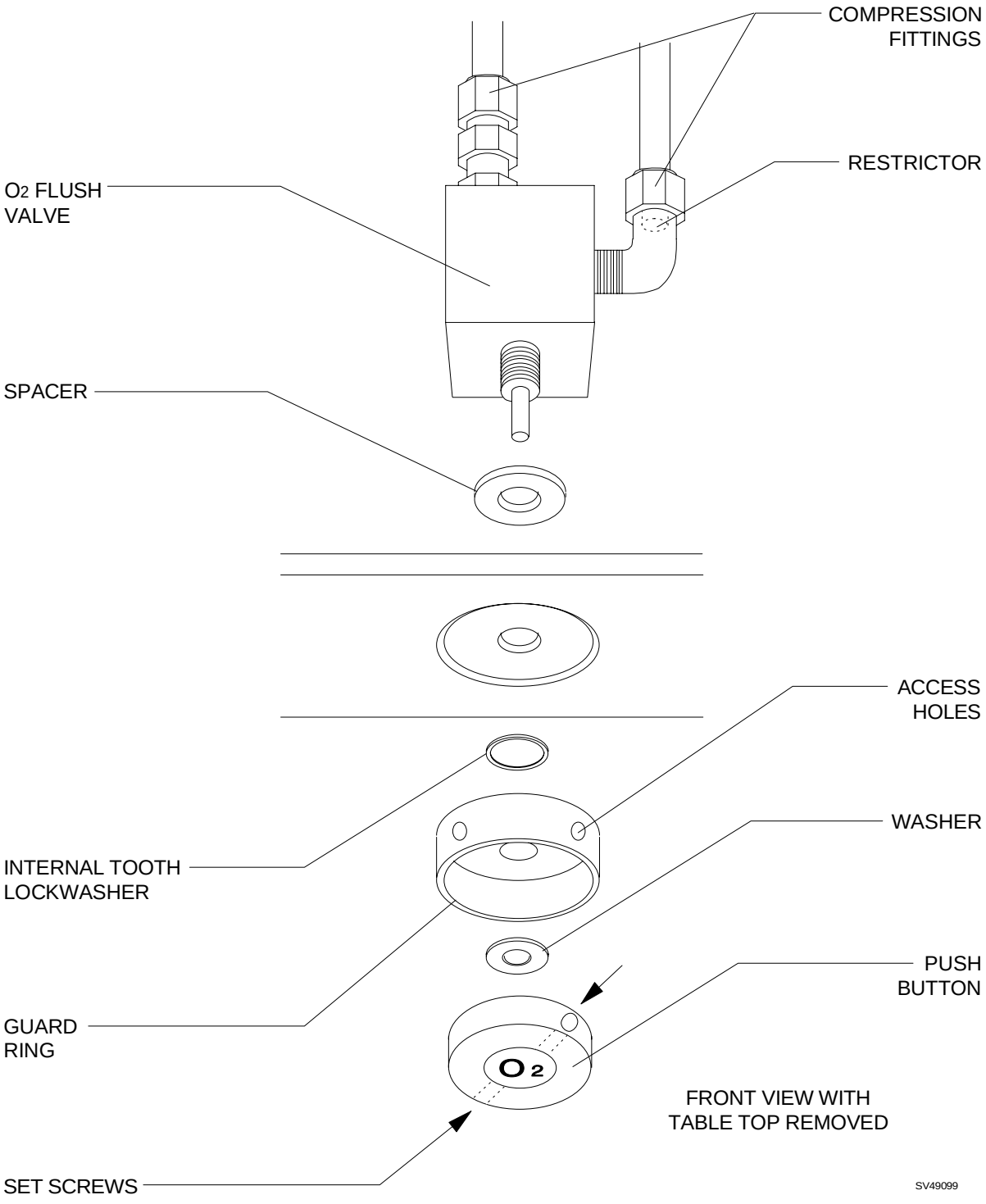


Figure 4-13: O_2 FLUSH VALVE

4.13.12 Connect the compression fittings to the valve. Be sure the flow restrictor is in place at the right-angle fitting.

4.13.13 Place the washer and the O_2 Flush button on the valve shaft.

4.13.14 Hold the O_2 Flush button in and turn it until a set screw is visible through an access hole in the guard ring. Tighten the set screw. Rotate the button 180 degrees until the other set screw is visible, and tighten the set screw.

4.13.15 Disconnect the absorber freshgas hose from the freshgas outlet. Connect a test gauge and B.P. bulb to the freshgas outlet, and perform the following test:

4.13.15.1 Open the oxygen cylinder valve.

4.13.15.2 Release any pressure that is indicated on the test gauge.

4.13.15.3 Over the next 60 seconds, the test gauge should not show a pressure increase greater than 2 cm H_2O.

4.13.15.4 Increase the pressure to 50 cm H_2O.

4.13.15.5 The pressure should not drop more than 10 cm H_2O in the next 30 seconds.

4.13.15.6 Disconnect the test gauge from the freshgas outlet.

4.13.15.7 Open the oxygen cylinder valve and allow the pressure to stabilize. (The cylinder pressure must be at least 1000 psi for this test.)

4.13.15.8 Close the oxygen cylinder valve.

4.13.15.9 The pressure should not drop more than 50 psi in two minutes.

4.13.15.10 Connect a volumeter to the freshgas outlet, and reset the volumeter to zero.

4.13.15.11 Press the O_2 Flush button and observe the flow rate. It should be between 45 and 65 liters per minute.

4.13.15.12 Disconnect the volumeter from the freshgas outlet.

4.13.16 Connect the absorber freshgas hose to the freshgas outlet.

4.13.17 Replace the table top and secure it with the mounting screws.

4.13.18 Connect the pipeline hoses.

4.13.19 Perform the PMS Procedure given in Section 6.

4.14 AV-E Ventilator Controller Assembly

The ventilator controller assembly is located in the left side of the ventilator box. Access to the controller requires removing the front panel from the ventilator box. Figure 4-14 shows the mounting screw locations and cable connections to the ventilator controller.

4.14.1 Set the System Power switch to STANDBY.

4.14.2 Remove the four screws holding the ventilator box front panel. Remove the panel and carefully separate the ventilator switch in-line connector.

4.14.3 Remove the two screws holding the ventilator controller assembly to the floor of the ventilator box.

4.14.4 Pull the controller assembly forward and disconnect the two cables from J1 and J2 at the back of the assembly, and remove the controller assembly.

4.14.5 Plug the cables that were previously removed into J1 and J2 on the back of the replacement controller assembly.

VENTILATOR BOX TOP VIEW

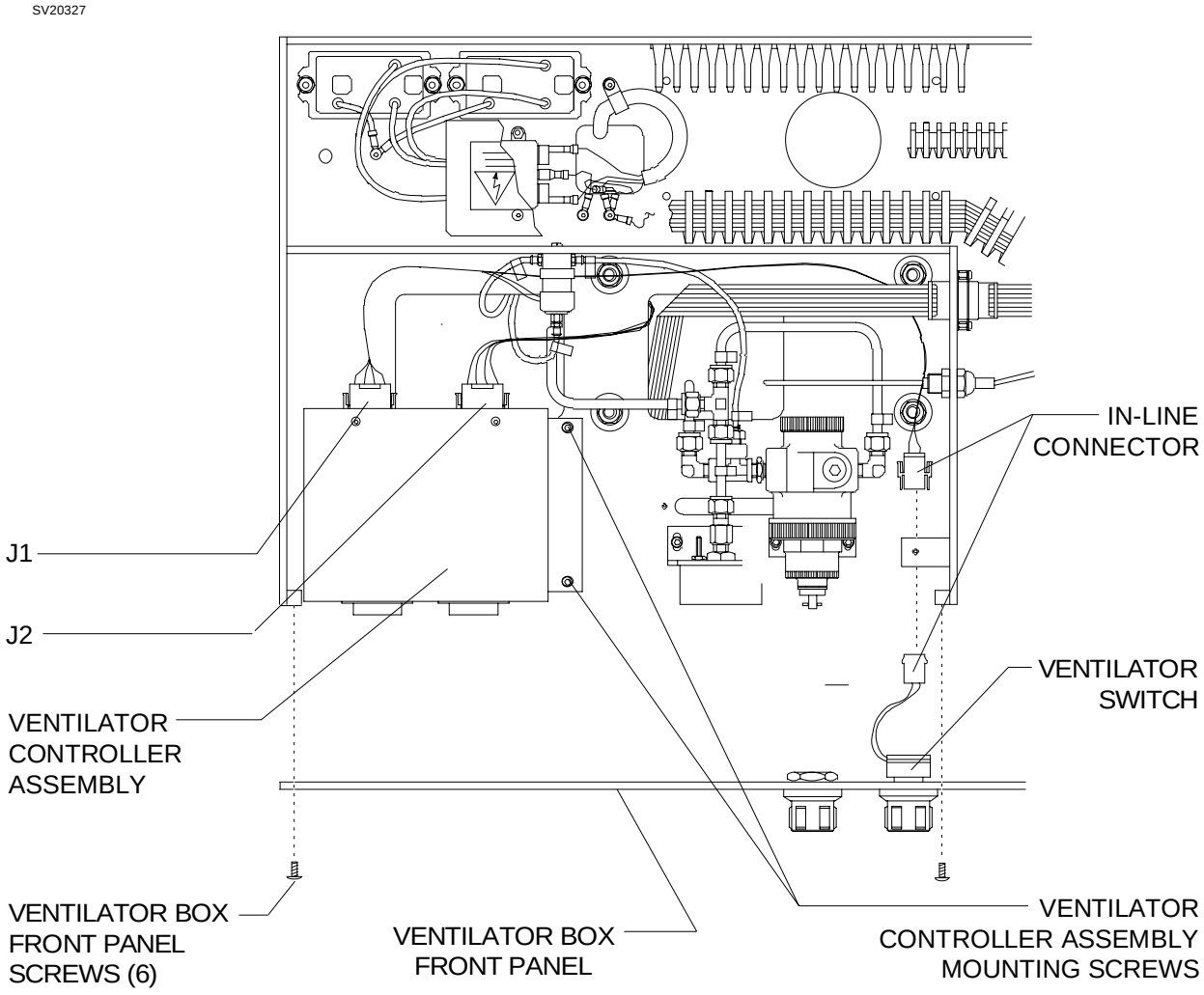


Figure 4-14: VENTILATOR CONTROLLER ASSEMBLY

4.14.6 Mount the replacement controller assembly to the floor of the ventilator box and secure it with the two mounting screws.

4.14.7 Join the ventilator switch in-line connector, and replace the front panel of the ventilator box.

4.14.8 Perform the PMS Procedure given in Section 6.

4.15 AV-E Ventilator Solenoid Valve

The ventilator solenoid valve is located in the ventilator box and is mounted on the inner back wall of the box. Replacement of the solenoid valve requires lifting the monitor box to gain access to its mounting and connections. Figure 4-15 shows the mounting location, electrical connections and tubing arrangement of the solenoid valve.

4.15.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.15.2 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of this procedure.

4.15.3 Raise the rear left side of the monitor box chassis approximately two inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.15.4 Remove the two screws holding the safety cover over the AC power filter, and remove the cover.

4.15.5 Remove the two screws holding the solenoid valve to the inner wall of the ventilator box.

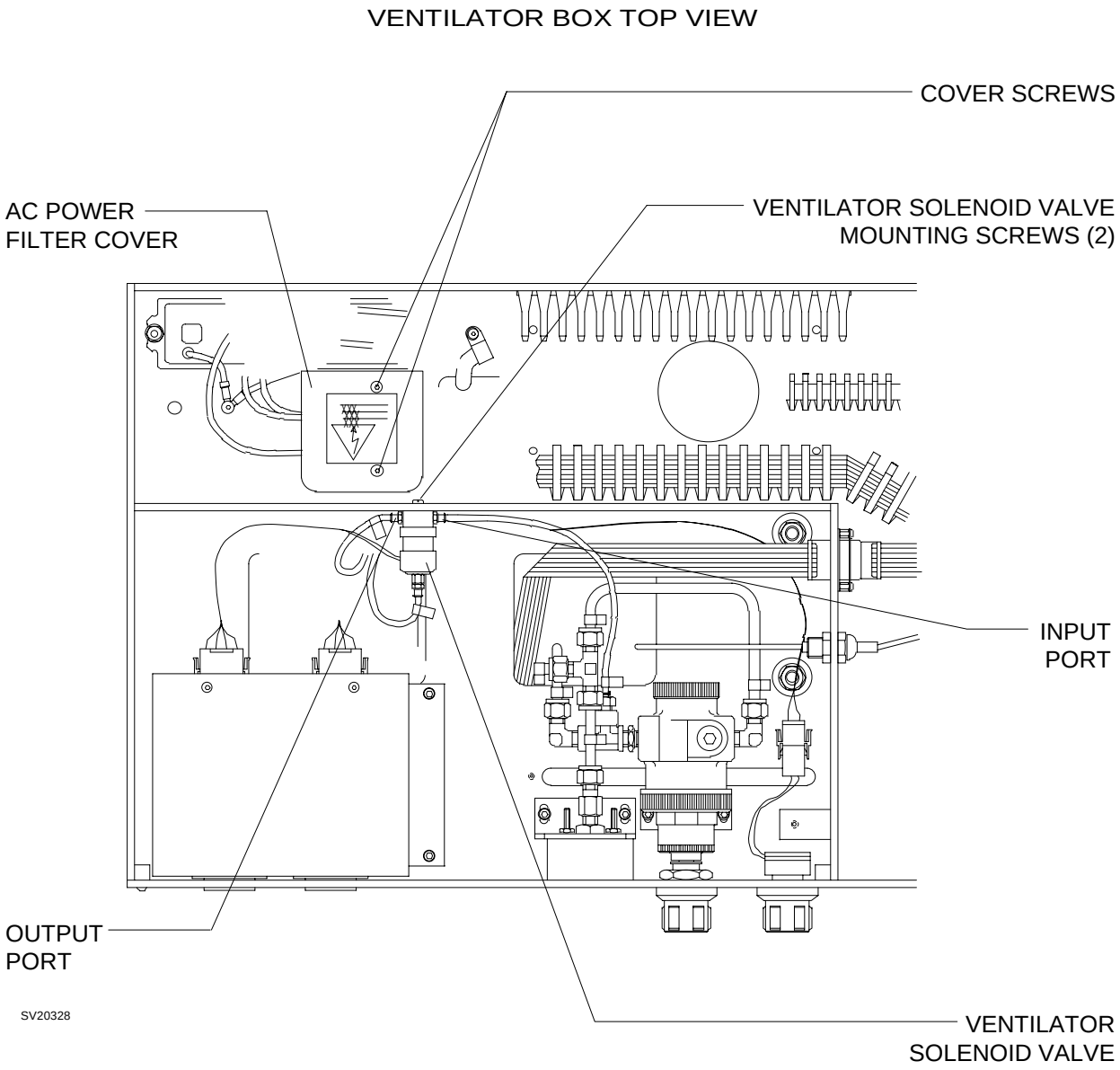


Figure 4-15: VENTILATOR SOLENOID VALVE

4.15.6 Remove the prop from the rear left side of the monitor box, and return the box to its normal position.

4.15.7 Raise the front of the monitor box approximately four inches, and prop the box open.

4.15.8 Pull the solenoid valve forward to gain access to its connections, and remove the electrical connections.

4.15.9 Remove the three flexible tubing connections and remove the solenoid valve. Mark each tube so that the replacement solenoid can be connected in the same manner.

4.15.10 Connect the flexible tubing to the replacement solenoid valve.

4.15.11 Connect the two wires to the solenoid, and place the solenoid near its mounting position.

4.15.12 Remove the prop from the front of the monitor box and lower the box to its original position.

4.15.13 Raise the rear of the monitor box chassis approximately two inches, and prop the box open.

4.15.14 Mount the solenoid valve to the ventilator box using the original hardware.

4.15.15 Replace the safety cover over the AC power filter and secure it with the two screws.

4.15.16 Remove the prop from the rear of the monitor box, and return the box to its normal position.

4.15.17 Replace the screws holding the monitor box to the ventilator box.

4.15.18 Restore power to the machine and perform the PMS Procedure given in Section 6.

4.16 AV-2 Ventilator Controller Assembly

The Ventilator Controller assembly is attached to the left front panel of the ventilator box and includes electrical and pneumatic components. Figure 4-16 shows the mounting screw locations and connections to the ventilator controller. Flexible tubing allows the assembly to be pulled from the front of the ventilator box without raising the monitor box.

4.16.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.16.2 Disconnect all pipeline hoses and close all cylinder valves.

CAUTION: The controller circuit board contains static sensitive devices. Use ESD protection when handling the controller assembly.

4.16.3 Remove the two screws securing the left end of the ventilator controller panel.

4.16.4 Pull the left side of the panel outward, slide it to the left until the locking tab on the right side of the panel is clear of its receptacle, then pull the assembly out far enough to gain access to its connections.

4.16.5 Disconnect the alarm channel wiring harness from J2 on the controller circuit board.

4.16.6 Disconnect the following large and small diameter pneumatic tubing (the letters are keyed to the illustration):

A: Small dia. tube from solenoid to rear vent fitting on bellows box
B: Large dia. tube from supply valve to venturi
C: Small dia. tube to auto-ranging valve
D: Large dia. tube from main switch (O_2 supply)

4.16.7 Remove the controller assembly from the machine.

4.16.8 Position the replacement controller assembly in the ventilator box and reconnect the four pneumatic lines.

4.16.9 Reconnect the alarm channel wire harness to J2 on the controller circuit board.

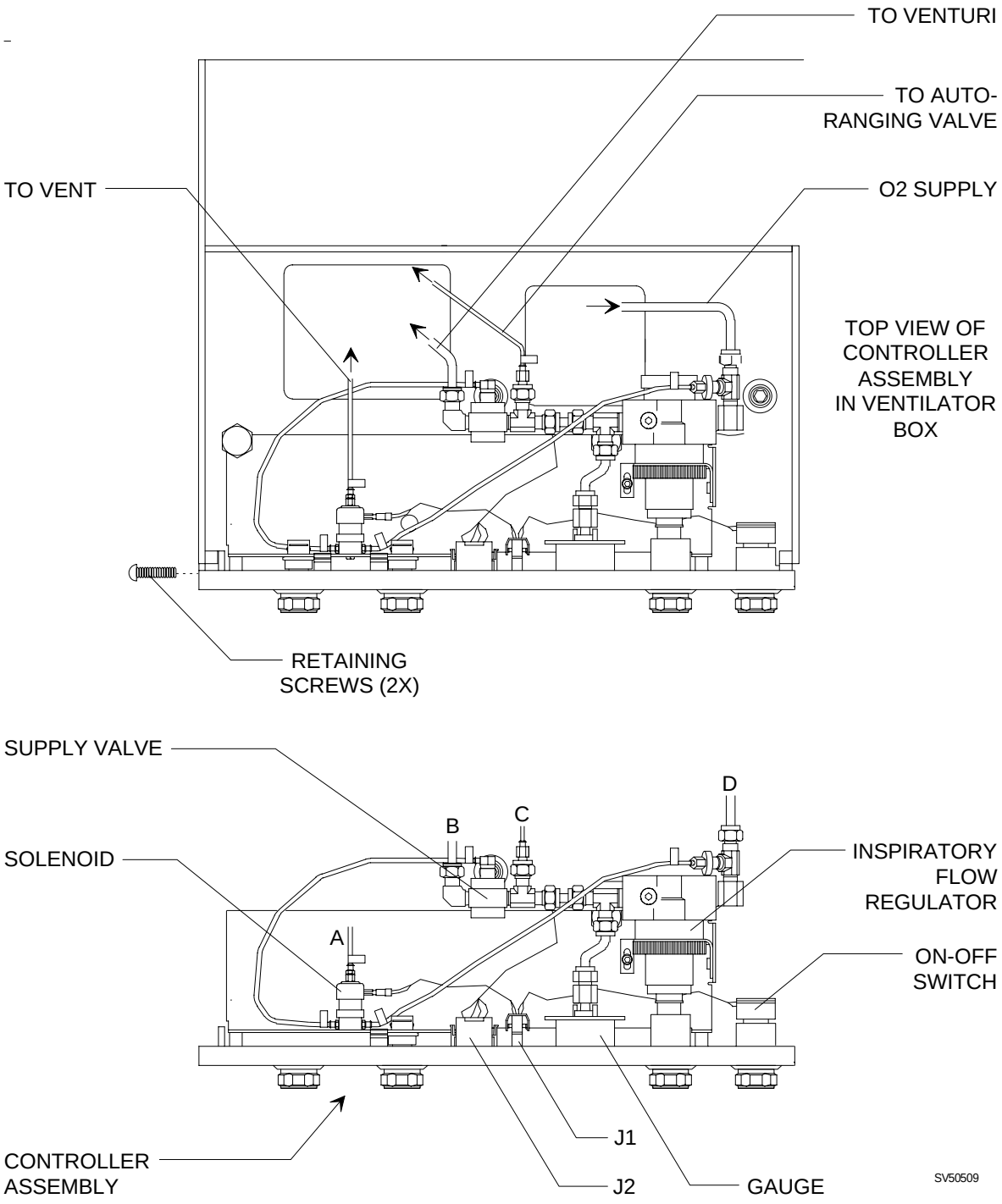


Figure 4-16: AV-2 VENTILATOR CONTROLLER ASSEMBLY

4.16.10 Slide the controller into the ventilator box, carefully fit the locking tab into its receptacle at the right side of the panel, and slide the assembly to the right until it is properly seated.

4.16.11 Reinstall the two retaining screws at the left side of the panel.

4.16.12 Perform the PMS Procedure given in Section 6.

4.17 Convenience Outlet AC Power Filter

The convenience outlet AC power filter is located in the back of the ventilator box near the AC convenience outlets. Access to the power filter requires lifting the monitor box. Figure 4-17 shows the location of the filter, its connections and its mounting arrangement.

4.17.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.17.2 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of this procedure.

4.17.3 Raise the rear of the monitor box chassis approximately two inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.17.4 Remove the two screws holding the safety cover over the AC power filter, and remove the cover.

4.17.5 Disconnect the AC wiring from each side of the filter. Note the position of the wires so they can be re-installed in the same manner.

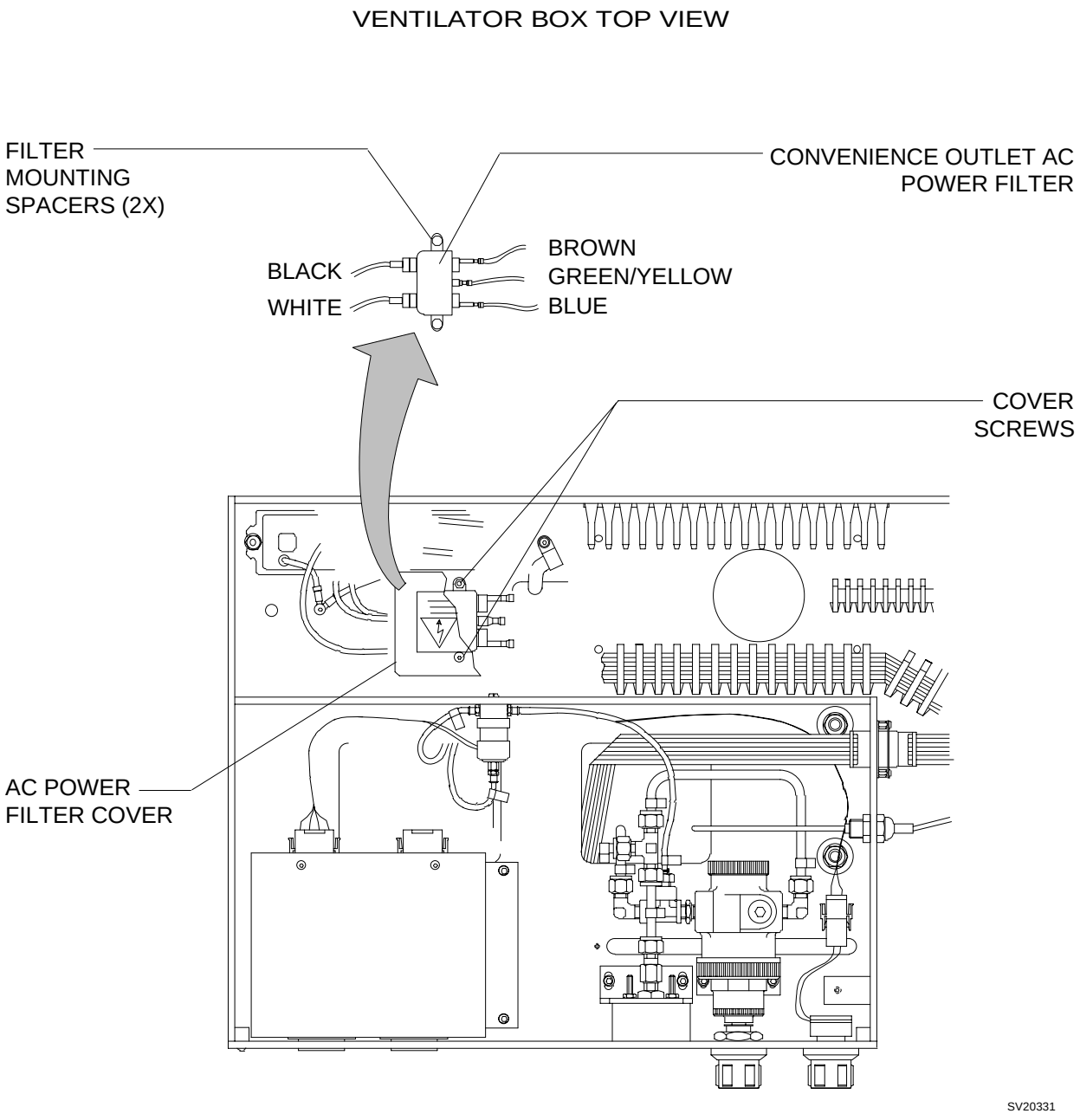


Figure 4-17: CONVENIENCE OUTLET AC POWER FILTER

4.17.6 Unscrew the two hex post nuts holding the filter to the ventilator box, and remove the filter.

4.17.7 Install the replacement filter and secure it with the two hex post nuts.

4.17.8 Connect the AC wiring to the replacement filter. Be sure to observe the wire color code as illustrated.

4.17.9 Place the safety cover over the filter and secure it with the two screws.

4.17.10 Remove the prop from the rear of the monitor box, and return the box to its normal position.

4.17.11 Replace the screws holding the monitor box to the ventilator box.

4.17.12 Restore power to the machine and perform the PMS Procedure given in Section 6.

4.18 AV-E Inspiratory Flow Regulator

The inspiratory flow regulator is located in the ventilator box. Access to the regulator requires removal of the ventilator box front panel, and lifting the monitor box. Figure 4-18 shows the regulator mounting arrangement and its connections.

4.18.1 Set the System Power switch to STANDBY.

4.18.2 Remove the four screws holding the ventilator box front panel. Remove the panel and carefully separate the ventilator switch in-line connector.

4.18.3 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of this procedure.

4.18.4 Raise the front of the monitor box chassis approximately four inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.18.5 Disconnect the two compression fittings at the regulator.

4.18.6 Remove the tie strap securing the small diameter flex tubing to the hose barb on the flow regulator assembly, and disconnect the tubing.

4.18.7 Un-screw the retaining ring holding the regulator to its mounting bracket, and remove the regulator.

4.18.8 Install the replacement regulator in the mounting bracket and tighten the mounting ring.

4.18.9 Connect the two compression fittings to the regulator.

4.18.10 Reattach the small diameter flex tubing previously removed from the regulator assembly and secure the connection with a tie strap.

4.18.11 Remove the prop from the front of the monitor box, and return the box to its normal position.

4.18.12 Replace the four screws holding the monitor box to the ventilator box.

VENTILATOR BOX TOP VIEW

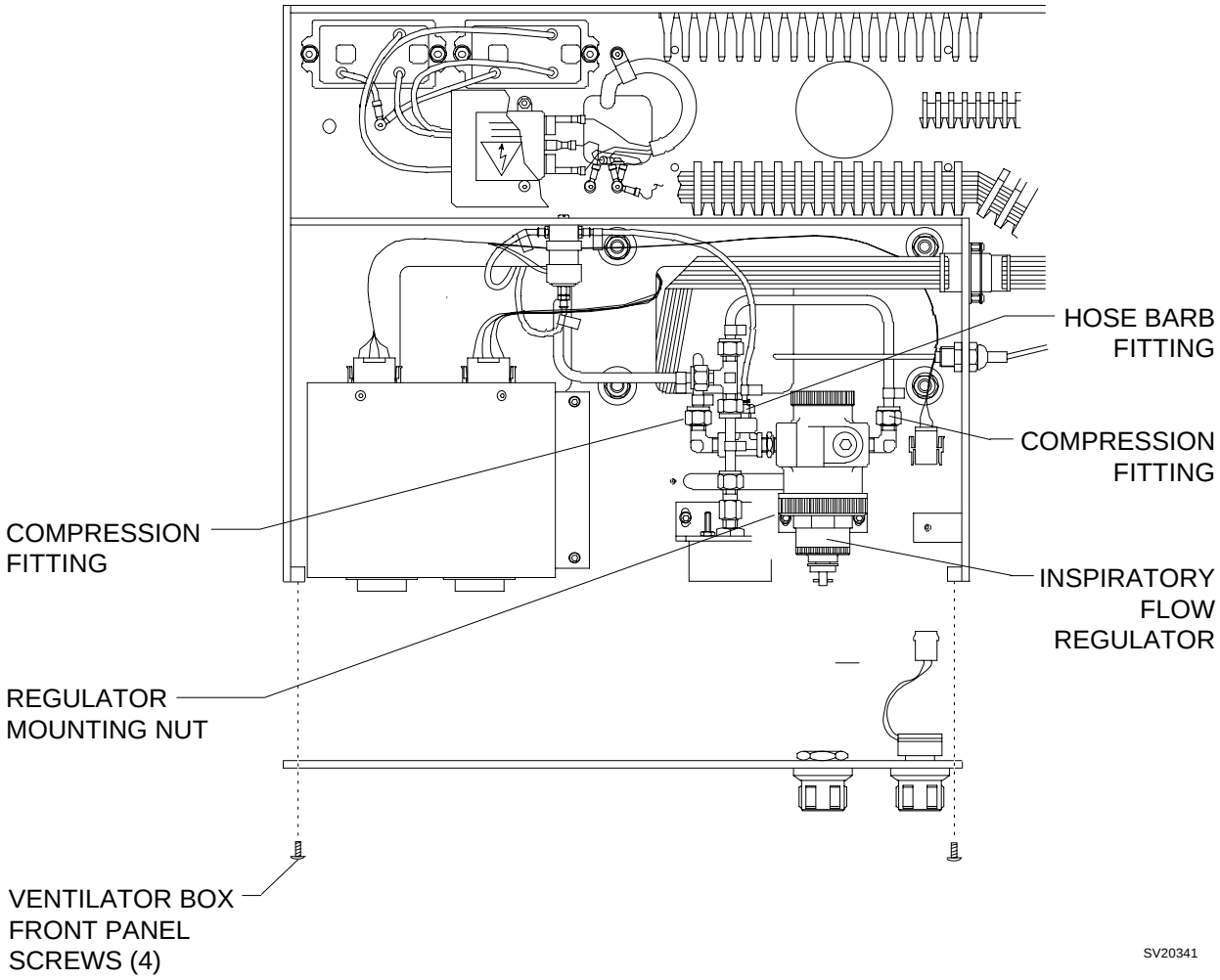


Figure 4-18: INSPIRATORY FLOW REGULATOR

4.18.13 Join the ventilator switch in-line connector, and replace the front panel of the ventilator box.

4.18.14 Perform the PMS Procedure given in Section 6.

4.19 Ventilator Bellows Valve and Guide Assembly (AV-E Ventilator)

The ventilator bellows valve and guide assembly is located in the bellows box on the left side of the machine. Access to the valve case and guide assembly requires that the bellows box front panel and the bellows canister be removed from the bellows box. The monitor box will also need to be raised for access to a connection inside the ventilator box.

Replacement Procedure 1 applies to machines with a two-piece tidal volume adjustment and valve case assembly inside the bellows box. Figure 4-19 shows the mounting and tubing arrangement.

Replacement Procedure 2 applies to machines with a one-piece tidal volume adjustment and valve case assembly inside the bellows box. Figure 4-19A shows the mounting and tubing arrangement for assemblies with either a Humphrey or a Clippard valve.

Replacement Procedure 1:

4.19.1 Set the System Power switch to STANDBY, remove AC power from the machine, and disable all circuit breakers.

4.19.2 Close all cylinder valves, and disconnect the pipeline hoses from the machine.

4.19.3 Press the O_2 FLUSH button to relieve pressure from the system.

4.19.4 Adjust the TIDAL VOLUME knob to fully extend the volume indicator to its minimum setting.

4.19.5 Disconnect the bellows hose and the scavenger hose from the bellows assembly. Loosen the wingnuts and remove the bellows assembly.

4.19.6 Remove the canister from the bellows box by pulling it downward.

4.19.7 Remove the screws holding the front panel and tidal volume adjustment knob, and remove the panel. The knob assembly remains with the panel. On machines with a two-piece panel, remove the angle plate above the knob panel. (Some older machines may have a non-removable panel above the bellows adjustment knob.)

4.19.8 Remove the four socket head screws securing the valve case assembly to the bellows top plate.

4.19.9 Carefully cut the tie strap at the exhaust port (front of valve) and remove the large hose.

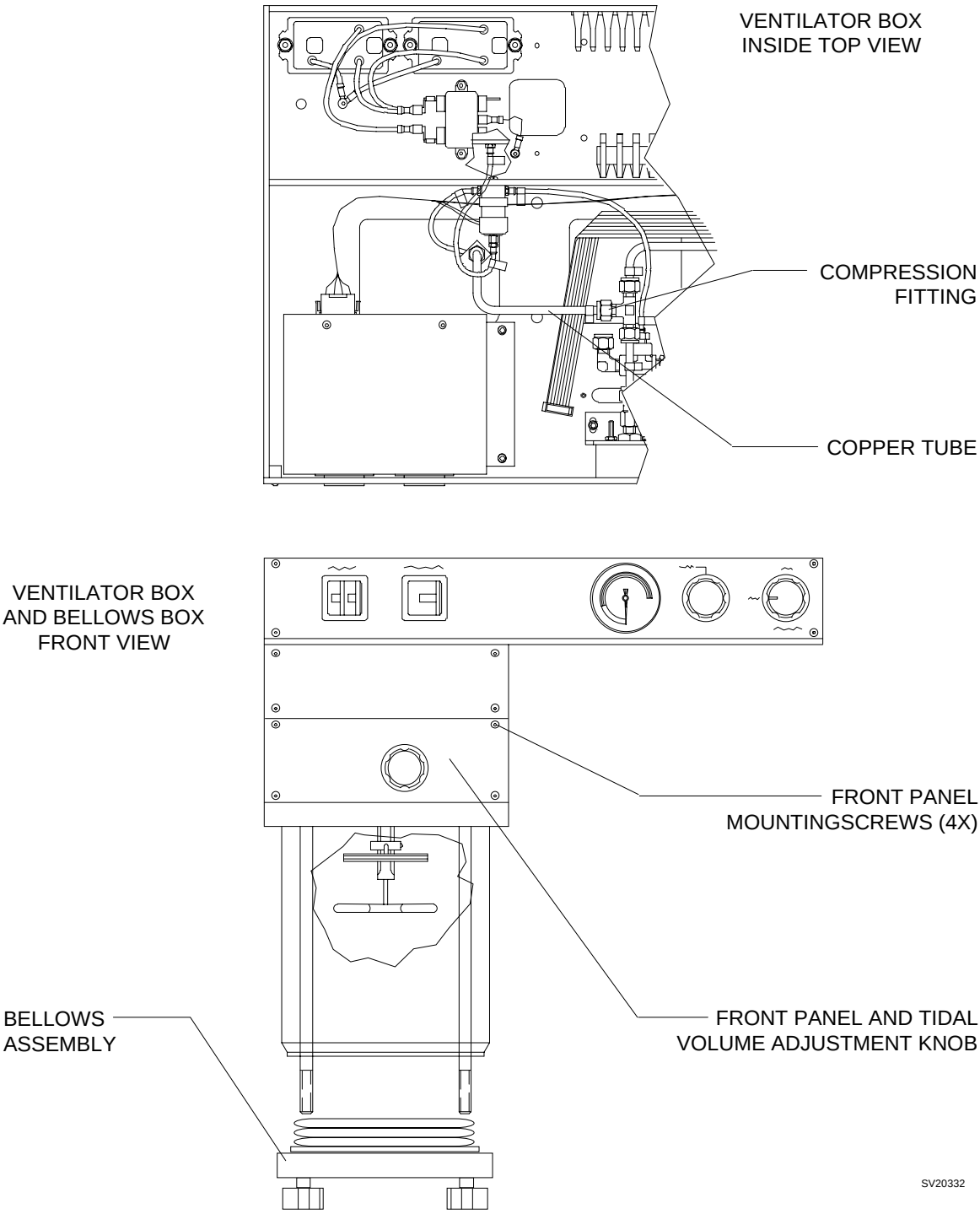


Figure 4-19: TWO-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY

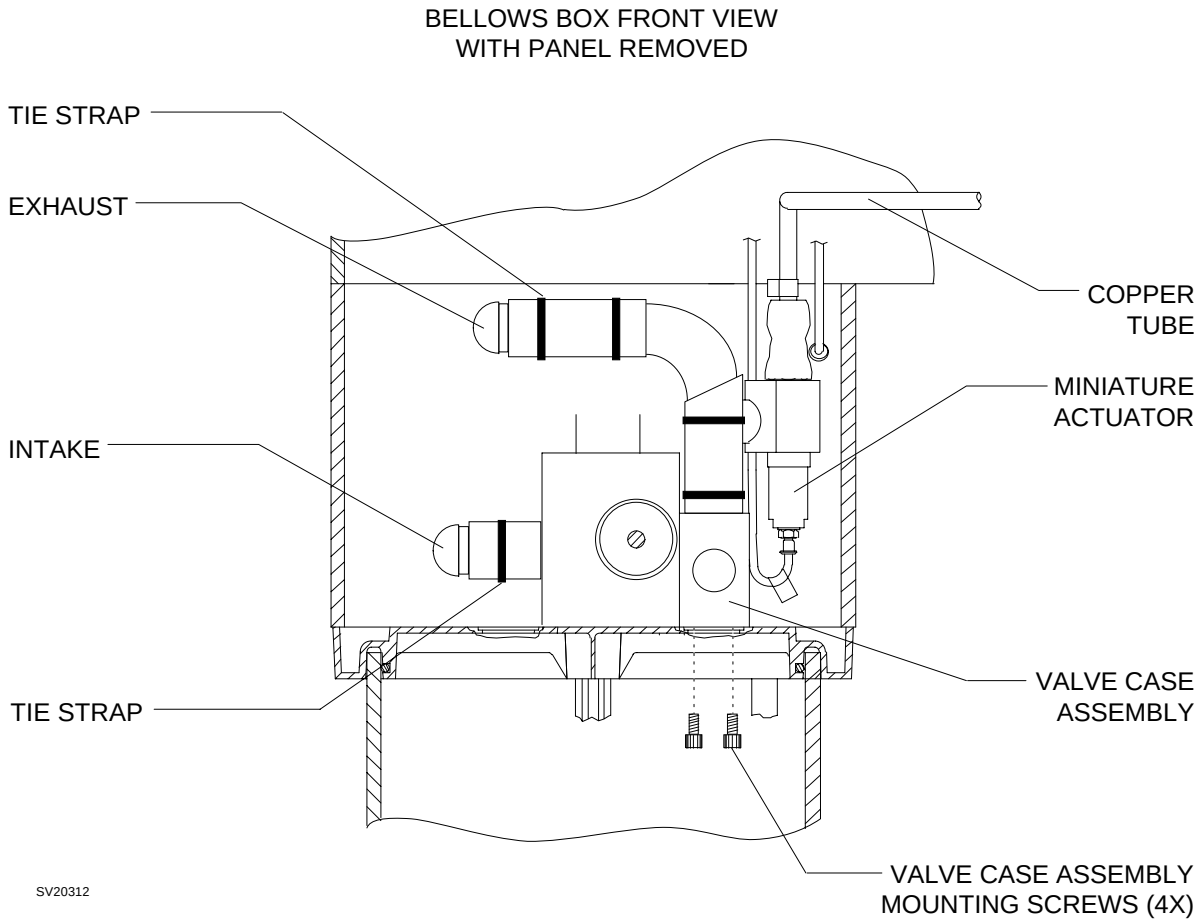


Figure 4-19: TWO-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY (continued)

4.19.10 Carefully cut the tie strap and remove the other end of the large hose at the top of the muffler interface wall.

4.19.11 Remove the three socket head screws securing the bellows top plate to the bellows box.

4.19.12 Carefully cut the tie strap at the intake port (rear of valve) and remove the large hose.

4.19.13 Disconnect the small diameter tubing from the hose barb on the bottom of the miniature actuator.

4.19.14 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of the procedure.

4.19.15 Raise the front of the monitor box chassis approximately four inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.19.16 Disconnect the compression fitting at the outboard end of the copper tube from the valve case assembly, and remove the valve case assembly.

4.19.17 Carefully position the replacement valve case assembly in the bellows box, with the copper tube extending up into the ventilator box, and connect the compression fitting in the ventilator box.

4.19.18 Connect the small diameter tubing to the hose barb on the bottom of the miniature actuator and secure the connection with a press-on clamp.

4.19.19 Attach the large hose to the intake port of the new valve case assembly and secure it with a new tie strap.

4.19.20 Secure the valve case assembly to the bellows top plate with the four screws that were previously removed. Be sure that the two O-rings in the bellows top plate are properly seated.

4.19.21 Secure the bellows top plate to the bellows box using the three screws that were previously removed.

4.19.22 Attach the large hose from the muffler interface wall and secure the connection with a new tie strap.

4.19.23 Attach the other large hose to the exhaust port on the valve case assembly and secure the connection with a new tie strap.

4.19.24 Remove the prop from the monitor box and carefully lower it into position. Replace the screws holding the monitor box to the ventilator box.

4.19.25 Place the bellows box front panel into position, ensure that the slot in the knob assembly is correctly aligned with the drive pin on the bellows adjustment shaft, and install the four screws holding the front panel to the machine.

4.19.26 Reattach the canister to the bellows box.

4.19.27 Reattach the bellows assembly and tighten the wingnuts holding it in place. Connect any hoses that were previously removed from the bellows assembly.

4.19.28 Reconnect the pipeline hoses and AC power cord, and reset all circuit breakers.

4.19.29 Perform the PMS Procedure given in Section 6.

Replacement Procedure 2:

4.19.30 Set the System Power switch to STANDBY, remove AC power from the machine, and disable all circuit breakers.

4.19.31 Close all cylinder valves, and disconnect the pipeline hoses from the machine.

4.19.32 Press the O_2 FLUSH button to relieve pressure from the system.

4.19.33 Adjust the TIDAL VOLUME knob to fully extend the volume indicator to its minimum setting.

4.19.34 Disconnect the bellows hose and the scavenger hose from the bellows assembly. Loosen the wingnuts and remove the bellows assembly and the canister.

4.19.35 Remove the canister from the bellows box by pulling it downward.

4.19.36 Remove the screws holding the front panel and tidal volume adjustment knob, and remove the panel. The knob assembly remains with the panel. On machines with a two-piece panel, remove the angle plate above the knob panel.

4.19.37 Remove the screws holding the monitor box to the ventilator box.

WARNING: Two people are required to perform the remaining portion of the procedure.

4.19.38 Raise the front of the monitor box chassis approximately four inches, and prop the box open.

WARNING: Ensure that AC power is removed from the machine before raising the monitor box. Failure to observe this precaution may cause injury by electric shock.

4.19.39 Remove the bellows guide by unscrewing its stem from the bellows adjustment rod.

4.19.40 Remove the volume indicator from the bellows adjustment rod by loosening its two set screws. Note the position of the indicator on the rod so that it can be reassembled in the same manner.

4.19.41 Remove the screws securing the muffler access panel at the rear of the bellows box, and remove the panel.

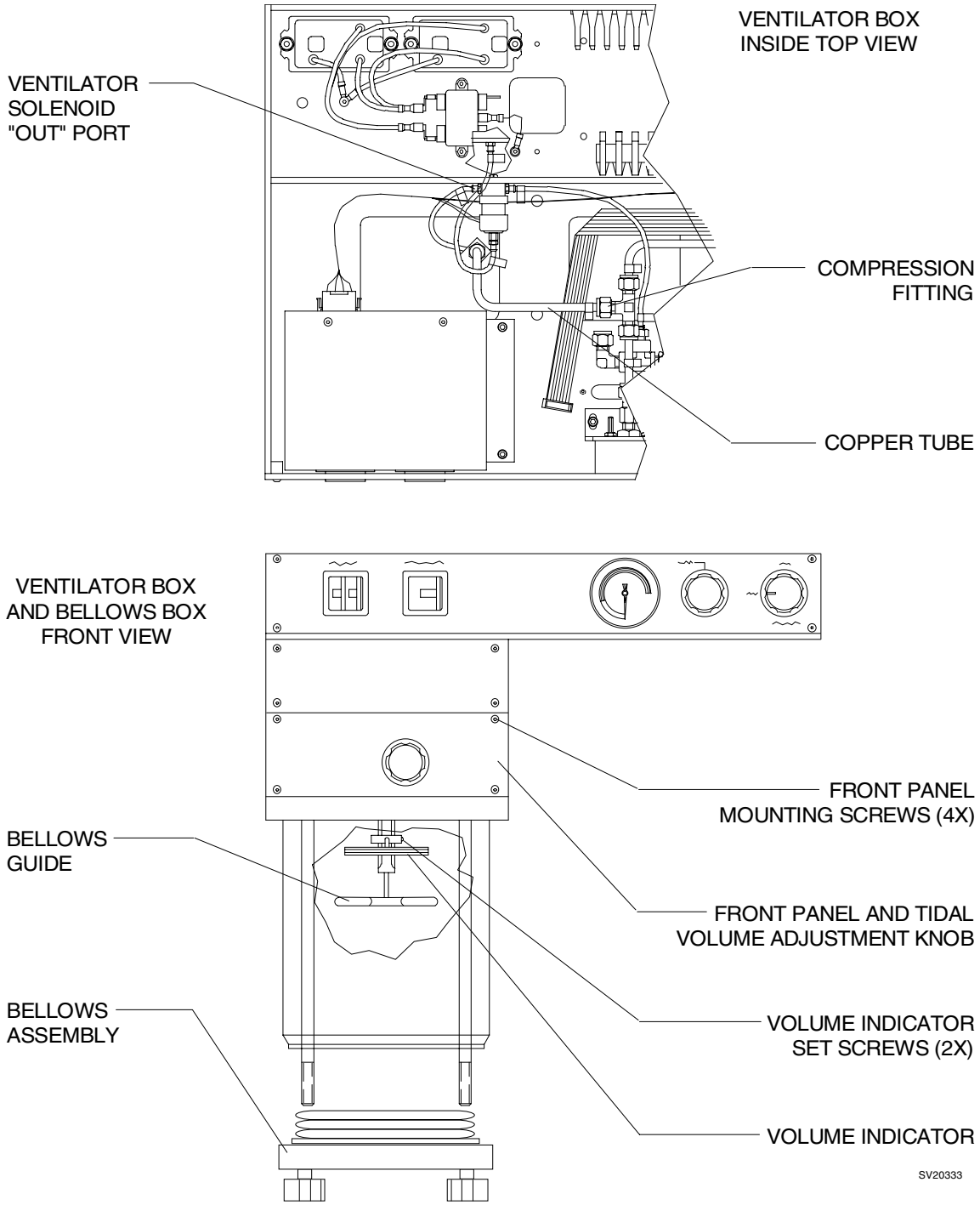


Figure 4-19A: ONE-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY

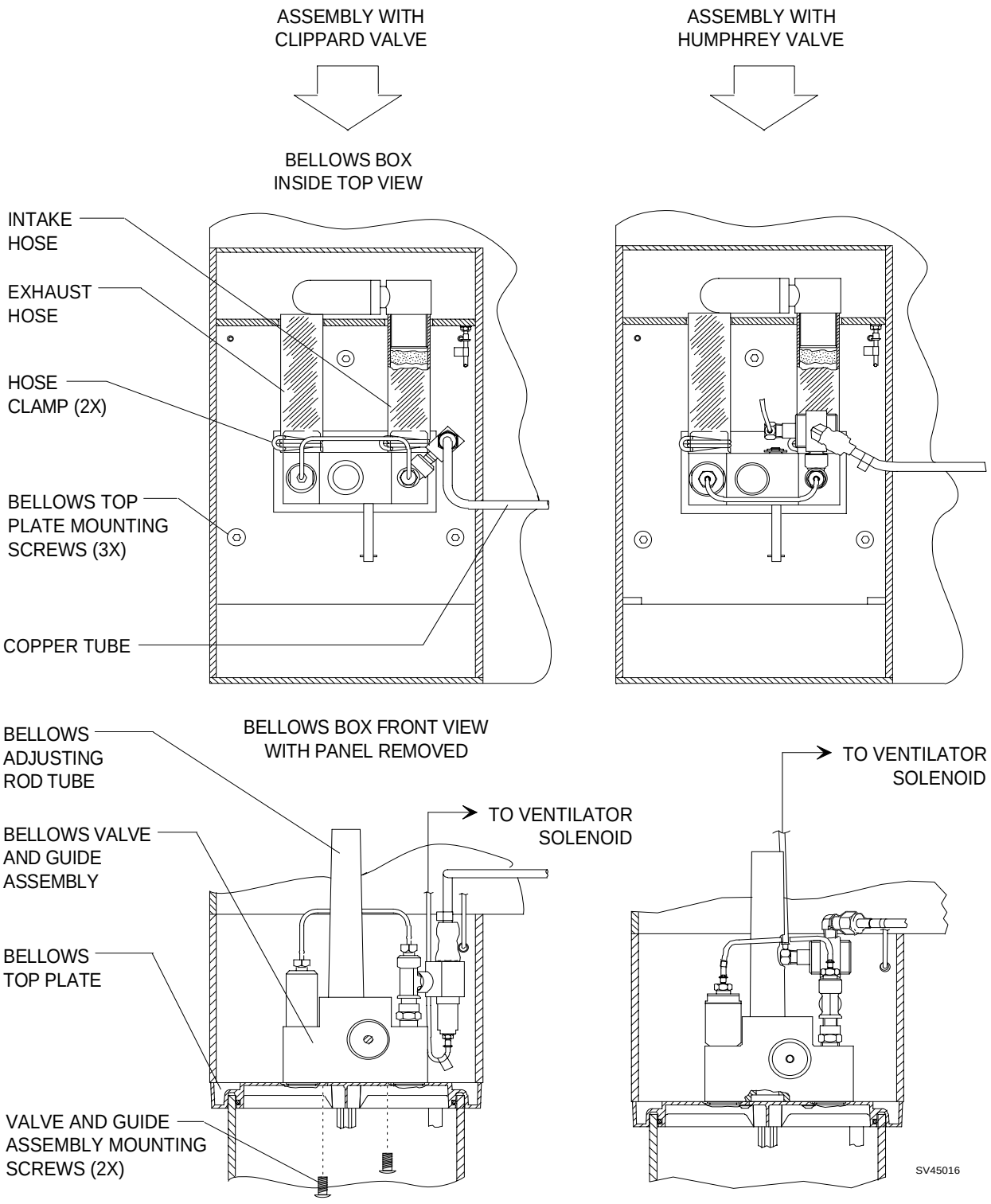


Figure 4-19A: ONE-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY (continued)

4.19.42 Remove the muffler/silencer (white tube) from the intake flange at the interface wall by turning the muffler counter-clockwise.

4.19.43 Disconnect the press-on clamp and small diameter tubing from the left side hose barb on the ventilator solenoid valve (port labeled "out").

4.19.44 Disconnect the compression fitting at the outboard end of the copper tube from the valve case assembly.

4.19.45 Unscrew the bellows adjustment rod tube from the top of the assembly. Do not misplace the spacer ring.

4.19.46 Pull the bellows adjustment rod up.

4.19.47 Remove the two screws securing the valve case and guide assembly to the bellows top plate.

NOTE: Be careful not to misplace the two O-rings and the spacer ring under the valve case assembly.

4.19.48 Pull both large diameter tubes forward until they clear the muffler housing interface wall.

4.19.49 Rotate the valve case and guide assembly as needed in order to withdraw it from the bellows box.

CAUTION: Do not damage any of the fittings or small hose barbs on the assembly during its removal.

4.19.50 Transfer the large diameter tubing and hose clamps to the intake and exhaust ports on the replacement valve case and guide assembly.

4.19.51 Carefully position the replacement valve case and guide assembly in the bellows box, with the copper tube extending up into the ventilator box, and with the intake and exhaust hoses correctly positioned in the muffler housing interface wall.

4.19.52 Secure the valve case assembly to the bellows top plate with the two screws that were previously removed. Be sure that the spacer ring and the two O-rings in the bellows top plate are properly seated.

4.19.53 Connect the copper tube to the tee fitting in the ventilator box.

4.19.54 Install the spacer ring and bellows adjustment rod tube at the top of the valve case and guide assembly.

4.19.55 Attach the small diameter tubing from the miniature actuator to the left side hose barb on the ventilator solenoid valve (port labeled "out"), and secure the connection with a press-on clamp.

NOTE: After the connection is made, ensure that there are no kinks or sharp bends in the tubing.

4.19.56 Reattach the muffler/silencer to the intake flange at the muffler housing interface, and reattach the rear access panel using the screws that were previously removed.

4.19.57 Install the volume indicator on the bellows adjustment rod in the same position as before disassembly, and tighten its two setscrews.

4.19.58 Install the bellows guide by screwing its stem into the bellows adjustment rod. Secure it with #222 (purple) Loctite.

4.19.59 Remove the prop from the monitor box and carefully lower it into position. Replace the screws holding the monitor box to the ventilator box.

4.19.60 Place the bellows box front panel into position, ensure that the slot in the knob assembly is correctly aligned with the drive pin on the bellows adjustment shaft, and install the four screws holding the front panel to the machine.

4.19.61 Replace the bellows assembly and tighten the wingnuts holding it in place. Connect any hoses that were previously removed from the bellows assembly.

4.19.62 Reconnect the pipeline hoses and AC power cord, and reset all circuit breakers.

4.19.63 Perform the PMS Procedure given in Section 6.

4.20 Ventilator Bellows Valve and Guide Assembly with Pressure Limit Control (AV-2 Ventilator)

The Ventilator Bellows Valve and Guide Assembly, and the Pressure Limit Control are located in the bellows box on the left side of the machine. Access to the components requires removal of the bellows box front panel, and removal of the upper bellows support plate from the bellows box. Figure 4-20 shows the pneumatic connections and the mounting arrangement of the components.

4.20.1 Set the System Power switch to STANDBY, and remove AC power from the machine.

4.20.2 Close all cylinder valves, and disconnect the pipeline hoses from the machine.

4.20.3 Press the O_2 Flush button to relieve pressure from the system.

4.20.4 Adjust the TIDAL VOLUME control to raise the volume indicator to its maximum setting.

4.20.5 Disconnect the breathing hose and the scavenger hose from the bellows assembly. Loosen the wing nuts and remove the bellows assembly.

4.20.6 Remove the canister from the bellows box by pulling it downward.

4.20.7 Unscrew the bellows guide from the adjustment rod.

4.20.8 Loosen the set screws on the tidal volume indicator (note the position of the indicator on the adjustment rod so that it can be reassembled in the same position) and remove the indicator.

4.20.9 Remove the screws holding the bellows box front panel and knob assemblies, and remove the panel.

4.20.10 Loosen the rear support plate screw, and remove the two front support plate screws.

4.20.11 Pull the support plate forward, then lower it to a point where the tubing connections are accessible.

4.20.12 Disconnect the large diameter tubing from the venturi, and the small diameter tubing from the auto-ranging valve.

4.20.13 Carefully remove the assembly from the machine. Mounting screws for the adjustable pressure limit control and the valve case assembly are shown in the illustration.

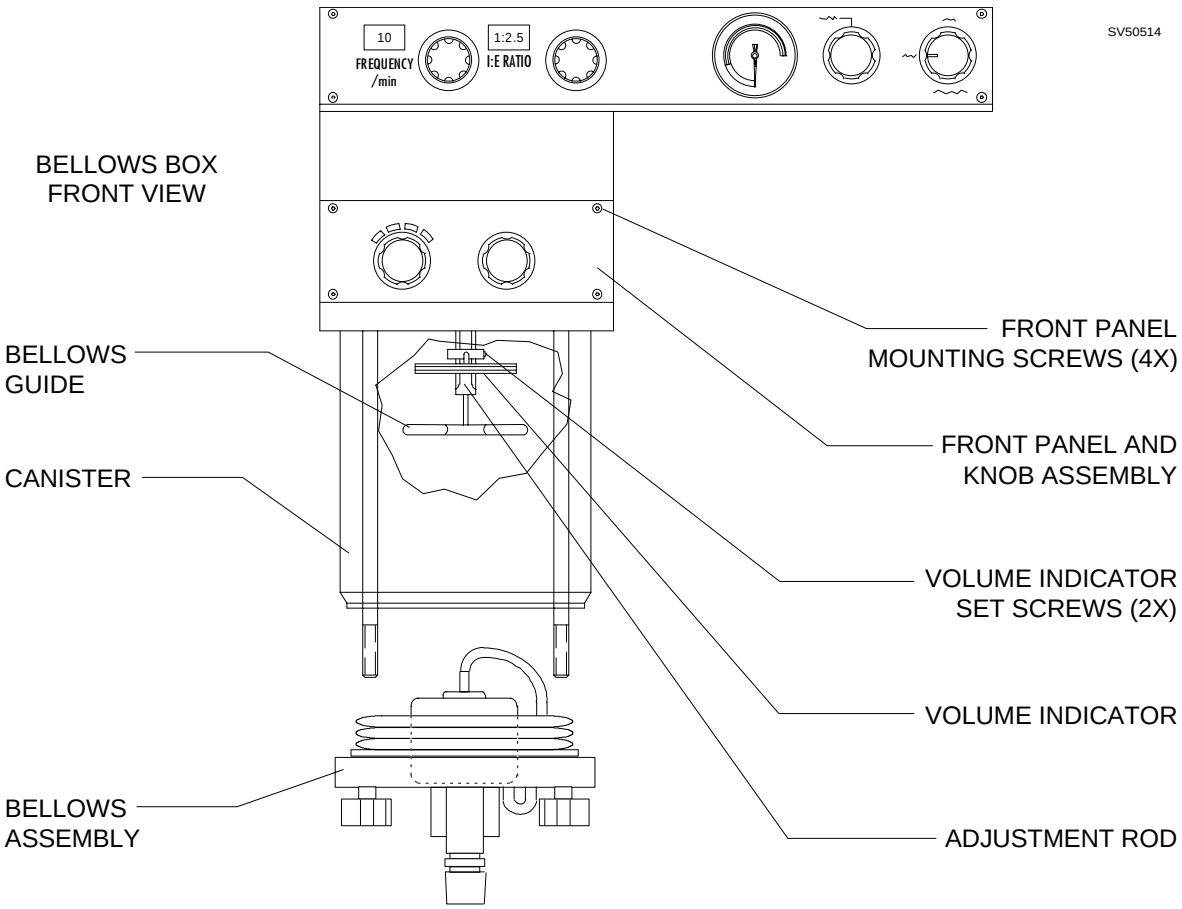


Figure 4-20: TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY

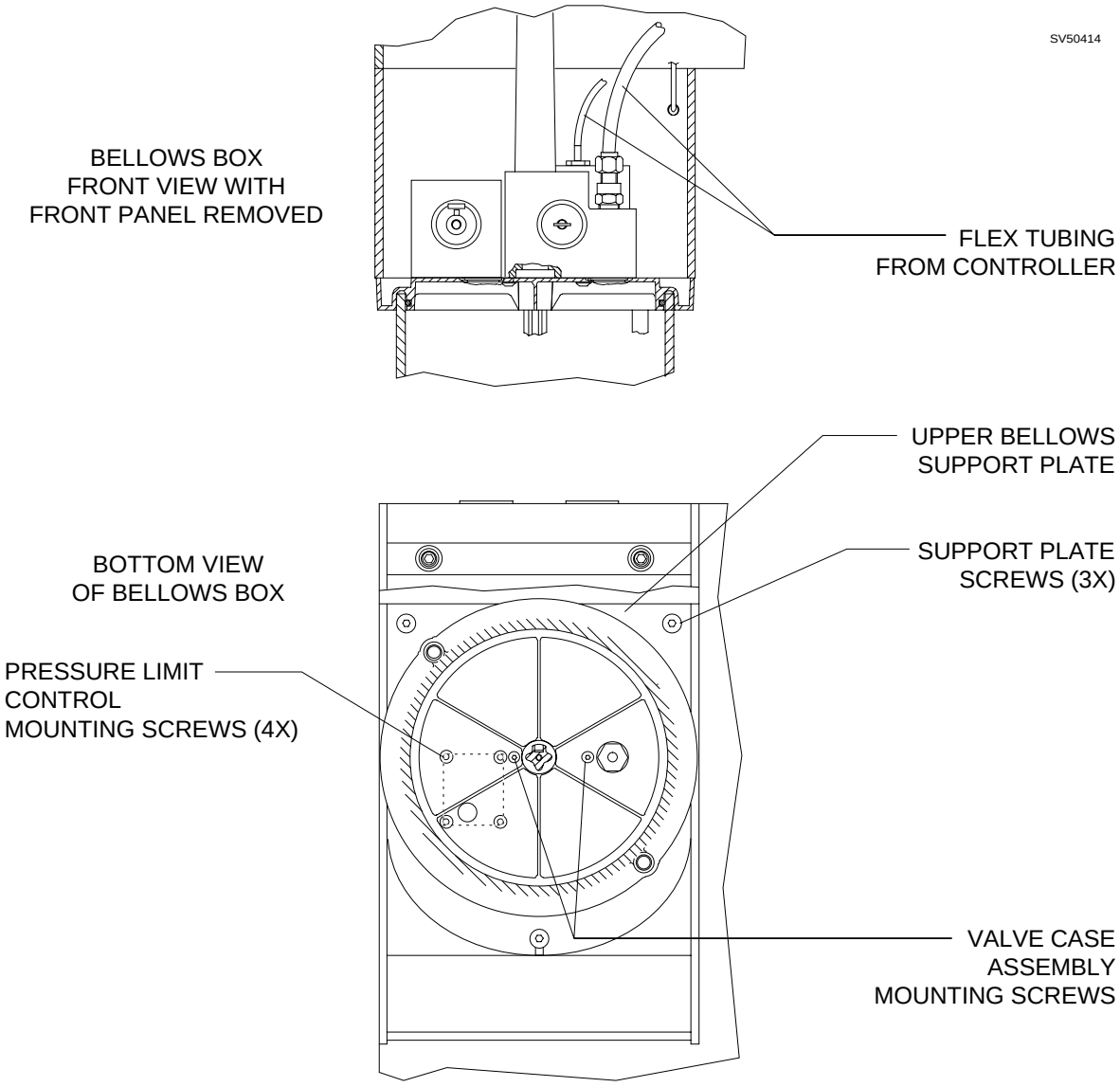


Figure 4-20: TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY (continued)

NOTE: If components are removed from the support plate, be sure that any spacers and O-rings are correctly positioned during reinstallation.

4.20.14 Following component replacement, position the support plate in the bellows box and reconnect the large and small diameter tubing that was previously removed.

4.20.15 Slide the support plate up and to the rear until it is seated properly in the bellows box.

4.20.16 Reinstall the two front support plate screws, and tighten the rear support plate screw.

4.20.17 Install the volume indicator on the bellows adjustment rod in the same position as before disassembly, and tighten its two setscrews.

4.20.18 Install the bellows guide by screwing its stem into the bellows adjustment rod.

4.20.19 Place the bellows box front panel into position, ensure that the slots in the knob assemblies are correctly aligned with their drive pins on the bellows adjustment and pressure limit control shafts, and reinstall the screws holding the front panel to the machine.

4.20.20 Replace the bellows canister; ensure that its markings are facing forward.

4.20.21 Replace the bellows assembly and tighten the wing nuts holding it in place.

4.20.22 Reconnect any hoses that were previously removed from the bellows assembly.

4.20.23 Reconnect the pipeline hoses and AC power cord.

4.20.24 Perform the PMS Procedure given in Section 6.

4.21 Alarm Channel (without oxygen supply pressure alarm switch)

Replacement of the alarm channel requires removal of the upper flowmeter front cover plate. (On later models the vapor box cover plate is extended to also cover the flowmeter shield and alarm channel.) The alarm channel assembly is held in place by two screws from the back. Figure 4-21 shows a rear view of the assembly and its connections.

4.21.1 Disconnect the pipeline hoses and close all cylinder valves.

4.21.2 Press the O_2 Flush valve to drain oxygen pressure from the system.

4.21.3 Set the System Power switch to STANDBY and remove AC power from the machine.

4.21.4 Remove the screws holding the rear cover, and remove the cover.

4.21.5 Remove the screws holding the table top, and lift out the table top.

CAUTION: The circuit board contains static sensitive devices. Use ESD protection when handling this assembly.

4.21.6 Disconnect the cables from J1, J2, J3 and J4 on the alarm circuit board.

WARNING: Ensure that AC power is removed from the machine before disconnecting the cables. Failure to observe this precaution may cause injury by electric shock.

4.21.7 Disconnect the two compression fittings at the system power switch valve.

4.21.8A Early models: Remove the two screws (from the back) holding the angled cover plate at the top of the channel. Hold the cover plate as the screws are removed from the back.

4.21.8B Later models (without the O_2/N_2O ratio alarm lamp): Remove the six screws holding the flowmeter shield and vapor box cover, and remove the panel.

4.21.9 Feed the flowmeter lights wire harness through the hole at the top of the alarm channel.

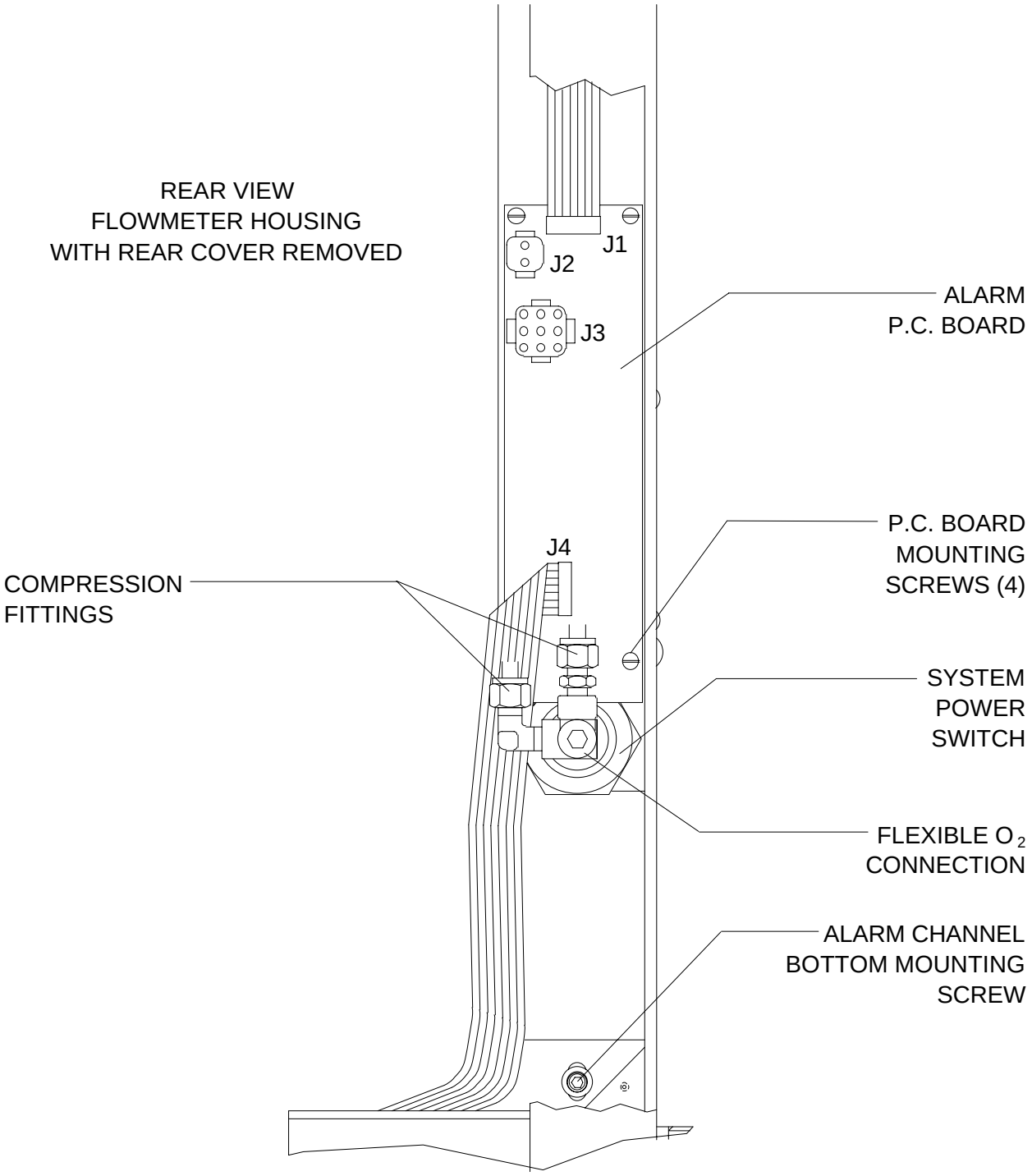


Figure 4-21: ALARM PANEL AND SYSTEM POWER SWITCH

4.21.10 Remove the alarm channel mounting screws. If the machine does not have an auxillary O_2 flow meter, skip the next two steps.

4.21.11 If the machine is equipped with an auxillary O_2 flow meter,pull the alarm channel forward far enough to gain access to the system power switch valve, cut the tie-wrap clamp on the flexible tube at the valve, and remove the tube from the valve.

4.21.12 Connect the flexible tube to the system power switch valve on the replacement alarm channel and install a new tie-wrap clamp.

4.21.13 Set the replacement alarm channel in position and connect the two compression fittings to the system power switch valve. Do not tighten the fittings yet.

4.21.14 Reinstall the alarm channel mounting screws.

4.21.15 Feed the flowmeter lights wire harness connector through the hole at the top of the alarm channel.

4.21.16 Reinstall the cover plate at the top of the channel and secure it with the hardware that was previously removed.

4.21.17 Tighten the two compression fittings at the system power switch valve and perform the following leak test:

4.21.17.1 Open the oxygen cylinder valve and allow the pressure to stabilize.

4.21.17.2 Close the oxygen cylinder valve.

4.21.17.3 The pressure should not drop more than 50 psi in two minutes. (The cylinder pressure must be at least 1000 psi for this test.)

4.21.18 Connect the cables that were previously removed from J1, J2, J3 and J4 on the alarm circuit board.

4.21.19 Replace the rear cover and its retaining screws.

4.21.20 Replace the table top and its mounting screws.

4.21.21 Connect the pipeline hoses and restore AC power to the machine.

4.21.22 Perform the PMS Procedure given in Section 6.

4.22 Alarm Channel and Oxygen Supply Pressure Alarm Switch

The alarm channel assembly includes the oxygen supply pressure alarm switch, the alarm circuit board, and the system power switch. Whenever the alarm channel is replaced, the oxygen supply pressure alarm switch must be tested to ensure that its operating point is set correctly. Removal of the alarm channel requires removal of the upper flowmeter and vapor box cover plate, and removal of the flowmeter housing rear cover. The alarm channel assembly is held in place by two screws from the back. Figure 4-22 shows a rear view of the assembly and its connections.

4.22.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.22.2 Close all cylinder valves except the O_2 valve.

4.22.3 Set the oxygen flow to 5 liters per min.

4.22.4 Open the other gas flow control valves to drain pressure from the system.

4.22.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.22.6 Set the System Power switch to STANDBY, and remove AC power from the machine.

4.22.7 Disable the circuit breakers on the power supply by pulling out each button with a knife or sharp object.

4.22.8 Remove the six screws holding the flowmeter shield and vapor box front coverpanel, and pull the panel forward approximately ½ inch.

4.22.9 Remove the screws holding the flowmeter housing rear cover, and remove the cover.

4.22.10 Remove the screws holding the table top, and lift out the table top.

4.22.11 Disconnect the cables from J1, J2, J3 and J4 on the alarm circuit board.

4.22.12 Disconnect the compression fitting on the O_2 line nearest to the oxygen supply pressure alarm switch.

4.22.13 Disconnect the remaining two O_2 lines at the top and bottom of the tee fitting.

4.22.14 If the machine is equipped with an auxiliary O_2 flowmeter, cut the tie strap on its flexible line and carefully remove the flex line from the hose barb.

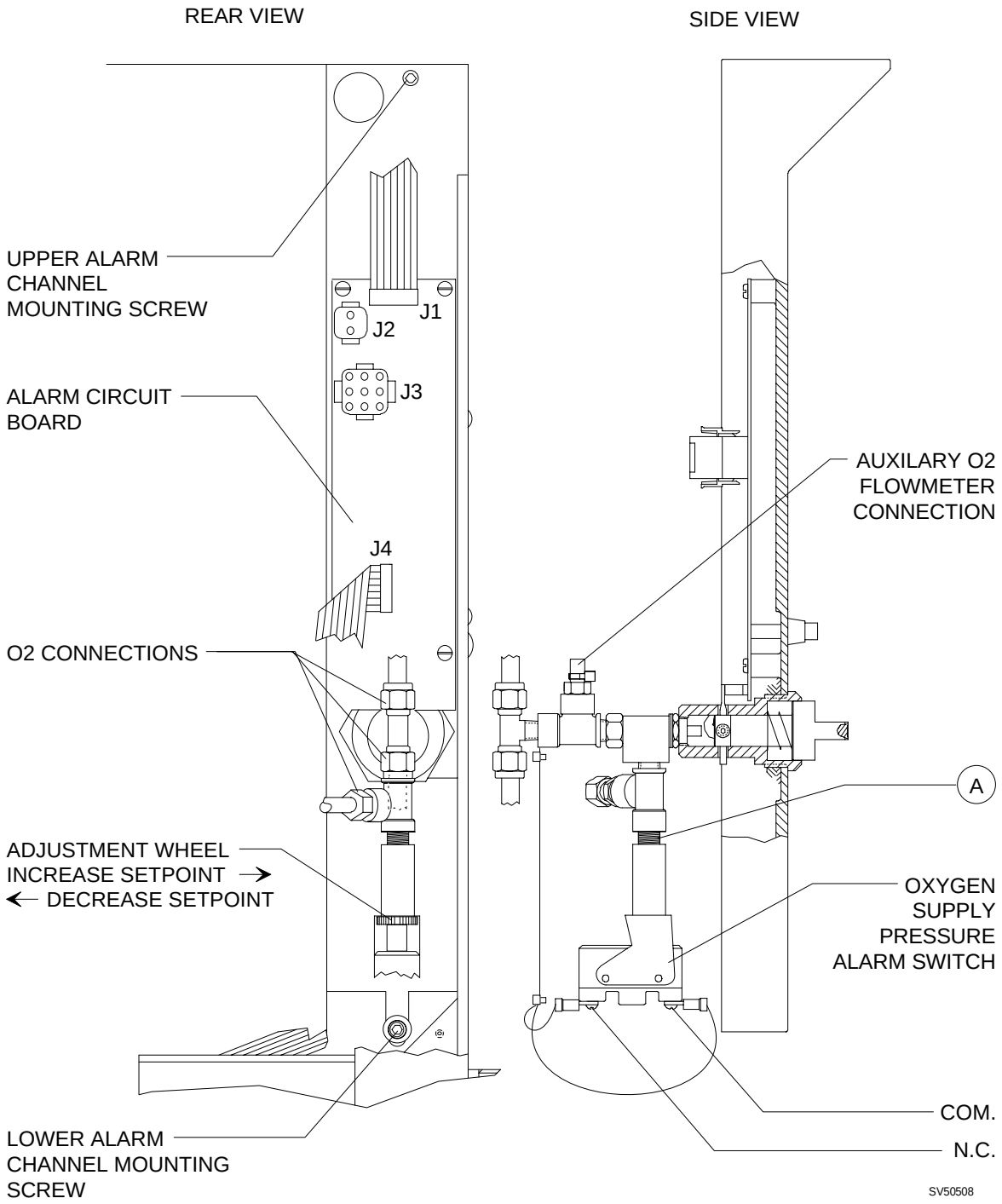


Figure 4-22: ALARM CHANNEL AND OXYGEN SUPPLY PRESSURE ALARM SWITCH

4.22.15 From the back of the flowmeter housing, remove the upper and lower alarm channel mounting screws.

4.22.16 At the front of the machine, pull the alarm channel assembly forward, and feed the flowmeter lights wire harness through the hole at the top of the alarm channel.

4.22.17 Disconnect the orange and orange/white wires from the oxygen supply pressure alarm switch.

4.22.18 The following steps apply to replacement of the oxygen supply pressure alarm switch. If the entire alarm channel assembly is being replaced, skip the next two steps.

4.22.19 Remove the alarm switch from the assembly at point Ⓐ as shown in the illustration.

4.22.20 Install the replacement alarm switch with sealing tape on the threads, and ensure that the switch is oriented on the assembly as shown in the illustration.

4.22.21 Connect the orange and orange/white wires to the replacement switch in the same manner as the original.

4.22.22 Feed the flowmeter lights wire harness through the hole at the top of the alarm channel, and set the alarm channel assembly into place.

4.22.23 Install the upper and lower alarm channel mounting screws.

4.22.24 If applicable, reconnect the flex line from the auxiliary O_2 flowmeter and install a new tie strap at the hose barb.

4.22.25 Reconnect the the O_2 lines, and tighten the three compression fittings.

4.22.26 Reconnect the cables to J1, J2, J3 and J4 on the alarm circuit board.

4.22.27 Reinstall the front flowmeter and vapor box cover with the six screws that were previously removed.

4.22.28 Pull the writing or keyboard tray out to its fully extended position.

4.22.29 Locate the tee fitting in the ¼ in. diameter output line of the O_2 regulator and remove the plug from the tee fitting.

4.22.30 Connect a dedicated O_2 test gauge to the tee fitting.

4.22.31 Connect AC power to the machine and enable the circuit breakers by pressing their buttons in.

4.22.32 Open an oxygen cylinder valve and turn the System Power switch to ON.

4.22.33 Set the oxygen flow to five liters per minute.

4.22.34 Close the oxygen cylinder valve.

4.22.35 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

4.22.36 If the alarm activates when the pressure is below 34 psi or above above 40 psi, turn the adjustment wheel (see illustration), repeat the test and adjust as necessary to bring the set point into the correct range.

4.22.37 Turn the System Power switch to STANDBY.

4.22.38 Disconnect the test gauge and replace the plug in the regulator line tee fitting.

4.22.39 Replace the table top and its retaining screws.

4.22.40 Replace the flowmeter housing rear cover and its retaining screws.

4.22.41 Connect the pipeline hoses.

4.22.42 Perform the PMS Procedure given in Section 6.

4.23 Caster

Each caster is retained by a set screw in the side of the lower frame rail as shown in Figure 4-23. Caster replacement requires that the machine be tilted to provide enough clearance for the caster stem to be withdrawn from the bottom of the frame rail.

WARNING: Do not tilt the machine more than 10 degrees or raise the casters more than 3½ inches from the floor. Failure to observe this precaution may result in a tip-over, causing personal injury. Vaporizers containing anesthetic agent may also be damaged.

4.23.1 Obtain a brace capable of supporting one side of the machine with its casters two to three inches from the floor.

4.23.2 Remove all unsecured equipment and accessories from the machine.

4.23.3 Lock the front casters.

4.23.4 Using at least two people, tilt the machine until the casters on one side are raised two to three inches from the floor, and position the support brace under the frame rail between the front and back casters.

4.23.5 Remove the plastic cap in the side of the frame rail to provide access to the caster stem set screw.

4.23.6 Loosen the set screw and remove the caster.

4.23.7 Insert the replacement caster into the frame and hold it in its seated position.

4.23.8 Tighten the caster stem set screw and replace the plastic cap in the frame rail.

4.23.9 Using at least two people, tilt the machine, remove the support brace and carefully lower the machine to the floor.

4.23.10 Check for proper operation of the caster and ensure that the front casters lock properly.

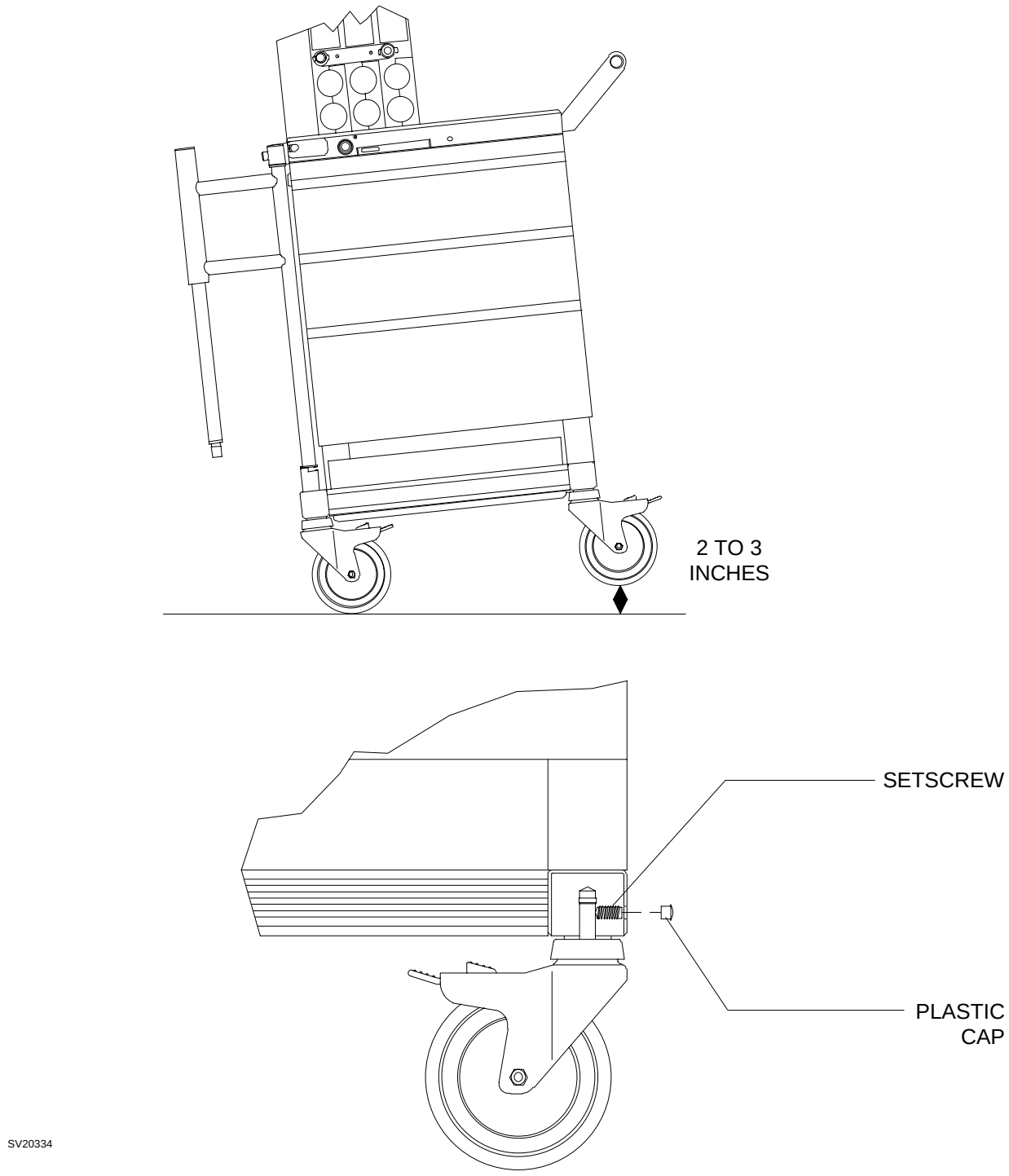


Figure 4-23: CASTER REPLACEMENT

4.23.11 Perform the PMS Procedure given in Section 6, including a vaporizer calibration verification.

4.23.12 Replace any unsecured equipment and accessories that were previously removed.

4.24 Battery

The AC backup battery is located on the power supply assembly in the monitor box and can be replaced without removing the power supply. Access to the battery requires removal of the monitor box top shelf, and removal of the power supply cover plate. Figure 4-24 shows the battery mounting arrangement and connections.

4.24.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor box. It is also recommended that the AC line cord be plugged into a test fixture which maintains the electrical service ground connection to the machine while isolating the line and neutral conductors.

4.24.2 Disable the three circuit breakers at the back of the monitor box by pulling out each button with a knife or sharp object.

4.24.3 Remove the screws holding the monitor box top shelf. Lift the back of the shelf and disconnect its ground wire from the chassis ground tab, then lift out the shelf.

4.24.4 On the power supply assembly, disconnect the AC power cable at J1, and disconnect the battery power cable at J7.

4.24.5 Remove the four cover plate retainer screws, and remove the power supply cover plate.

4.24.6 Loosen the four battery retainer captive mounting screws, and remove the battery retainer.

4.24.7 Lift out the battery and disconnect the two wiring harness connectors from the battery.

4.24.8 If the replacement battery is not supplied with a wiring harness attached, transfer the existing harness to the replacement battery. Connect the yellow wire to the (+) battery tab, and the black wire to the (-) battery tab. Wrap the battery in a plastic bag in the same manner as the original battery.

4.24.9 Position the replacement battery in the power supply chassis.

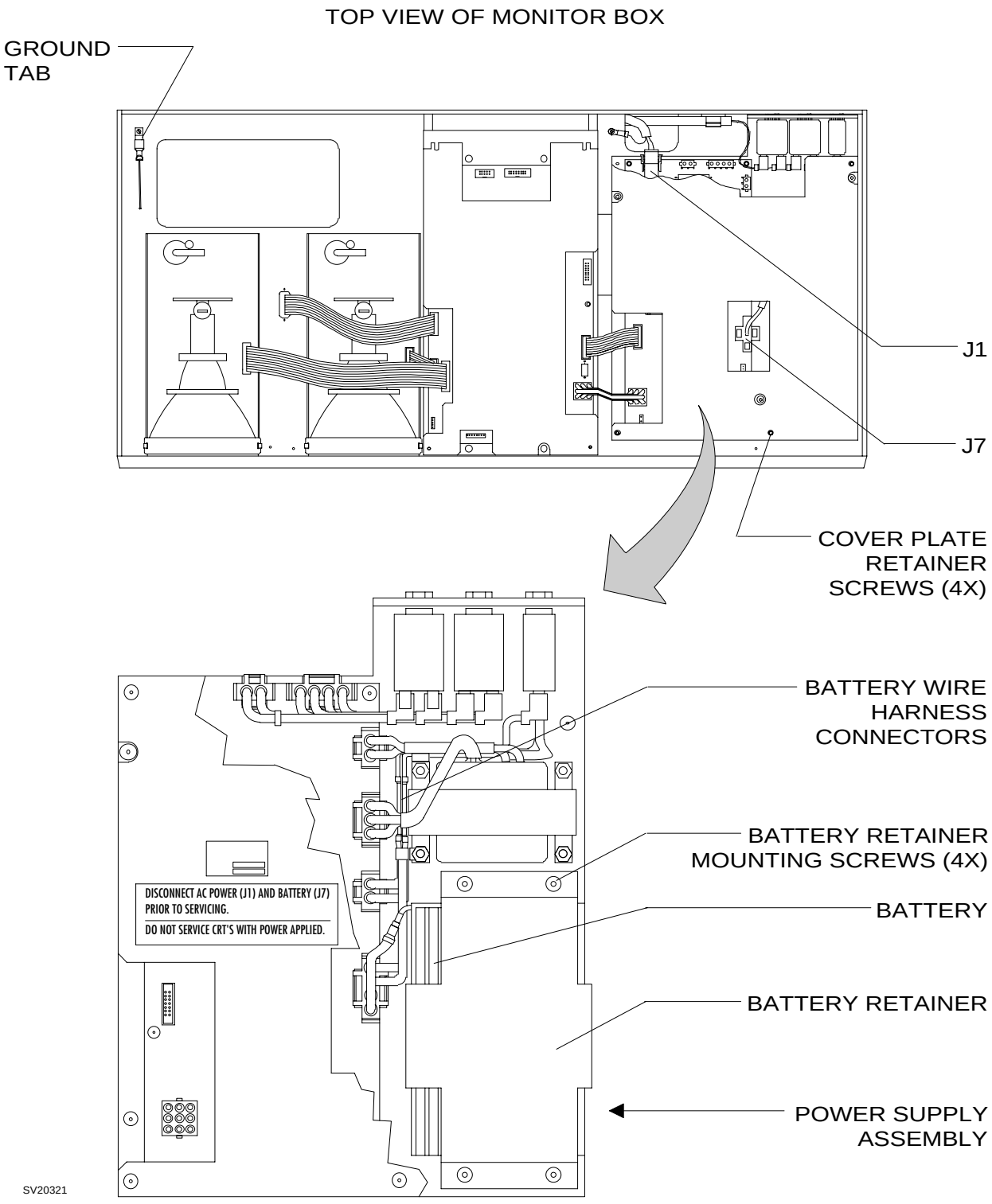


Figure 4-24: BATTERY REPLACEMENT

4.24.10 Reinstall the battery retainer and tighten the captive mounting screws.

4.24.11 Reinstall the power supply cover plate.

4.24.12 Connect the cables that were previously removed from J7 and J1 on the power supply assembly.

4.24.13 Place the monitor box top shelf into position, connect its ground wire to the chassis ground tab, and reinstall the top shelf screws.

4.24.14 Reset the circuit breakers at the back of the monitor box.

4.24.15 Perform the PMS Procedure given in Section 6.

4.25 Power Supply

The power supply assembly is located within the monitor box. Access to the power supply requires removal of the monitor box top shelf. Figure 4-25 shows the power supply assembly mounting arrangement and connections.

4.25.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor box. It is also recommended that the AC line cord be plugged into a test fixture which maintains the electrical service ground connection to the machine while isolating the line and neutral conductors.

4.25.2 Disable the three circuit breakers at the back of the monitor box by pulling out each button with a knife or sharp object.

4.25.3 Remove the screws holding the monitor box top shelf. Lift the back of the shelf and disconnect its ground wire from the chassis ground tab, then lift out the shelf.

4.25.4 On the power supply assembly, disconnect the AC power cable at J1, and disconnect the battery power cable at J7.

4.25.5 Disconnect the data cable at J9, and disconnect the output cable at J10.

4.25.6 Disconnect the Brown and Blue receptacle wires connected to the top of Circuit Breaker #3.

4.25.7 Loosen the four captive mounting screws on the baseplate of the power supply assembly.

4.25.8 Lift the front of the power supply first, and then lift the assembly out of the monitor box.

4.25.9 Position the replacement assembly in the monitor box and tighten the captive mounting screws.

4.25.10 Connect the following cables:

Output Cable to J10
Data Cable to J9
Battery Cable to J7
AC Power Cable to J1
Brown and Blue receptacle wires to CB3

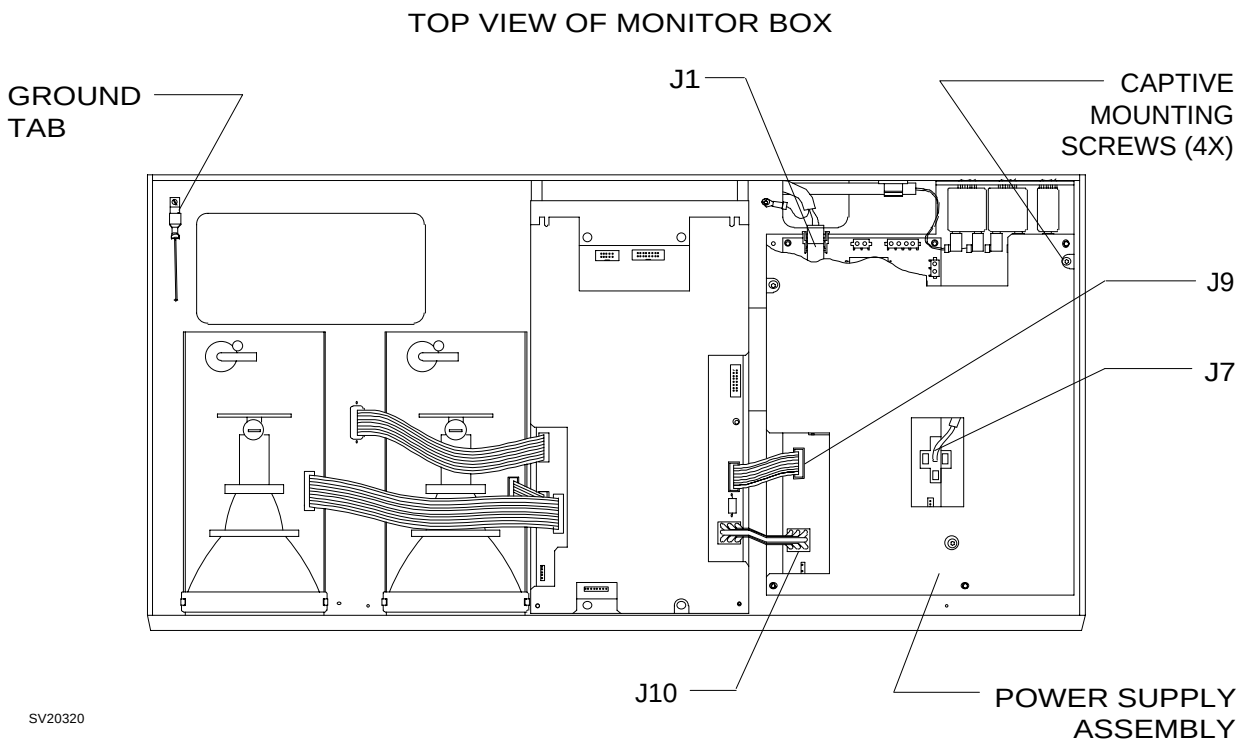


Figure 4-25: POWER SUPPLY

4.25.11 Place the monitor box top shelf into position, connect its ground wire to the chassis ground tab, and reinstall the top shelf screws.

4.25.12 Reset the circuit breakers at the back of the monitor box.

4.25.13 Perform the PMS Procedure given in Section 6.

4.26 Processor Assembly

The processor assembly is located within the monitor box. Access to the processor requires removal of the monitor box top shelf. Figure 4-26 shows the processor assembly mounting arrangement and its connections.

4.26.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor box. It is also recommended that the AC line cord be plugged into a test fixture which maintains the electrical service ground connection to the machine while isolating the line and neutral conductors.

4.26.2 Disable the three circuit breakers at the back of the monitor box by pulling out each button with a knife or sharp object.

4.26.3 Remove the screws holding the monitor box top shelf. Lift the back of the shelf and disconnect its ground wire from the chassis ground tab, then lift out the shelf.

4.26.4 On the power supply assembly, disconnect the AC power cable at J1, and disconnect the battery power cable at J7.

4.26.5 Disconnect the following cables from the processor assembly:

J5 Power	J4 CRT
J6 Data	J1 Keypad
J7 Alarm	J2 Keypad
J8 Alarm	J9 Spiromed Sensor
J3 CRT	J10 O_2 Sensor

4.26.6 Carefully disconnect the tubing at the right-angle fitting on the baromed sensor line. Be careful not to bend or crimp the hose barb.

4.26.7 Loosen the four captive mounting screws on the baseplate of the processor assembly.

4.26.8 Lift the front of the processor assembly first, and then lift the assembly out of the monitor box.

4.26.9 Position the replacement assembly in the monitor box and tighten the captive mounting screws.

4.26.10 Connect the cables that were previously removed from J1 thru J10 on the processor assembly.

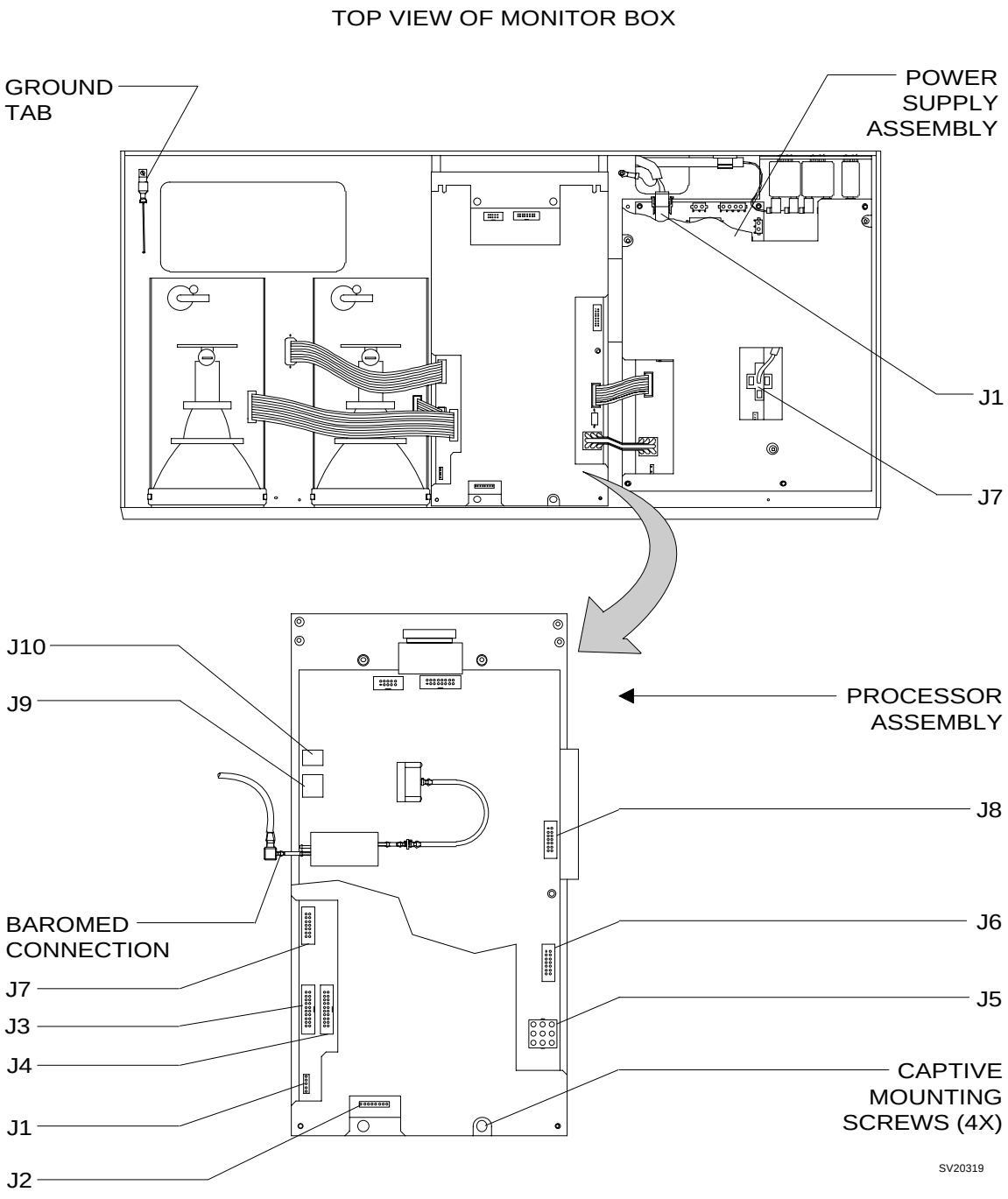


Figure 4-26: PROCESSOR ASSEMBLY

4.26.11 Connect the cables that were previously removed from J7 and J1 on the power supply assembly.

4.26.12 Place the monitor box top shelf into position, connect its ground wire to the chassis ground tab, and reinstall the top shelf screws.

4.26.13 Reset the circuit breakers at the back of the monitor box.

4.26.14 Perform the PMS Procedure given in Section 6.

4.27 CRT Assemblies

Access to the two CRT assemblies in the monitor box requires removal of the top shelf. Figure 4-27 shows the CRT mounting arrangement and connections. The following procedure applies to both CRT assemblies.

4.27.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor box. It is also recommended that the AC line cord be plugged into a test fixture which maintains the electrical service ground connection to the machine while isolating the line and neutral conductors.

4.27.2 Disable the three circuit breakers at the back of the monitor box by pulling out each button with a knife or sharp object.

4.27.3 Remove the screws holding the monitor box top shelf. Lift the back of the shelf and disconnect its ground wire from the chassis ground tab, then lift out the shelf.

4.27.4 On the power supply assembly, disconnect the AC power cable at J1, and disconnect the battery power cable at J7.

4.27.5 Disconnect the ribbon cable from H10 on the CRT assembly. (If the CRT assembly next to the processor is being replaced, disconnect the ribbon cables from J1, J4 and J7 on the processor board.)

4.27.6 Remove the four socket head mounting screws, and lift the CRT assembly from the monitor box.

4.27.7 Position the replacement CRT assembly in the monitor box and reinstall the four mounting screws. Before tightening the screws, slide the CRT assembly as far forward as possible.

4.27.8 Connect the ribbon cable to H10 on the CRT assembly. (Reconnect the cables to J1, J4 and J7 on the processor board if necessary.)

4.27.9 Connect the cables that were previously removed from J7 and J1 on the power supply assembly.

4.27.10 Reset the circuit breakers at the back of the monitor box, and restore power to the machine.

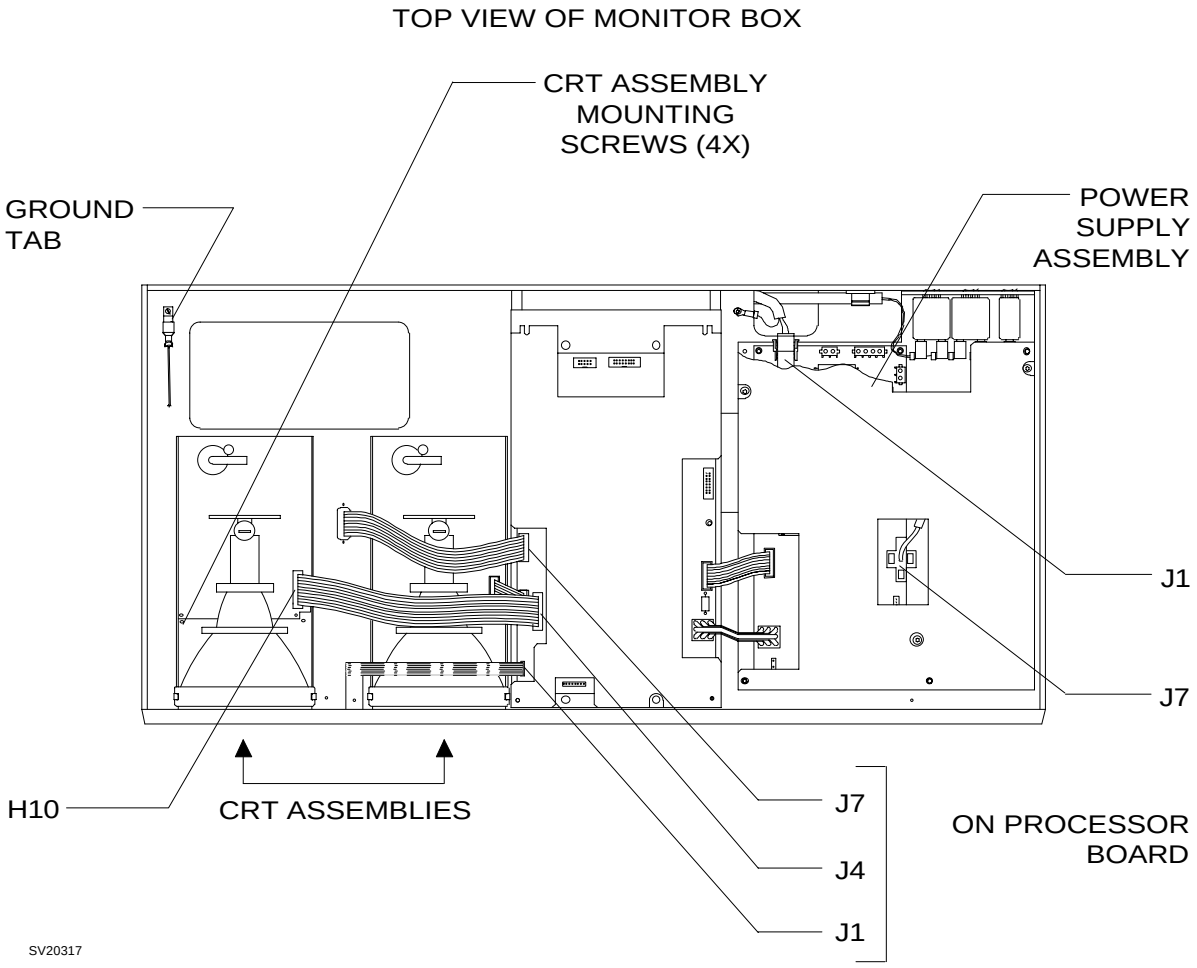


Figure 4-27: CRT ASSEMBLIES

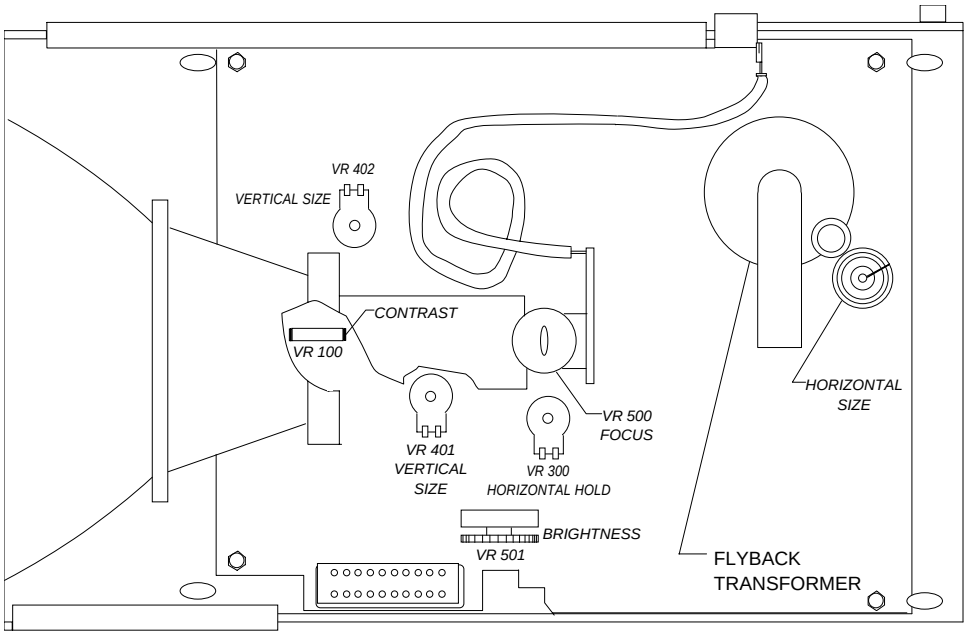


Figure 4-27A: CRT ADJUSTMENTS

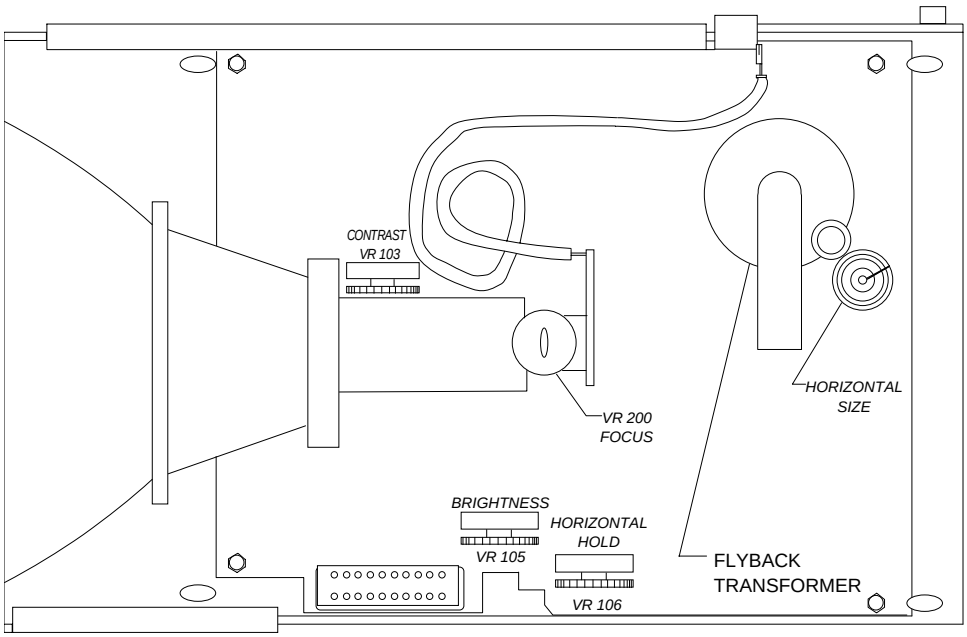


Figure 4-27B: CRT ADJUSTMENTS (ALTERNATE MODEL)

WARNING: When making adjustments to the CRT assembly, use only non-metallic alignment tools and be careful not to touch any of the high voltage leads or CRT circuitry.

4.27.11 Turn the System Power switch to ON, and observe the display. If necessary, adjust the size, centering, contrast, brightness and focus controls to obtain a sharp and properly aligned display.

NOTE: Typical locations of CRT adjustments are shown in Figure 4-27A. An alternate model arrangement is shown in Figure 4-27B.

4.27.12 Turn the System Power switch to STANDBY.

4.27.13 Place the monitor box top shelf into position, connect its ground wire to the chassis ground tab, and reinstall the top shelf screws.

4.27.14 Perform the PMS Procedure given in Section 6.

4.28 Keypads

The alarm keypad and the CRT keypad are part of the front bezel assembly. Access to the keypads requires removal of the monitor box top shelf and removal of the CRT assemblies, processor, and filter panel retainer brackets. Figure 4-28 shows the keypad and filter panel mounting arrangement.

4.28.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Use ESD protection when servicing any of the assemblies inside the monitor box. It is also recommended that the AC line cord be plugged into a test fixture which maintains the electrical service ground connection to the machine while isolating the line and neutral conductors.

4.28.2 Disable the three circuit breakers at the back of the monitor box by pulling out each button with a knife or sharp object.

4.28.3 Remove the screws holding the monitor box top shelf. Lift the back of the shelf and disconnect its ground wire from the chassis ground tab, then lift out the shelf.

4.28.4 On the power supply assembly, disconnect the AC power cable at J1, and disconnect the battery power cable at J7.

4.28.5 Disconnect the following cables from the processor assembly:

J5 Power	J4 CRT
J6 Data	J1 Keypad
J7 Alarm	J2 Keypad
J8 Alarm	J9 Spiromed Sensor
J3 CRT	J10 O_2 Sensor

4.28.6 Carefully disconnect the tubing at the right-angle fitting on the baromed sensor line. Be careful not to bend or crimp the hose barb.

4.28.7 Loosen the four captive mounting screws on the baseplate of the processor assembly.

4.28.8 Lift the front of the processor assembly first, and then lift the assembly out of the monitor box.

4.28.9 On each CRT assembly, remove the four socket head mounting screws and lift the assembly from the monitor box.

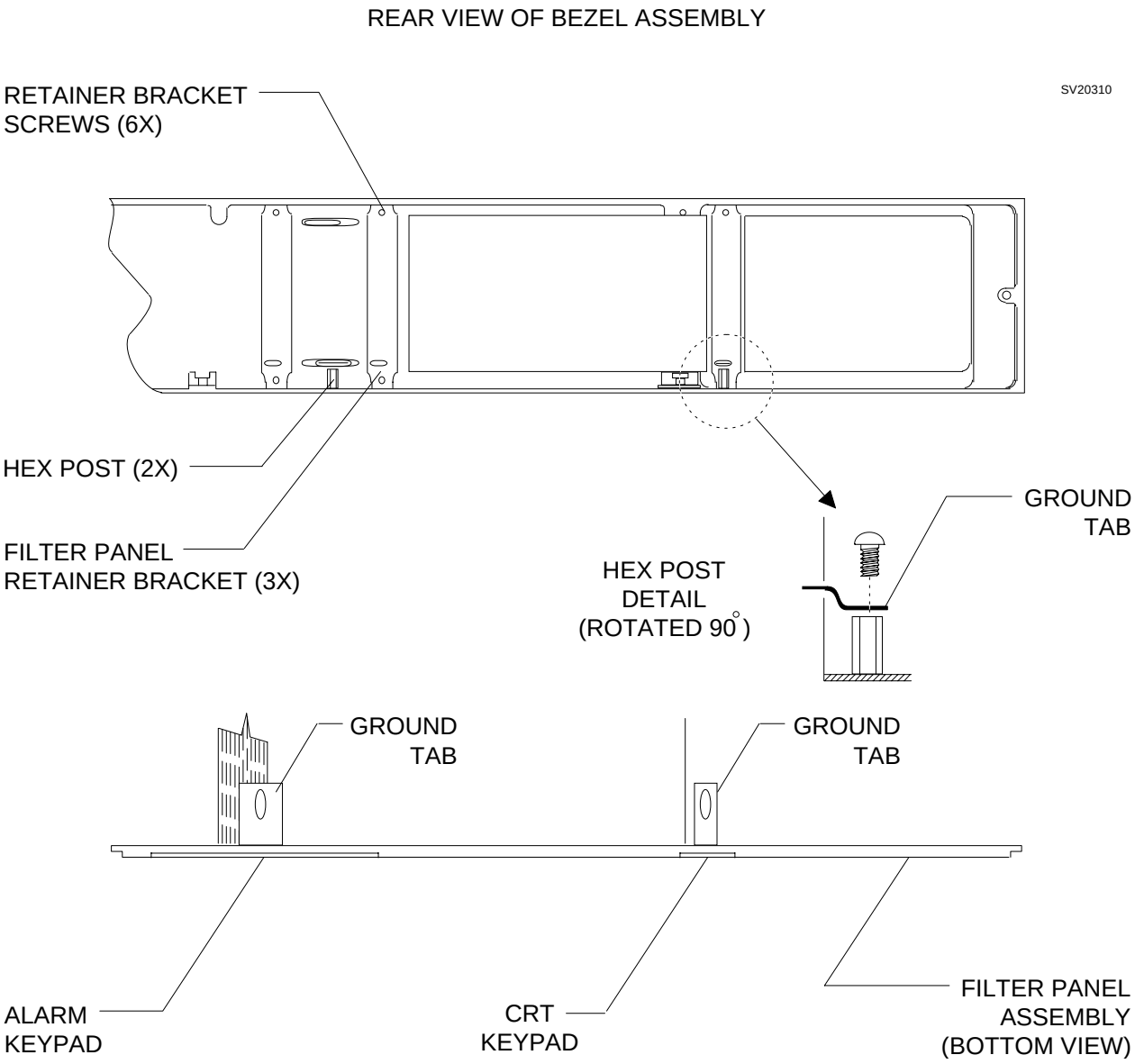


Figure 4-28: ALARM AND CRT KEYPADS

4.28.10 Remove the screws connecting the ground tabs of the keypads to the hex posts on the floor of the monitor box.

4.28.11 Remove the two hex posts from the floor of the monitor box.

4.28.12 Remove the three filter panel retainer brackets from the back of the bezel assembly.

4.28.13 Tilt the bottom of the filter panel inward, and remove the panel from the front bezel. The keypad(s) can then be separated from the filter panel.

4.28.14 Install the replacement keypad(s) on the filter panel, and carefully place the filter panel into the front bezel.

4.28.15 Reinstall the filter panel retainer bracket between the CRT panels. Carefully feed the CRT keypad ground tab through the slot in the retainer bracket. Reinstall the remaining two retainer brackets.

4.28.16 Reinstall the two hex posts that were previously removed from the floor of the monitor box.

4.28.17 Carefully connect the keypad ground tabs to the hex posts with the screws that were previously removed. Be careful not to twist or damage the ground tabs.

4.28.18 Reinstall the two CRT assemblies. Slide each assembly as far forward as possible before tightening its mounting screws.

4.28.19 Reinstall the processor assembly and tighten its captive mounting screws. Reconnect the cables that were previously removed from J1 thru J10 on the processor assembly.

4.28.20 Connect the cables that were previously removed from J7 and J1 on the power supply assembly.

4.28.21 Place the monitor box top shelf into position, connect its ground wire to the chassis ground tab, and reinstall the top shelf screws.

4.28.22 Reset the circuit breakers at the back of the monitor box.

4.28.23 Perform the PMS Procedure given in Section 6.

4.29 SPIROMED Respiratory Volume Sensor

The respiratory volume sensor is installed between the top of the absorber assembly and the expiratory valve. Figure 4-29 shows the volume sensor mounting arrangement, gaskets and connection to the interface panel.

4.29.1 Set the System Power switch to STANDBY.

4.29.2 Disconnect the sensor plug from the volume sensor receptacle on the interface panel.

4.29.3 Remove the expiratory valve by unscrewing the valve retaining nut.

4.29.4 Remove the volume sensor from the absorber assembly by unscrewing its retaining nut.

CAUTION: Do not twist the body of the sensor when loosening the retaining nut. Hold the sensor while loosening the retaining nut to prevent damage to the unit.

4.29.5 Install the replacement volume sensor on the absorber assembly. Ensure that the gasket is seated properly and hand tighten the retaining nut.

4.29.6 Install the expiratory valve on the sensor. Ensure that the gasket is seated properly and hand tighten the valve retaining nut.

4.29.7 Connect the sensor plug to the volume sensor receptacle on the interface panel.

4.29.8 Restore power to the machine and perform the respiratory flow monitor calibration procedure given in Section 5.

4.29.9 Perform the PMS Procedure given in Section 6.

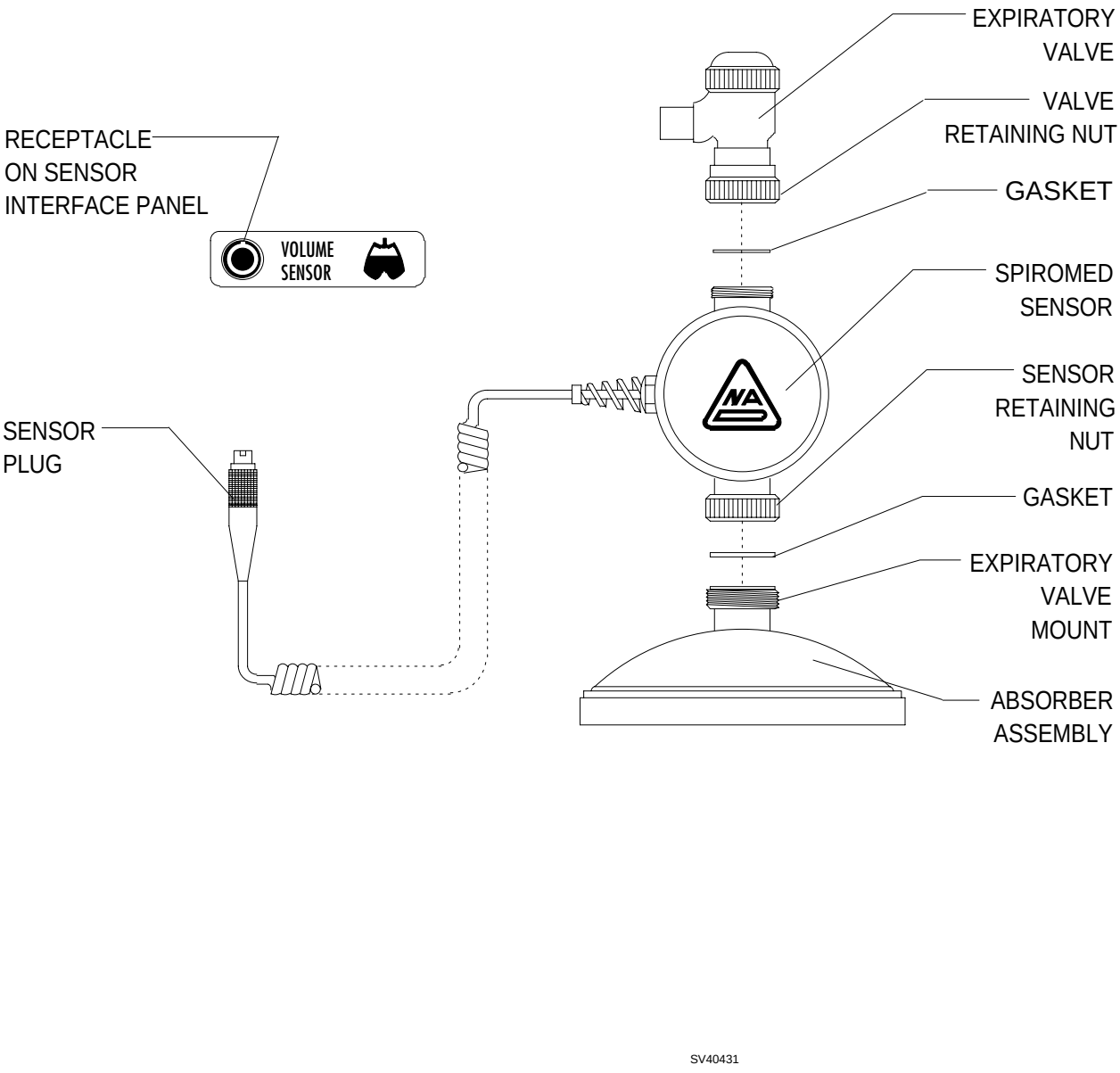


Figure 4-29: RESPIRATORY VOLUME SENSOR

4.30 Oxygen Sensor

The oxygen sensor is located on top of the inspiratory valve. Figure 4-30 shows the arrangement of the sensor capsule and its housing, and also its connection to the interface panel.

4.30.1 Set the System Power switch to STANDBY.

4.30.2 Pull the oxygen sensor housing from the inspiratory valve dome. (It is a press fit.)

4.30.3 Unscrew the cover from the sensor housing and remove the sensor capsule.

4.30.4 Remove the replacement sensor capsule from its shipping container and install it in the housing. Ensure that the copper rings on the capsule mate with the electrical contacts in the sensor housing.

4.30.5 Wait 15 minutes to allow the sensor capsule to stabilize.

4.30.6 Restore power to the machine and perform the 21% calibration procedure for the oxygen sensor given in Section 5.

4.30.7 Press the sensor assembly into the inspiratory valve dome.

4.30.8 Perform the PMS Procedure given in Section 6.

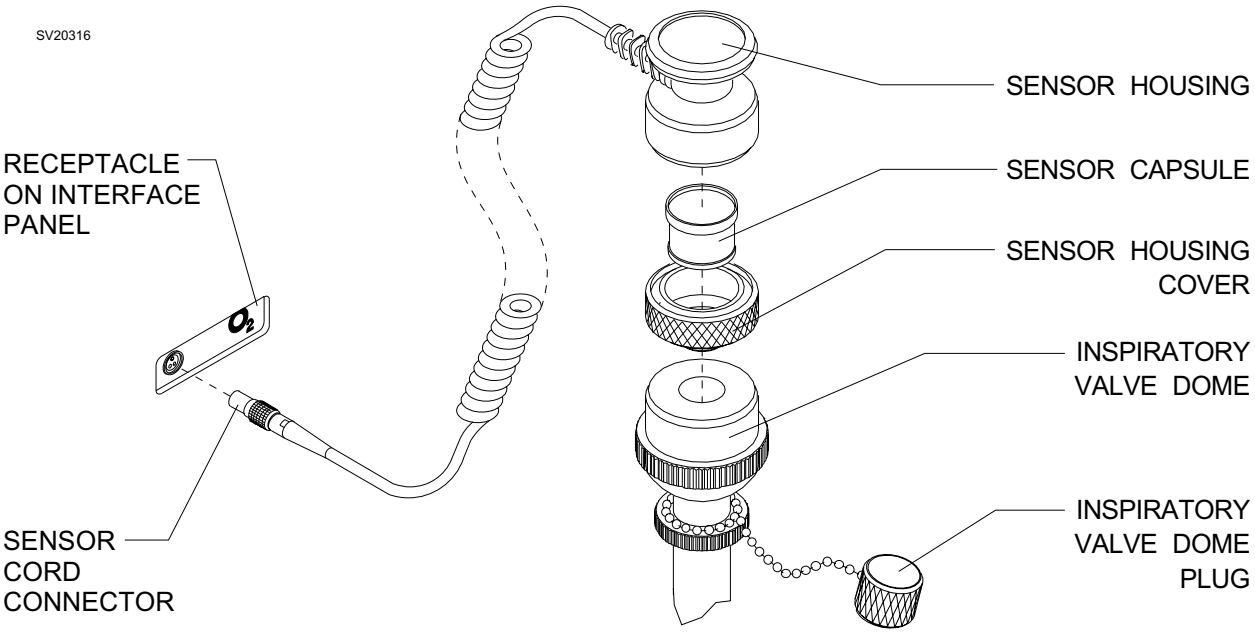


Figure 4-30: OXYGEN SENSOR REPLACEMENT

4.31 Manual Sphygmomanometer

The manual sphygmomanometer gauge is mounted on a threaded piece attached to the underside of the boom arm mounting block. If the machine is equipped with an optional O.R. Data Manager, the gauge mount is located on the display arm mount. Figure 4-31 shows the gauge and cuff connections to the BP interface panel.

4.31.1 Disconnect the gauge line from the BP GAUGE fitting on the BP interface panel.

4.31.2 Remove the gauge by unscrewing its mounting ring from the gauge mount.

4.31.3 Install the replacement gauge on the gauge mount, and hand tighten the gauge mounting ring. Ensure that the gauge is facing forward.

4.31.4 Connect the gauge line to the BP GAUGE fitting on the BP interface panel.

4.31.5 Ensure that the remaining connections are properly made:

Connect the hose on the blood pressure cuff to an extension hose, and the other end of the extension hose to the BP CUFF fitting on the BP interface panel.

Connect the inflation bulb hose to the BP BULB fitting on the front of the machine.

4.31.6 Perform the following leak test on the manual sphygmomanometer:

4.31.6.1 Place the blood pressure cuff around a rigid cylindrical object approximately the same diameter as a human arm.

4.31.6.2 Inflate the cuff to a pressure of 200 mm Hg, as indicated on the gauge.

4.31.6.3 The pressure should not drop more than 10 mm Hg in 30 seconds.

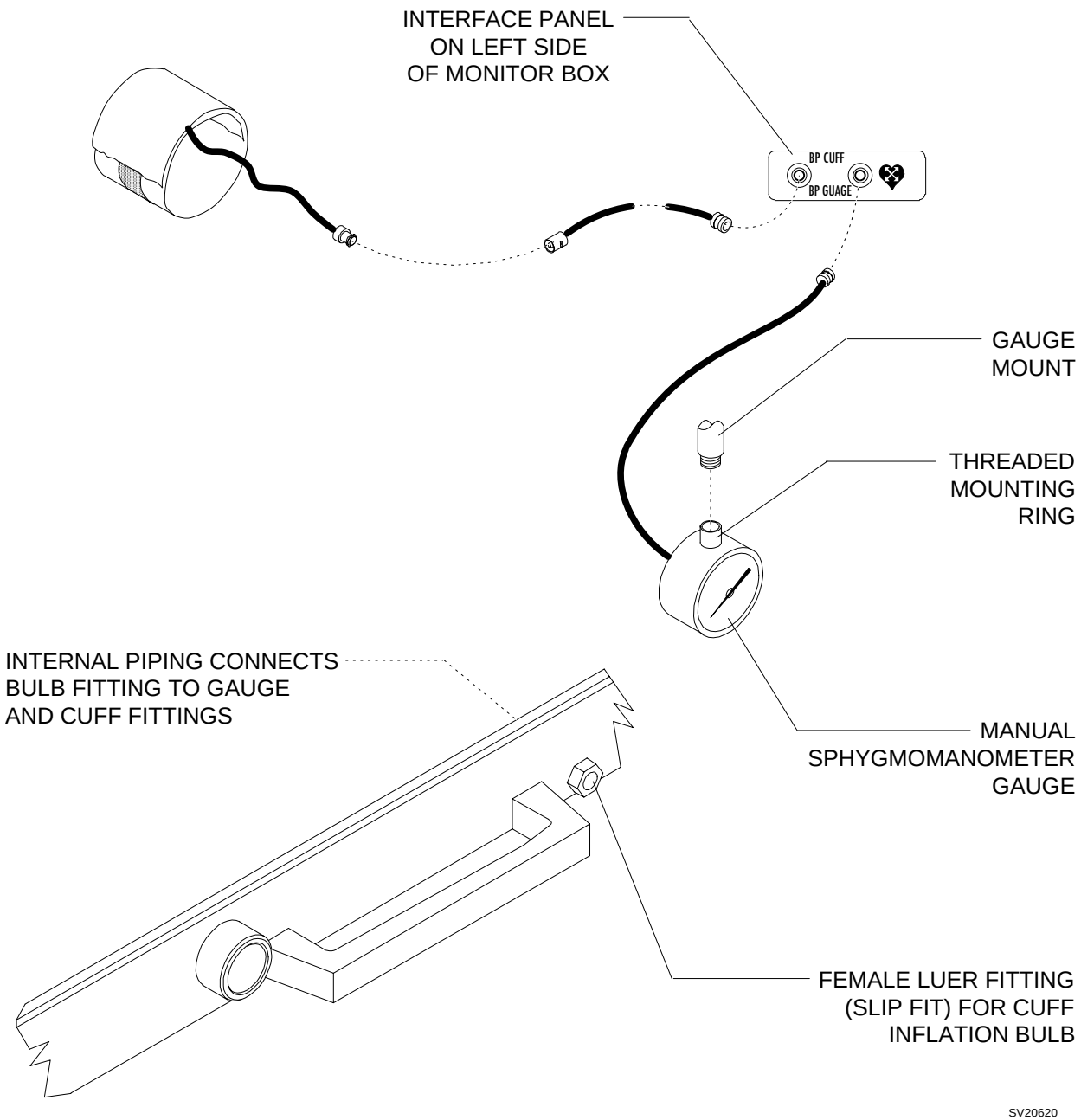


Figure 4-31: MANUAL SPHYGMOMANOMETER

4.32 Auxiliary Oxygen Flow Meter

Old and new style auxiliary oxygen flowmeters are attached to the side of the machine's flowmeter housing by two screws - accessible from inside the housing. Later installations of the new style auxiliary oxygen flowmeter have a stud and nut arrangement for mounting. A flexible O_2 supply tube from the flowmeter connects to a hose barb fitting at the system power switch. Figure 4-32 shows a typical mounting and tubing arrangement.

4.32.1 Disconnect all pipeline hoses and close all cylinder valves.

4.32.2 Press the O_2 Flush button to drain oxygen pressure from the system.

4.32.3 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.32.4 Remove the back cover from the flowmeter housing.

4.32.5 Cut the tie strap on the flexible tube at the system power switch, and remove the tube.

4.32.6 Remove the screws (or nuts) securing the auxiliary O_2 flowmeter, and remove the flowmeter.

4.32.7 Position the replacement flowmeter at the side of the flowmeter housing (feed the flex tubing through the clearance hole) and secure the auxiliary O_2 flowmeter with the two screws (or nuts) that were previously removed.

4.32.8 Connect the flex tubing to the hose barb fitting behind the Clippard valve, and secure it with a tie strap.

4.32.9 Reinstall the flowmeter housing back cover.

4.32.10 Connect the pipeline hoses and restore AC power to the machine.

4.32.11 Perform the PMS Procedure given in Section 6.

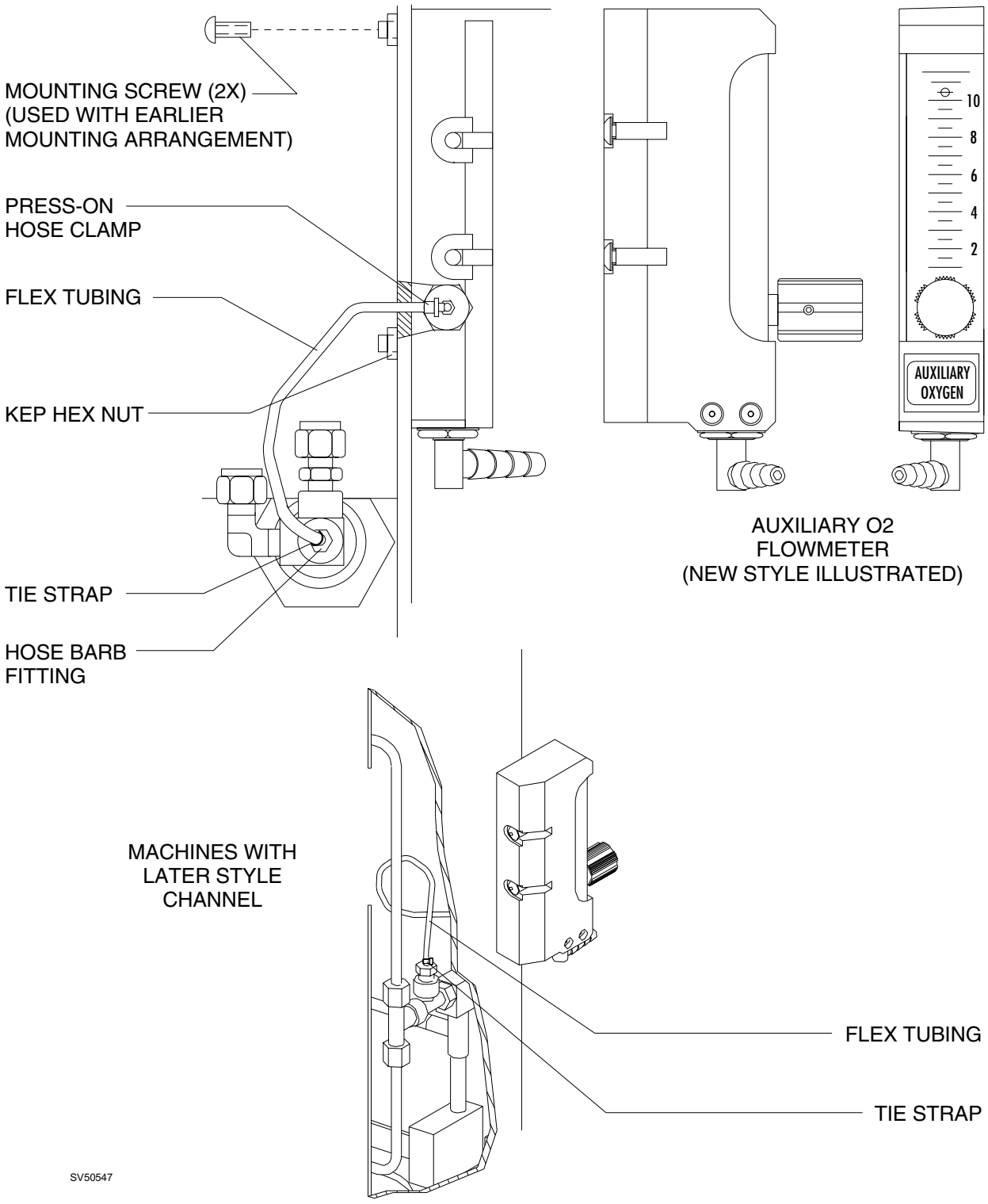


Figure 4-32: AUXILIARY O_2 FLOWMETER

4.33 PEEP Valve Magnet Assembly Replacement

The PEEP valve magnet assembly removal and replacement is outlined in the following procedure. Figure 4-33 shows the knob and magnet assembly details.

NOTE: Some older PEEP valve assemblies require the use of a tamper-proof 5/56 hex key (P/N S010056).

4.33.1 Loosen the two set screws on the block, at each side of the PEEP knob using a 5/64 hex key. Back these screws out until they are flush with the block to allow proper removal of the knob assembly.

4.33.2 Using a flat head screw driver, carefully pry the knob and magnet assembly away from the block, and remove the assembly.

4.33.3 Remove the four or six screws securing the retaining ring on the knob and magnet assembly, and remove the retaining ring.

4.33.4 Remove the magnet assembly from the knob and discard the magnet in an appropriate manner.

4.33.5 Insert the new magnet assembly into the knob.

On new style knobs, make sure the magnet's dowel pin engages the slots in the knob. If the magnet is not oriented correctly there will be freeplay in the knob before it turns the magnet.

4.33.6 Reinstall the retaining ring and secure it with the screws that were previously removed.

4.33.7 Turn the set screws into the PEEP block until you can just see them from the inside of the block.

4.33.8 Apply a thin coat of high vacuum grease to the O-rings on the magnet assembly to aid in its installation.

4.33.9 Align the holes of the magnet assembly with the set screw holes, and install the knob & magnet assembly into the PEEP block.

4.33.10 Slowly tighten the set screws. If the holes are lined up correctly. you will be able to tighten the set screws several turns until they stop. If you experience resistance, STOP tightening the set screw to prevent damage to the magnet assembly. Re-align the magnet assembly and tighten the set screw correctly.

4.33.11 Perform the PMS procedure given in Section 6.

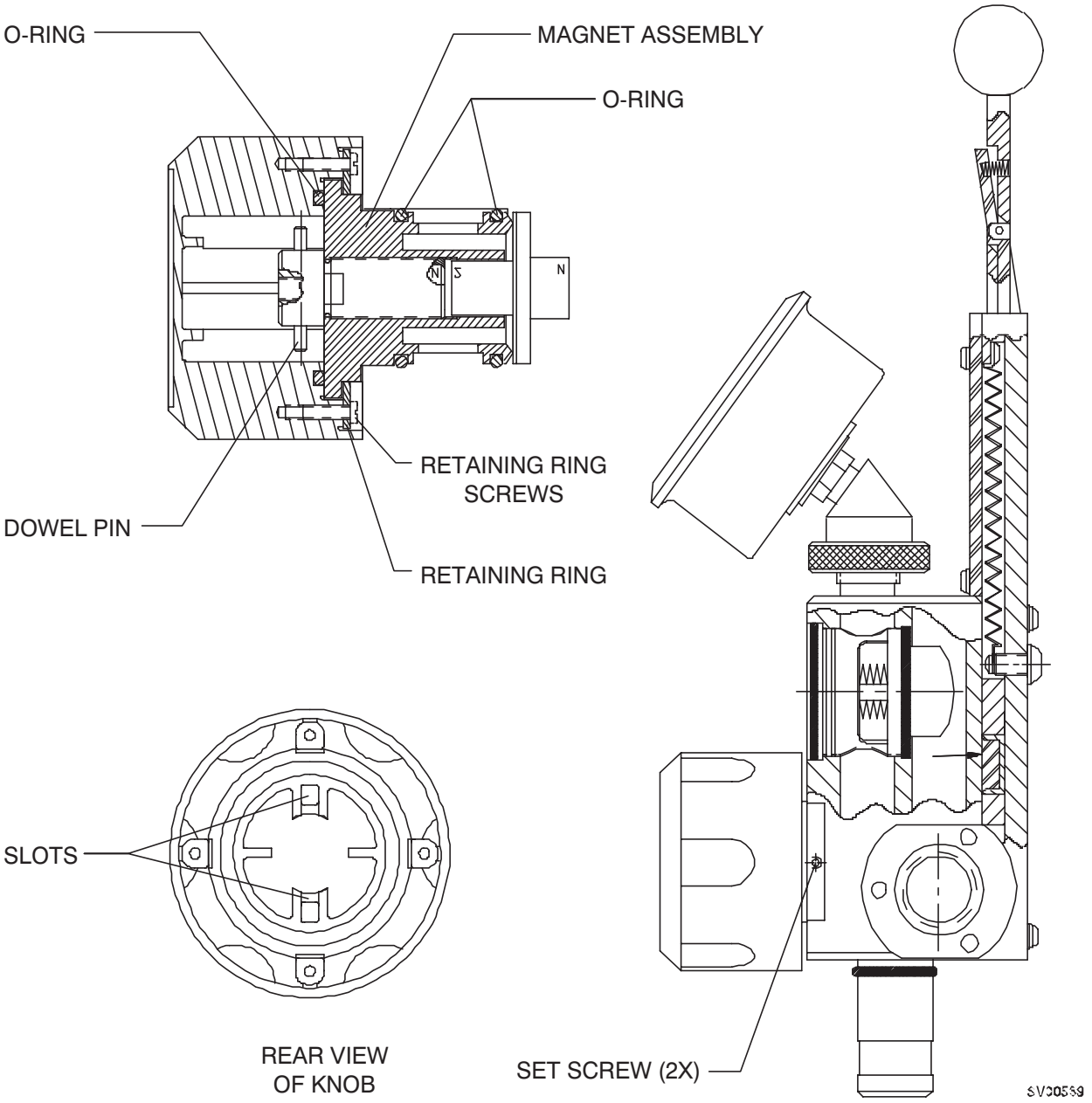


Figure 4-33: PEEP Valve Magnet Assembly Replacement

5.0 ADJUSTMENT AND CALIBRATION PROCEDURES

Equipment Required:

-- Test Gauges for setting cylinder pressure regulators,

-- Oxygen Monitor for adjusting ORMC or ORC

-- Test fixture with breathing pressure line connector, TEE connector, gauge, and inflation device, for breathing pressure monitor calibration

5.1 Cylinder Pressure Regulator Adjustment (except CO2)

5.1.1 Disconnect all pipeline hoses and set the System Power switch to ON.

5.1.2 Close all cylinder valves except the O_2 valve.

5.1.3 Set the oxygen flow to 4 liters per min.

5.1.4 Open the other gas flow control valves to drain pressure from the system.

5.1.5 Close the O2 cylinder valve. Close all of the flow control valves and press the O_2 Flush valve to drain oxygen pressure from the system.

5.1.6 Set the System Power switch to STANDBY.

5.1.7 Remove the table top from the machine and remove the top cabinet drawer. Pull the writing tray out out to its fully extended position.

NOTE: Minimum cylinder pressures for this adjustment shall be:
N2O & CO2: 600 psi; O2, Air, He, He/O2, N2: 1000 psi.

5.1.8 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

5.1.9 Connect a test gauge to the TEE fitting.

NOTE: For gases other than O2, the O2 cylinder valve must be open to allow other gases to flow. For N2O regulator adjustment, open the N2O flow control valve completely; then open the O2 flow control valve until the N2O flow reaches 4 L/min.

5.1.10 Open the cylinder valve and set the System Power switch to ON.

5.1.11 Set the O2 flow to 4 L/min. (also set the N20 or other gas flow to 4 L/min. if these regulators are being adjusted).

5.1.12 Remove the acorn nut on the bottom of the regulator to expose the adjusting screw. For N2O, turn the screw until the test gauge indicates 46 psi. (50 psi for CSA machines.) For O2 and other gases, use the compensated regulator output setting based on the cylinder pressure given in the following table.

CAUTION: Based on information supplied by the cylinder regulator manufacturer, when the regulator is used for gases other than N2O or CO2, its output pressure will decrease 0.5 psi for every 100 psi increase in cylinder pressure above 1000 psi. Currently, these regulators are calibrated at 47 psi with a cylinder supply of 1000 psi. If a 2000 psi cylinder is then installed, the regulator output will be 42 psi. This change in output must be compensated for to provide accurate performance throughout the cylinder's working range.

NOTE: Cylinder pressure compensation for the N2O regulator is not required.

Cylinder Pressure (psi)	Compensated Regulator Output Setting (psi)	Compensated Regulator Output Tolerances (-4, +2)
2000	42 (*45)	38 - 44 (*41 - 47)
1800	43 (*46)	39 - 45 (*42 - 48)
1600	44 (*47)	40 - 46 (*43 - 49)
1400	45 (*48)	41 - 47 (*44 - 50)
1200	46 (*49)	42 - 48 (*45 - 51)
1000	47 (*50)	43 - 49 (*46 - 52)

* Canada Settings

NOTE: If the O2 cylinder regulator is adjusted according to the chart, perform the following test to verify that the Lo O2 supply alarm is not activated during ventilation.

Open the O2 cylinder valve, install a breathing circuit with test lung to absorber, and make the following settings:

MAN/AUTO selector to AUTO

Ventilator:
FREQUENCY: 10 BPM
I:E Ratio: 1:2
Tidal Volume: 1400 mL
PLC: MAX
INSP FLOW: HIGH

Set the Fresh Gas flow to 10 L/min.

Turn on the ventilator. While the ventilator is cycling, press the O2 flush button and verify that the Lo O2 Supply alarm is not activated. If the alarm is activated, refer to Section 5.2 for Oxygen Supply Pressure Alarm Switch Adjustment.

5.1.13 Replace the acorn nut on the bottom of the regulator.

5.1.14 Close the cylinder valve and allow pressure to drain from the system.

5.1.15 Close all of the flow control valves and set the System Power switch to STANDBY.

5.1.16 Disconnect the test gauge from the TEE fitting and replace the plug in the fitting.

5.1.17 Replace the table top and its retaining screws.

5.1.18 Replace the top drawer in the cabinet.

5.1.19 Connect the pipeline hoses.

5.1.20 Perform the PMS Procedure given in Section 6.

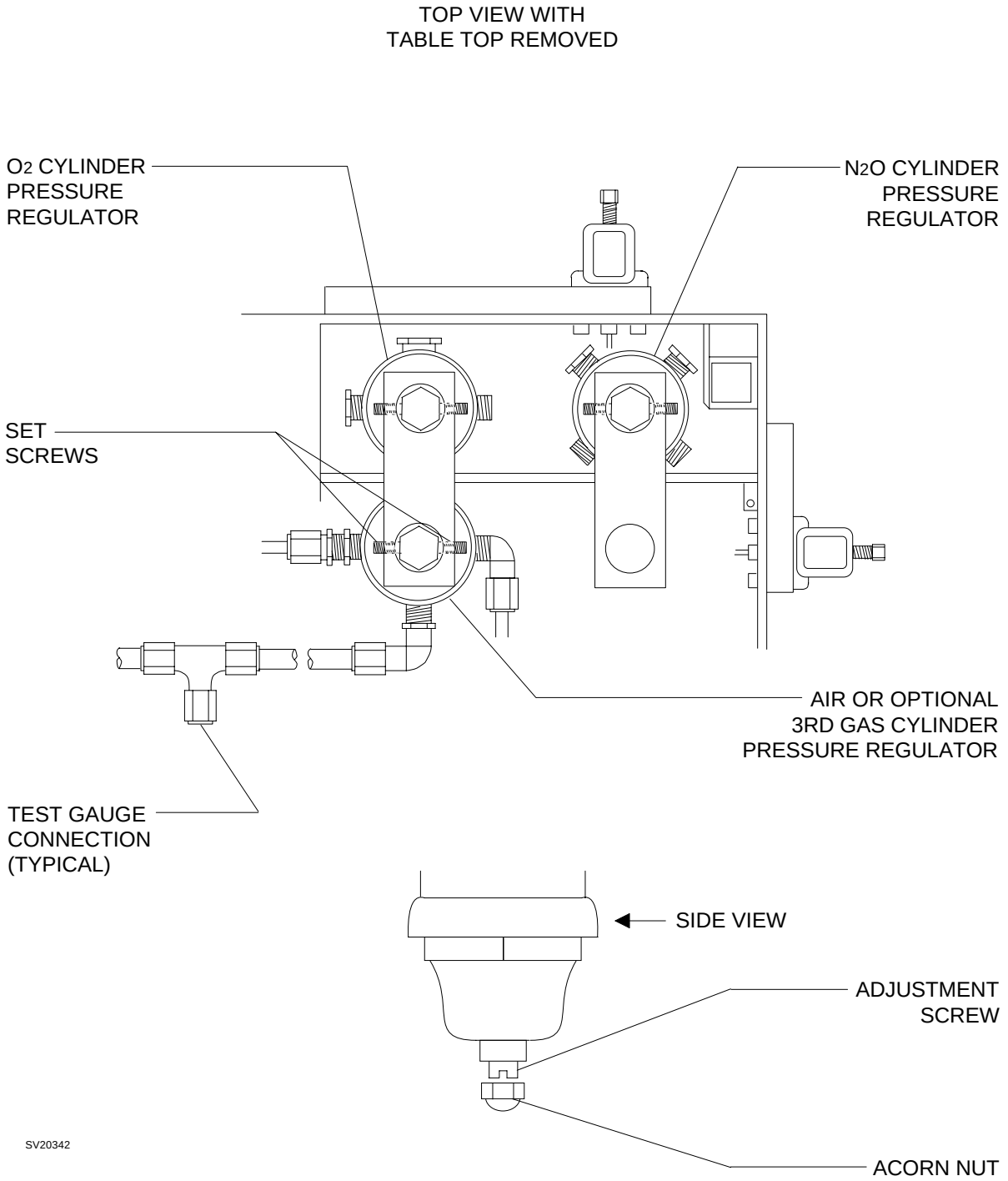


Figure 5-1: CYLINDER PRESSURE REGULATOR ADJUSTMENT

5.1A CO2 Cylinder Pressure Regulator Adjustment

5.1.1.A Perform Steps 5.1.1 thru 5.1.7.

5.1.2.A Open the CO_2 cylinder valve and set the System Power switch to ON.

5.1.3.A Fully open the CO_2 flow control valve.

5.1.4.A Remove the acorn nut on the bottom of the CO_2 regulator to expose the adjusting screw. Turn the screw until the CO_2 flowmeter indicates 550 ml/min.

5.1.5.A Replace the acorn nut on the bottom of the regulator.

5.1.6.A Close the cylinder valve and allow pressure to drain from the system.

5.1.7.A Close the flow control valve and set the System Power switch to STANDBY.

5.1.8.A Replace the table top and its retaining screws.

5.1.9.A Replace the top drawer in the cabinet.

5.1.10.A Connect the pipeline hoses.

5.1.11.A Perform the PMS Procedure given in Section 6.

5.2 Oxygen Supply Pressure Alarm Switch Adjustment (earlier machines)

5.2.1 Disconnect all pipeline hoses and set the System Power switch to ON.

5.2.2 Close all cylinder valves except the O_2 valve.

5.2.3 Set the oxygen flow to 5 liters per min.

5.2.4 Open the other gas flow control valves to drain pressure from the system.

5.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

5.2.6 Set the System Power switch to STANDBY.

5.2.7 Remove the flowmeter housing rear cover. Remove the table top and pull the writing or keyboard tray out to its fully extended position.

5.2.8 Locate the TEE fitting in the ¼ in. diameter O_2 regulator output line, and remove the plug from the TEE fitting.

5.2.9 Connect a dedicated O_2 test gauge to the TEE fitting.

5.2.10 Open the O_2 cylinder valve and set the System Power switch to ON.

5.2.11 Set the oxygen flow to 5 liters per min.

5.2.12 Close the oxygen cylinder valve.

5.2.13 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

5.2.14 If the alarm activates when the pressure is below 34 psi, turn the adjustment wheel to increase the setpoint (see illustration), repeat the test and adjust as necessary to bring the set point into the correct range.

If the alarm activates when the pressure is above 40 psi, turn the adjustment wheel to decrease the setpoint (see illustration), repeat the test and adjust as necessary to bring the set point into the correct range.

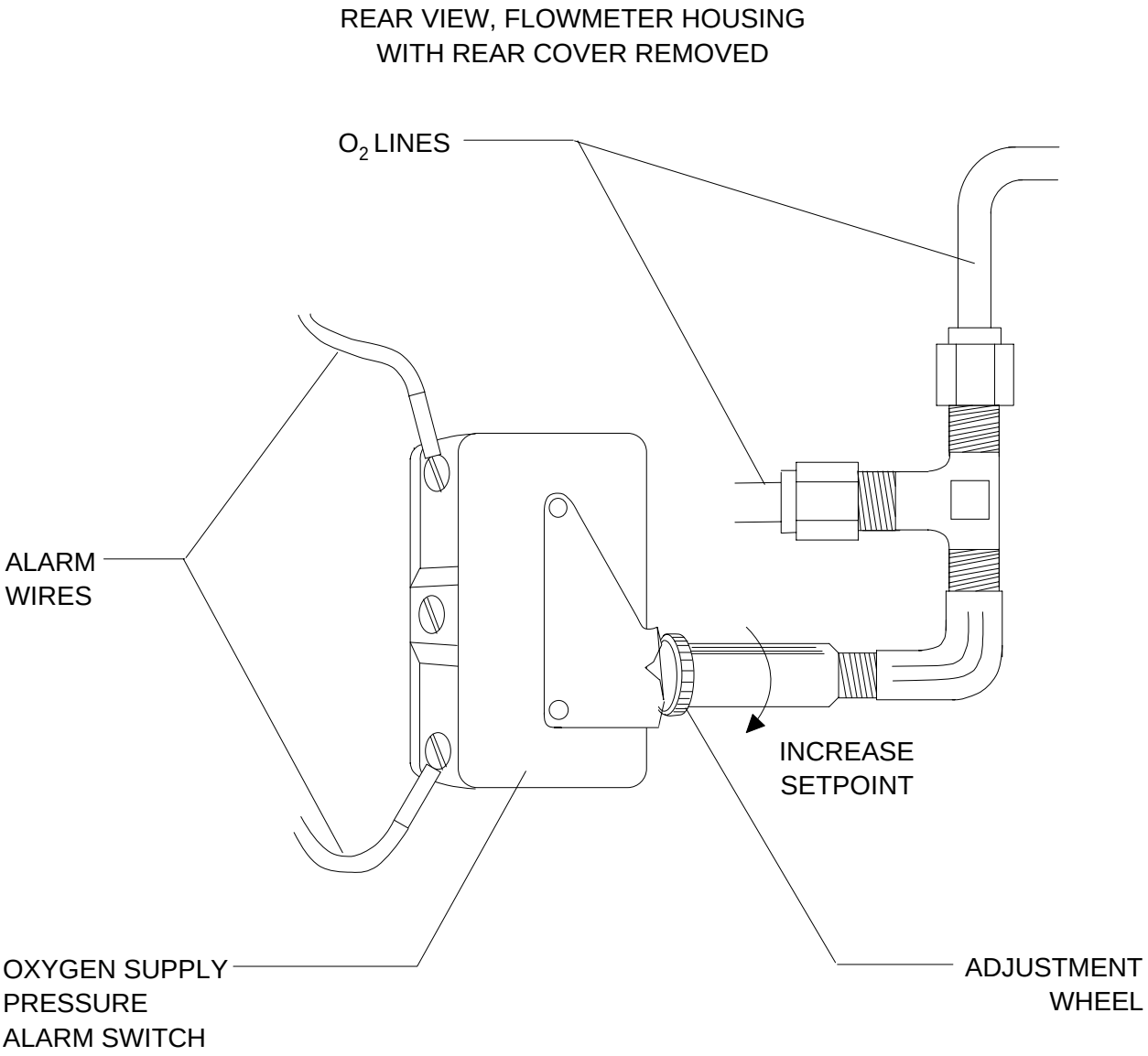


Figure 5-2: O_2 ALARM SWITCH (earlier machines)

5.2.15 Set the System Power switch to STANDBY.

5.2.16 Disconnect the test gauge and replace the plug in the regulator line TEE fitting.

5.2.17 Replace the table top and its retaining screws.

5.2.18 Replace the rear cover and its retaining screws.

5.2.19 Connect the pipeline hoses.

5.2.20 Perform the PMS Procedure given in Section 6.

5.3 Oxygen Supply Pressure Alarm Switch Adjustment (later machines with switch on alarm channel)

5.3.1 Disconnect all pipeline hoses and set the System Power switch to ON.

5.3.2 Close all cylinder valves except the O_2 valve.

5.3.3 Set the oxygen flow to 5 liters per min.

5.3.4 Open the other gas flow control valves to drain pressure from the system.

5.3.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

5.3.6 Set the System Power switch to STANDBY.

5.3.7 Remove the rear cover from the flowmeter housing. Remove the table top and pull the writing or keyboard tray out to its fully extended position.

5.3.8 Locate the TEE fitting in the ¼ in. diameter O_2 regulator output line, and remove the plug from the TEE fitting.

5.3.9 Connect a dedicated O_2 test gauge to the TEE fitting.

5.3.10 Open the O_2 cylinder valve and set the System Power switch to ON.

5.3.11 Set the oxygen flow to 5 liters per min.

5.2.12 Close the oxygen cylinder valve.

5.3.12 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

5.3.13 If the alarm activates when the pressure is below 34 psi or above 40 psi, turn the adjustment wheel (see illustration), repeat the test and adjust as necessary to bring the set point into the correct range.

5.3.14 Turn the System Power switch to STANDBY.

5.3.15 Disconnect the test gauge and replace the plug in the regulator line TEE fitting.

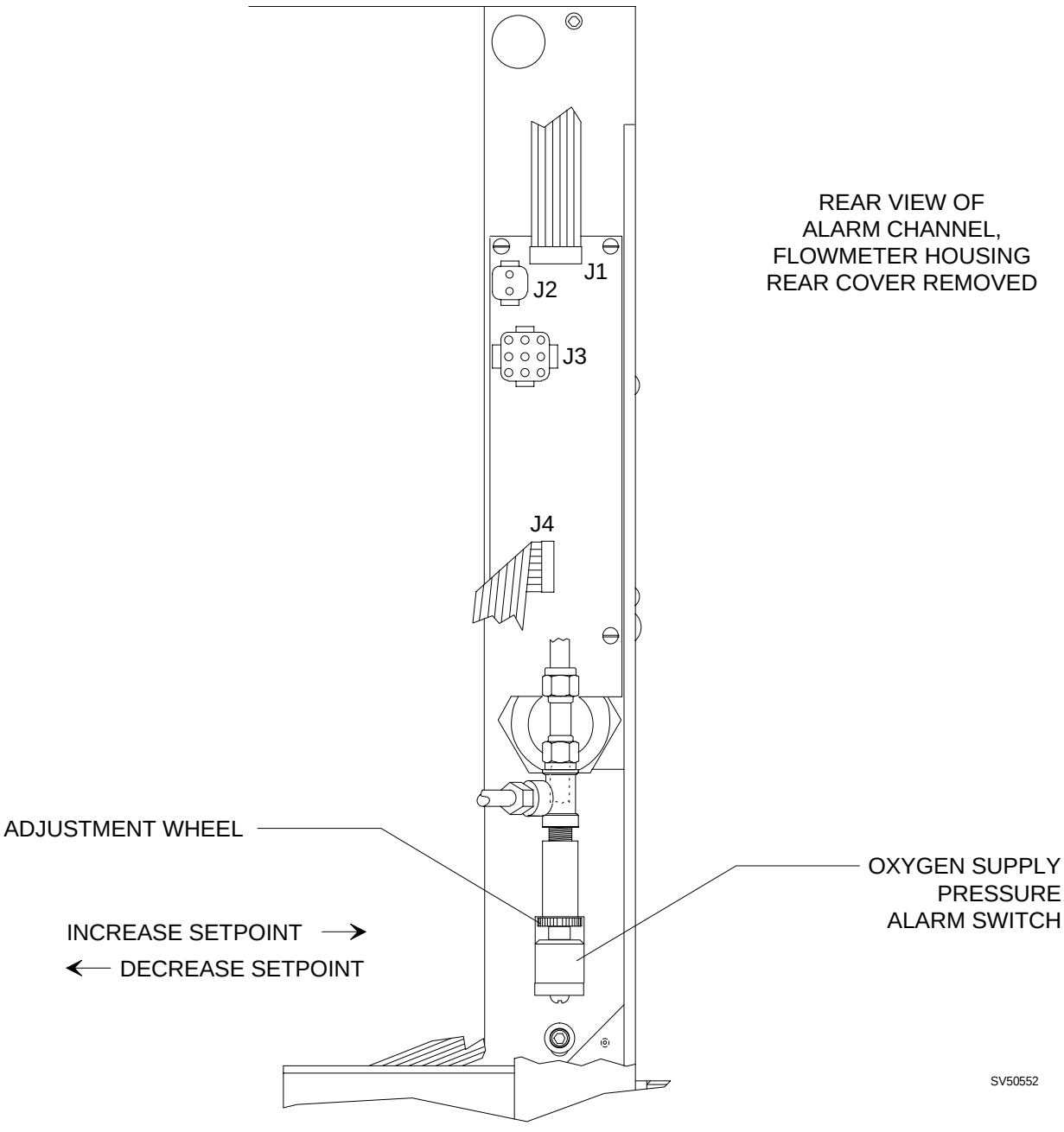


Figure 5-3: OXYGEN SUPPLY PRESSURE ALARM SWITCH (later machines)

5.3.16 Replace the table top and its retaining screws.

5.3.17 Replace the rear cover and its retaining screws.

5.3.18 Connect the pipeline hoses.

5.3.19 Perform the PMS Procedure given in Section 6.

5.4 Oxygen Ratio Monitor/Controller (ORMC) Adjustment

5.4.1 Remove the rear cover of the vapor box.

5.4.2 Connect a calibrated oxygen monitor to the Freshgas Outlet.

5.4.3 Disconnect the pipeline hoses.

5.4.4 Open the oxygen and nitrous oxide cylinder valves.

5.4.5 Set the System Power switch to ON.

5.4.6 Close the O_2 flow control valve.

5.4.7 Open the N_2O flow control valve to its counter-clockwise stop.

5.4.8 If there is no nitrous oxide flow, proceed to Step 5.4.10.

5.4.9 If there is nitrous oxide flow, loosen setscrew E and move the cam mounting bracket to the right until the nitrous oxide flow stops. Tighten setscrew E.

5.4.10 Slowly open the O_2 flow control valve.

5.4.11 If the nitrous oxide starts to flow when the oxygen flow is between 200 and 300 ml per minute, proceed to Step 5.4.14.

5.4.12 If the nitrous oxide does not start to flow when the oxygen flow is between 200 and 300 ml per minute, loosen setscrew E and move the cam mounting bracket to the left until nitrous oxide flow starts. Tighten setscrew E.

5.4.13 Repeat steps 5.4.6 thru 5.4.12 until no further adjustment of the cam mounting bracket is needed.

5.4.14 Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

NOTE: Steps marked with an asterisk (*) do not apply to later model machines that do not have the O_2/N_2O ratio lamp on the alarm channel.

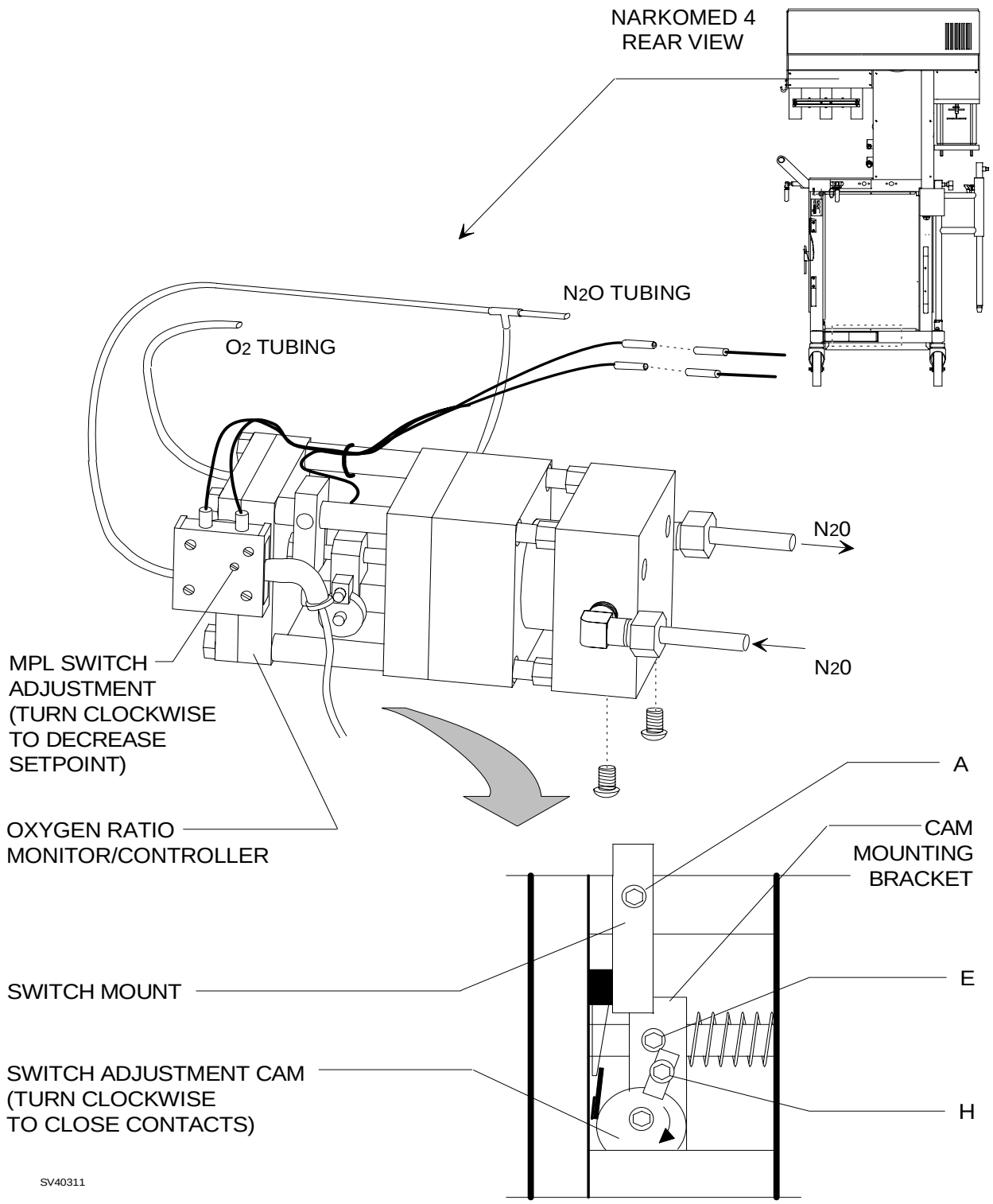


Figure 5-4: OXYGEN RATIO MONITOR/CONTROLLER ADJUSTMENTS

5.4.15 The oxygen concentration should be between 21% and 29% oxygen.

* 5.4.16 If the yellow O_2/N_2O FLOW RATIO lamp on the alarm panel is lighted, proceed to step 5.4.20.

* 5.4.17 If the yellow O_2/N_2O FLOW RATIO lamp on the alarm panel is not lighted, loosen setscrew H and turn the switch adjustment cam until it is pointing downward.

* 5.4.18 Loosen setscrew A and move the switch mount until it is nearly touching the switch adjustment cam. Tighten setscrew A.

* 5.4.19 Turn the switch adjustment cam clockwise until the contacts close and the O_2/N_2O FLOW RATIO lamp is lighted. Tighten setscrew H.

* 5.4.20 Close the N_2O flow control valve.

* 5.4.21 Adjust the oxygen flow to 1 liter per minute.

* 5.4.22 Slowly open the N_2O flow control valve.

* 5.4.23 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should light as soon as the ORMC limits the flow of nitrous oxide.

* 5.4.24 Adjust the oxygen flow to 1.5 liters per minute.

* 5.4.25 Slowly open the N_2O flow control valve.

* 5.4.26 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should light as soon as the ORMC limits the flow of nitrous oxide.

5.4.27 Adjust the oxygen flow to 2 liters per minute.

5.4.28 Slowly open the N_2O flow control valve.

* 5.4.29 The yellow O_2/N_2O FLOW RATIO lamp on the alarm panel should light as soon as the ORMC limits the flow of nitrous oxide.

5.4.30 Close the oxygen flow control valve. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

5.4.31 The nitrous oxide flow should stop when the flow of oxygen is between 200 and 300 ml per minute.

* 5.4.32 If the O_2/N_2O FLOW RATIO lamp turns off when the nitrous oxide flow drops to between 100 and 200 ml per minute, proceed to Step 5.4.34.

* 5.4.33 If the O_2/N_2O FLOW RATIO lamp does not turn off when the nitrous oxide flow drops to between 100 and 200 ml per minute, adjust the MPL switch until the O_2/N_2O FLOW RATIO lamp turns off.

5.4.34 Close the N_2O flow control valve and set the System Power switch to STANDBY.

5.4.35 Replace the rear cover of the vapor box.

5.4.36 Perform the PMS Procedure given in Section 6.

5.5 Oxygen Ratio Controller (ORC) Adjustment

NOTE: See Procedure 5.5A for low flow ORC (P/N 4113229) adjustment.

5.5.1 Remove the rear cover of the flowmeter housing.

5.5.2 Connect a calibrated oxygen monitor to the fresh gas outlet.

5.5.3 Disconnect the pipeline hoses.

5.5.4 Open the oxygen and nitrous oxide cylinder valves.

5.5.5 Set the System Power switch to ON.

5.5.6 Close the O_2 and N_2O flow control valves.

5.5.7 Set the O_2 flow control valve to 10 l/min.

5.5.8 Set the N_2O flow control valve to 10 l/min.

5.5.9 Set the O_2 flow control valve to 800 ml/min for one (1) minute. Verify that the O_2 concentration indicates 21% to 29% O_2.

5.5.10 Decrease the oxygen flow rate.

5.5.11 If the nitrous oxide does not stop when the oxygen flow is between 325 and 350 ml per minute, loosen the adjusting screw locknut and turn the adjusting screw (counter-clockwise to decrease N_2O flow, clockwise to increase N_2O flow). Tighten the locknut.

5.5.12 Repeat steps 5.5.6 thru 5.5.11 until no further adjustment is needed.

5.5.13 Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

5.5.14 The oxygen concentration should be between 21% and 29% oxygen.

5.5.15 Slowly decrease the oxygen flow to 800 ml/min. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

5.5.16 Reduce the O_2 flow to 500 ml/min. Verify that the N_2O flow is greater than or equal to 600 ml/min.

REAR VIEW OF FLOWMETER HOUSING
WITH REAR COVER REMOVED

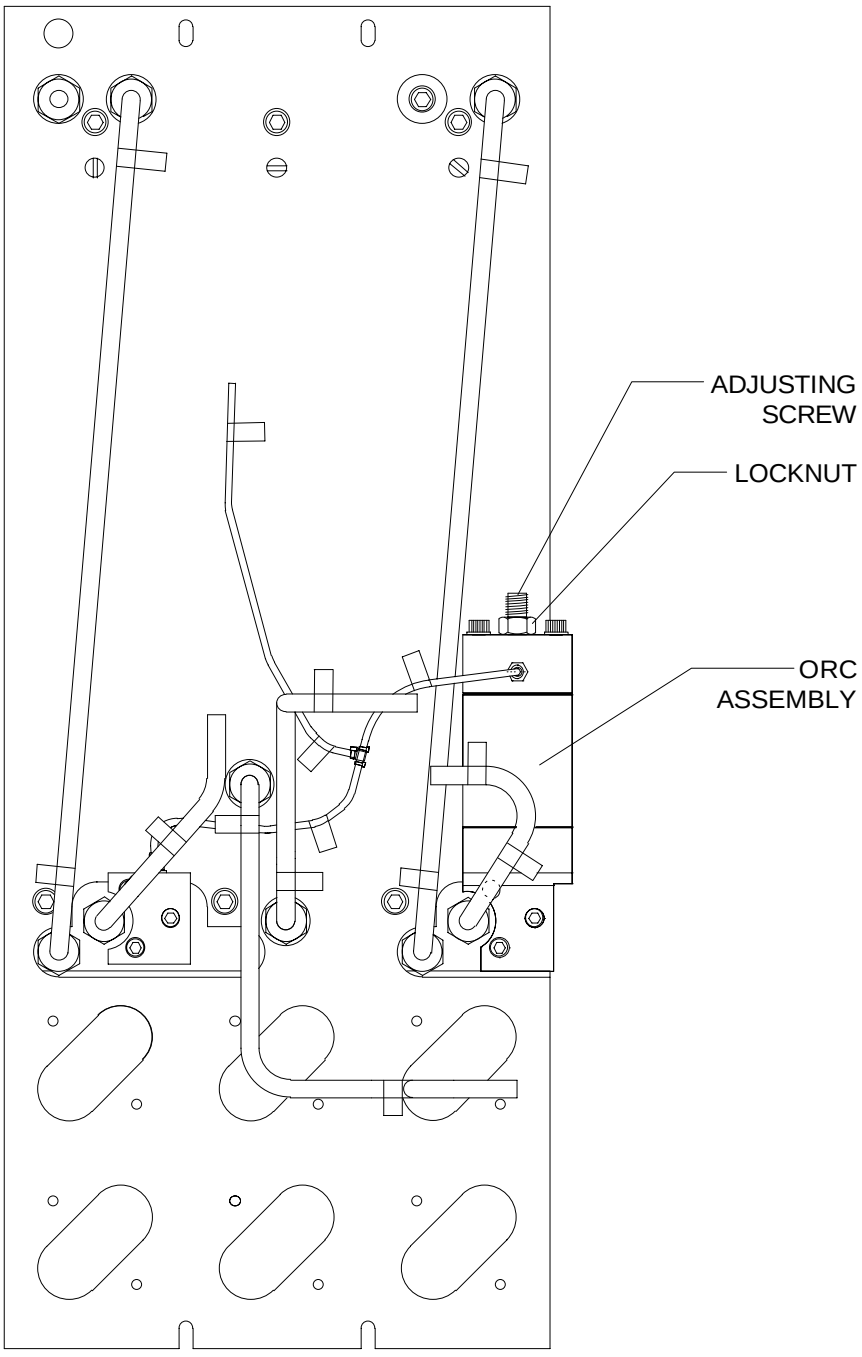


Figure 5-5: OXYGEN RATIO CONTROLLER

5.5.17 The nitrous oxide flow should stop when the flow of oxygen is between 250 and 400 ml per minute.

5.5.18 Close the N_2O flow control valve and turn the System Power switch to STANDBY.

5.5.19 Reconnect the pipeline hoses.

5.5.20 Replace the flowmeter housing rear cover.

5.5.21 Perform the PMS Procedure given in Section 6.

5.5A Low Flow Oxygen Ratio Controller (ORC) Adjustment

5.5.1A Remove the rear cover of the flowmeter housing.

5.5.2A Connect a calibrated oxygen monitor to the fresh gas outlet.

5.5.3A Disconnect the pipeline hoses.

5.5.4A Pinch the N_2O bypass line on the ORC. See Figure 5-5A.

5.5.5A Open the oxygen and nitrous oxide cylinder valves.

5.5.6A Set the System Power switch to ON.

5.5.7A Close the O_2 and N_2O flow control valves.

5.5.8A Set the O_2 flow control valve to 10 l/min.

5.5.9A Set the N_2O flow control valve to 10 l/min.

5.5.10A Set the O_2 flow control valve to 800 ml/min for one (1) minute. Verify that the O_2 concentration indicates 21% to 29% O_2.

5.5.11A Decrease the oxygen flow rate.

5.5.12A If the nitrous oxide flow does not stop when the oxygen flow rate is between 325 and 350 ml per minute, loosen the adjusting screw locknut and turn the adjusting screw (counter-clockwise to decrease N_2O flow, clockwise to increase N_2O flow). Tighten the locknut.

5.5.13A Repeat steps 5.5.7A thru 5.5.12A until no further adjustment is needed.

5.5.14A Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

5.5.15A The oxygen concentration should be between 21% and 29% oxygen.

5.5.16A Slowly decrease the oxygen flow to 800 ml/min. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

5.5.17A Reduce the O_2 flow to 500 ml/min. Verify that the N_2O flow is greater than or equal to 600 ml/min.

5.5.18A The nitrous oxide flow should stop when the flow of oxygen is between 250 and 400 ml per minute.

5.5.19A Un-pinch the N_2O bypass line on the ORC.

5.5.20A Close the O_2 flow control valve, and fully open the N_2O flow control valve. Verify that the O_2 concentration is 22 - 31%.

5.5.21A Close the N_2O flow control valve and turn the System Power switch to STANDBY.

5.5.22A Reconnect the pipeline hoses.

5.5.23A Replace the flowmeter housing rear cover.

5.5.24A Perform the PMS Procedure given in Section 6.

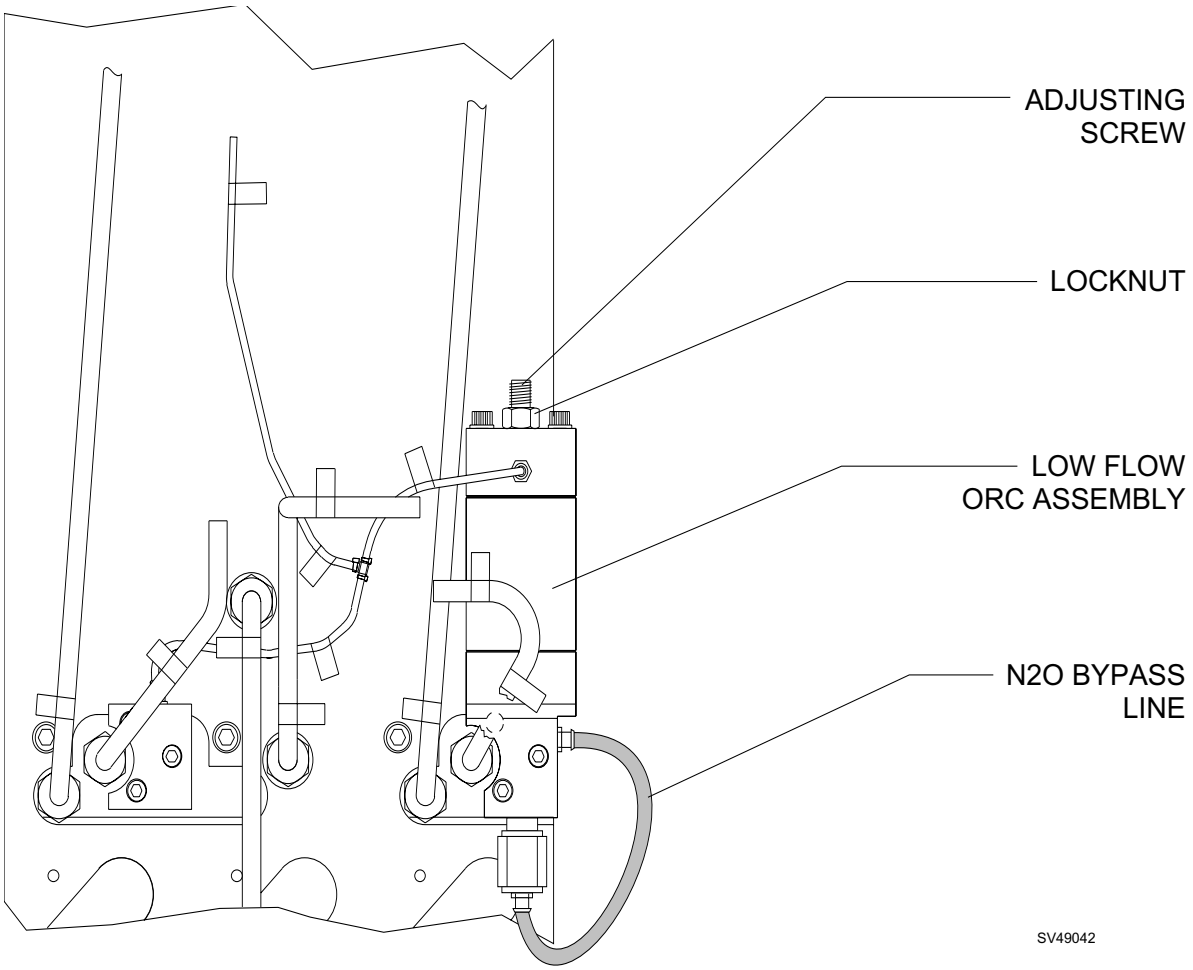


Figure 5-5A: LOW FLOW OXYGEN RATIO CONTROLLER

5.6 Oxygen Sensor Calibration

5.6.1 Zero Calibration

5.6.1.1 Turn the System Power switch to ON.

5.6.1.2 Press and release the CONFIG key, then simultaneously press the CONFIG, 21%, and APNEA ALARM DISABLE keys to bring up the service menu screen.

NOTE: For this procedure, the keys to the right of the data display will function as labeled on the display. For example: the TREND key functions as the EXIT key.

5.6.1.3 Deleted

5.6.1.4 Press the CALIBRATION key to bring up the calibration menu screen.

5.6.1.5 Remove the oxygen sensor capsule from its housing and allow several minutes for the displayed offset readings to stabilize. (The inspiratory valve dome plug should be in place.)

NOTE: The displayed readings should be between 125 and 145, and the difference between CELL A and CELL B readings should be no greater than 8.

5.6.1.6 Press the O2MED key to store the new readings. The message "O2MED OFFSET STORED" will be displayed.

5.6.2 21% Calibration

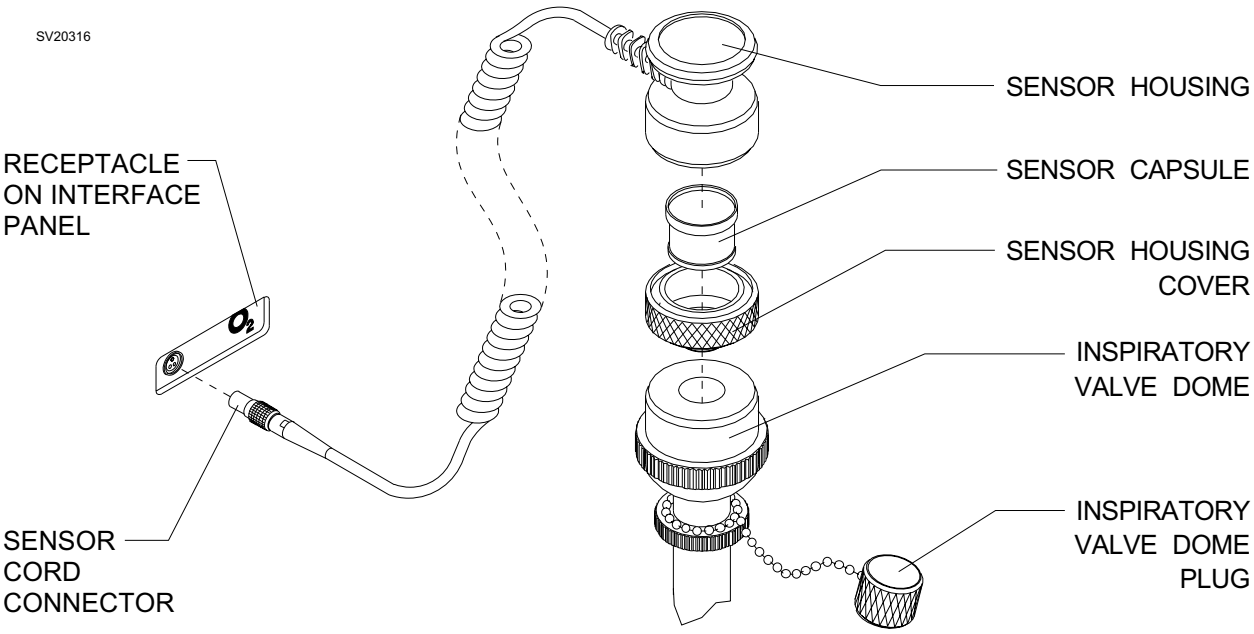
5.6.2.1 Press the EXIT key to leave the calibration screen.

5.6.2.2 Press the EXIT key to leave the service menu screen.

5.6.2.3 Replace the sensor capsule in its housing, but do not install the housing in the inspiratory valve dome.

5.6.2.4 Hold the sensor assembly away from any gas fittings to ensure that it is exposed only to ambient air, and allow it to stabilize for several minutes.

5.6.2.5 Press the 21% key. The message "CALIBRATING" will appear on the data display.



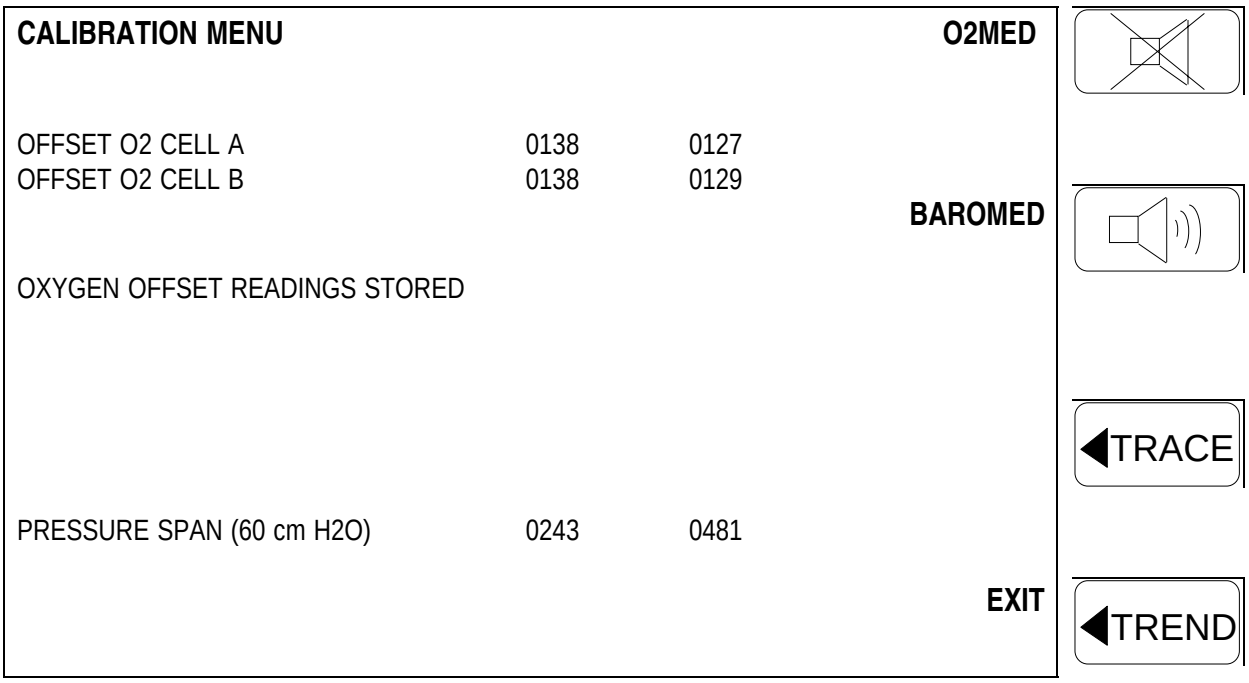


Figure 5-6: OXYGEN SENSOR CONNECTIONS AND CALIBRATION SCREEN

NOTE: The length of time that the sensor takes to calibrate depends on the gas mixture to which the sensor had been exposed prior to calibration. If the sensor had been exposed to 21% oxygen for greater than one minute, calibration can take as little as 10 seconds. If the sensor had been exposed to higher concentrations of oxygen, calibration may last up to 50 seconds. Typically, calibration will last less than 30 seconds.

5.6.2.6 When calibration is completed, the CALIBRATING message will disappear and the currently sensed oxygen concentration will appear on the data display.

5.6.2.7 Turn the System Power switch to STANDBY.

5.7 Breathing Pressure Monitor Calibration

5.7.1 Turn the System Power switch to ON.

5.7.2 Press and release the CONFIG key, then simultaneously press the CONFIG, 21%, and APNEA ALARM DISABLE keys to bring up the service menu screen.

NOTE: For this procedure, the keys to the right of the data display will function as labeled on the display. For example: the TREND key functions as the EXIT key.

5.7.3 Deleted

5.7.4 Press the CALIBRATION key to bring up the calibration menu screen.

5.7.5 Disconnect the breathing pressure hose from the absorber.

5.7.6 Connect a test fixture having a TEE connector, an external gauge, and an inflation device, to the breathing pressure line.

5.7.7 Connect a short hose between the inspiratory and expiratory valves.

5.7.8 Place the Auto/Man selector valve in the BAG position, and turn the APL valve fully clockwise.

5.7.9 Remove the bag and occlude the bag mount.

5.7.10 Pressurize the circuit to 60 cm H_2O as shown on the test gauge.

5.7.11 The displayed PRESSURE SPAN (60 cm H20) reading should be between 465 and 519.

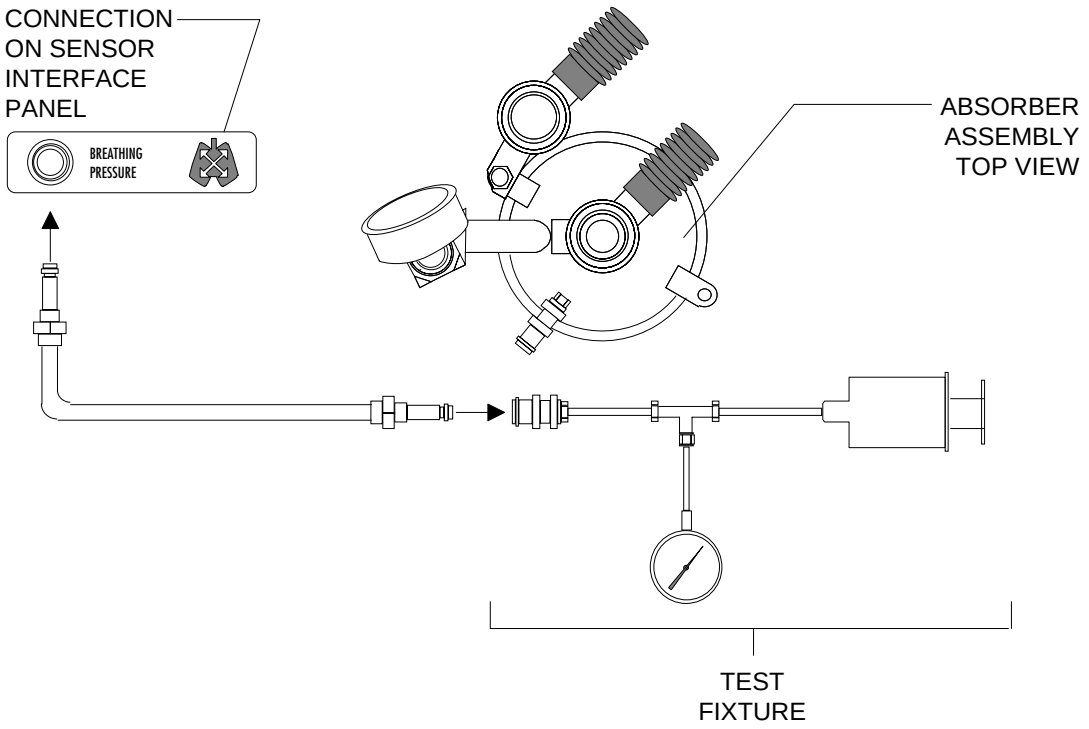
5.7.12 Press the BAROMED key to store the new reading. The message "PRESSURE SPAN READING STORED" will be displayed.

5.7.13 Press the EXIT key to leave the calibration screen.

5.7.14 Press the EXIT key to leave the service menu screen.

5.7.15 Remove the test fixture from the breathing pressure line, and reconnect the line to the absorber.

5.7.16 Turn the System Power switch to STANDBY, and restore all breathing system connections.



SV20322

CALIBRATION MENU			**O2MED**
OFFSET O2 CELL A	0138	0127	
OFFSET O2 CELL B	0138	0129	
			BAROMED
OXYGEN OFFSET READINGS STORED			
			TRACE
PRESSURE SPAN (60 cm H2O)	0243	0481	
			EXIT
			TREND

Figure 5-7: BAROMED CALIBRATION SETUP AND SCREEN

5.8 Vaporizer Interlock Adjustment

5.8.1 Set the System Power switch to STANDBY.

5.8.2 Turn the center vaporizer handwheel ON. The left and the right vaporizer handwheels should be locked in their Zero position. If the left or right vaporizer does not lock, tighten the corresponding center set screw until the handwheel locks properly.

5.8.3 Turn the center vaporizer OFF and turn the left vaporizer ON. The center and the right vaporizer handwheels should be locked in their Zero position. If the right vaporizer does not lock, loosen the locking nut on the right set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE: Do not over-tighten the set screws. Each vaporizer handwheel must turn easily while the other vaporizers are locked .

5.8.4 Turn the left vaporizer OFF and turn the right vaporizer ON. The center and the left vaporizer handwheels should be locked in their Zero position. If the left vaporizer does not lock, loosen the locking nut on the left set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE: When the interlock adjustment procedure is completed, ensure that all vaporizer handwheels are set to their zero or OFF position.

5.8.5 Perform the PMS Procedure given in Section 6.

VAPORIZER INTERLOCK MECHANISM REAR VIEW

SV40660

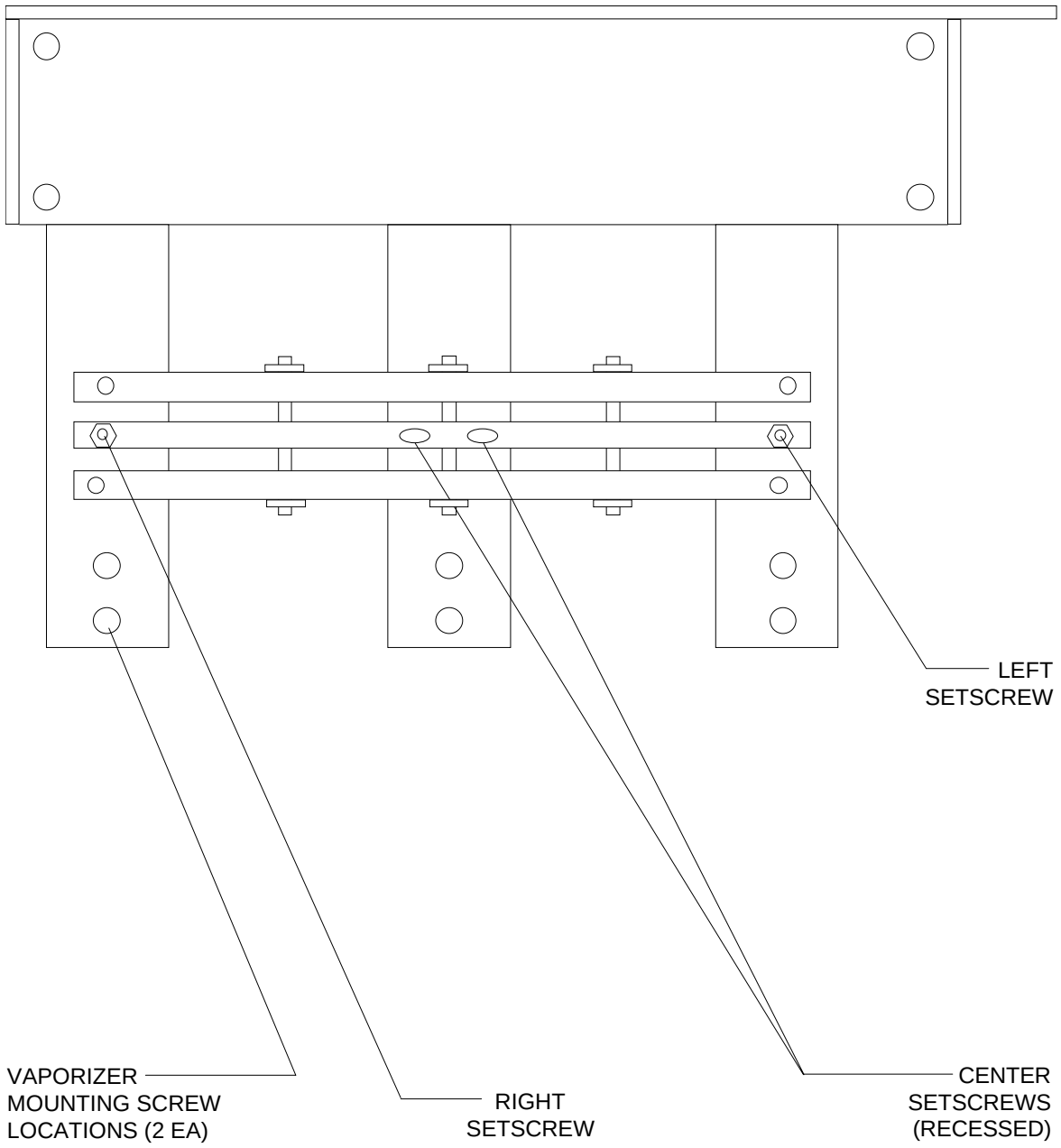


Figure 5-8: VAPORIZER INTERLOCK ADJUSTMENT

6.0 PMC PROCEDURE, NARKOMED 2B

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

Materials Required:

-- Dow Corning High Vacuum Grease, P/N S4105908

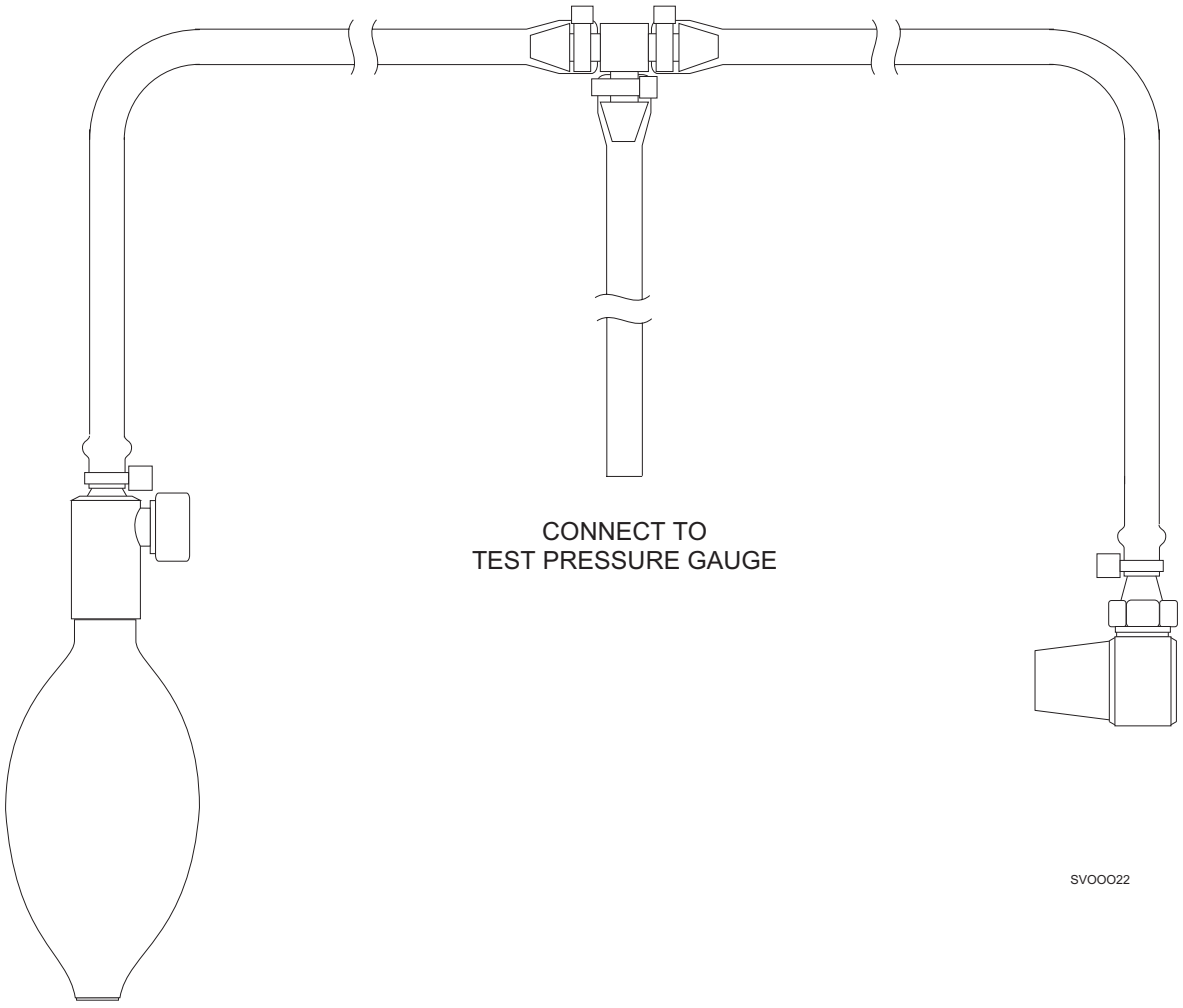
-- Spiromed Sensor Lubrication Kit, P/N 2218180

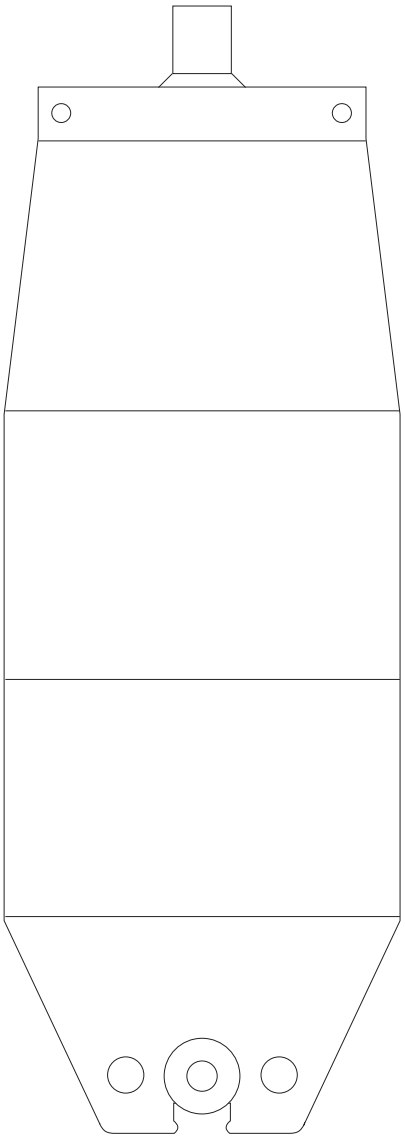
-- Breathing Bag, 3 liter, P/N 9995330 or equivalent

-- Tube, Corrugated, 22 mm x 12 in. long, P/N 9995112

Test equipment illustrations are shown on the following pages.

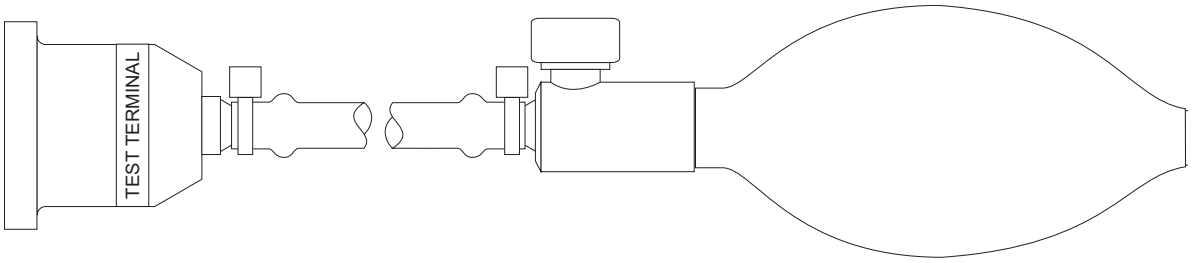
4113119
FRESH GAS LEAK TEST DEVICE



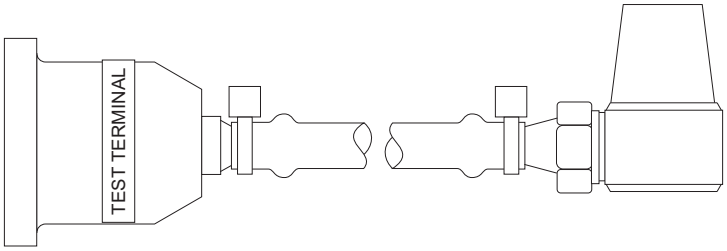


4115128
SIEMENS TEST LUNG

SVOOO25



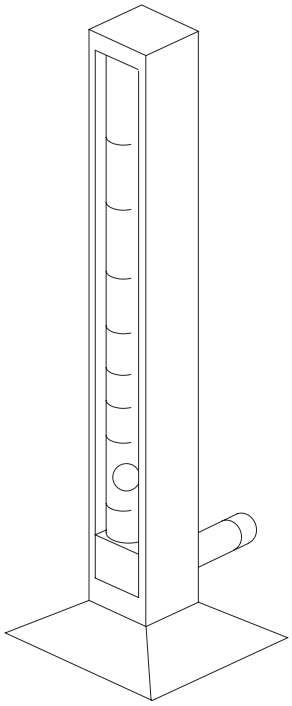
S010159
BREATHING SYSTEM LEAK TEST DEVICE



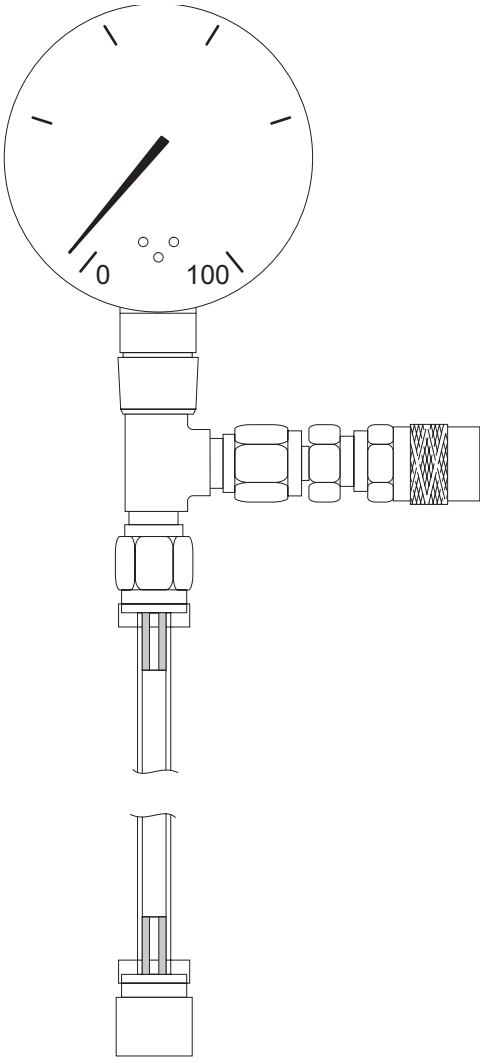
SVOOO23

S010158
FRESH GAS OUTLET VOLUME TEST DEVICE

SVOOO27

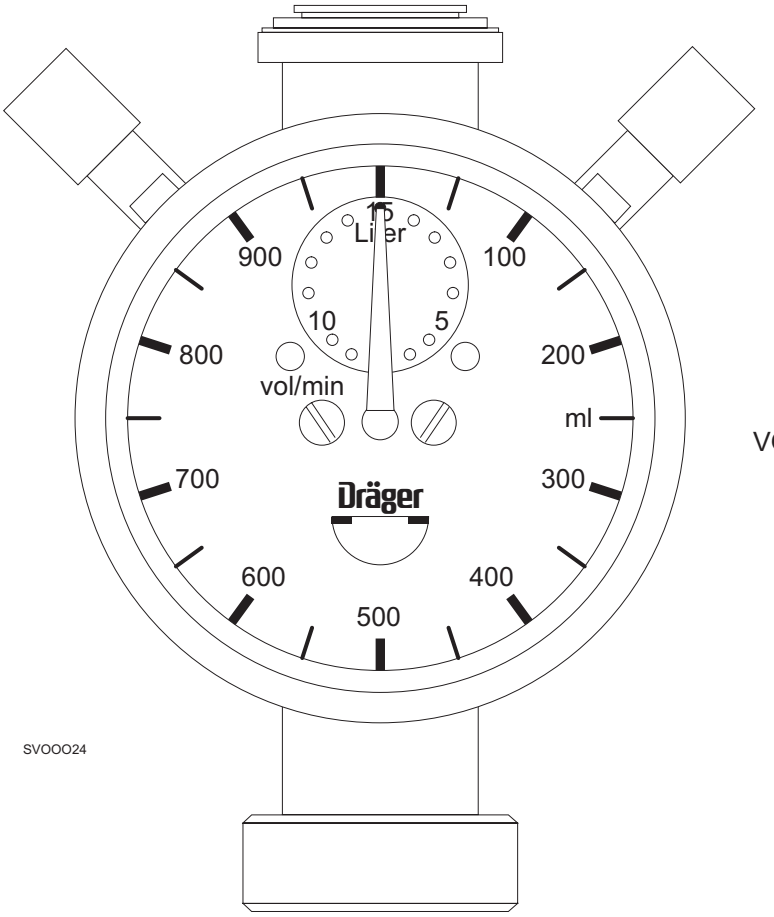


S000081
FLOW METER
TEST STAND

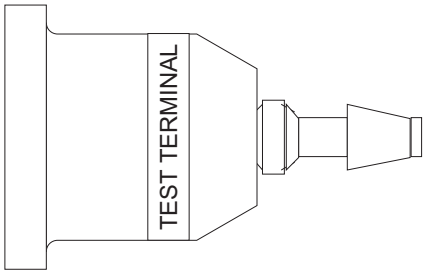


S000063
REGULATOR TEST
PRESSURE GAUGE

PMC PROCEDURE (continued) **NM2B**



2212300
MINUTE
VOLUMETER



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 2B anesthesia machine.

A PMC consists of a complete Periodic Manufacturer's Service procedure and a certification level inspection based on DMI 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 DMI'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, 2**C 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 certificaiton 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 2B Anesthesia System

1. Use the PM Certification form for Narkomed 2B/ 2C/ GS (P/N S010211) Anesthesia Systems (P/N S010211).

2. Completely fill in the header information.

3. Determine if the ventilator has an MJV-2 square Clippard valve. If ventilator has an MJV-2, perform the lubrication procedure in accordance with SP00062. Write in the date of lubrication next to the "MJV-2 LUBRICATION" line on the Periodic Manufacturer's Certification form. If the ventilator has a Humphrey valve, 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. NORTH AMERICAN DRÄGER 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.

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.

PM Certification Procedure for Narkomed 2B Anesthesia System

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 the machine to receive certification.

10. Proceed with PM Certification procedure. If any tests fail refer to the "Failure Codes" listing in DMI 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 DMI 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 2B 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 PMS 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 Ω 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 Ω 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 Ω 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 Spiromed 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 Spiromed sensor interface connector keyway pin (at the 12 o'clock position). 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 Ω), 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:

Ground	Polarity
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 TEST	PASS	NARKOMED 2B
FIRMWARE TEST	PASS	VERSION x.xx DIAGNOSTICS
MEMORY TEST	PASS	COPYRIGHT, NAD INC. 1987-94
TIMERS TEST	PASS	
ANALOG TEST	PASS	
AUDIO TEST - PRIMARY	PASS	
- BACKUP	PASS	
SERIAL I/O TEST	PASS	
CLOCK TEST	PASS	
BACKUP MEMORY TEST	PASS	
AC POWER TEST	PASS	
RESERVE POWER TEST	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 CONFIG key on the monitor controls keypad.

6.4.2 The alarm CRT should display the Configuration Screen.

6.4.3 Verify the correct Time and Date.

6.4.4 Adjust the Volume to the highest number.

6.5 SERVICE DATA

6.5.1 Access the Configure screen, then press the following keys on the monitor controls key panel: 21% key and APNEA ALARM DISABLE key (simultaneously), and then the CONFIG key (while still holding the previous two keys). The alarm CRT should then display the Service Menu Screen.

6.5.2 Press the DIAGNOSTICS key. The alarm CRT should display the Diagnostics Menu Screen.

(✓) 6.5.5 Record any Error Log codes.

(✓) 6.5.3 Record the Last Service Date.

(✓) 6.5.4 Press the RESET DATE key.

6.5.6 Key Panel

6.5.6.1 Press the KEY TEST key.

6.5.6.2 The alarm CRT should display the outline of all keys on the display panel.

6.5.6.3 Press each key on the display panel, one at a time.

(✓) 6.5.6.4 As each key on the display panel is pressed, do all the corresponding keys on the alarm CRT illuminate? ___(Y)

NOTE: The TREND key should be pressed last, because it also exits the Key Panel Test Screen.

6.6 CALIBRATIONS

6.6.1 Press the CALIBRATION key on the Service Menu Screen to bring up the Calibration Menu 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 "OFFSET O_2 CELL A" and "OFFSET O_2 CELL B" readings (displayed in left column) are as close as possible to each other with a difference not greater than 8, press the O_2 MED key and verify that the new offset values are stored.

NOTE: The higher the offset, the higher the calculated oxygen concentration at higher oxygen concentrations.

6.6.4 Put the oxygen sensor capsule into the oxygen sensor housing.

6.6.5 Disconnect the Baromed breathing pressure sensor line from the absorber.

6.6.6 This step intentionally left blank.

6.6.7 Connect a test fixture and digital pressure manometer to the breathing pressure sensor line.

6.6.8 Pressurize the circuit to 60 cm H_2O.

6.6.9 The "PRESSURE SPAN (60 cm H_2O)" reading should display between 465 and 519.

(✓) 6.6.10 Press the BAROMED key to store the reading. The following message should be displayed: "PRESSURE SPAN READING 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 Press the EXIT key to exit the Calibration Screen.

6.6.13 Press the EXIT key to exit the Service Menu Screen.

(✓) 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.

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 H_2O 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. 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 H_2O.

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 H_2O.

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 cmH_2O.

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 O_2 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 cmH_2O.

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.

6.8.1.7 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.

6.8.1.11 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 H_2O gauge at zero (0)? ___ (Y)

6.8.1.15 Remove the O_2Med sensor plug from the inspiratory valve dome adapter and examine the two O-rings at the bottom of the plug.

6.8.1.16 Reinstall the O_2Med 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

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 H_2O of pressure to the system.

(✓) 6.8.4.6 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

6.8.4.7 Turn on the left mounted vaporizer to the first graduated marking.

6.8.4.8 Apply 50 cm H_2O of pressure to the system.

(✓) 6.8.4.9 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

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 O_2 flow control valve to 5 l/min., purge the system for 5 seconds, then close the O_2 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 H_2O)

(✓) 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 H_2O)

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 H_2O pressure to the absorber system.

(✓) 6.8.5.8 After 30 seconds, what is the pressure in the absorber system? ___ cm H_2O ($\geq$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 H_2O ($\leq$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.

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 cmH_2O.

(✓) 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 cmH_2O.

(✓) 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 and expiration valves.

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 O_2 flow to 4 l/min.

6.8.7.3.5 Inflate the simulated lung by briefly using the O_2 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 O_2 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 H_2O (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 H_2O? ___(Y)

6.8.8.8 Adjust the absorber PEEP valve counterclockwise to its minimum position.

6.8.8.9 Close the O_2 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 O_2 sensor plug into the O_2 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 cmH_2O 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 50cmH_2O to the Bain Circuit via test terminal and inflation bulb.

(✓) 6.8.9.7 After 30 seconds, what is the pressure on the cmH_2O digital pressure meter? (45 to 50 cmH_2O)

6.8.9.8 Verify that the pressure indicated on the cmH_2O gauge is within 3 cmH_2O 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 O_2 flow to 10 L/min.

(✓) 6.8.9.12 What is the pressure on the cmH_2O digital pressure meter? (≤ 3 cmH_2O)

6.8.9.13 Verify that the pressure indicated on the cmH_2O gauge is within 3 cmH_2O 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 Is it possible to adjust the center vapor? ___ (N)

6.10.4 Is it possible to adjust the right (viewed from the front of the machine) vapor? ___(N)

6.10.5 Adjust the handwheel on the left vapor to zero (0).

6.10.6 Adjust the handwheel on the center vapor to any concentration above zero 0).

6.10.7 Is it possible to adjust the left vapor? ___ (N)

6.10.8 Is it possible to adjust the right vapor? ___ (N).

6.10.9 Adjust the handwheel on the center vapor to zero (0).

6.10.10 Adjust the handwheel on the right vapor to any concentration above zero (0).

6.10.11 Is it possible to adjust the left vapor? ___ (N).

6.10.12 Is it possible to adjust the center vapor? ___ (N).

6.10.13 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 O_2 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 O_2 cylinder valve, and press the O_2 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 O_2 regulator output line, and remove the plug from the TEE fitting.

6.12.9 Connect a dedicated O_2 test gauge to the TEE fitting.

NOTE: Two test gauges are required to avoid contamination of the O_2 circuit from the other gases: a dedicated test gauge for O_2, and a second test gauge for the other gases.

6.12.10 Open the O_2 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 O_2 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 CO_2 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.

(✓) 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.

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

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.

(✓) 6.13.6 Nitrogen High Pressure Leak - if applicable

6.13.6.1 Set the gas selector switch to ALL GASES.

6.13.6.2 Open the nitrogen cylinder valve.

6.13.6.3 Let the pressure stabilize.

6.13.6.4 Close the nitrogen cylinder valve and remove the cylinder.

6.13.6.5 Observe the nitrogen cylinder pressure gauge.

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

6.13.6.7 Attach the nitrogen cylinder.

(✓) 6.13.7 Helium High Pressure Leak - if applicable

6.13.7.1 Set the gas selector switch to ALL GASES.

6.13.7.2 Open the helium cylinder valve.

6.13.7.3 Let the pressure stabilize.

6.13.7.4 Close the helium cyl. valve and remove the cylinder.

6.13.7.5 Observe the helium cylinder pressure gauge.

6.13.7.6 After two (2) minutes, what is the pressure loss? ___ PSI (<50).

6.13.7.7 Attach the helium cylinder.

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 O_2 and N_2O 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 O_2 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 N_2O pipeline supply.

6.14.1.8 Disconnect the O_2 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 N_2O 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 Nitrogen O.F.P.D. - if applicable

6.14.5.1 Set the gas selector switch to ALL GASES.

6.14.5.2 Open the nitrogen cylinder valve.

6.14.5.3 Open one (1) oxygen cylinder valve.

6.14.5.4 Set the nitrogen flow to 4 l/min; set the oxygen flow to 4 l/min.

6.14.5.5 Close the oxygen cylinder valve.

(✓) 6.14.5.6 Does the flow of nitrogen cease when the oxygen pressure is depleted? ___ (Y)

6.14.5.7 Close the nitrogen flow control valve.

6.14.5.8 Set the gas selector switch to O_2+N_2O.

6.14.5.9 Close the oxygen flow control valve.

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

6.14.6 Helium O.F.P.D. - if applicable

6.14.6.1 Set the gas selector switch to ALL GASES.

6.14.6.2 Open the helium cylinder valve.

6.14.6.3 Open one (1) oxygen cylinder valve.

6.14.6.4 Set the helium flow to 4 l/min; set the oxygen flow to 4 l/min.

6.14.6.5 Close the oxygen cylinder valve.

(✓) 6.14.6.6 Does the flow of helium cease when the oxygen pressure is depleted? ___ (Y)

6.14.6.7 Close the helium flow control valve.

6.14.6.8 Set the gas selector switch to O_2 + N_2O.

6.14.6.9 Close the oxygen flow control valve.

6.14.7 Oxygen Supply Pressure Alarm

6.14.7.1 If not already connected, connect a dedicated O_2 test gauge to the TEE fitting in the O_2 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 O_2 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 O_2 pressure from the system, then close the flow control valve.

6.14.7.7 Remove the test gauge from the TEE fitting in the O_2 regulator output line and replace the plug.

6.15 FLOWMETERS

(✓) 6.15.1 Oxygen Flowmeter

6.15.1.1 Open the O_2 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 O_2 cylinder valve and bleed the pressure.

6.15.1.4 Connect the O_2 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 O_2 + N_2O position.

(✓) 6.15.1.8 What is the minimum flow of oxygen? ___ ml (100-200 ml/min); (0 ml for 4107615A (Minimum O_2 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 N_2O pipeline supply, and verify the proper operation of the N_2O flowmeter.

6.15.2.6 Is the correct flow control knob and label attached to the N_2O 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)

(✓) 6.15.6 Nitrogen Flowmeter - if applicable

6.15.6.1 Set the gas selector switch to ALL GASES.

6.15.6.2 Open the nitrogen gas cylinder valve.

6.15.6.3 Is it possible to adjust the flow of the nitrogen over the full range of the flowmeter? ___ (Y)

6.15.6.4 Close the nitrogen flow control valve.

6.15.6.5 Is the correct flow control knob and label attached to the nitrogen flow control valve? ___ (Y)

(✓) 6.15.7 Helium Flowmeter - if applicable

6.15.7.1 Set the gas selector switch to ALL GASES.

6.15.7.2 Open the helium gas cylinder valve.

6.15.7.3 Is it possible to adjust the flow of helium over the full range of the flowmeter? ___ (Y)

6.15.7.4 Close the helium flow control valve.

6.15.7.5 Is the correct flow control knob and label attached to the helium flow control valve? ___ (Y)

6.15.7.6 Set the gas selector switch to O_2 + N_2O.

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

6.16 O2 MED

6.16.1 Disconnect the O_2 sensor cable from the oxygen sensor interface.

6.16.2 The following messages shall appear on the display: "O_2 SENS DISC", "O_2 NOT CAL", "O_2 ALRM OFF".

6.16.3 Reconnect the O_2 Med sensor.

6.16.4 The "O_2 SENS DISC" message shall disappear.

6.16.5 Press the "21%" key to calibrate the O_2 Med.

NOTE: Make sure the sensor is stabilized in ambient air for several minutes.

(✓) 6.16.6 After the calibration is completed, what is the oxygen concentration? ___ % (21)

6.16.7 This step intentionally left blank.

6.16.8 The alarm CRT shall display "% OXYGEN LOW" under the warning heading. There should be a continuous audible alarm.

6.16.9 What is the low oxygen alarm default? ___ % (30)

6.16.10 This step intentionally left blank.

6.16.11 Press the LO oxygen alarm key. Does a box appear around the low alarm limit? ___ (Y)

6.16.12 Verify that the low alarm limit has a range from 21 to 99% (18 to 99% with firmware version 2.03 and later).

6.16.13 Place the sensor into the inspiratory valve dome adapter. Set the Man/Auto selector to 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 the lowest setting possible, and verify the "% OXYGEN LOW" message has cleared.

6.16.16 Press the HI oxygen alarm key. 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 22%.

6.16.19 Set the high alarm to 95.

6.16.20 the alarm CRT shall display "% OXYGEN HI" under the ADVISORY column.

6.16.21 Return the high alarm to 100.

6.16.22 The "% OXYGEN HI" message will now disappear.

(✓) 6.16.23 Within three minutes, what is the oxygen concentration? ___% (97-100)

6.17 OXYGEN CONCENTRATIONS

6.17.1 Oxygen + Nitrous Oxide Concentration Test

6.17.1.1 Verify the oxygen flow is at 4 l/min.

6.17.1.2 Depress the O_2 Flush button for 5 seconds.

6.17.1.3 Does the O_2Med 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 Test - if applicable

6.17.2.1 Depress the O_2FLUSH button for 5 seconds.

6.17.2.2 Does the O_2Med 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 O_2 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 O_2 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 O_2+N_2O.

* 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 "O_2 FLUSH" for 15 seconds.

6.17.3.2 Does the O_2 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 O_2 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 O_2+N_2O.

6.17.4 Oxygen + Carbon Dioxide Concentration - if applicable

6.17.4.1 Depress the O_2FLUSH button for 15 seconds.

6.17.4.2 Set the oxygen flow to 1000 ml.

6.17.4.3 Does the O_2MED 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 O_2 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 O_2+N_2O.

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

6.17.5 Oxygen + Nitrogen Concentration - if applicable

6.17.5.1 Depress the O_2FLUSH button for 5 seconds.

6.17.5.2 Does the O_2MED read 97-100% within 3 minutes?___ (Y)

6.17.5.3 Set the gas selector switch to ALL GASES.

6.17.5.4 Set O_2 flow to 4 l/min; nitrogen flow to 2 l/min.

(✓) 6.17.5.5 What is the oxygen concentration after the value stabilizes? ___ % (64-70)

6.17.5.6 Close the nitrogen cylinder valve and bleed the pressure from the circuit.

6.17.5.7 Close the nitrogen flow control valve.

6.17.5.8 Set the gas selector switch to O_2+N_2O.

6.17.5.9 Close the oxygen flow control valve.

6.17.6 Oxygen + Helium Concentration - if applicable

6.17.6.1 Depress the O_2 FLUSH button for 15 seconds.

6.17.6.2 Does the O_2 MED read 97-100% within 3 minutes? ___ (Y)

6.17.6.3 Set the gas selector switch to ALL GASES.

6.17.6.4 Set O_2 flow to 4 l/min; helium flow to 2 l/min.

(✓) 6.17.6.5 What is the oxygen concentration after the value stabilizes? ___% (64-70)

6.17.6.6 Close the helium cylinder valve and bleed the pressure from the circuit.

6.17.6.7 Close the helium flow control valve.

6.17.6.8 Set the gas selector switch to O_2+N_2O.

6.17.6.9 Close the oxygen flow control valve.

(✓) 6.18 AUXILIARY OXYGEN FLOWMETER - if applicable

6.18.1 Close the auxiliary oxygen flowmeter flow control valve.

6.18.2 Connect a cm H_2O pressure manometer to the outlet.

6.18.3 Is there an increase in pressure? ___ (N)

6.18.4 Apply a pressure of 50 cm H_2O to the manometer.

6.18.5 After 30 seconds, what is the pressure on the manometer? ___(>40 cm H_2O)

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 O_2Med 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 O_2Med 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 - if applicable

* 6.19A.1 Set the Gas Selector switch to O_2 + N_2O.

6.19A.2 Depress the O_2FLUSH 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 O_2 flow to 500 ml/min. Verify that the N_2O 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 O_2 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.

6.19B OXYGEN RATIO MONITOR CONTROLLER

6.19B.1 Depress the O_2 FLUSH for 15 seconds.

6.19B.2 Turn the N_2O flow control valve counter-clockwise to its stop position.

6.19B.3 Slowly increase the oxygen flow until nitrous oxide begins to flow.

6.19B.4 What is the oxygen flow rate? ___(200-400 ml/min.)

(✓) 6.19B.5 Slowly increase the oxygen flow until the "O_2/N_2O FLOW RATIO" LED on the alarm panel is lighted.

6.19B.6 What is the nitrous oxide flow rate? ___(150-300 ml/min.)

6.19B.7 Set the oxygen flow to 1000 ml/min.

6.19B.8 Adjust the nitrous oxide flow until the ORMc controls the nitrous oxide.

(✓) 6.19B.9 What is the oxygen concentration after the value stabilizes? ___% (21-29)

6.19B.10 Does the "O_2/N_2O FLOW RATIO" LED turn "ON" on the ALARM PANEL? ___ (Y)

6.19B.11 Does the "O_2/N_2O LOW" message appear in the ADVISORY column? ___ (Y)

6.19B.12 Open the nitrous oxide flow control valve to the stop position.

6.19B.13 Adjust the oxygen flow to 1.5 l/min.

(✓) 6.19B.14 What is the oxygen concentration after the value stabilizes? ___ % (21-29)

6.19B.15 Adjust the oxygen flow to 2 l/min.

(✓) 6.19B.16 What is the oxygen concentration after the value stabilizes? ___ % (21-29)

6.19B.17 Adjust the oxygen flow to 4 l/min.

(✓) 6.19B.18 What is the oxygen concentration after the value stabilizes? ___ % (21-29)

* 6.19B.19 Set the Gas Selector switch to ALL GASES.

* Does not apply to 2-gas machines.

6.19B.20 Is the "O_2/N_2O FLOW RATIO" alarm activated? ___ (N)

* 6.19B.21 Set the Gas Selector switch to "O_2+N_2O".

6.19B.22 Close the oxygen flow control valve.

(✓) 6.19B.23 What is the flow of nitrous oxide? ___ ml/min. (0)

6.19B.24 Is the "O_2/N_2O FLOW RATIO" alarm activated? ___ (N)

6.19B.25 Close the nitrous oxide flow control valve.

* Does not apply to 2-gas machines.

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 Press the THRESHOLD key on the main keypad. A box shall appear around the Threshold Alarm Limit.

6.20.4 What is the threshold alarm default? ___ cm H_2O (12)

6.20.5 Verify that the threshold alarm limit has a range from 5 to 30 cm H_2O.

6.20.6 Adjust the threshold to 10 cm H2O.

6.20.7 Press the HIGH key in the Baromed section of the main keypad. A box shall appear around the High Pressure Alarm Limit.

6.20.8 What is the high alarm limit default? ___ cm H_2O (50)

6.20.9 Verify that the high alarm limit has an adjustable range from 30 to 120 cm H_2O. (Later software versions allow range up to 125 cm H_2O).

6.20.10 Set the high alarm limit to 65 cm H_2O.

6.20.11 Increase the pressure to 25 cm H_2O; decrease the pressure to 20 cm H_2O.

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 H_2O (7-13)

6.20.19 Adjust the threshold to 18 cm H_2O.

6.20.20 Increase the pressure to 20 cm H_2O, maintain the pressure, and start a stopwatch.

(✓) 6.20.21 What is the time when CONTINUOUS PRES appears in the Caution column? ___ sec (12-18)

(✓) 6.20.22 Decreasing the pressure slowly, what is the pressure at which the CONTINUOUS PRES alarm deactivates? ___ cm H_2O (15-21)

6.20.23 Slowly increase the pressure.

(✓) 6.20.24 At what pressure does the VENT PRESSURE HI alarm activate? ___ cm H_2O (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 H_2O (-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 Enable the APNEA ALARM by pressing the APNEA ALARMS DISABLE key in the main keypad.

6.20.31 Verify that APNEA ALARM DISABLE key will not disable the APNEA Alarm when the ventilator switch is ON.

6.20.32 Remove the test equipment and reconnect the breathing pressure sensor line to the absorber.

6.21 VENTILATOR

NOTE: Set the Pressure Limit control to MAX, and the PEEP valve to the minimum position, if applicable.

** 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 O_2 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 O_2 Flush.

(✓) 6.21.17 What is the peak inspiratory pressure? ___ cm H_2O (>30 cm H_2O)

6.21.18 Attach a 3-liter bag 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:

FREQ.	I:E RATIO	FREQ.	I:E RATIO	FREQ.	I:E RATIO
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 OFF.

6.23 SPIROMED

6.23.1 Press the LOW key in the Minute Volume Alarms section of the main keypad. A box shall appear around the Minute Volume Alarm Limit.

6.23.2 What is the low minute volume alarm default? ___ (3.0)

6.23.3 Verify that the minute volume has a low alarm limit range from 0.5 to 10.0 by increments of 0.1.

6.23.4 Adjust the low minute volume alarm to 2.0 liters.

6.23.5 Disable the VOLUME ALARM by pressing the VOLUME ALARMS DISABLE key in the Minute Volume Alarms section of the main keypad. 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 After 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 and the exhalation valve.

6.23.10 Attach a patient circuit with a 3-liter bag to the absorber system.

6.23.11 Reconnect the ventilator hose to the Ventilator Hose terminal.

6.23.12 Adjust the FREQUENCY to 6 BPM.

6.23.13 Adjust the I:E RATIO to 1:2.

6.23.14 Adjust the flow to the maximum of the LOW zone.

6.23.15 Adjust the oxygen flow to 2 l/min.

6.23.16 Adjust the Tidal Volume to 200 ml.

6.23.17 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)

6.23.18 Adjust the low alarm limit above the indicated minute volume.

6.23.19 Does the MINUTE VOLUME LO message appear in the Caution column? ___ (Y)

6.23.20 Adjust the low alarm limit below the indicated minute volume.

6.23.21 Does the MINUTE VOLUME LO message in the Caution column deactivate? ___ (Y)

6.23.22 Increase the tidal volume to 1000 ml and the frequency to 10 BPM.

6.23.23 Press the O_2 Flush momentarily to inflate the bellows.

(✓) 6.23.24 Are the tidal and minute volumes on the Spiromed and on the test volumeter within 20% of each other? ___ (Y)

6.23.25 Create a reverse flow by loosening the expiratory valve dome.

(✓) 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.

6.23.28 Disconnect the Spiromed sensor 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 Connect the Spiromed sensor to the Volume Sensor interface and verify that the alarms clear.

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 O_2 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 O_2 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.

6.24A.9 Press the O_2 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 O_2 flow to 5 l/min.

6.24A.12 Adjust the INSPIRATORY FLOW to maximum.

6.24A.13 Adjust the Tidal Volume to maximum.

(✓) 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 O_2 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 H_2O (≤3)

6.24B.6 Adjust the O_2 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 Ration 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 O_2 to 3 l/min.

6.25A.8 Occlude the 15mm patient side of the Y-piece and fill the bellows by pressing the O_2 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? ___cmH_2O >30

6.25A.11 What is the pressure when the bellows completes its upward travel? ___cmH_2O ≤3

6.25A.12 Verify that with the Pediatric Bellows Fine Flow Control turned fully counter-clockwise the bellows does not collapse during inspiration.

6.25A.13 Install a 3 L breathing bag onto the patient circuit Y-piece.

6.25A.14 Fill the bellows by pressing the O_2 Flush button.

6.25A.15 Adjust the O_2 flow to 10 l/min.

(✓) 6.25A.16 What is the PEEP? ___cmH_2O (≤3)

6.25A.17 Adjust the O_2 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.

6.25A.20 Adjust the O_2 flow to 5 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 Ration 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 O_2 to 3 l/min.

6.25B.6 Occlude the 15mm patient side of the Y-piece and fill the bellows by pressing the O_2 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? ___cmH_2O >30

6.25B.9 What is the pressure when the bellows completes its upward travel? ___cmH_2O ≤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 O_2 Flush button.

6.25B.12 Adjust the O_2 flow to 10 l/min.

(✓) 6.25B.13 What is the PEEP? ___cmH_2O (≤3)

6.25B.14 Adjust the O_2 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.

6.25B.18 Adjust the O_2 flow to 5 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 O_2 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 Set the I:E RATIO to 1:1.

(✓) 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: Press the TRACE key and verify that the lower half of the alarm CRT displays the Breathing Pressure waveform.

(✓) 6.26.2 Trend: Press the TREND key and verify that the lower half of the alarm CRT can selectively display percent oxygen, breaths per minute, and minute volume.

NOTE: Information must be available in order to be displayed.

6.26.2.1 Turn the ventilator OFF.

6.27 PRESSURE LIMIT CONTROLLER (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 H_2O is achieved.

6.27.7 Set the Pressure Limit Control to 30.

(✓) 6.27.8 What is the peak pressure? ___ cm H_2O (27-33)

6.27.9 Set the Pressure Limit Control to the Min position.

(✓) 6.27.10 What is the peak pressure? ___ cm H_2O (<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 BELLOWS PEEP VALVE - if applicable

6.28.1 Connect a 12 in. hose between the inspiratory and expiratory valves, and set the oxygen flow to 5 l/min.

6.28.2 Adjust the PEEP valve clockwise to the maximum position.

6.28.3 Turn the ventilator ON.

(✓) 6.28.4 What is the PEEP on the Baromed monitor? ___ cm H_2O (18-25)

6.28.5 Adjust the PEEP valve counter-clockwise to the minimum position.

6.28.6 What is the PEEP on the Baromed monitor? ___ cm H_2O (≤3)

6.28.7 Close the O_2 flow control valve.

6.28.8 Turn the ventilator OFF.

(✓) 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 twice.

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)

6.29.7 Press the key labeled with a crossed-out speaker once.

6.29.8 Does the "SILENCE 60" message appear on the display? ___ (Y)

6.29.9 Press the key labeled with a speaker producing sound.

6.29.10 Does the "SILENCE" message disappear from the display? ___ (Y)

6.30 OXYGEN FLUSH VALVE

Turn the System Power switch to STANDBY.

6.30.1 Press and release the O_2FLUSH 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 O_2 Med into the valve dome adapter on the inspiratory valve.

6.30.8 Close all flow control valves.

6.30.9 Press the O_2FLUSH button.

(✓) 6.30.10 What is the O_2 concentration after the value stabilizes?___%O_2 (97-100)

6.30.11 Remove the O_2 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 O_2 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 O_2Med 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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7.0 SOFTWARE UPDATE PROCEDURE

Software updates to the NARKOMED 2B are supplied as firmware in the form of a replaceable EPROM. Figure 7-1 shows the location of the firmware chip on the processor board and its orientation. Access to the chip requires removal of the monitor box top shelf, and removal of the processor assembly cover plate.

Parts required: Firmware NM2B 4110476
(Version 2.04 includes the electronic version of the O_2 low pressure alarm whistle for Canadian machines.)

7.1 Set the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: ESD precautions must be observed when servicing any of the assemblies inside the monitor box. It is also recommended that the AC line cord be plugged into a test fixture which maintains the electrical service ground connection to the machine while isolating the line and neutral conductors.

7.2 Disable the three circuit breakers at the back of the monitor box by pulling out each button with a knife or sharp object.

7.3 Remove the screws holding the monitor box top shelf. Lift the back of the shelf and disconnect its ground wire from the chassis ground tab, then lift out the shelf.

7.4 On the power supply assembly, disconnect the AC power cable at J1, and disconnect the battery power cable at J7.

7.5 Remove the screws holding the cover plate to the processor assembly, and remove the cover.

7.6 Carefully remove the firmware chip, U33, from the processor board.

7.7 Insert the replacement firmware chip into the socket. Be sure that the index on the chip is facing as shown in the illustration.

7.8 Reinstall the cover plate on the processor assembly.

7.9 Connect the cables that were previously removed from J7 and J1 on the power supply assembly.

7.10 Reset the circuit breakers at the back of the monitor box.

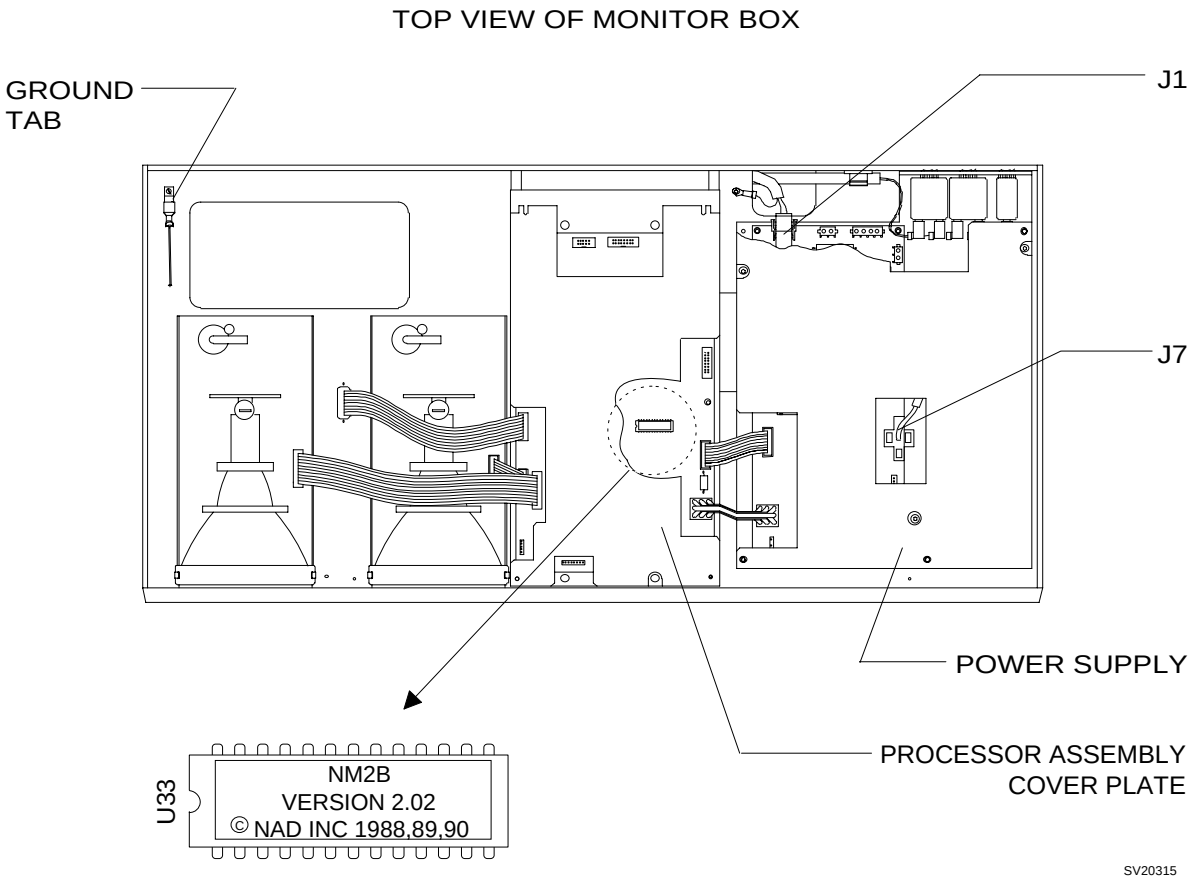

Figure 7-1: FIRMWARE CHIP LOCATION

7.11 Turn the System Power switch to ON, and observe the software version number that appears on the power-up diagnostics screen. Verify that it matches the label on the replacement firmware chip.

7.12 Turn the System Power switch to STANDBY.

7.13 Place the monitor box top shelf into position, connect its ground wire to the chassis ground tab, and reinstall the top shelf screws.

7.14 Perform the PMS Procedure given in Section 6.

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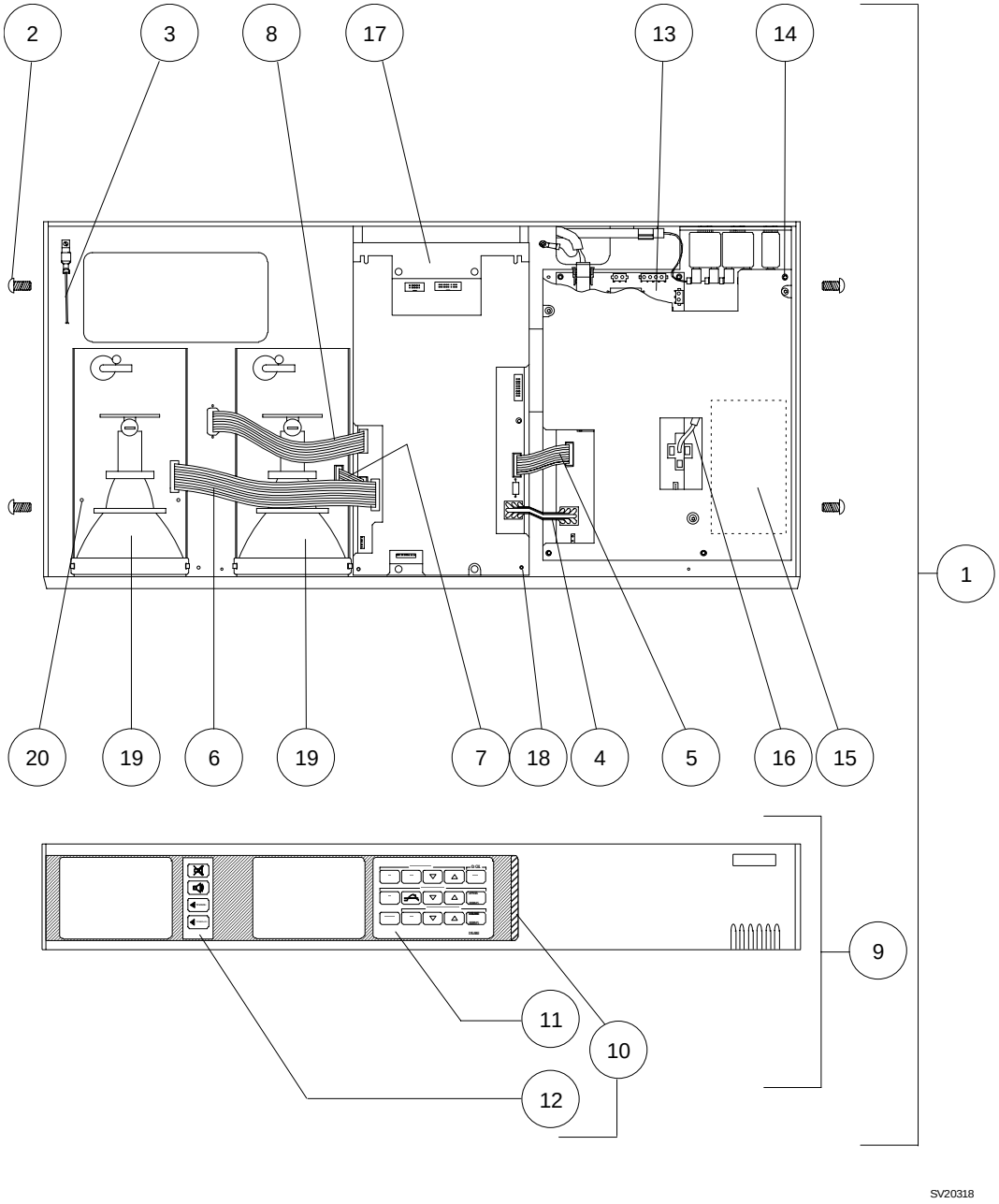
8.0 Spare and Replacement Parts

Part numbers for field-replaceable items on the NARKOMED 2B anesthesia system are listed on the following pages, along with part numbers for related hardware and cables.

The item numbers are keyed to the accompanying illustrations to aid in identifying the item and its location.

ASSEMBLY/PART PAGE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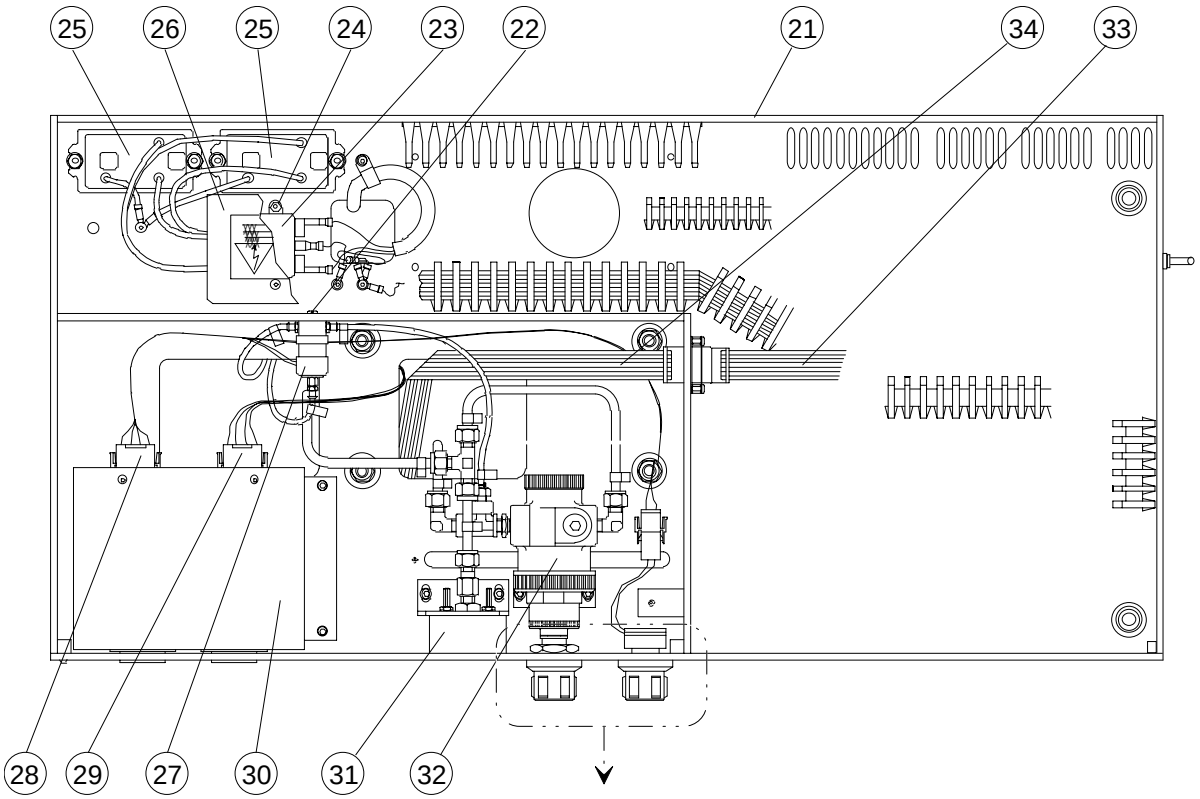
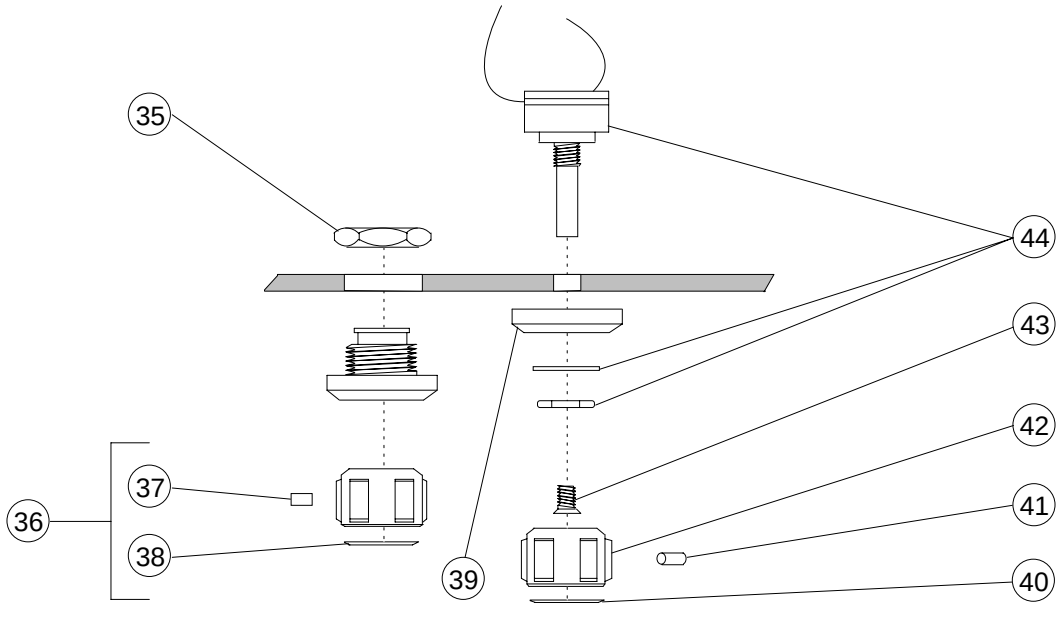
SV20318

ITEM	DESCRIPTION	PART NUMBER
1	Deleted	
2	Screw, Monitor Chassis Cover (7x)	HW04006
3	Ground Wire Assembly	4109650
4	Cable, Power Supply to Processor (Power)	4109570
5	Cable, Power Supply to Processor (Data)	4109550
6	Cable, Processor to CRT (Left)	4109559
7	Cable, Processor to CRT (Right)	4109560
8	Cable, Monitor Box to Processor (Alarm)	4109563
9	Deleted	
10	Filter Panel & Switch Assembly	4109629
11	Alarm Keypad	4109491
12	CRT Keypad	4109490
	Filter Panel Retainer Bracket (3x)	4110813
	Screw, Retainer Bracket	HW09014
13	Power Supply Assembly	
	Replaced by	4112681-001
	Service Exchange part number is	SE4112681-001
	Power Supply Assembly, 220/240V	
	Replaced by	4112682-001
	Service Exchange part number is	SE4112682-001
14	Screw, Cover Plate (4x)	HW09000
15	Battery, 12V Rechargeable	4106093
16	Wire Harness, Battery	4109579
	Replaced by	4112792-001
17	Processor Assembly	4109638
	Service Exchange part number	SE4109638
18	Screw, Cover Plate (4x)	HW09000
	Firmware NM2B VER x.xx (Chip)	4110476
19	CRT Assembly (2x)	4109610
20	Screw, CRT Mounting (4x each CRT)	HW09004

MACHINES WITH AV-E VENTILATOR

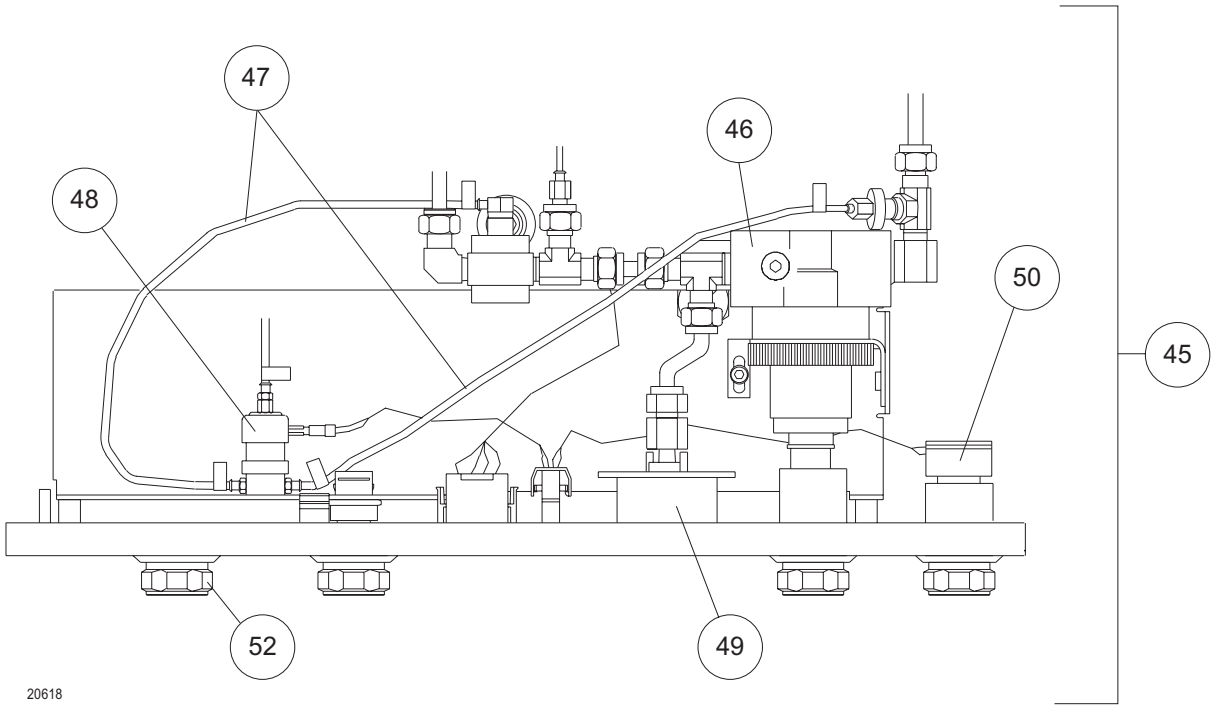




SV20017

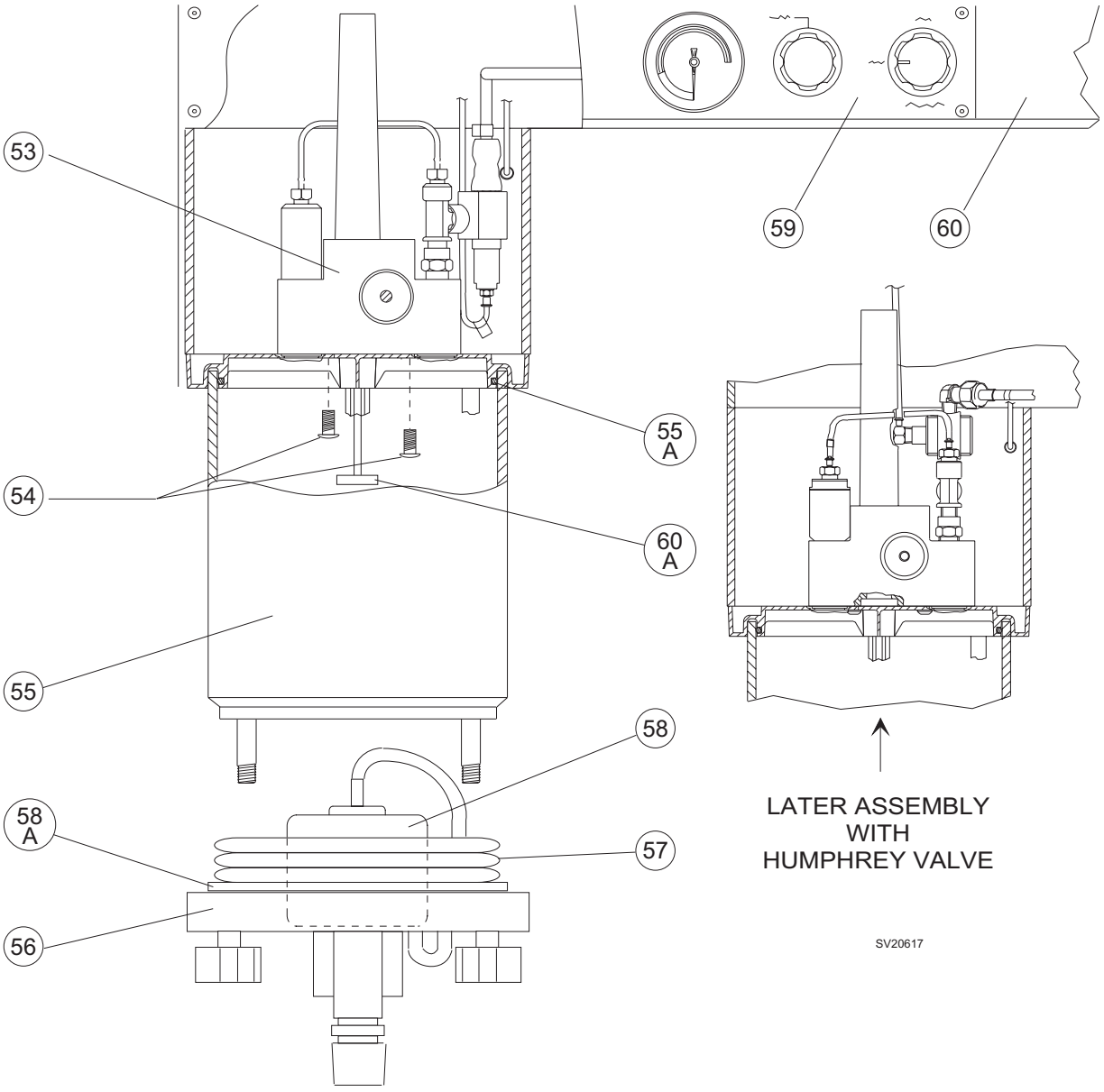
ITEM	DESCRIPTION	PART NUMBER
	Machines with AV-E Ventilator:	
21	Deleted	
22	Screw, Ventilator Solenoid Mounting (2x)	HW02011
23	AC Power Filter	4107759
24	Spacer, AC Power Filter Mounting (2x)	4110589-007
25	AC Receptacle (2x)	4106086
	AC Receptacle, later design (not interchangeable)	4112574-001
26	AC Power Filter Cover	4109622
	Later replaced by	4112822
	Screw, AC Power Filter Cover (2x)	HW09016
27	Ventilator Solenoid	4110906
28	Wire Harness, AVE Switch and Solenoid	4109771
29	Wire Harness, Alarm Channel	4109236
30	Ventilator Controller Assembly	4108948
31	Inspiratory Flow Gauge Assembly	4108856
	New Part Number (Gauge Only)	4111989
	Gauge cover, modified	4103624
32	Inspiratory Flow Regulator Assembly	4108846
	Service Exchange P/N	SE4108846
	Inspiratory flow regulator rebuild kits:	
	"Round" regulator	4105893
	"Square" regulator	S010060
33	Cable Assembly, Ventilator Box to Monitor Box	4109267
34	Cable Assembly, Ventilator Box to Alarm Channel	4109072
35	Nut, Knob Assembly Mounting	4107460
36	Knob Assembly, Incl. Knob, Bezel and Shaft Coupling	4107556
37	Setscrew	HW04007
38	Label	4103396
39	Bezel	4109767
40	Label	4107453
41	Setscrew	HW04007
42	Knob	4103394
43	Screw, Bezel Retainer (2x)	HW03038
44	Switch Assembly	4109768

MACHINES WITH AV-2 VENTILATOR



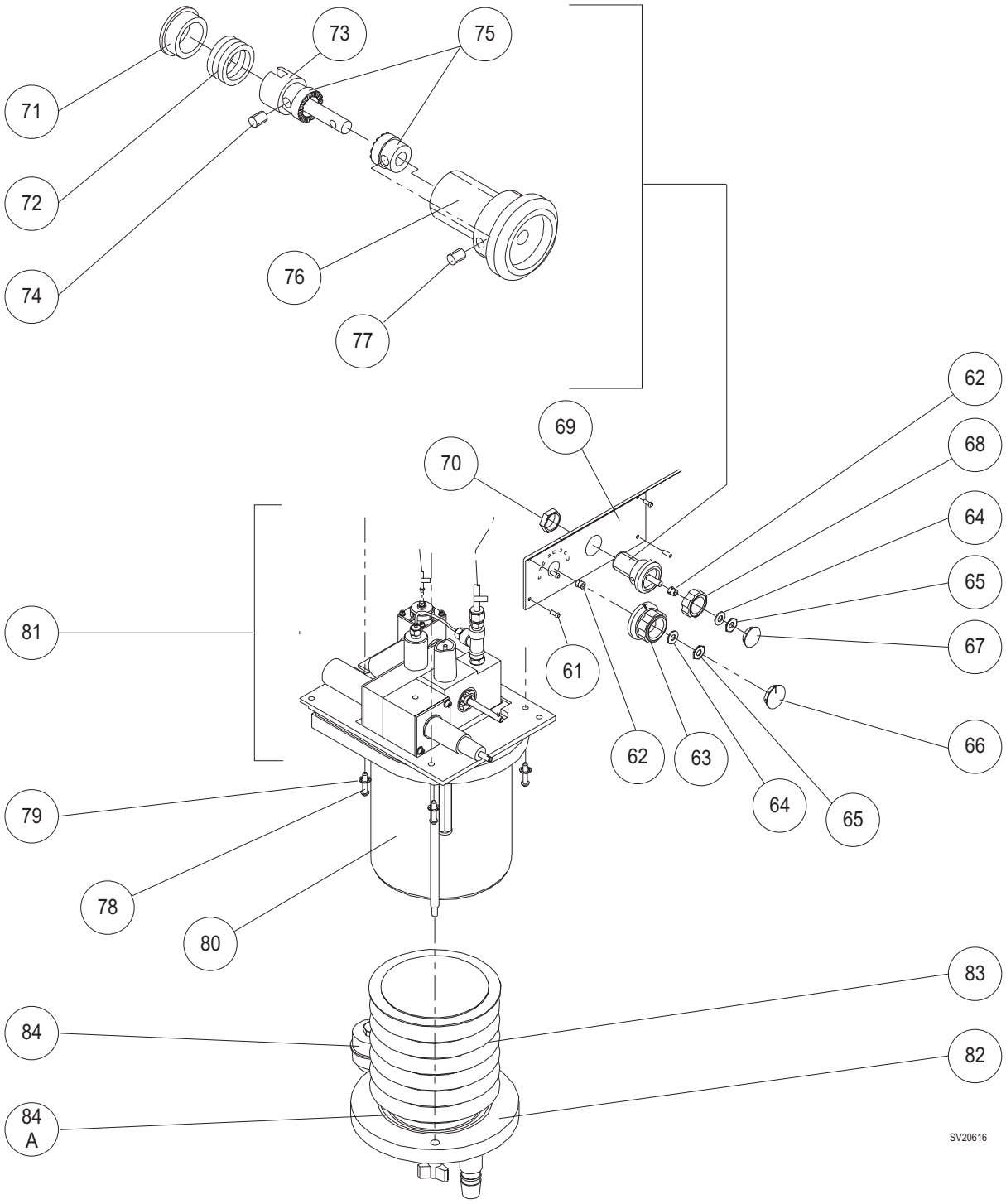
ITEM	DESCRIPTION	PART NUMBER
	Machines with AV-2 Ventilator:	
45	AV-2 Ventilator Controller Assembly (Bezel Assembly)	4112273
	Service Exchange part number is	SE4112273-S01
46	Inspiratory Flow Regulator	4114252
47	1/8 in. Tygon tubing	ML08003
48	Solenoid	4110906
49	Gauge	4112251-001
50	On-Off Switch & Wire Harness (Incl. Solenoid Wire Harness)	4112253
51	Deleted	
52	Knob (4x)	4112157
	(new part number)	4113281
	Knob Cover (3x) (all except ON-OFF switch)	4112245-003
	(new part number)	4113278-002
	Knob Cover (ON-OFF switch)	4112245-002
	(new part number)	4113278-001
	Machines with AV-2+ Ventilator:	
45	AV-2+ Ventilator Controller Assembly (bezel asm)	4113132-001
	Service Exchange P/N	SE4113132-001
46	Inspiratory Flow Regulator	4114252
47	1/8 in. Tygon tubing	ML08003
48	Solenoid	4110906
49	Gauge	4113137
50	On-Off Switch & Wire Harness	4113136
52	Knob (4x)	4113281
	Knob Cover (3x) (all except On-Off switch)	4113278-002
	Knob Cover (On-Off switch)	4113278-001

MACHINES WITH AV-E VENTILATOR



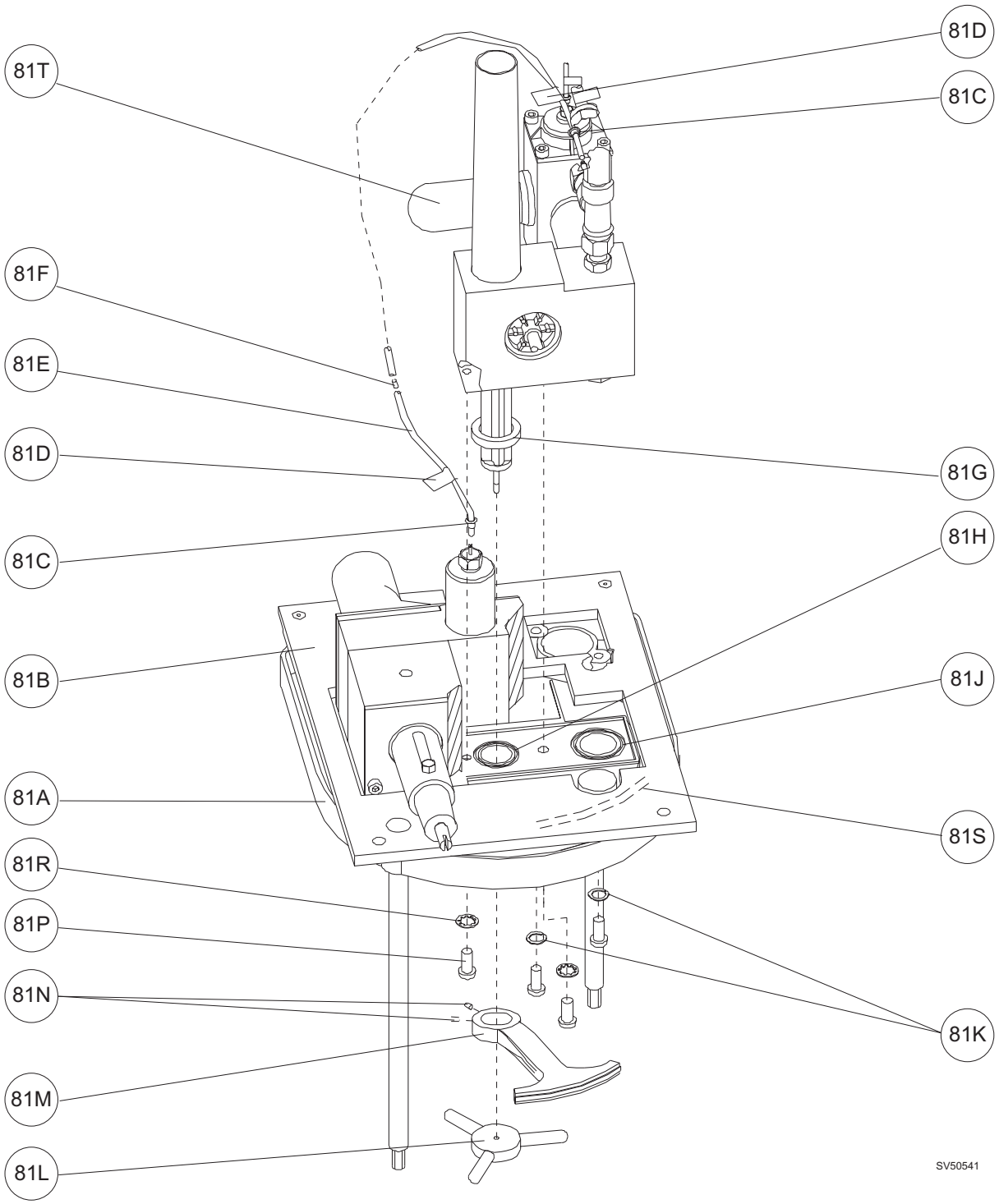
ITEM	DESCRIPTION	PART NUMBER
53	Ventilator Bellows Valve & Guide Assembly	4110775
	Service Exchange P/N	SE4110775
54	Screw, Valve & Guide Assembly Mounting (2x)	HW09013
	O-ring	4104595
	O-ring	4108708
	Bellows Valve Case Asm (Early Design)(Service Exchange)	SE10025
	Screw, Valve Case Assembly Mounting (4x)	HW01016
	O-ring (2x)	4102336
55	Bellows Canister	4106948
55A	O-ring, Bellows Canister	4107018
56	Bellows Assembly, Adult	4106935
	Service Exchange P/N	SE4106935
	Bellows Asm, Adult w/PLC (not shown)	4109664
	Service Exchange P/N	SE4109664
	Valve, Bellows PEEP (not shown)	4106350
	Service Exchange P/N	SE4106350
57	Bellows Sub-assembly, Adult (Urethane Non-Latex)	4106930-001
	O-ring #217 (neoprene)	4101817
	Bellows Asm, Pediatric	4109700
58	Relief Valve Assembly	4108050
	Diaphragm Assembly	4110960
58A	Gasket	4105849
59	Ventilator Box Front Panel, Left	4111420
60	Ventilator Box Front Panel, Right	4111421
60A	Tidal Volume Indicator	4108276

MACHINES WITH AV-2 VENTILATOR



ITEM	DESCRIPTION	PART NUMBER
	Machines with AV-2 Ventilator:	
61	Screw, 6-32 x ⅜ in. Btn Hd Skt (4x)	HW09000
62	Collet	4112167
63	Knob, PLC Adj.	
	(new part number)	4113279
64	Flat Washer, #10	HW66003
65	Hex Nut, M5 x 0.5	4112066
66	Knob Cover	4112245-002
	(new part number)	4113278-002
67	Knob Cover	4113278-002
68	Knob	4112152
	(new part number)	4113280
69	Front Plate, Bellows Box	4112230
70	Panel Nut	4107460
71	Spring Retainer	4107546
72	Spring	4110975
73	Shaft	4112175
74	Set Screw, 6-32 x 3/16 in.	HW07002
75	Clutch	4107544
76	Housing	4112467
77	Set Screw, 6-32 x ¼ in.	HW04003
78	Screw, ¼-20 x 1 in. Btn Hd Skt (3x)	HW09057
79	Lock Washer, ¼ int-t (3x)	HW67017
80	Canister	4106948
	O-ring, Bellows Canister	4107018
81	Bellows Valve Assembly (Parts Breakdown listed on a subsequent page)	4112272
	Service Exchange P/N	SE4112272-001
82	Bellows Assembly, Adult	4106935
	Service Exchange P/N	SE4106935
83	Urethane (Non-Latex) Bellows Sub-assembly, Adult	4106930-001
	O-ring #217 (neoprene)	4101817
84	Relief Valve Assembly	4108050
	Diaphragm Assembly	4110960
84A	Gasket	4105849

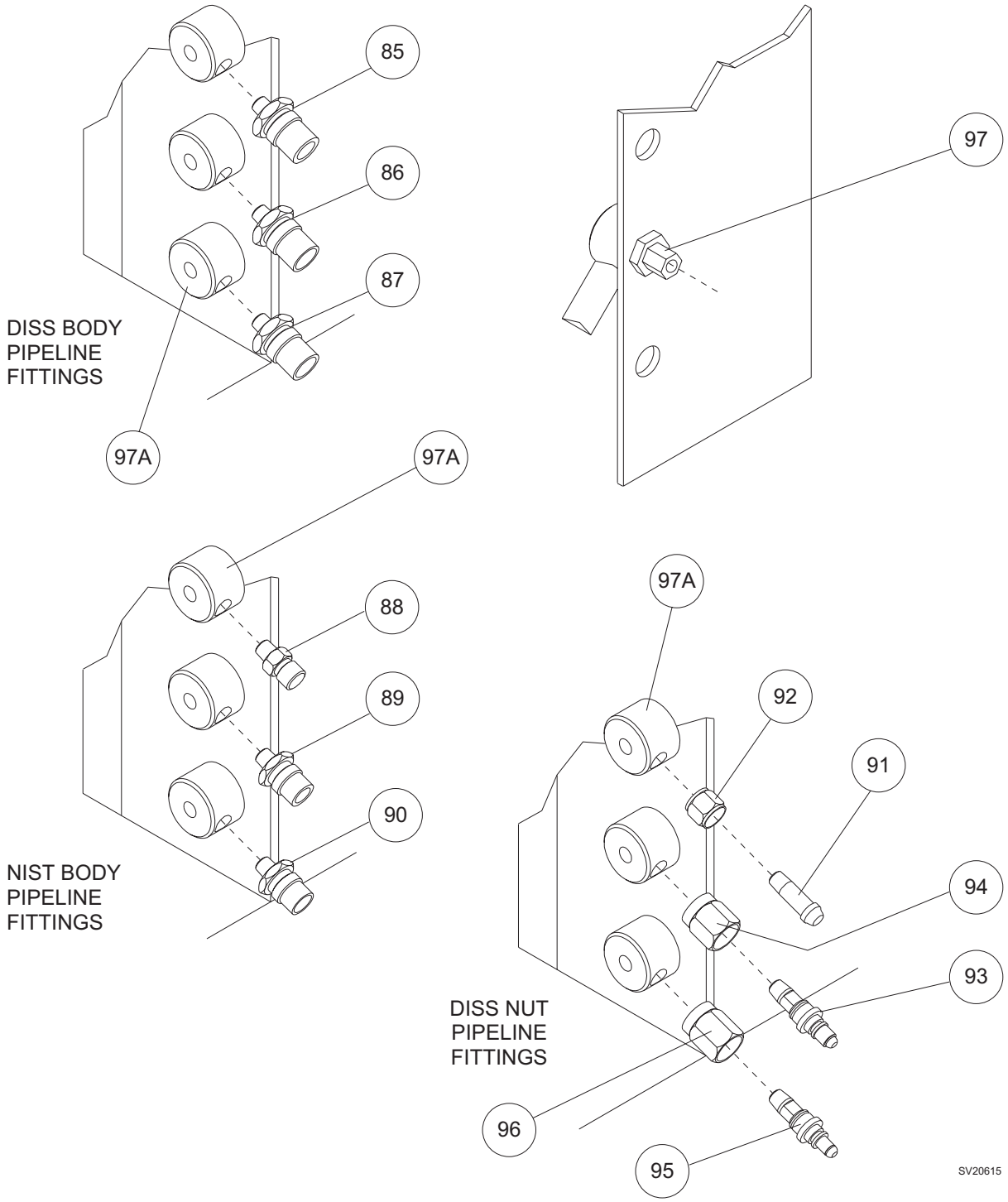
SPARE AND REPLACEMENT PARTS (continued) NM2B



ITEM	DESCRIPTION	PART NUMBER
81 (Ref)	Bellows Valve Assembly	4112272
	Service Exchange P/N	SE4112272-S01
81A	Bellows Top Plate	4111872
81B	Adapter Plate	4111979
81C	Press-on Hose Clamp (2x)	4104161
81D	Label, O_2 Tubing (2x)	4109871
81E	Hose, 0.075 I.D.	ML08003
81F	Restrictor	4107639
81G	Guide Ring	1101294
81H	O-ring #019 (Silicone)	4107096
81J	O-ring #022 (Neoprene)	4104595
81K	Lockwasher, #8 Split (2x)	HW65011
81L	Bellows Top Guide	4110735
81M	Volume Indicator	4108276
81N	Set Screw, 6-32 x ¼ in. cup point (2x)	HW04003
81P	Screw, 8-32 x ⅜ in. btn hd skt (4x)	HW09008
81R	Lock Washer, #8 int-t (2x)	HW67000
81S	O-ring #256 (Neoprene)	4107018
81T	Silencer	4110999
	*Bellows adjustment rod	4110727
	*Rod	4106918

*Also used in SE4110775 valve case asm

MACHINES CONFIGURED WITH AN ORC



ITEM	DESCRIPTION	PART NUMBER
	DISS Body Pipeline Fittings:	
85	O_2 DISS Fitting*	4102563
86	Air DISS Fitting*	4102886
87	N_2O DISS Fitting*	4111384
	NIST Body Pipeline Fittings:	
88	O_2 Male NIST Connector	4110388
89	Air Male NIST Connector	4110386
90	N_2O Male NIST Connector	4111382
	DISS Nut Pipeline Fittings:	
91	O_2 DISS Nipple*	4103877
92	O_2 DISS Nut*	4102848
93	Air DISS Nipple*	4111385
94	Air DISS Nut*	4103120
95	N_2O DISS Nipple*	4111383
96	N_2O DISS Nut*	4102850
97	Pipeline Inlet Filter Asm (Typ., All Inlets)	4106198
	Filter	4102532
	Connector	4106897
	O-ring for N_2O DISS Nipple	4113494

* These items were included as part of pipeline inlet assemblies on earlier machine configurations with an ORMC. Assembly numbers are listed below for reference:

Pipeline Inlet Assembly, O_2	4109345
Pipeline Inlet Assembly, O_2 (Canada)	4109297
Pipeline Inlet Assembly, N_2O	4109344
Pipeline Inlet Assembly, N_2O (Canada)	4109298
Pipeline Inlet Assembly, Air	4109412
Pipeline Inlet Assembly, Air (Canada)	4109861

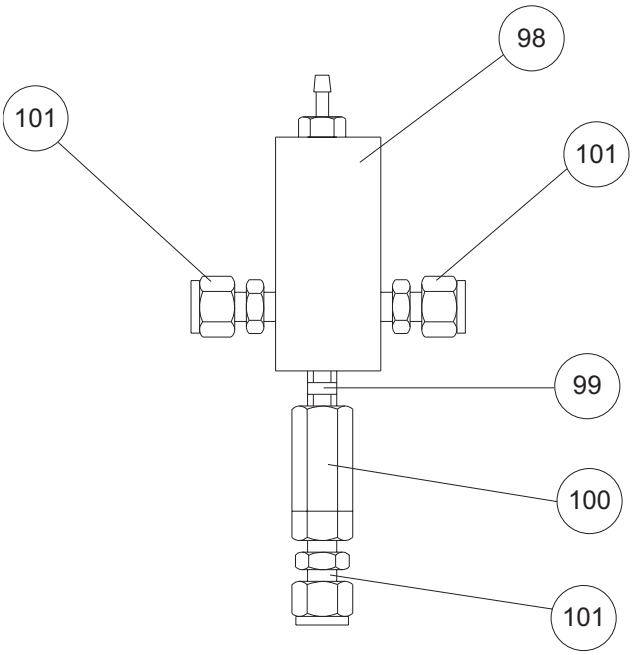
NOTE: Positions of O_2 and Air pipeline inlets are reversed on earlier machines.

Common parts:

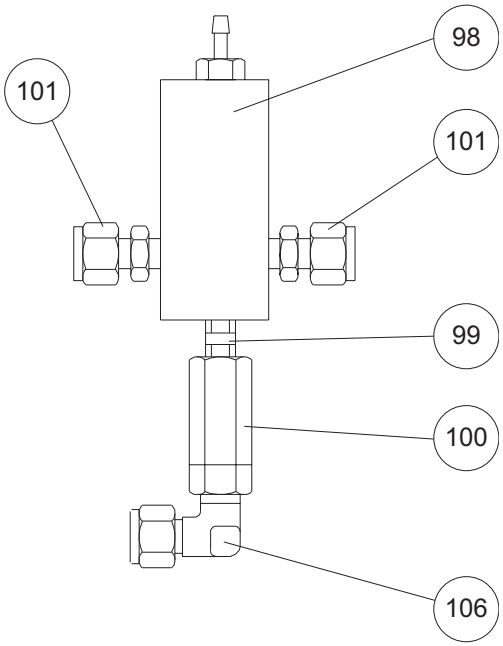
97A	Pipeline Inlet Housing (old No.)	4102559
	(replaced by)	4113363
	(new no.)	4113974
	Nut, ⅝-18	HW52002
	Lock Washer, ⅝ int-t	HW67001

MACHINES CONFIGURED WITH AN ORC

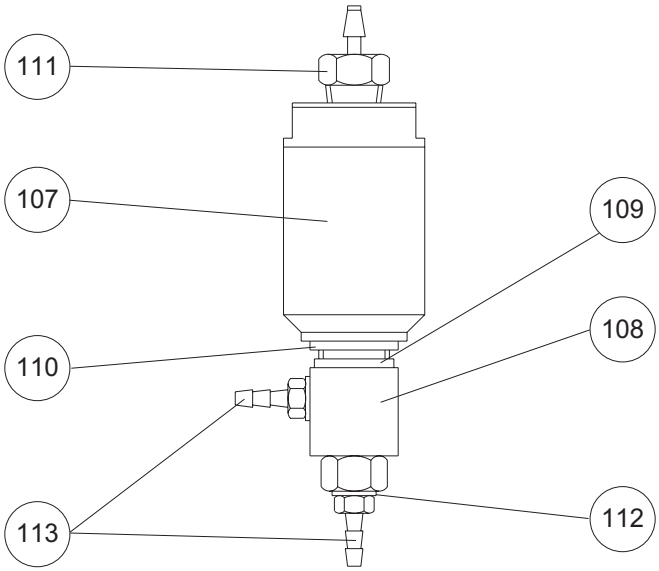
N2O FAILSAFE ASSEMBLY



AIR OR THIRD GAS FAILSAFE ASSEMBLY



MINIMUM FLOW O2 VALVE ASSEMBLY



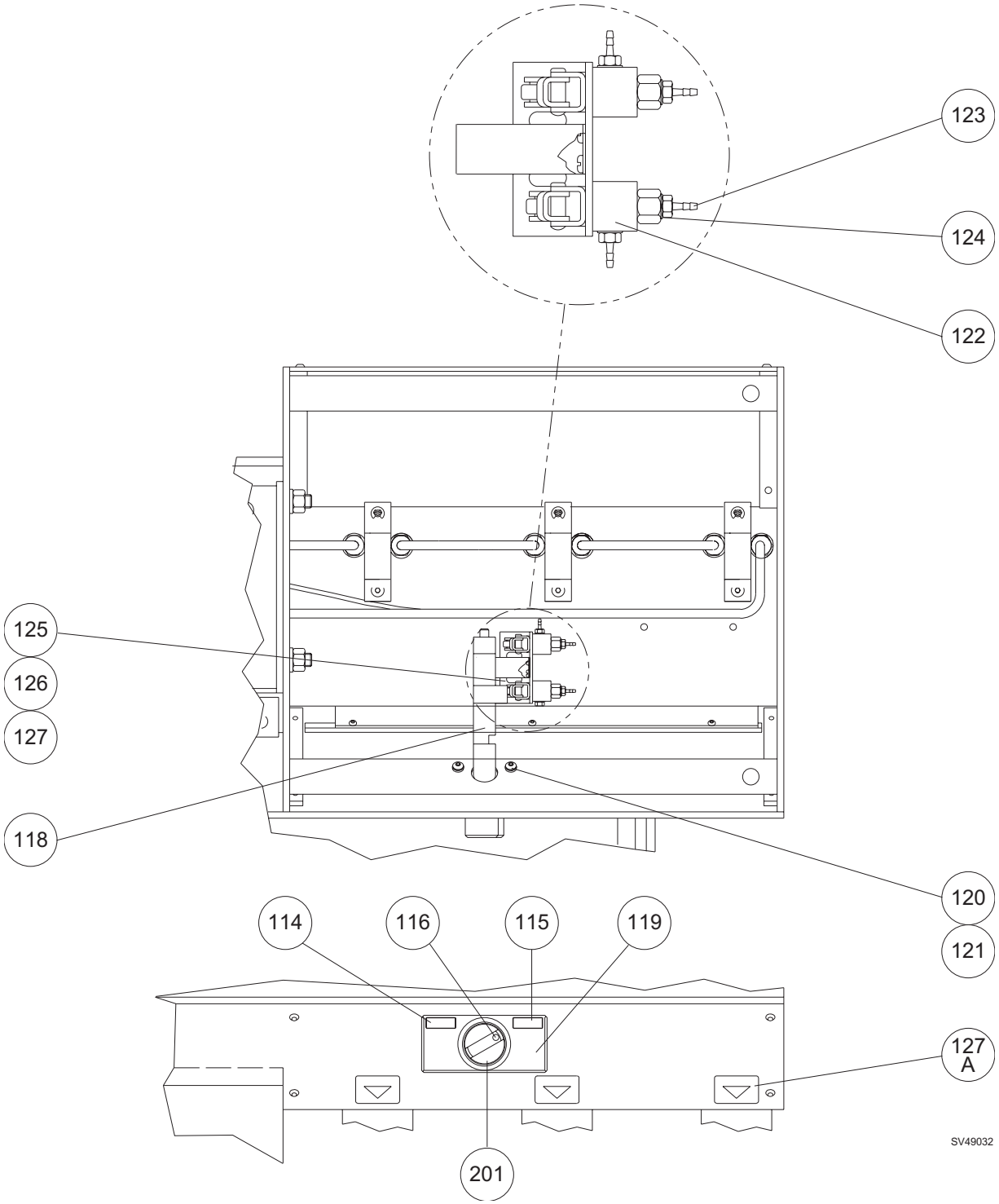
SV20614

ITEM	DESCRIPTION	PART NUMBER
	*N_2O Failsafe Assembly:	
98	Failsafe Block Asembly	4112043
99	Nipple, ⅛ NPT x ¾ in.	4102784
100	Check Valve, MJCV-1	4105815
101	Straight Fitting, ¼Tube x ⅛ MPT (3x)	4109408
	*Air or 3rd Gas Failsafe Assembly:	
98	Failsafe Block Asembly	4112043
99	Nipple, ⅛ NPT x ¾ in.	4102784
100	Check Valve, MJCV-1	4105815
101	Straight Fitting, ¼Tube x ⅛ MPT (2x)	4109408
102	Deleted	
103	Deleted	
104	Deleted	
105	Deleted	
106	Elbow Fitting, ¼Tube x ⅛ MPT	4109410
	Minimum O_2 Flow Valve Assembly:	
107	Pilot Actuator	4102055
108	Valve, 2-Way Poppet	4103549
109	Lock Washer	(Supplied with Valve)
110	Spacer	4110792-013
111	Hose barb fitting, 1/16 I.D. Hose x ⅛ MPT (requires press-on hose clamp 4104161)	4111771
112	Washer (2x)	4102165
113	Fitting, 1/16 I.D. Hose x 10-32 (2x)	4103445
	Later design fitting has integral seal (replaces previous two items)	4112707
	Tie Strap, 0.131W x 8.04L (2x)	1101732

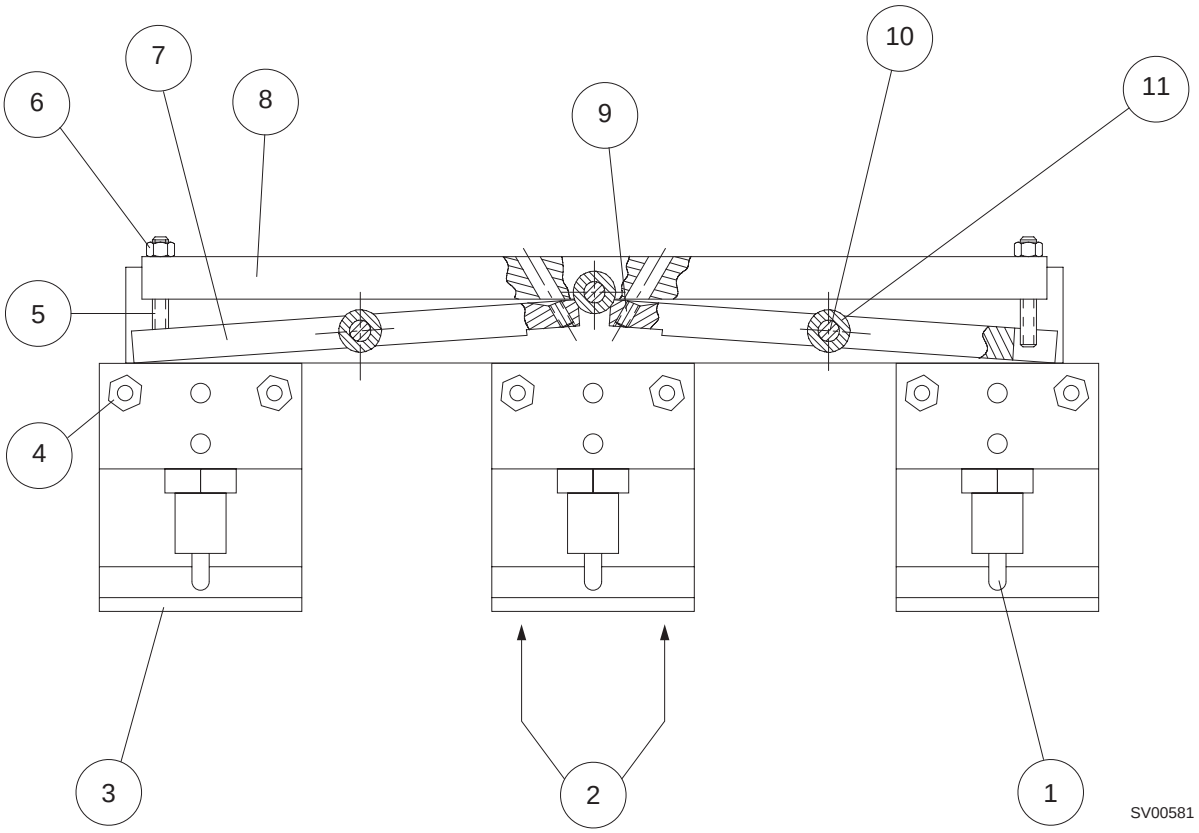
* On earlier machine configurations with an ORMC, the failsafe assemblies are three-port devices and were listed as complete assemblies with fittings installed. Assembly numbers are listed below for reference:

N_2O Failsafe Assembly	4108686
Air or 3rd gas Failsafe Assembly	4108687
Alternate P/N for earlier asms w/T-fitting between check valve and OFPD	4108696

MACHINES CONFIGURED WITH AN ORC



ITEM	DESCRIPTION	PART NUMBER
	Gas Selector Switch Assembly:	
114	Label, O_2 + N_2O	4108461
115	Label, ALL GASES	4108462
116	Label, Dot	4103423
117	Knob	4103169
	Set screw, locking, 8-32 x 3/8 in. cup pt.	HW10004
	(Later style knobs use non-locking set screw)	HW04025
118	Camshaft, Gas Selector	4109867
119	Block, Gas Selector Switch	4109866
120	Switch Asm Mounting Screws, 8-32 x 3/8 in. skt hd (2x)	HW01012
121	Lock Washer, #8 int-t (2x)	HW67000
	Valve Assembly, Gas Selector:	
122	Valve, Gas Selector (2x)	4103621
123	Fitting, 1/16 I.D. Hose x 10-32 (4x)	4103445
124	Washer (4x)	4102165
	later design fitting has integral seal (replaces previous two items)	4112707
125	Valve Asm Mounting Screws, 10-32 x 5/16 in. skt hd (2x)	HW01022
126	Lock Washer, #10 int-t (2x)	HW67006
127	Flat Washer, #10 (2x)	HW66003
127A	Label, vaporizer arrow	4112055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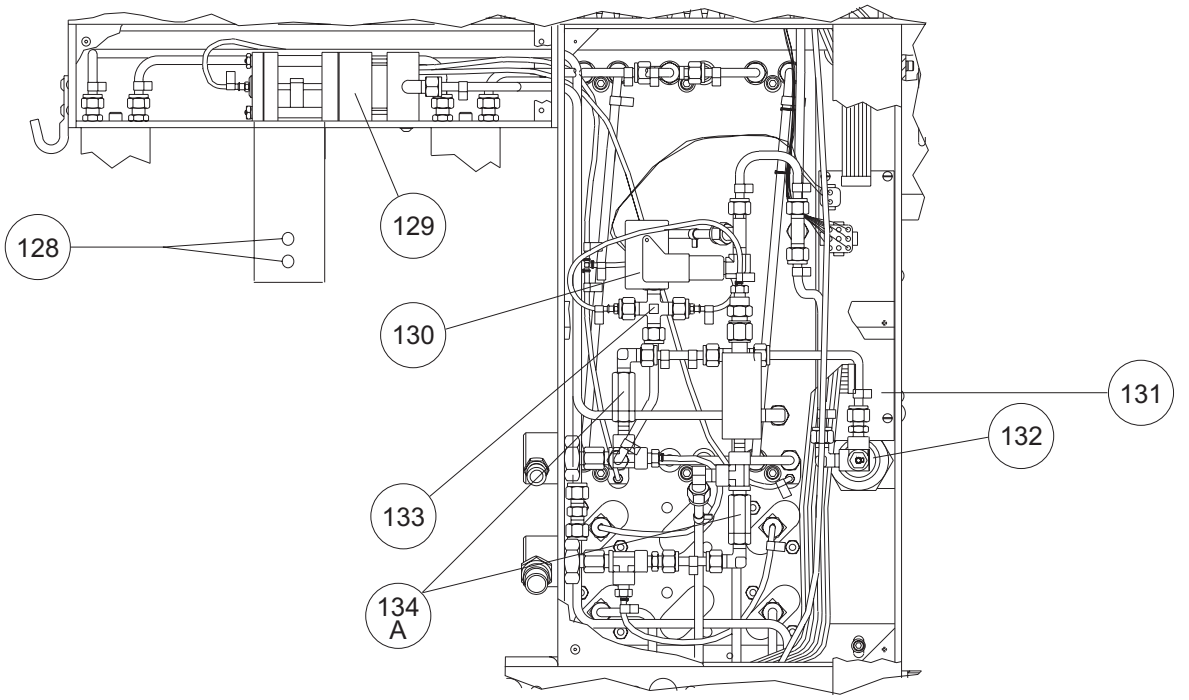
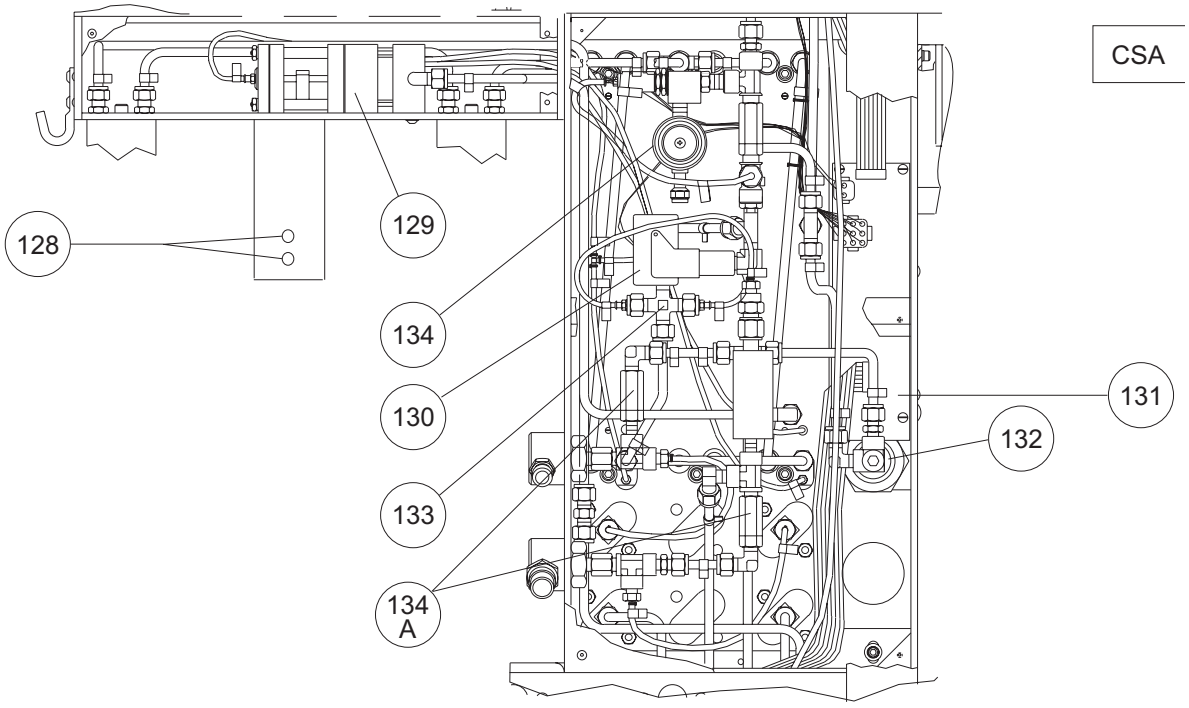
ITEM	DESCRIPTION	PART NUMBER
1	Pin assembly	4110187
2	O-rings (2x per vaporizer)	2121929
3	Cover assembly, vapor block (plastic)	4112699
4	Straight fitting, 1/4 tube	4109408
5	Set screw, 10-32 (2x)	HW04012
6	Kep nut, 10-32 (2x)	HW55002
7	Pivot arm, short (2x)	4104975
8	Pivot arm, long	4108043
9	Set screw, 8-32 (2x)	4111693
10	Pin	4104343
11	Spacer	4110792-014

Not shown:

	Support bar	4104976

EARLIER MACHINE CONFIGURATION (TYPICAL)





SV20613

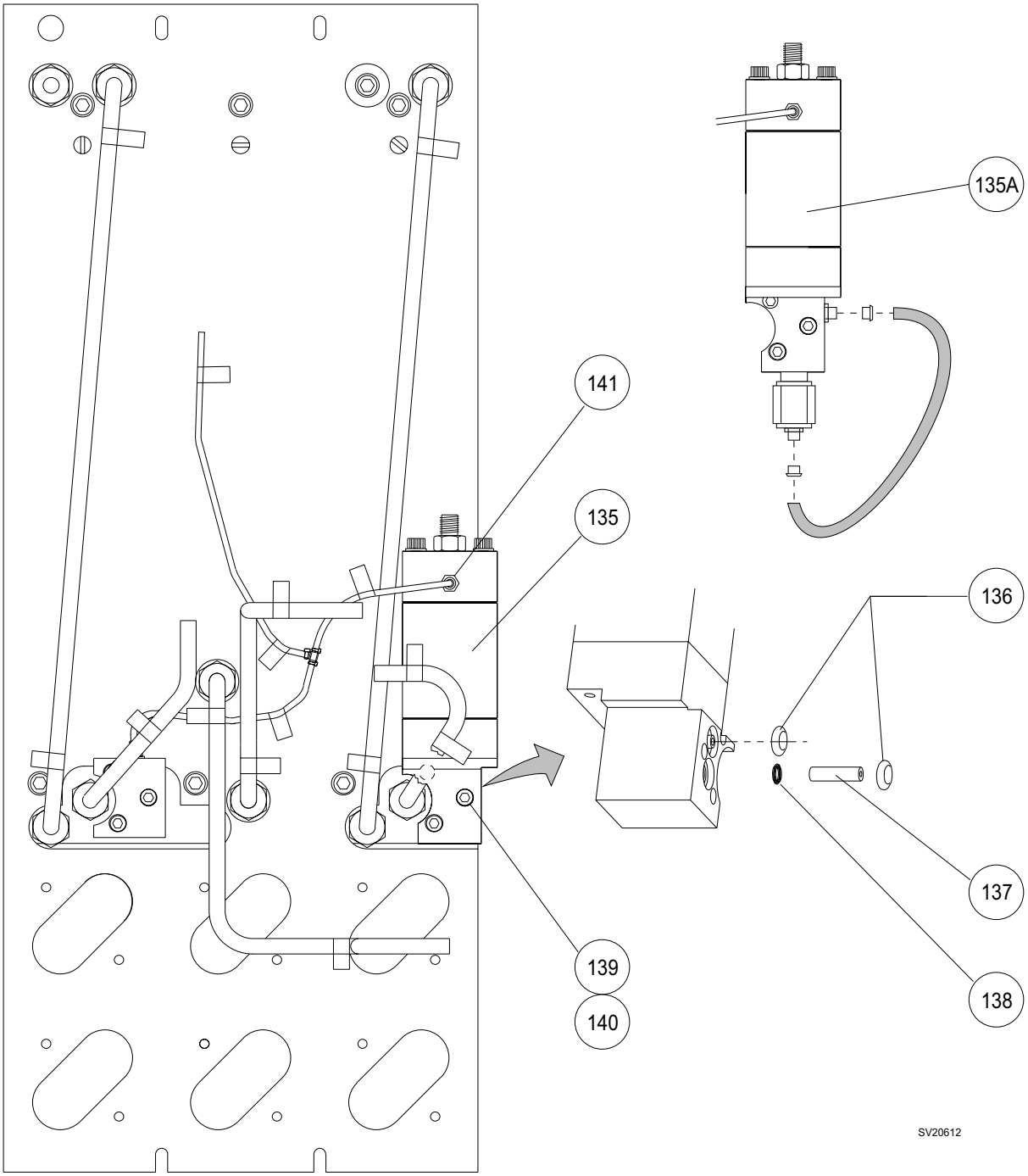
ITEM	DESCRIPTION	PART NUMBER
128	Vaporizer Mounting Screw, 4 x 30 Metric (2x Per Vaporizer)	HW01072
	Vaporizer Gasket, O-Ring (2x Per Vaporizer)	2121929
	Vapor block cover assembly	4112699

The following items apply to earlier machine configurations and are listed here for reference:

129	Oxygen Ratio Monitor/Controller (ORMC) (Early models)	4109271
	Service Exchange P/N	SE4109271
	(Later models without electrical connections)	4111765
	Service Exchange P/N	4111765
130	Oxygen Supply Pressure Alarm Switch	4106037
131	Alarm Channel Assembly (Early models)	4108592
	Service Exchange P/N	SE4108592
	Later models without O_2/N_2O ratio lamp	4111522
	Service Exchange P/N	SE10029
132	Main Switch Valve & Fitting Assembly (Early models)	4109285
133	Minimum oxygen flow restrictor, wht (ORMC/ORC)	4110738-004
	Minimum oxygen flow restrictor, brn (ORC w/bypass)	4110738-007
	O-ring, #008 (Neoprene) (2x)	4102022
	Washer (2x)	4102165
	Ftg, Str, 1/16 ID hose x 10-32 M (2x)	4103445
	Bushing, restrictor asm (2x)	4109424
134	Oxygen Supply Low Pressure Alarm Whistle (Canada)	4109946
	Reservoir Assembly, Alarm Whistle (Canada)	4109947
134A	Pipeline check valve	4105815

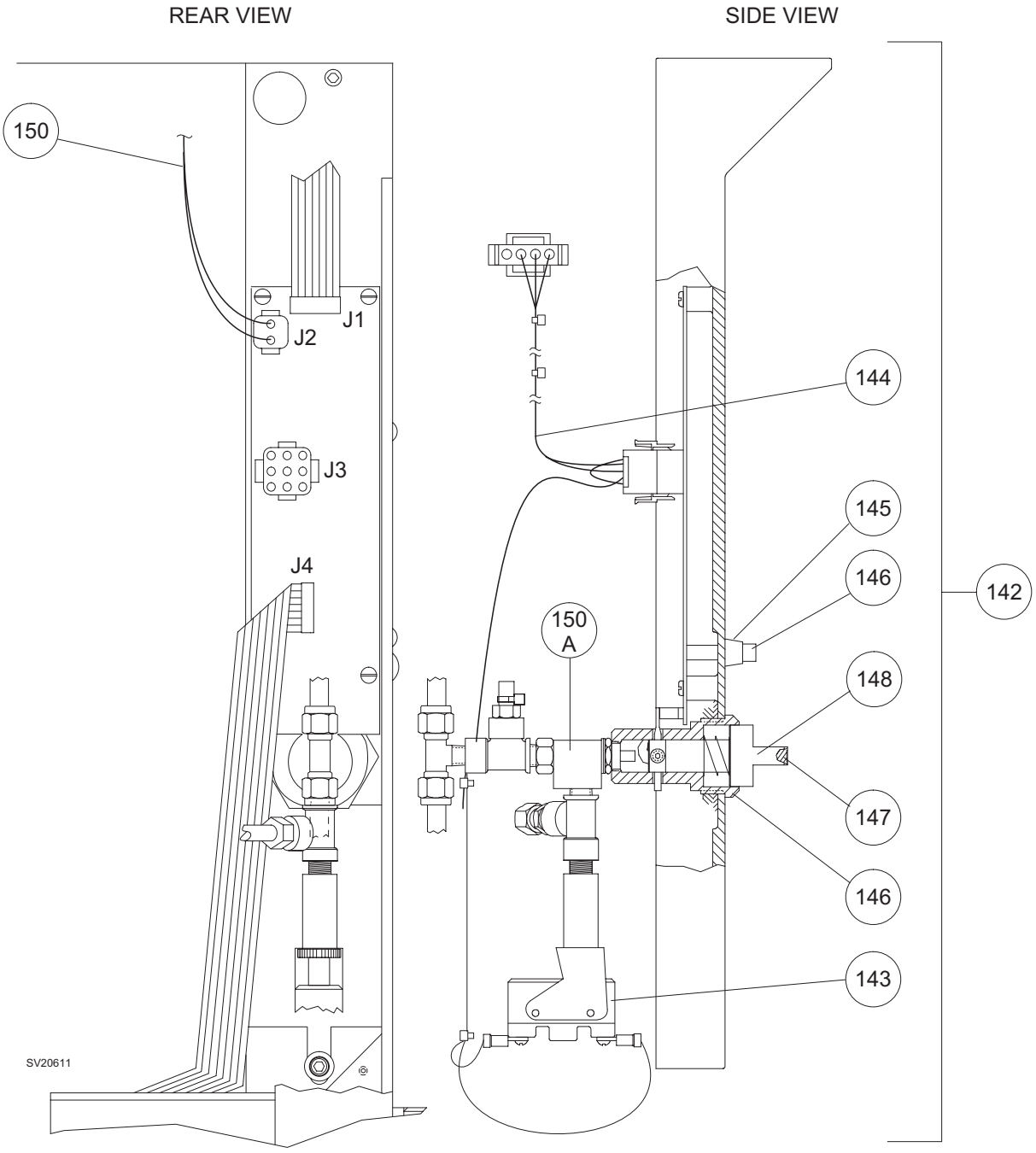
LATER MACHINES WITH ORC AS PART OF FLOWMETER SUB-ASSEMBLY

REAR VIEW OF FLOWMETER HOUSING
WITH REAR COVER REMOVED



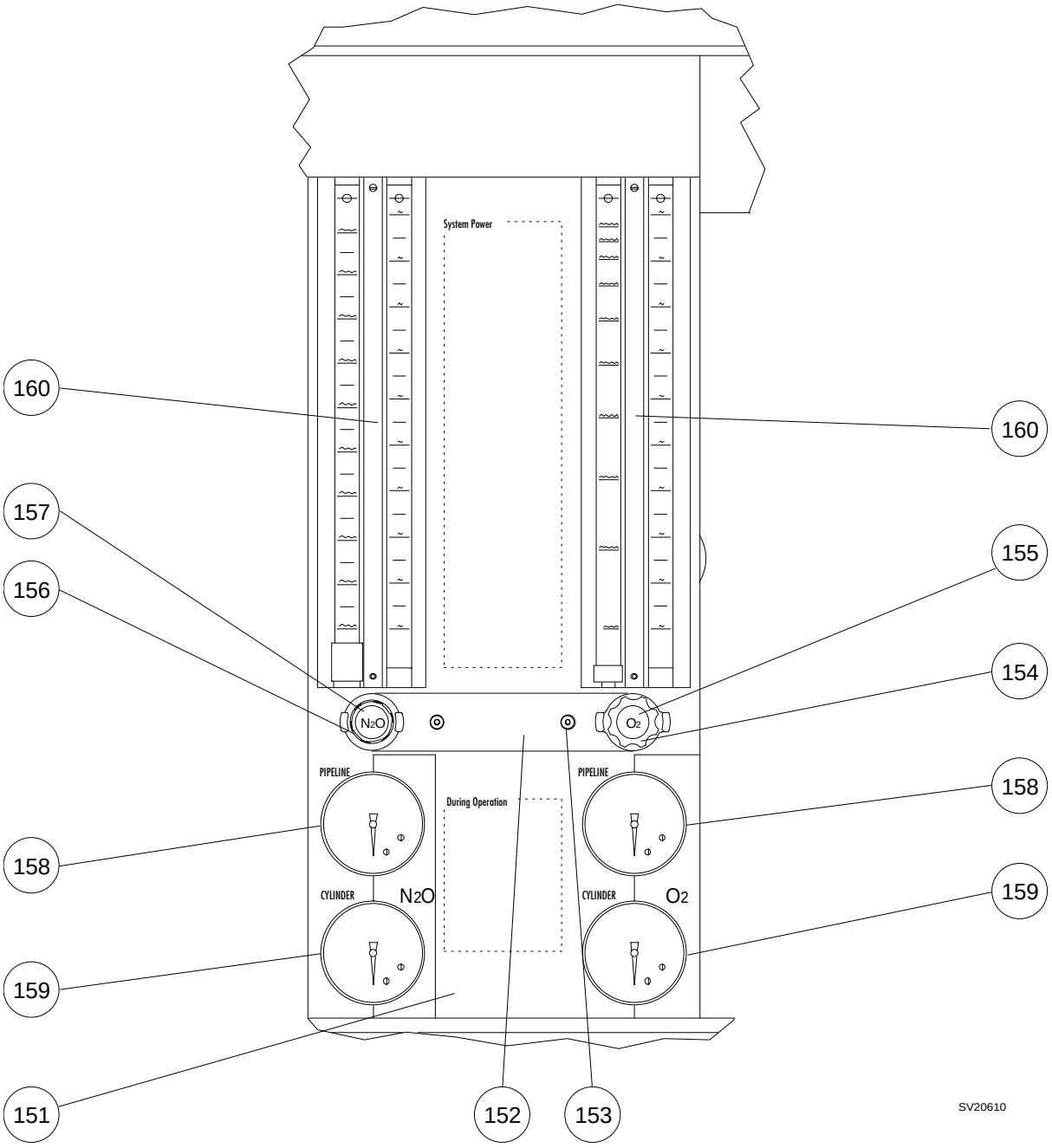
ITEM	DESCRIPTION	PART NUMBER
135	ORC Assembly	4111800
	Service Exchange P/N	SE4111800
135A	ORC Assembly, low flow design for later machines	4113329-001
	Service Exchange P/N	SE4113329-001
136	O-ring, #105 (Neoprene) (2x)	4111893
137	Filter	4111805
138	O-ring, 0.066 x 0.042 (Buna-n)	4111894
139	Screw, 8-32 x 1½ in. skt hd (3x)	HW01020
140	Lock Washer, #8 split (3x)	HW65001
141	Hose Clamp, Press-on	4104161

LATER MODELS WITH OXYGEN SUPPLY PRESSURE ALARM SWITCH



ITEM	DESCRIPTION	PART NUMBER
142	Alarm Channel Assembly	4112125
143	Oxygen Supply Pressure Alarm Switch	4106037
144	Wire Harness, Alarm Switch & J3 to Ventilator Controller	4112146
145	Housing, Push Button	4106046
146	Cap, Push Button	4106047
147	Label, Dot	4103423
148	Knob, Main Switch	4106044
149	Housing, Main Switch	4106045
	Alarm Channel Service Replacement No.	SE10029
	Alarm Channel w/O2/N2O LED: Service Exchange P/N	SE4108529
150	Wire Harness, Flowmeter Lights to Alarm Channel J2	4108594
150A	Clippard valve	4103588

For earlier machine configurations, see Alarm Channel listing on a previous page.


160
157
156
158
159
151
152
153
160
155
154
158
159
System Power
During Operation
PIPELINE
PIPELINE
CYLINDER
CYLINDER
N2O
O2
SV20610

ITEM	DESCRIPTION	PART NUMBER

The following Flowmeter Shield part numbers apply to later madel machines with flowmeter sub-assemblies having an ORC:

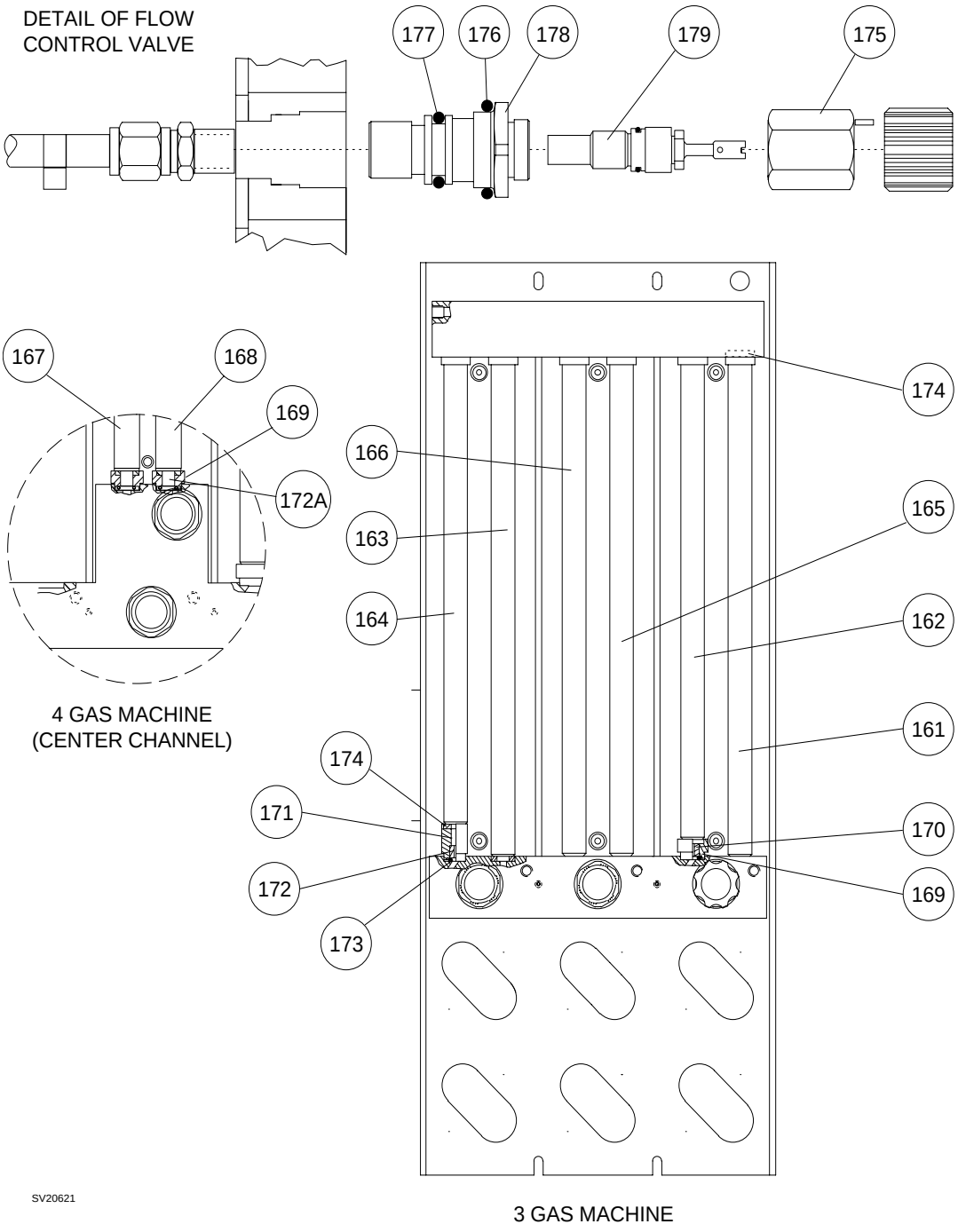
151	Shield, Flowmeter, 2 Gas N_2O/O_2, Domestic	4111824-001
	Shield, Flowmeter, 2 Gas N_2O/O_2, Canada	4111824-002
	Shield, Flowmeter, 2 Gas, Export	4111825
	Shield, Flowmeter, 3 Gas Air, Domestic	4111830-001
	Shield, Flowmeter, 3 Gas O_2-He, Domestic	4111831
	Shield, Flowmeter, 3 Gas Air, Canada	4111830-002
	Shield, Flowmeter, 3 Gas, Export, 6 Gauge	4111826
	Shield, Flowmeter, 3 Gas, Export, 5 Gauge	4111827
	Shield, Flowmeter, 4 Gas, Air/CO_2, Domestic	4111829-003
	Shield, Flowmeter, 4 Gas, Air/O_2-He, Domestic	4111829-001
	Shield, Flowmeter, 4 Gas, Air/O_2-He, Canada	4111829-002
	Shield, Flowmeter, 4 Gas, Export	4111828

The following Flowmeter Shield part numbers apply to earlier machine configurations:

	Shield, Flowmeter, 2 Gas	4110584-001
	Shield, Flowmeter, 3 Gas (Air)	4110585-001
	Shield, Flowmeter, 2 Gas (Canada)	4110584-002
	Shield, Flowmeter, 3 Gas (Air) (Canada)	4110585-002
	Shield, Flowmeter, 4 Gas (Export)	4111226
152	Knob Guard, 2 Gas	4110621
	Knob Guard, 3 Gas	4110574
153	Screw, 6-32 x 7/16 btn hd (2x)	HW09017
154	Knob, O_2	4103156
155	Label, O_2 Flow Control Knob, Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
156	Knob, Flow	4103736
157	Label, N_2O Flow Control Knob, Blue (USA, UK, Canada)	4103904
	Gray (Germany)	4111266-004
	Label, Air Flow Control Knob, Yellow (USA, Germany)	4103905
	Black/White (UK, Canada)	4105982
	Label, CO_2 Flow Control Knob, Gray (USA,UK, Canada)	4103908
	Black (Germany)	4111266-006
	Label, O_2-He Flow Control Knob, Green/Brown (USA)	4110951
	White/Brown (Canada)	4110952
158	Gauge, 100 psi	4110575-001
	Gauge, 7.0 bar	4110575-003
159	Gauge, 3000 psi	4110575-002
	Gauge, 200 bar	4110575-004

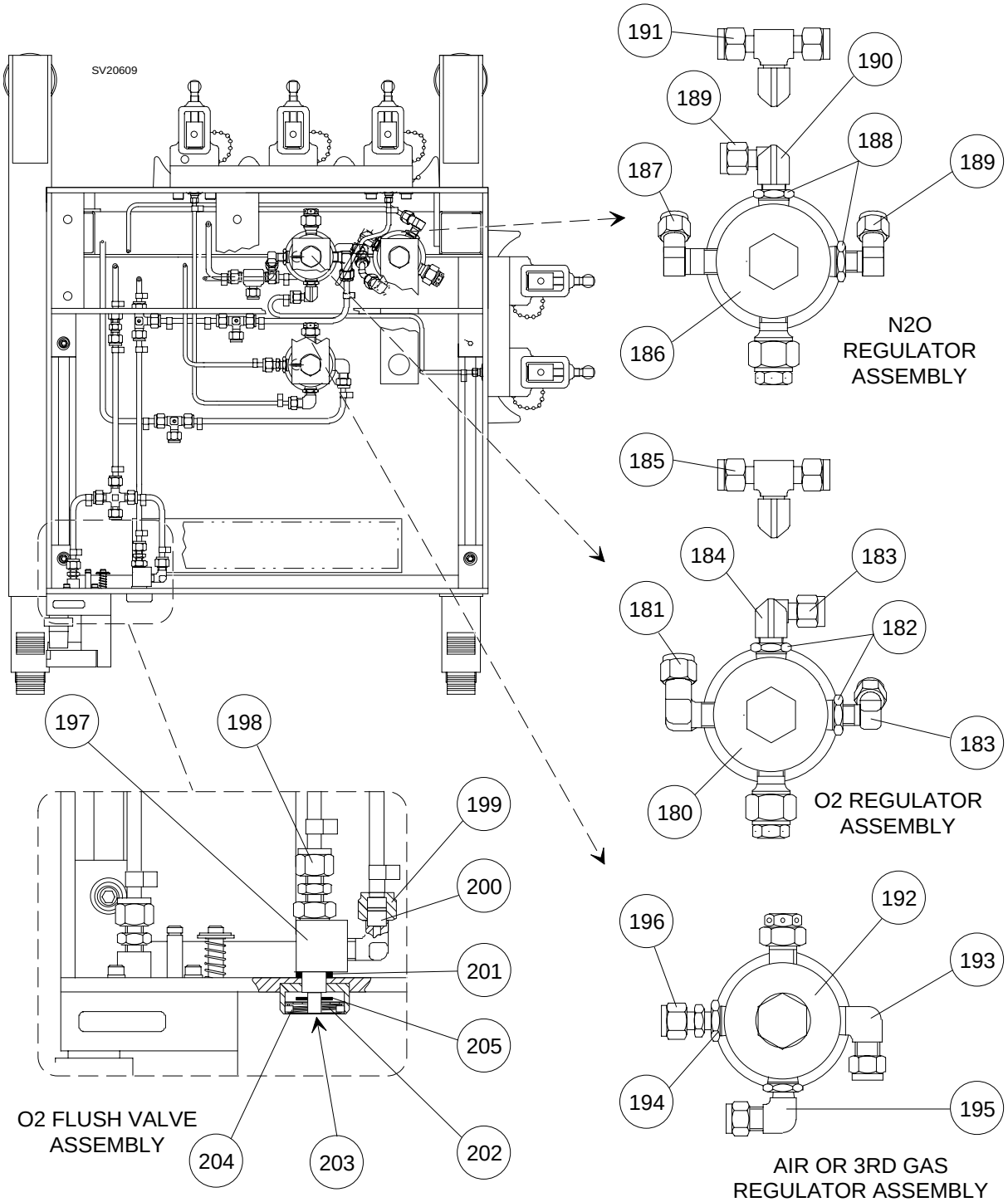
The following gauge part numbers apply to earlier machine configurations:

Gauge, 100 psi O2	4103076
Gauge, 4000 psi O2	4103074
Gauge, 1000 psi N2O	4103100
Gauge, 2000 psi N20	4103075
Gauge cover, screw-on (old style)	4103624
160 Flowmeter Light Circuit Assembly	4107370


DETAIL OF FLOW
CONTROL VALVE
177
176
178
179
175
167
168
169
172A
4 GAS MACHINE
(CENTER CHANNEL)
174
166
165
163
164
162
161
174
171
170
172
169
173
SV20621
3 GAS MACHINE

ITEM	DESCRIPTION	PART NUMBER
161	Flow Tube, O_2, 1-10 l/min	4103418
	Later style w/o color band	4112560-001
	Flow Tube, O_2, 0.6-10 l/min (Low Flow)	4107699
	Later style w/o color band	4112568-001
162	Flow Tube, O_2, 100-1000 ml/min	4103417
	Later style w/o color band	4112559-001
	Flow Tube, O_2, 20-500 ml/min (Low Flow)	4107698
	Later style w/o color band	4112567-001
163	Flow Tube, N_2O, 1-10 l/min	4103420
	Later style w/o color band	4112562-001
	Flow Tube, N_2O, 0.6-10 l/min (Low Flow)	4105758
	Later style w/o color band	4112564-001
164	Flow Tube, N_2O, 100-1000 ml/min	4103419
	Later style w/o color band	4112561-001
	Flow Tube, N_2O, 20-500 ml/min (Low Flow)	4105757
	Later style w/o color band	4112563-001
165	Flow Tube, Air, 1-10 l/min	4106693
	Later style w/o color band	4112566-001
166	Flow Tube, Air, 100-1000 ml/min	4106692
	Later style w/o color band	4112565-001
167	Flow Tube, Air, 0.2-10 l/min (4-gas machines)	1101084
	Later style w/o color band	4112558-001
168	Flow Tube, CO_2, 0.05-1.0 l/min (4-gas machines)	1101081
	Later style w/o color band	4112557-001
	Flow Tube, O_2-He, 2-10 l/min (4-gas machines)	4110956
	Later style w/o color band	4112569-001
169	O_2 Restrictor Housing	4103440
170	O_2 Restrictor, Red (use w/ORMC & ORC)	4110738-003
171	N_2O Restrictor Housing	4111716
172	N_2O Restrictor, Blue (use w/ ORMC only)	4110738-002
	Black (machines w/ORC: E-Z Plumb)	4110738-005
172A	Restrictor, Yellow (CO_2 only)	4110738-006
173	O-ring, #010, Neoprene (one per each restrictor housing)	4101872
174	Gasket, Large, 2x per Flow Tube	4102724
	Parts common to all flow control valves:	
175	Stop Pin Nut	4103382
176	O-ring, #018, Neoprene	4102336
177	O-ring, #112, Neoprene (machines w/ORC: E-Z Plumb)	4102141
	O-ring, #113, Neoprene (earlier machines)	4102792
178	Insert, Flow Control Valve, unplated (machines w/ORC: E-Z Plumb)	4111819-001
	plated, (4th gas only)(machines w/ORC: E-Z Plumb)	4111819-002
	Insert, Flow Control Valve (earlier machines)	4110573
179	Valve, Flow Control	4115871

LATER MACHINE CONFIGURATIONS



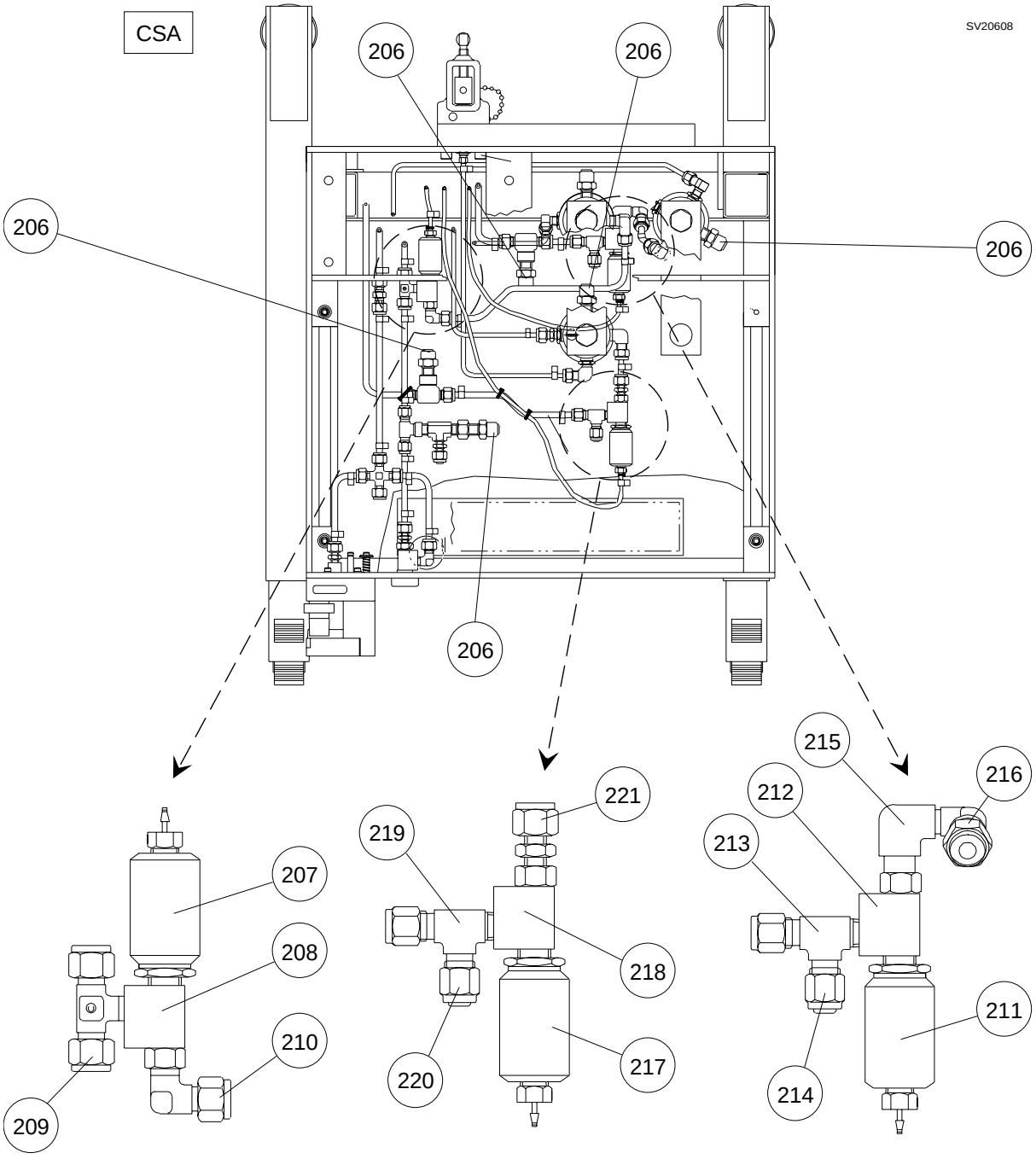
ITEM	DESCRIPTION	PART NUMBER
	*O_2 Regulator Assembly:	
180	Regulator	4103590
181	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
182	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
183	Elbow Fitting, 3/16 Tube x ⅛ MPT (2x)	4109409
184	Elbow Fitting, ⅛ MPT x ⅛ FPT	4103513
185	Tee Fitting, 3/16 Tube x 3/16 Tube x ⅛ MPT [Replaces previous two items if machine has an additional O_2 yoke]	4109404
	*N_2O Regulator Assembly:	
186	Regulator	4103591
187	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
188	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
189	Elbow Fitting, 3/16 Tube x ⅛ MPT (2x)	4109409
190	Elbow Fitting, ⅛ MPT x ⅛ FPT	4103513
191	Tee Fitting, 3/16 Tube x 3/16 Tube x ⅛ MPT [Replaces previous two items if machine has an additional N_2O yoke]	4109404
	*Air or 3rd Gas Regulator Assembly:	
192	Regulator	4103590
193	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
194	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
195	Elbow Fitting, 3/16 Tube x ⅛ MPT	4109409
196	Straight Fitting, 3/16 Tube x ⅛ MPT	4109415
	O_2 Flush Valve and Related Parts:	
197	Valve, Clippard, 2 way	4103340
198	Straight Fitting, ¼ Tube x ⅛ MPT	4109408
199	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
200	Restrictor	4101867
201	Spacer	4110792-006
202	Button, O_2 FLUSH	4103249
203	Label, ⅝ Dot, O_2, Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
204	Set Screw, 3-48 x 3/16 (2x)	HW04020
205	Washer	4110792-021

See next page for CSA items.

* On earlier machine configurations the regulators were listed as complete assemblies with fittings installed. Assembly numbers are listed below for reference:

Regulator Assembly, O_2 Cylinder Pressure	4103797
Regulator Assembly, N_2O Cylinder Pressure	4103798
Regulator Assembly, Air Cylinder Pressure	4104603

LATER MACHINE CONFIGURATIONS



O2 CYLINDER CUTOFF VALVE ASSEMBLY

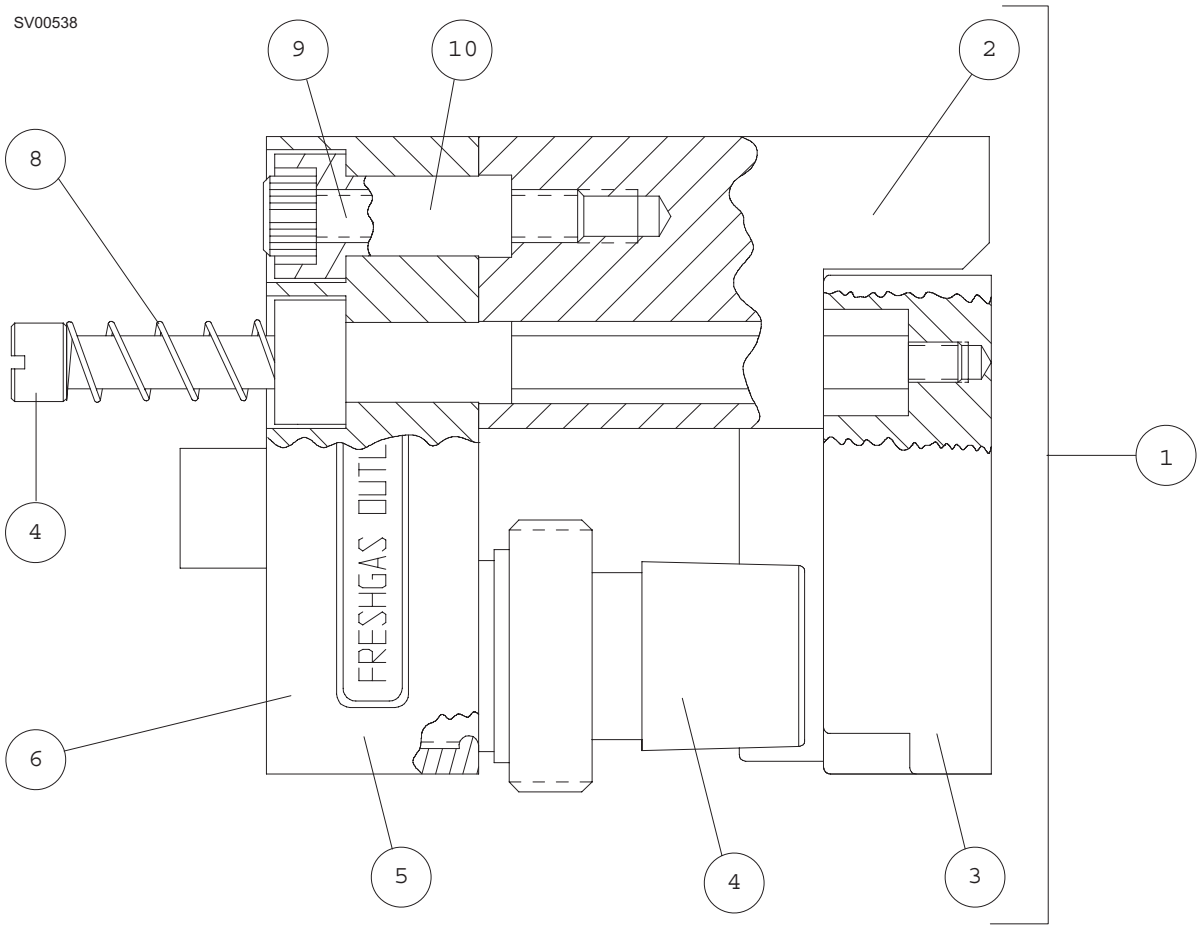
AIR OR 3RD GAS CYLINDER CUTOFF VALVE ASSEMBLY

N2O CYLINDER CUTOFF VALVE ASSEMBLY

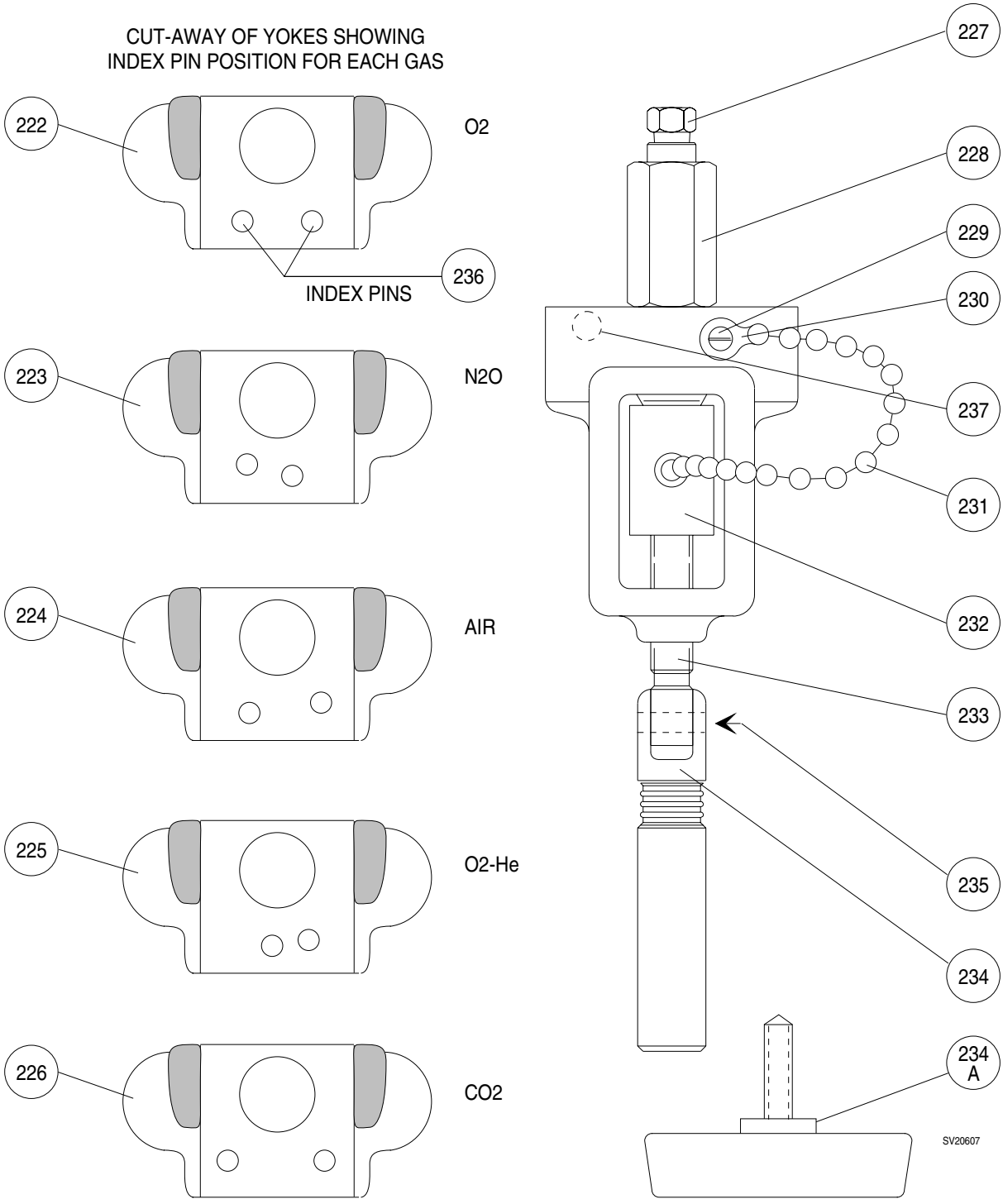
ITEM	DESCRIPTION	PART NUMBER
	CSA Items:	
206	Relief Valve, 70 psi (Canada)	4110364
	*O_2 Cylinder Cutoff Valve Assembly (Canada)	
207	Pilot Actuator, Modified	4106498
208	Clippard Valve, MJVO-2	4106218
209	Tee Fitting, ¼ Tube x ¼ Tube x ⅛ MPT	4109406
210	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
	*N_2O Cylinder Cutoff Valve Assembly (Canada)	
211	Pilot Actuator, Modified	4106498
212	Clippard Valve, MJVO-2	4106218
213	Tee Fitting, ¼ Tube x ⅛ MPT x ¼ Tube	4109407
214	Plug, ¼ Tube	4103072
215	Elbow Fitting, ⅛ MPT x ⅛ FPT	4103513
216	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
	*Air or 3rd Gas Cylinder Cutoff Valve Assembly (Canada)	
217	Pilot Actuator, Modified	4106498
218	Clippard Valve, MJVO-2	4106218
219	Tee Fitting, ¼ Tube x ⅛ MPT x ¼ Tube	4109407
220	Plug, ¼ Tube	4103072
221	Straight Fitting, ¼ Tube x ⅛ MPT	4109408

* On earlier machine configurations the cutoff valves and regulators were listed as complete assemblies with fittings installed. Assembly numbers are listed below for reference:

Cylinder Cutoff Valve Assembly, O_2 (Canada)	4110163
Cylinder Cutoff Valve Assembly, N_2O (Canada)	4110161
Cylinder Cutoff Valve Assembly, 3rd Gas (Canada)	4110162
Regulator Assembly, O_2 Cylinder Pressure (Canada)	4110656
Regulator Assembly, N_2O Cylinder Pressure (Canada)	4110655
Regulator Assembly, He/Air/N_2 Cylinder Pressure (Canada)	4110568
Regulator Assembly, CO_2 Cylinder Pressure (Canada)	4110657


SV00538
9
10
2
8
1
4
FRESHGAS OUTL
6
5
4
3

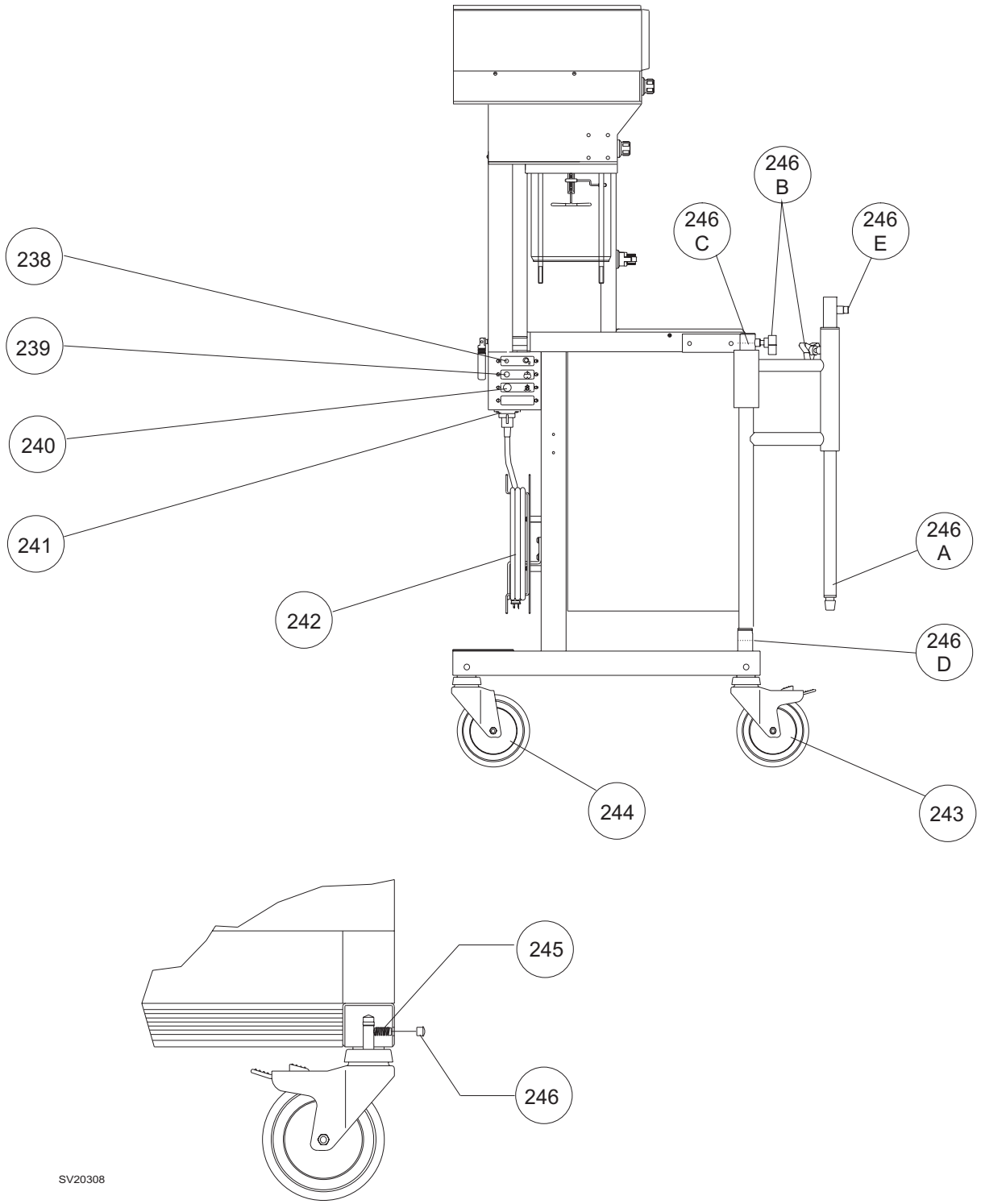
ITEM	DESCRIPTION	PART NUMBER
1	Fresh Gas outlet assembly (Canada)	4109015
2	Block, guide	4110707
3	Plate, locking	4110708-001
4	Common outlet, 15mm x 22mm	4109013
5	Block, solder asm	4108662-001
6	Label, "Freshgas Outlet"	4108666-001
7	Screw, 1/4 OD x 1/4-28 x 4.6 L sltd	4109011
8	Spring, CPRSN, 0.36 OD x 1 3/8 L	4110975-002
9	Screw, 1/4-20 x 1 1/4 L, cap skt hd	HW01039
10	Bushing	4108658


CUT-AWAY OF YOKES SHOWING
INDEX PIN POSITION FOR EACH GAS
222
O2
236
INDEX PINS
223
N2O
224
AIR
225
O2-He
226
CO2
227
228
229
230
237
231
232
233
235
234
234 A
SV20607

ITEM	DESCRIPTION	PART NUMBER
222	Yoke, O_2*	1101620
223	Yoke, N_2O*	1101621
224	Yoke, Air*	1101625
225	Yoke, O_2-He*	4110957
226	Yoke, CO_2*	1101624
	Parts Common to All Yokes:	
227	Nut, 3/16 Tube	4104716
228	Check Valve Assembly	4111792
229	Screw, 10-32 x ⅜ in. rd hd	HW06006
230	Chain Coupling	4101868
231	Chain, #10 Bead (5.75 in.)	4103940
	Chain Coupling and Chain are superseded by Chain Assembly	4112495-003
232	Plug	1101655
	Plug assembly includes items 230, 231, 232	4112755-001
233	Bolt, Toggle Handle	1101556
234	Handle	1101595
234A	Plastic T-handle & bolt (replaces Items 233, 234, 235)	4113536
235	Roll Pin	HW75003
236	Screw (Index Pin) (2x per yoke)	4105929
237	Yoke Labels:	
	Label, O_2, Green (USA)	1101768
	White (UK)	4103890
	Blue (Germany)	4111266-001
	Label, N_2O, Blue (USA, UK, Canada)	1101619
	Gray (Germany)	4111266-003
	Label, Air, Yellow (USA, Germany)	4102742
	Black/White (UK)	4103826
	Label, O_2-He, Green/Brown (USA)	4110950
	White/Brown (Canada)	4110942
	Label, CO_2, Gray (USA, UK)	1101639
	Black (Germany)	4111266-005

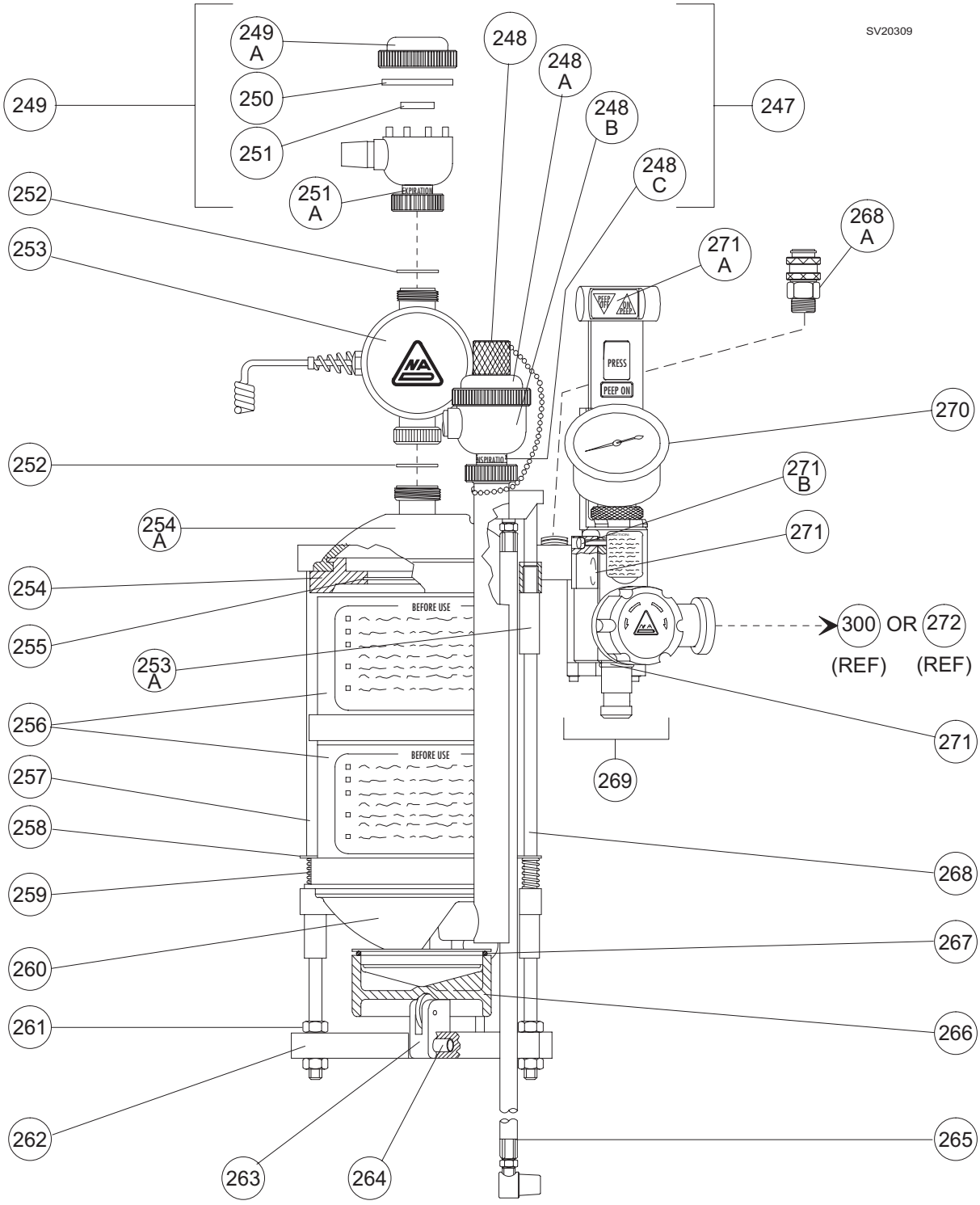
* On earlier machine configurations the yokes were listed as complete assemblies with check valves, labels and all hardware. Assembly numbers are listed below for reference:

Cylinder Yoke Assembly, O_2	1101640
Cylinder Yoke Assembly, O_2 (Canada)	4109943
Cylinder Yoke Assembly, N_2O	1101641
Cylinder Yoke Assembly, Air	1101645
Cylinder Yoke Assembly, Air (Canada)	4109944
Cylinder Yoke Assembly, CO_2	1101644


238
239
240
241
242
244
243
246 B
246 C
246 E
246 A
246 D
245
246
SV20308

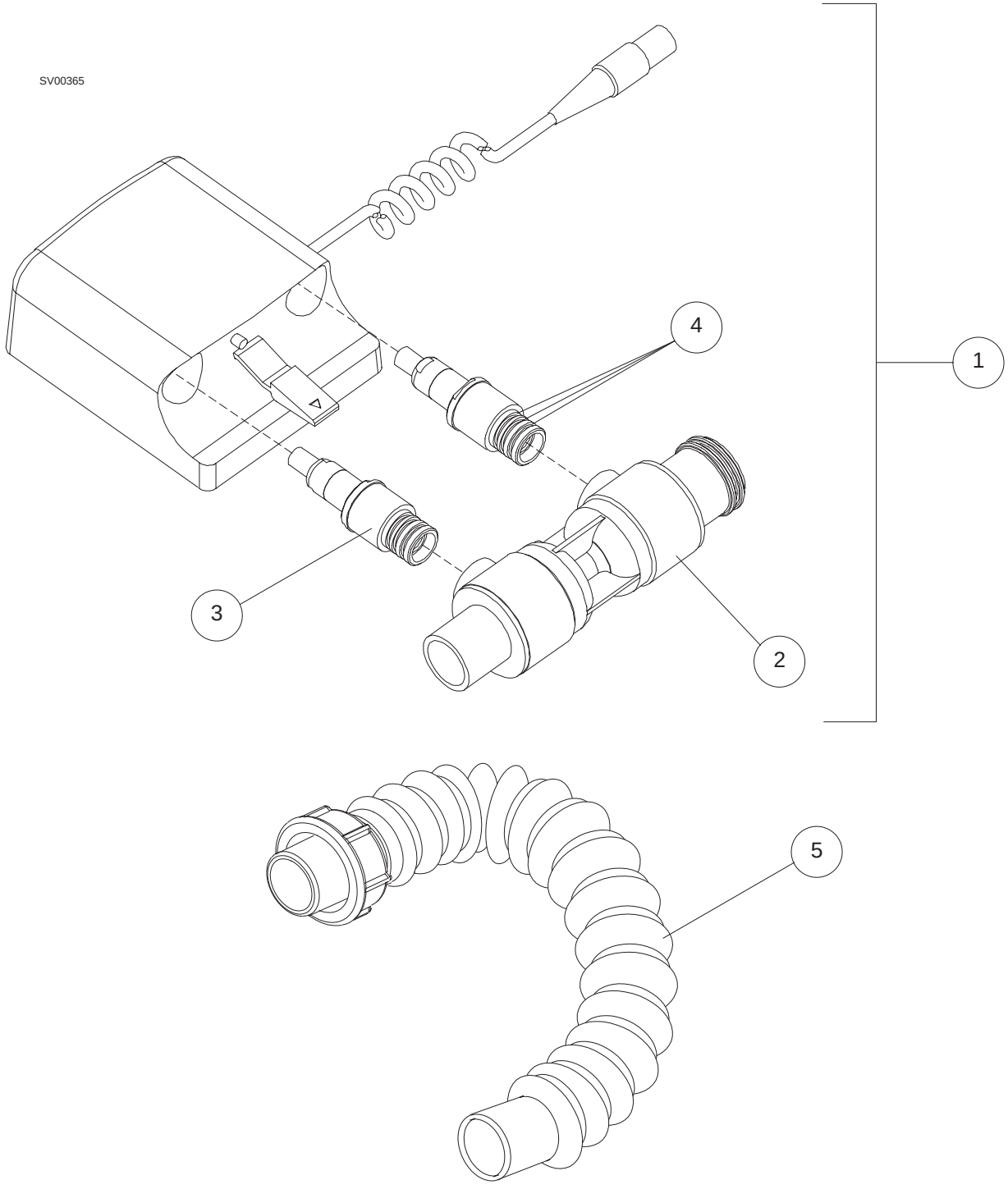
ITEM	DESCRIPTION	PART NUMBER
238	O_2MED Interface Panel Assembly	4110136
239	SPIROMED Interface Panel Assembly	4108960
240	BAROMED Interface Panel Assembly	4108996
	Panel Assembly Mounting Screws (2x each panel)	HW09000
241	Filter, AC Power Line	4109578
	Filter Mounting Screws (2x)	HW09018
242	AC Power Cord Assembly	4109600
	AC Power Cord Assembly (Export)	4110625
243	*Caster W/Brake (2x)	4111849
	*6" Caster W/Brake	4113006-002
244	*Caster W/O Brake (2x)	4111850
	*6" Caster W/O Brake	4113006-001
	Kit, Caster Replacement: converts old post & pin casters to E-Z Roll post & pin casters	S010135
245	Setscrew, Caster (4x)	HW04017
246	Hole Plug, Setscrew (4x)	4102729
246A	Absorber Pole	1101724
246B	Wing Screw, ⅜-16 x 1 in.	1100078
246C	Roll pin, lg	HW75005
246D	Roll pin, sm	HW75004
246E	Set screw	1101684

*NOTE: There is a 1" difference in height between the two versions of 6" casters. The 4111849 and 4111850 have a 1" washer/spacer.

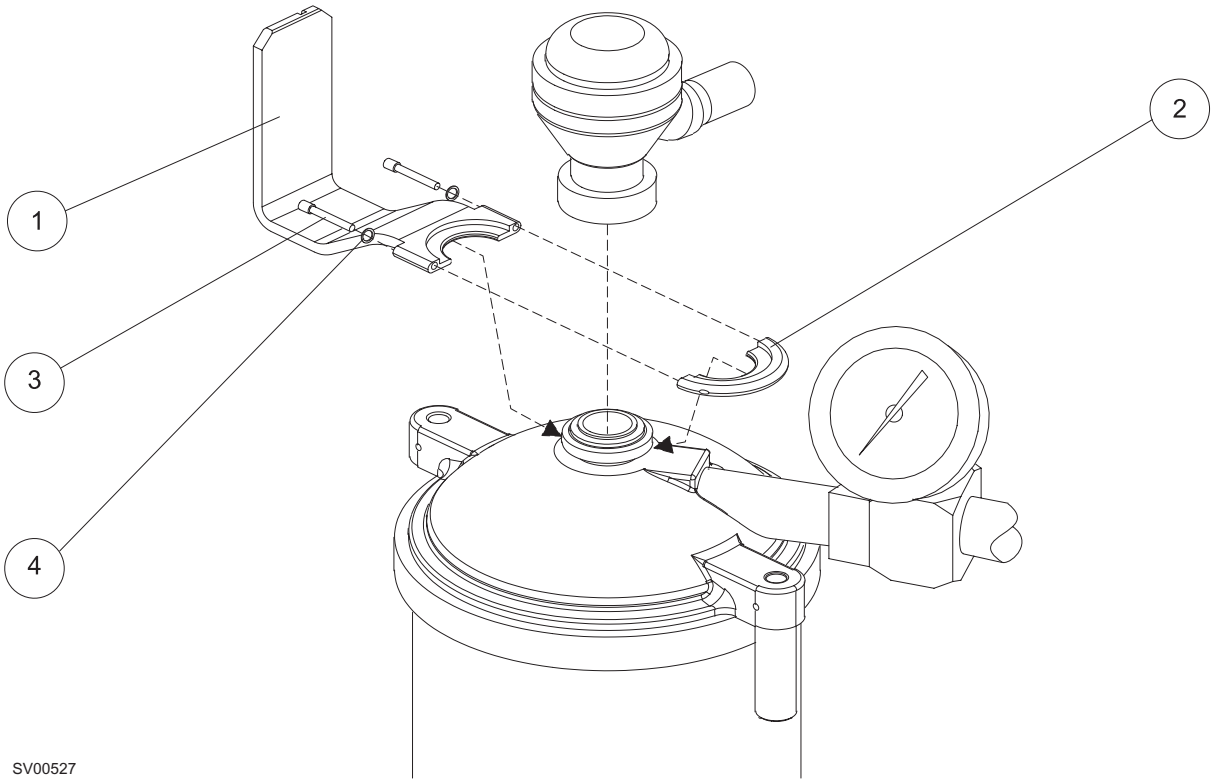

SV20309
249
A
250
251
251
A
248
248
A
248
B
248
C
247
252
253
252
254
A
254
255
253
A
256
257
258
259
260
261
262
263
264
265
266
267
268
268
A
271
A
270
271
B
271
271
269
300 OR 272
(REF) (REF)
PRESS
PEEP ON
BEFORE USE
BEFORE USE
INSPIRATION
EXPIRATION

ITEM	DESCRIPTION	PART NUMBER
	Absorber Assembly	4109430
	Absorber Assembly with PEEP and bypass valve	4109431
247	Inspiratory Valve Assembly (incl. O_2 sensor mount)	4112773-001
	Ref: Valve w/o O_2 Sensor Mount (old no.)	2122810
248	Plug Assembly, Oxygen Sensor	4106387
248A	Dome & Label, Inspiratory Valve	4108329
248B	Valve Assembly .....4112151 Service Exchange	SE4112151
248C	Label, Inspiration	1100559
249	Expiratory Valve Assembly .....4112150 Service Exchange	SE4112150
249A	Dome	2109230
250	Gasket, Valve Dome (Both Valves)	2109231
251	Disk (Both Valves)	2123249
251A	Label, Expiration	1100565
252	Gasket, Valve Mount	1101690
253	Spiromed Sensor .....4106362 Service Exchange	SE4106362
253A	Bushing, BR 9/16-18M x 3/8-16F x 2.5	1101023
254	Gasket, Canister Top	4105848
254A	Dome assembly, chrome	1101351
255	Screen, Canister	1100022
256	Canister Assembly (2x)	4105851
257	Rod, Left	1101356
258	Clip, E-Ring (2x)	1100097
259	Spring (2x)	4110975-010
260	Bottom Sub-Assembly	4108358
	later replaced by	4112932
	Gasket, absorber bottom (not shown)	1101001
261	Nut, 3/8-16 SS (4x)	HW50010
262	Cam Bar (2x)	1101018
263	Cam Assembly	1101015
264	Dowel Pin	1101017
265	Hose Assembly, Fresh Gas	4108577
266	Dust Cap	4106874
267	O-Ring	4102940
268	Rod, Right	1101355
268A	Quick Disconnect Fitting (Breathing Pressure)	4108139
269	PEEP Bypass and Valve Assembly ....4111527 Service Exchange	SE4111527
	Magnet assembly	4114419
	O-ring, #126 (neoprene)	4111878
	Knob	4113558
270	Gauge Assembly, Breathing Pressure (Incl Mtg Ring and O-Ring)	4115275
	Gauge, 20/80 cmH2O	4115273
	Replacement Cover	4113387
	Replacement Ring	4113388
271	O-Ring, #117, Silicone (2x)	4105766
271A	Label, ON/OFF	4110294
271B	Screw, 8-32 x 1/2 in. cap skt hd (4x)	HW01014
	Breathing press hose asm (quick disc. ftg on each end)	4109368
	Breathing press hose asm (quick disc. ftg one end, Luer fitting other end)	4108528
	Quick disconnect fitting (male)	4108137
	Clear tubing	ML08007
	O_2 Sensor: Complete Assembly, including capsule	
	Sensor Capsule:	new number: 6850645
	Housing Assembly	4106363
	Adapter (cover)	4106385
	O-ring, #025 (viton)	4105791
	O-ring, #016 (viton) (2x)	4106388

SPARE AND REPLACEMENT PARTS (continued) NM2B



ITEM	DESCRIPTION	PART NUMBER
1	Ultrasonic Flow Sensor Assembly	4115754
	Service Exchange part number	4115777
2	Flow Housing	4114444
3	Transducer - set of two, incl. O-rings	4114445
4	O-ring - set of six	4115147
5	Connector Hose	4114912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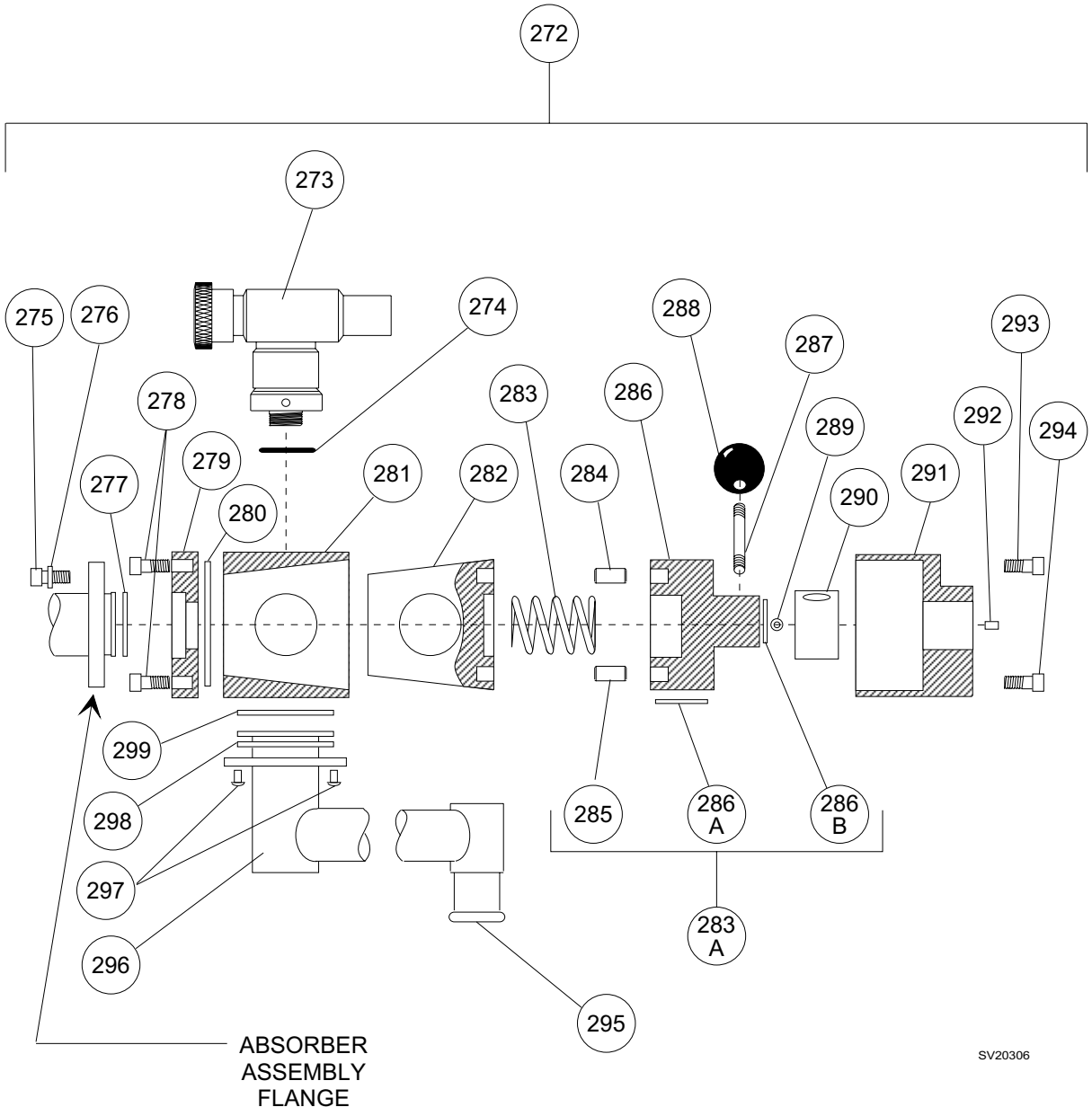
SV00527

ITEM	DESCRIPTION	PART NUMBER
1.	Bracket, Flow Sensor mounting	4114889
2.	Clamp, Flow Sensor mounting	4114888
3.	Screw, 4-40 x 1.1 L cap skt hd (2x)	HW01103
4.	Washer, lock, split #4	HW65000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286 A
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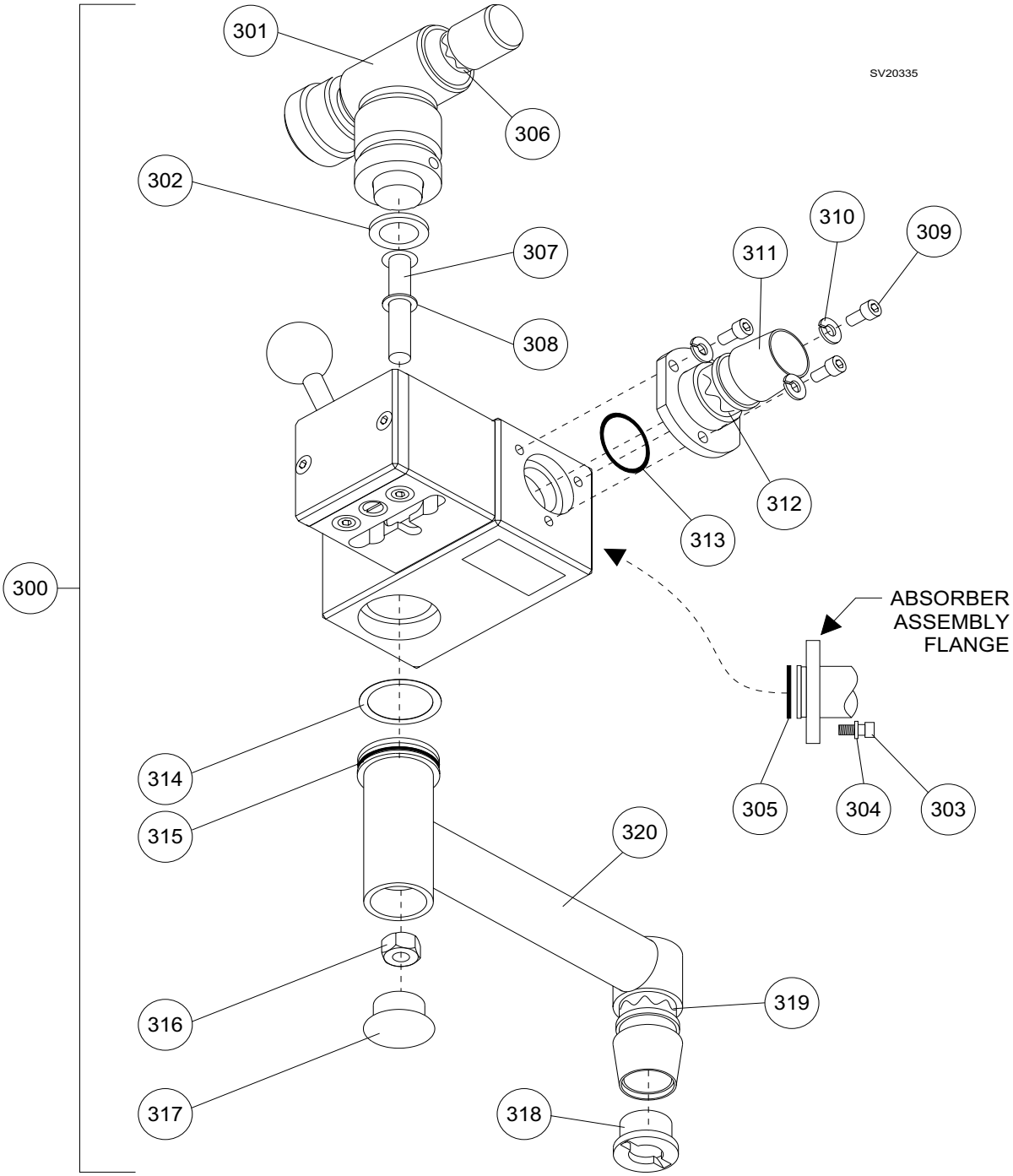
283 A
ABSORBER ASSEMBLY FLANGE
SV20306

ITEM	DESCRIPTION	PART NUMBER
272	Valve, Man/Auto Selector	4102698
273	APL Valve	4104839
274	Fiber Washer	(Supplied with APL Valve)
275	Screw, Selector Valve Mounting, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
276	Lock Washer, Selector Valve Mounting, #8 int-t (3x)	HW67000
277	O-Ring, Neoprene	4102941
278	Screw, Adapter Flange Mounting, 8-32 x ½ in. (4x)	HW01014
279	Adapter Flange	4102694
280	O-Ring, Silicone	4105767
281	Valve Housing	4102734
282	Valve Channel	4102692
283	Spring	4110975 P-005
283A	Switch Assembly	4102700
284	Dowel Pin, 0.187 x ¾ in.	HW76002
285	Dowel Pin, 0.250 x ⅝ in.	HW76003
286	Valve Switch	4102690
286A	Label, Bag/Auto	4102699
286B	Label, Dot, NAD	1101098
287	Stem	1101011
288	Ball	4101848
289	Ball Bearing (2x)	1101637
290	Cover	4103118
291	Valve Switch Block	4102691
292	Screw, Adjustment, ¼-28 x ¼ in. (2x)	HW04014
293	Screw, Valve Switch Block Mounting, Upper, 8-32 x ¼ in. (2x)	HW01019
294	Screw, Valve Switch Block Mounting, Lower, 8-32 x ½ in. (2x)	HW01020
295	Bag Connector	4102894
296	Swivel Bag Mount Assembly	1101334
297	Screw, Bag Mount, 8-32 x ⅜ in. (4x)	HW02015
298	O-Ring, Silicon	4105868
299	Glide Ring, Teflon	1101335


SV20335
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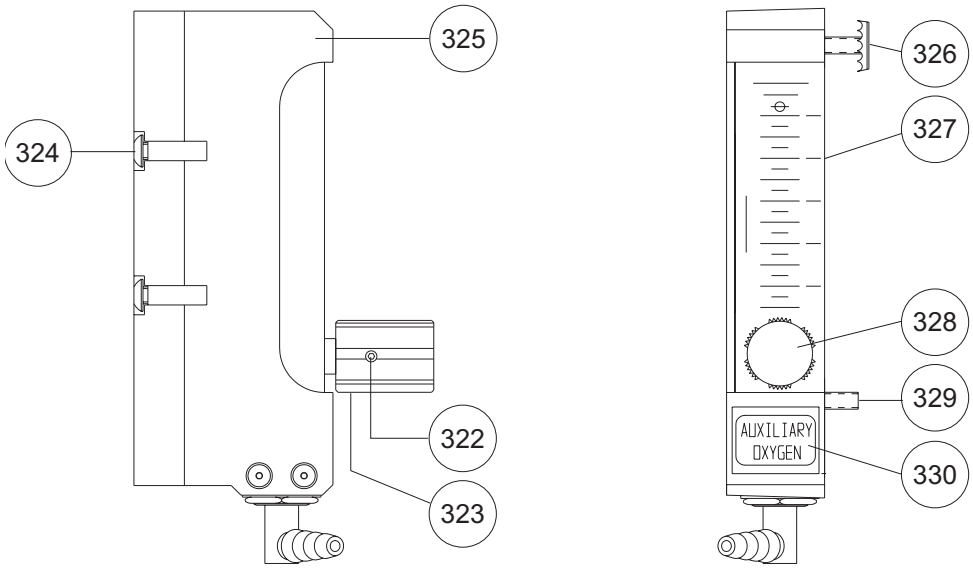
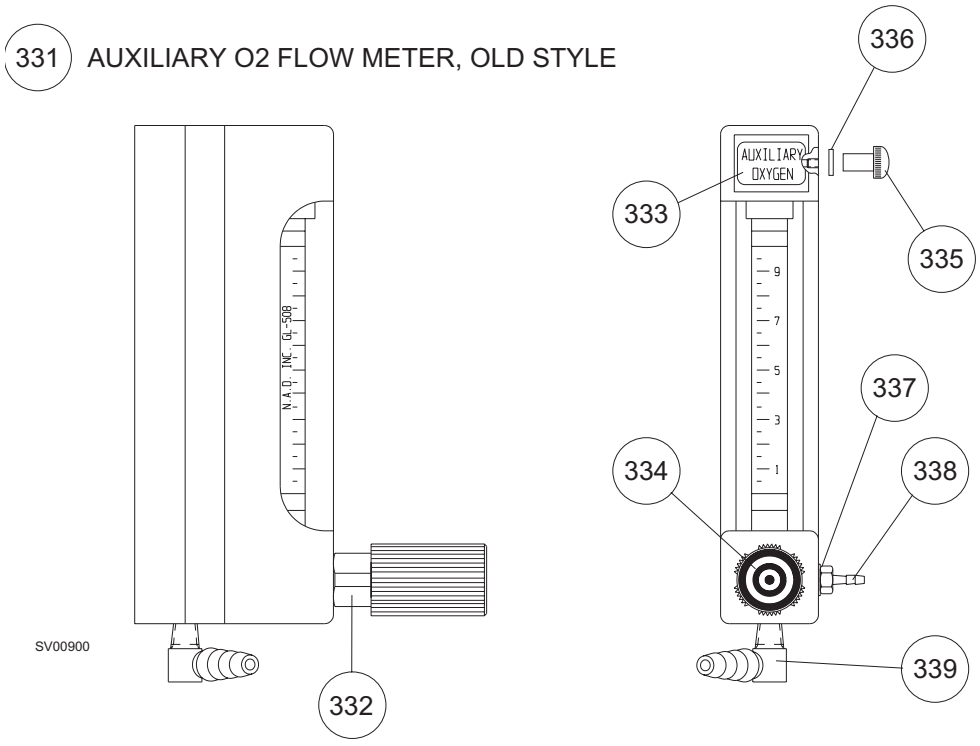
ITEM	DESCRIPTION	PART NUMBER
300	Valve, Man/Auto Selector (later design)	4112217-001
	Service Exchange P/N	SE4112217-001
301	APL Valve	4104839
302	Fiber Washer	(Supplied with APL Valve)
303	Screw, Selector Valve Mounting, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
304	Lock Washer, Selector Valve Mounting, #8 int-t (3x)	HW67000
305	O-Ring, #117 Silicone	4105766
306	Label, "Scavenger Hose"	4104806
307	Screw, 5/16-18 x 3¾ in. Rd Hd	HW06023
308	Spacer	4110792-070
309	Screw, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
310	Lock Washer, #8 split (3x)	HW65011
311	Connector Assembly, 22mm	4106744
312	Label, "Ventilator Hose"	1100563
313	O-Ring, #117 Silicone	4105766
314	Spacer	4110792-071
315	O-Ring, #120 EPDM	4112629-001
316	Nut, 5/16-18 Hexseal	4112613-001
317	Hole Plug, 3/16 in. dia.	4111663-001
318	Bag Connector	4102894
319	Label, "Breathing Bag"	1100561
320	Bag Mount Assembly	4112622-001

321 AUXILIARY O2 FLOW METER, NEW STYLE



331 AUXILIARY O2 FLOW METER, OLD STYLE



ITEM	DESCRIPTION	PART NUMBER
321	Auxiliary O_2 Flow Meter Assembly, new style	4109310
	Service Exchange P/N	SE4109310
	Kit, Auxiliary O2 Flowmeter (new installation, incl. hardware)	S4109310
322	Set Screw, cup point, 6-32 x ¼ in.	HW04003
323	Knob	4111442
324	Screw, 10-32 x 1 1/16 in. btn hd (2x)	HW09043
325	Housing	4111053
326	Kep nut, 10-32	HW55002
327	Flowmeter (incl. tube & valve)	4111460
328	Label, ⅝ w/dot and green & white rings	4109373
329	Set Screw, cup point, 10-32 x ⅞ (2x) (used as mtg stud)	HW04011
330	Label, AUXILIARY OXYGEN	4109381
331	Auxiliary O_2 Flow Meter Assembly, old style	4109391
332	Valve, flow control, sub-compact	S0B7271
333	Label, AUXILIARY OXYGEN	4109381
334	Label, ⅝ w/dot and green & white rings	4109373
335	Screw, 10-32 x 5/8 in. cap skt hd	HW01027
336	Flat washer, #10	HW66003
337	Fiber washer	4102165
338	Hose barb ftg, 10-32 x 1/16 hose	4103445
339	Ell, 3/16 hose	4109387
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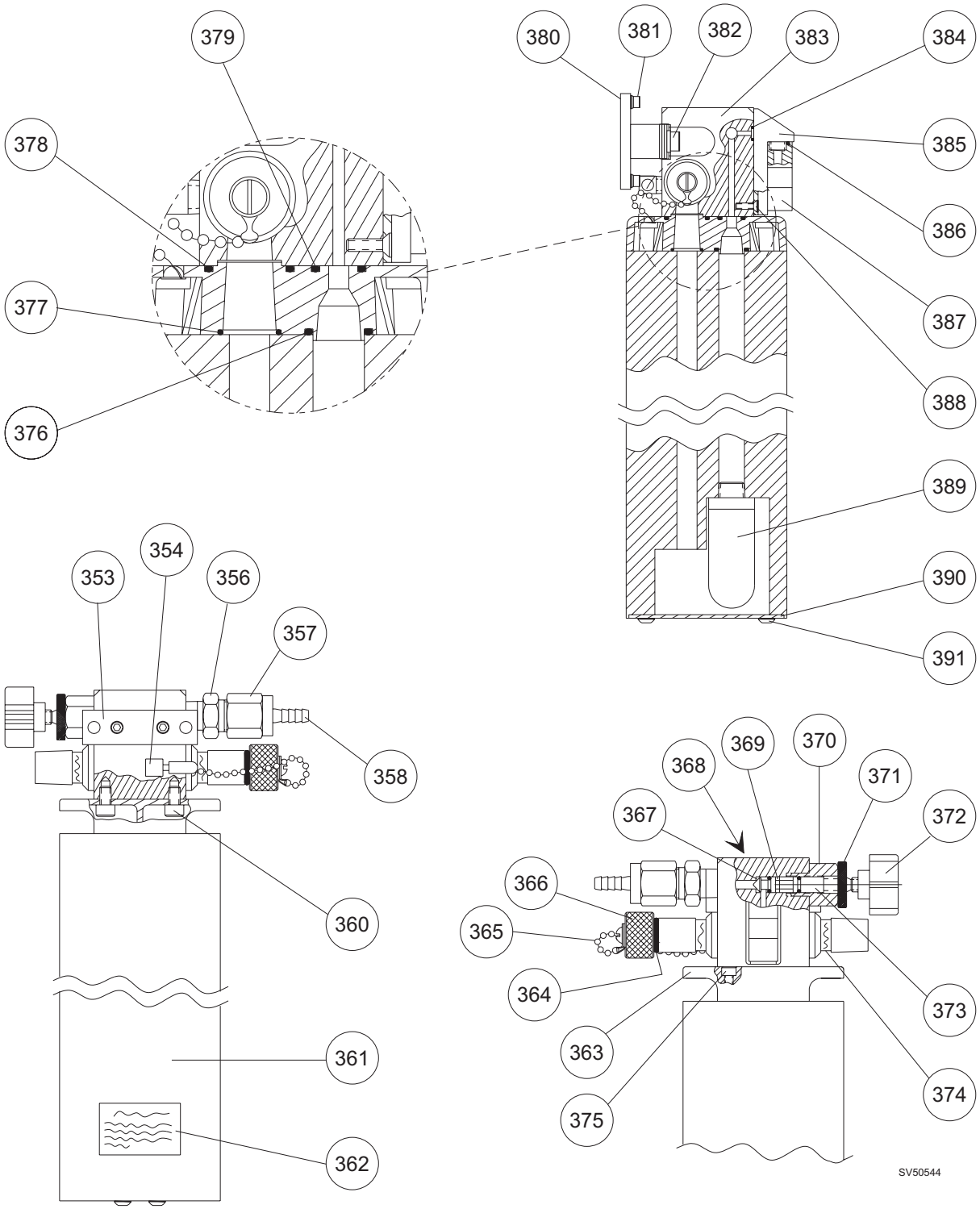
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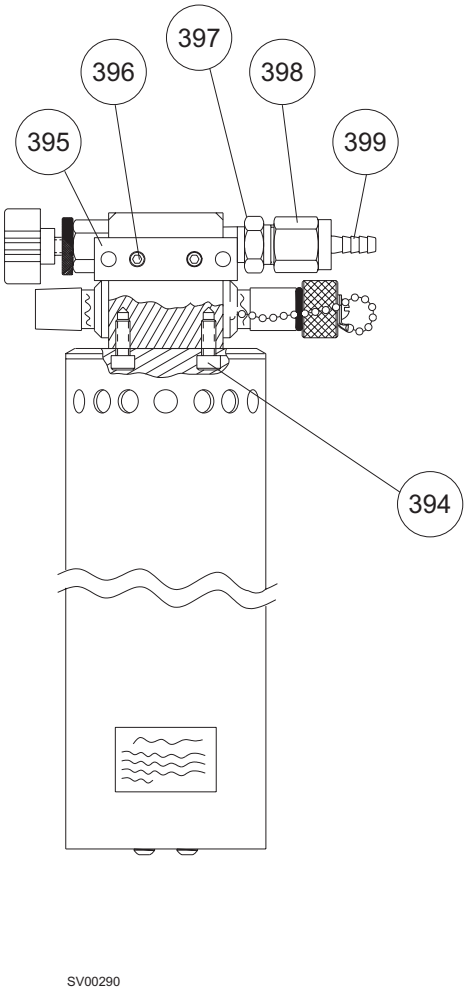
ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly	4107624
353	Mounting Bracket	4109314
354	Elbow, ⅛ M x ¼ in. hose	4106881
355	Deleted	
356	Body, DISS VAC x ¼ MPT	4103669
357	Nut, DISS VAC	4103122
358	Hose Barb Nipple	4103123
359	Deleted	
360	Screw, ¼-20 x ⅜ in. skt hd (2x)	HW01033
361	Reservoir	4110982
362	Label, CAUTION	4104294
363	Reservoir Top	4110979
364	O-ring #112 (neoprene)	4102141
365	Chain, 8¼ lg	4112495-005
366	Plug	4102140
367	O-ring #008 (neoprene)	4102022
368	Label, ACTIVATE HOSPITAL VACUUM	4109305
369	Retaining Ring	4110997
370	Nut, Valve Stem Retainer	4109316
371	Lock Nut, ⅜-24	4112137
372	Wing Nut	4105699
373	Spindle	4112138
374	Label, SCAVENGER HOSE (2x)	4104806
375	Screw, 10-32 x ¾ in. skt hd (4x)	HW01028
376	O-ring #019 (neoprene)	4106458
377	O-ring #015 (neoprene)	4104602
378	O-ring #019 (neoprene)	4106458
379	O-ring #013 (neoprene)	4102234
380	Bracket Assembly	4106231
381	Screw, 10-32 x ½ in. skt hd (2x)	HW01025
	Lock Washer, #10 split (2x)	HW65003
	Flat Washer, #10 (2x)	HW66003
382	Screw, ¼-20 x ½ in. skt hd (2x)	HW01034
	Lock Washer, ¼ int-t (2x)	HW67005
383	Block	4111002
384	O-ring, #008 (neoprene)	4102022
385	Flowmeter Housing	4110980
386	O-ring, #012 (neoprene)	1101523
387	Flowmeter	4112289
388	Screw, 6-32 x ⅜ in. flat hd (2x)	HW05006
389	Silencer	4110999
390	Reservoir Cap	4111000
391	Screw, 10-32 x ⅜ in. btn hd (4x)	HW09005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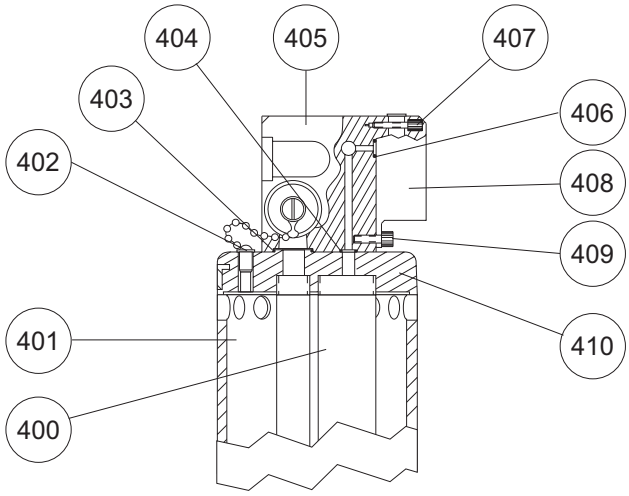
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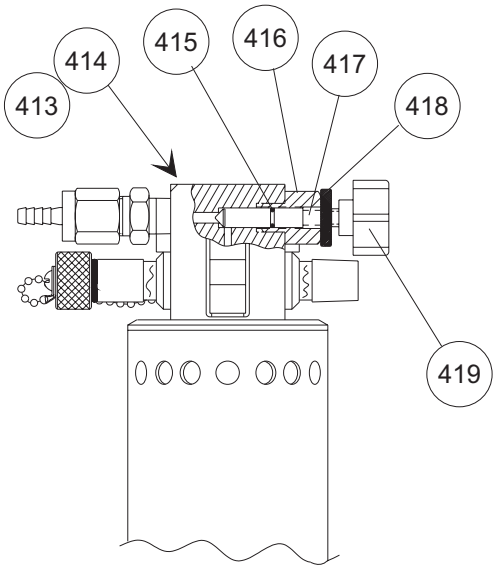
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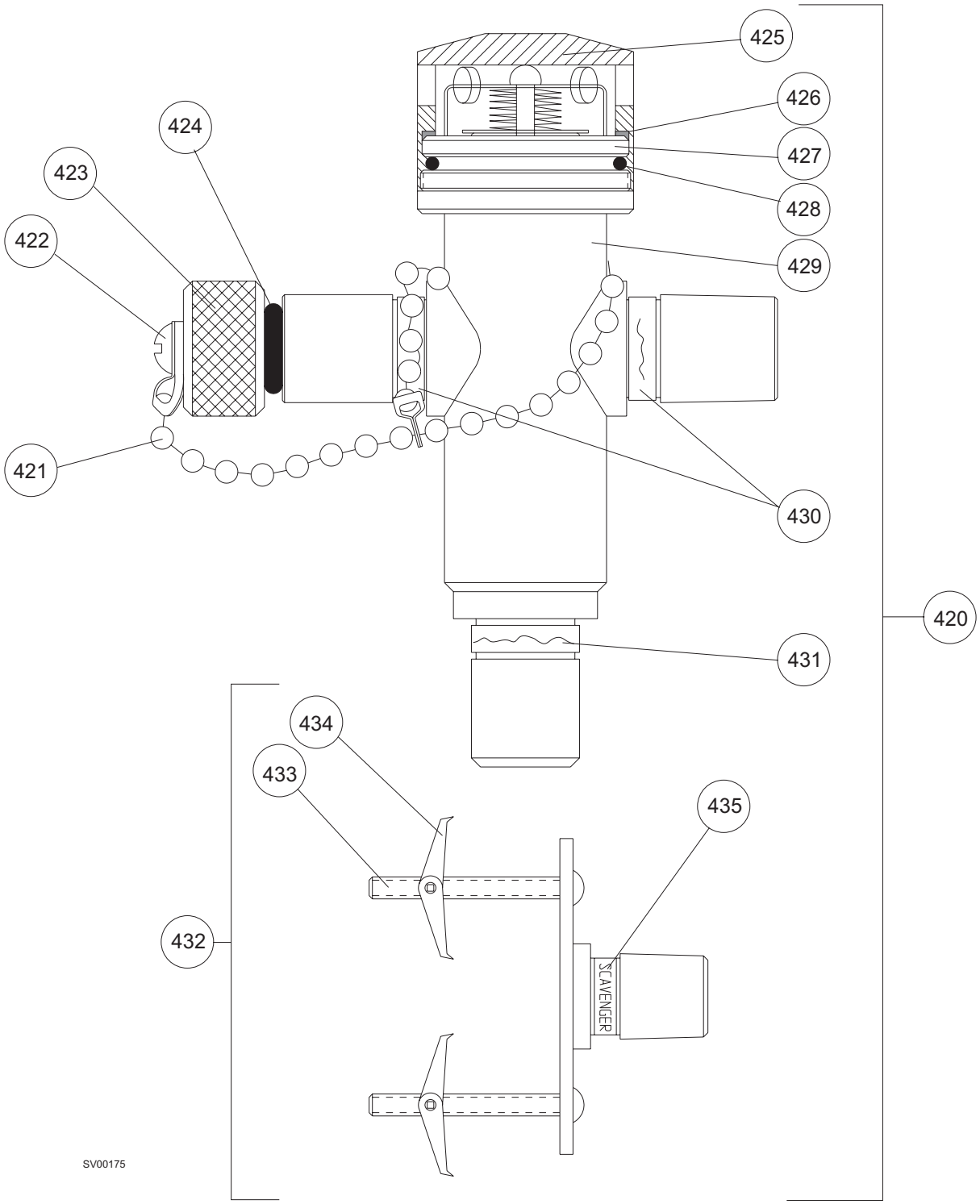
ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly, old style	4109321
392	Deleted	
393	Deleted	
394	Screw, cap skt hd, ¼-20 x ¾ in. (2x)	HW01036
395	Mounting Bracket	4109314
396	Screw, flat hd, 8-32 x ¾ in. (2x)	HW03026
397	DISS body x ¼ MPT	4103669
398	DISS nut	4103122
399	Hose barb	4103123
400	Tube, 1 in. dia	4109312
401	Tube, ¾ in. dia	4109311
402	Screw, btn hd, 10-32 x ⅜ in.	HW09005
403	O-ring, #016 neoprene	4109322
404	O-ring, #010 neoprene	4101872
405	Block	4109309
406	O-ring, #008 neoprene	4102022
407	Screw, cap skt hd, 6-32 x ⅝ in.	HW01067
408	Flowmeter	4109306
409	Screw, cap skt hd, 6-32 x ¼ in.	HW01007
410	Deleted	
411	Deleted	
412	Deleted	
413	Deleted	
414	Label, ACTIVATE HOSPITAL VACUUM	4109305
415	O-ring, #008 neoprene	4102022
416	Nut, valve stem retainer	4109316
417	Spindle	4102068
418	Lock nut, ⅜-24	4105990
419	Wing nut	4105699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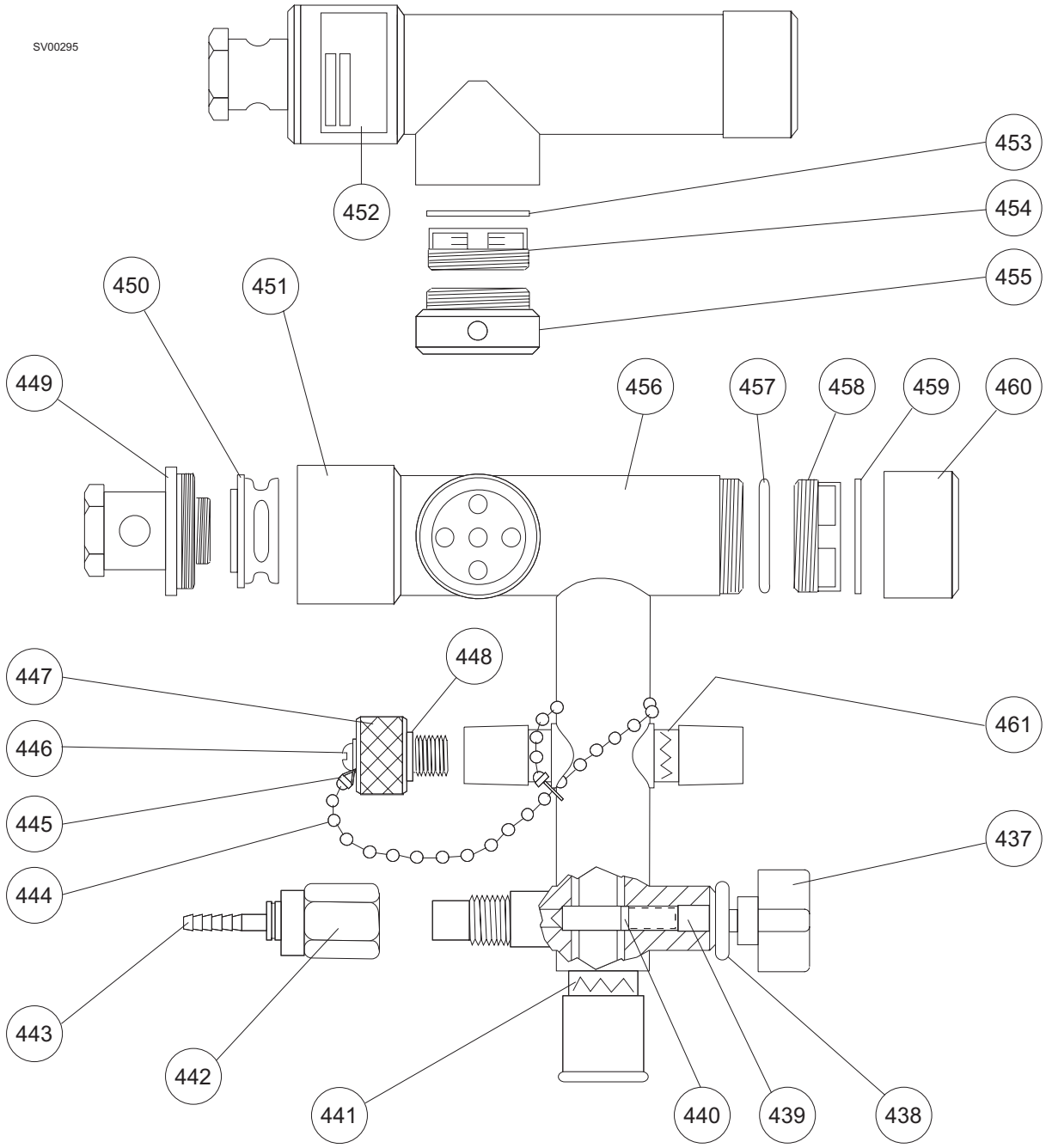
SCAVENGER
SV00175

ITEM	DESCRIPTION	PART NUMBER
420	Scavenger, A/C	4106161
421	Chain assembly, 8¼ in.	4112495-006
422	Screw, round hd, 10-32 x ½ in.	HW06007
423	Plug	4102140
424	O-ring, #112 neoprene	4102141
425	Dust cover	1101527
426	Spacer	4110792-007
427	Valve 'A' 5 cm H_2O	2207032
428	O-ring, #027 neoprene	4101871
429	Body, solder assembly	4102105
430	Label, SCAVENGER HOSE (2x)	4104806
431	Label, EXHAUST	4106878
432	Vent Grill Adapter (for 19 mm hose)	1101312
433	Screw, round hd, 10-24 x 3 in. (2x)	HW06012
434	Toggle nut (2x)	4101862
435	Label, SCAVENGER HOSE	4104806
436	Deleted	
	Hose Barb Adapter	4108114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ITEM	DESCRIPTION	PART NUMBER
	Suction Scavenger	4102088
437	Wing nut	4105699
438	Deleted	
439	Spindle	4102068
440	O-ring, #008 neoprene	4102022
441	Label, RESERVOIR BAG	4106879
442	DISS nut	4103122
443	Hose barb	4103123
444	Bead Chain, 8¼ in.	4103940
445	Chain coupling (2x)	4101868
446	Screw, round hd, 10-32 x ½ in.	HW06007
447	Plug	4102140
448	O-ring, #112 neoprene	4102141
449	Cap assembly	4104659
450	'A' Valve, 1.8 cm H_2O	2116219
451	Housing assembly	4104755
452	Deleted	
453	Seal, 'A' valve	4106321
454	'A' Valve, 0.5 cm H_2O	7264277
455	Dust cap	4102036
456	Deleted	
457	O-ring, #215 neoprene	4102038
458	'A' Valve, 5 cm H_2O	2207032
459	Spacer	4110792-007
460	Dust cap	4102035
461	Label, SCAVENGER HOSE (2x)	4104806

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Narkomed 2B Service Manual

Rev. Y summary of changes

Page	Description
6-1E thru 6-61	Entire section revised to reflect PMC nomenclature Test equipment illustrations added at front of section (5 pages)

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