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Drägermedical

A Dräger and Siemens Company

Technical Service Manual

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Narkomed 2B Anesthesia System

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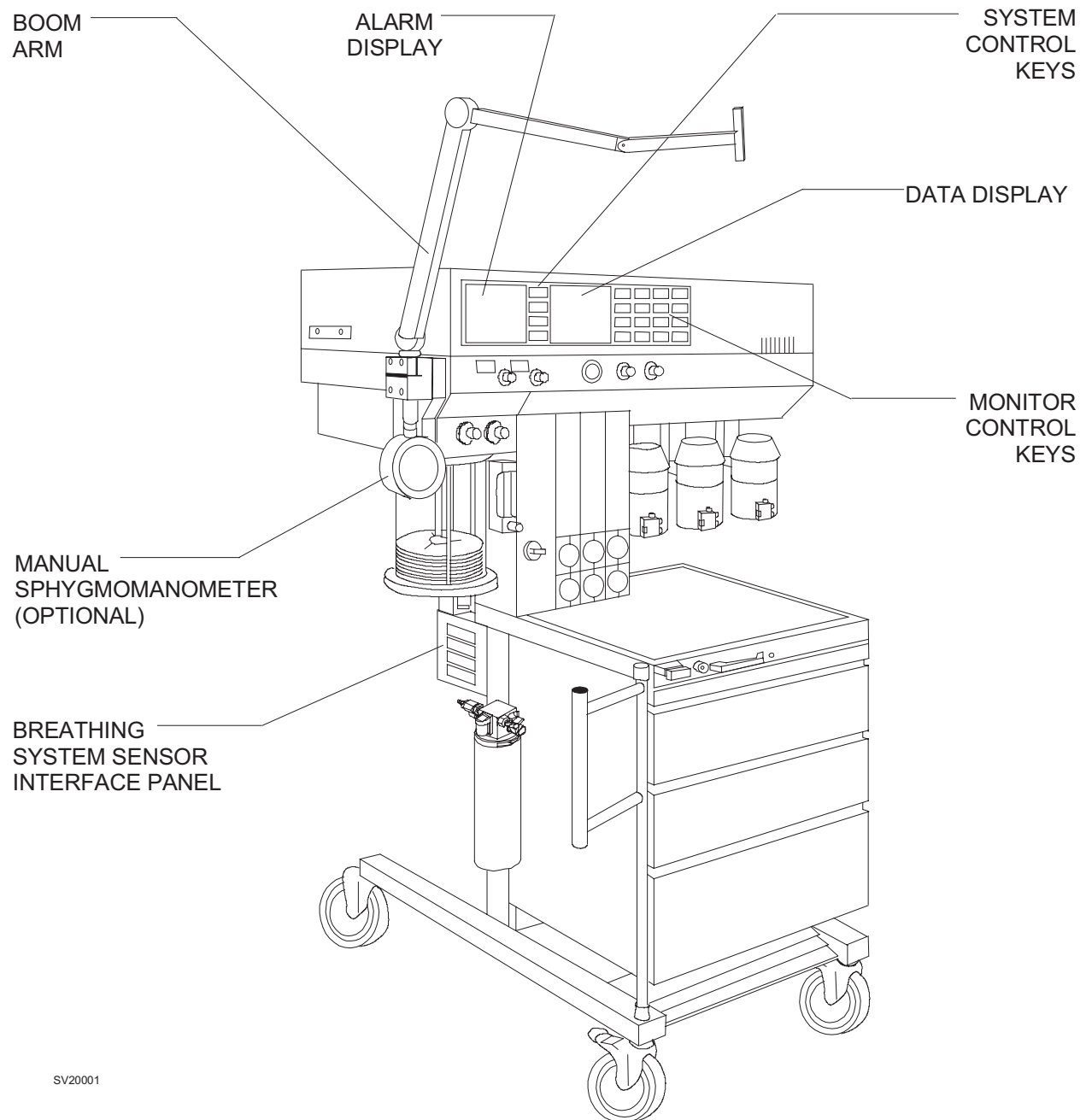
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1.0 RECOMMENDATIONS

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 Draeger Medical, Inc. (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 Certification (PMC) 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 PMC 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.

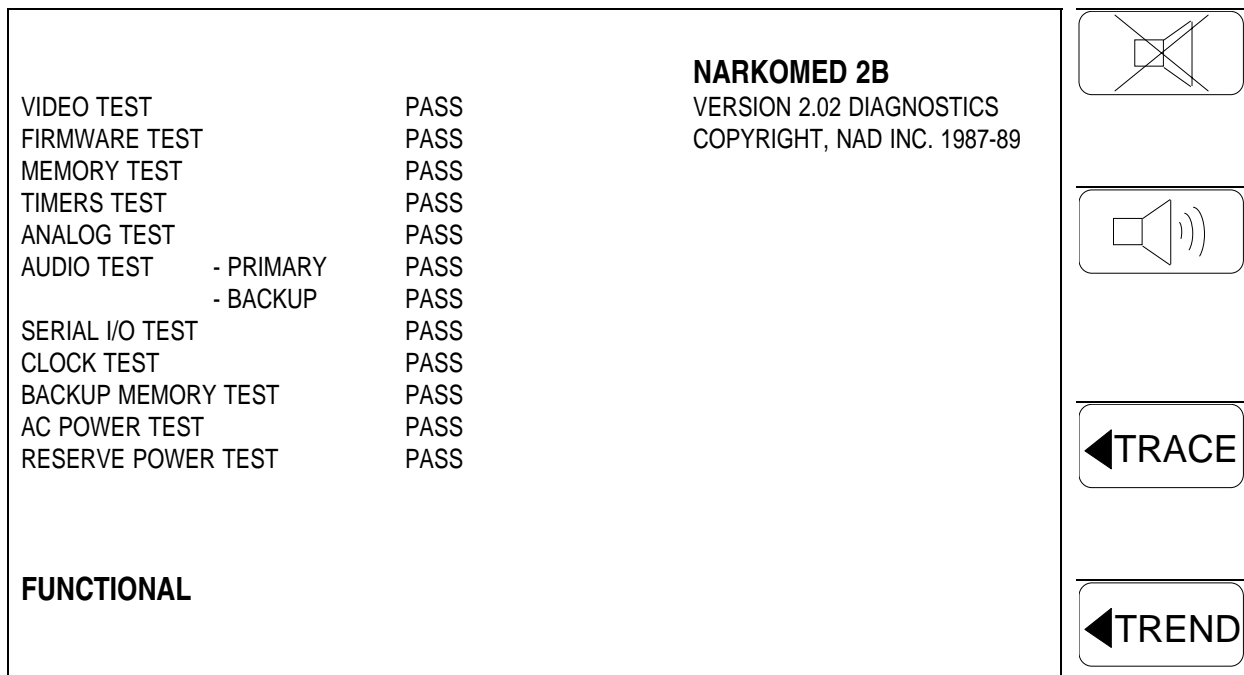


Figure 2-1: POWER-UP DIAGNOSTICS SCREEN

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.

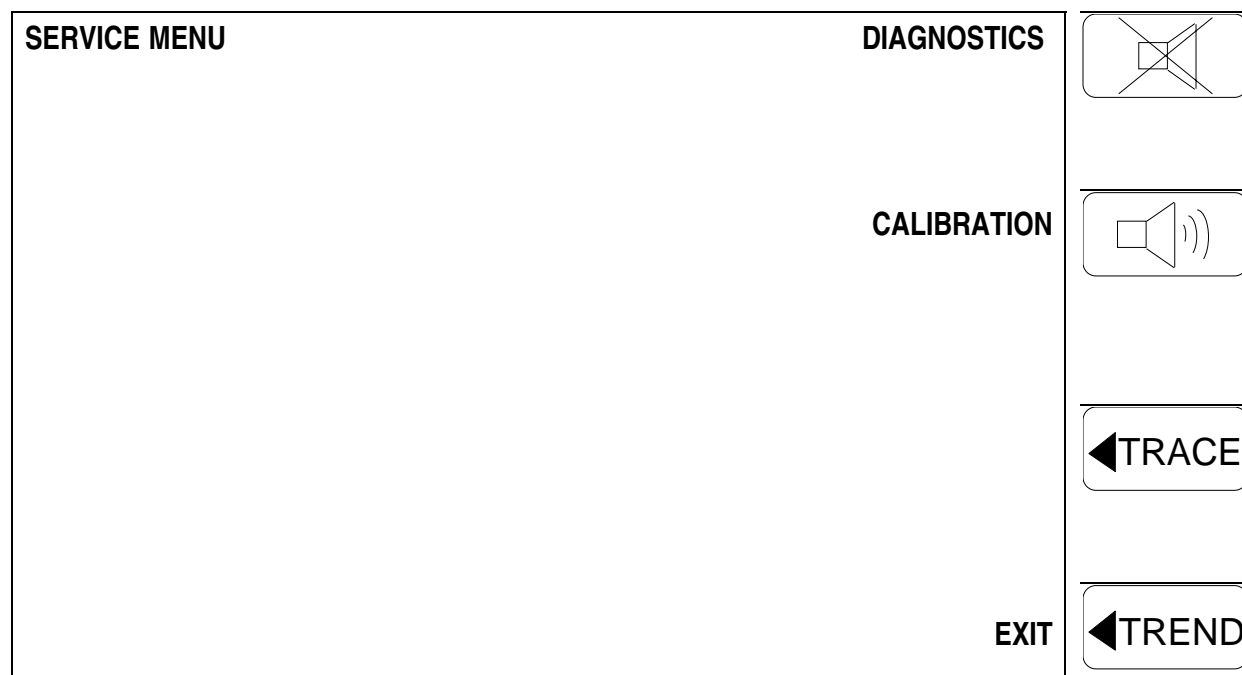


Figure 2-2: SERVICE MENU SCREEN

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.

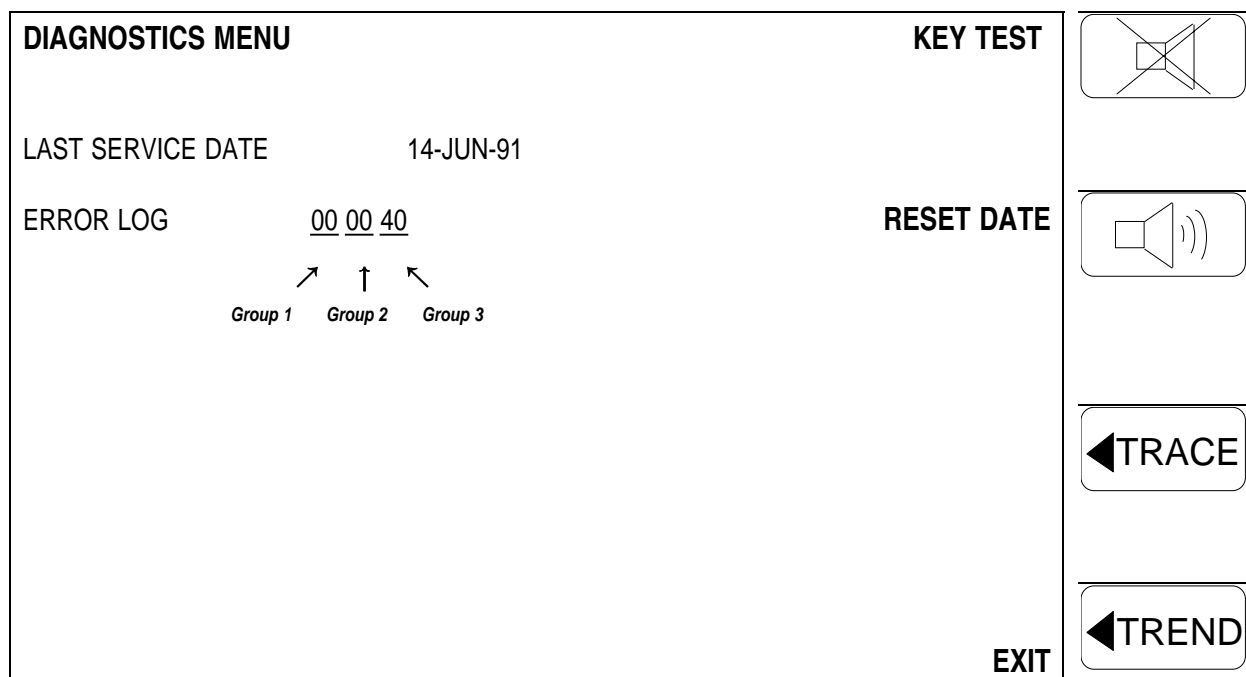


Figure 2-3: DIAGNOSTICS MENU SCREEN

DIAGNOSTICS (continued)

NM2B

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)

NM2B

DIAGNOSTICS (continued)

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)

DIAGNOSTICS (continued)

NM2B

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.

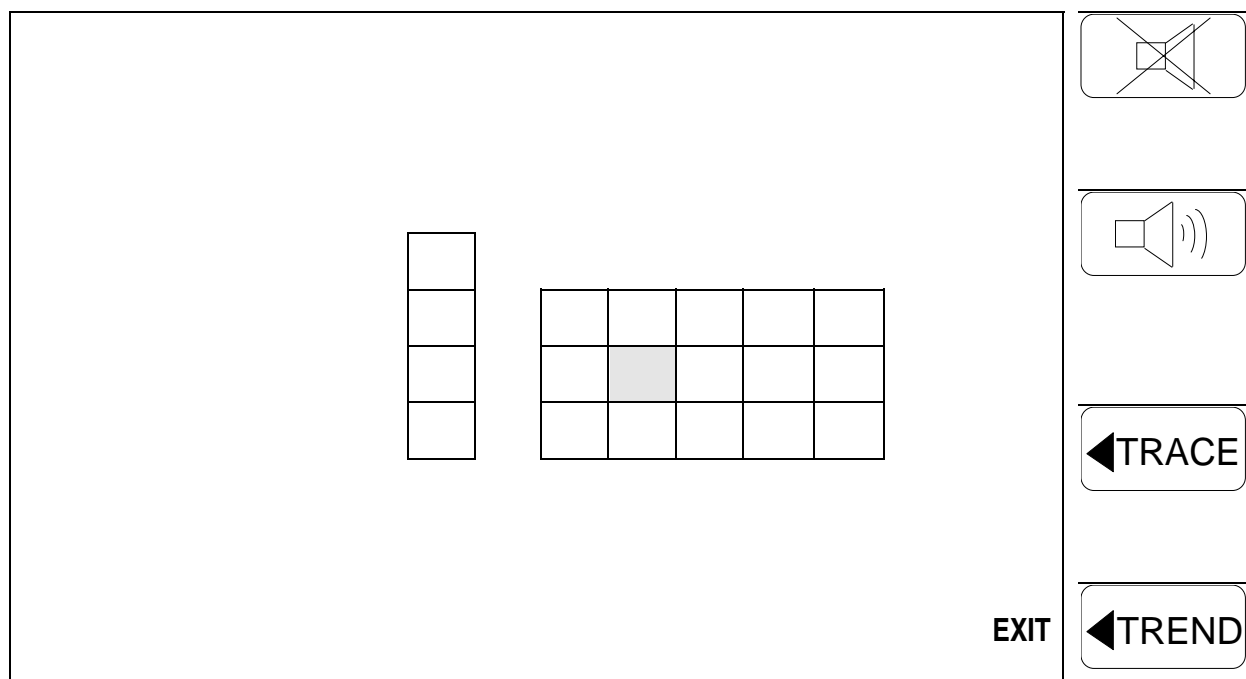


Figure 2-4: KEY PANEL TEST SCREEN

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 H₂O 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.

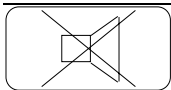
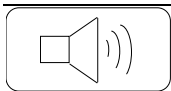


CALIBRATION MENU		O2MED	
OFFSET O2 CELL A	0138	0127	
OFFSET O2 CELL B	0138	0129	
		BAROMED	
OXYGEN OFFSET READINGS STORED			
			
PRESSURE SPAN (60 cm H2O)	0243	0481	
		EXIT	

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

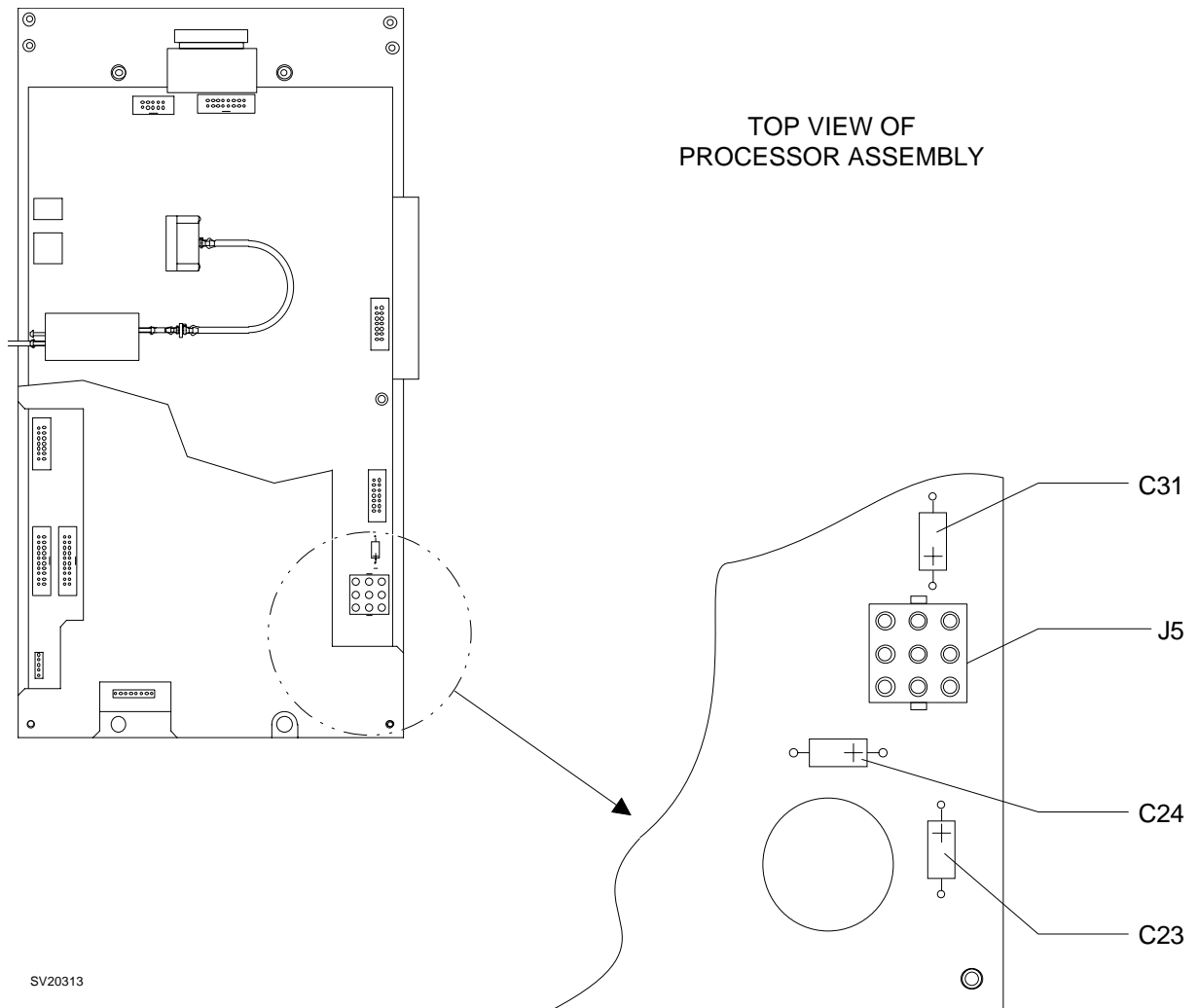


Figure 3-1: PROCESSOR BOARD VOLTAGE TEST POINTS

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.

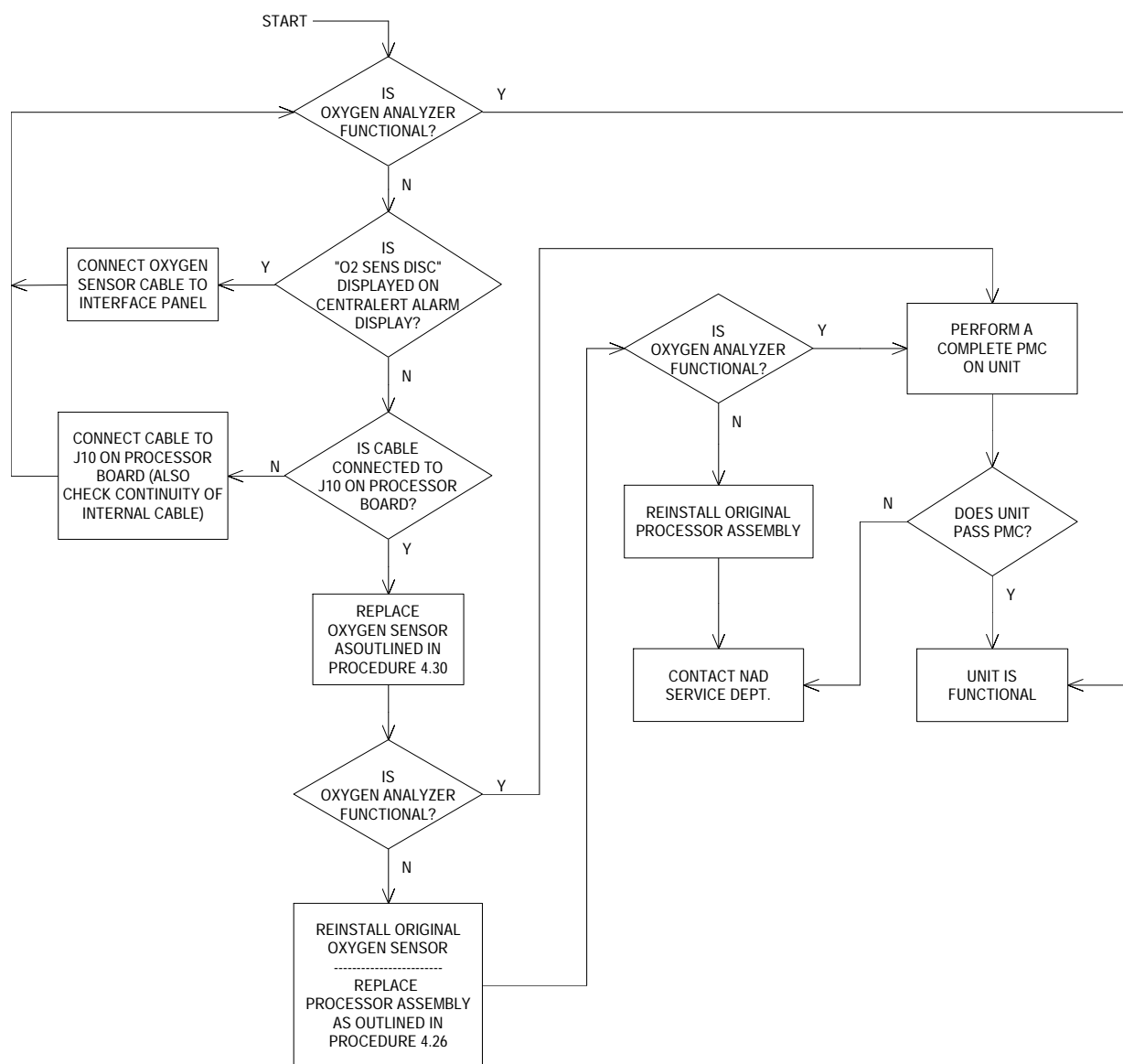
3.3 Troubleshooting Guides

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.

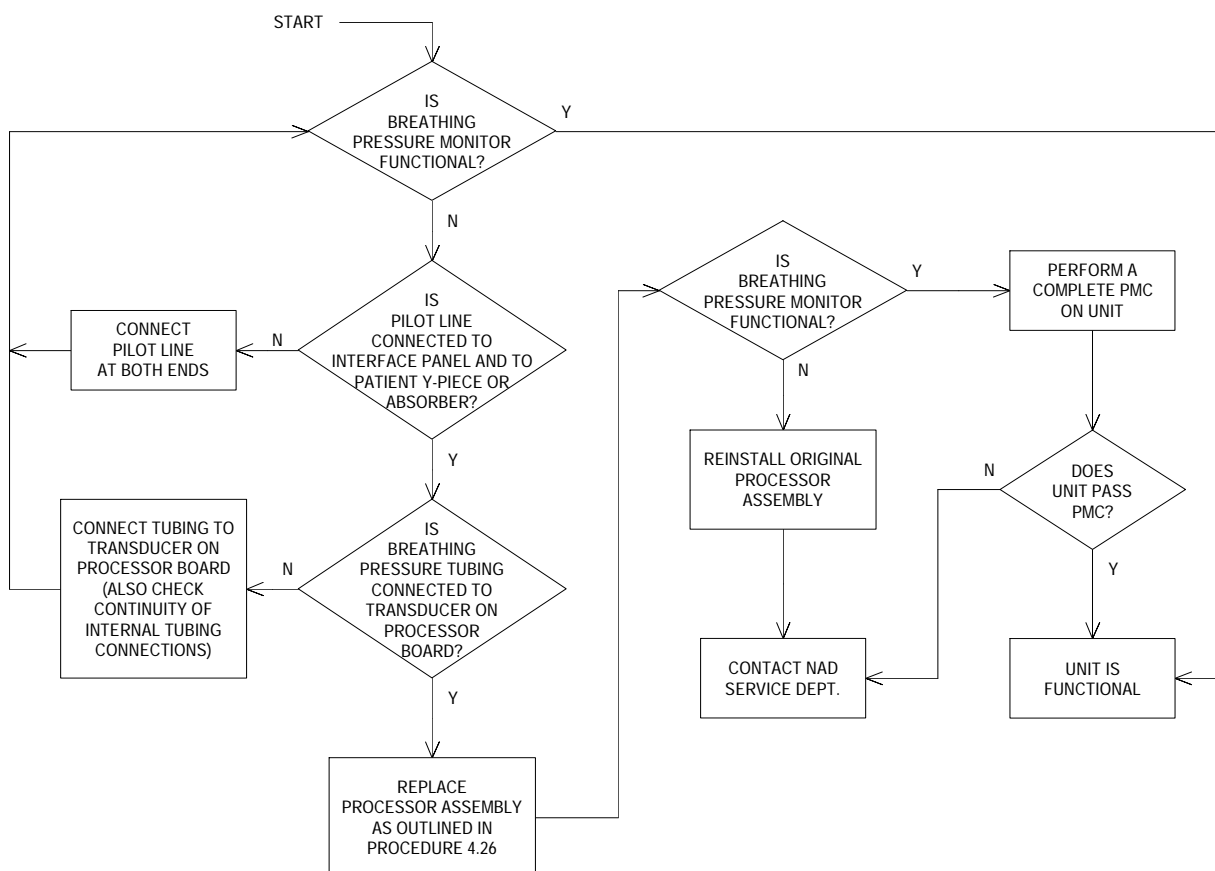
TABLE 3-2: NARKOMED 2B FAILURE MODE AND SYMPTOM LIST

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

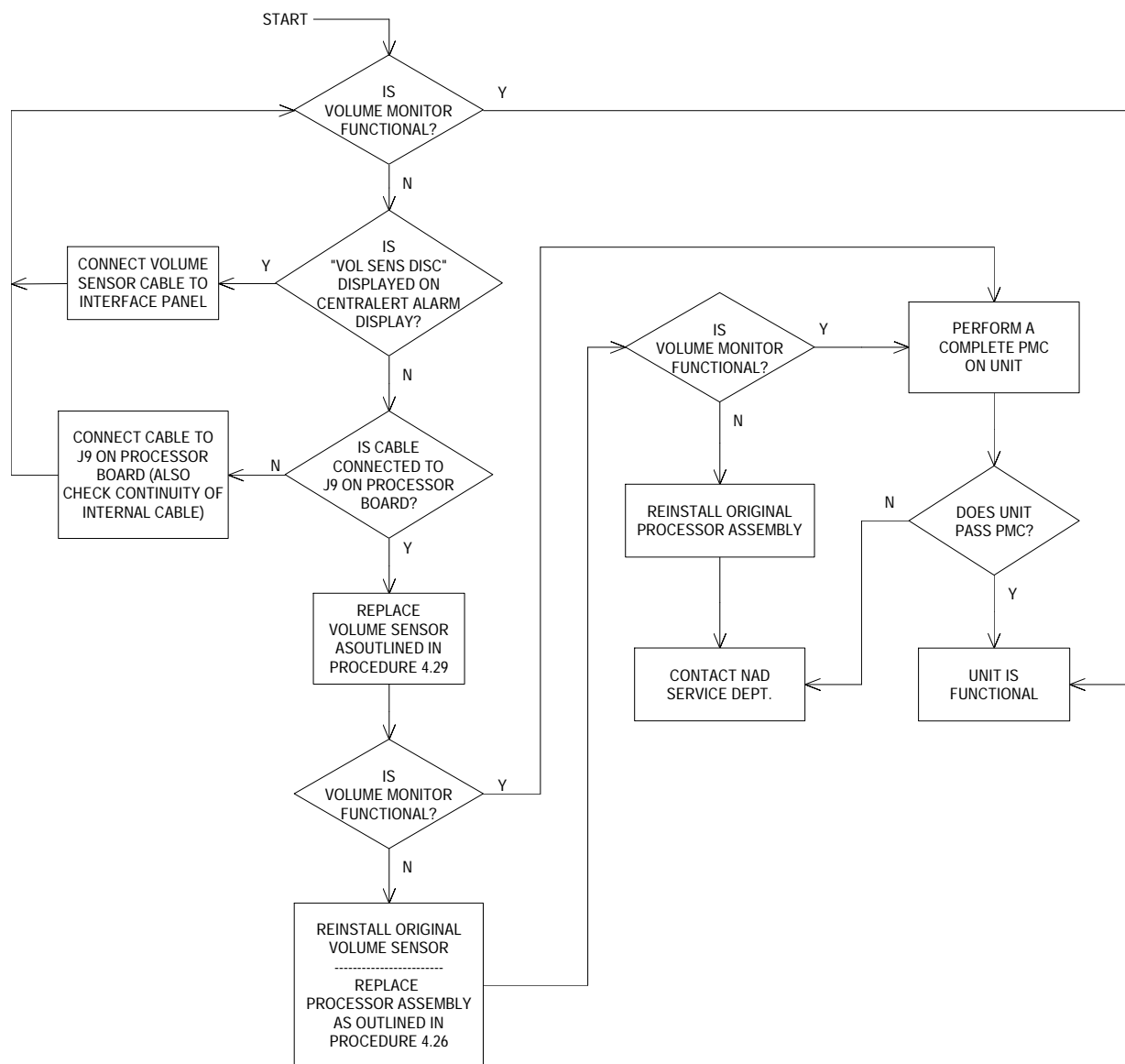
GUIDE 1: Loss of O₂ Monitor



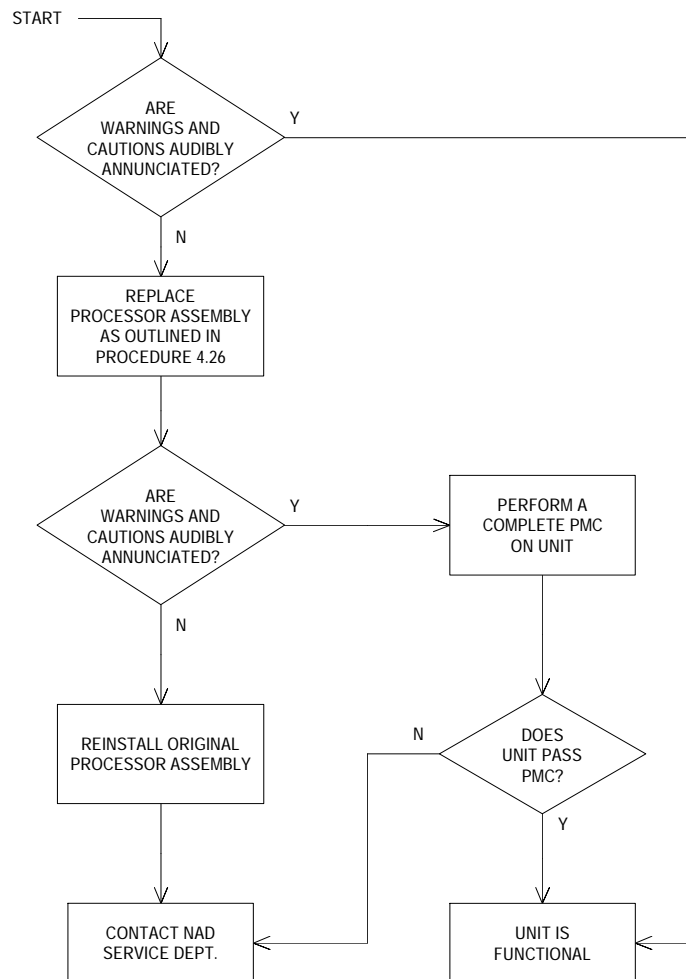
GUIDE 2: Loss of Breathing Pressure Monitor



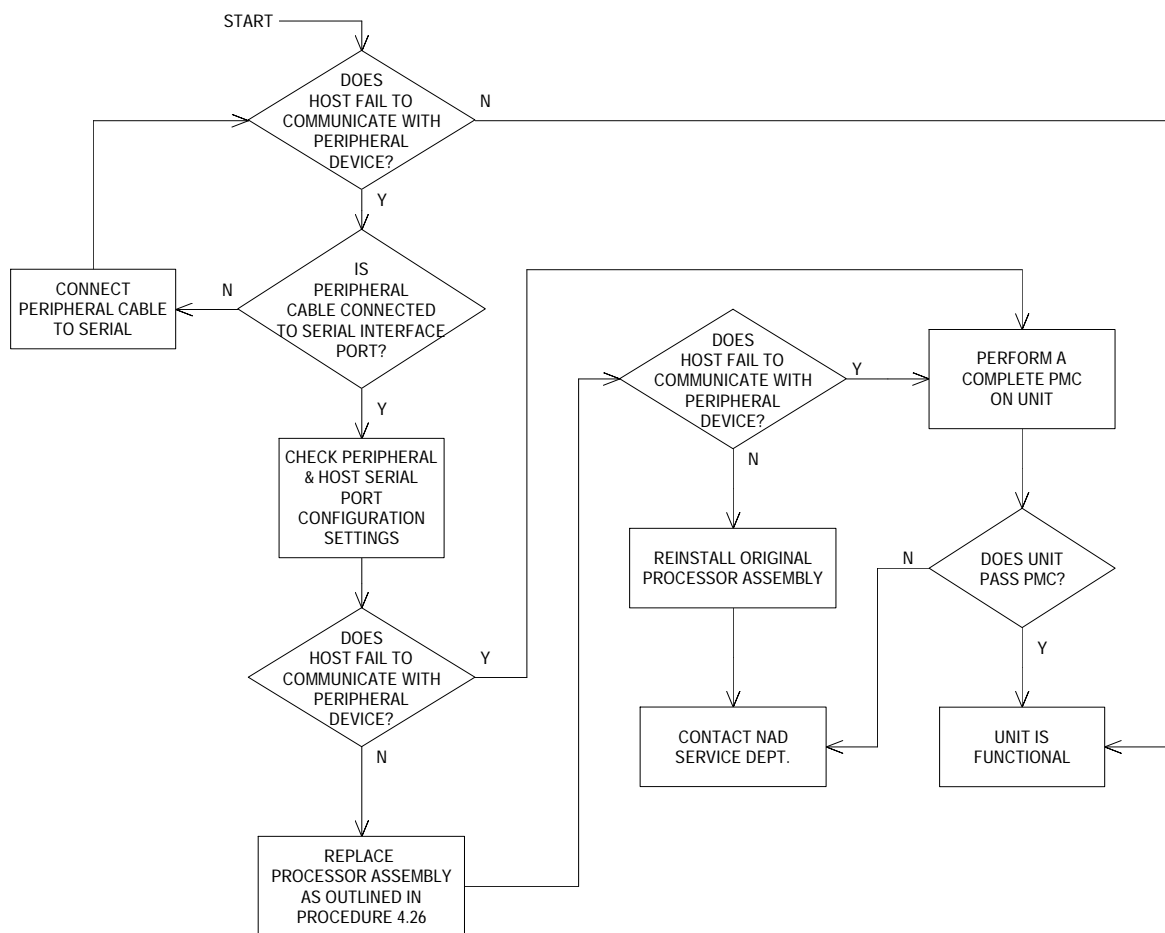
GUIDE 3: Loss of Respiratory Volume Monitor



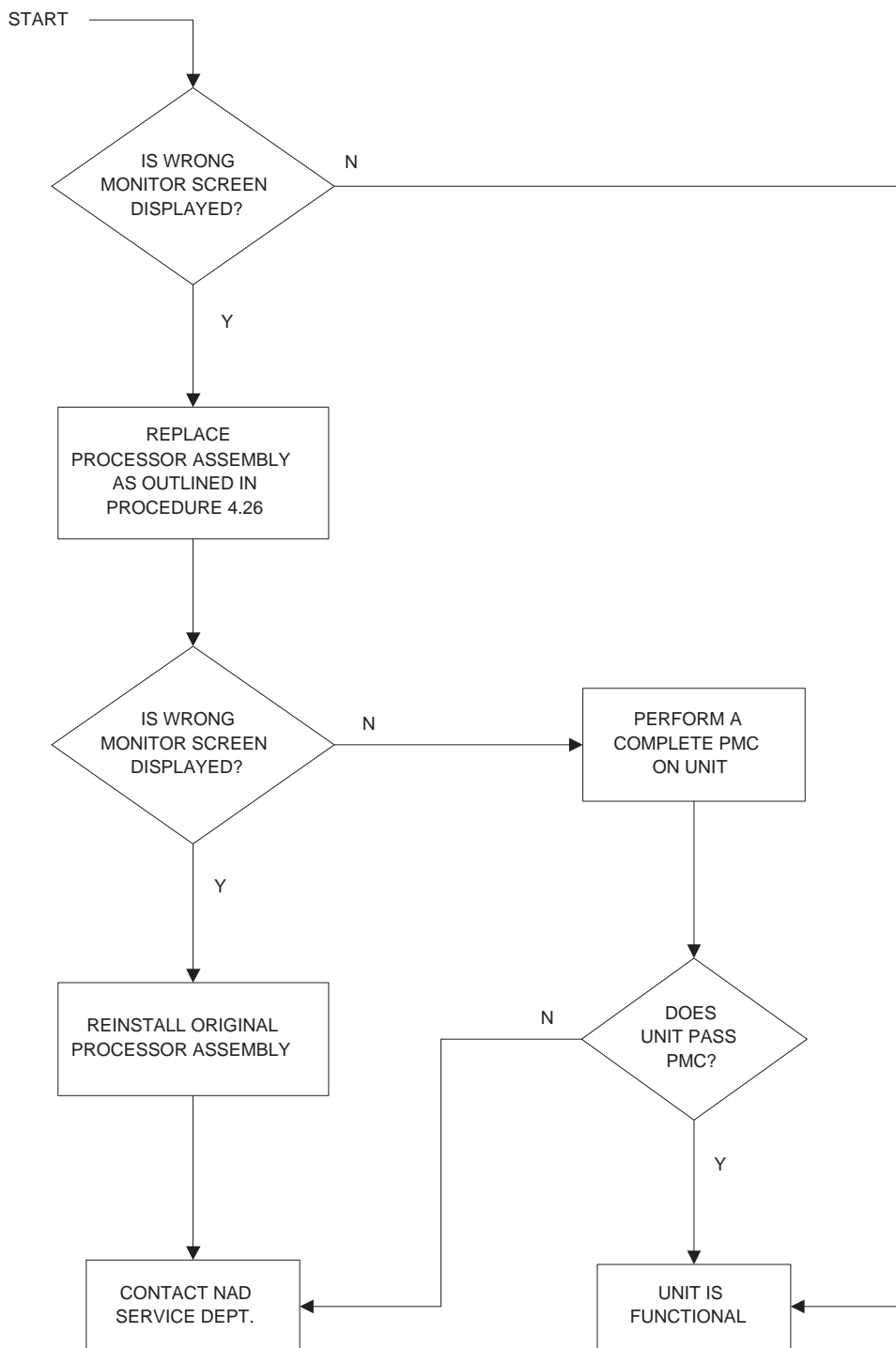
GUIDE 4: No Audio Alarms



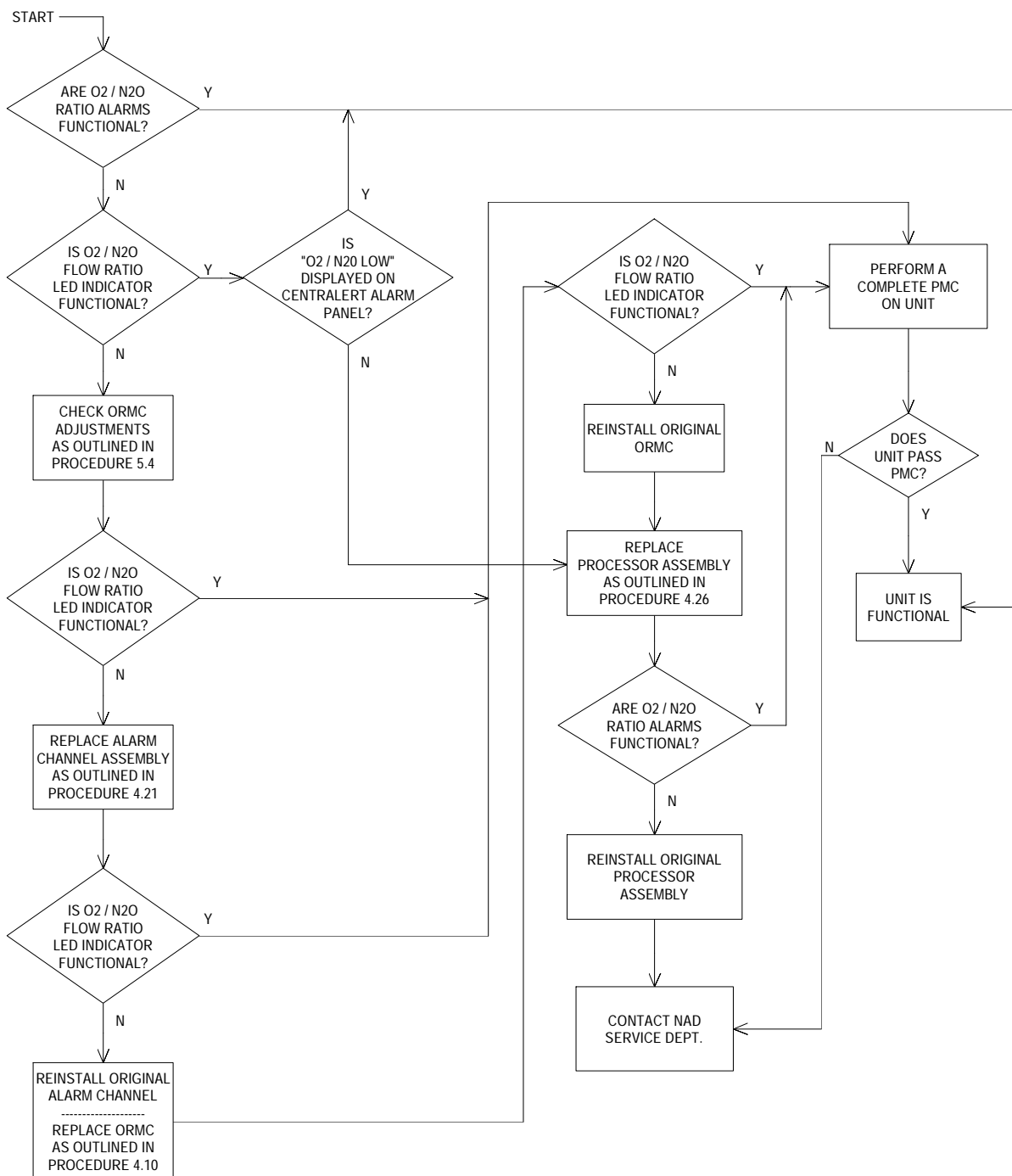
GUIDE 5: Vitalink Failure



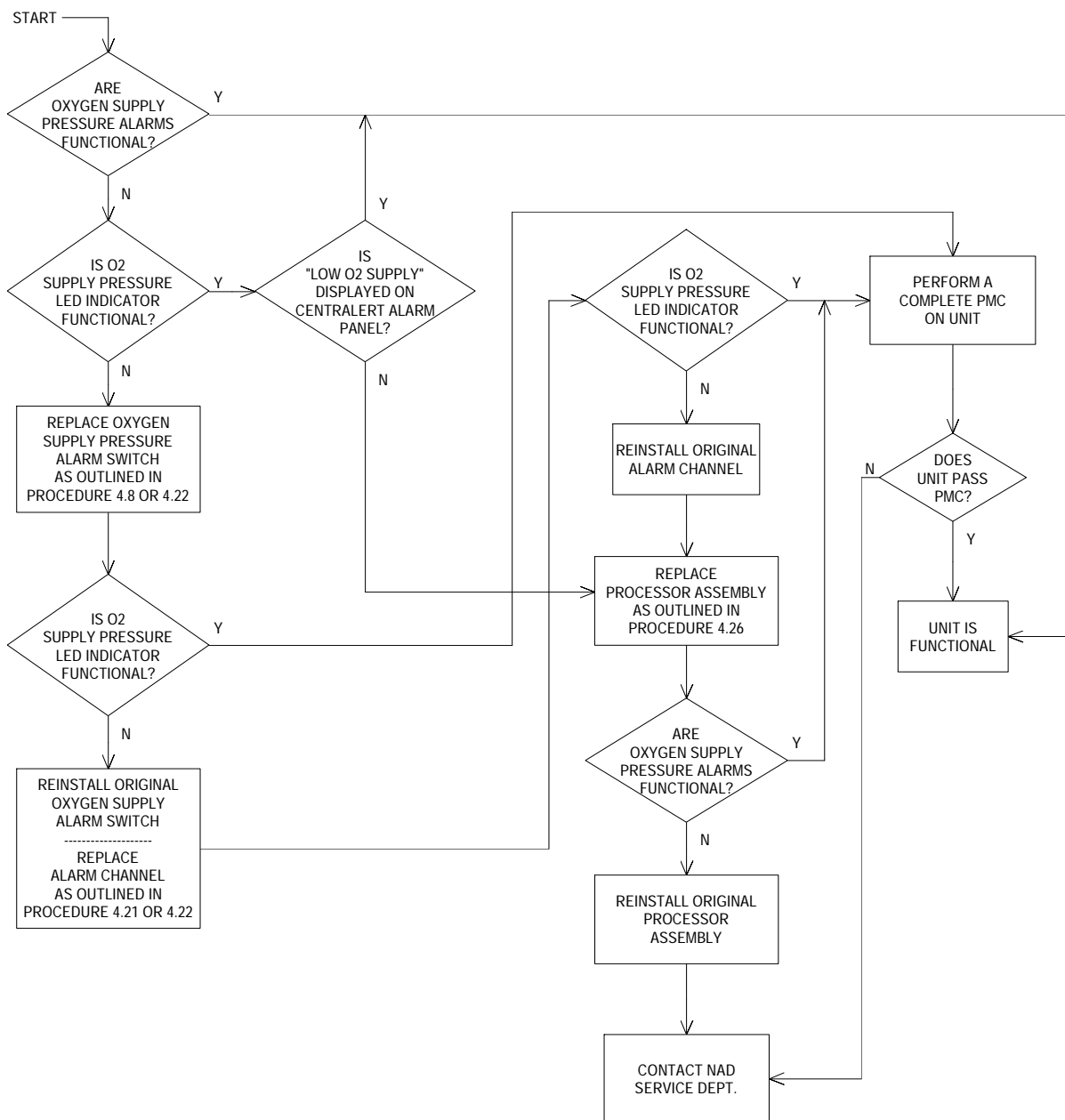
GUIDE 6: Incorrect Display



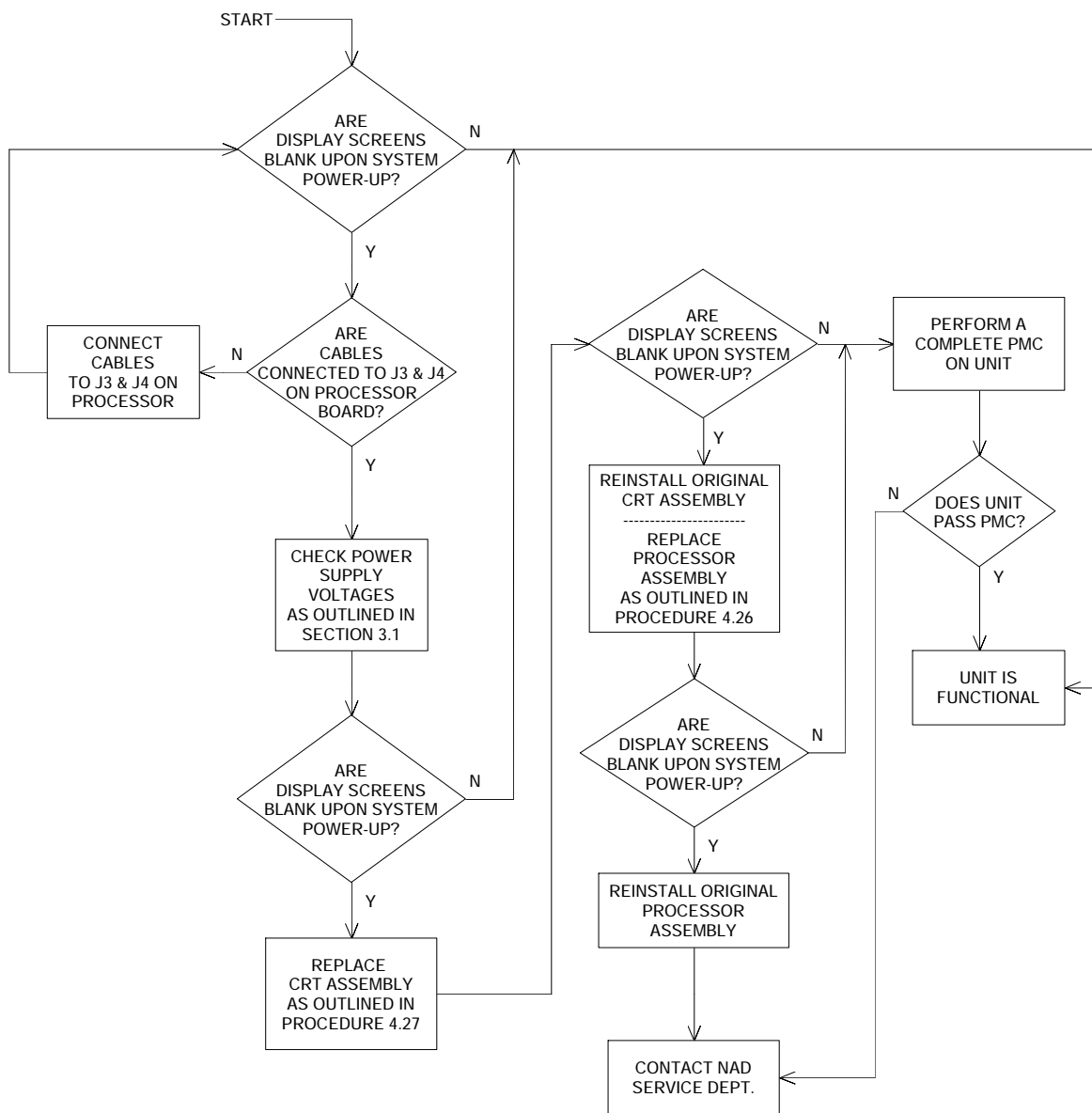
GUIDE 7: No Oxygen Ratio Monitor Alarms



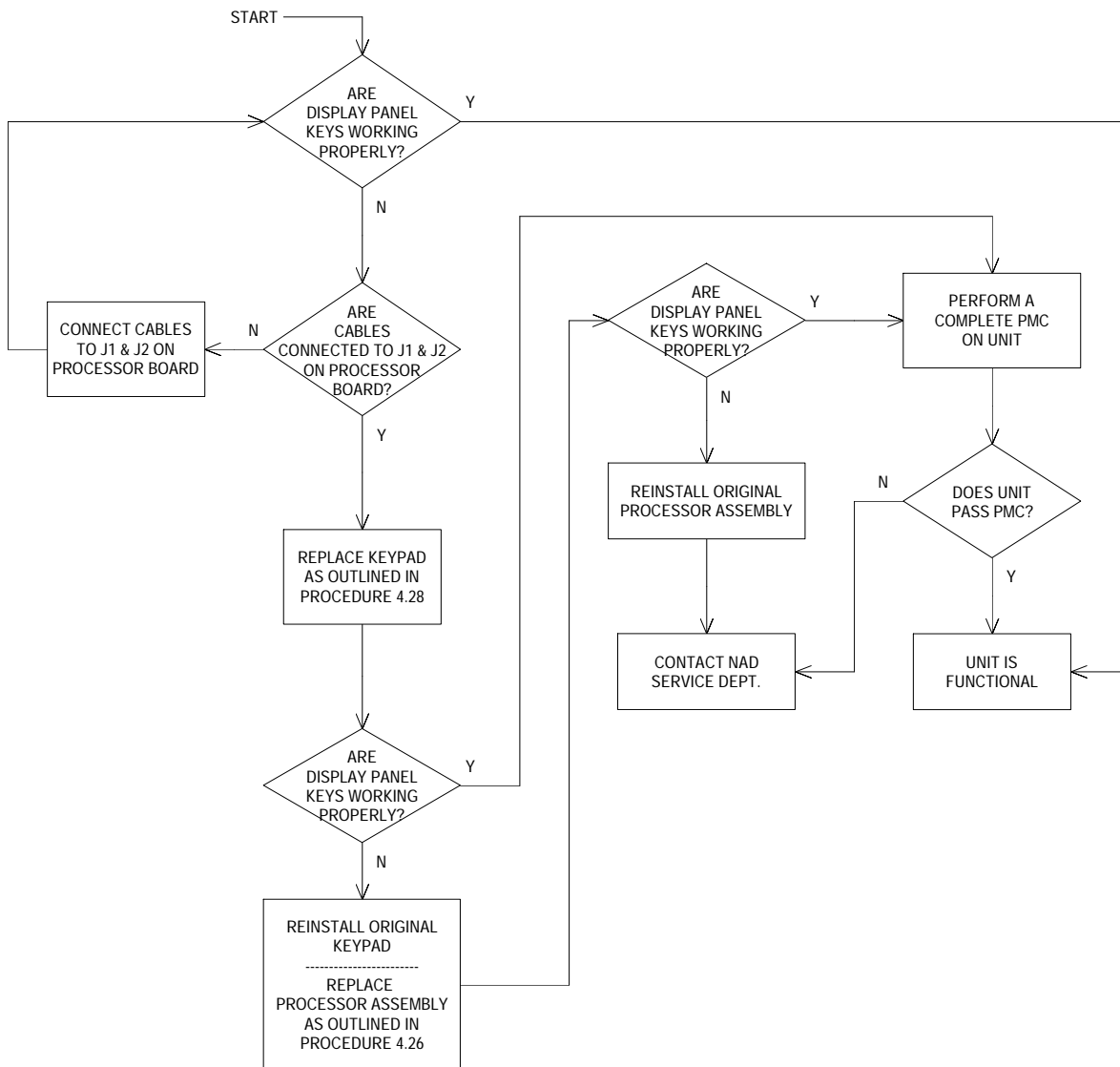
GUIDE 8: No Oxygen Supply Pressure Alarms



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 PMC 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 O₂ 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 O₂ cylinder valve, and close the flow control valves. Press the O₂ 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.

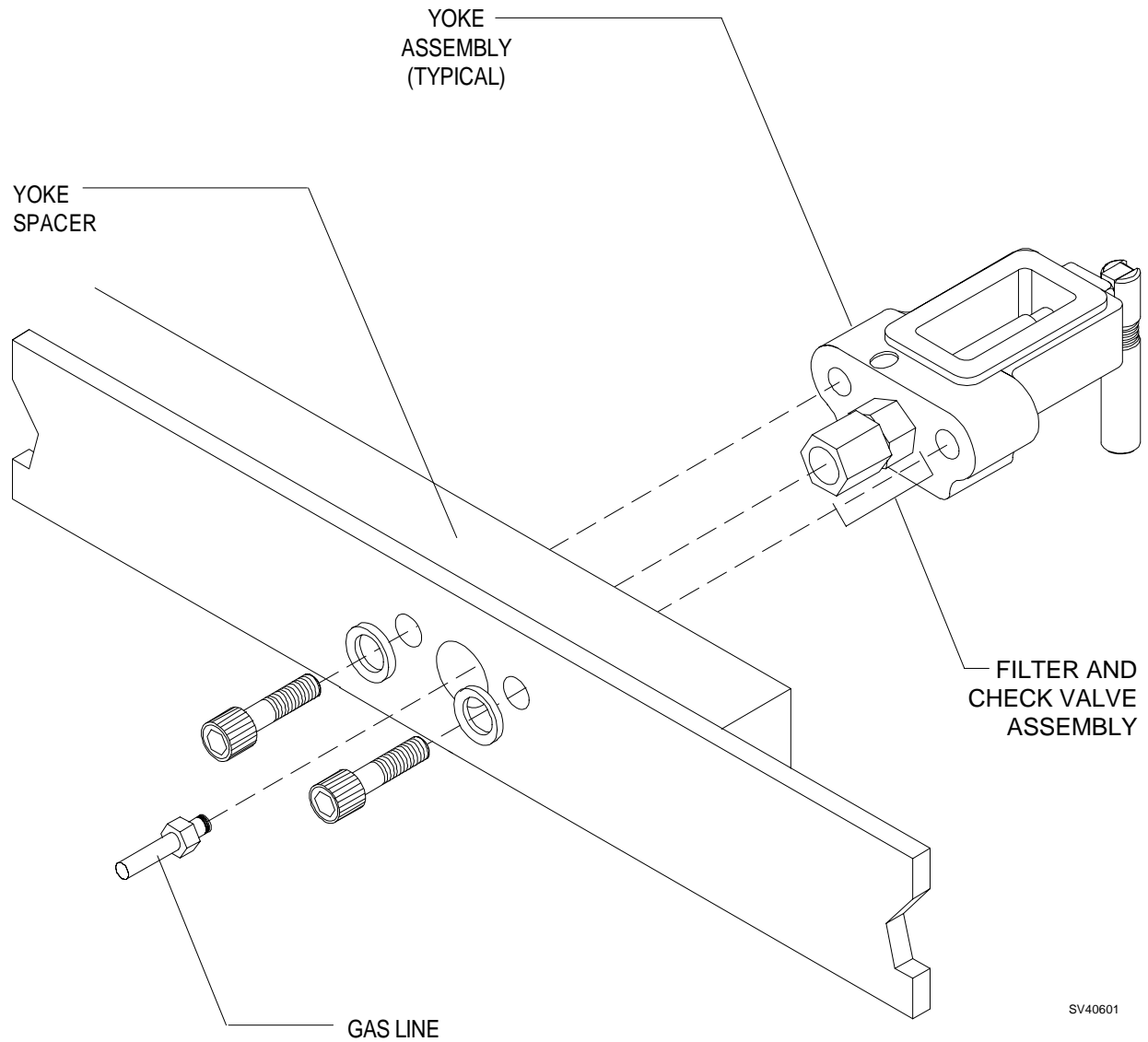


Figure 4-1: CYLINDER YOKE ASSEMBLY

REPLACEMENT PROCEDURES (continued)

NM2B

- 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 ₂ O	: 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 PMC Procedure given in Section 6.

4.2 Cylinder Pressure Regulators

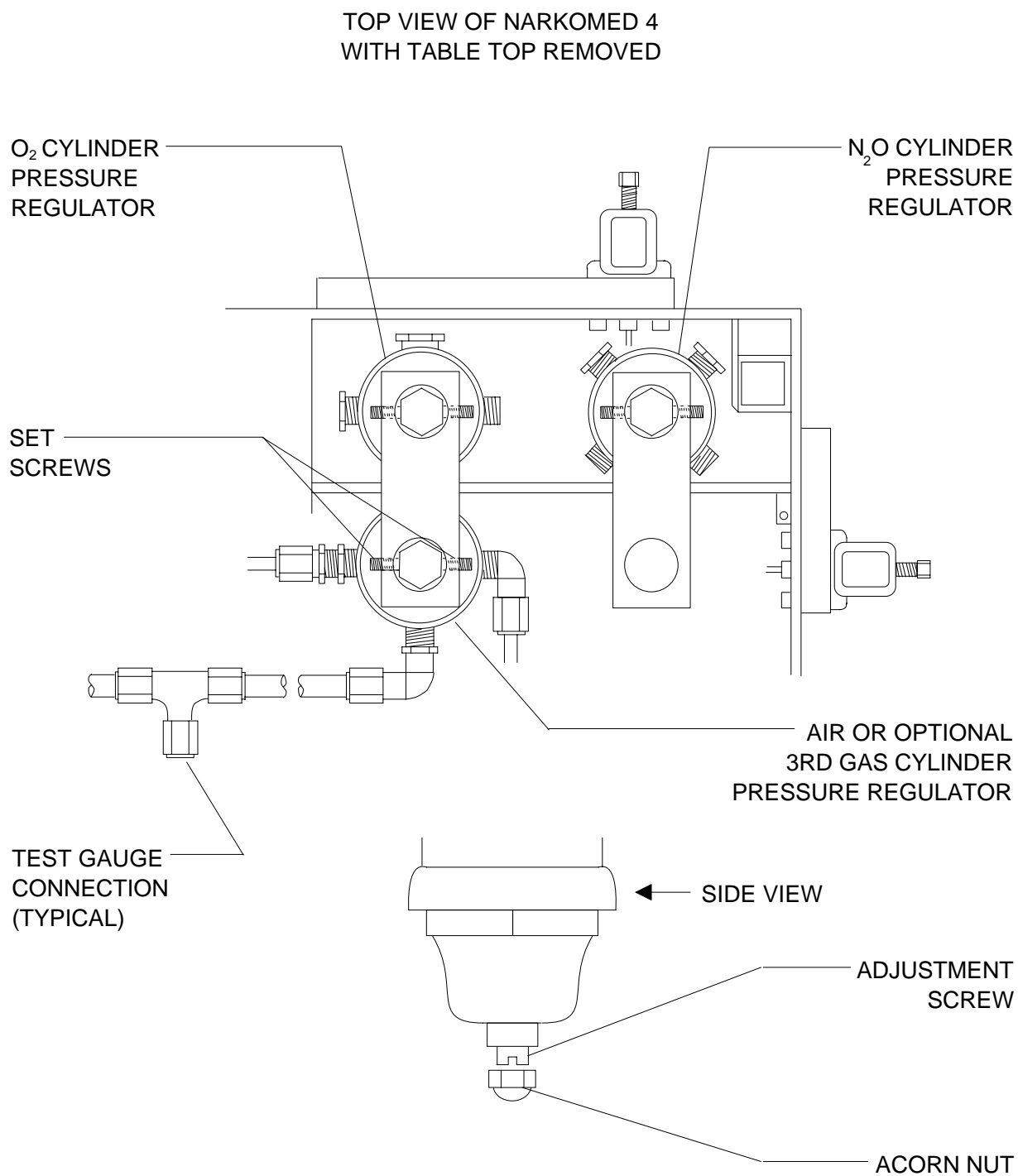
Access to the cylinder pressure regulators requires that the table top be removed from the anesthesia machine. Figure 4-2 shows the mounting arrangement of the regulators and typical connections.

- 4.2.1 Disconnect all pipeline hoses and set the System Power switch to ON.
- 4.2.2 Close all cylinder valves except the O₂ 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 O₂ cylinder valve, and close the flow control valves. Press the O₂ 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.



CPR

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 ₂ O	: 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 PMC 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 O₂, Air or 3rd gas, and N₂O 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 O₂ 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 O₂ Cutoff Valve shall be performed at each PMC. (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 O₂ 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 O₂ cylinder valve, and close the flow control valves. Press the O₂ 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.

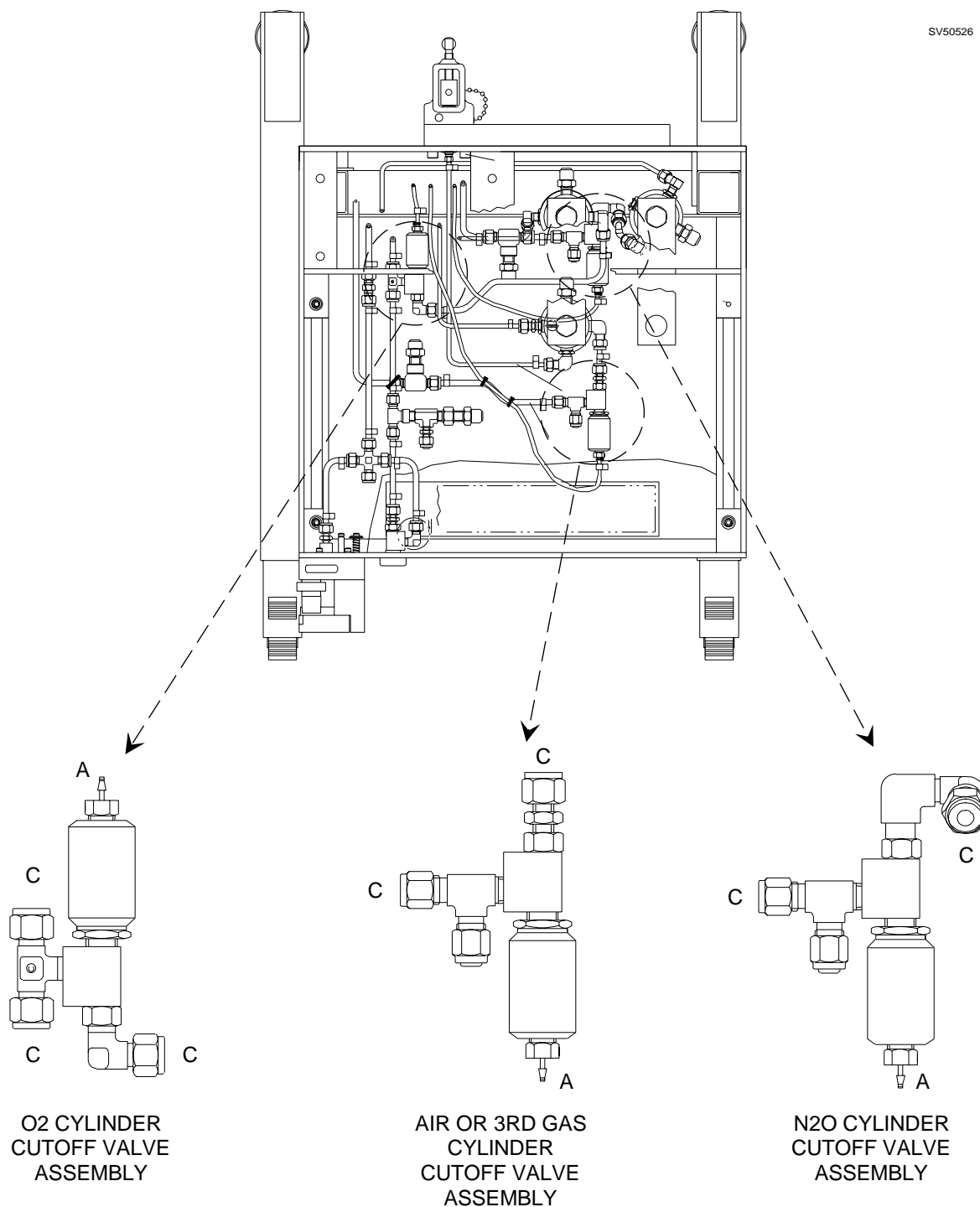


Figure 4-3: CYLINDER CUTOFF VALVES (CANADA)

REPLACEMENT PROCEDURES (continued)

NM2B

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 ₂ O	: 745 PSI

--Set the System Power switch to ON.

--For the O₂ cutoff valve: open the O₂ cylinder valve and set the oxygen flow to 4 liters per min.

--For the N₂O cutoff valve: open the O₂ cylinder valve and the N₂O 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 PMC Procedure given in Section 6.

O₂ Flow Test:

--Disconnect all pipeline supplies.

--Install a full O₂ 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 O₂ FLUSH button while observing the O₂ 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 O₂ 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 O₂ 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 O₂ cylinder valve, and close the flow control valves. Press the O₂ 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 O₂/N₂O 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 O₂ 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.

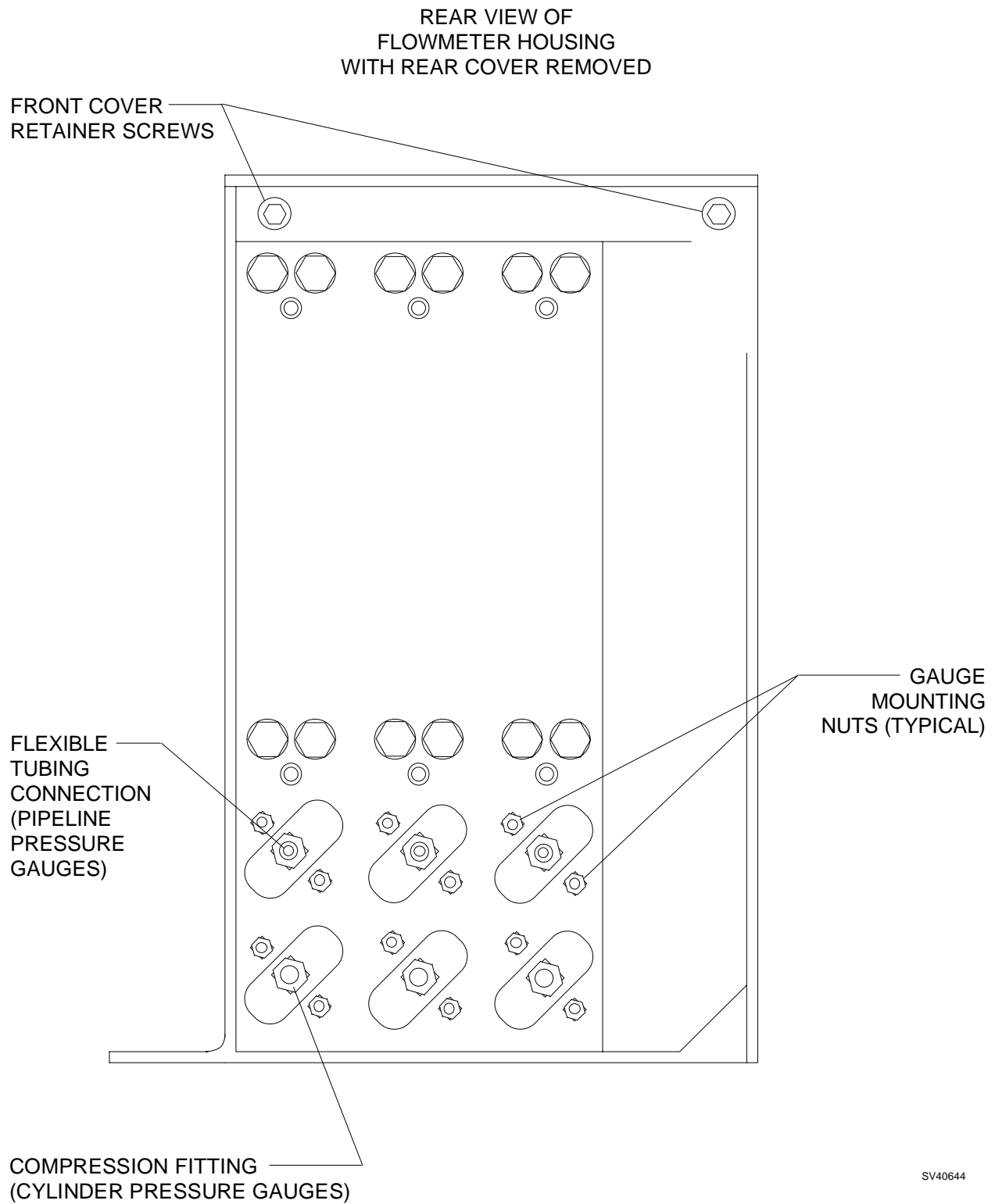


Figure 4-4: CYLINDER AND PIPELINE PRESSURE GAUGES

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:

REPLACEMENT PROCEDURES (continued)

NM2B

- 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:

O₂ : 1000 PSI
N₂O : 700 PSI
HE : 1000 PSI
CO₂ : 800 PSI
AIR : 1000 PSI
N₂ : 1000 PSI
O₂-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 O₂ flow control knob and tighten its setscrews. If the knob is installed properly, the O₂ 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 PMC 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 O₂ 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 O₂ cylinder valve, and close the flow control valves. Press the O₂ 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.

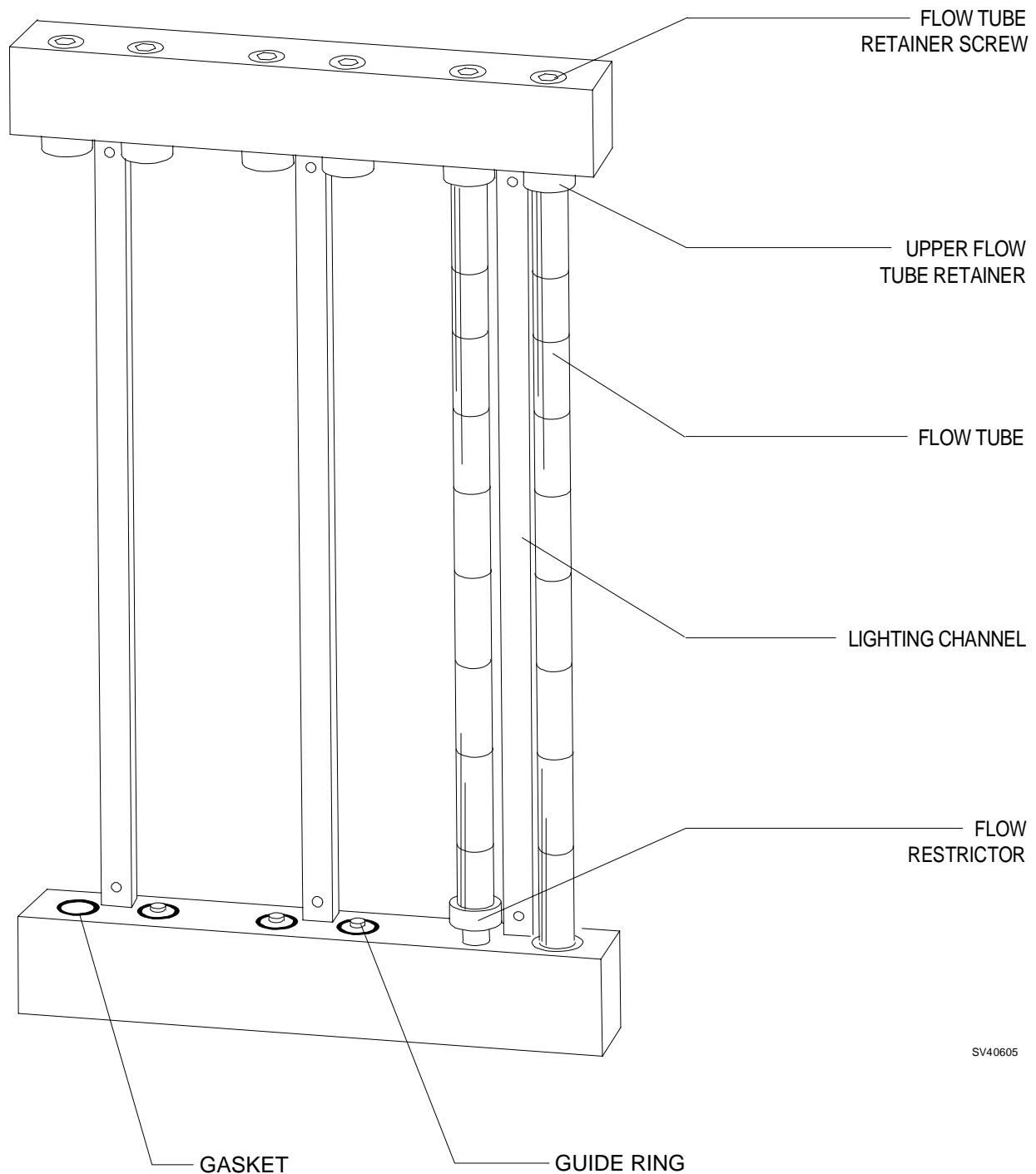
4.4.9B Later models (without the O₂/N₂O ratio alarm lamp): Remove the six screws holding the flowmeter shield and vapor box cover panel, and remove the panel.

4.5.10 Remove the O₂ 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.



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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 H₂O.

4.5.17.3 The pressure should not drop more than 10 cm H₂O 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.

REPLACEMENT PROCEDURES (continued)

NM2B

- 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 O₂ flow control knob and tighten its setscrews. If the knob is installed properly, the O₂ 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 PMC Procedure given in Section 6.

4.6 Flow Control Valves

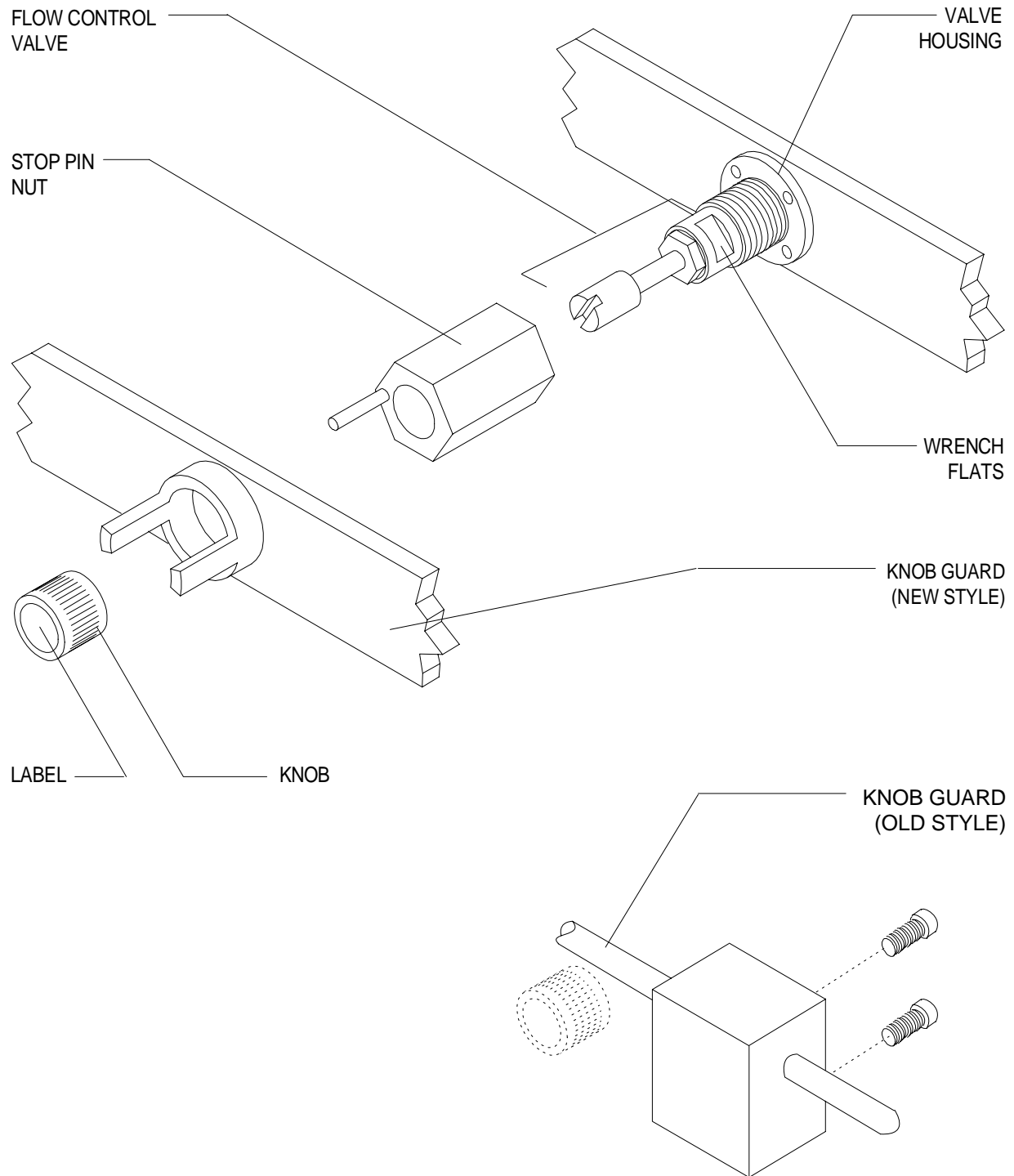
The flow control valves have replaceable elements that are removable from the front of the gas instrumentation panel as shown in Figure 4-6. Each flow control knob has a clockwise positive stop arrangement that prevents damage to the valve seat. Whenever a valve cartridge is replaced, the "off stop" 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 O₂ 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 O₂ cylinder valve and the O₂ flow control valve. Press the O₂ Flush valve to drain oxygen pressure from the system.
- 4.6.6 Set the System Power switch to STANDBY.
- 4.6.7 Remove the O₂ 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.)

REPLACEMENT PROCEDURES (continued)

NM2B



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Figure 4-6: FLOW CONTROL VALVES

4.6.14 Set the System Power switch to ON.

4.6.15A For the O₂ 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 PMC 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 O₂ 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 O₂ cylinder valve and the O₂ flow control valve. Press the O₂ 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 O₂ 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.

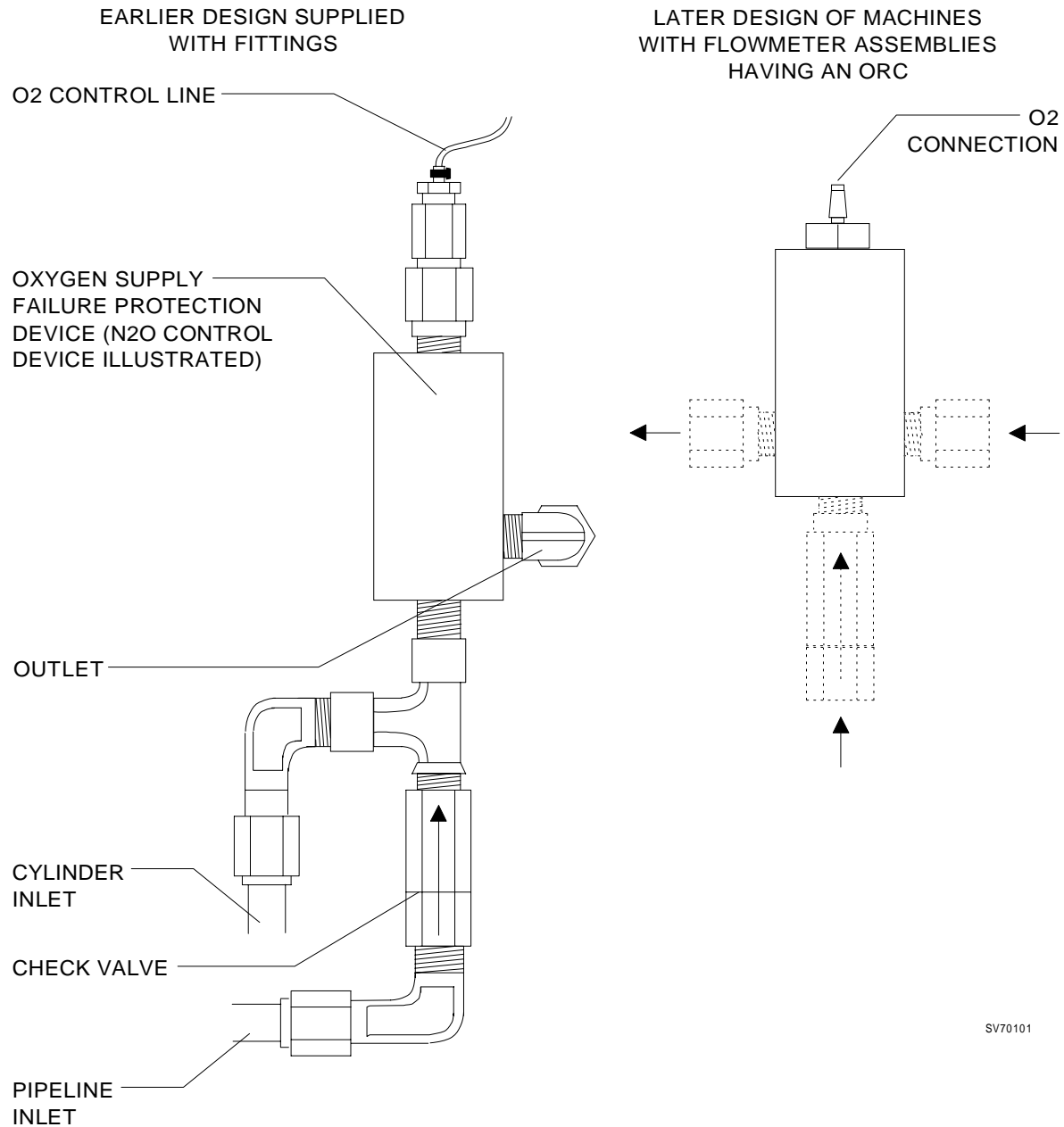


Figure 4-7: OXYGEN SUPPLY FAILURE PROTECTION DEVICE

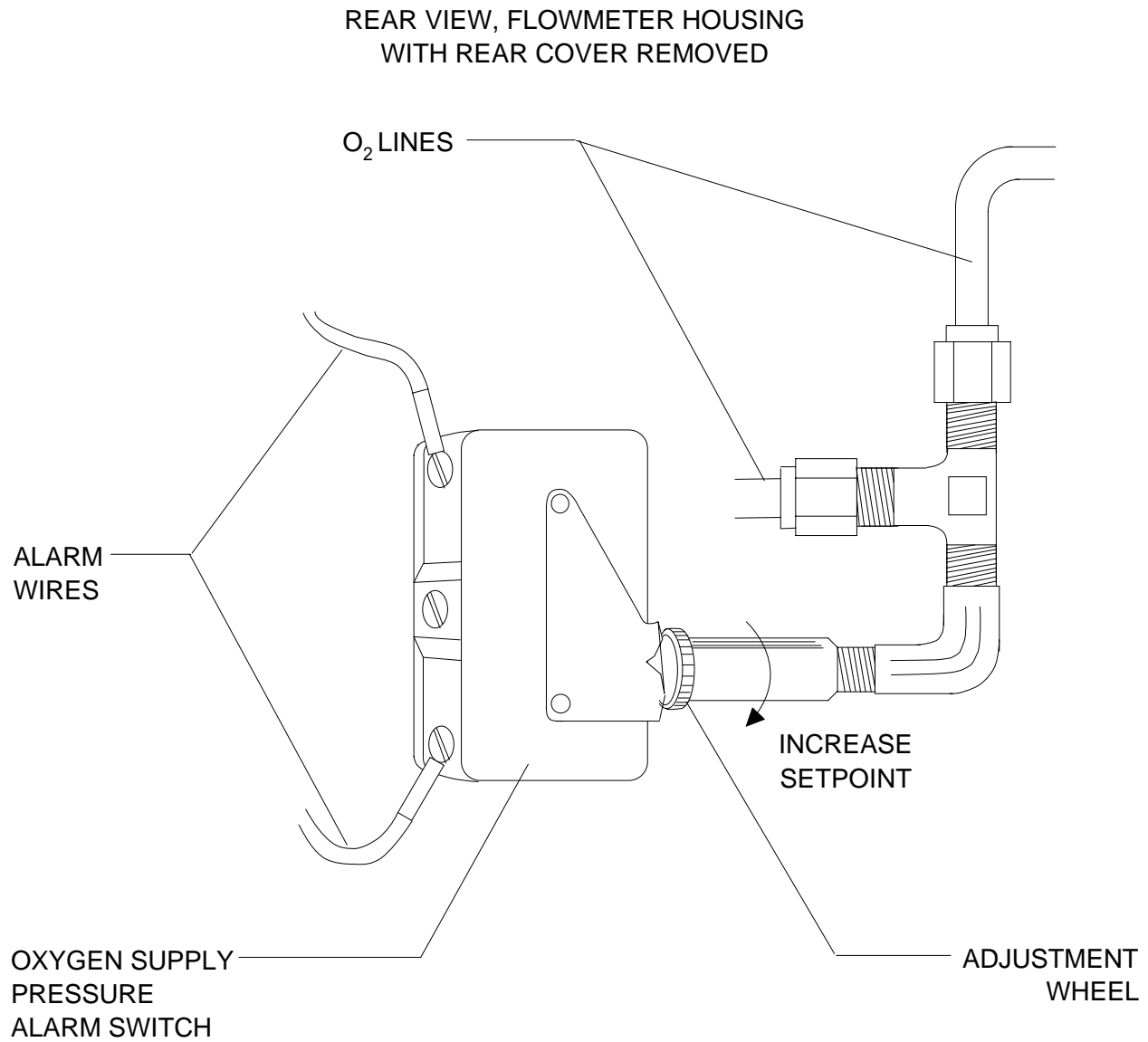
- 4.7.12 Perform the following test:
 - 4.7.12.1 Open the cylinder valves.
 - 4.7.12.2 Set the System Power switch to ON.
 - 4.7.12.3 Set the oxygen flow to five liters per minute.
 - 4.7.12.4 Set the other gas flow to five liters per minute.
 - 4.7.12.5 Close the oxygen cylinder valve.
 - 4.7.12.6 As 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 PMC 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 O₂ 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 O₂ 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 O₂ cylinder valve and the O₂ flow control valve. Press the O₂ 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 O₂ 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 O₂ regulator and remove the plug from the TEE fitting.
- 4.8.14 Connect a dedicated O₂ test gauge to the TEE fitting.



OSPAS

Figure 4-8: OXYGEN SUPPLY PRESSURE ALARM SWITCH

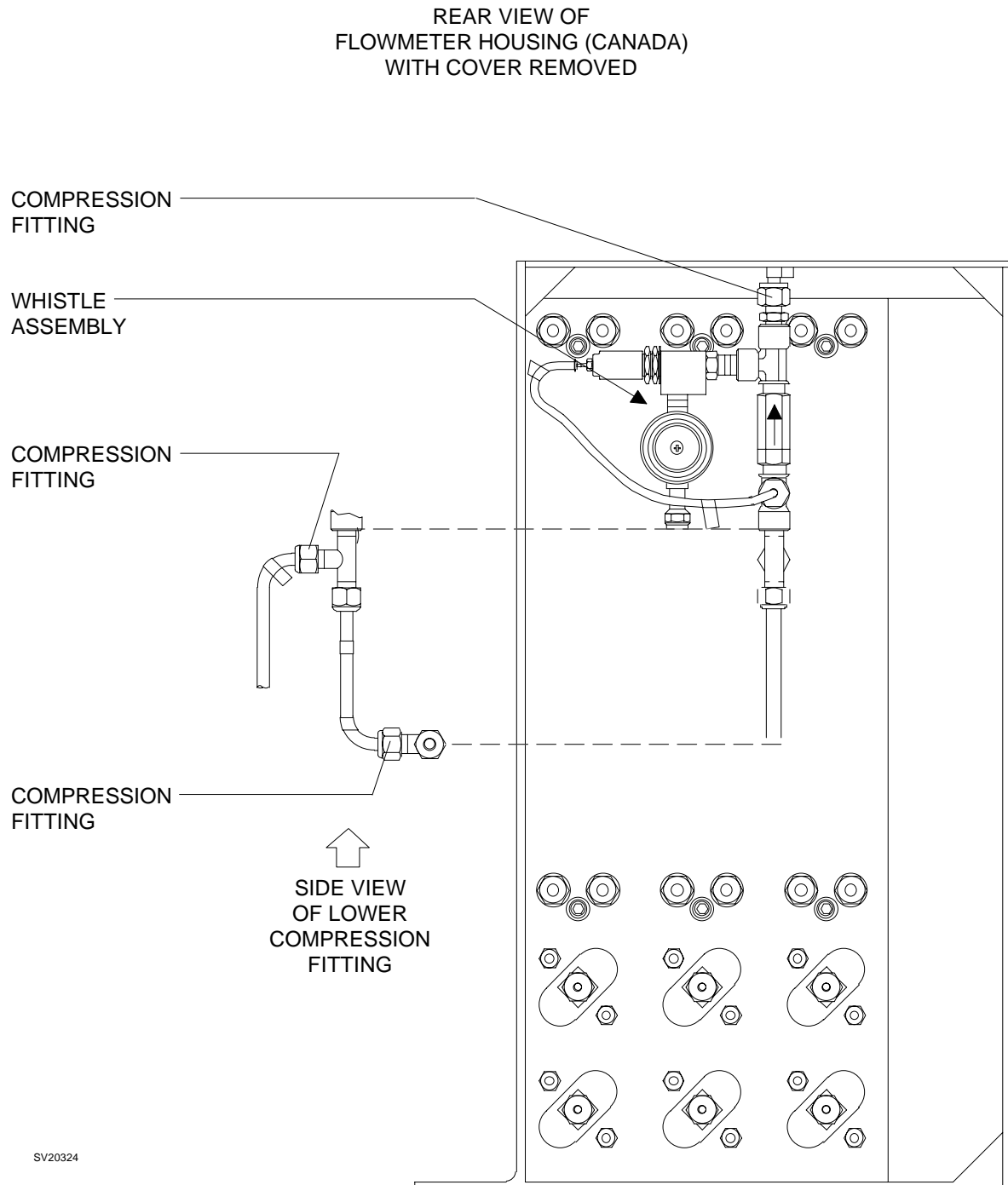
- 4.8.15 Open the oxygen cylinder valve and set the System Power switch to ON.
- 4.8.16 Set the oxygen flow to five liters per minute.
- 4.8.17 Close the oxygen cylinder valve.
- 4.8.18 As the pressure drops, the O₂ SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the 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 PMC 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 O₂ 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 PMC Procedure given in Section 6.



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

REPLACEMENT PROCEDURES (continued)

NM2B

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 O₂/N₂O 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 O₂ 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 O₂ cylinder valve and the O₂ flow control valve. Press the O₂ 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 O₂ tubing from the left side of the ORMC, and disconnect the flexible N₂O 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 N₂O lines.
- 4.10.13 Disconnect the remaining flexible N₂O tubing from the tee fitting at the front of the ORMC. (Later models do not have the tee fitting.)

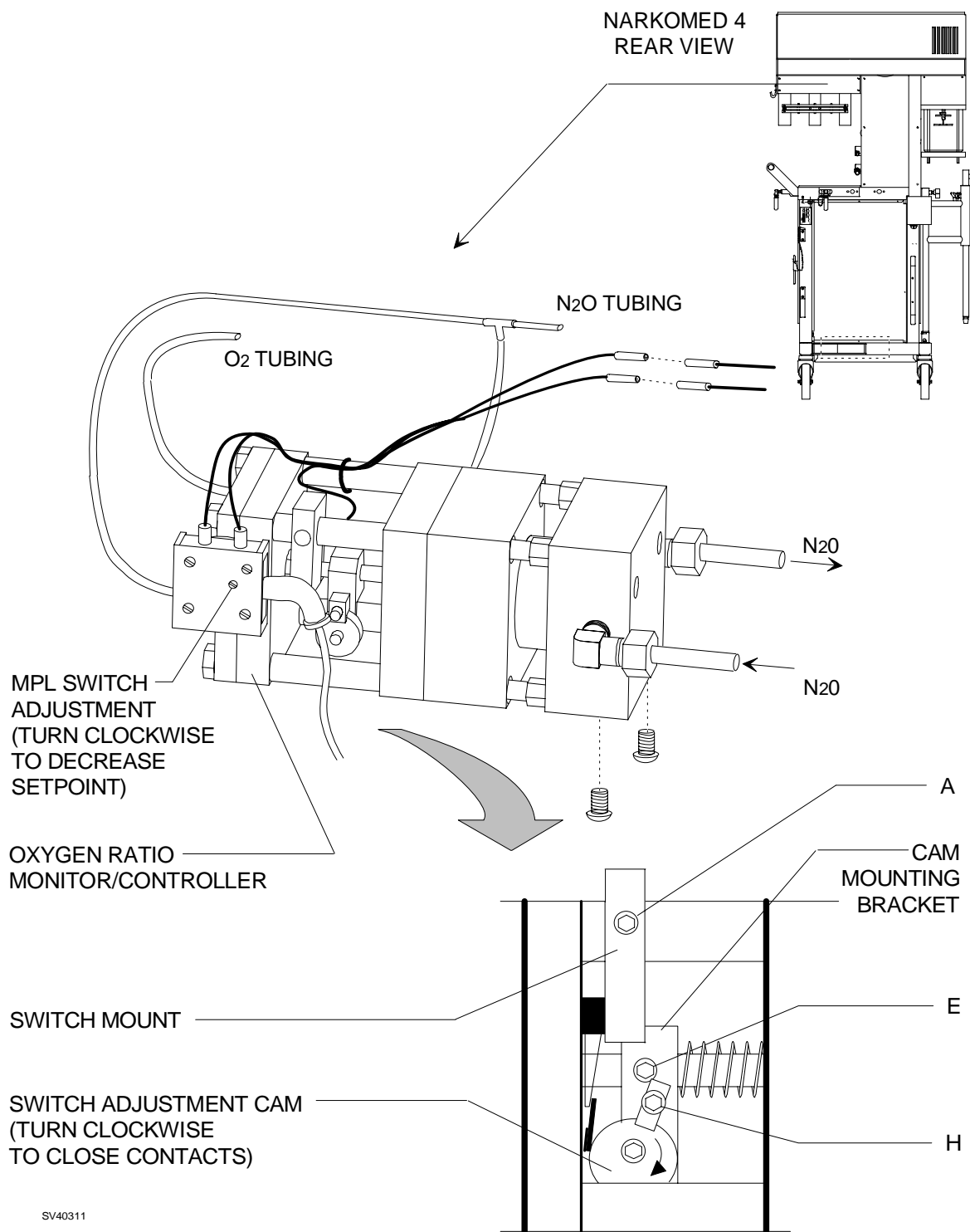


Figure 4-10: OXYGEN RATIO MONITOR/CONTROLLER

REPLACEMENT PROCEDURES (continued)

NM2B

- 4.10.14 Connect the flexible N₂O 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 N₂O 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 O₂ tubing to the left side of the ORMC, and connect the flexible N₂O 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 O₂ and N₂O cylinder valves.
- 4.10.19 Set the System Power switch to ON, and perform the following test:
 - 4.10.19.1 Open the N₂O flow control valve three turns. There should be no nitrous oxide flow.
 - 4.10.19.2 Slowly open the O₂ 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 O₂/N₂O 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 O₂/N₂O 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 O₂/N₂O 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 N₂O 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 PMC 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 N₂O 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 O₂ 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 O₂ cylinder valve and the O₂ flow control valve. Press the O₂ 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 O₂ 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 N₂O 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 N₂O 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 O₂ line to the ORC and secure it with the press-on hose clamp.
- 4.11.11 Open the O₂ and N₂O cylinder valves.

REAR VIEW OF FLOWMETER HOUSING
WITH REAR COVER REMOVED

SV50504

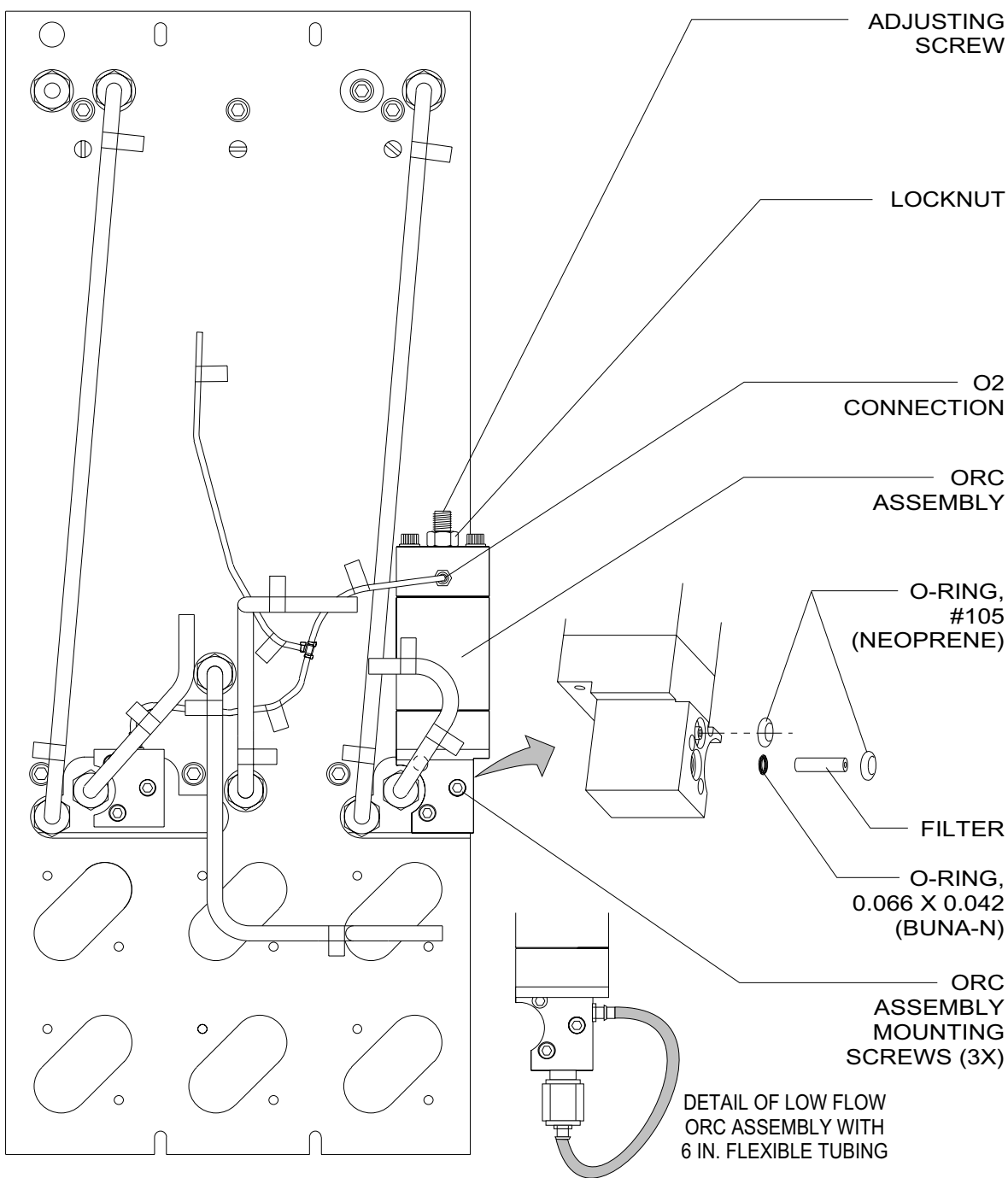


Figure 4-11: OXYGEN RATIO CONTROLLER

REPLACEMENT PROCEDURES (continued)

NM2B

- 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 PMC 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.

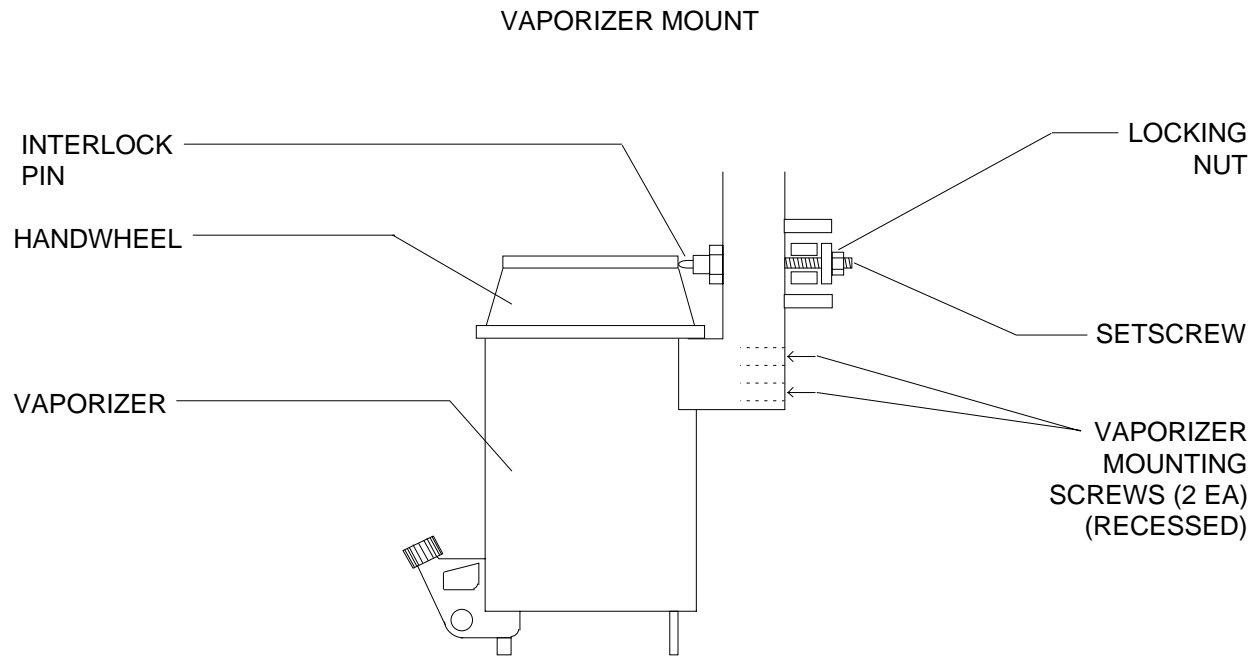
4.12.8 While holding the vaporizer, remove the mounting screws and carefully separate the vaporizer from the machine. Note the arrangement of gaskets so that the replacement vaporizer can be installed in the same manner.

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.

REPLACEMENT PROCEDURES (continued)

NM2B



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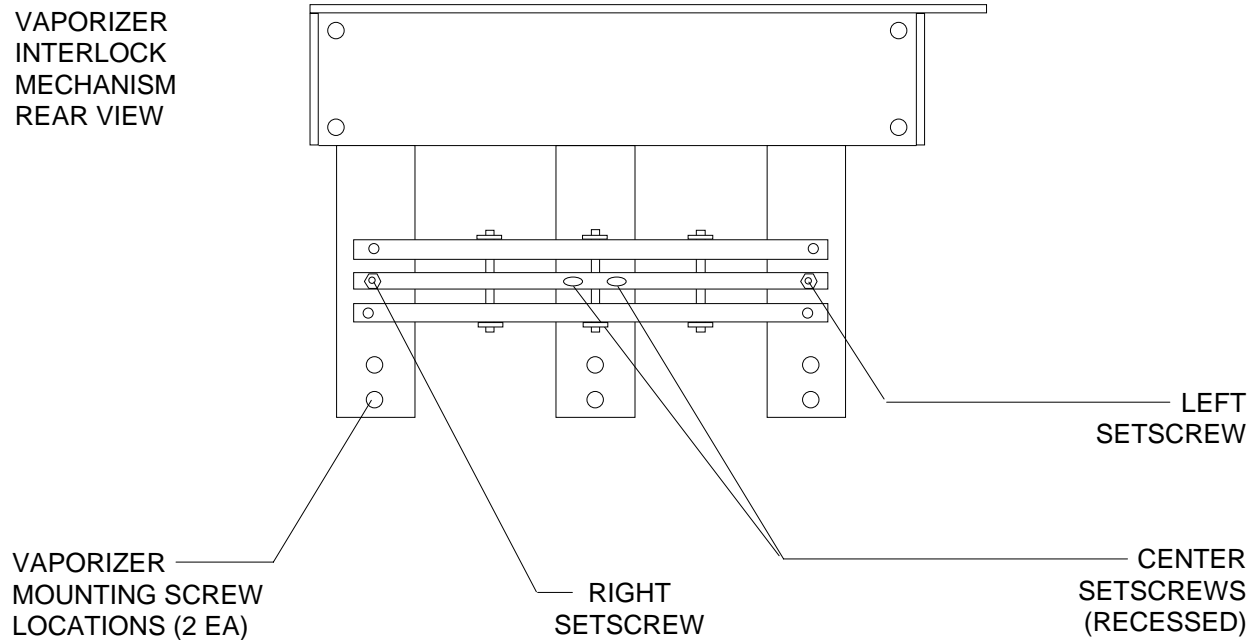


Figure 4-12: VAPORIZER INSTALLATION AND INTERLOCK ADJUSTMENT

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 PMC Procedure given in Section 6.

4.13 O₂ Flush Valve

The O₂ 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 O₂ cylinder valve.
- 4.13.4 Press the O₂ 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 O₂ 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 O₂ Flush button 180 degrees, hold it in and loosen the other set screw.
- 4.13.8 Remove the O₂ 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 O₂ 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 O₂ 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.

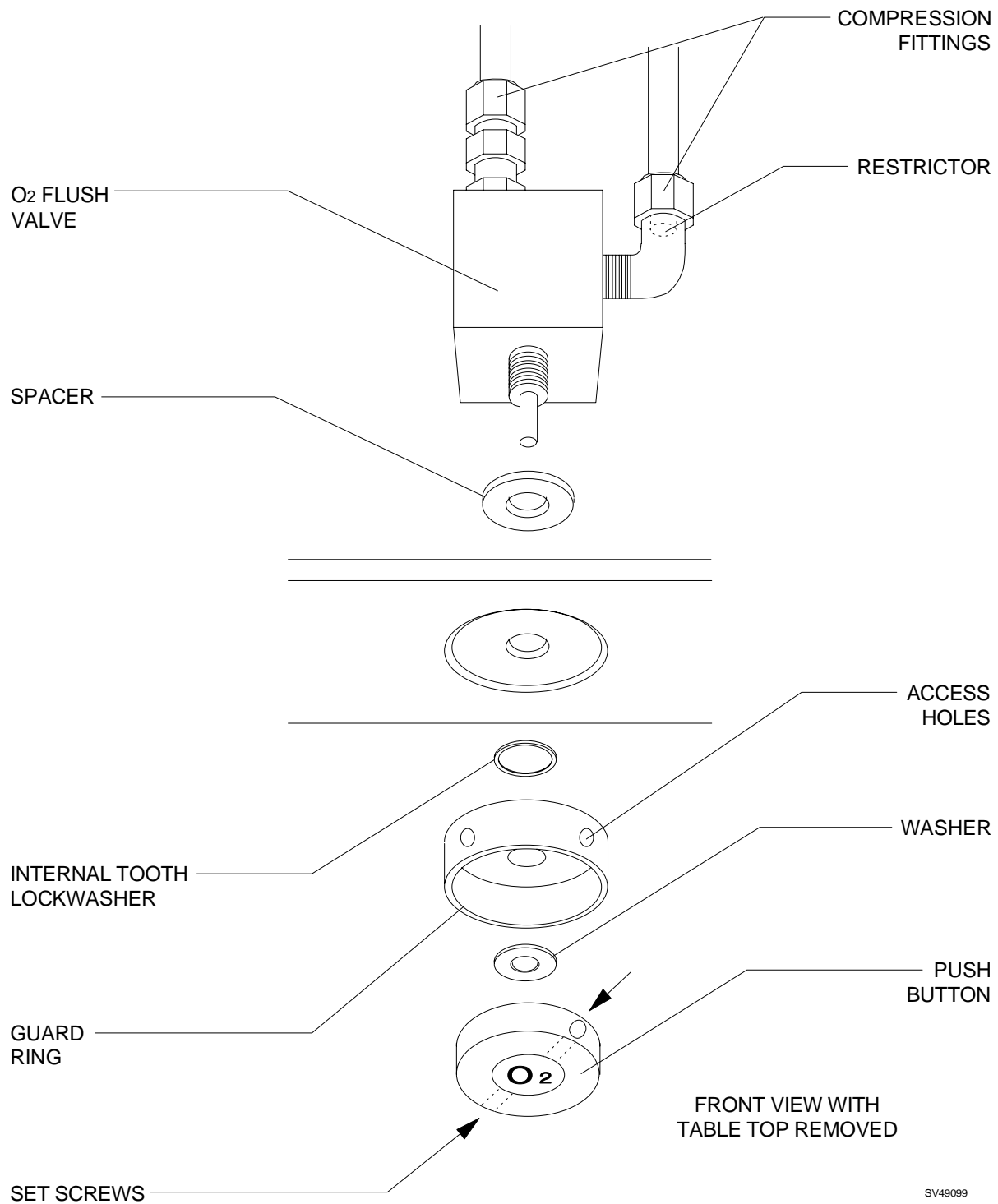


Figure 4-13: O₂ FLUSH VALVE

REPLACEMENT PROCEDURES (continued)

NM2B

- 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 O₂ Flush button on the valve shaft.
- 4.13.14 Hold the O₂ 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 H₂O.
 - 4.13.15.4 Increase the pressure to 50 cm H₂O.
 - 4.13.15.5 The pressure should not drop more than 10 cm H₂O 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 O₂ 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 PMC 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

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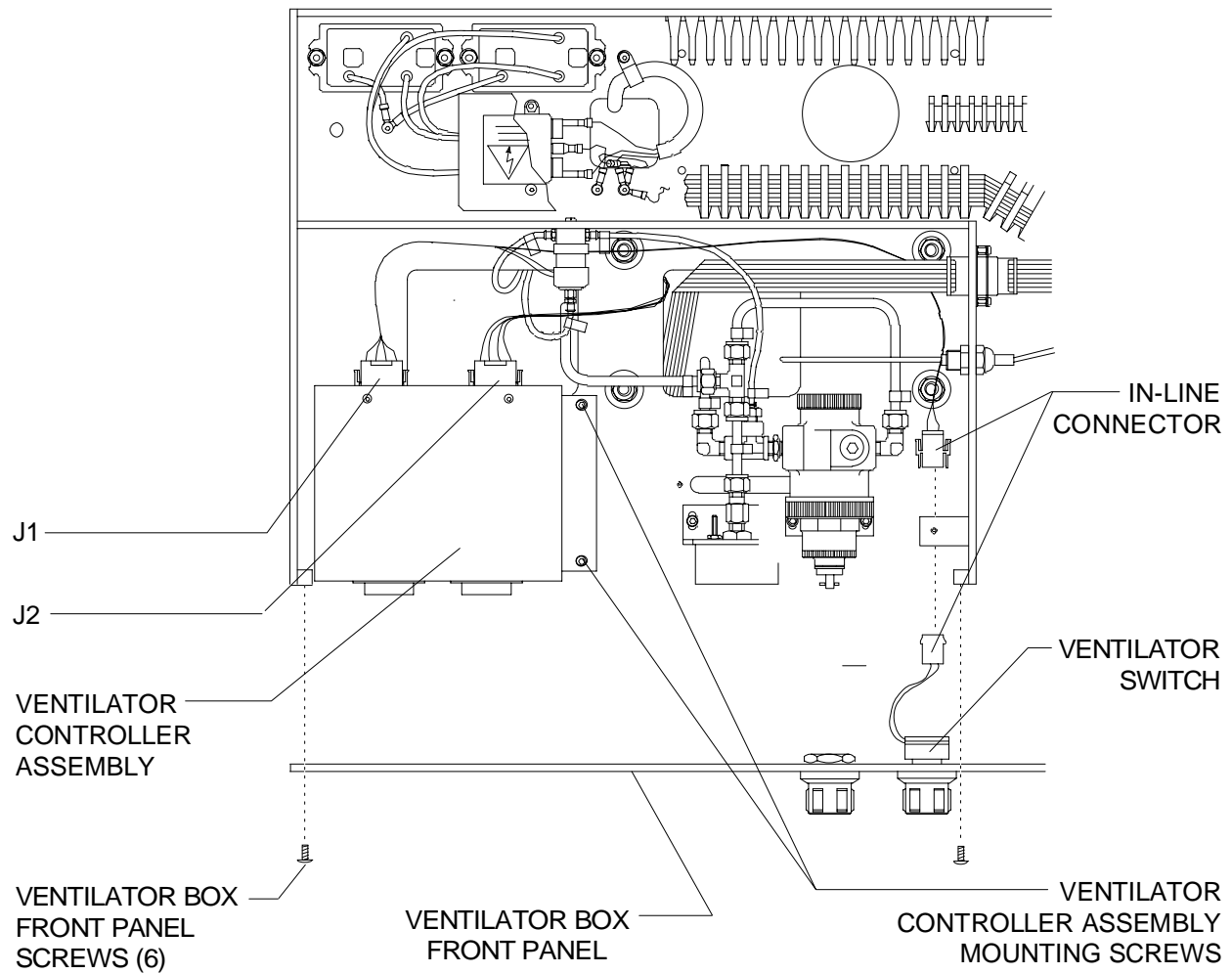


Figure 4-14: VENTILATOR CONTROLLER ASSEMBLY

REPLACEMENT PROCEDURES (continued)

NM2B

- 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 PMC 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.

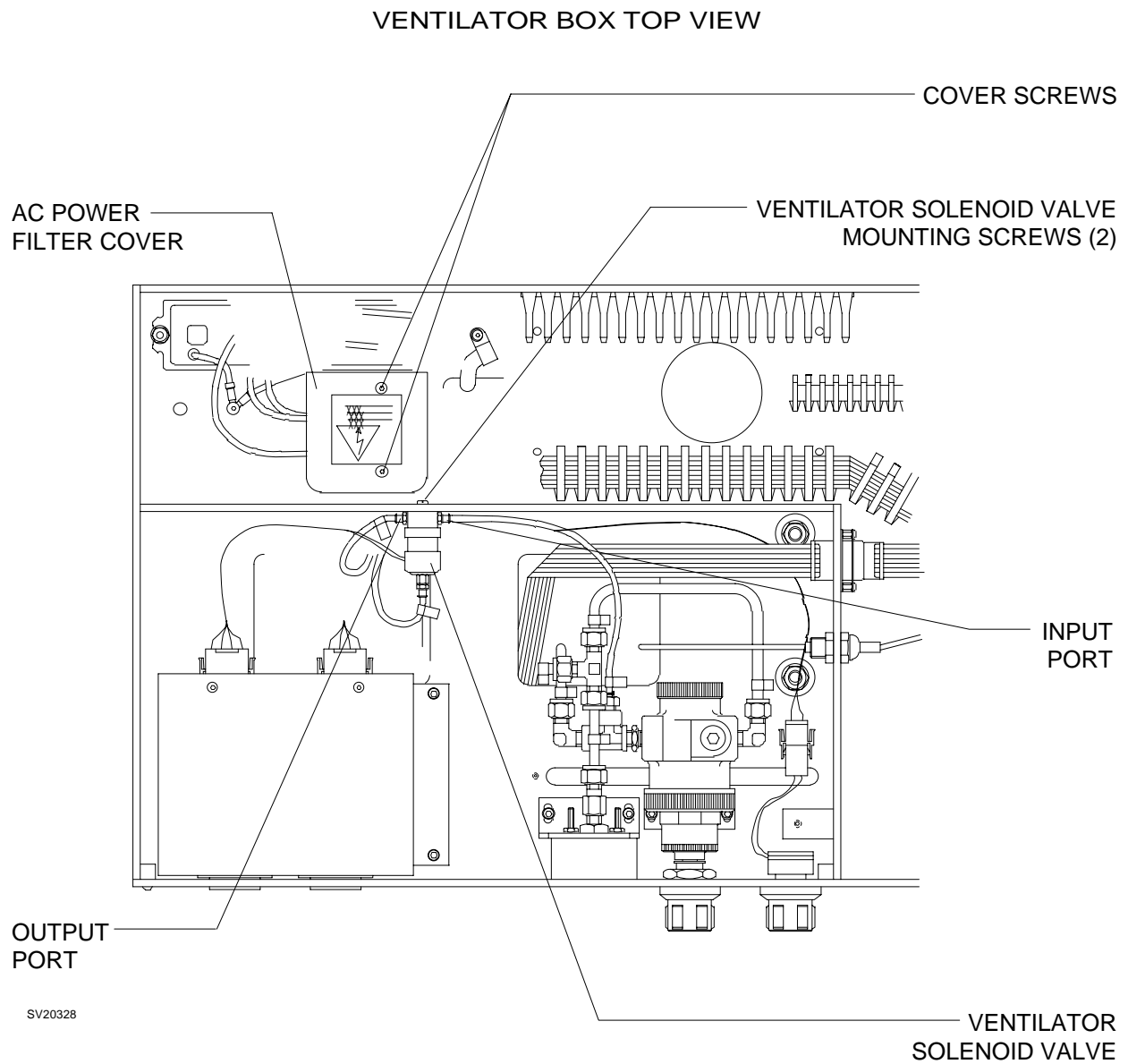


Figure 4-15: VENTILATOR SOLENOID VALVE

- 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 PMC 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

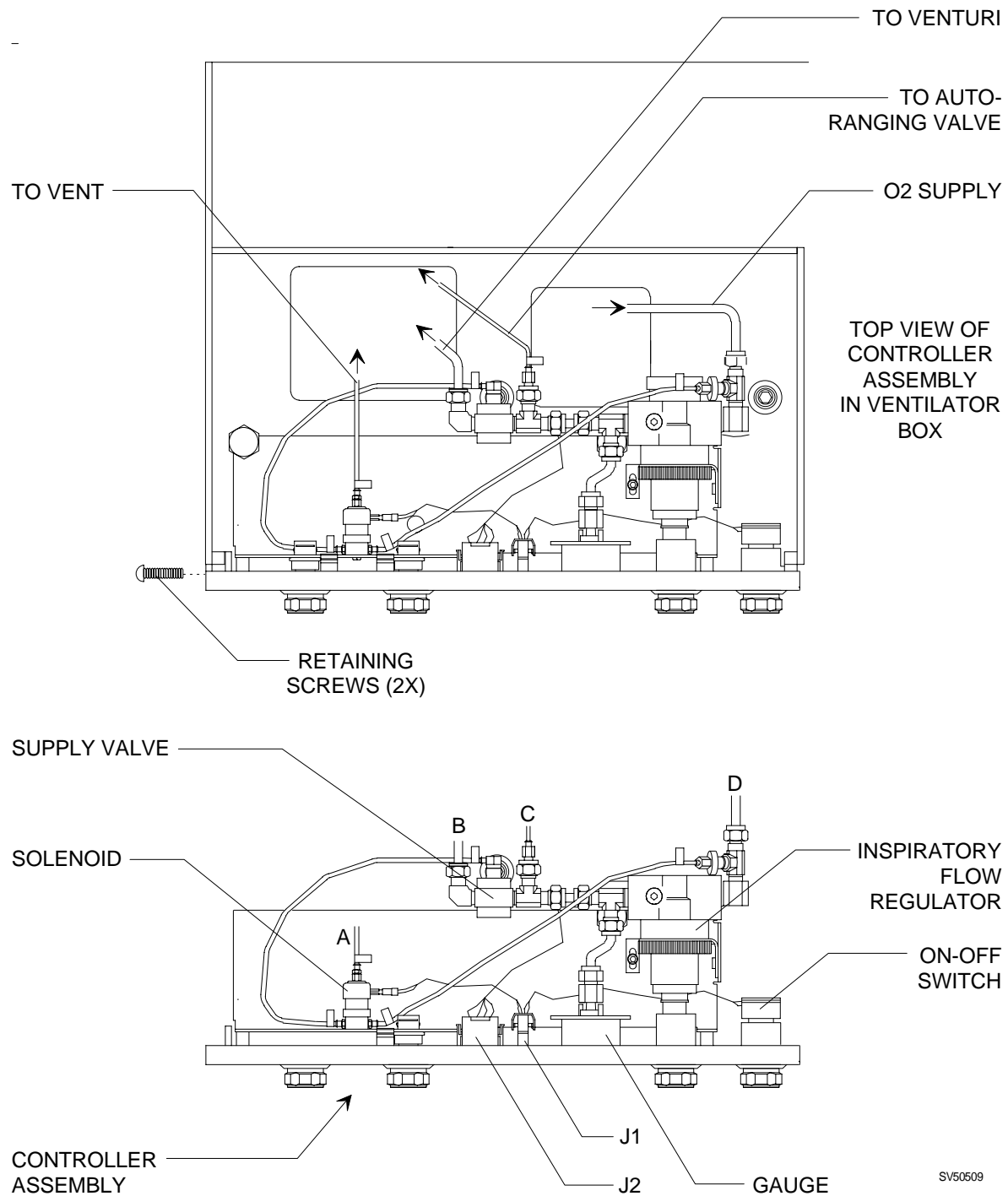
C: Small dia. tube to auto-ranging valve

D: Large dia. tube from main switch (O₂ 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.



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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 PMC 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.

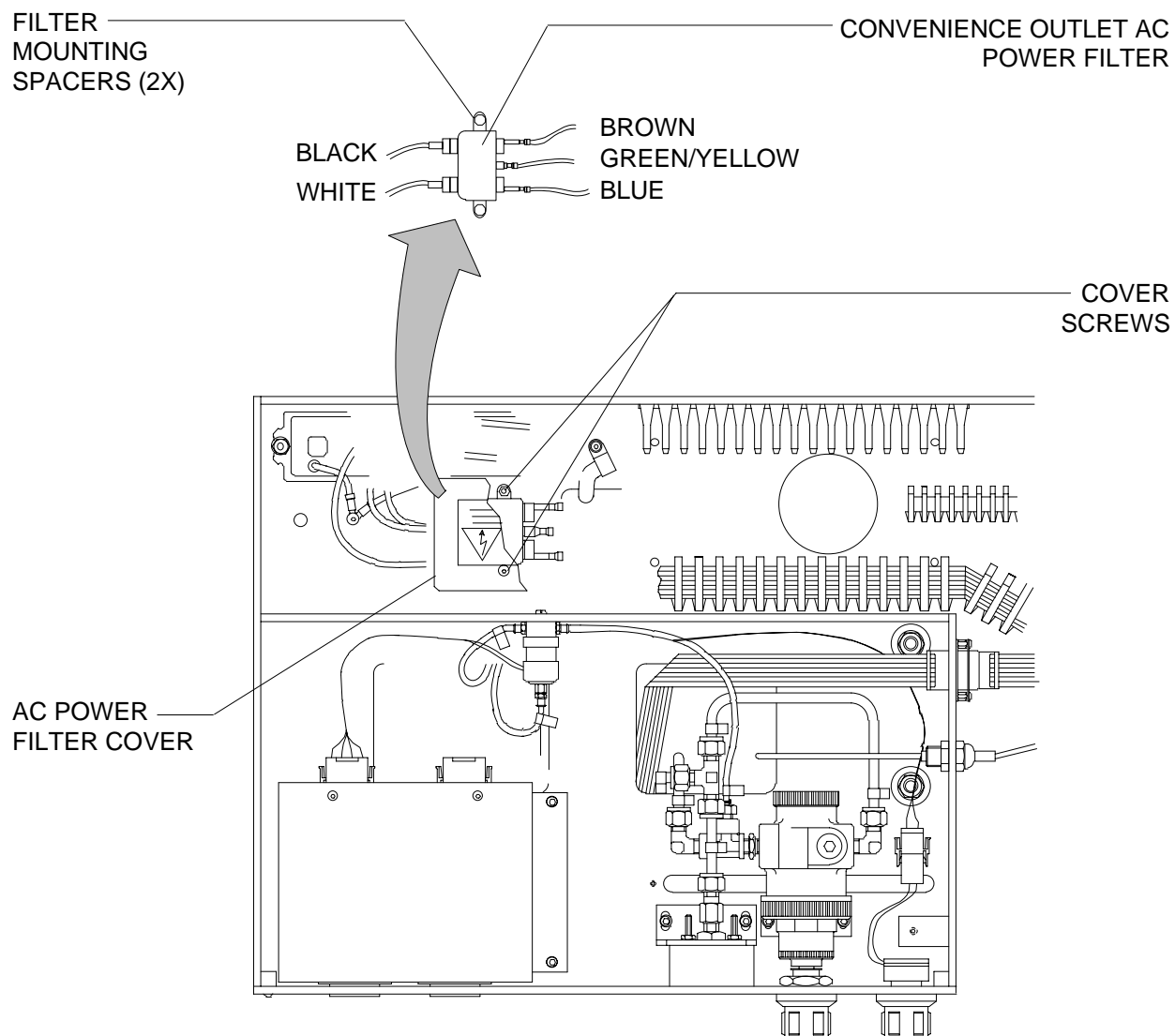
4.17.3 Raise the rear of the monitor box chassis approximately two inches, and prop the box open.

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.

VENTILATOR BOX TOP VIEW



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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 PMC 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.

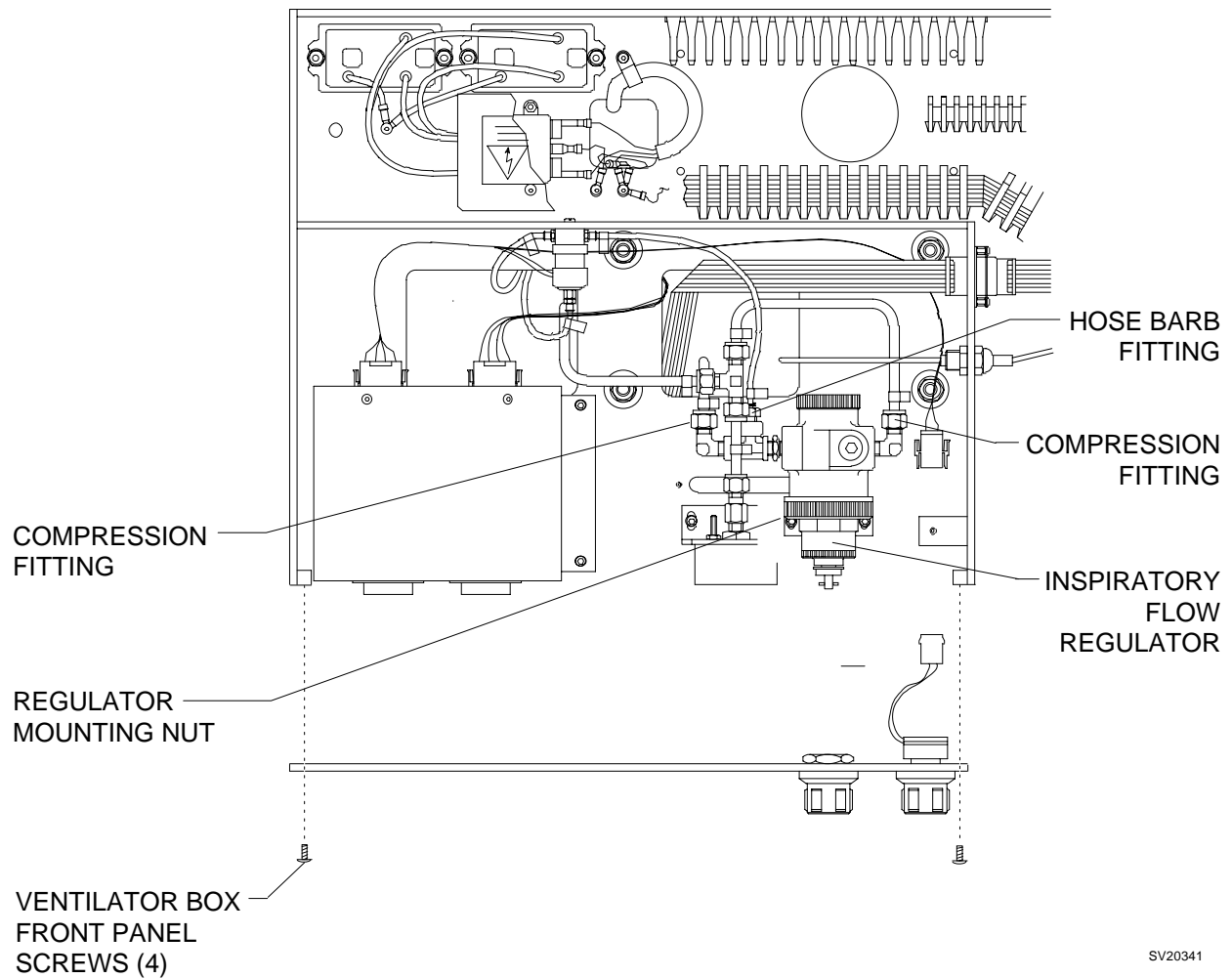
4.18.9 Connect the two compression fittings to the regulator.

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



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Figure 4-18: INSPIRATORY FLOW REGULATOR

REPLACEMENT PROCEDURES (continued)

NM2B

- 4.18.13 Join the ventilator switch in-line connector, and replace the front panel of the ventilator box.
- 4.18.14 Perform the PMC 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 O₂ 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.

REPLACEMENT PROCEDURES (continued)

NM2B

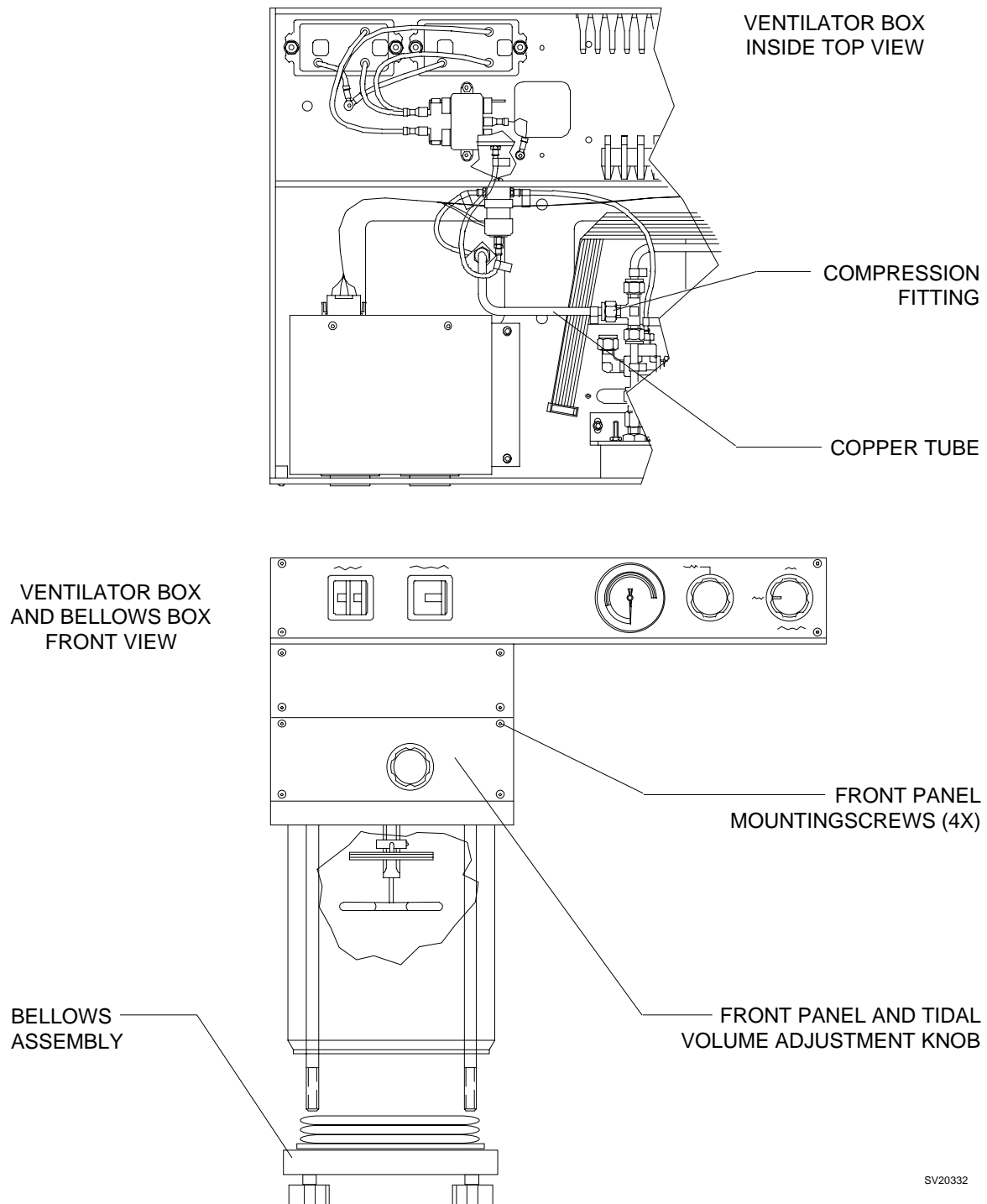


Figure 4-19: TWO-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY

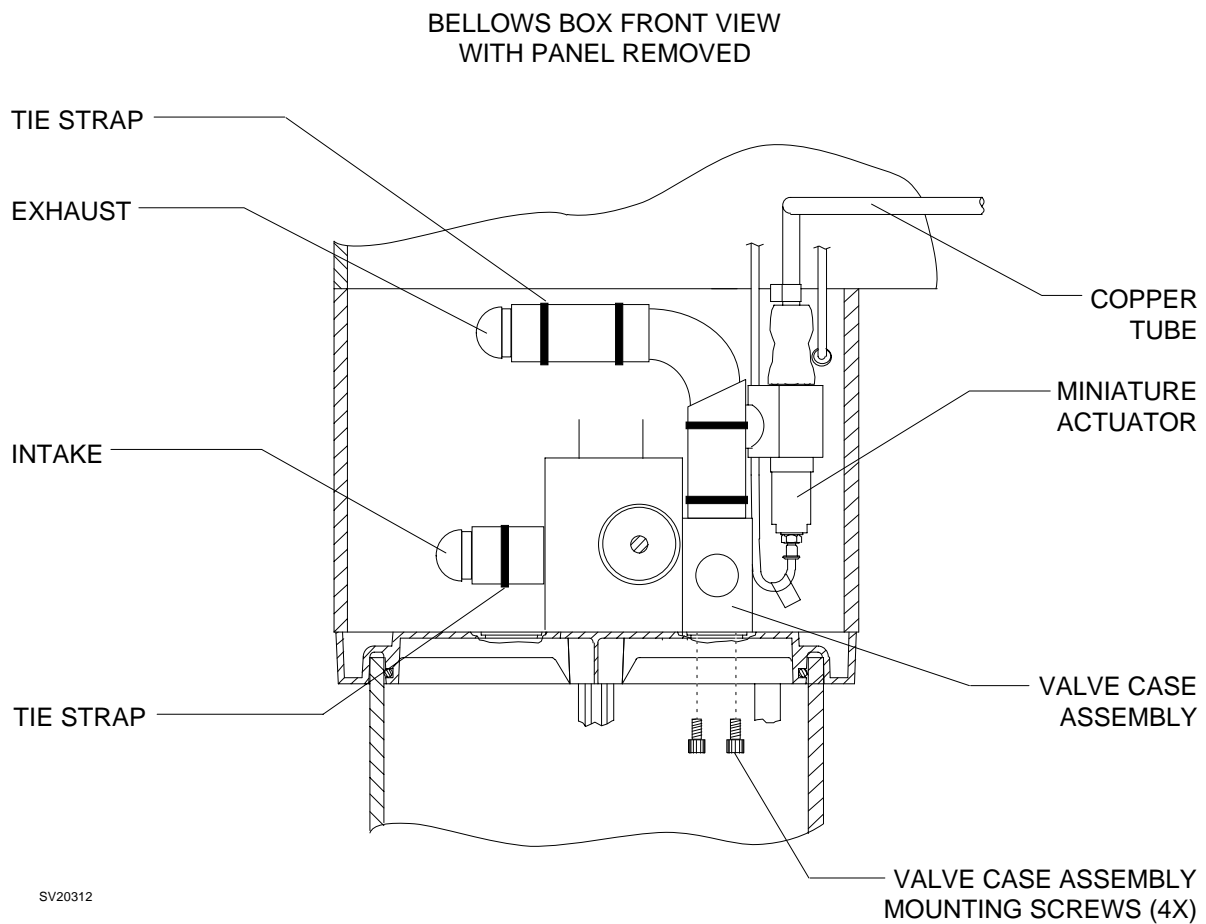


Figure 4-19: TWO-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY (continued)

REPLACEMENT PROCEDURES (continued)

NM2B

- 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 PMC 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 O₂ 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.

NM2B

REPLACEMENT PROCEDURES (continued)

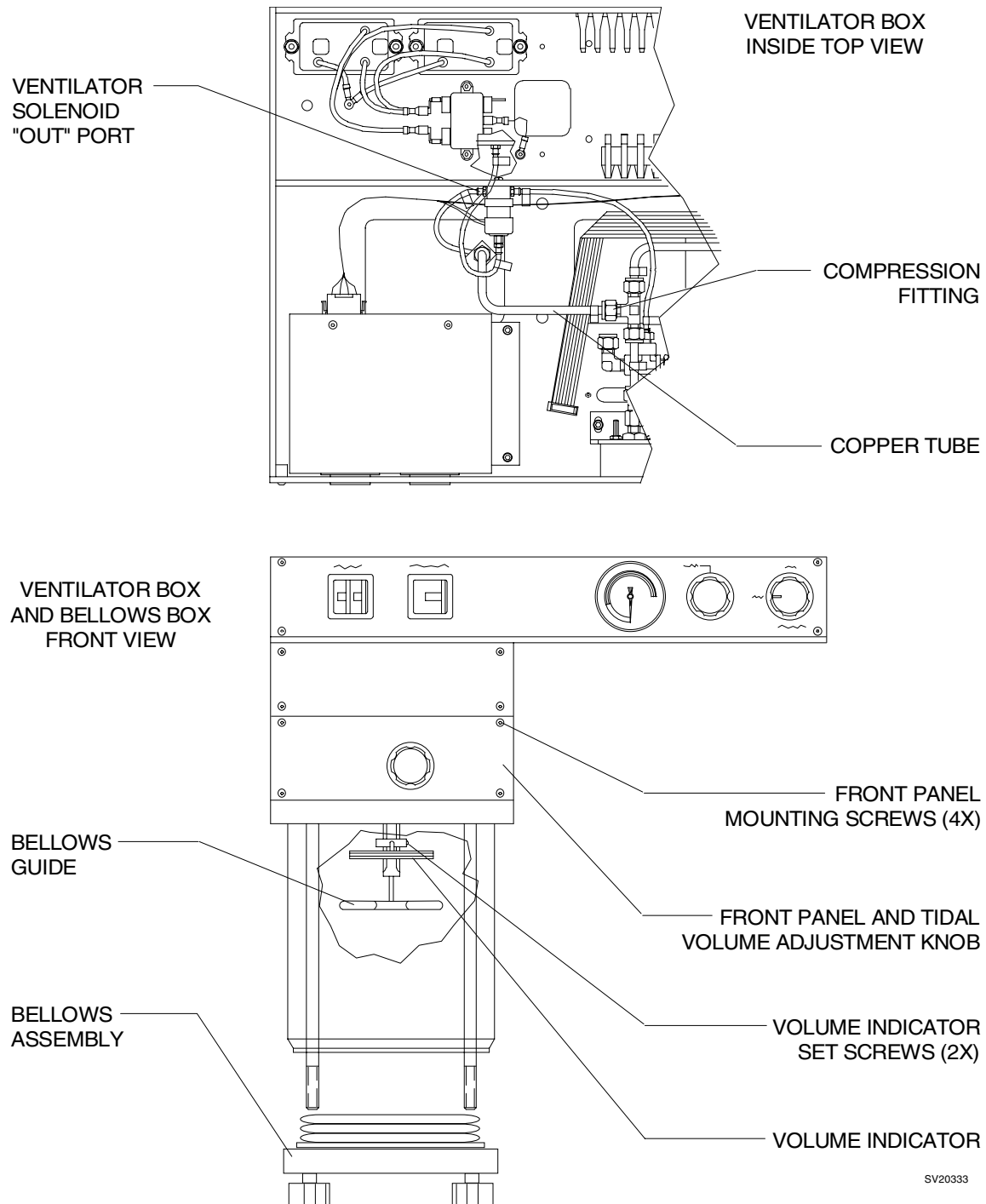


Figure 4-19A: ONE-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY

REPLACEMENT PROCEDURES (continued)

NM2B

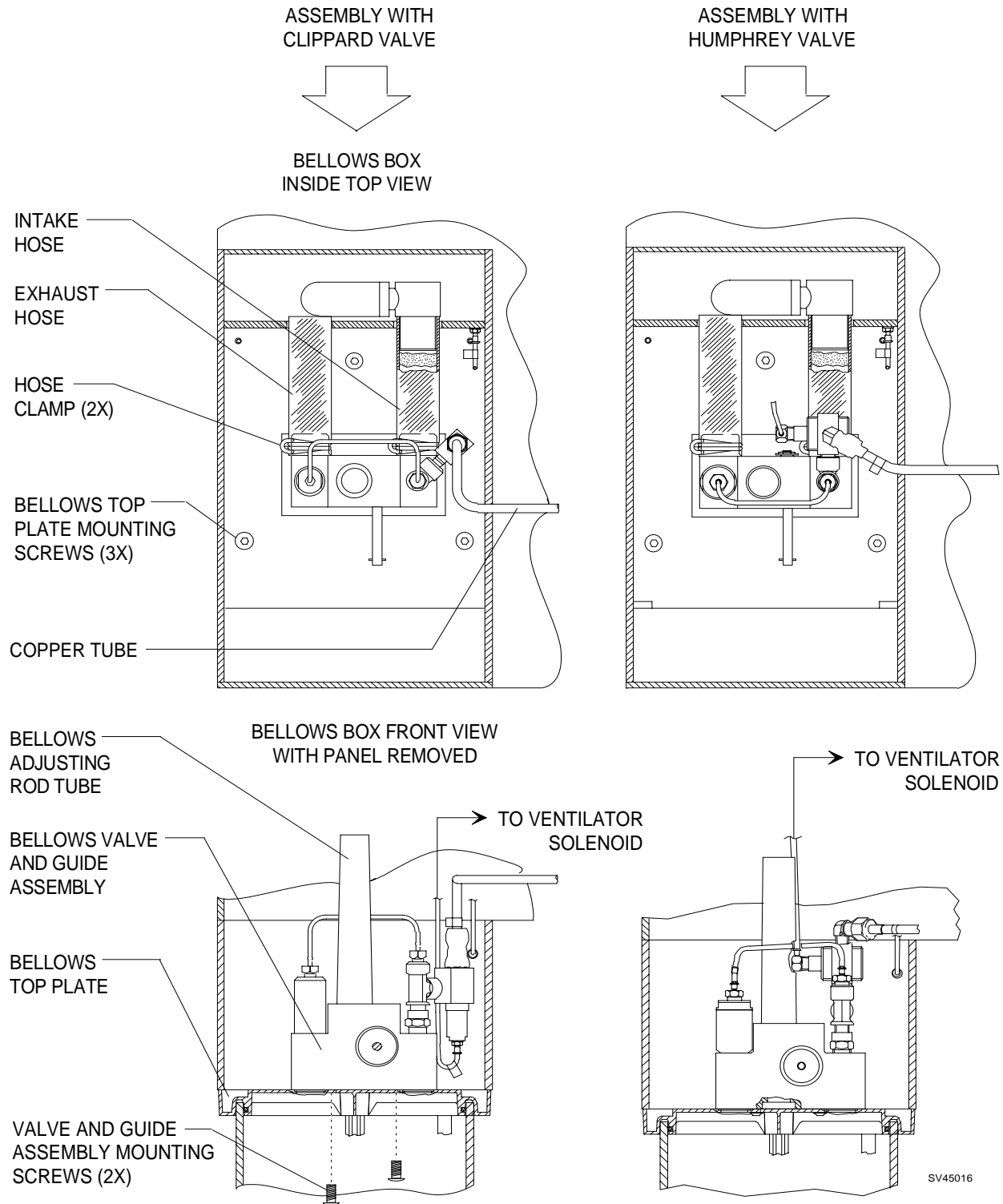


Figure 4-19A: ONE-PIECE TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY (continued)

- 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.

REPLACEMENT PROCEDURES (continued)	NM2B
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- 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 PMC 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 O₂ 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.

REPLACEMENT PROCEDURES (continued)

NM2B

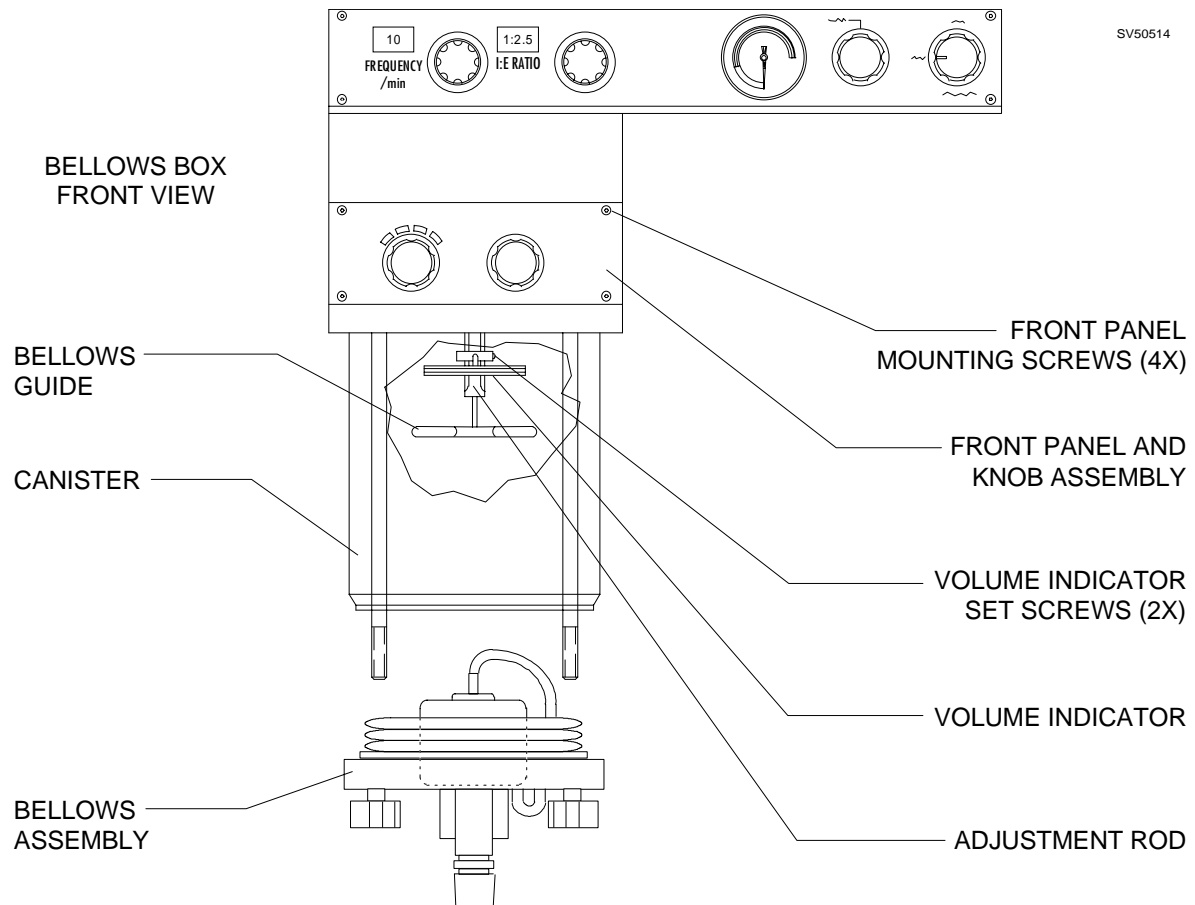


Figure 4-20: TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY

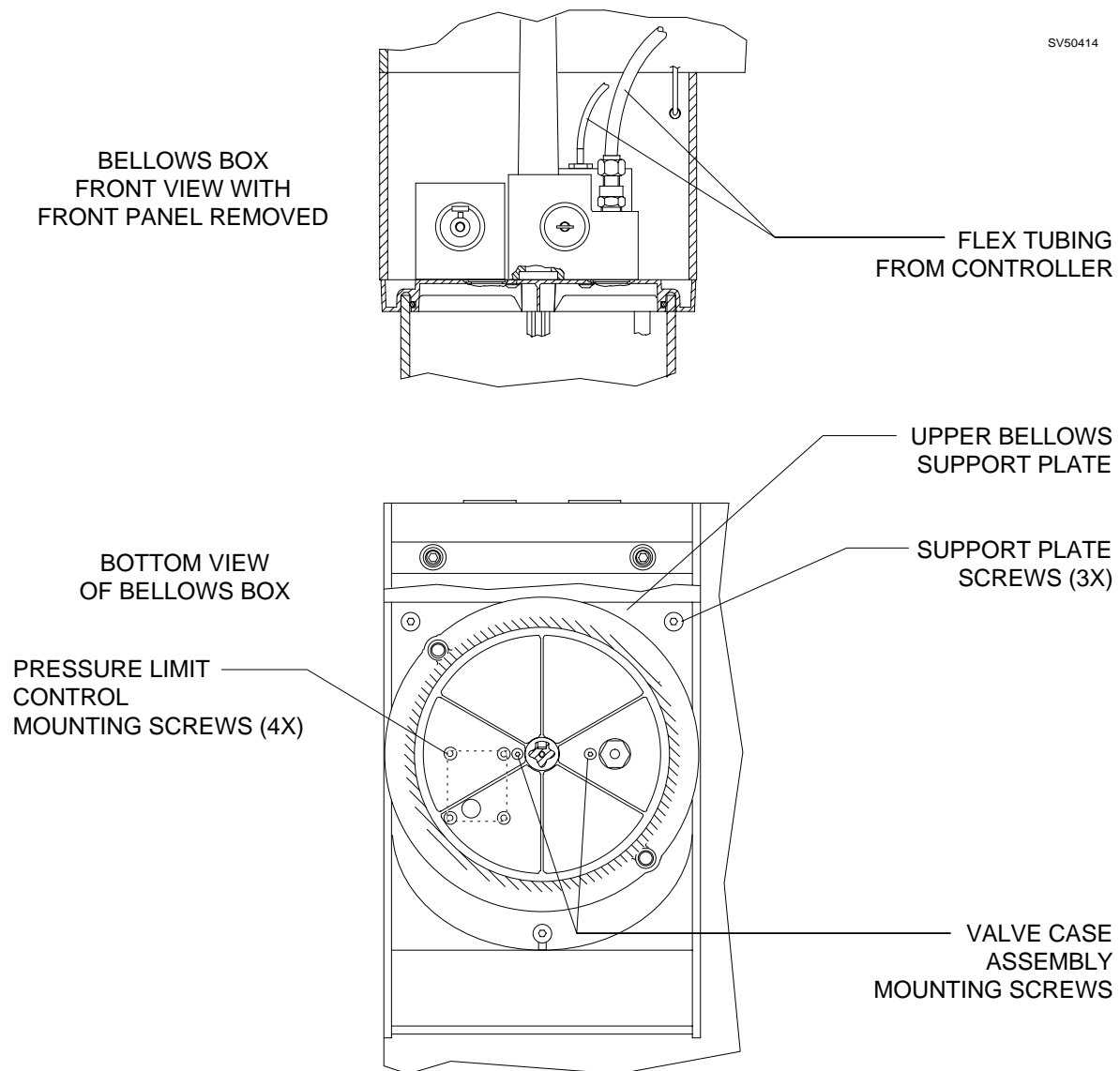


Figure 4-20: TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY (continued)

REPLACEMENT PROCEDURES (continued)

NM2B

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 PMC 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 O₂ 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 O₂/N₂O 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.

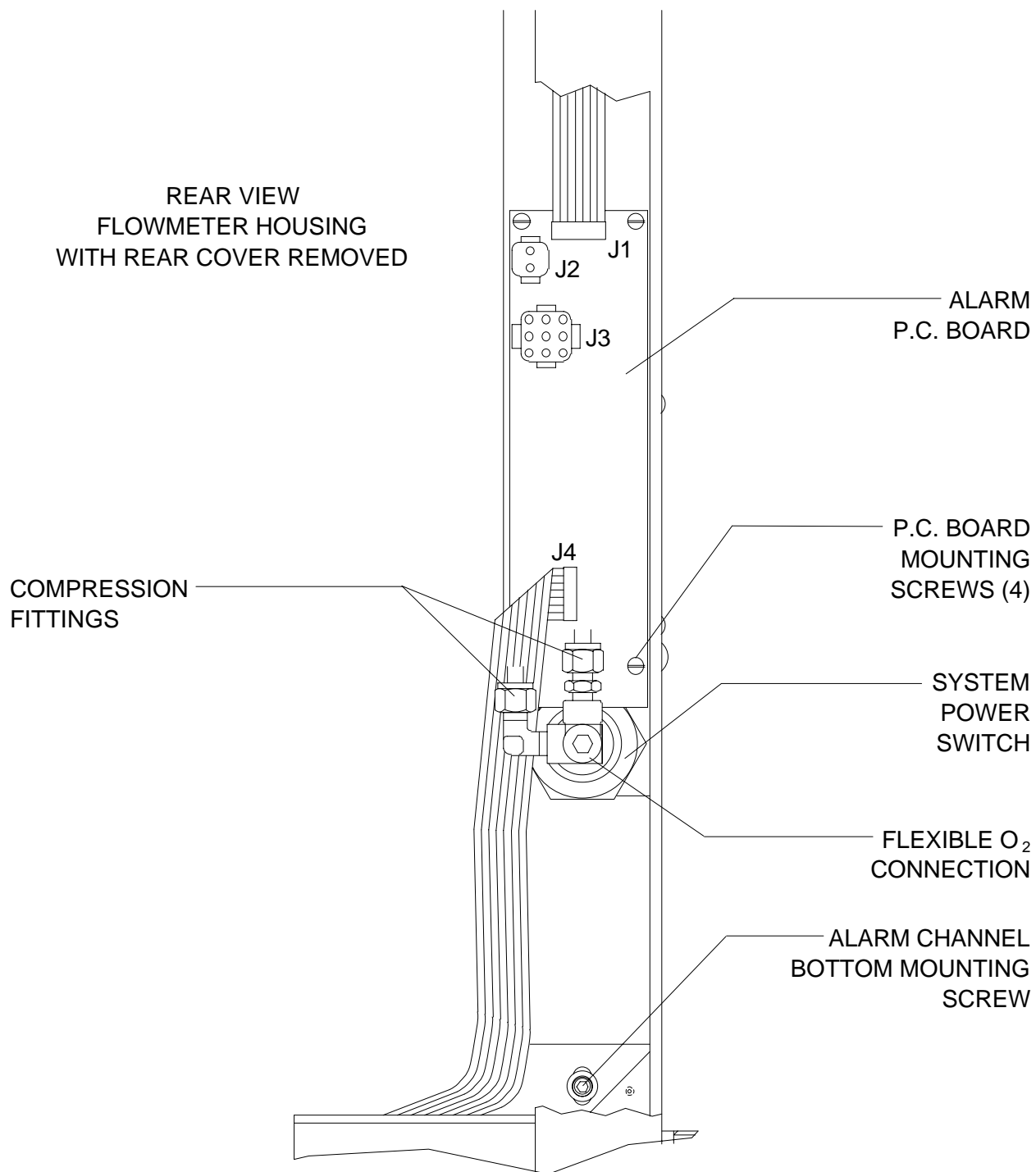


Figure 4-21: ALARM PANEL AND SYSTEM POWER SWITCH

- 4.21.10 Remove the alarm channel mounting screws. If the machine does not have an auxillary O₂ flow meter, skip the next two steps.
- 4.21.11 If the machine is equipped with an auxillary O₂ 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 PMC 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 O₂ 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 O₂ cylinder valve and the O₂ flow control valve. Press the O₂ 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 O₂ line nearest to the oxygen supply pressure alarm switch.
- 4.22.13 Disconnect the remaining two O₂ lines at the top and bottom of the tee fitting.
- 4.22.14 If the machine is equipped with an auxiliary O₂ flowmeter, cut the tie strap on its flexible line and carefully remove the flex line from the hose barb.

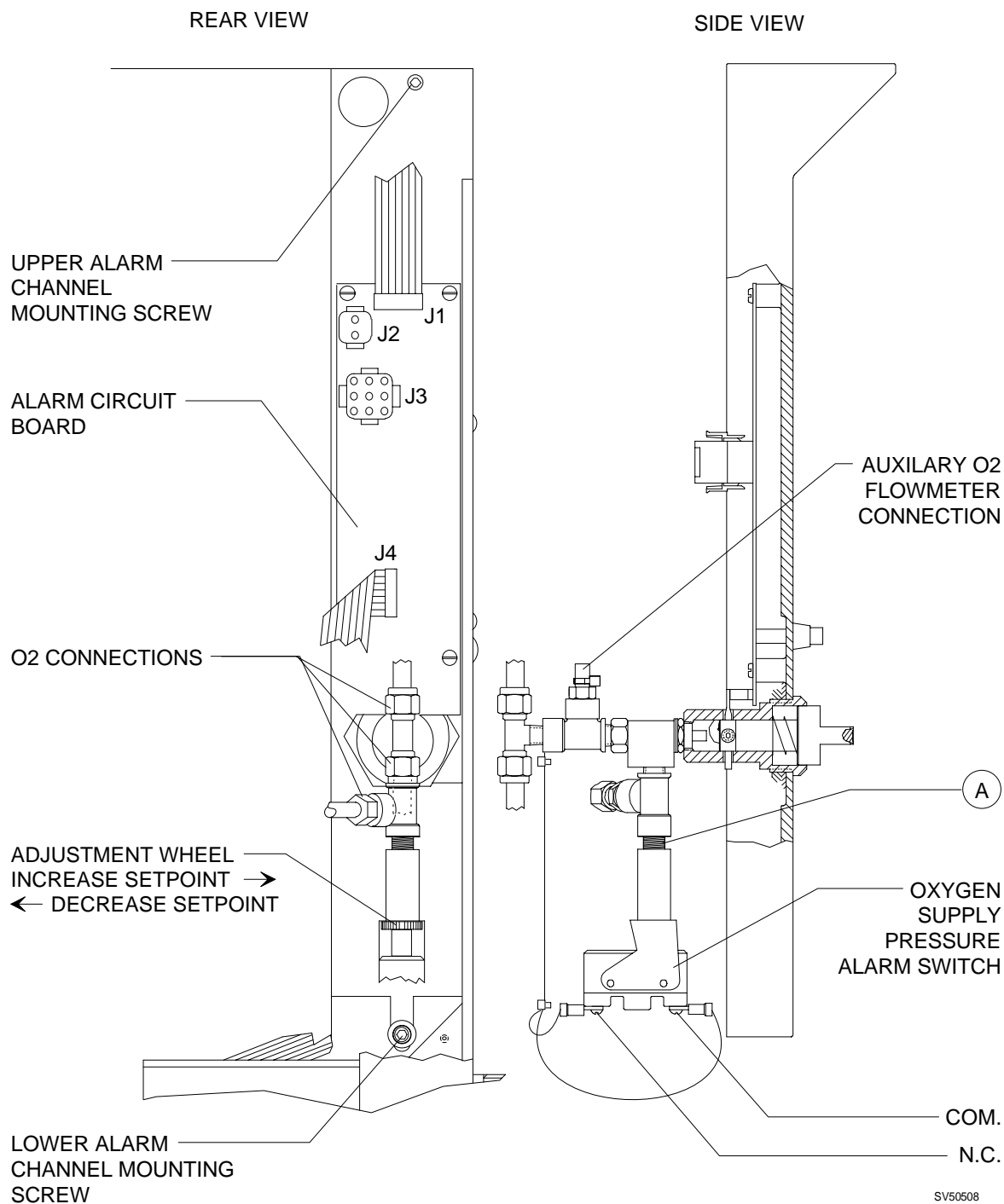


Figure 4-22: ALARM CHANNEL AND OXYGEN SUPPLY PRESSURE ALARM SWITCH

REPLACEMENT PROCEDURES (continued)

NM2B

- 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 O₂ flowmeter and install a new tie strap at the hose barb.
- 4.22.25 Reconnect the the O₂ 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 O₂ regulator and remove the plug from the tee fitting.
- 4.22.30 Connect a dedicated O₂ 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 O₂ 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 PMC 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.

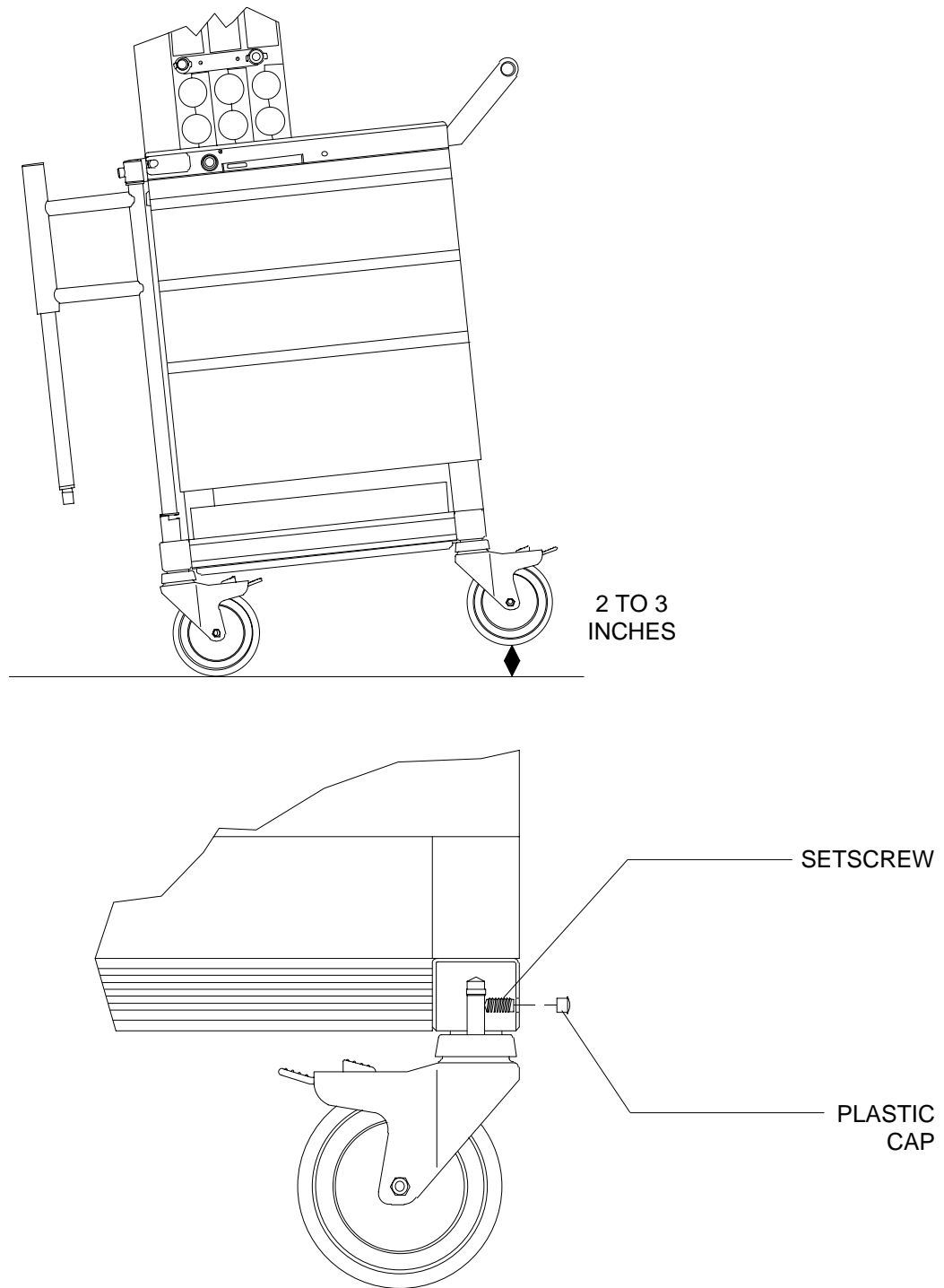


Figure 4-23: CASTER REPLACEMENT

REPLACEMENT PROCEDURES (continued)

NM2B

- 4.23.11 Perform the PMC 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.

REPLACEMENT PROCEDURES (continued)

NM2B

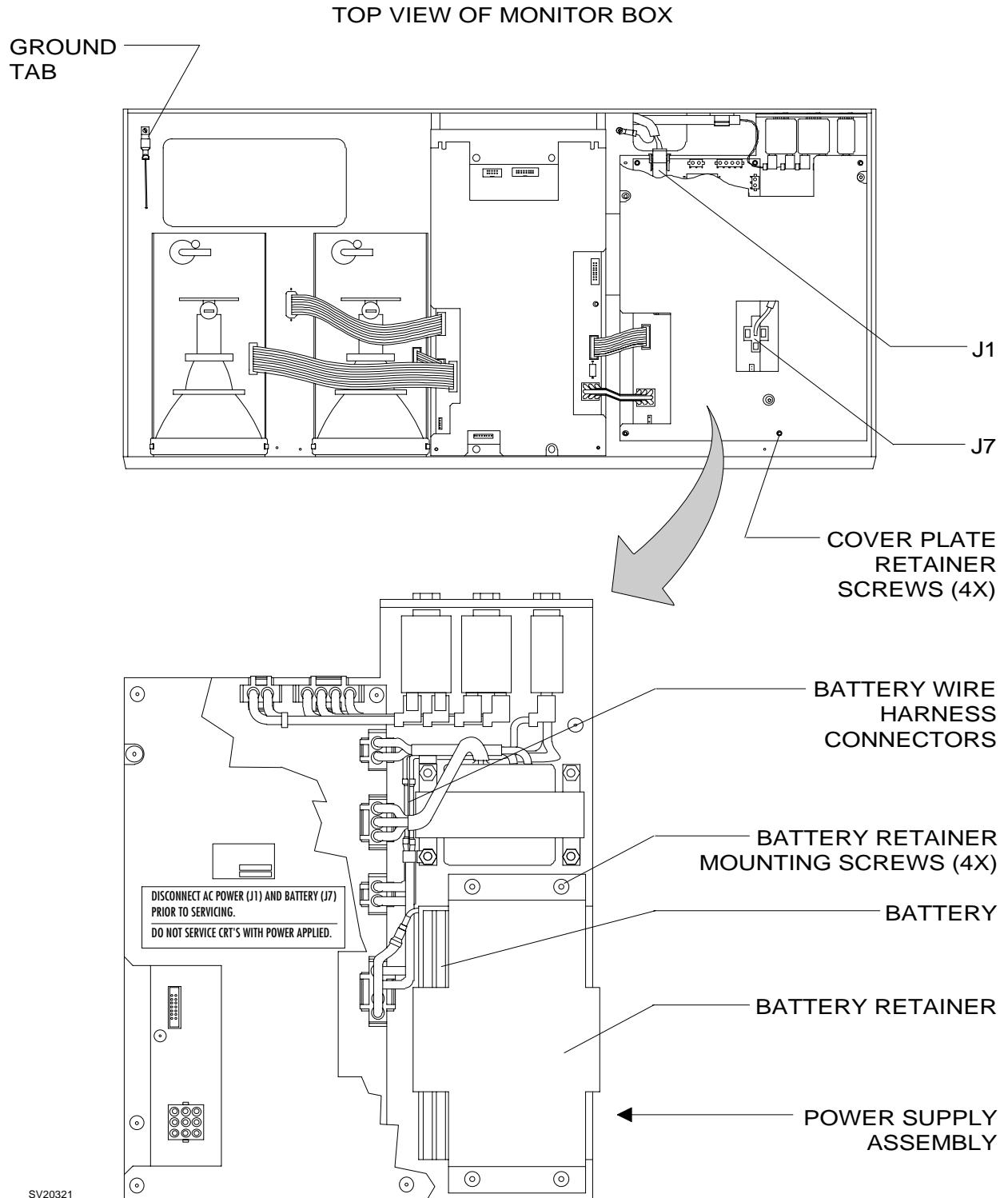


Figure 4-24: BATTERY REPLACEMENT

- 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 PMC 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

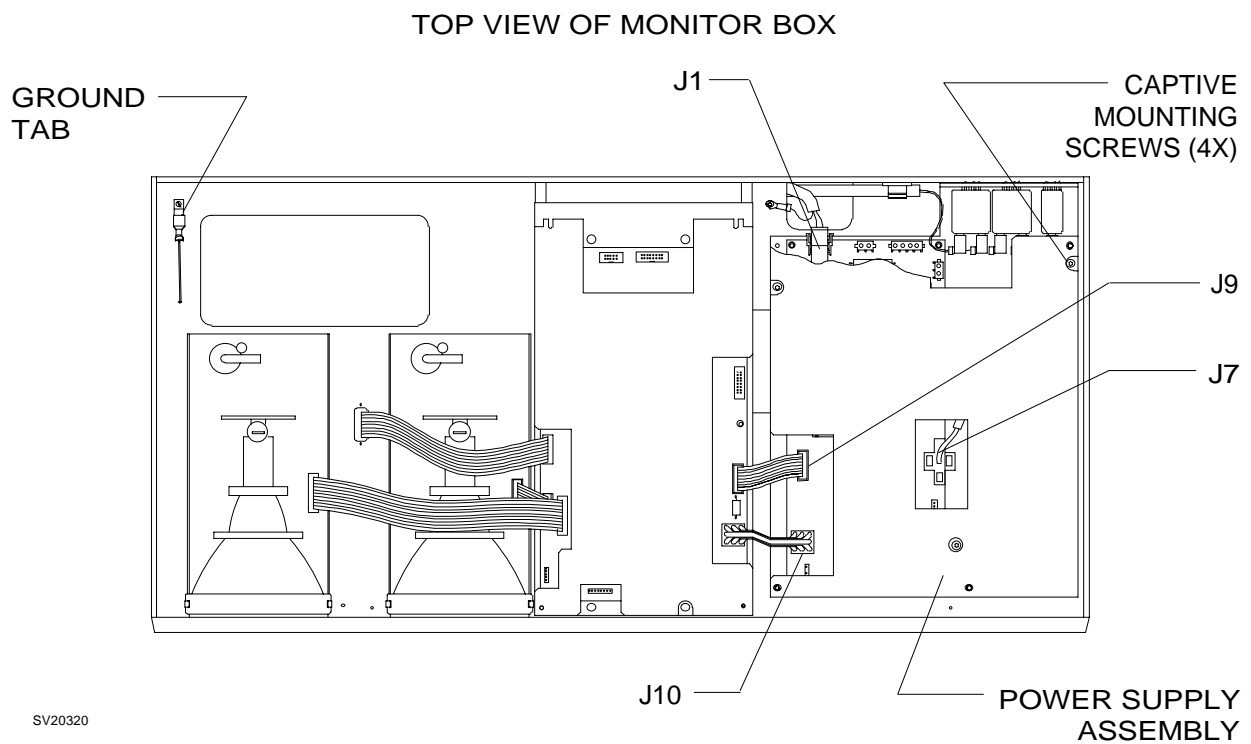


Figure 4-25: POWER SUPPLY

REPLACEMENT PROCEDURES (continued)

NM2B

- 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 PMC 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.

TOP VIEW OF MONITOR BOX

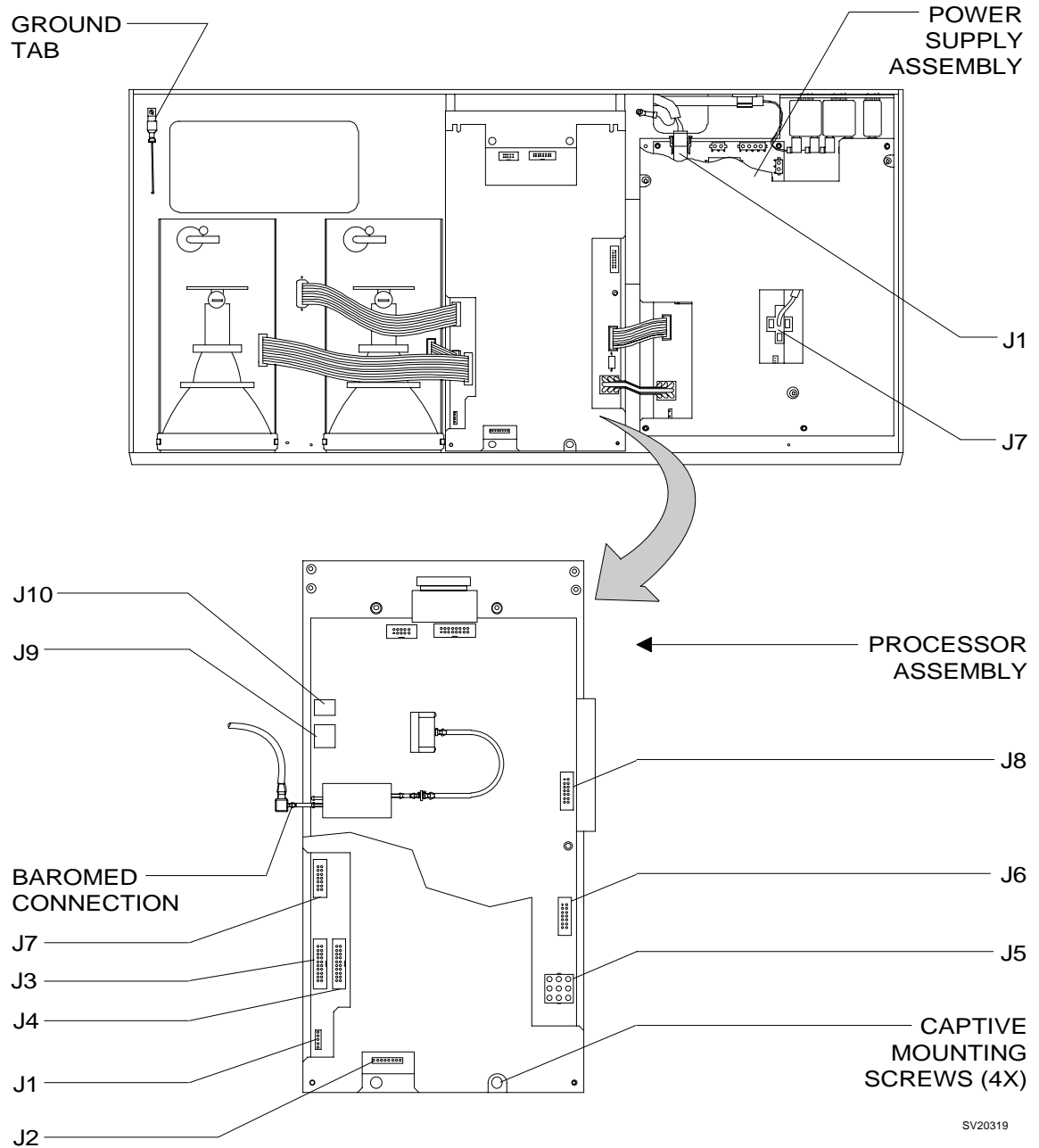


Figure 4-26: PROCESSOR ASSEMBLY

- 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 PMC 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.

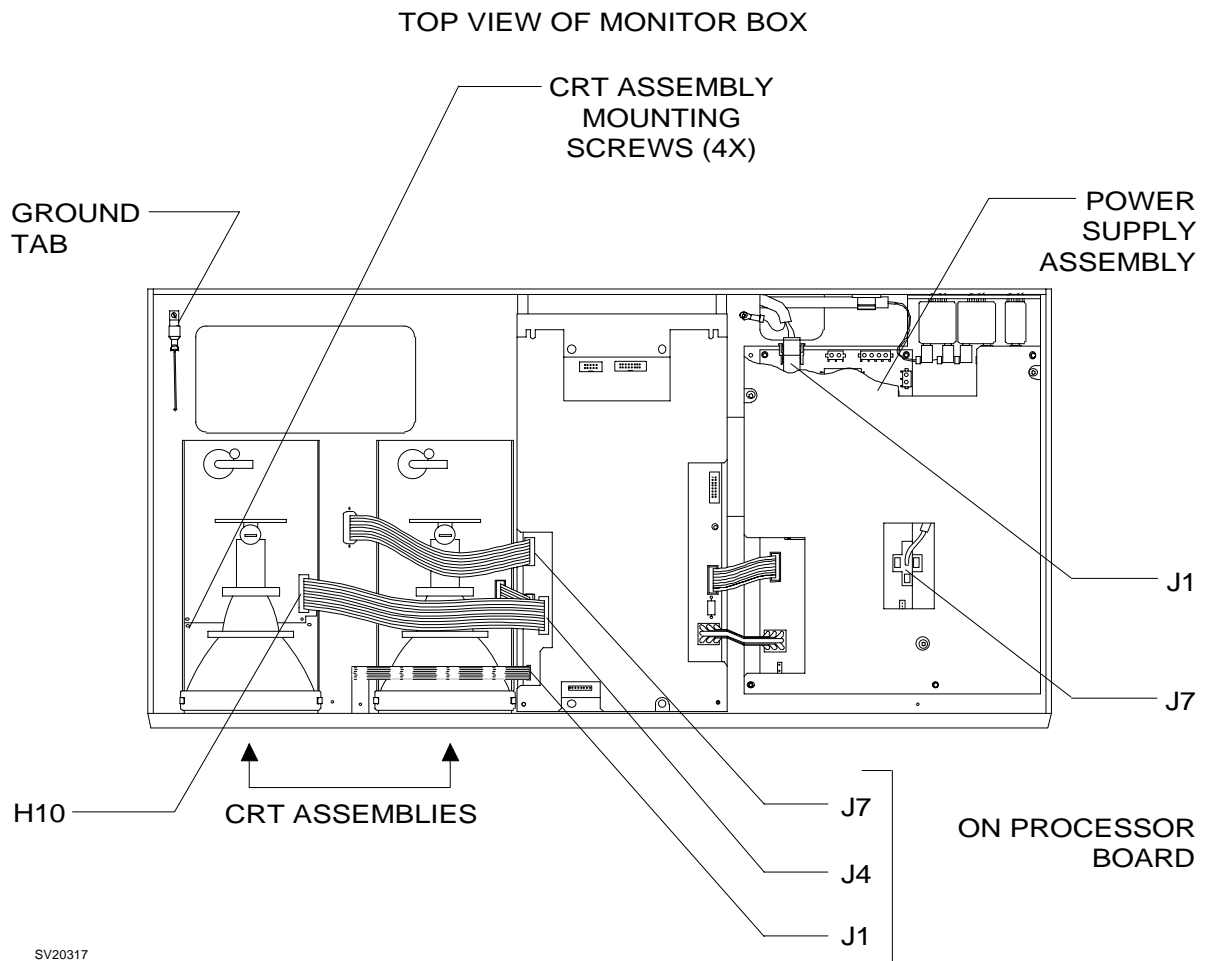


Figure 4-27: CRT ASSEMBLIES

REPLACEMENT PROCEDURES (continued)

NM2B

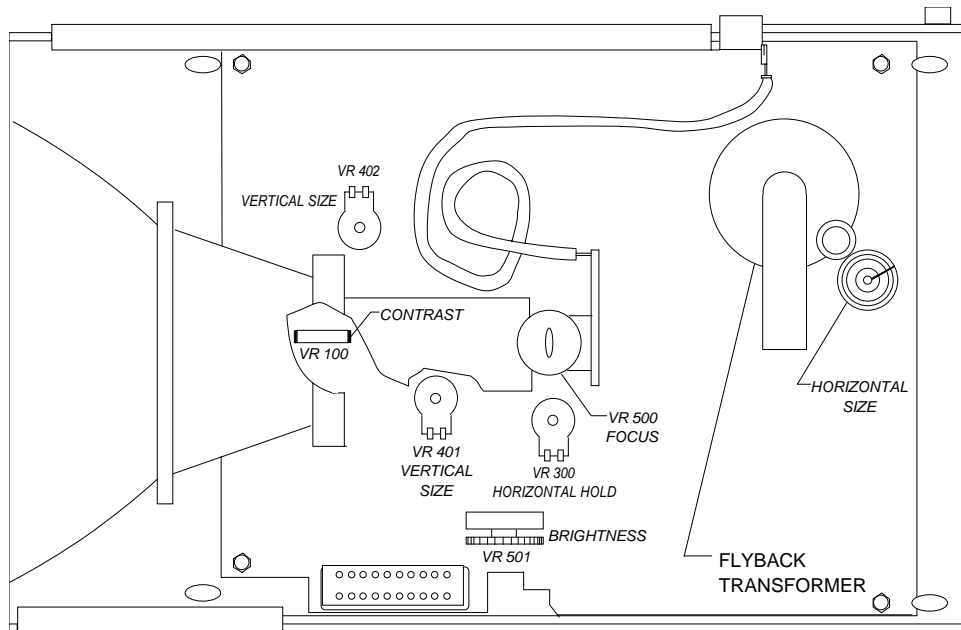


Figure 4-27A: CRT ADJUSTMENTS

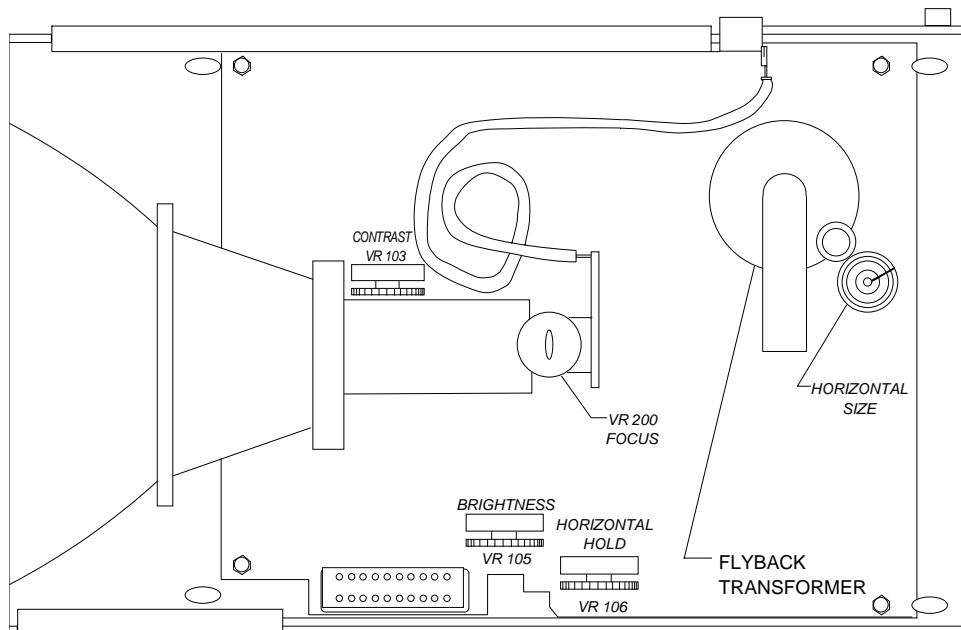


Figure 4-27B: CRT ADJUSTMENTS (ALTERNATE MODEL)

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 PMC 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.

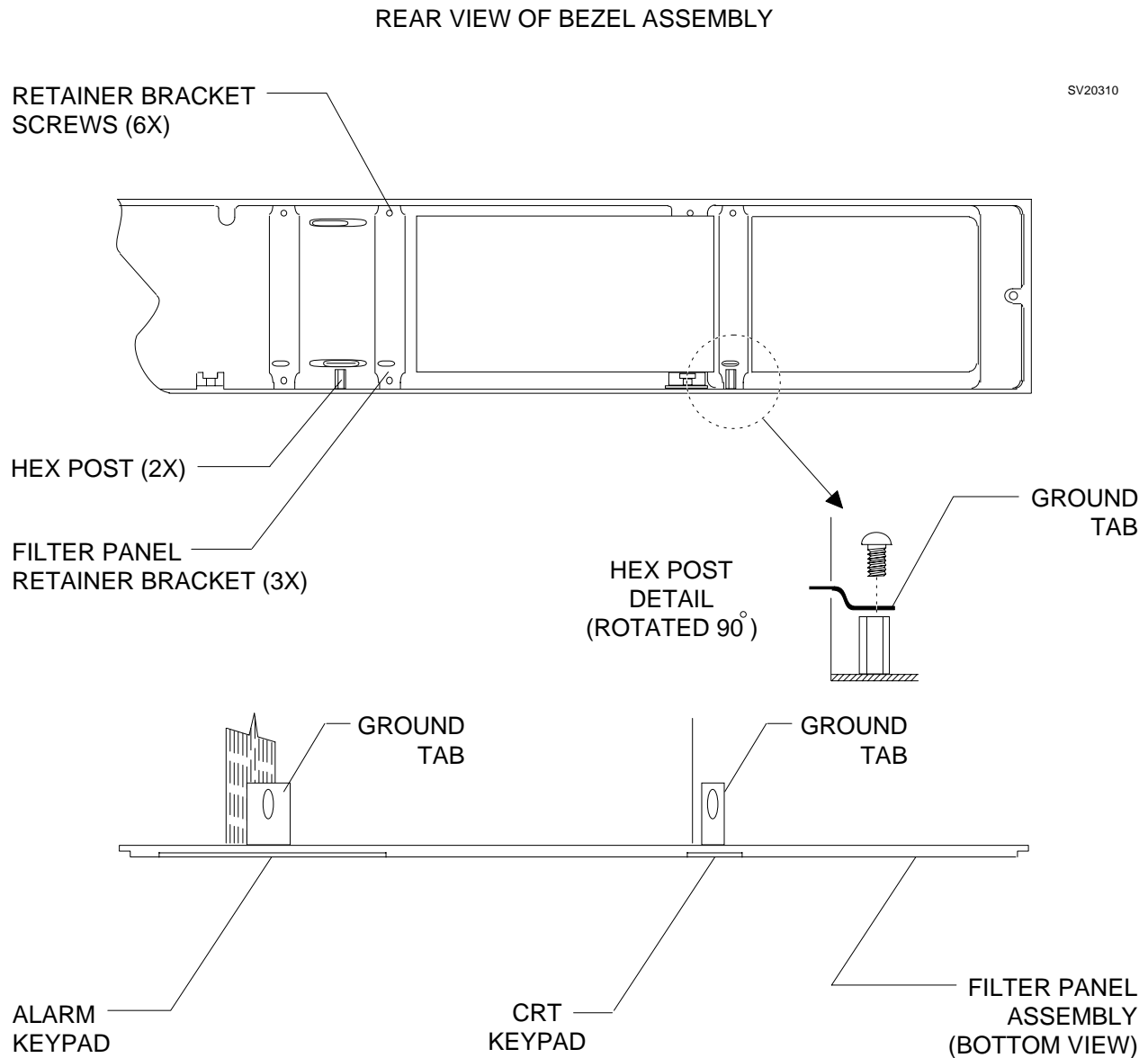


Figure 4-28: ALARM AND CRT KEYPADS

REPLACEMENT PROCEDURES (continued)

NM2B

- 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 PMC 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.

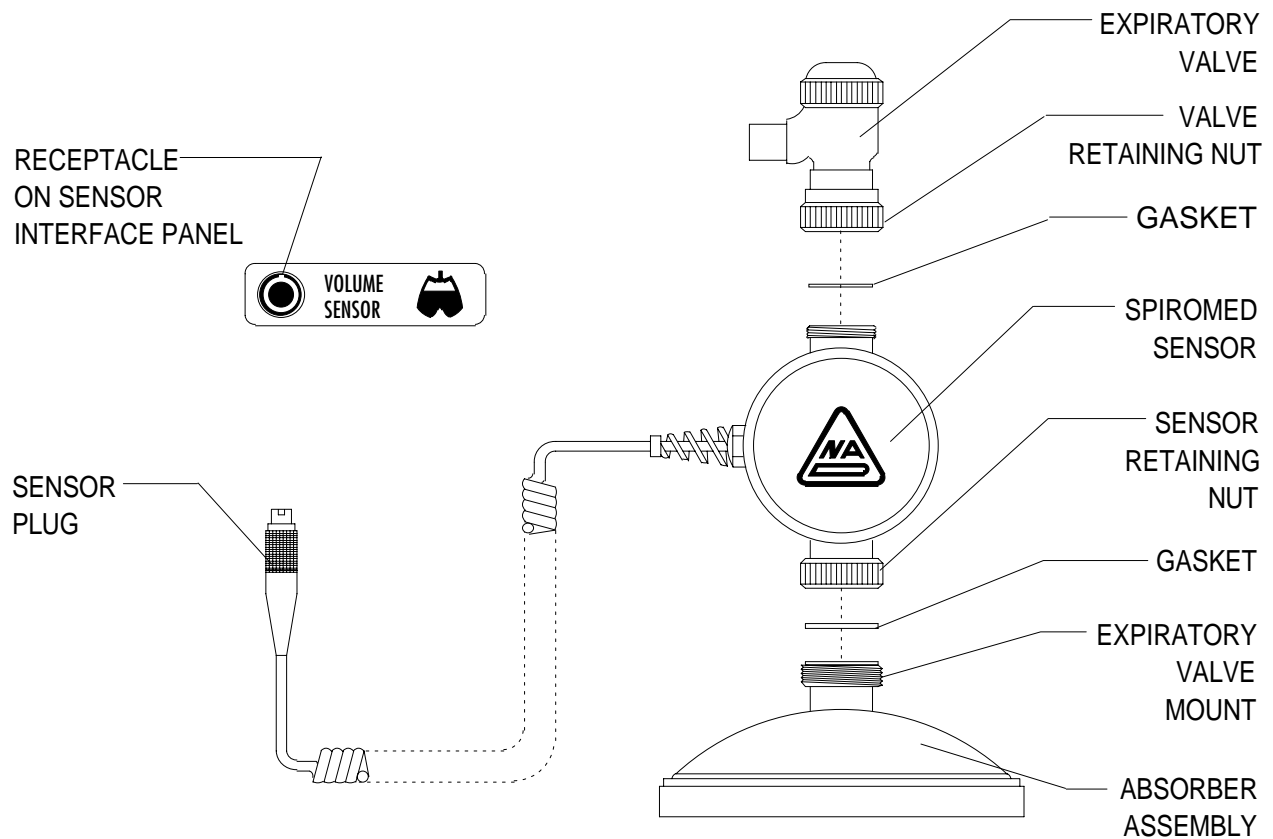
- 4.29.1 Set the System Power switch to STANDBY.
- 4.29.2 Disconnect the sensor plug from the volume sensor receptacle on the interface panel.
- 4.29.3 Remove the expiratory valve by unscrewing the valve retaining nut.
- 4.29.4 Remove the volume sensor from the absorber assembly by unscrewing its retaining 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 PMC Procedure given in Section 6.

REPLACEMENT PROCEDURES (continued)

NM2B



SV40431

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 PMC Procedure given in Section 6.

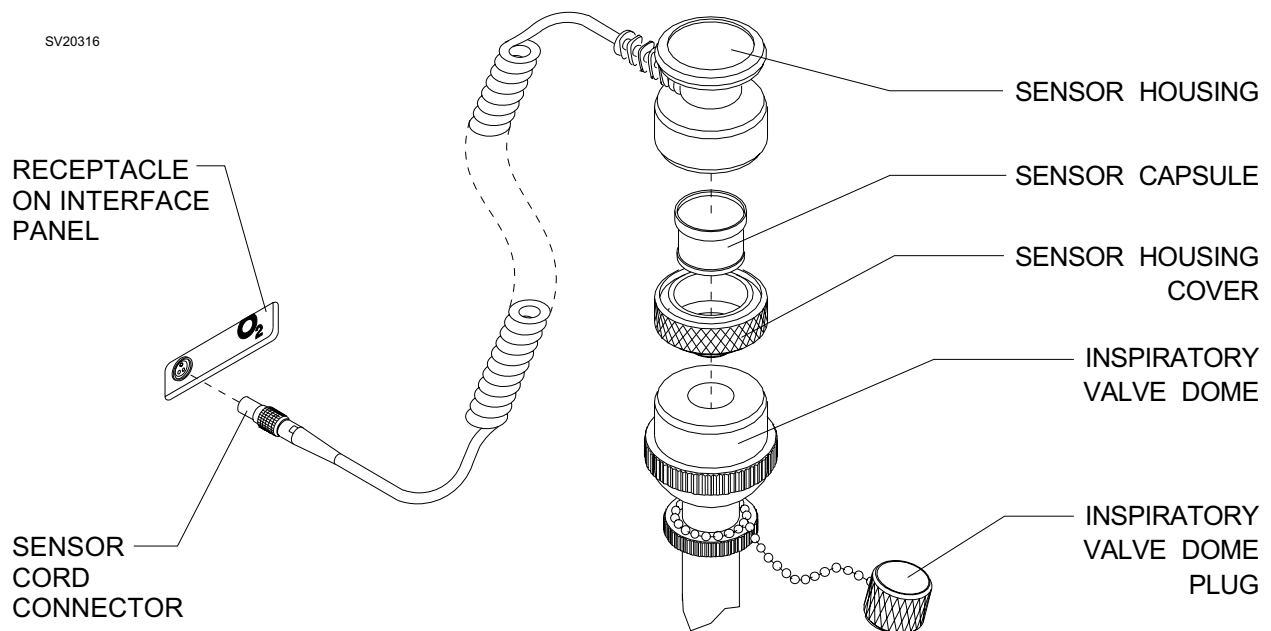


Figure 4-30: OXYGEN SENSOR REPLACEMENT

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.

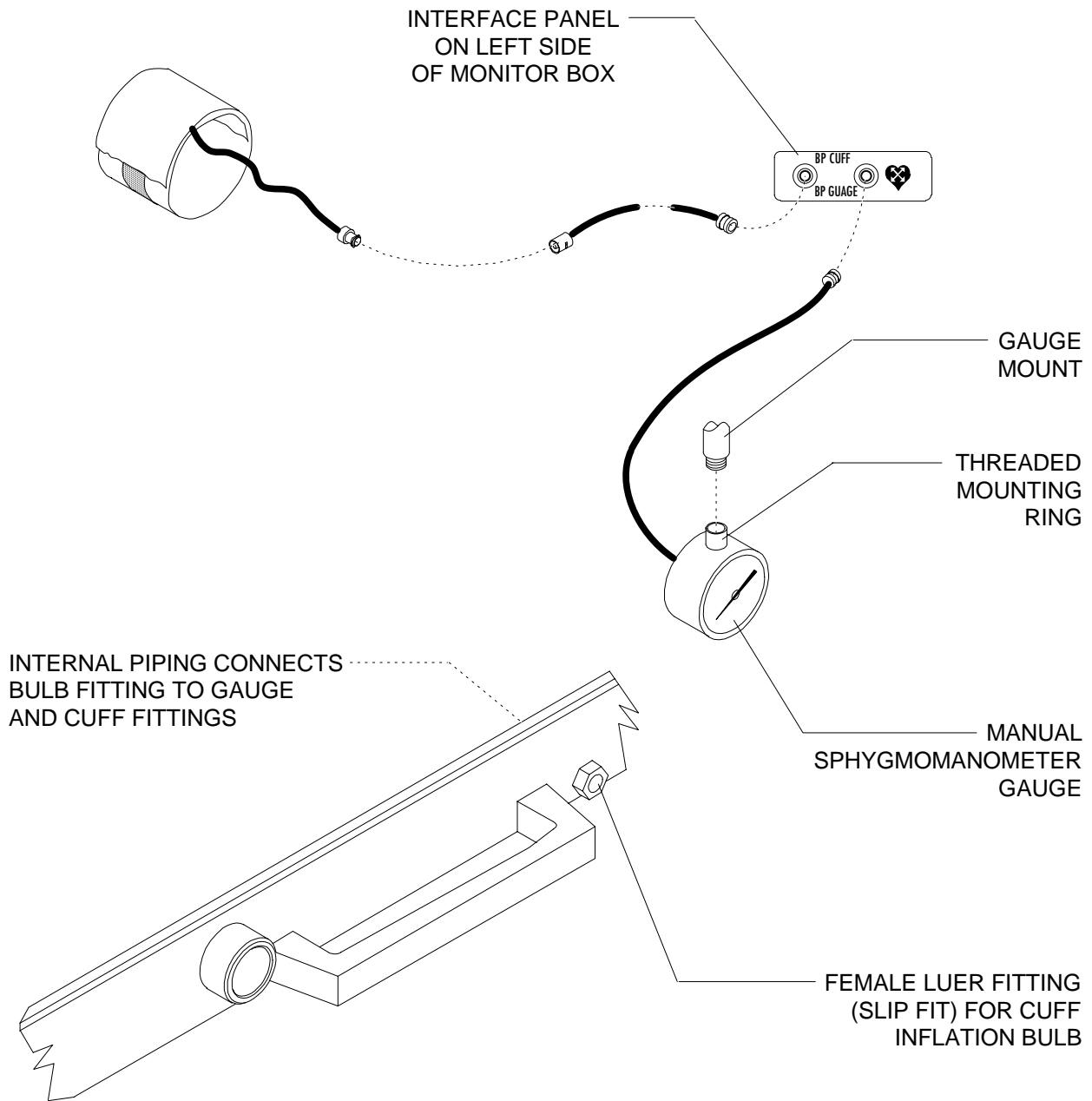
Connect the inflation bulb hose to the BP BULB fitting on the front of the machine.

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.



SV20620

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 O₂ 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 O₂ 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 O₂ 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 O₂ 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 PMC Procedure given in Section 6.

REPLACEMENT PROCEDURES (continued)

NM2B

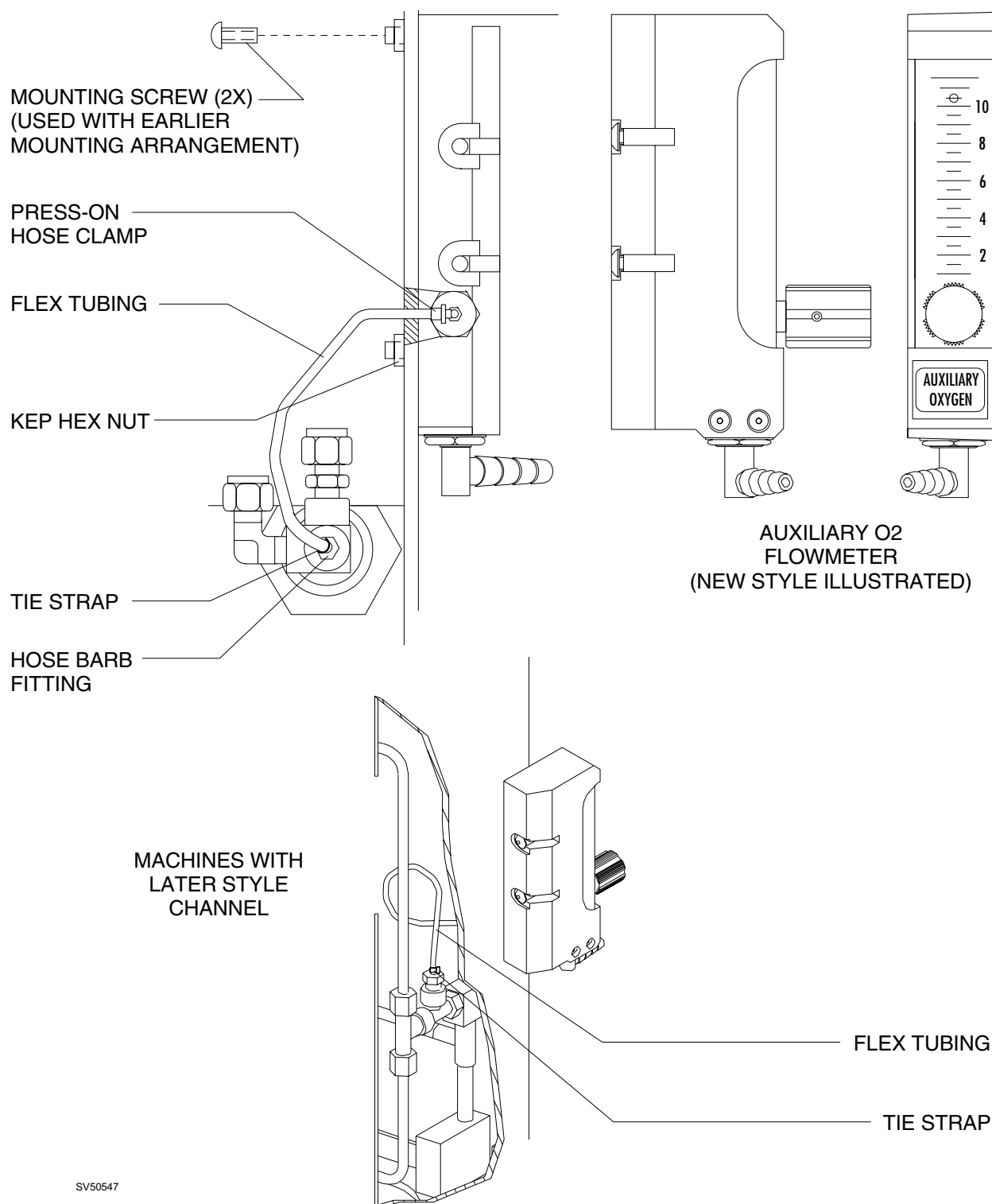


Figure 4-32: AUXILIARY O₂ FLOWMETER

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 PMC procedure given in Section 6.

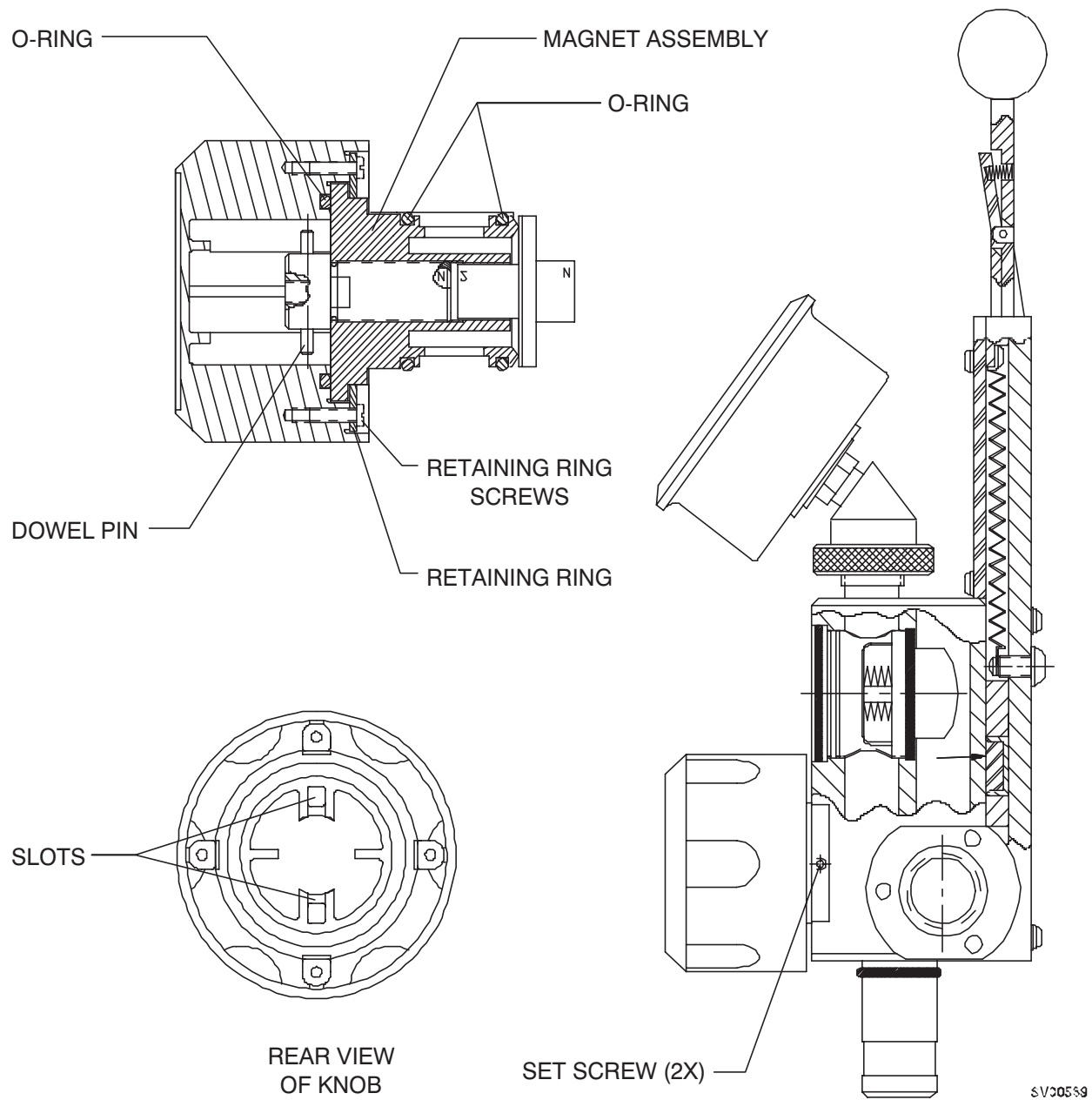


Figure 4-33: PEEP Valve Magnet Assembly Replacement

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

ADJUSTMENT AND CALIBRATION PROCEDURES (continued)

NM2B

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 O₂ 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 O₂ 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 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 N₂O 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 PMC Procedure given in Section 6.

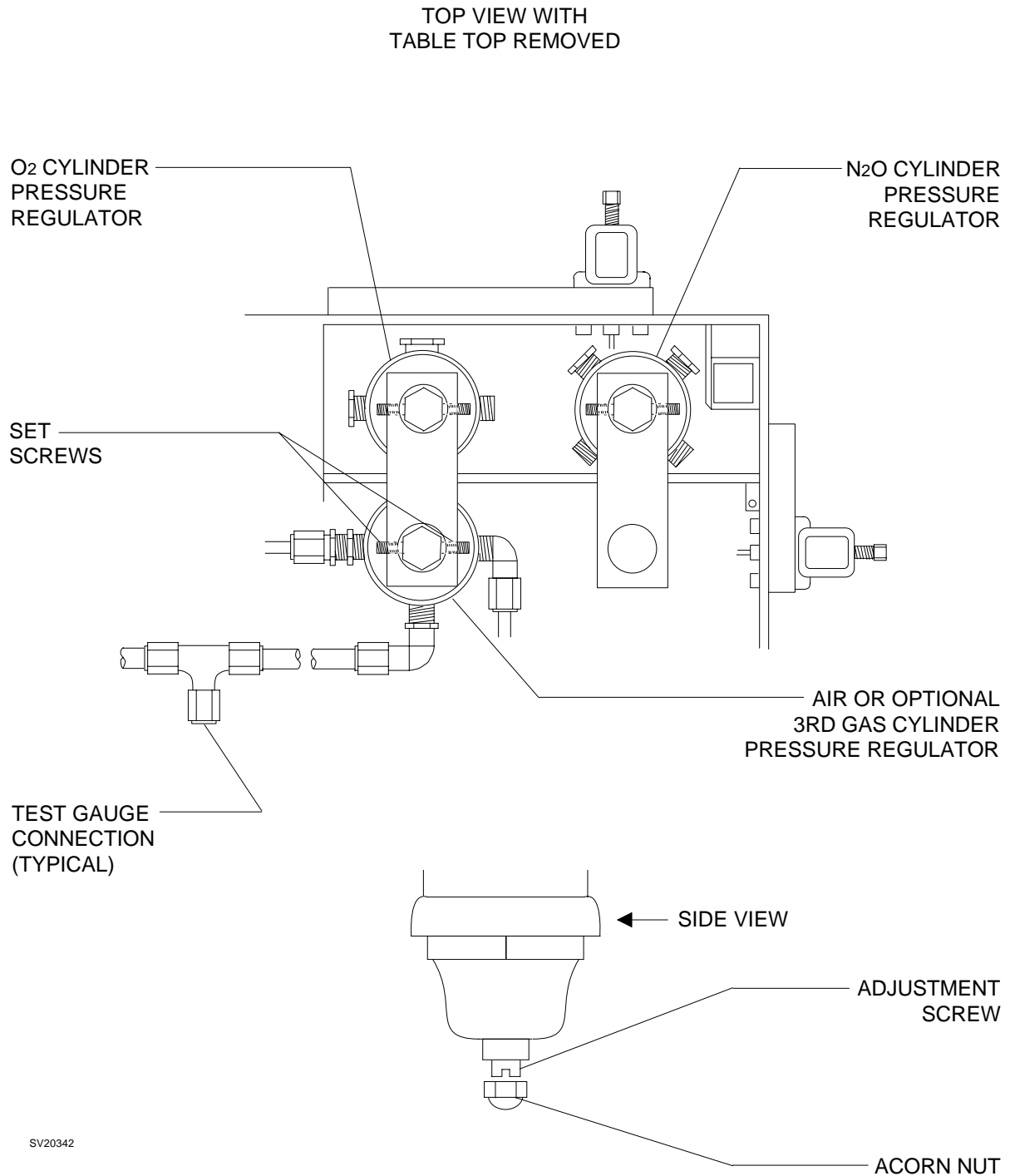


Figure 5-1: CYLINDER PRESSURE REGULATOR ADJUSTMENT

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 CO₂ cylinder valve and set the System Power switch to ON.

5.1.3.A Fully open the CO₂ flow control valve.

5.1.4.A Remove the acorn nut on the bottom of the CO₂ regulator to expose the adjusting screw. Turn the screw until the CO₂ 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.

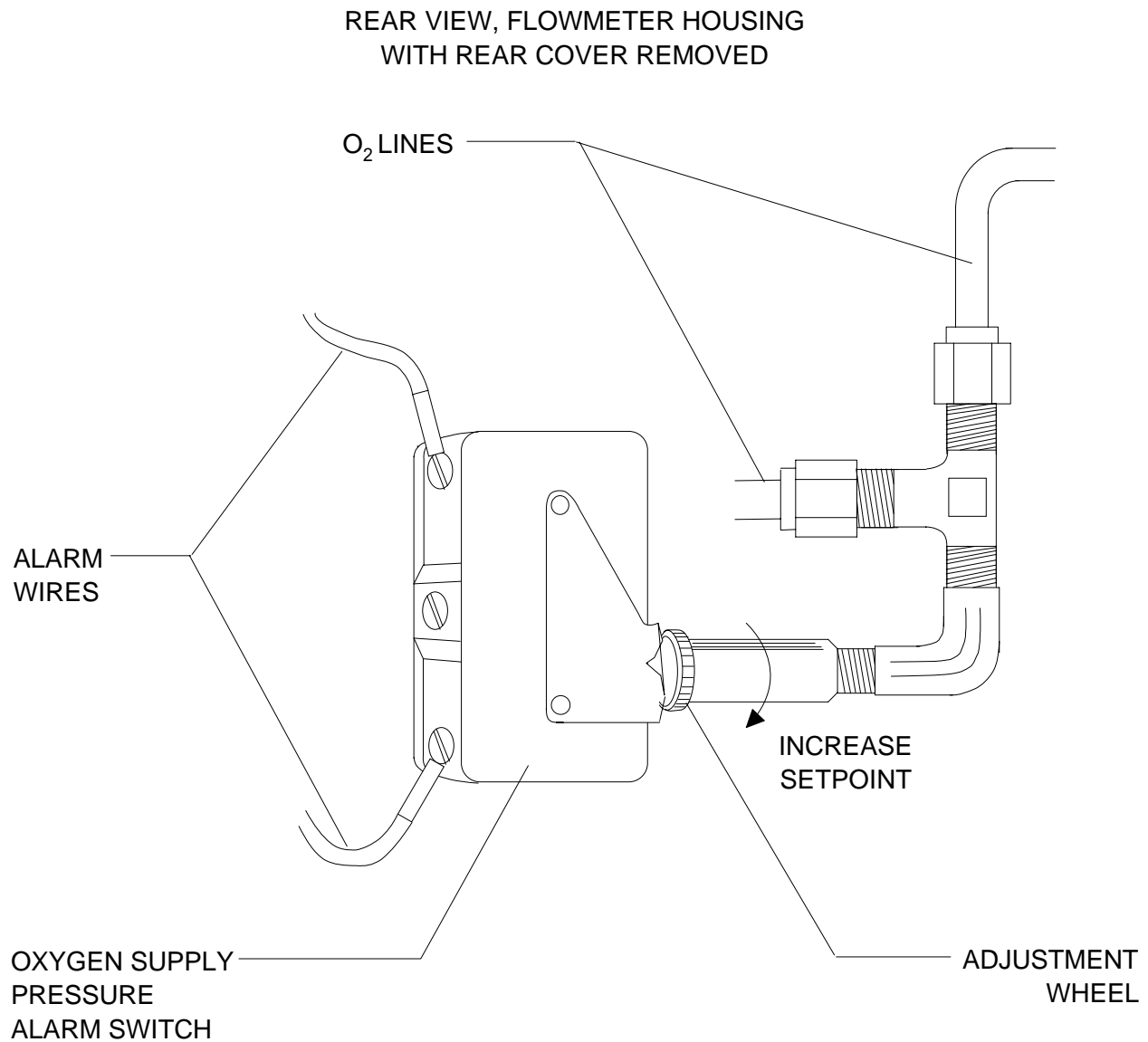
5.1.10.A Connect the pipeline hoses.

5.1.11.A Perform the PMC 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 O₂ 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 O₂ cylinder valve, and close the flow control valves. Press the O₂ 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 O₂ regulator output line, and remove the plug from the TEE fitting.
- 5.2.9 Connect a dedicated O₂ test gauge to the TEE fitting.
- 5.2.10 Open the O₂ 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 O₂ 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.



OSPAS

Figure 5-2: O₂ 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 PMC 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 O₂ 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 O₂ cylinder valve, and close the flow control valves. Press the O₂ 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 O₂ regulator output line, and remove the plug from the TEE fitting.
- 5.3.9 Connect a dedicated O₂ test gauge to the TEE fitting.
- 5.3.10 Open the O₂ 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 O₂ 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.

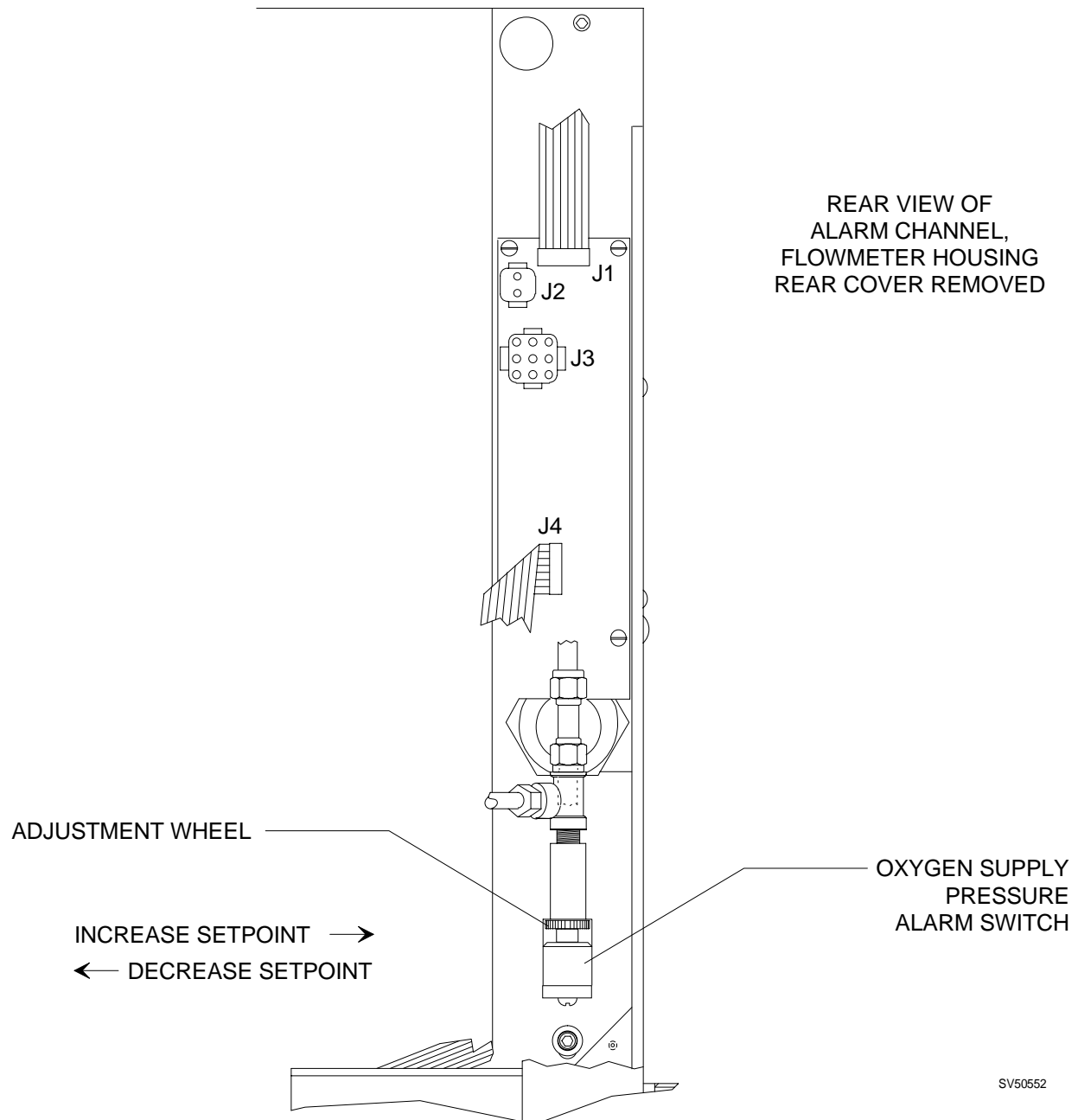


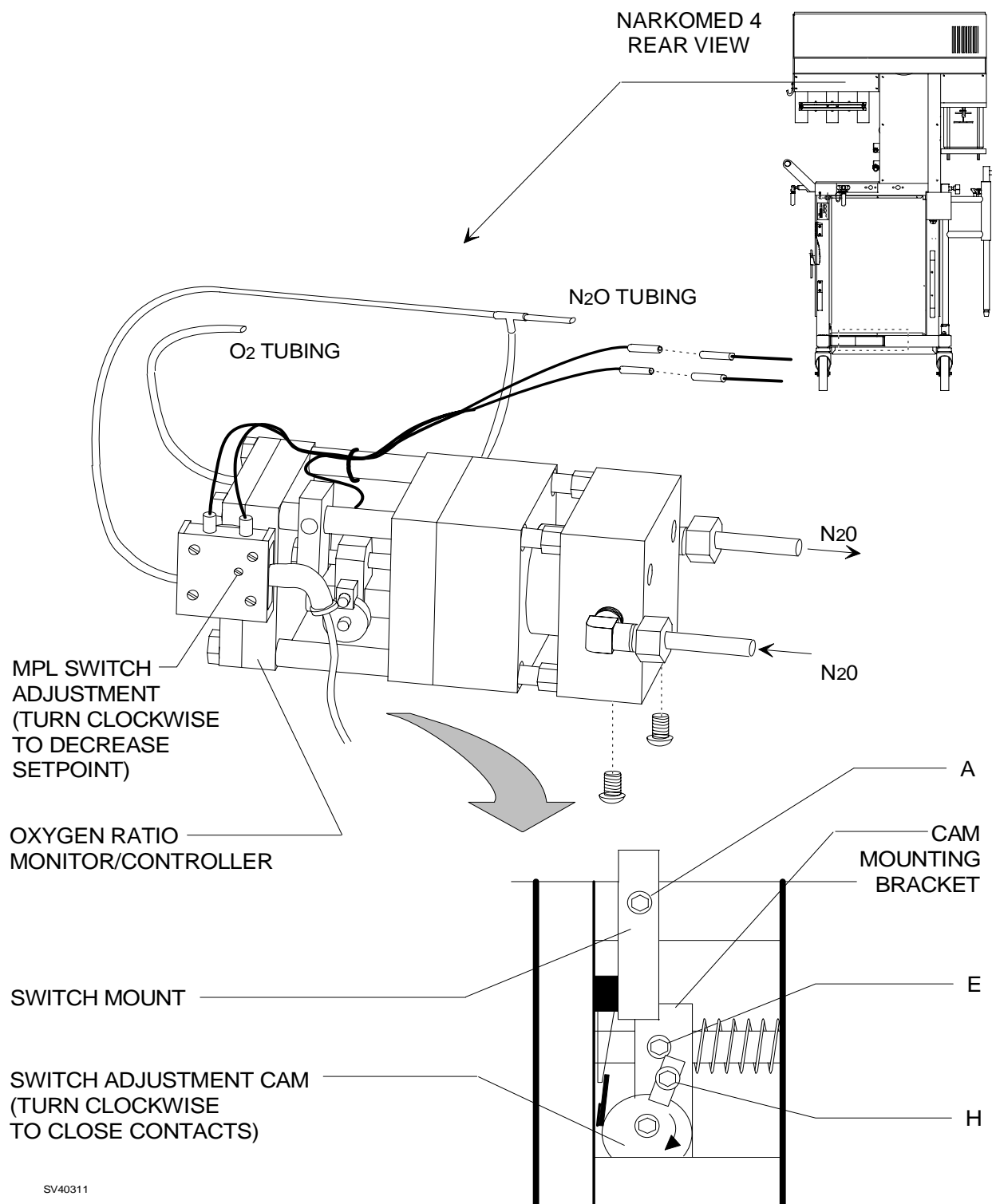
Figure 5-3: OXYGEN SUPPLY PRESSURE ALARM SWITCH (later machines)

- 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 PMC 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 O₂ flow control valve.
- 5.4.7 Open the N₂O 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 O₂ 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 O₂/N₂O ratio lamp on the alarm channel.



SV40311

Figure 5-4: OXYGEN RATIO MONITOR/CONTROLLER ADJUSTMENTS

NM2B	ADJUSTMENT AND CALIBRATION PROCEDURES (continued)
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- 5.4.15 The oxygen concentration should be between 21% and 29% oxygen.
- * 5.4.16 If the yellow O₂/N₂O FLOW RATIO lamp on the alarm panel is lighted, proceed to step 5.4.20.
- * 5.4.17 If the yellow O₂/N₂O 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 O₂/N₂O FLOW RATIO lamp is lighted. Tighten setscrew H.
- * 5.4.20 Close the N₂O flow control valve.
- * 5.4.21 Adjust the oxygen flow to 1 liter per minute.
- * 5.4.22 Slowly open the N₂O flow control valve.
- * 5.4.23 The yellow O₂/N₂O 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 N₂O flow control valve.
- * 5.4.26 The yellow O₂/N₂O 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 N₂O flow control valve.
- * 5.4.29 The yellow O₂/N₂O 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.

ADJUSTMENT AND CALIBRATION PROCEDURES (continued)

NM2B

- 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 O₂/N₂O 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 O₂/N₂O 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 O₂/N₂O FLOW RATIO lamp turns off.
- 5.4.34 Close the N₂O 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 PMC 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 O₂ and N₂O flow control valves.
- 5.5.7 Set the O₂ flow control valve to 10 l/min.
- 5.5.8 Set the N₂O flow control valve to 10 l/min.
- 5.5.9 Set the O₂ flow control valve to 800 ml/min for one (1) minute. Verify that the O₂ concentration indicates 21% to 29% O₂.
- 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 N₂O flow, clockwise to increase N₂O 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 O₂ flow to 500 ml/min. Verify that the N₂O flow is greater than or equal to 600 ml/min.

REAR VIEW OF FLOWMETER HOUSING
WITH REAR COVER REMOVED

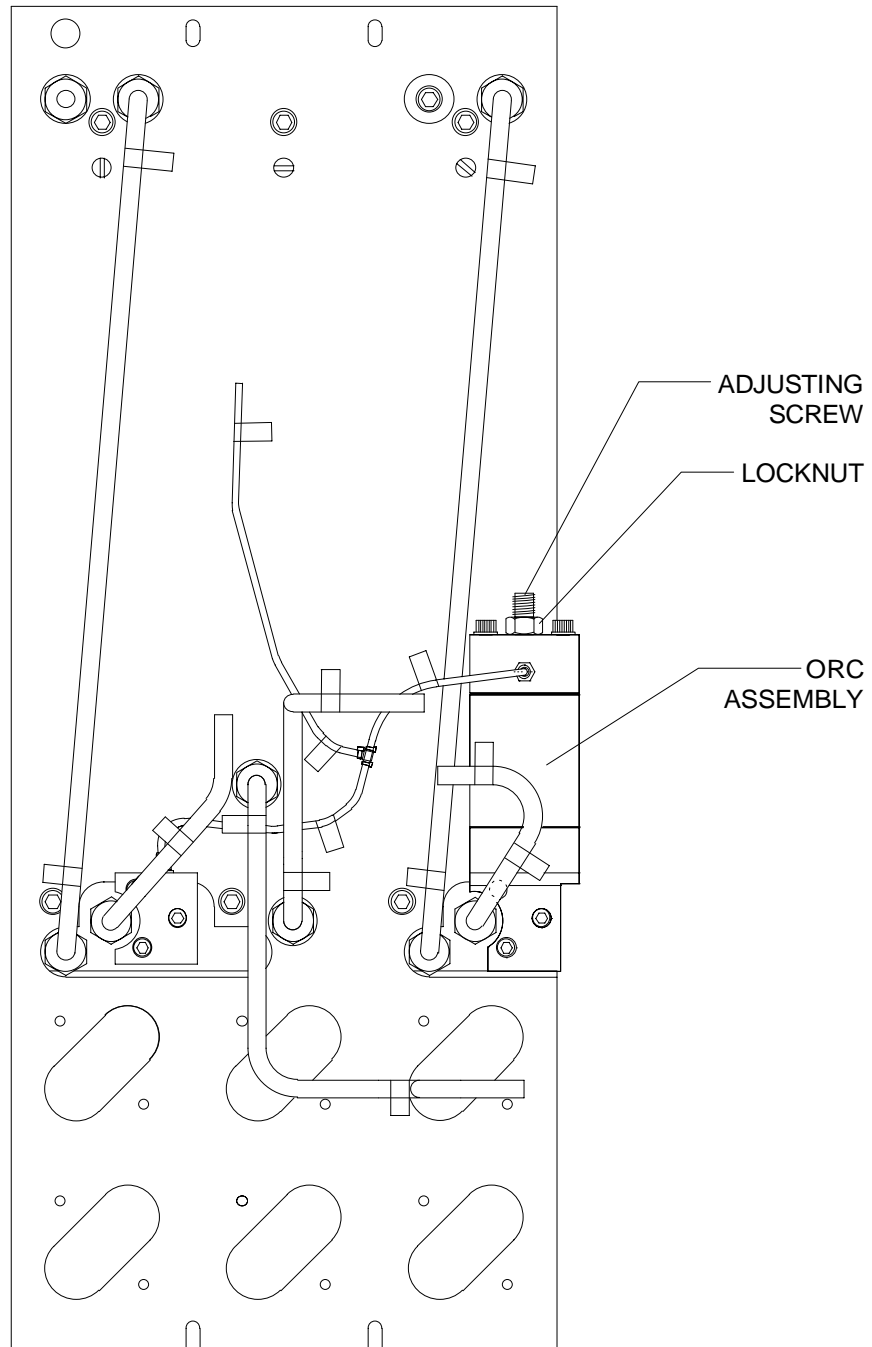


Figure 5-5: OXYGEN RATIO CONTROLLER

- 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 N₂O 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 PMC 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 N₂O 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 O₂ and N₂O flow control valves.
- 5.5.8A Set the O₂ flow control valve to 10 l/min.
- 5.5.9A Set the N₂O flow control valve to 10 l/min.
- 5.5.10A Set the O₂ flow control valve to 800 ml/min for one (1) minute. Verify that the O₂ concentration indicates 21% to 29% O₂.
- 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 N₂O flow, clockwise to increase N₂O 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 O₂ flow to 500 ml/min. Verify that the N₂O 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 N₂O bypass line on the ORC.
- 5.5.20A Close the O₂ flow control valve, and fully open the N₂O flow control valve. Verify that the O₂ concentration is 22 - 31%.
- 5.5.21A Close the N₂O 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 PMC Procedure given in Section 6.

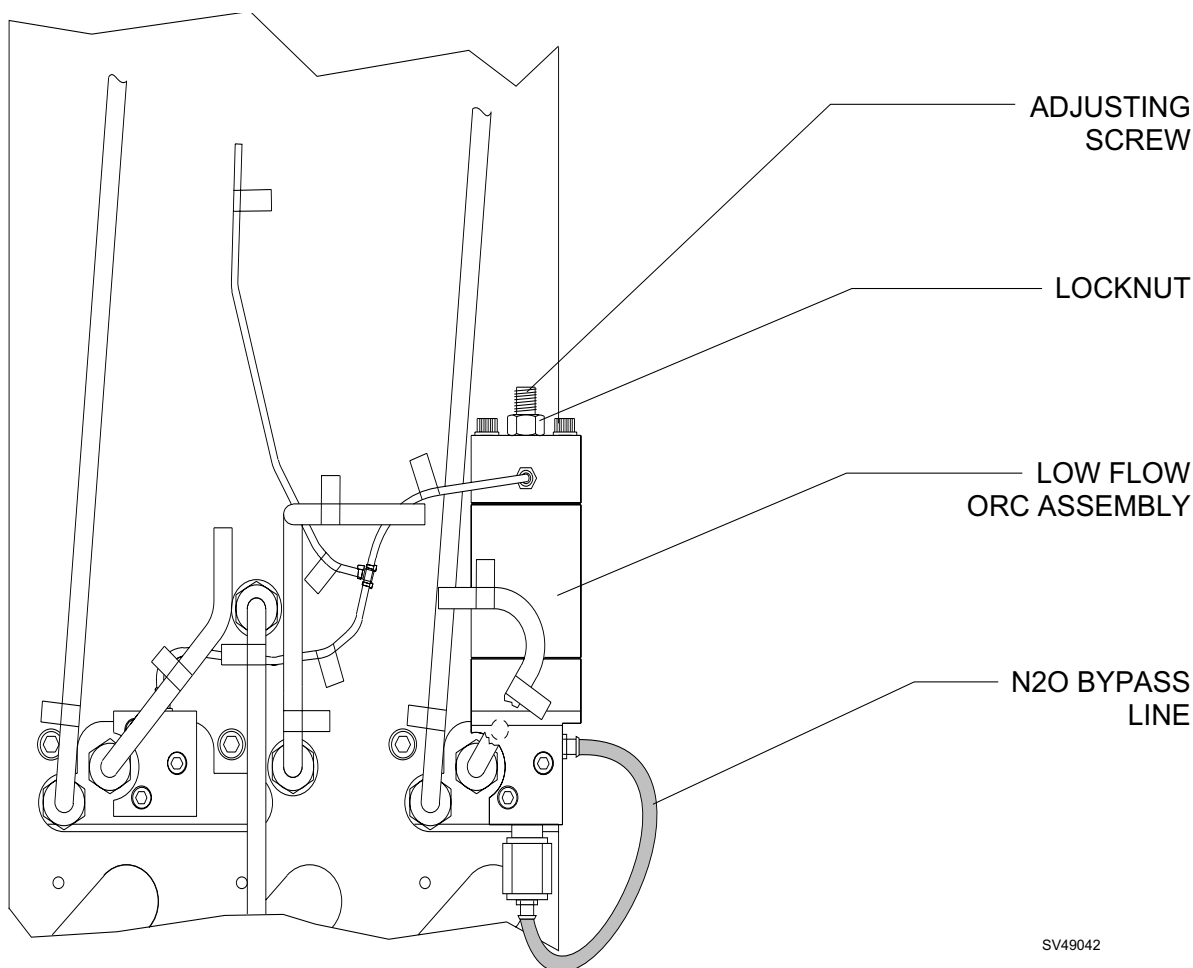


Figure 5-5A: LOW FLOW OXYGEN RATIO CONTROLLER

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.

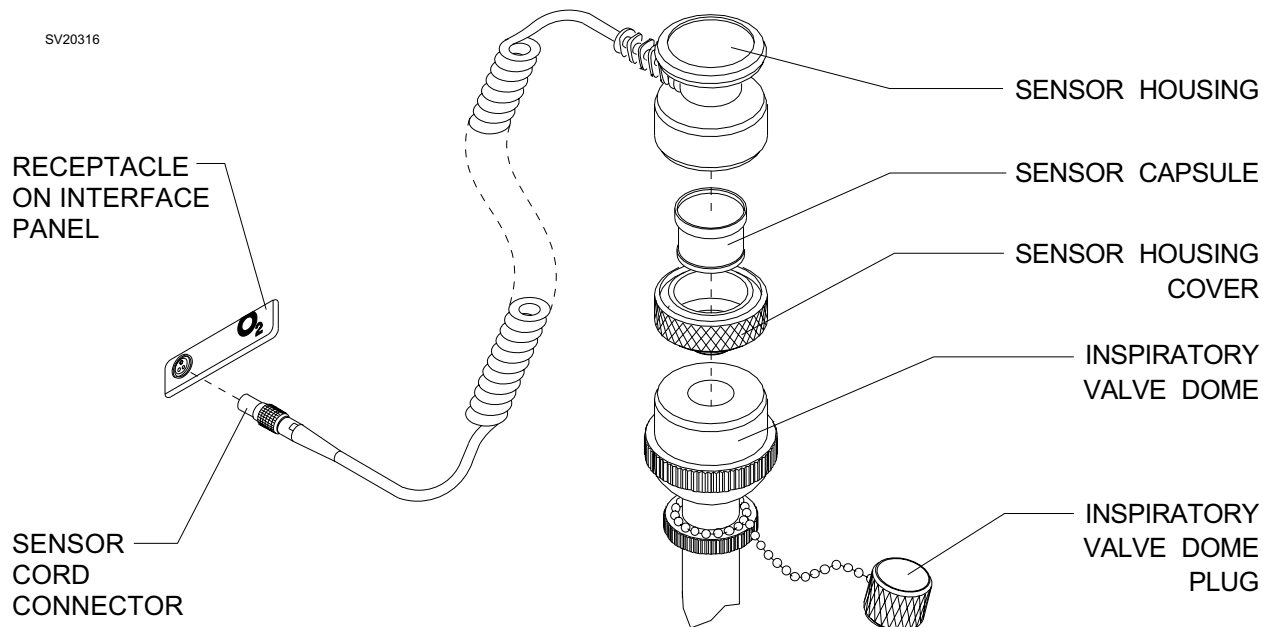
5.6.2.3 Replace the sensor capsule in its housing, but do not install the housing in the inspiratory valve dome.

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.

NM2B

ADJUSTMENT AND CALIBRATION PROCEDURES (continued)



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

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 H₂O as shown on the test gauge.

5.7.11 The displayed PRESSURE SPAN (60 cm H₂O) 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.

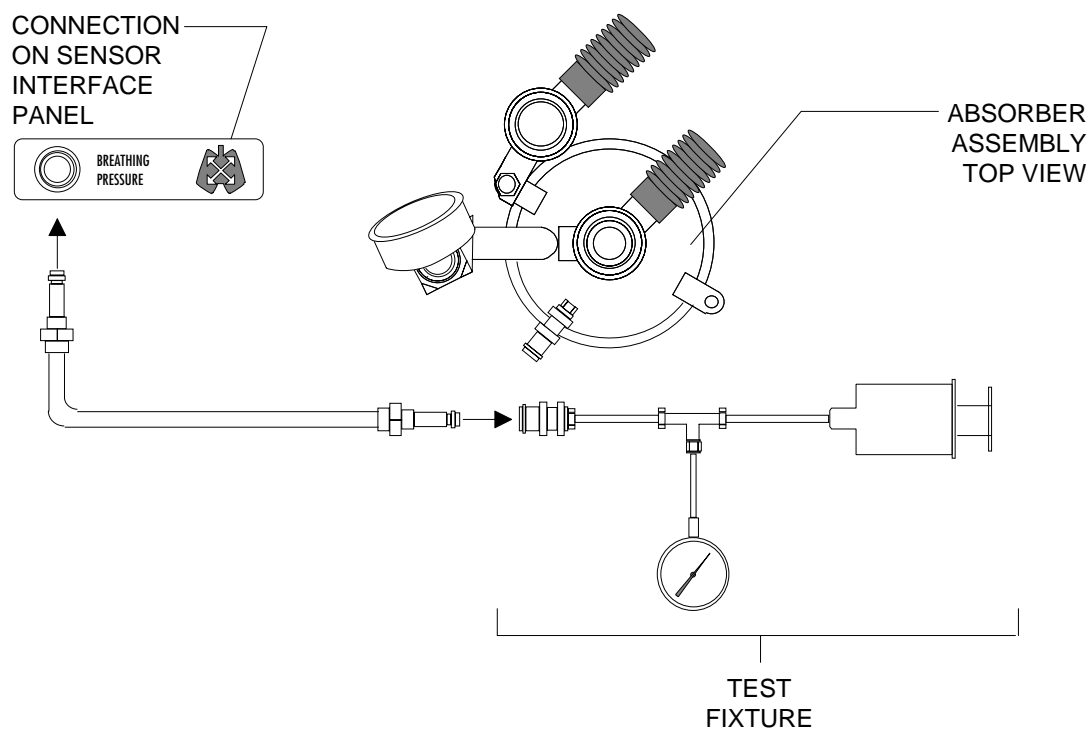
5.7.14 Press the EXIT key to leave the service menu screen.

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.

ADJUSTMENT AND CALIBRATION PROCEDURES (continued)

NM2B



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CALIBRATION MENU			O2MED
OFFSET O2 CELL A	0138	0127	
OFFSET O2 CELL B	0138	0129	
OXYGEN OFFSET READINGS STORED			BAROMED
			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 PMC Procedure given in Section 6.

VAPORIZER INTERLOCK MECHANISM REAR VIEW

SV40660

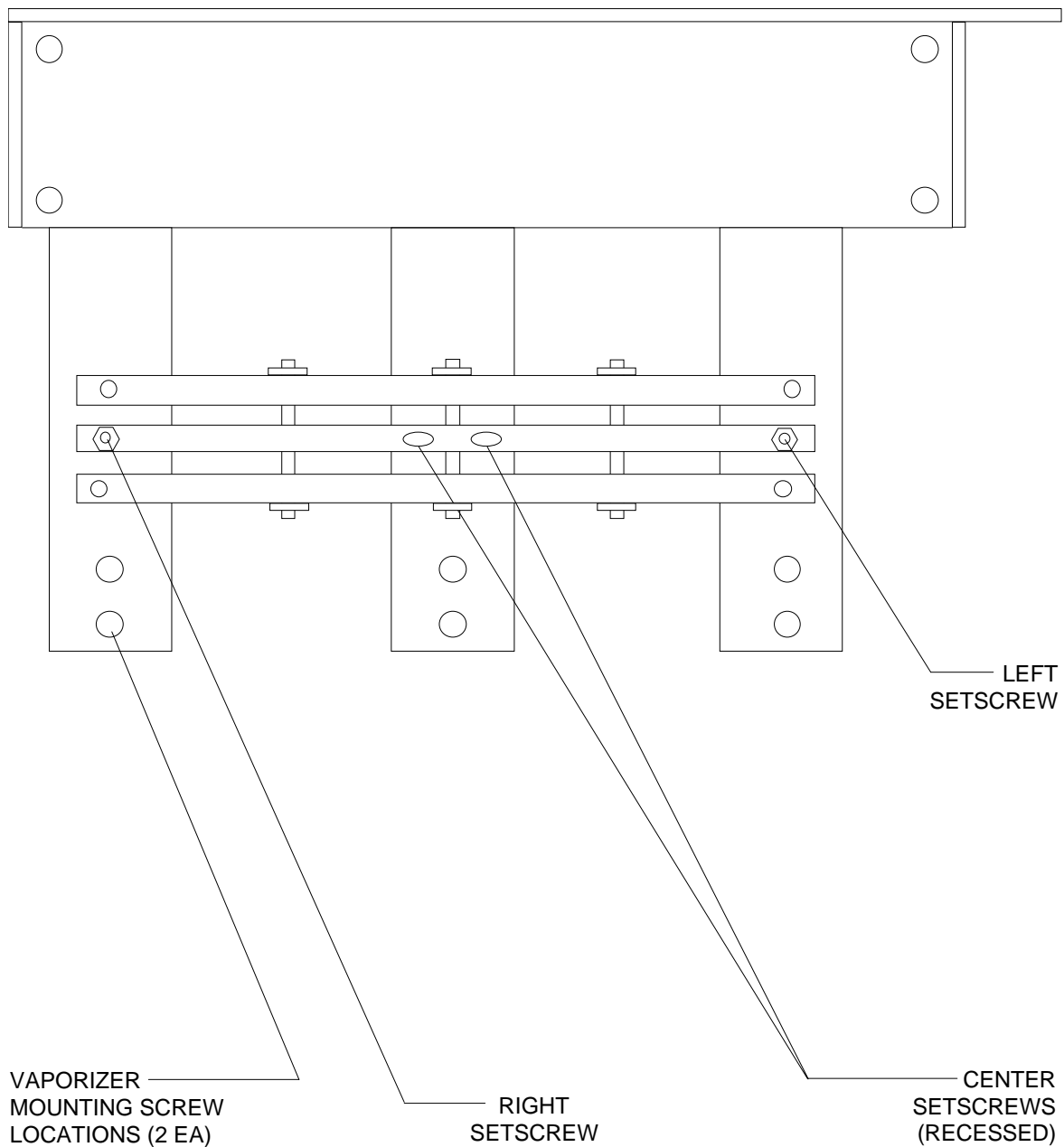


Figure 5-8: VAPORIZER INTERLOCK ADJUSTMENT

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 is available from Draeger Medical, Inc. and shall be completed by the Technical Service Representative 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. Refer to the current Anesthesia Equipment & Monitoring System Service Information CD-ROM Service Procedures section for vapor concentration verification procedures.

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.

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. Examples are: multimeter, digital pressure meter, Riken gas analyzer, safety analyzer, volumeter, trace gas analyzer, simulators.

Test Equipment Required:

- *Electrical Safety Analyzer (Bioteck 501 Pro or equivalent)
- *Pressure Gauge with DISS Adapters (P/N 4114807 or equivalent)
- *Flowmeter 0-250 ml min. (P/N S000081 or equivalent)
- *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
- Test Lung (P/N 4115128)
- AC Receptacle Circuit Tester

Materials Required:

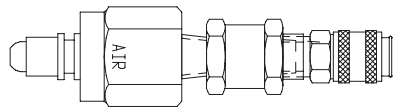
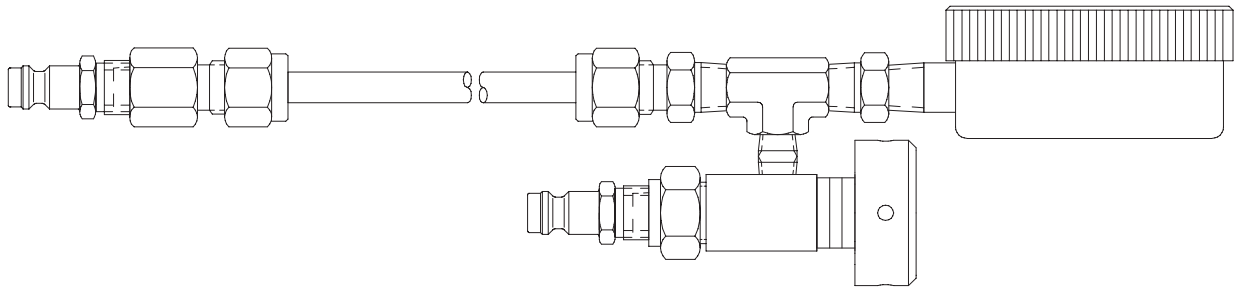
- Spiromed Lubrication Kit (P/N 2218180)
- Breathing Bag 3 liter (P/N 9995330 or equivalent)
- Patient Circuit: Y-piece, elbow, 2x 32" x 22mm hoses
- Hose 22 mm x 32" (P/N 9995132)
- Fresh Gas Outlet Volume Test Device (P/N S010158 or equivalent)

Materials Required (continued):

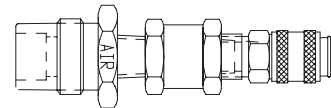
- Fresh Gas Leak Test Adapter (P/N 4115041 or equivalent)
- Volumeter/Fresh Gas Adapter (P/N 4115042)
- Test Terminal 2x (P/N 4104389 or equivalent)
- Breathing System Leak Test Device (P/N S010159 or equivalent)
- PDM/Suction Adapter (P/N 4115038)
- Scavenger Adapter (P/N 4108114)
- NIBP w/Luer Test Adapter (P/N 4116111-001)
- Pressure Monitor Test Adapter (P/N 4115043 or equivalent)

Key test equipment and materials illustrations are shown on following pages.

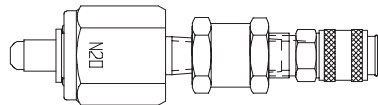
4114807 PRESSURE TEST ASSEMBLY , WITH ADAPTERS



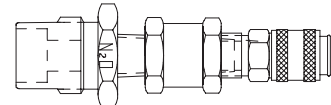
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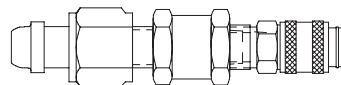
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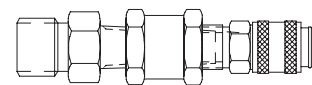
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4114830-003



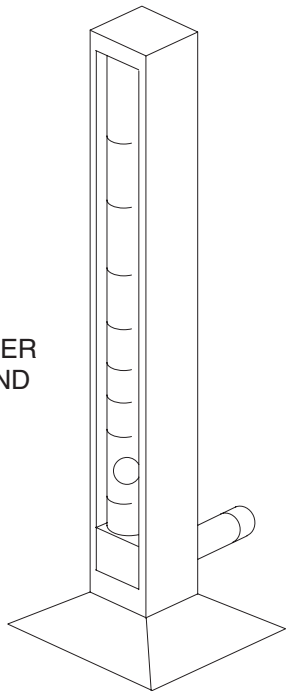
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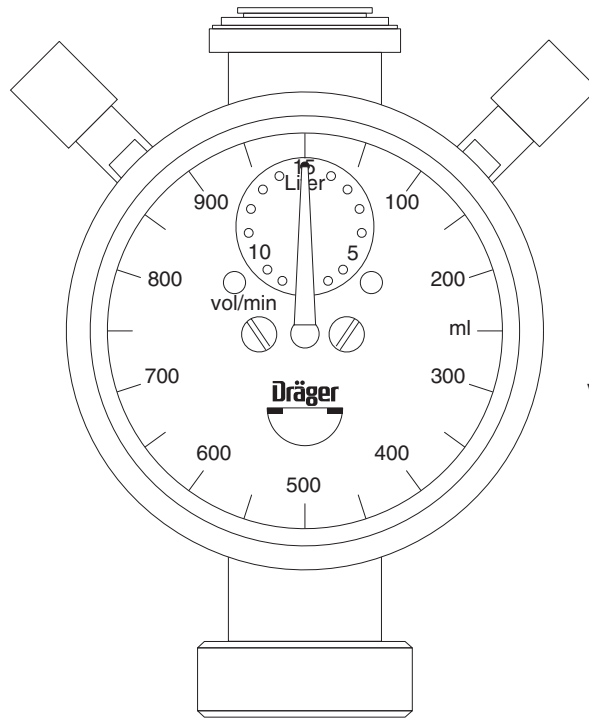
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SP15001

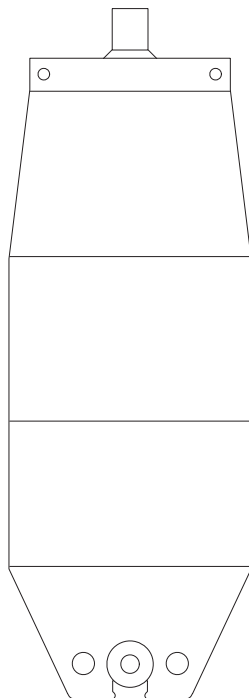
S000081
FLOW METER
TEST STAND



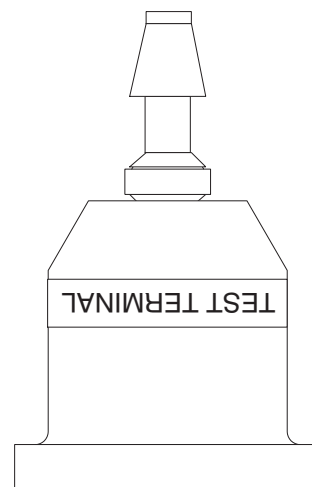
2212300
MINUTE
VOLUMETER



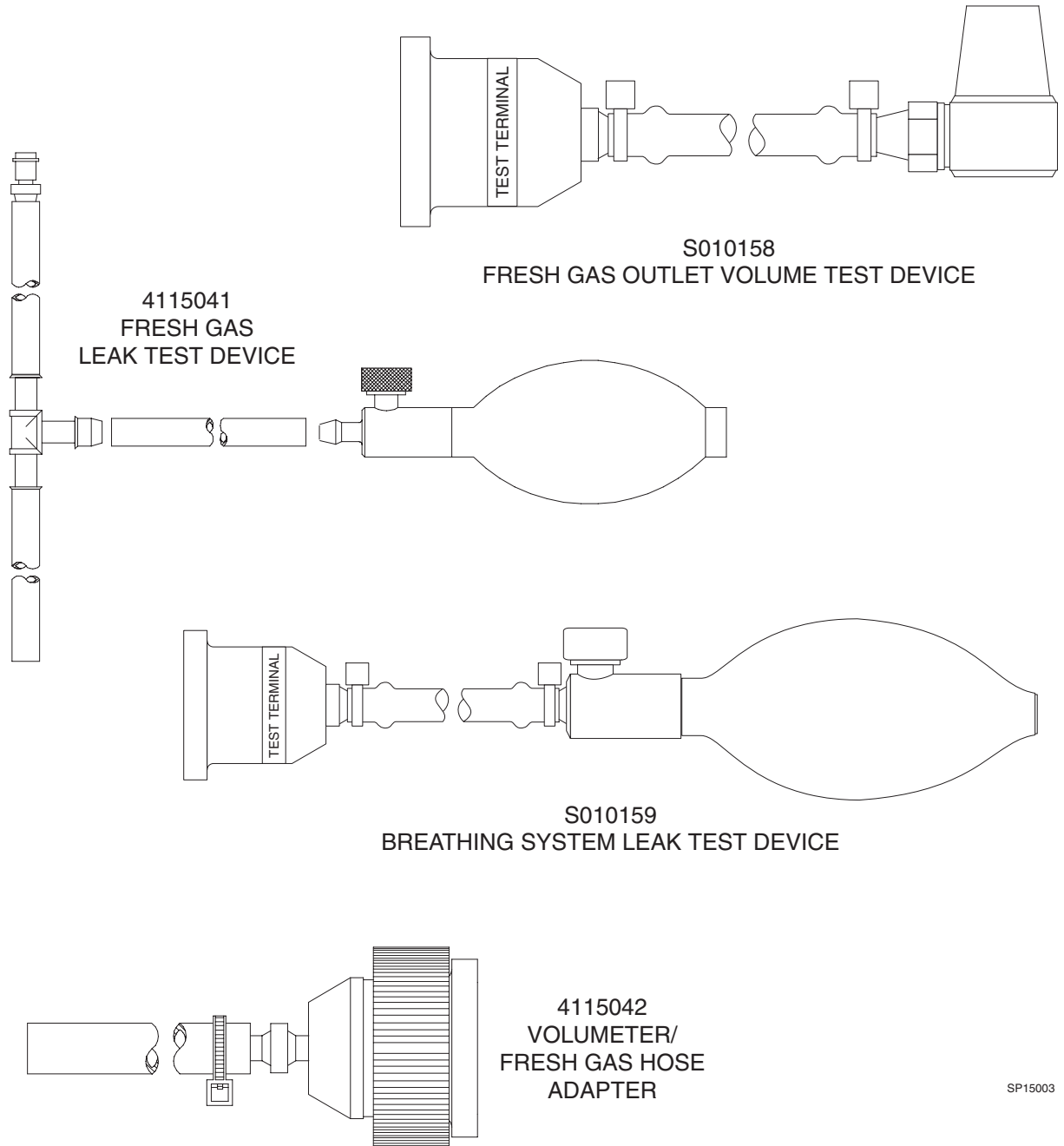
4115128
SIEMENS TEST LUNG



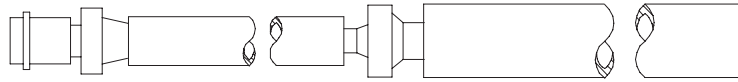
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TEST TERMINAL
ADAPTER



SP15002

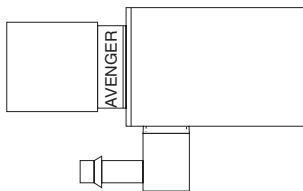


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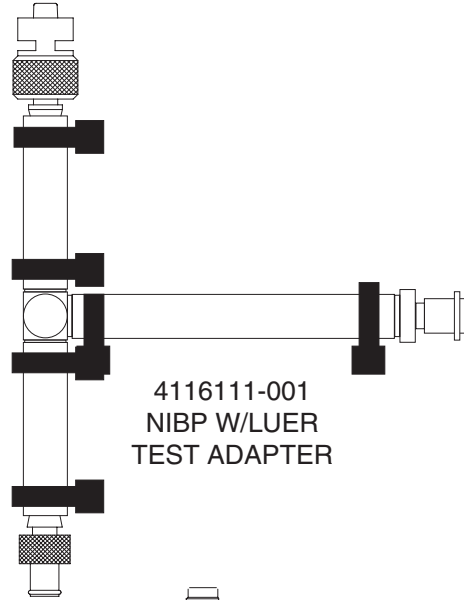
4115038

PDM TO PATIENT SUCTION ADAPTER



4108114

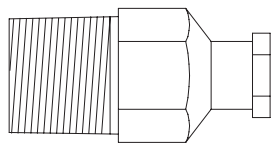
SCAVENGER ADAPTER



4116111-001

NIBP W/LUER
TEST ADAPTER

4110709
LUER (F) 1/8 MPT

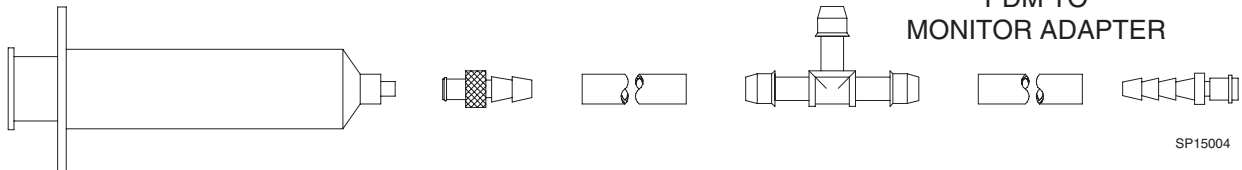


ADAPTER FOR TOP PORT
ON CAPNOMED FLOW METER



4115043

PDM TO
MONITOR ADAPTER



SP15004

Periodic Manufacturer's Certification General Instructions

The purpose of this manual is to provide detailed instructions for performing a Periodic Manufacturer's Certification (PMC) inspection on a Narkomed 2B Anesthesia machine.

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

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

Field Service Procedure:

Periodic Manufacturer's Certification Forms - Part Number SP00175. This procedure illustrates sample checklists with typical periodic maintenance items filled in, including vapor concentrations verification tests, parts replaced, general comments and certification levels. Also included are sample PMC labels marked to show several levels of certifications. An excerpt from 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 DMI Recommendations or Failure Codes apply to machine being inspected. (Only item number 33 - "No Recommendations" shall apply for this certification level.)

Certified with Recommendations- A numbered DMI Recommendation or Failure Code with a code of B applies to the machine being examined.

Conditionally Certified- A numbered DMI Recommendation or Failure Code with a code of BCI or BCII applies to the machine being examined.

No Certification- A numbered DMI Recommendation or Failure Code 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 2B** could have DMI Recommendation number 21 and Failure Code 61.1 that 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 DMI Recommendation numbers 14 and 21 apply.

14 - CO₂/Agent monitor exhaust port is not properly connected to the waste gas scavenger. Code B. 21 - No ventilator pressure limit control. Code B.

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

A **Narkomed 2B, 2C or GS** could have DMI Recommendation 30 apply. 30 - Anesthesia machine is equipped with inhalation anesthesia vaporizers without an agent analyzer in the breathing system. Code B.

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

A **Narkomed 6000** could have no DMI Recommendations or Failure Codes apply. The correct certification level for this machine is Code A, **"CERTIFIED"**. The correct certification for this machine is A, which means **"CERTIFIED"**.

Code, D also means "NO CERTIFICATION", also means the machine shall not receive a Periodic Manufacturer's Certification label. The machine shall 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(r) Validation" labels have been removed.

PM Certification Procedure for Narkomed 2B Anesthesia System

1. Use the PM Certification form for Narkomed 2B/ 2C/ GS Anesthesia Systems (P/N S010211).
2. Completely fill in the header information.
3. Determine if the ventilator has an MJV-2 square Clippard valve. If ventilator has an MJV-2, perform the lubrication procedure every 12 months in accordance with SP00062. Place a check mark and indicate the next lubrication due date in the "Vent Valve Lube Due" line on the Periodic Manufacturer's Certification form. If the ventilator has a Humphrey valve (lubrication is not required), indicate so with a (H) next to the "Vent Valve Lube Due" line on the Periodic Manufacturer's Certification form.
4. Replace the VENTILATOR RELIEF VALVE DIAPHRAGM every 12 months in accordance with SP00075. Place a check mark and indicate the next replacement date at "Relief Valve Diaphragm Due" line on the Periodic Manufacturer's Certification form.
5. 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 condition 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.
6. 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, a No Agent To Test or the test results @ 1%, 2.5%, 4% for H, E, I, or S vaporizers, or @ 4%, 10%, 12%, 16% for Desflurane vaporizers, and a PASS or FAIL indication. This label shall be attached to the upper right side of the vaporizer. If vaporizer fails the concentration verification, internal leak, or exclusion system tests, check "NO" in the "RECOMMENDED FOR USE" section on the PM Certification form. Place a "CAUTION DO NOT USE" label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the customer to remove the failed vaporizer from the machine and install a replacement vaporizer or an adapter block onto the mount. All nonfunctional vaporizers must be removed from service for machine to receive certification.

7. 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 Draeger Medical, Inc. to assess the proper certification level.
8. Based on the "EQUIPMENT CONDITION" inspect the machine for any "DMI RECOMMENDATIONS" that would apply. Use the Narkomed 2C section of the "RECOMMENDATION GUIDELINES INDEX" (P/N S010250). Note all applicable DMI recommendations on the Executive Summary.

NOTE: If using a carbon form, indicate the Equipment Condition number and to see reverse side under the "RECOMMENDATIONS / GENERAL COMMENTS" section of the form.

9. 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, P/N 4114857. This label shall be placed at a prominent location on the left side of the machine after all other previous PMC and Vigilance Audit Validation labels have been removed.
10. 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.
11. If applicable, remove the previous PM CERTIFICATION VALIDATION label and attach the new label (P/N S010006 w/phone #, or S010007 w/o phone #) in a prominent location on the rear of the anesthesia machine.
12. 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 near the flowmeter shield of the anesthesia machine.
13. Have the customer sign each PM Certification form or the Executive Summary, and review any Failure Codes equipment conditions and DMI Recommendations with the customer.
14. Return top copy to Draeger Medical, Inc. Service Department, keep middle copy for service organization records, give bottom copy to customer.

(✓) 6.1 SELF-DIAGNOSTICS

- 6.1.1 Turn the System Power switch to ON and verify the "ON" LED is lighted?
- 6.1.2 Verify all LED's on the keypad and ventilator displays are lit if applicable. Verify the flowmeter lights operate properly.
- 6.1.3 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	

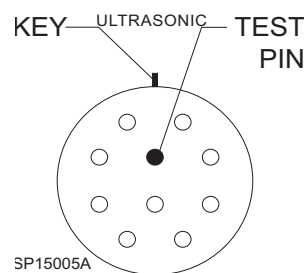
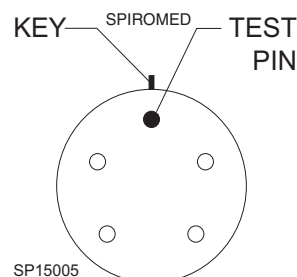
FUNCTIONAL

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

(✓) 6.2 ELECTRICAL SAFETY- One Year Service Interval; Due Date _____

- (✓) 6.2.1 Ground Continuity
 - 6.2.1.1 Unplug the AC power cord for all devices mounted to the machine that may provide an alternate path to earth ground, such as a Desflurane vaporizer.
 - 6.2.1.2 Unplug the machine's AC power cord and plug the power cord of the safety analyzer into this AC receptacle.
 - NOTE:** Do not plug the safety analyzer power cord into a line isolation monitor circuit, as inaccurate readings may occur.
 - NOTE:** The BIOTECH 501 PRO will automatically test the source outlet for open ground (or ground resistance of 31 Ohms or higher), reverse polarity, open neutral and open line. (The latter two conditions will prevent the analyzer from powering up.)
 - 6.2.1.3 Turn on the safety analyzer and set it's function switch to the GROUND WIRE RESISTANCE position. Attach the test lead to the red SINGLE LEAD connector of the analyzer. Connect the other end of the red test lead to the AC receptacle ground socket on the safety analyzer. Verify a displayed resistance of 0.00 ohms or, if necessary, press the CALIBRATE key on the front panel of the analyzer to zero the device.

- 6.2.1.4 Set the safety analyzer GROUND switch to NORMAL. Set the POLARITY switch to OFF.
- 6.2.1.5 Plug the machine's AC power cord into the safety analyzer.
- 6.2.1.6 Apply the analyzer's test lead to a cylinder yoke bolt.
- 6.2.1.7 What is the value displayed on the safety analyzer? ____ ohm (0-0.1)
- (✓) 6.2.2 Circuit Isolation
- 6.2.2.1 Disconnect the respiratory volume sensor cord from the interface panel.
- 6.2.2.2 Using a multimeter set to its highest resistance range apply the test leads between the yoke bolt and circuit common at the volume interface test pin. Refer to the corresponding illustrations for the proper test pin locations. There shall be no continuity between these points.
- 6.2.2.3 Reconnect the respiratory volume sensor cord to the interface panel.
- 6.2.3 Chassis Leakage Current
- 6.2.3.1 Apply the analyzer test lead to a cylinder yoke bolt.
- 6.2.3.2 Set the safety analyzer to the CHASSIS LEAKAGE CURRENT position.
- (✓) 6.2.3.3 Record the total leakage current with the Polarity and Ground switches set as follows:
- | <u>Ground</u> | <u>Polarity</u> |
|---------------|-----------------|
| Normal | Normal |
| Open | Normal |
| Open | Reversed |
| Normal | Reversed |
- 6.2.3.4 Verify that the leakage current is 100* microamps or less in each of the switch positions (110 microamps or less for the 220/240 volt power supply option).
- 6.2.3.5 300 microamps if external monitors are plugged into convenience receptacles.
- 6.2.3.6 Shut off and unplug the safety analyzer. Remove the anesthesia machine plug from the analyzer and plug it back into the original AC receptacle.



(✓) 6.2.4 Convenience Receptacle and Auxiliary Outlet Strip

NOTE: This test will check the convenience receptacle and the auxiliary strip outlets for fault conditions such as open ground, reverse polarity, open line and open neutral.

6.2.4.1 Unplug all power cords from the convenience receptacles and auxiliary outlet strip.

6.2.4.2 Plug the Receptacle Tester into the first outlet to be tested. Verify no wiring fault is indicated then remove test plug and move it to the next convenience outlet. Repeat this process until all convenience outlets and auxiliary strip outlets are tested.

6.2.4.3 Plug-in all power cords previously removed from the convenience receptacles and auxiliary outlet strip.

(✓) 6.3 CONFIGURATION

6.3.1 Press the CONFIG key.

6.3.2 Verify the correct Time and Date is displayed.

6.4 SERVICE DATA

6.4.1 From the CONFIG screen, press and hold the 21% and APNEA ALARM DISABLE keys, then press the CONFIG key (while still holding the previous two keys). The alarm CRT should display the Service Menu screen.

6.4.2 Press the DIAGNOSTICS key.

6.4.3 Remedy any Error Log codes. Contact the Draeger Medical, Inc. Technical Service Department if necessary.

6.4.4 Press the RESET DATE key.

6.4.5 Press the KEY TEST key twice.

6.4.6 The alarm CRT should display the outline of all keys on the display panel.

6.4.7 Press each key on the display panel, one at a time.

6.4.8 This step intentionally left blank.

6.4.9 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.

6.4.10 This step intentionally left blank.

6.4.11 Press the TREND key to exit the DIAGNOSTIC menu.

6.4.12 Press the exit key to exit the main service screen, If not performing monitor calibrations press the exit key again to return to normal operation mode.

(✓) 6.5 CALIBRATIONS - One Year Service Interval; Due Date ____

6.5.1 Press the CALIBRATIONS key on the Service Menu to bring up the Calibrations menu.

6.5.2 Remove the Oxygen sensor from the valve dome adapter, and remove the Oxygen sensor capsule from the Oxygen sensor housing.

(✓) 6.5.3 When the "OFFSET O₂ CELL A" and "OFFSET O₂ CELL B" readings (displayed in left column) Have stabilized and are as close as possible to each other with a difference not greater than 8, press the O₂ MED key and verify that the new offset values are stored.

NOTE: The higher the offset, the higher the calculated O₂ concentration appears at high concentrations.

6.5.4 Put the Oxygen sensor capsule into the Oxygen sensor housing.

6.5.5 Disconnect the breathing pressure monitor's sensor line from the absorber.

6.5.6 Connect a pressure monitor adapter, (P/N 4115043) and calibrated digital pressure manometer to the breathing pressure sensor line.

6.5.7 Pressurize the circuit to 60 cm H₂O and allow the Current Value to stabilize. Reading should be between 465 and 519.

6.5.8 This step intentionally left blank.

6.5.9 This step intentionally left blank.

(✓) 6.5.10 Press the BAROMED key and verify the following message: "PRESSURE READINGS STORED".

6.5.11 Release the pressure, disconnect the manometer and test fixture, and reconnect the breathing pressure sensor line to the absorber.

6.5.12 Press the EXIT key to exit the Calibration Screen.

6.5.13 Press the EXIT key to Set the cursor to EXIT and press the trigger to return to normal operation.

(✓) 6.6 ABSORBER MAINTENANCE

6.6.1 Remove the O₂ sensor or the plug from the inspiratory valve dome adapter and examine the O-rings on each assembly. Replace O-rings as necessary.

6.6.2 Remove the inspiratory and the expiratory valve domes.

6.6.3 Are all pins on the valve crater undamaged? Inspiratory ____ (Y)
Expiratory ____ (Y)

6.6.4 Are all pins on the valve domes undamaged? Inspiratory ____ (Y)
Expiratory ____ (Y)

6.6.5 Is the valve disc in good condition? Inspiratory ____ (Y) Expiratory ____ (Y)

6.6.6 Are the valve dome washers in good condition? ____ (Y)

- 6.6.7 Reinstall the inspiratory and expiratory valve domes.
- 6.6.8 Ultrasonic Flow Sensor - If applicable
 - 6.6.8.1 Remove the Ultrasonic Flow Sensor connector hose.
 - 6.6.8.2 Is the connector hose, connector, and O-ring in good condition? ____ (Y)
 - 6.6.8.3 Remove the expiratory valve.
 - 6.6.8.4 Is the washer under the valve in good condition? ____ (Y)
 - 6.6.8.5 Reattach the expiratory valve.
 - 6.6.8.6 Remove the ultrasonic flow sensor from the mounting bracket.
 - 6.6.8.7 Remove the flow housing/transducer assembly from the electronics housing.
 - 6.6.8.8 Remove both transducers from the flow housing; examine each O-ring and condition of all components, then reassemble the ultrasonic flow sensor.
 - 6.6.8.9 Reattach the ultrasonic flow sensor to the mounting bracket.
 - 6.6.8.10 Reattach the connector hose between the sensor and expiratory valve.
- 6.6.9. Lubrication, Spiromed Sensor - If applicable
 - 6.6.9.1 Remove the expiratory valve.
 - 6.6.9.2 Is the washer under the valve in good condition? ____ (Y)
 - 6.6.9.3 Remove the Spiromed sensor.
 - 6.6.9.4 Is the washer under the sensor in good condition? ____ (Y)
 - 6.6.9.5 Locate the four lateral holes at the sides of the Spiromed sensor marked by arrows.
CAUTION: Use only Sensor Lubrication Kit P/N 2218180 for the following procedure.
 - 6.6.9.6 Dip the tip of the pipette into the lubricant and draw lubricant into the pipette by pulling the pin backwards.
 - 6.6.9.7 Insert the pipette into one of the four holes as far as it will go. Push the pin forward to its stop and inject lubricant into the hole.
 - 6.6.9.8 Repeat the previous 2 steps for the lubricating three remaining holes.
 - 6.6.9.9 Wipe any lubricant residue from the exterior of the sensor.
 - 6.6.9.10 Reattach the sensor to the absorber top dome.
 - 6.6.9.11 Reattach the expiratory valve to spiromed sensor.
- 6.6.10. Remove the inspiratory valve assembly.

- 6.6.11. Is the washer under the valve in good condition? ____ (Y)
- 6.6.12. Reinstall the inspiratory valve.
- 6.6.13. Are there two (2) spring clips on the absorber rods? ____ (Y)
- 6.6.14. Inspect the following: canisters, canister gaskets, dust cup and O-ring, and soda lime.
- 6.6.15. Are the canisters, canister gaskets, dust cup and O-ring, and soda lime in good condition? ____ (Y)
- 6.6.16. Verify the cm H₂O gauge at zero (0) and readjust if necessary.
- NOTE:** The small slotted screw is the zero adjust.
- 6.6.17. Reinstall the O₂ sensor plug into the inspiratory valve dome adapter.
- 6.6.18. Remove the 15-mm connector from the FRESHGAS OUTLET.
- 6.6.19. Is the Freshgas Outlet assembly in good condition? ____ (Y)
- 6.6.20. Reconnect the 15-mm connector to the FRESHGAS OUTLET.
- 6.6.21. Repack MAN/AUTO Selector Valve, If applicable
 - 6.6.21.1. Remove the four screws securing the stick shift block to the selector valve body and remove the block.
 - 6.6.21.2. Remove the spring and valve channel from the valve body.
 - 6.6.21.3. Remove all residual lubricant from the valve channel.
 - 6.6.21.4. Remove all residual lubricant from the valve body.
 - 6.6.21.5. 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.
 - 6.6.21.6. Insert the valve channel into the valve body.
 - 6.6.21.7. Insert the spring into the stick shift block.
 - 6.6.21.8. Align the index pins on the stick shift block to the holes in the valve channel.
 - 6.6.21.9. Secure the stick shift block to the selector valve body with the four screws that were previously removed.
 - 6.6.21.10. Operate the selector valve handle and verify smooth movement.

(✓) 6.7 HIGH PRESSURE LEAK

NOTE: Minimum cylinder pressures required for High Pressure Leak tests are:
O₂, Air, O₂-HE, N₂, HE: 1000 psi \ N₂O, CO₂: 600 psi;

- 6.7.1. Turn the machine main switch to Standby.
- 6.7.2. Verify the Auxiliary Oxygen flow control valve is closed.

- 6.7.3 Disconnect all pipeline supply hoses at the wall outlets.
- 6.7.4 Open then close and remove each cylinder and if applicable remove the yoke plug from each additional yoke assembly.
- 6.7.5 Note the reading on each the cylinder pressure gauge and start a stop watch.
- 6.7.6 Are the two (2) yoke index pins installed securely in each yoke? ____ (Y)
- 6.7.7 Is the proper gas I.D. label affixed to each yoke? ____ (Y)
- 6.7.8 After two (2) minutes, is the pressure loss for each gas equal or less than 50 psi? ____ (Y)
- 6.7.9 Verify the presence of only one (1) cylinder washer, then reattach and secure the cylinders to each yoke assembly, then open each cylinder valve.

6.8 BREATHING SYSTEM

- 6.8.1 Breathing System Leak/Exclusion
 - 6.8.1.1 Close all flow control valves.
 - 6.8.1.2 Set the AUTO/MAN selector to BAG.
 - 6.8.1.3 Close the APL valve.
 - 6.8.1.4 Interconnect a 22 mm hose (P/N 9995132) between the inspiratory valve and expiratory valve or expiratory port on the ultrasonic flow sensor, if applicable.
 - 6.8.1.5 Attach a test terminal (P/N 4104389) to the Fresh Gas Leak Test Adapter (P/N 4115041) then attach the test terminal to the bag mount.
 - 6.8.1.6 Apply 50 cm H₂O test pressure to the absorber system and start a stop watch.
 - 6.8.1.7 Is the pressure on the absorber pressure gauge within 47 to 53 cm H₂O? ____ (Y)
 - (✓) 6.8.1.8 After thirty (30) seconds, is the breathing system test pressure equal or greater than 40 cm H₂O? ____ (Y)
 - 6.8.1.9 If applicable, turn on the left mounted vaporizer to the first graduated marking. Reapply 50 cm H₂O of pressure to the system and start a stopwatch. Is it possible to turn on either the center or right vapors? ____ (N)
 - (✓) 6.8.1.10 After thirty (30) seconds, is the left vaporizer test pressure equal or greater than 40 cm H₂O? ____ (Y) Turn off the left vaporizer.
 - 6.8.1.11 If applicable, turn on the center mounted vaporizer to the first graduated marking. Reapply 50 cm H₂O of pressure to the system and start a stopwatch. Is it possible to turn on either the left or right vapors? ____ (N)

- (✓) 6.8.1.12 After thirty (30) seconds, is the center vaporizer test pressure equal or greater than 40 cm H₂O? ____ (Y) Turn off the center mounted vaporizer.
- 6.8.1.13 If applicable, turn on the right mounted vaporizer to the first graduated marking. Reapply 50 cm H₂O of pressure to the system and start a stopwatch. Is it possible to turn on either the left or center vapors? ____ (N)
- (✓) 6.8.1.14 After thirty (30) seconds, is the right vaporizer test pressure equal or greater than 40 cm H₂O? ____ (Y) Turn off the right mounted vaporizer.
- (✓) 6.8.1.15 Did all vaporizer exclusion verifications test positive? ____ (Y)
- 6.8.2 APL Valve
 - 6.8.2.1 Open the APL valve to its stop.
 - 6.8.2.2 Turn the System Power switch to ON.
 - 6.8.2.3 Set the Oxygen flow to 8 l/min.
 - (✓) 6.8.2.4 Is the pressure within 0 to 3 cm H₂O? ____ (Y)
- 6.8.3 O₂ Flush
 - 6.8.3.1 Attach a 33 mm x 22 Female Adapter (P/N 4115087) to the top port of the test volumeter.
 - 6.8.3.2 Disconnect the hose from the expiratory valve or expiratory hose terminal on the ultrasonic flow sensor, if applicable and attach it to the test volumeter adapter.
 - 6.8.3.3 Close the APL valve.
 - 6.8.3.4 Press and hold the O₂ FLUSH button for 6 seconds; multiply the value obtained by 10.
 - (✓) 6.8.3.5 Is the calculated O₂ flush flow rate 45 to 65 l/min.? ____ (Y)
 - 6.8.3.6 After releasing the flush, does the flow of Oxygen stop immediately? ____ (Y)
 - 6.8.3.7 Remove the test equipment.
- 6.8.4 Expiratory Valve Leak
 - 6.8.4.1 Connect a 22 mm hose (P/N 9995132) between the inspiration valve and the bag mount.
 - 6.8.4.2 Connect a test terminal (P/N 4104389) to the expiration valve or expiratory hose terminal on the ultrasonic flow sensor, if applicable.
 - 6.8.4.3 Connect a 0-250 ml/min. flowmeter (S000081) to the test terminal.

- 6.8.4.4 Turn up the Oxygen flow until the system pressurizes to 30 cm H₂O. Adjust the APL valve as necessary to maintain 30 cm H₂O.
- (✓) 6.8.4.5 Is the value indicated on the flowmeter within 0 to 60 ml/min.? ____ (Y)
- 6.8.4.6 Close APL valve.
- 6.8.4.7 Remove all test equipment.
- 6.8.5 Inspiration Valve Leak
 - 6.8.5.1 Turn the System Power switch to Standby.
 - 6.8.5.2 Connect a test terminal (P/N 4104389) to the inspiratory valve.
 - 6.8.5.3 Connect a Fresh Gas Leak Adapter (P/N 4115041) and calibrated pressure meter to the test terminal on the inspiratory valve.
 - 6.8.5.4 Connect another test terminal to the bag connector.
 - 6.8.5.5 Connect a 0-250 ml/min. flowmeter (S000081) to the test terminal on the bag mount.
 - 6.8.5.6 Pressurize the test circuit to 30 cm H₂O.
 - (✓) 6.8.5.7 Is the value indicated on the flowmeter within 0 to 60 ml/min.? ____ (Y)
 - 6.8.5.8 Turn the system power switch to ON.
 - 6.8.5.9 Remove all test equipment.
- 6.8.6 PEEP Valve w/Bypass - If applicable
 - 6.8.6.1 Open the APL valve. If PEEP valve is mounted on the bellows, set the AUTO/BAG valve to AUTO.
 - 6.8.6.2 Interconnect the inspiratory valve and expiratory valve or expiratory port on the ultrasonic flow sensor, if applicable with a 22 mm hose (P/N 9995132).
 - 6.8.6.3 Attach a Breathing System Leak Test Adapter (P/N S010159) to the bag mount.
 - 6.8.6.4 Disconnect the pressure pilot line from the absorber and replace it with a PDM To Monitor Adapter (P/N 4115041).
 - 6.8.6.5 Connect a test gauge to the adapter.
 - 6.8.6.6 Set the O₂ flow to 5 l/min.
 - 6.8.6.7 * Place the PEEP bypass in the ON position.
 - 6.8.6.8 Adjust the absorber PEEP valve clockwise to the maximum position.
 - 6.8.6.9 Does the PEEP valve adjust smoothly? ____ (Y)

- (✓) 6.8.6.10 Is the maximum PEEP indicated on the test gauge within 15 to 22 cm H₂O? ____ (Y)
- 6.8.6.11 * Place the PEEP bypass in the OFF position.
- 6.8.6.12 * Does the PEEP return to ≤ 3 cm H₂O? ____ (Y)
- 6.8.6.13 Adjust the absorber PEEP valve counterclockwise to its minimum position.
- 6.8.6.14 Does the PEEP return to ≤ 3 cm H₂O? ____ (Y)
- 6.8.6.15 Close the O₂ flow control valve.
- 6.8.6.16 Remove the test equipment and reconnect the pilot line to the absorber.
- 6.8.6.17 If PEEP valve is mounted on the bellows return the AUTO/BAG valve to BAG.
- * These items apply only to machines with a PEEP by-pass.
- 6.8.7 Bain Circuit Adapter - If applicable
 - 6.8.7.1 Close the Bain Circuit APL valve by turning the knob fully clockwise.
 - 6.8.7.2 Verify the cm H₂O gauge at zero (0) and readjust if necessary.
 - NOTE:** The small slotted screw is the zero adjust.
 - 6.8.7.3 Insert the O₂ sensor plug into the O₂ sensor inlet on the Bain Circuit.
 - 6.8.7.4 Attach a Breathing System Leak Device (P/N S010159) to the Breathing Bag port on the Bain Circuit.
 - 6.8.7.5 Disconnect the pressure pilot line from the Bain Circuit and replace it with a PDM To Monitor Adapter (P/N 4115041).
 - 6.8.7.6 Connect a test gauge to the adapter.
 - 6.8.7.7 Occlude the expiration port on the Bain Circuit.
 - 6.8.7.8 Apply 50cm H₂O test pressure to the Bain Circuit.
 - 6.8.7.9 Is the pressure indicated on the cm H₂O gauge within 3 cm H₂O of the digital pressure meter reading? ____ (Y)
 - (✓) 6.8.7.10 After 30 seconds, is the test pressure 45 to 50 cm H₂O? ____ (Y)
 - 6.8.7.11 Open the APL valve by turning the knob fully counter-clockwise.
 - 6.8.7.12 Connect a Fresh Gas Outlet Volume Adapter (P/N S010158) between the fresh gas outlet and the Expiration port of the Bain Circuit.
 - 6.8.7.13 Set the O₂ flow to 8 l/min.

- (✓) 6.8.7.14 Is the test pressure within 0 to 3 cm H₂O? ____ (Y)
- 6.8.7.15 Remove the test equipment and reconnect the pilot line to the Bain Circuit.

6.9 OXYGEN ANALYZER

- 6.9.1 Press the O₂ CAL key to perform an O₂ Calibration.
- NOTE:** Make sure that the sensor has stabilized in ambient air for several minutes.
- (✓) 6.9.2 After calibration is completed, is the O₂ concentration 21 %? ____ (Y)
- 6.9.3 The warning message % OXYGEN LOW shall appear on the central alarm display, and a continuous alarm shall sound.
- 6.9.4 Press the Alarm Silence key and verify the audio alarm is silenced.
- 6.9.5 Place the Oxygen sensor into the inspiratory valve dome adapter.
- 6.9.6 Set the AUTO/MAN selector to BAG.
- 6.9.7 Close the APL valve.
- 6.9.8 Attach a 22 mm hose (P/N 9995132) to the inspiratory valve.
- 6.9.9 Attach a Breathing System Leak Test Device (P/N S010159) to the bag mount.
- 6.9.10 Press the O₂ Flush.
- 6.9.11 After 10 seconds, is the O₂ concentration 90 to 100 % O₂? ____ (Y)
- 6.9.12 Release the O₂ Flush, does the flow cease immediately? ____ (Y)
- 6.9.13 Set the Oxygen flow to 10 l/min.
- (✓) 6.9.14 After 1 minute, is the O₂ concentration 97 to 100%? ____ (Y)

6.10 FLOWMETERS/GAS CONCENTRATIONS

- (✓) 6.10.1 Oxygen Flowmeter
 - 6.10.1.1 Is it possible to adjust the flow of Oxygen over the full range of the flowmeters? ____ (Y)
 - 6.10.1.2 Set the Oxygen flow to 4 l/min.
 - 6.10.1.3 Is the correct flow control knob and label attached to the Oxygen flow control valve? ____ (Y)
- (✓) 6.10.2 Oxygen-Helium Flowmeter - If applicable
 - 6.10.2.1 Set the gas selector to ALL GAS, if applicable. Is it possible to adjust the flow of the Oxygen-Helium over the full range of the flowmeter? ____ (Y)
 - 6.10.2.2 Set the Oxygen-Helium flow to 2 l/min.
 - 6.10.2.3 *After the value stabilizes, is the O₂ concentration 72 to 78% O₂? ____ (Y)

6.10.2.4 Close the Oxygen-Helium flow valve.

6.10.2.5 Is the correct flow control knob and label attached to the Oxygen-Helium flow control valve? ____ (Y)

*Oxygen-Helium specifications are given @ 25% O₂. Cylinder content deviations will affect this value. The expected concentration values can be obtained by replacing the '25' % O₂ value given for O₂-HE with the actual cylinder content as follows:

$$\frac{(2 \text{ l/min O}_2\text{-HE} \times '25') + (4 \text{ l/min. O}_2 \times 100)}{6 \text{ l/min - Total Flow}} = \% \text{ O}_2$$

(✓) 6.10.3 Helium Flowmeter - If applicable

6.10.3.1 Set the gas selector to ALL GAS, if applicable.

6.10.3.2 Is it possible to adjust the flow of the Helium over the full range of the flowmeter? ____ (Y)

6.10.3.3 Set the Helium flow to 2 l/min.

6.10.3.4 After the value stabilizes, is the O₂ concentration 64 to 70? ____ (Y)

6.10.3.5 Close the Helium flow valve.

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

(✓) 6.10.4 Nitrogen Flowmeter - If applicable

6.10.4.1 Set the gas selector to ALL GAS, if applicable.

6.10.4.2 Is it possible to adjust the flow of the Nitrogen over the full range of the flowmeter? ____ (Y)

6.10.4.3 Set the Nitrogen flow to 2 l/min.

6.10.4.4 After the value stabilizes, is the O₂ concentration 64 to 70%? ____ (Y)

6.10.4.5 Close the Nitrogen flow valve.

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

(✓) 6.10.5 Carbon Dioxide Flowmeter - If applicable

6.10.5.1 Set the gas selector to ALL GAS, if applicable. Is it possible to adjust the flow of the Carbon Dioxide over its range of 550 ml/min.? ____ (Y)

6.10.5.2 Set the Oxygen flow to 1000 ml/min.

6.10.5.3 Set the Carbon Dioxide flow to 500 ml/min.

6.10.5.4 After the value stabilizes, is the O₂ concentration 64 to 70%? ____ (Y)

6.10.5.5 Close the Carbon Dioxide flow valve.

- 6.10.5.6 Readjust the Oxygen flow to 4 l/min.
- 6.10.5.7 Is the correct flow control knob and label attached to the Carbon Dioxide flow control valve? ____ (Y)
- (✓) 6.10.6 Air Flowmeter - If applicable
 - 6.10.6.1 If not configured with an Air Cylinder yoke, attach the Air Pipeline hose.
 - 6.10.6.2 Set the gas selector to ALL GAS, if applicable. Is it possible to adjust the flow of the Air over the full range of the flowmeter? ____ (Y)
 - 6.10.6.3 Set the Air flow to 2 l/min.
 - 6.10.6.4 After the value stabilizes, is the O₂ concentration 71 to 77%? ____ (Y)
 - 6.10.6.5 Close the Air flow control valve.
 - 6.10.6.6 Is the correct flow control knob and label attached to the Air flow control valve? ____ (Y)
- 6.10.7 Nitrous Oxide Flowmeter
 - 6.10.7.1 Set the Nitrous Oxide flow to 2 l/min.
 - 6.10.7.2 After the value stabilizes, is the O₂ concentration 64 to 70% ____ (Y)
 - 6.10.7.3 Is the correct flow control knob and label attached to the Nitrous Oxide flow control valve? ____ (Y)
 - 6.10.7.4 Is it possible to adjust the flow of Nitrous Oxide over the full range of the flowmeter? ____ (Y)
- 6.10.8 Oxygen Ratio Control - If applicable
 - 6.10.8.1 Open the Nitrous Oxide flow control valve to the stop position.
 - (✓) 6.10.8.2 After the value stabilizes, is the O₂ concentration 21 to 29%? ____ (Y)
 - 6.10.8.3 Set the Oxygen flow to 2 l/min.
 - (✓) 6.10.8.4 After the value stabilizes, is the O₂ concentration 21 to 29%? ____ (Y)
 - 6.10.8.5 Set the Oxygen flow to 1 l/min.
 - (✓) 6.10.8.6 After the value stabilizes, is the O₂ concentration 21 to 29%? ____ (Y)
 - 6.10.8.7 Reduce the O₂ flow to 500 ml/min. Verify that the N₂O flow is greater than or equal to 600 ml/min.
 - 6.10.8.8 Close the Oxygen flow control valve.
 - 6.10.8.9 Close the Nitrous Oxide flow control valve.

- 6.10.9 Oxygen Ratio Monitor Controller - If applicable
 - 6.10.9.1 Close the Oxygen flow control valve.
 - 6.10.9.2 * Set the Gas Selector switch to "O₂+N₂O".
 - 6.10.9.3 Slowly increase the Oxygen flow until Nitrous Oxide begins to flow. Is the oxygen flow rate 200 to 400 ml/min.? ____ (Y)
 - 6.10.9.4 Slowly increase the Oxygen flow until the "O₂/N₂O FLOW RATIO" LED on the alarm panel is lighted. Is the nitrous oxide flow rate 150-300 ml/min, or 700-800 if configured with Minimum O₂ Flow Elimination? ____ (Y)
 - 6.10.9.5 Set the oxygen flow to 1000 ml/min.
 - 6.10.9.6 Open the nitrous oxide flow control valve to the stop position.
 - 6.10.9.7 Is the "O₂/N₂O FLOW RATIO" alarm activated? ____ (Y)
 - (✓) 6.10.9.8 After the value stabilizes, is the oxygen concentration 21 to 29%? ____ (Y)
 - 6.10.9.9 Adjust the oxygen flow to 2 l/min.
 - (✓) 6.10.9.10 After the value stabilizes, is the oxygen concentration 21 to 29%? ____ (Y)
 - 6.10.9.11 Adjust the oxygen flow to 4 l/min.
 - (✓) 6.10.9.12 After the value stabilizes, is the oxygen concentration 21 to 29%? ____ (Y)
 - 6.10.9.13 Is the "O₂/N₂O FLOW RATIO" alarm activated? ____ (Y)
 - 6.10.9.14 * Set the Gas Selector switch to ALL GASES.
 - 6.10.9.15 * Is the "O₂/N₂O FLOW RATIO" alarm activated? ____ (N)
 - 6.10.9.16 * Set the Gas Selector switch to "O₂+N₂O".
 - 6.10.9.17 Close the oxygen flow control valve.
 - 6.10.9.18 What is the flow of nitrous oxide? ____ ml/min. (0)
 - 6.10.9.19 Is the "O₂/N₂O FLOW RATIO" alarm activated? ____ (N)
 - 6.10.9.20 Close the nitrous oxide flow control valve.
 - * Does not apply to 2-gas machines.
- (✓) 6.10.10 Auxiliary Oxygen Flowmeter - If applicable
 - 6.10.10.1 Connect a test pressure monitor to the outlet using a PDM/Suction adapter (P/N 4115038).
 - 6.10.10.2 Increase the pressure to 50 cm H₂O.
 - 6.10.10.3 After 10 seconds, is the pressure within 40 to 60 cm H₂O? ____ (Y)
 - 6.10.10.4 Remove the test gauge and adapter.

- 6.10.10.5 Is it possible to adjust the flow over the full range of the flowmeter? ____ (Y)
- 6.10.10.6 Set the flow rate to 5 l/min.
- 6.10.10.7 Hold the Oxygen sensor at the flowmeter outlet.
- 6.10.10.8 After the value stabilizes, is the O₂ concentration within 80 to 100% ____ (Y)
- 6.10.10.9 Replace the Oxygen sensor into the Inspiratory valve dome.
- 6.10.10.10 Close the Auxiliary Oxygen flow control valve.

(✓) 6.11 HIGH PRESSURE REGULATOR - Six Month Service Interval; Due Date ____

6.11.1 N₂O Regulator

NOTE: Minimum cylinder pressure for N₂O regulator test is 600 psi.

- 6.11.1.1 Configure the test gauge (P/N 4114807) using a N₂O nut/stem DISS connector (P/N 4114830-004) on the hose, and N₂O DISS body connector (P/N 4114830-003) on the valve body side. If the machine is configured with CSA style fittings reverse the position of the connectors.
- 6.11.1.2 Connect the test fixture hose to the machine's Nitrous Oxide pipeline inlet.
- 6.11.1.3 Connect the Nitrous Oxide pipeline supply hose to the test fixture.
- 6.11.1.4 Open the Nitrous Oxide and the Oxygen cylinder valves.
- 6.11.1.5 Set the Oxygen and Nitrous Oxide flows to 4 l/min.
- 6.11.1.6 Depress the push button on the test device.
- (✓) 6.11.1.7** Release the push button. After the pressure decay stabilizes, is the regulator output pressure 40 to 49 psi? ____ (Y)
- 6.11.1.8 Remove the test fixture.

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

6.11.2 Air Regulator - If applicable

NOTE: Minimum cylinder pressure for Air regulator test is 1000 psi.

- 6.11.2.1 Configure the test gauge (P/N 4114807) using an Air nut/stem DISS connector (P/N 4114830-002) on the hose and a DISS body connector (P/N 4114830-001) on the valve body side. If the machine is configured with CSA style fittings reverse the position of the connectors.
- 6.11.2.2 Connect the test fixture hose to the machine's Air pipeline inlet.
- 6.11.2.3 Connect the Air pipeline supply hose to the test fixture.
- 6.11.2.4 Set the Air flow to 4 l/min.
- 6.11.2.5 Depress the push button on the test device.
- (✓) 6.11.2.6 Release the push button. After the pressure decay stabilizes, is the regulator output pressure within tolerance given in the following table? ____ (Y)

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

Cylinder Pressure psi	USA Compensated Regulator output tolerances	ISO Compensated Regulator output tolerances
2000	38 to 44	41 to 47
1800	39 to 45	42 to 48
1600	40 to 46	43 to 49
1400	41 to 47	44 to 50
1200	42 to 48	45 to 51
1000	43 to 49	46 to 52

- 6.11.2.7 Remove the test fixture.

6.11.3 O₂ Regulator

NOTE: Minimum cylinder pressure for O₂ regulator test is 1000 psi.

- 6.11.3.1 Configure a test gauge (P/N 4114807) using an O₂ nut/stem DISS connector (P/N 4114830-006) on the hose and an O₂ DISS body connector (P/N 4114830-005) on the valve body side. If the machine is configured with CSA style fittings reverse the position of the connectors.
- 6.11.3.2 Connect the test fixture hose to the machine's Oxygen pipeline inlet.
- 6.11.3.3 Connect the Oxygen pipeline supply hose to the test fixture.

- 6.11.3.4 Set the Oxygen flow to 4 l/min.
- 6.11.3.5 Depress the push button on the test device.
- (✓) 6.11.3.6 Release the push button. After the pressure decay stabilizes, is the regulator output pressure within the tolerance given in the following table? ____ (Y)

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

Cylinder Pressure psi	USA Compensated Regulator output tolerances	ISO Compensated Regulator output tolerances
2000	38 to 44	41 to 47
1800	39 to 45	42 to 48
1600	40 to 46	43 to 49
1400	41 to 47	44 to 50
1200	42 to 48	45 to 51
1000	43 to 49	46 to 52

(✓) 6.12 LOW O₂ SUPPLY - Six Month Service Interval

- 6.12.1 Close the Oxygen cylinder valve and drain all Oxygen pressure.
- 6.12.2 Depress the push button on the test device.
- 6.12.3 Adjust the Oxygen flow to 500 ml/min.
- 6.12.4 Release the test device push button.
- 6.12.5 Is the pressure on the test gauge when the LO O₂ SUPPLY message appears within 34 to 40 psi? ____ (Y)
- 6.12.6 Remove the test equipment.

6.13 OXYGEN SUPPLY FAILURE PROTECTION

- 6.13.1 Connect all pipeline supplies.
- 6.13.2 Close the Oxygen flow control valve if applicable.
- (✓) 6.13.3 *Is the flow of Oxygen 100 to 200ml/min; or 0 ml/min for Minimum O₂ Flow Elimination? ____ (Y)
- 6.13.4 Open the Nitrous Oxide flow control valve.
- (✓) 6.13.5 *Is the flow of Nitrous Oxide 375 to 750 ml/min.; or 0 ml/min if without Bypass? ____ (Y)

- 6.13.6 Adjust the Oxygen, Nitrous Oxide and additional gas flow to 4 l/min. Set Carbon Dioxide Flow to 500 ml/min., if applicable.
 - 6.13.7 Disconnect the Oxygen pipeline supply and close the Oxygen cylinder valve.
 - (✓) 6.13.8 Do all flows cease when the Oxygen pressure is depleted? ____ (Y)
 - 6.13.9 Reconnect the Oxygen pipeline supply.
 - 6.13.10 Close all cylinder valves and then disconnect the Nitrous Oxide pipeline supply, and Air pipeline if applicable.
 - 6.13.11 Drain the cylinder contents then reconnect the pipeline supplies.
 - 6.13.12 Close all flow control valves.
- * Nitrous Oxide Bypass flow and Minimum Oxygen flow specifications are given @ 50 psi. Pipeline pressure deviations may affect these tests.

6.14 PRESSURE MONITOR

- 6.14.1 Disconnect the breathing pressure sensor line from the absorber.
- 6.14.2 Connect a PDM Adapter (P/N 4115043) and test pressure gauge to the breathing pressure sensor line.
- 6.14.3 Adjust the test pressure to 0 cm H₂O.
- 6.14.4 Simultaneously set AUTO/BAG valve to AUTO, or set the Ventilator switch to the ON position and start a stopwatch.
- (✓) 6.14.5 Does the APNEA PRESSURE appear on the alarm display as a CAUTION within 13 to 17 seconds? ____ (Y)
- (✓) 6.14.6 Increase the test pressure slowly. Does the APNEA PRRESSURE alarm deactivate within 10 to 14 cm H₂O? ____ (Y)
- 6.14.7 First decrease the pressure then increase the test pressure above the threshold line shown on the display, and begin timing with a stopwatch.
- (✓) 6.14.8 Does the CONTINUOUS PRES appear as a warning within 13 to 17 seconds? ____ (Y)
- (✓) 6.14.9 Decrease the pressure slowly. Does the CONTINUOUS PRES alarm deactivate within 10 to 14 cm H₂O? ____ (Y)
- (✓) 6.14.10 Increase the test pressure slowly. Does a VENT PRESS HI activate as a warning alarm within 47 to 53 cm H₂O? ____ (Y)
- (✓) 6.14.11 Create a sub-atmospheric test pressure slowly. Does the SUB ATM PRES warning alarm activate within -7 to -13 cm H₂O? ____ (Y)
- 6.14.12 Set the AUTO/BAG valve to BAG, or set the Ventilator switch to the off position.
- 6.14.13 Open APL valve.
- 6.14.14 Remove the test equipment and reconnect the breathing pressure sensor line to the absorber.

6.15 VENTILATOR

NOTE: Readjustment of inspiratory flow to limit the inspiratory plateau may be required to reduce erratic tidal volumes and breath rates caused by artifact volumes.

- 6.15.1 Remove the bellows hose and the scavenger hose at the ventilator relief valve. Remove the bellows sub-assembly and remove bellows.
- 6.15.2 Visually inspect the bellows for deterioration particularly at its seams and corrugations.
- 6.15.3 Verify the presence of its sealing O-ring and reassemble the components.
- 6.15.4 Turn on the ventilator on using the ON/OFF knob.
- 6.15.5 If applicable, does the FAULT indicator turn on? (Y)
- 6.15.6 Set the AUTO/MAN selector switch to AUTO.
- 6.15.7 If applicable, does the FAULT indicator turn off? (Y)
- 6.15.8 Set the FREQUENCY to 10 BPM.
- (✓) 6.15.9 If applicable, press and hold the EXTENDED RANGE switch and set the I:E ratio to 2:1. Using a stopwatch, time the extended I:E ratio. Is the inspiratory time within 3.6 to 4.4 seconds and the expiratory time between 1.8 to 2.2 seconds? ____ (Y)
- (✓) 6.15.10 Set the I:E RATIO to 1:2. Using a stopwatch, time the I:E ratio. Is the inspiratory time between 1.8 to 2.2 seconds and the expiratory time within 3.6 to 4.4 seconds? ____ (Y)
- 6.15.11 Adjust the Oxygen flow to 500 ml/min.
- 6.15.12 Set the Tidal Volume to 1200, or if testing an external pediatric bellows set the tidal volume to approximately 300 ml.
- 6.15.13 Attach a patient circuit to the absorber system.
- 6.15.14 Set the pressure limit control to MAX, if applicable.
- 6.15.15 Adjust the Inspiratory Flow to the bottom of the LOW zone.
- 6.15.16 Occlude the Y-piece.
- 6.15.17 Press the O₂ Flush momentarily to inflate the bellows.
- 6.15.18 Adjust the Inspiratory Flow until a peak pressure of 80 cm H₂O is achieved.
- (✓) 6.15.19 If applicable, set the Pressure Limit Control to within the 30 range. Readjust within the band as necessary to achieve proper value. Is the peak pressure at the 30 range within 27 to 33 cm H₂O? ____ (Y)
- (✓) 6.15.20 If applicable, set the Pressure Limit Control to the MIN position. Is the peak pressure at the MIN range 0 to 15 cm H₂O? ____ (Y) Return the Pressure Limit control to MAX.

- 6.15.21 Loosen the expiratory valve dome, or if equipped with an ultrasonic flow sensor, open the Y-piece and disconnect the hose attached to the exhalation valve and blow into it.
- (✓) 6.15.22 Does the Reverse Flow message appear on the display? ____ (Y)
- 6.15.23 Tighten the expiratory valve dome if applicable, or if equipped with an ultrasonic flow sensor reconnect the hose between the expiratory valve and the flow sensor.
- 6.15.24 Insert a test minute volumeter in between absorber dome and Spiromed, or exhalation valve and absorber dome if equipped with an ultrasonic flow sensor.
- 6.15.25 Open the Y-piece.
- 6.15.26 Turn the ventilator off. Is the VOL-ALRM OFF message displayed in the Advisory column? (Y) If not, press the APNEA ALARMS DISABLE key.
- 6.15.27 Turn the ventilator on and start a stop watch.
- (✓) 6.15.28 Does APNEA-VOLUME appear as a Caution within 13 to 17 seconds? ____ (Y)
- 6.15.29 Attach a 3 liter breathing bag to the Y-piece.
- NOTE:** Bag should be placed on a flat horizontal surface to reduce artifact volume.
- 6.15.30 Press the O2 Flush momentarily to inflate the bellows.
- 6.15.31 Set the Inspiratory Flow to the MED and readjust as necessary to fully collapse the bellows.
- (✓) 6.15.32 Observe the operation of each unidirectional valve disc at eye level. Does the inspiratory valve disc raise only during the inspiration phase, and the expiratory valve raise only during the exhalation phase? ____ (Y)
- (✓) 6.15.33 Is the tidal volume on the volume monitor and on the test volumeter within 20 % of each other? ____ (Y)
- 6.15.34 Does the volume monitor display 10 BPM? ____ (Y)
- 6.15.35 Does the display correctly track the Breathing Pressure waveform? ____ (Y)
- 6.15.36 If ventilator is and AV2 or AV2+ skip this test. 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	22	1:1.5	33	1:2
44	1:2.5	55	1:3	66	1:3.5
77	1:4	88	1:4.5	99	1:4.5
00	1:4.5	10	1:2		

6.16 BELLOWS ADULT - If applicable

- (✓) 6.16.1 Is the tidal volume indicated on the test volumeter 960 to 1440 ml? ____ (Y)
- (✓) 6.16.2 Does the bellows remain fully inflated during the expiratory pause phase? ____ (Y)
- 6.16.3 Remove the ventilator hose from the VENTILATOR HOSE terminal.
- 6.16.4 Attach a test terminal to the bellows assembly ventilator hose terminal.
- 6.16.5 Connect a 0-250 ml/min. flowmeter (P/N S000081) to the test terminal.
- 6.16.6 Set the FREQUENCY to 1 BPM.
- (✓) 6.16.7 Is the drive gas leakage indicated during the inspiratory phase 0 to 50 ml? ____ (Y)
- 6.16.8 Remove the test equipment from the ventilator hose terminal and reconnect the ventilator hose to the VENTILATOR HOSE terminal.
- 6.16.9 Set the FREQUENCY to 10 BPM.
- 6.16.10 Adjust the O₂ flow to 10 l/min.
- 6.16.11 Adjust the Tidal Volume to maximum.
- 6.16.12 Press the O₂ Flush momentarily to inflate the bellows.
- 6.16.13 Adjust the INSPIRATORY FLOW to fully compress the bellows.
- (✓) 6.16.14 Is the Tidal Volume on the test volumeter greater than 1400 ml? ____ (Y)
- (✓) 6.16.15 Is the PEEP value displayed on the monitor 0 to 3 cm H₂O? ____ (Y)
- 6.16.16 Remove the breathing bag from the Y-piece and replace it with a test lung.
- 6.16.17 Adjust the Oxygen flow to 300 ml/min.
- 6.16.18 Adjust the Tidal Volume to 200 ml.
- 6.16.19 Does the bellows stop adjust smoothly and engage properly? ____ (Y)
- 6.16.20 Adjust the INSPIRATORY FLOW to fully compress the bellows.
- (✓) 6.16.21 Is the Tidal Volume on the test volumeter 125 to 250 ml? ____ (Y)
- 6.16.22 Close the Oxygen flow control valve.
- 6.16.23 Remove the test lung, set the AUTO/BAG selector valve to BAG and set the ventilator switch to the off position if applicable.
- 6.16.24 Press the VOLUME ALRMS DISABLE and the APNEA ALRM DISABLE keys.

6.17 BELLOWS PEDIATRIC EXTERNAL - If applicable

- 6.17.1 Adjust the fine flow control of the pediatric bellows attachment fully clockwise.
- 6.17.2 Remove the breathing bag from the Y-piece and replace it with a test lung (P/N 4115128).
- 6.17.3 Press the O₂ Flush momentarily to inflate the bellows.

- (✓) 6.17.4 Does the bellows remain fully inflated during the expiratory pause phase? ____ (Y)
- 6.17.5 Set the ventilator frequency to 20 BPM.
- 6.17.6 Adjust the O₂ flow to 3 l/min.
- (✓) 6.17.7 Is the tidal volume on the test volumeter greater than 250 ml? ____ (Y)
- 6.17.8 Adjust the tidal volume to the 100 ml mark on the pediatric bellows assembly.
- (✓) 6.17.9 Is the tidal volume on the test volumeter within 65 to 135 ml? ____ (Y)
- 6.17.10 Verify that with the Pediatric Bellows Fine Flow Control turned fully counter-clockwise the bellows does not collapse during inspiration. Readjust the knob to the fully clockwise position.
- 6.17.11 Adjust the O₂ flow to 10 l/min.
- (✓) 6.17.12 Is the PEEP displayed on the monitor 0 to 3 cm H₂O? ____ (Y)
- 6.17.13 Close the Oxygen flow control valve.
- 6.17.14 Remove the ventilator hose from the VENTILATOR HOSE terminal.
- 6.17.15 Attach a test terminal (P/N 4104389) to the bellows assembly ventilator hose terminal.
- 6.17.16 Connect a 0-250 ml/min. flowmeter (P/N S000081) to the test terminal.
- 6.17.17 Set the FREQUENCY to 1 BPM.
- 6.17.18 Set the I:E RATIO to 1:1.
- 6.17.19 Set the Inspiratory Flow to MAX.
- (✓) 6.17.20 Is the drive gas leakage indicated during the inspiratory phase 0 to 50 ml/min? ____ (Y)
- 6.17.21 Remove the test equipment and reattach the ventilator hose to the VENTILATOR HOSE terminal.
- 6.17.22 Set AUTO/BAG valve to BAG and set the ventilator switch to the off position if applicable.
- 6.17.23 Press the VOLUME ALRMS DISABLE and the APNEA ALRM DISABLE keys.

6.18 BELLOWS PEDIATRIC INTERNAL - If applicable

- 6.18.1 Remove the breathing bag from the Y-piece and replace it with a test lung (P/N 4115128).
- 6.18.2 Press the O₂ Flush momentarily to inflate the bellows.
- (✓) 6.18.3 Does the bellows remain fully inflated during the expiratory pause phase? ____ (Y)
- 6.18.4 Set the ventilator frequency to 20 BPM.
- 6.18.5 Set the Oxygen flow to 3 liters.

- (✓) 6.18.6 Is the tidal volume on the test volumeter greater than 250 ml? ____ (Y)
 - 6.18.7 Adjust the inspiratory flow and Pressure limit control if applicable control until the bellows collapses to the 100 ml mark on the pediatric bellows assembly.
 - (✓) 6.18.8 Is the tidal volume on the test volumeter 65 to 35 ml? ____ (Y)
 - 6.18.9 Adjust the Oxygen flow to 10 l/min.
 - (✓) 6.18.10 Is the PEEP displayed on the monitor within 0 to 3 cm H₂O? ____ (Y)
 - 6.18.11 Close the Oxygen flow control valve.
 - 6.18.12 Remove the ventilator hose from the ventilator hose terminal.
 - 6.18.13 Attach a test terminal to the bellows assembly ventilator hose terminal.
 - 6.18.14 Connect a flowmeter test stand (P/N S000081) to the test terminal.
 - 6.18.15 Set the frequency to 1 BPM.
 - 6.18.16 Set the I:E RATIO to 1:1.
 - (✓) 6.18.17 Is the flow indicated during the inspiratory phase less than 50 ml? ____ (Y)
 - 6.18.18 Remove the test equipment and reattach the ventilator hose to the VENTILATOR HOSE terminal.
 - 6.18.19 Return pressure limit control to MAX.
 - 6.18.20 Set AUTO/BAG valve to BAG and set the ventilator switch to the off position if applicable.
 - 6.18.21 Press the VOLUME ALRMS DISABLE and the APNEA ALRM DISABLE keys.
- (✓) 6.19 OPEN RESERVOIR SCAVENGER 6-Month Service Interval; Due Date ____, If applicable

NOTE: If the ambient air in the local environment contains a significant amount of dust and lint, the cleaning frequency must be increased to compensate for these conditions.

- 6.19.1 OPEN RESERVOIR SCAVENGER CLEANING
 - 6.19.1.1 Remove the scavenger hoses and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace as needed.
 - 6.19.1.2 Disconnect the hospital vacuum source from the scavenger.
 - 6.19.1.3 Cleaning procedure for assemblies with 2 large relief ports. If configured with many small vent ports skip to step.
 1. Remove the four screws securing the reservoir tube to the main block. Examine the two sealing O-rings and replace as necessary.
 2. Remove the screws securing the access panel at the bottom of the scavenger canister.
 3. Remove and inspect the silencer; replace if needed.

4. Clean the reservoir tube with compressed air if necessary.
 5. Remove the flowmeter from its housing by turning it counterclockwise.
 6. Inspect the tube and clean with compressed air if needed.
 7. Apply vacuum to the port at top of the flowmeter housing.
 8. Go to step 6.19.2.5.
- 6.19.1.4 Cleaning procedure for assemblies with many small vent ports.
1. Remove the scavenger mounting screws.
 2. 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.
 3. Remove the hardware securing the flowmeter. Remove the brass retainer at the bottom of the assembly. Inspect the for lint or dust accumulation. Clean with compressed air if necessary.
 4. Unthread the reservoir canister from the body.
 5. Remove the hardware securing the tube assembly to the block. Inspect for lint or dust accumulation. Clean with compressed air if necessary and replace O-rings if necessary.
 6. Probe all gas passages of the block to ensure there are no occlusions. Clean with compressed air if necessary.
- 6.19.1.5 Reassemble the scavenger assembly, attach the scavenger hose and reactivate the vacuum source.
- 6.19.2 OPEN RESERVOIR PRESSURE TESTING
- 6.19.2.1 Activate the Scavenger vacuum supply.
- 6.19.2.2 Turn the scavenger needle valve fully clockwise (closed).
- 6.19.2.3 Uncap the hose barb adapter at the rear of the scavenger and connect a test pressure monitor to the hose barb on the adapter using a PDM/Suction Adapter (P/N 4115038). If the scavenger does not contain a hose barb adapter install a scavenger adapter (P/N 4108114) between the 19-mm hose terminal on the scavenger and the scavenger hose.
- 6.19.2.4 Interconnect the inspiratory and expiratory valves or expiratory port on the ultrasonic flow sensor, if applicable with a 22-mm hose.
- 6.19.2.5 Attach a Breathing System Leak Test Device (P/N S010159) to the bag mount.
- 6.19.2.6 Set the AUTO/BAG valve to the BAG position.

- 6.19.2.7 Open the APL valve.
- 6.19.2.8 Set the Oxygen flow on the anesthesia machine to 8 l/min.
- 6.19.2.9 The test pressure gauge shall indicate a pressure of less than 1.0 cm H₂O.
- 6.19.2.10 Close all flow control valves on the anesthesia machine.
- 6.19.2.11 Adjust the scavenger needle valve until the flowmeter indicates between the white lines.
- 6.19.2.12 What is the pressure on the test gauge? ____ cm H₂O (0 to - 0.5)
- 6.19.2.13 Remove the test equipment, re-cap the scavenger adapter port or remove the scavenger adapter and reconnect the scavenger hose.

(✓) 6.20 A/C SCAVENGER - 6 Month Service Interval; Due Date _____, If applicable

NOTE: If the ambient air in the local environment contains a significant amount of dust and lint, the cleaning frequency must be increased to compensate for these conditions.

6.20.1 A/C SCAVENGER CLEANING

- 6.20.1.1 Remove the scavenger hoses and drain any accumulated moisture. Inspect the hoses for deterioration, then reinstall or replace it if needed.
- 6.20.1.2 Remove the safety relief valve housing by unscrewing it in a counter-clockwise direction.
- 6.20.1.3 Inspect the O-ring and replace it if needed.
- 6.20.1.4 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's fragile disk.
- 6.20.1.5 Remove any accumulated lint or dust from the valve with a soft brush. The valve may be further cleaned with a low flow of Air or Oxygen. The scavenger body can be cleaned with a moist cloth.
- 6.20.1.6 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.
- 6.20.1.7 Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.20.2 AC SCAVENGER TESTING

- 6.20.2.1 Set the AUTO/BAG valve to the BAG position.
- 6.20.2.2 Open the APL valve.

- 6.20.2.3 Occlude the bag mount connector with a Breathing System Leak Test Device (P/N S010159).
- 6.20.2.4 Interconnect the inspiratory and expiratory valves or expiratory port on the ultrasonic flow sensor, if applicable with a 22-mm hose.
- 6.20.2.5 Set the Oxygen flow on the anesthesia machine to 8 l/min.
- 6.20.2.6 Install a scavenger adapter (P/N 4108114) between the 19-mm hose terminal on the scavenger and the scavenger hose.
- 6.20.2.7 Connect a test pressure monitor to the hose barb on the adapter using a PDM/Suction Adapter (P/N 4115038).
- 6.20.2.8 Remove the transfer hose from the bottom of the scavenger and occlude this port.
- 6.20.2.9 What is the pressure on the test gauge? ____ cm H₂O (5 to 10)
- 6.20.2.10 Remove the test equipment and reconnect the scavenger hose and the transfer hose.
- 6.20.2.11 Close the Oxygen flow control valve.

(✓) 6.21 BAG SCAVENGER - Six Month Service Interval; Due Date _____, If applicable

NOTE: If the ambient air in the local environment contains a significant amount of dust and lint, the cleaning frequency must be increased to compensate for these conditions.

6.21.1 BAG SCAVENGER CLEANING

- 6.21.1.1 Remove the scavenger hoses and drain any accumulated moisture. Inspect the hoses for deterioration, then reinstall or replace as needed.
- 6.21.1.2 Remove the reservoir bag and drain any accumulated moisture and inspect it for deterioration, then reinstall or replace as needed. All under sized or single use bags must be replaced with 5-liter reusable style reservoir bag.
- 6.21.1.3 Remove the plastic valve cover on the front surface of the scavenger body by turning it in a counter-clockwise direction.
- 6.21.1.4 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.
- 6.21.1.5 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.
- 6.21.1.6 Reinstall the plastic washer and valve into the scavenger body. Replace the valve cover.
- 6.21.1.7 Unscrew the valve housing on the left side of the scavenger body by turning its fitting counter-clockwise with a wrench.

- 6.21.1.8 Unscrew the valve from the housing by turning it in a counterclockwise direction.
- 6.21.1.9 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.
- 6.21.1.10 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.
- 6.21.1.11 Remove the valve housing on the right side of the scavenger body by turning it counter-clockwise.
- 6.21.1.12 Inspect the rubber O-ring and replace if worn.
- 6.21.1.13 Remove the valve from the housing by turning it counterclockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.
- 6.21.1.14 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.
- 6.21.1.15 Reinstall the valve and plastic washer into the housing.
- 6.21.1.16 Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.
- 6.21.2 BAG SCAVENGER TESTING
 - 6.21.2.1 Activate the Scavenger vacuum supply.
 - 6.21.2.2 Turn the scavenger needle valve fully clockwise (closed).
 - 6.21.2.3 Install a scavenger adapter (P/N 4108114) between the 19-mm hose terminal on the scavenger and the scavenger hose.
 - 6.21.2.4 Connect a test pressure monitor to the hose barb on the adapter using a PDM/Suction Adapter (P/N 4115038).
 - 6.21.2.5 Set the AUTO/MAN valve to the BAG position.
 - 6.21.2.6 Connect a 22mm breathing hose between the absorber's inspiratory valve and expiratory valve or expiratory hose terminal on the ultrasonic flow sensor, if applicable.
 - 6.21.2.7 Open the APL valve.
 - 6.21.2.8 Occlude the bag mount connector.
 - 6.21.2.9 Press the O₂ Flush button to inflate the scavenger reservoir bag.
 - 6.21.2.10 Open the Oxygen flow control valve to 8 l/min.
 - 6.21.2.11 Does the reading on the test gauge indicate a pressure less than or equal to 10.0 cm H₂O? ____ (Y)

- 6.21.2.12 Adjust the scavenger needle valve to allow typical suction through the scavenger.
- 6.21.2.13 Close all flow control valves on the machine.
- 6.21.2.14 Does the gauge indicate a pressure of less than or equal to -1.0 cm H₂O? ____ (Y)
- 6.21.2.15 Remove the test equipment and reconnect the scavenger hose.
- 6.21.2.16 Close the Oxygen flow control valve.

(✓) 6.22 SUCTION REGULATOR - 6-month Service Interval; Due Date _____, If applicable

- 6.22.1 Set the vacuum on/off valve to the ON position.
- 6.22.2 Set the regulator to indicate 250 mm Hg.
- 6.22.3 Connect a digital pressure meter to the collecting inlet stem of the suction bottle.
- 6.22.4 Set the digital pressure meter to the mm Hg scale.
- 6.22.5 Is the vacuum indicated on the digital pressure meter within 200 to 300 mm Hg? ____ (Y)
- 6.22.6 Set the vacuum on/off valve to the OFF (vertical) position.
- 6.22.7 Turn the vacuum control knob fully counter-clockwise.

(✓) 6.23 MANUAL SPHYGMOMANOMETER - 6-month Service Interval; Due Date _____, If applicable

- 6.23.1 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.
- 6.23.2 Insert an NIBP-Luer Test Adapter (P/N 4116111-001) inline between the blood pressure cuff and the extension hose.
- 6.23.3 Wrap the blood pressure cuff around an "E" cylinder.
- 6.23.4 Hand-pump the squeeze bulb until pressure of 200 mm Hg is indicated on the test gauge and start a stop watch.
- 6.23.5 Does the Sphygmomanometer indicate within 180 to 220 mm Hg? ____ (Y).
- 6.23.6 After thirty (30) seconds, is the pressure on the Sphygmomanometer gauge within 190 to 200 mm Hg? ____ (Y)
- 6.23.7 Remove test equipment.
- 6.23.8 Remove the blood pressure cuff from the "E" cylinder.
- 6.23.9 Does the Sphygmomanometer indicate within the band? ____ (Y)

6.24 FINAL TESTS

- (✓) 6.24.1** Is the machine's Operator's Instruction manual in close proximity of the machine? ____ (Y)

- 6.24.2 Does the table lamp work properly if fitted? ____ (Y)
- 6.24.3 Verify all cylinder pressure gauges indicate zero.
- 6.24.4 Verify the pipeline hoses are connected to the hospital pipeline.
- 6.24.5 Verify the APL valve knob is turned completely counterclockwise (fully open).
- 6.24.6 Place the AUTO/BAG selector in the BAG position.
- 6.24.7 Verify the ventilator hose is connected between the Auto/Man valve and Ventilator hose terminal.
- 6.24.8 Verify the pressure pilot line is connected between the machine interface and absorber.
- 6.24.9 Verify the Oxygen sensor is removed from the inspriatory valve dome adapter.
- 6.24.10 Verify the inspriatory valve dome is plugged.
- 6.24.11 Unplug the machine's AC power cord, then press and hold the "BATTERY TEST" button. Is green Battery Test LED lighted? ____ (Y)
- 6.24.12 Plug the power cord back into the original AC receptacle.

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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 O₂ 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.

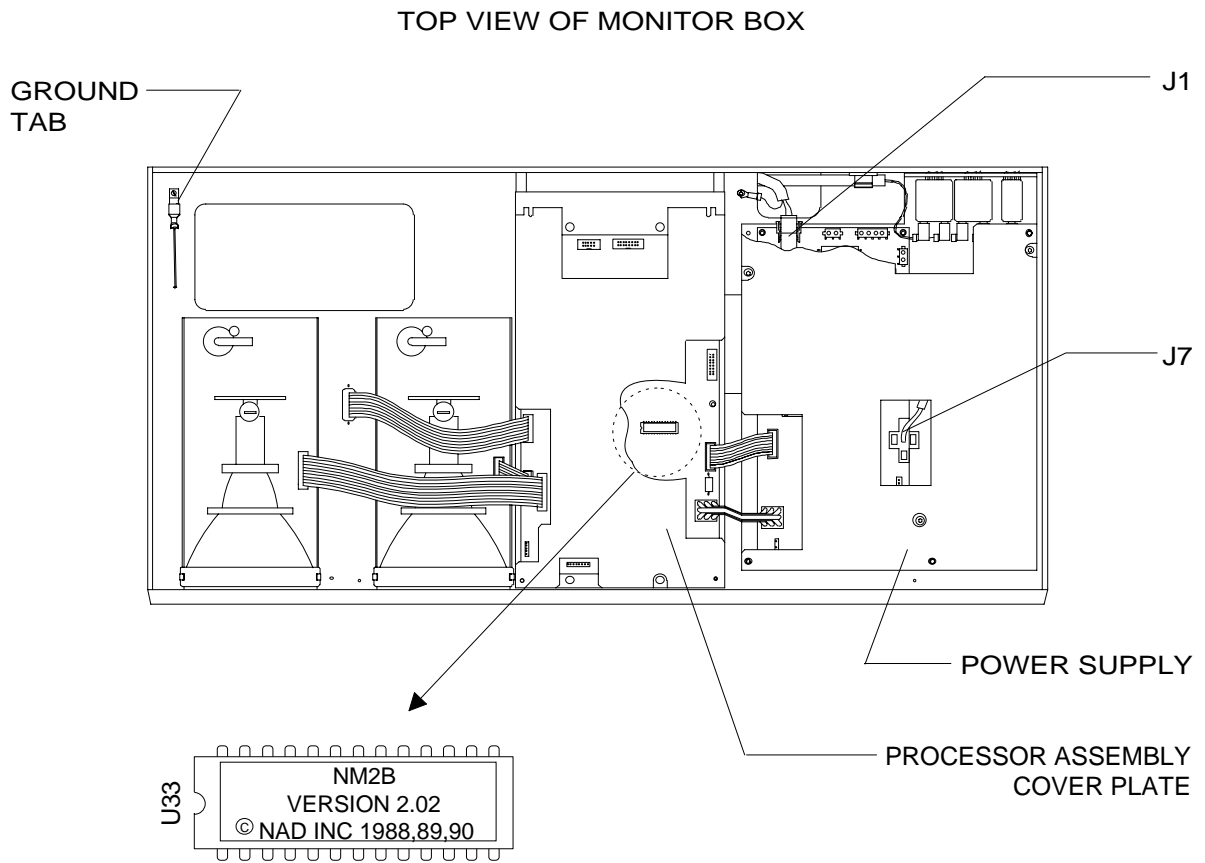
- 7.6 Carefully remove the firmware chip, U33, from the processor board.

- 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.



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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 PMC Procedure given in Section 6.

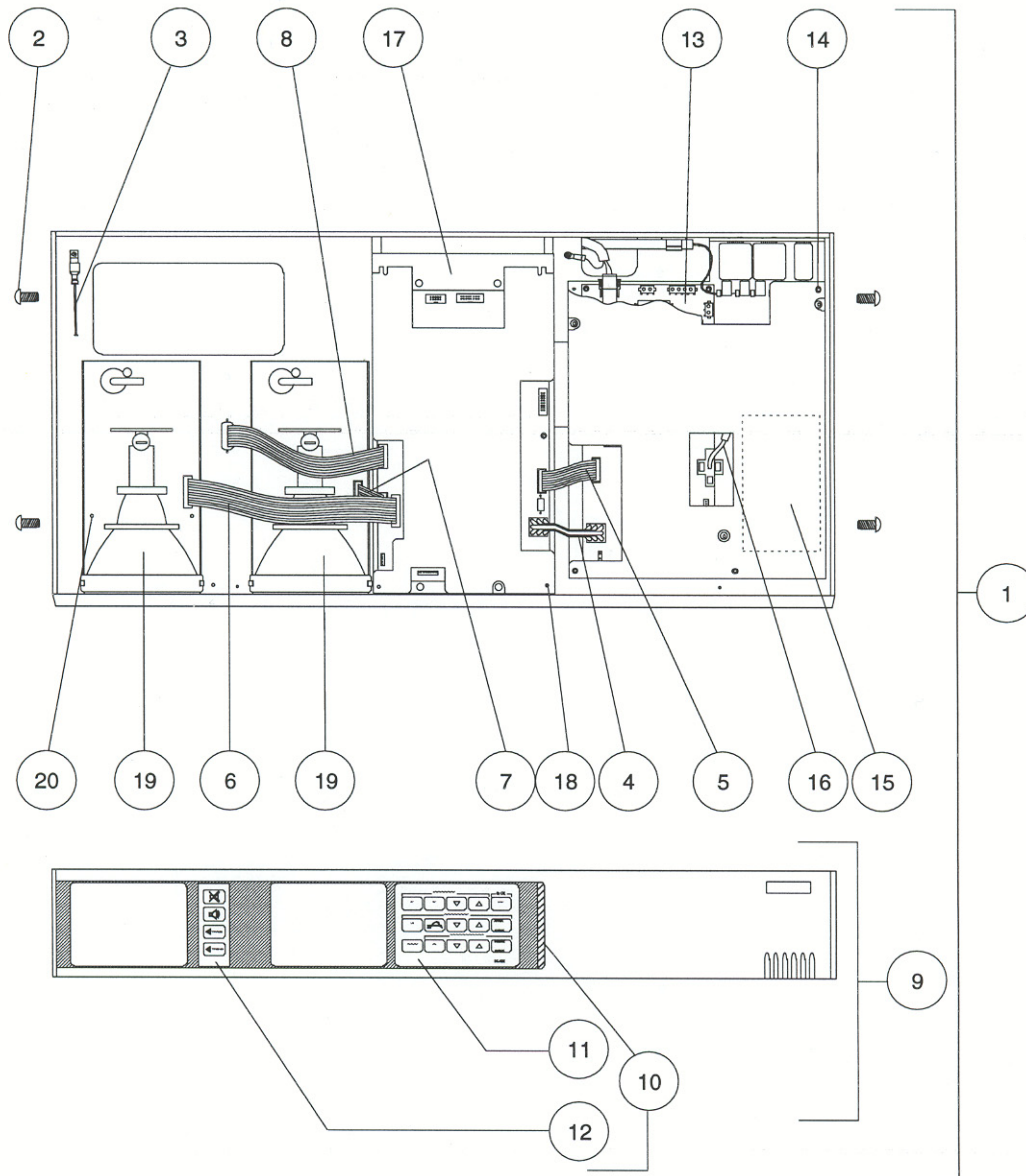
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8.0 SPARE AND REPLACEMENT PARTS

Part numbers for field-replaceable items on the NARKOMED 2B anesthesia system are listed on the following pages, along with the 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.

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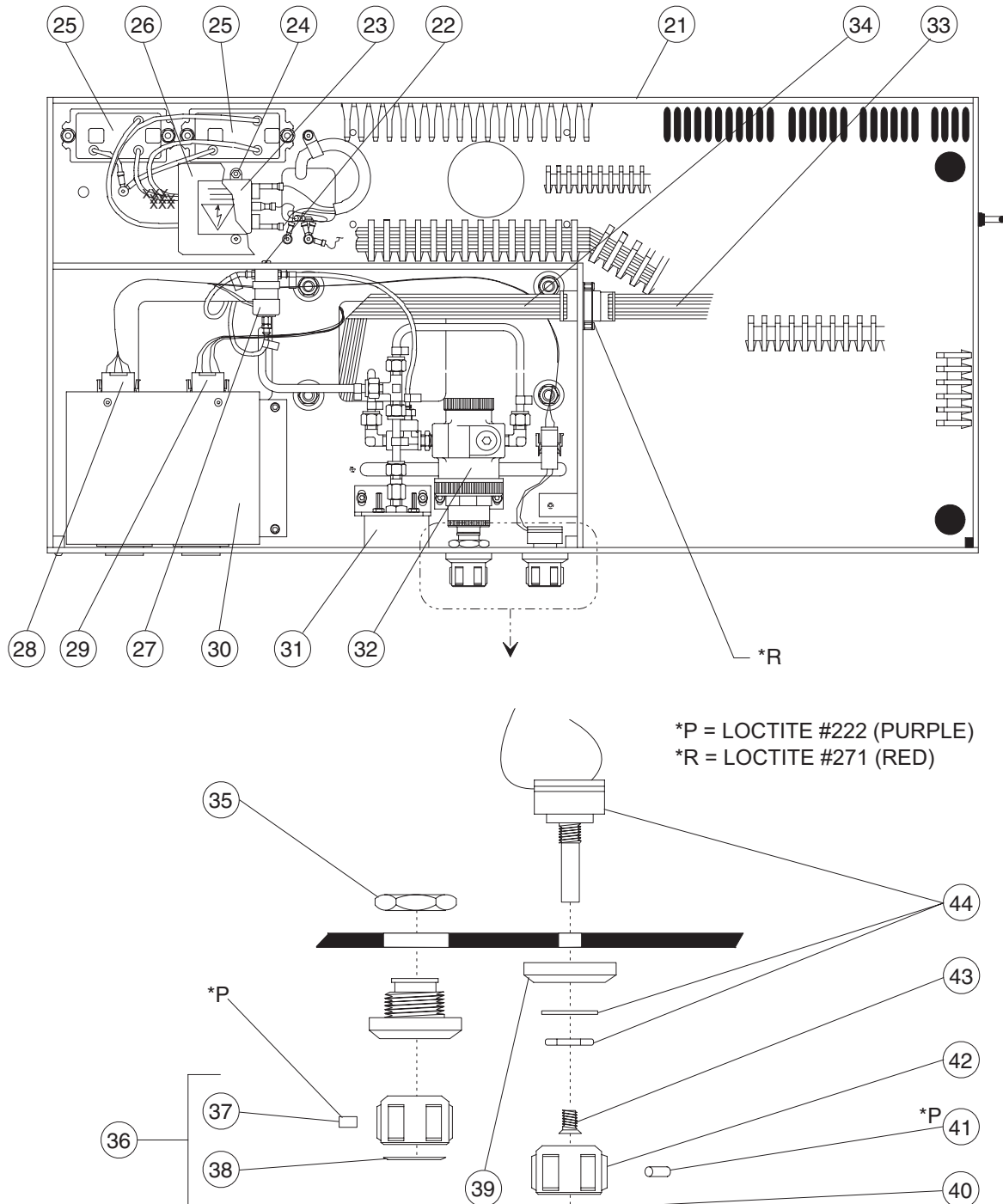
Figure 8-1. Monitor Chassis, Front Bezel, Power Supply, Processor Assembly, CRT Assemblies

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

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
	Power Supply Assembly, 220/240V	
	Replaced by	4112682-001
	Service Exchange part number is	SE4112682
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

MACHINE WITH AV-E VENTILATOR



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Figure 8-2. AV-E Ventilator Box Assembly, Incl. Controller

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
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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

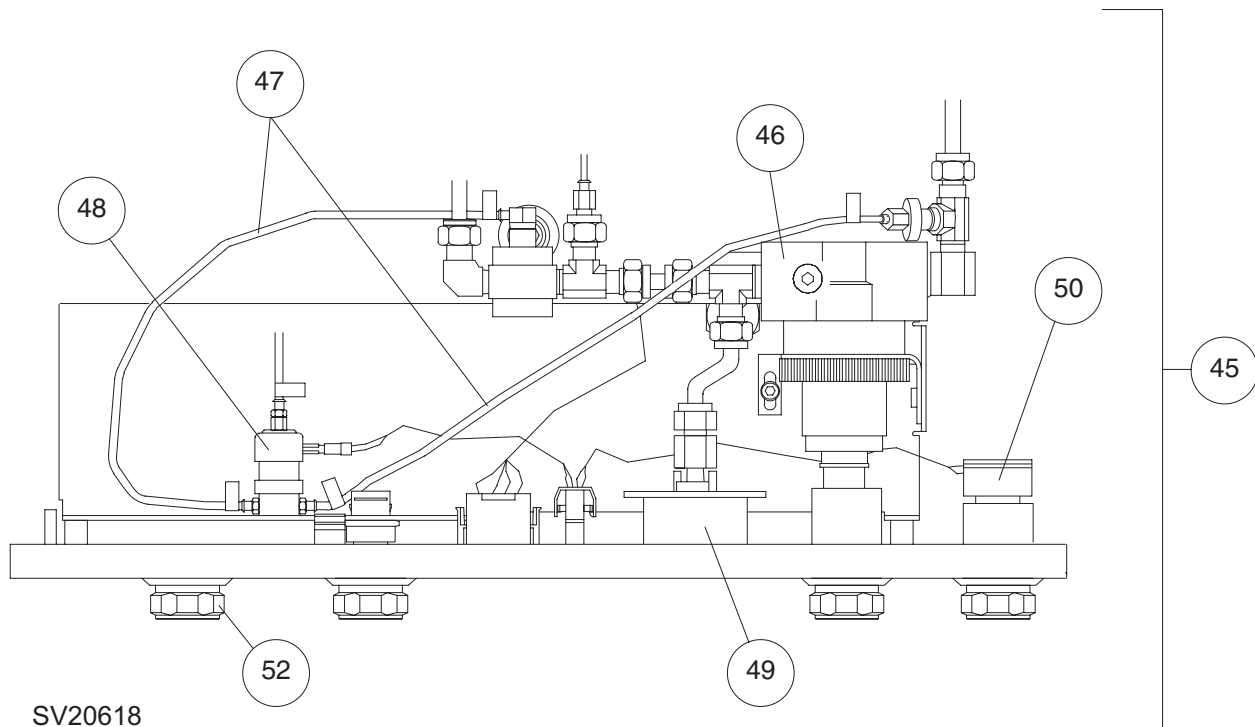


Figure 8-3. AV-2 Ventilator Controller Assembly

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
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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
51.	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

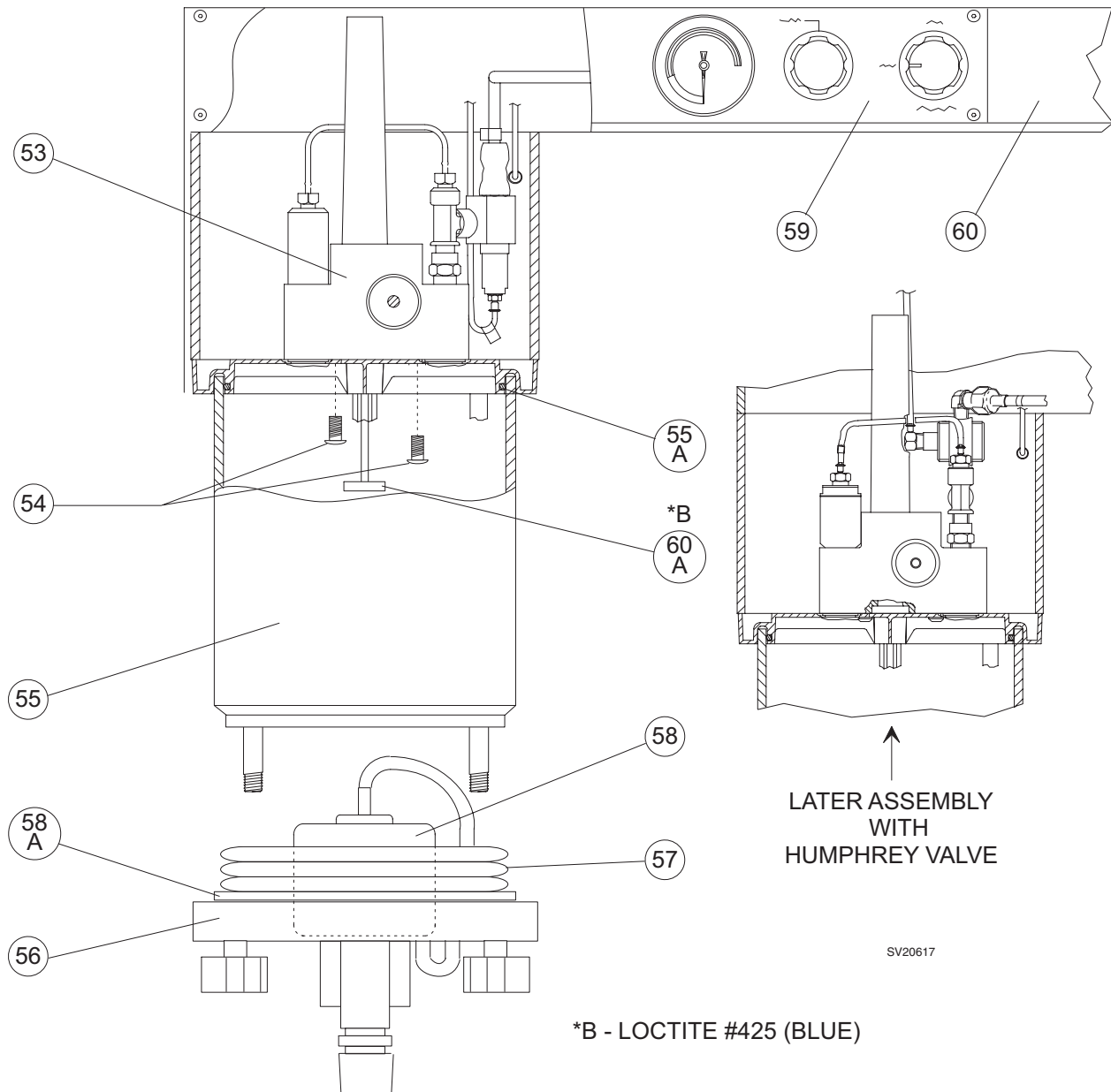
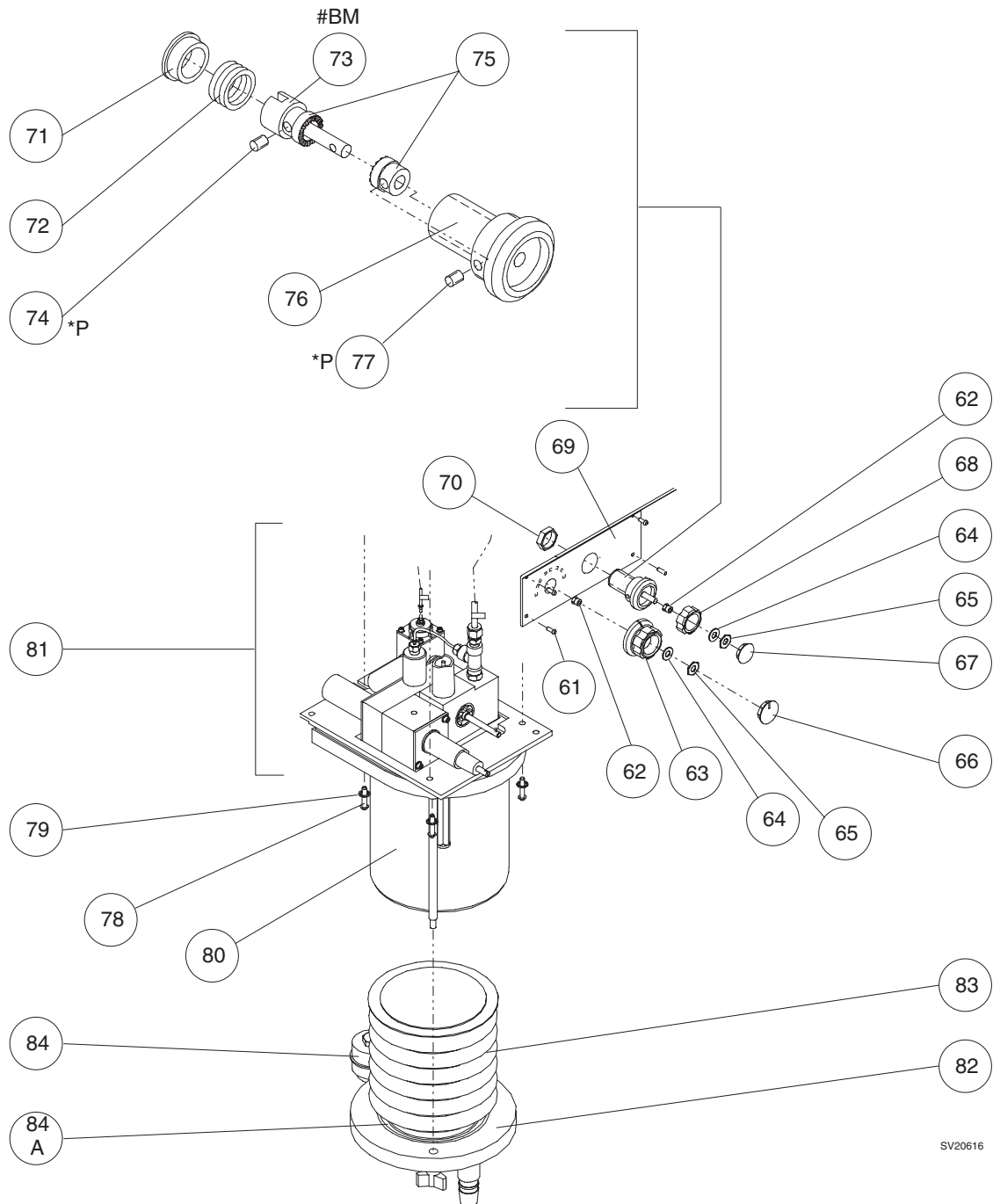


Figure 8-4. AV-E Ventilator Bellow Valve & Guide Assembly

NARKOMED 2B	SPARE AND REPLACEMENT PARTS (continued)
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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



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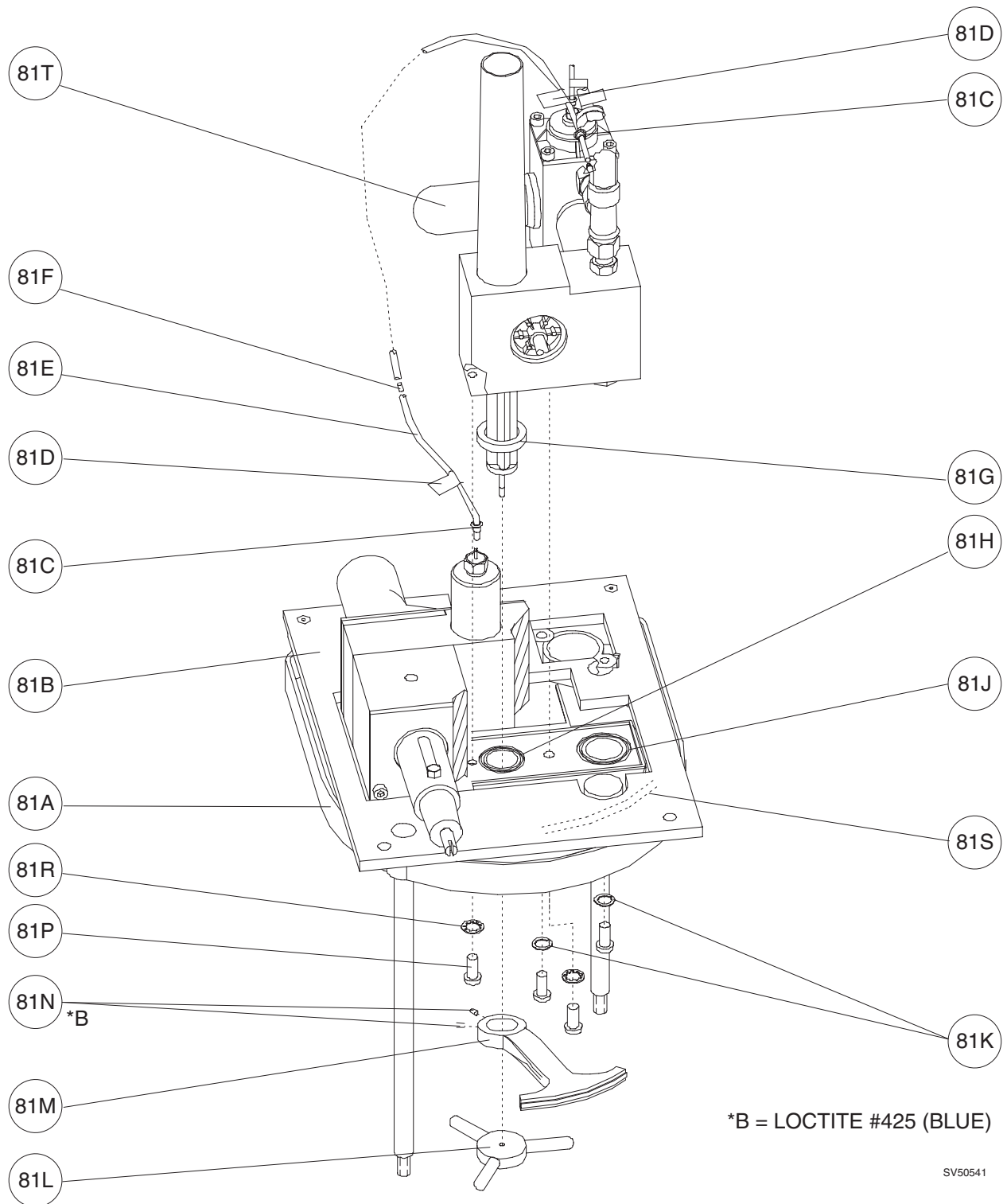
*P = LOCTITE #222 (PURPLE)
#BM = BELRAY ANTI SEIZE MOLY LUBE

Figure 8-5. Valve Case and Guide Assembly, Pressure Limit Control, Bellow Assembly

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
Machines with AV-2 Ventilator:		
61.	Screw, 6-32 x 3/8 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 1/4 in.	HW04003
78.	Screw, 1/4-20 x 1 in. Btn Hd Skt (3x)	HW09057
79.	Lock Washer, 1/4 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-S01
82.	Bellows Assembly, Adult4	106935
	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



SV50541

Figure 8-6. Bellow Valve Assembly Details

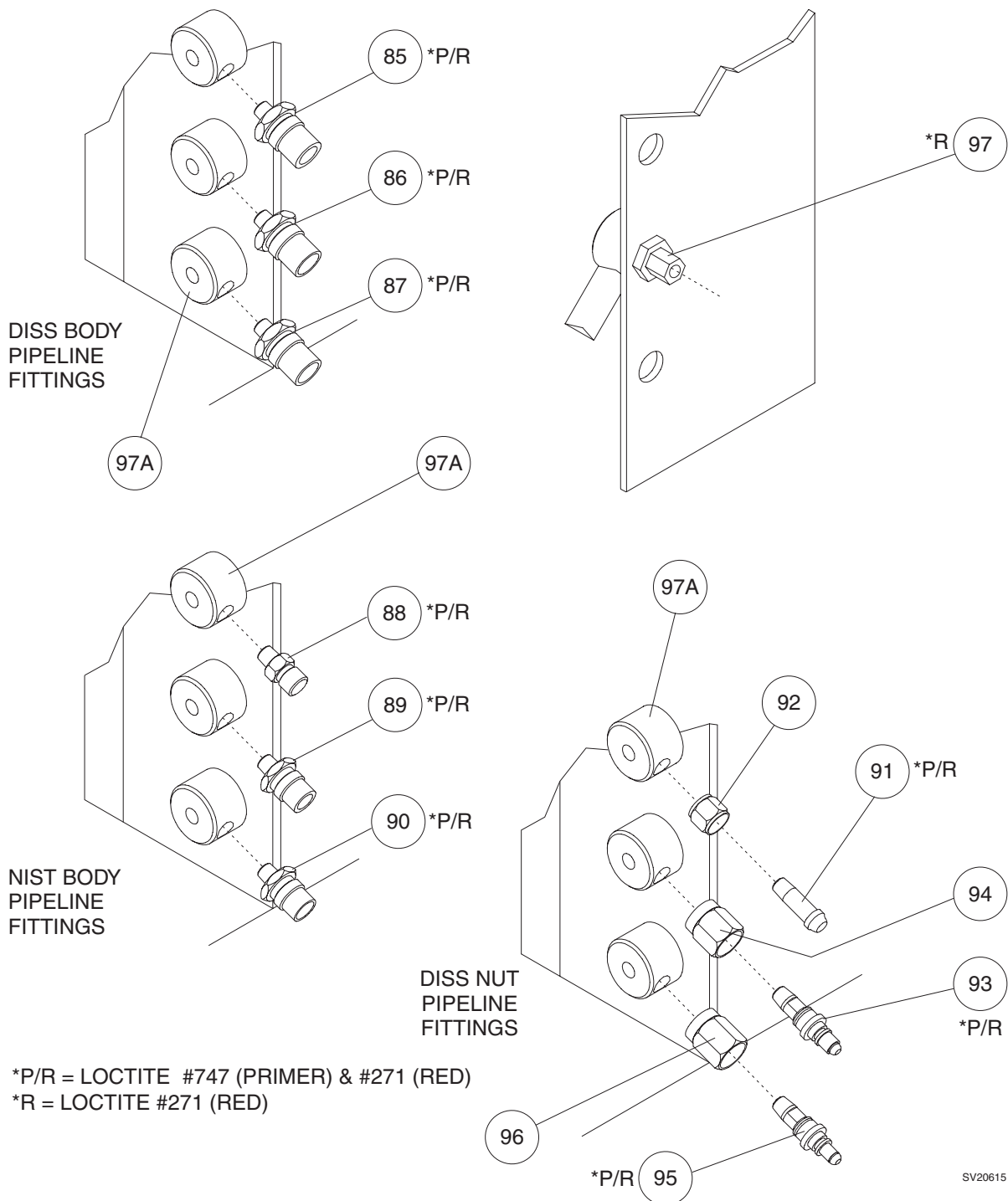
NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

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, O2 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 1/4 in. cup point (2x)	HW04003
81P	Screw, 8-32 x 3/8 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



SV20615

Figure 8-7. Pipeline Inlet Fittings

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
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DISS Body Pipeline Fittings:

85.	O2 DISS Fitting*	4102563
86.	Air DISS Fitting*	4102886
87.	N2O DISS Fitting*	4111384

NIST Body Pipeline Fittings:

88.	O2 Male NIST Connector	4110388
89.	Air Male NIST Connector	4110386
90.	N2O Male NIST Connector	4111382

DISS Nut Pipeline Fittings:

91.	O2 DISS Nipple*	4103877
92.	O2 DISS Nut*	4102848
93.	Air DISS Nipple*	4111385
94.	Air DISS Nut*	4103120
95.	N2O DISS Nipple*	4111383
96.	N2O DISS Nut*	4102850

97.	Pipeline Inlet Filter Asm (Typ., All Inlets)	4106198
-----	--	---------

	O-ring for N2O 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, O2	4109345
	Pipeline Inlet Assembly, O2 (Canada)	4109297

	Pipeline Inlet Assembly, N2O	4109344
	Pipeline Inlet Assembly, N2O (Canada)	4109298

	Pipeline Inlet Assembly, Air	4109412
	Pipeline Inlet Assembly, Air (Canada)	4109861

NOTE: Positions of O2 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, 5/8-18	HW52002
	Lock Washer, 5/8 int-t	HW67001

MACHINES CONFIGURED WITH AN ORC

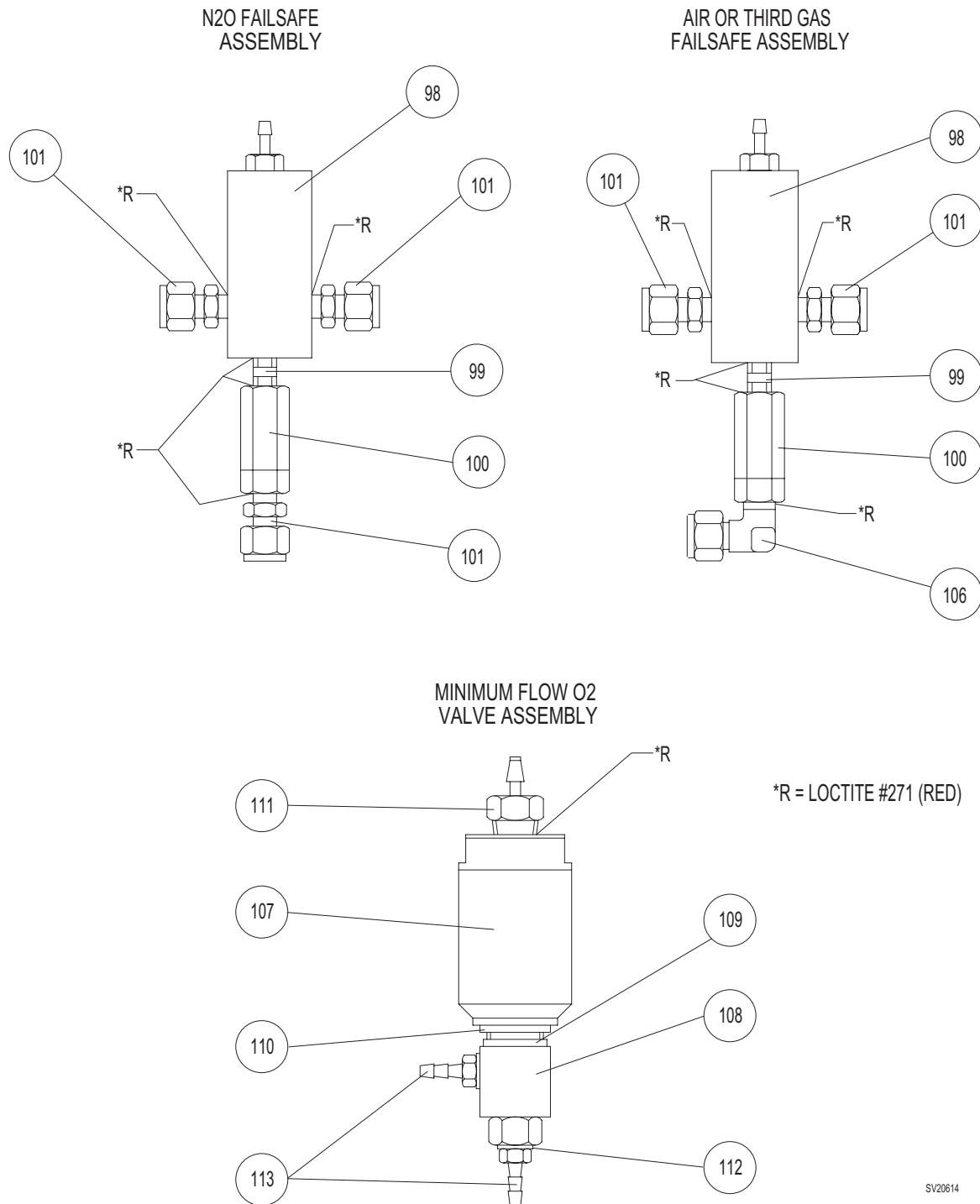


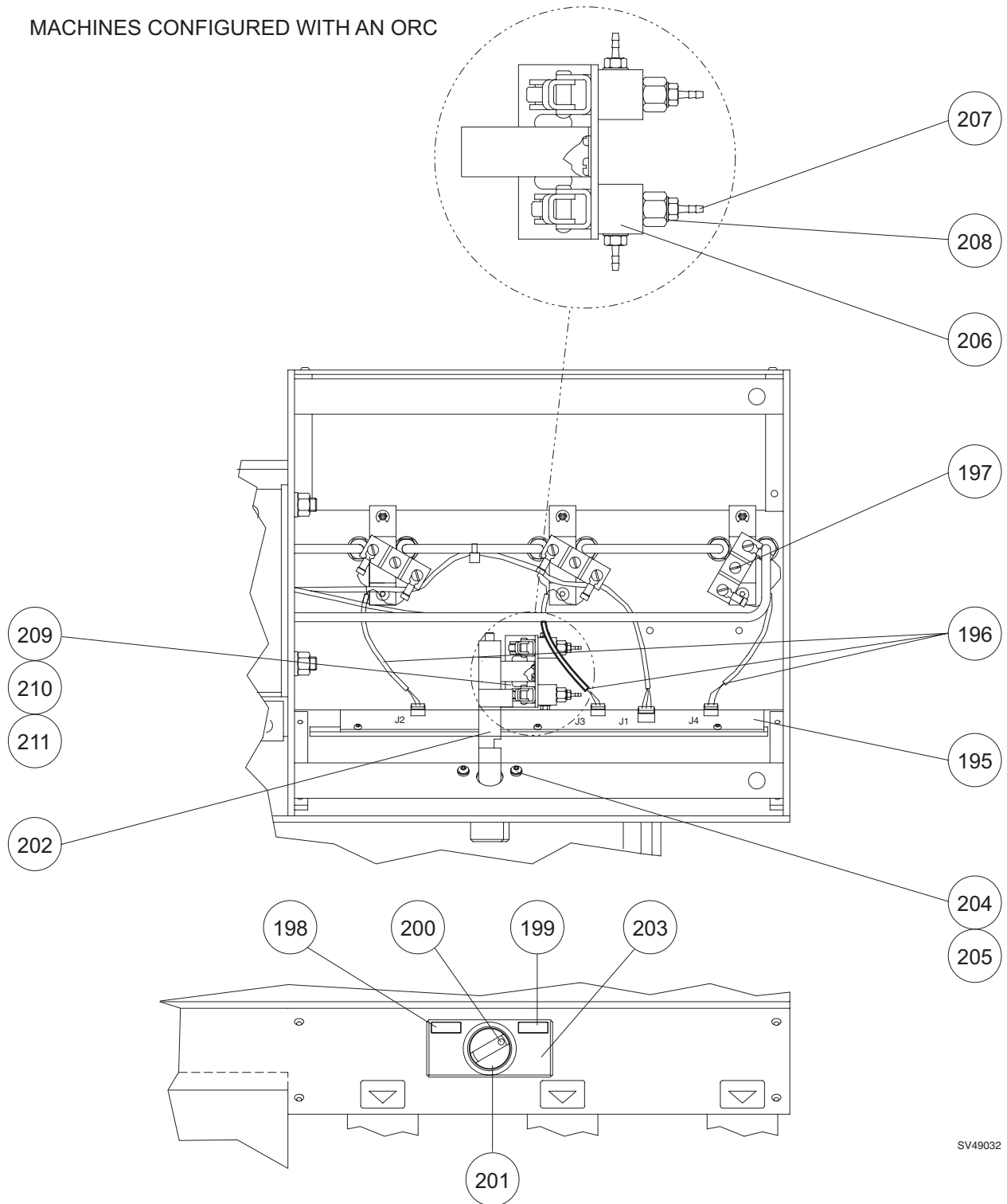
Figure 8-8. Fail-safe Assemblies, Minimum O2 Flow Valve Assembly

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
*N2O Failsafe Assembly:		
98.	Failsafe Block Assembly	4112043
99.	Nipple, 1/8 NPT x 3/4 in.	4102784
100.	Check Valve, MJCV-1	4105815
101.	Straight Fitting, 1/4Tube x 1/8 MPT (3x)	4109408
*Air or 3rd Gas Failsafe Assembly:		
98.	Failsafe Block Assembly	4112043
99.	Nipple, 1/8 NPT x 3/4 in.	4102784
100.	Check Valve, MJCV-1	4105815
101.	Straight Fitting, 1/4Tube x 1/8 MPT (2x)	4109408
102.	Deleted	
103.	Deleted	
104.	Deleted	
105.	Deleted	
106.	Elbow Fitting, 1/4Tube x 1/8 MPT	4109410
Minimum O2 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 1/8 MPT	4111771
	(requires press-on hose clamp 4104161)	
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:		
N2O 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



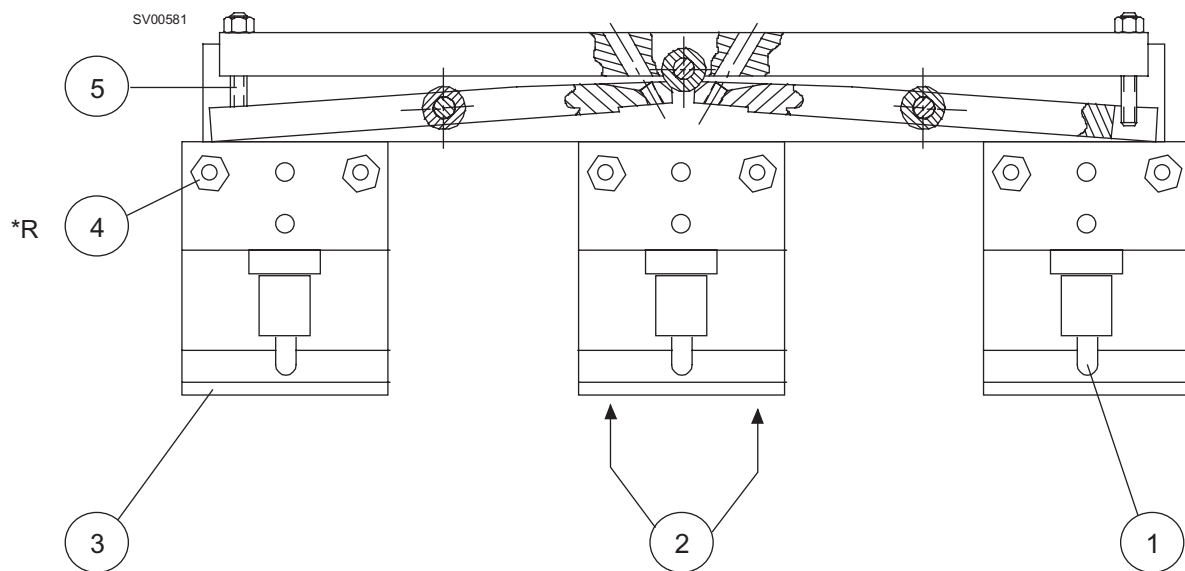
SV49032

Figure 8-9. Gas Selector Switch and Valves

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
Gas Selector Switch Assembly:		
114.	Label, O2 + N2O	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



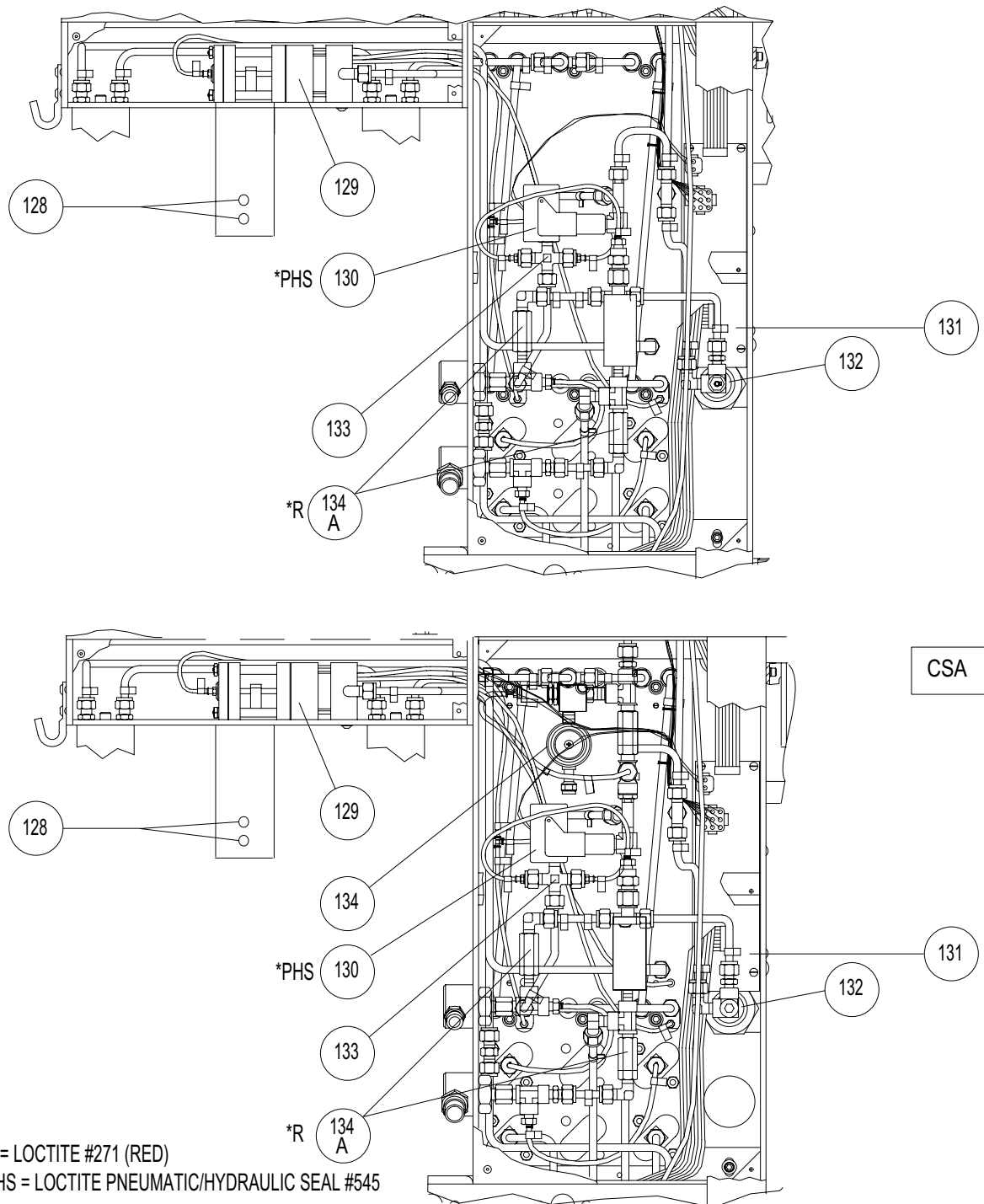
*R = LOCTITE # 271 (RED)

Figure 8-10. Vapor Exclusion System

NARKOMED 2B	SPARE AND REPLACEMENT PARTS (continued)
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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.	Interlock Asm, Triple Exclusion	4112700-001

EARLIER MACHINE CONFIGURATION (TYPICAL)



SV20613

Figure 8-11. ORMC (Earlier Config.) O2 Alarm Switch Alarm Channel, Alarm Whistle

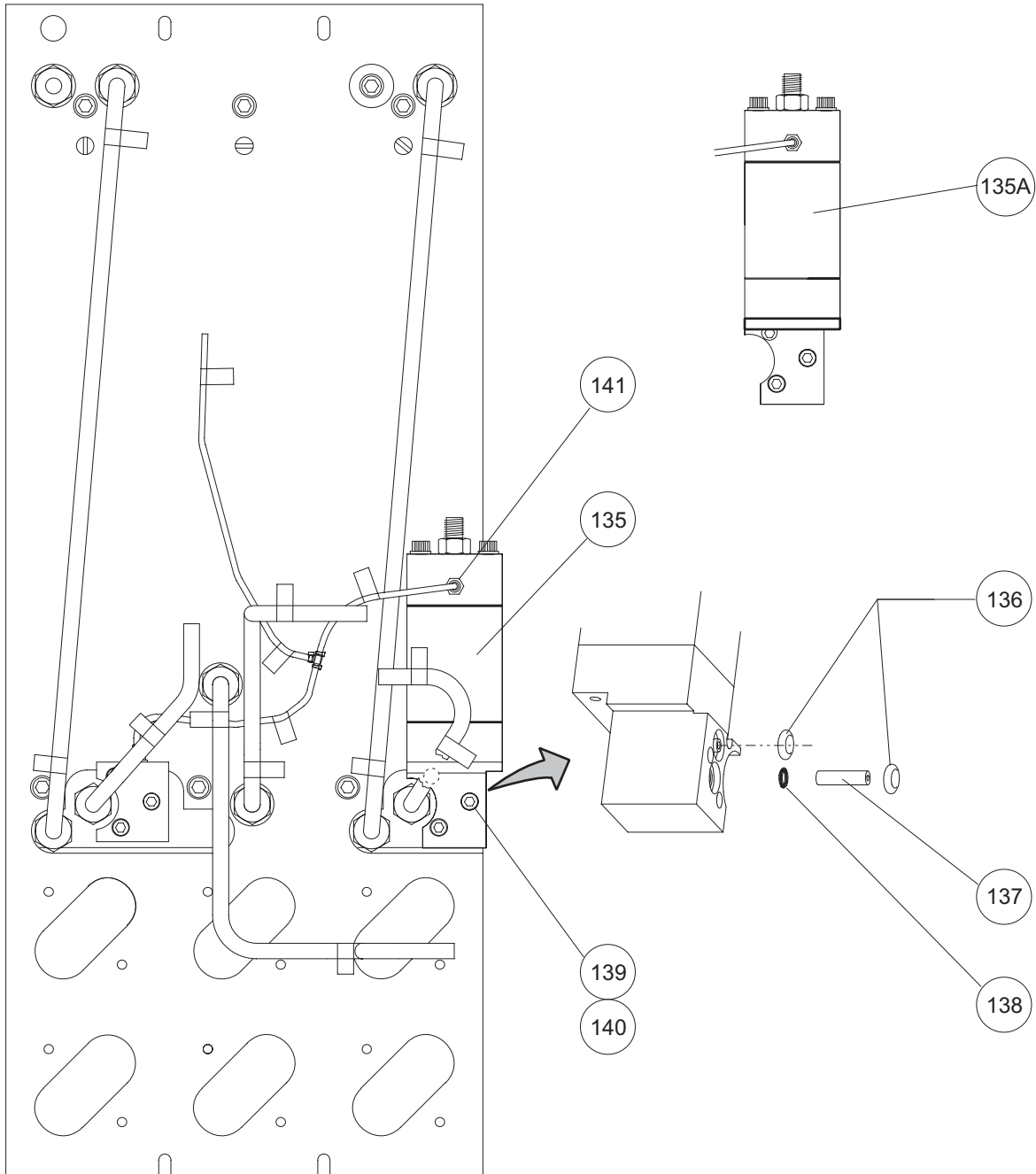
NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

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 O2/N2O 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 THE FLOWMETER SUB-ASSEMBLY

REAR VIEW OF FLOWMETER HOUSING
WITH REAR COVER REMOVED



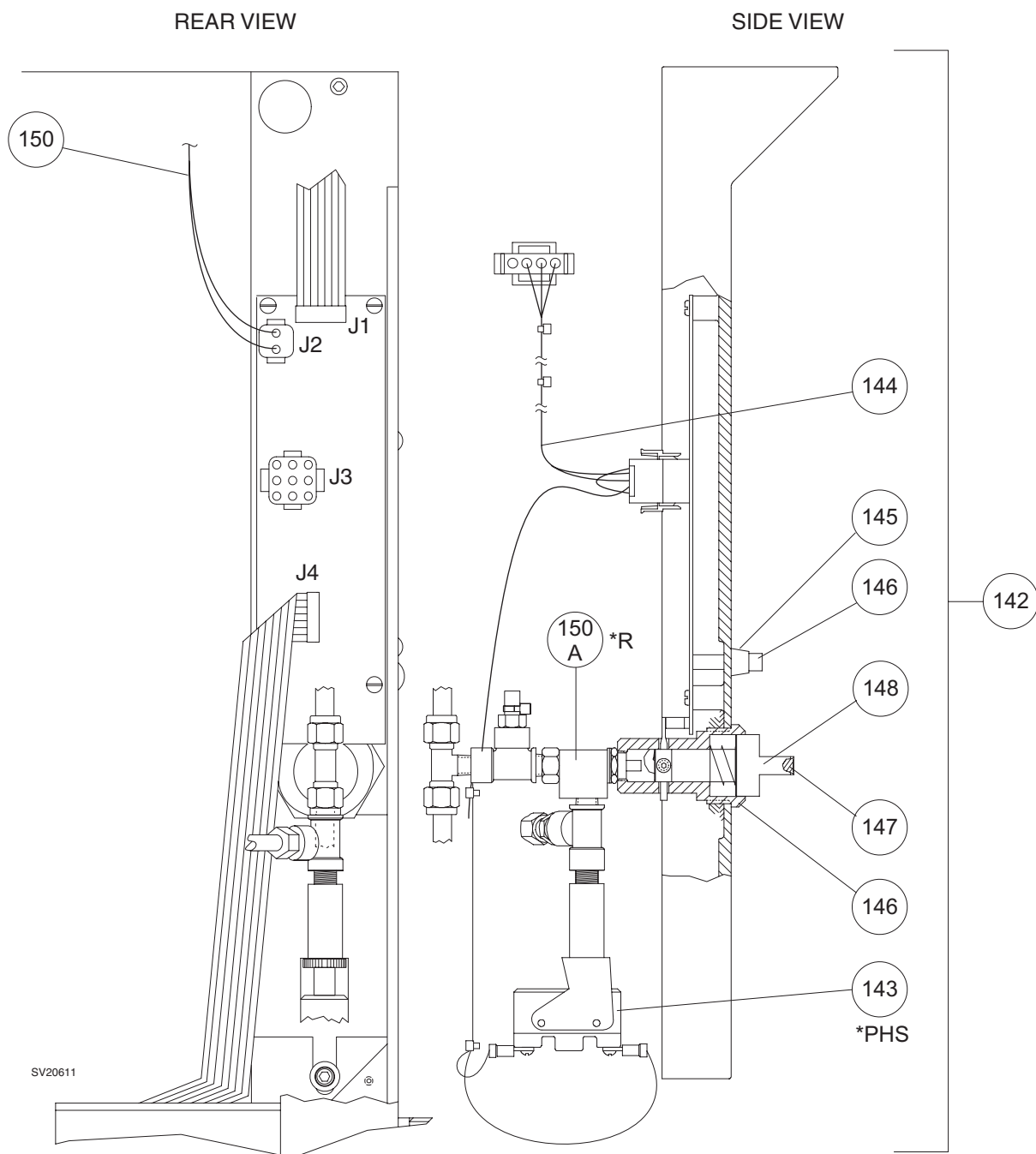
SV20612

Figure 8-12. ORC Assembly

NARKOMED 2B	SPARE AND REPLACEMENT PARTS (continued)
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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



*R = LOCTITE #271 (RED)

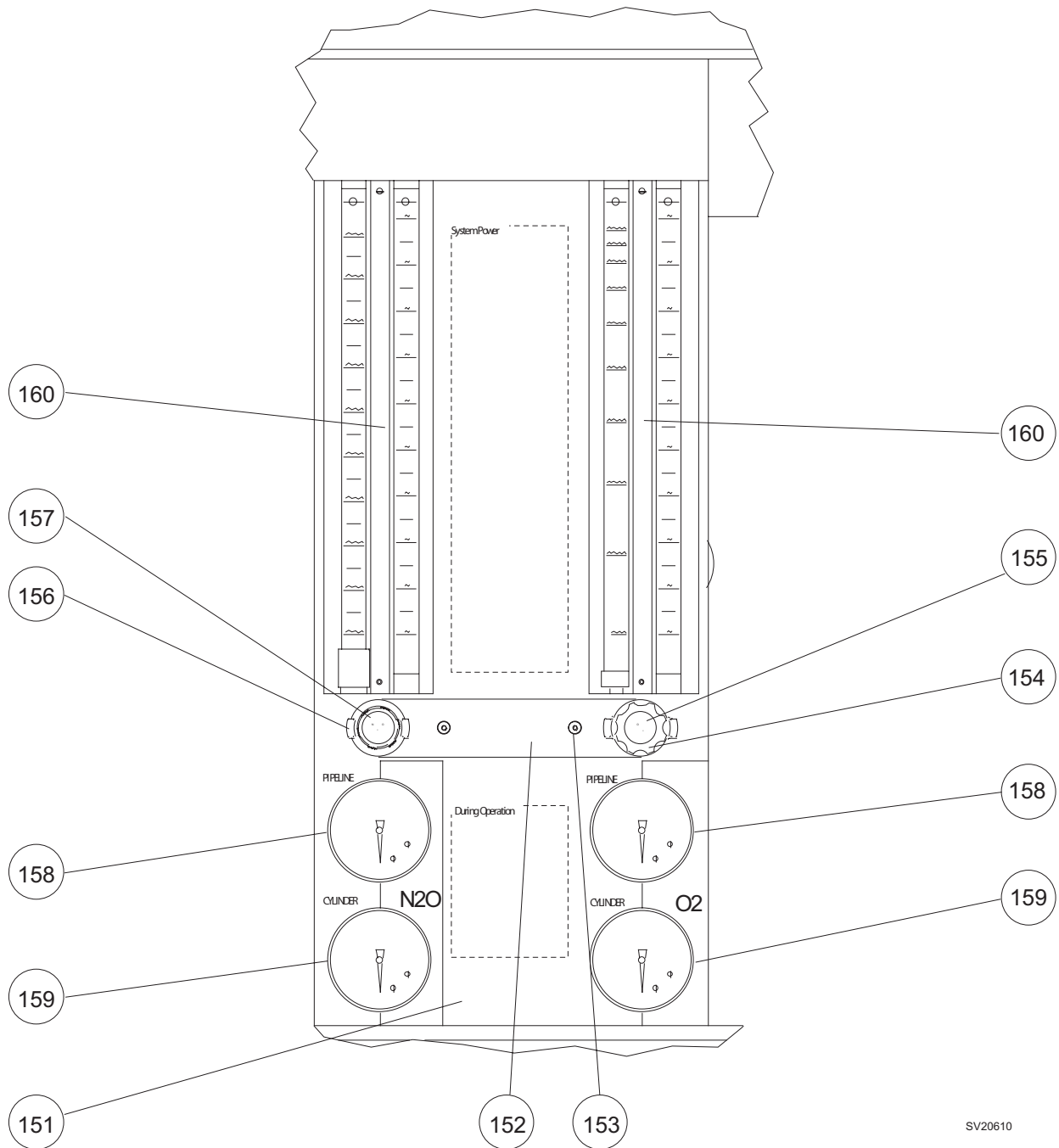
*PHS = LOCTITE PNEUMATIC/HYDRAULIS SEAL #545

Figure 8-13. Alarm Channel Assembly with O2 Alarm Switch (Later Configuration)

NARKOMED 2B	SPARE AND REPLACEMENT PARTS (continued)
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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.



SV20610

Figure 8-14. Flowmeter Shields, Knobs, Labels and Gauges

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
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The following Flowmeter Shield part numbers apply to later model machines with flowmeter sub-assemblies having an ORC:

151.	Shield, Flowmeter, 2 Gas N2O/O2, Domestic	4111824-001
	Shield, Flowmeter, 2 Gas N2O/O2, Canada	4111824-002
	Shield, Flowmeter, 2 Gas, Export	4111825
	Shield, Flowmeter, 3 Gas Air, Domestic	4111830-001
	Shield, Flowmeter, 3 Gas O2-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/CO2, Domestic	4111829-003
	Shield, Flowmeter, 4 Gas, Air/O2-He, Domestic	4111829-001
	Shield, Flowmeter, 4 Gas, Air/O2-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 Gas4	110574
153.	Screw, 6-32 x 7/16 btn hd (2x)	HW09017
154.	Knob, O2	4103156
155.	Label, O2 Flow Control Knob, Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
156.	Knob, Flow.	4103736
157.	Label, N2O 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, CO2 Flow Control Knob, Gray (USA,UK, Canada)	4103908
	Black (Germany)	4111266-006
	Label, O2-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 N2O.	4103075
	Gauge cover, screw-on (old style)	4103624
160.	Flowmeter Light Circuit Assembly	4107370

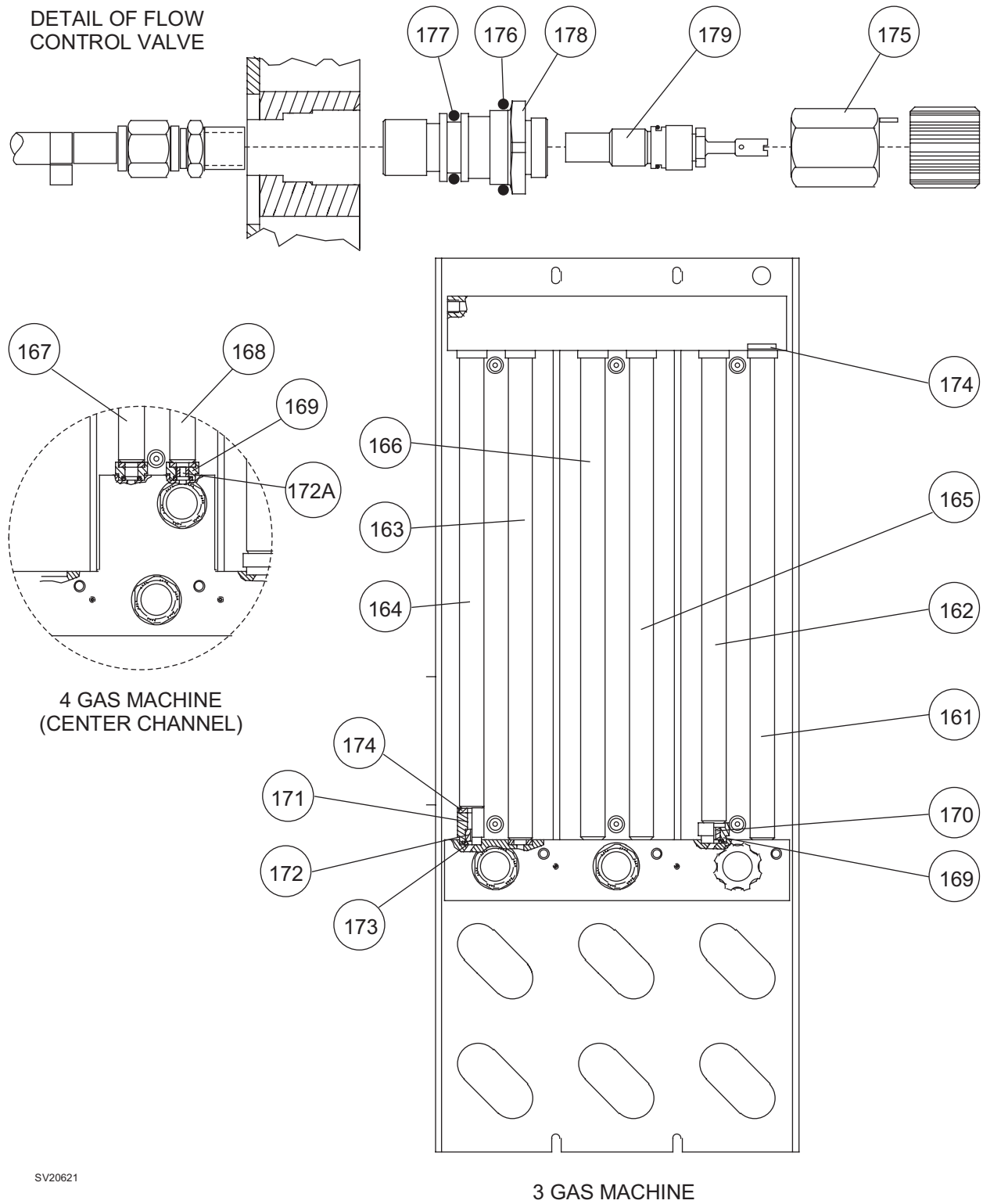


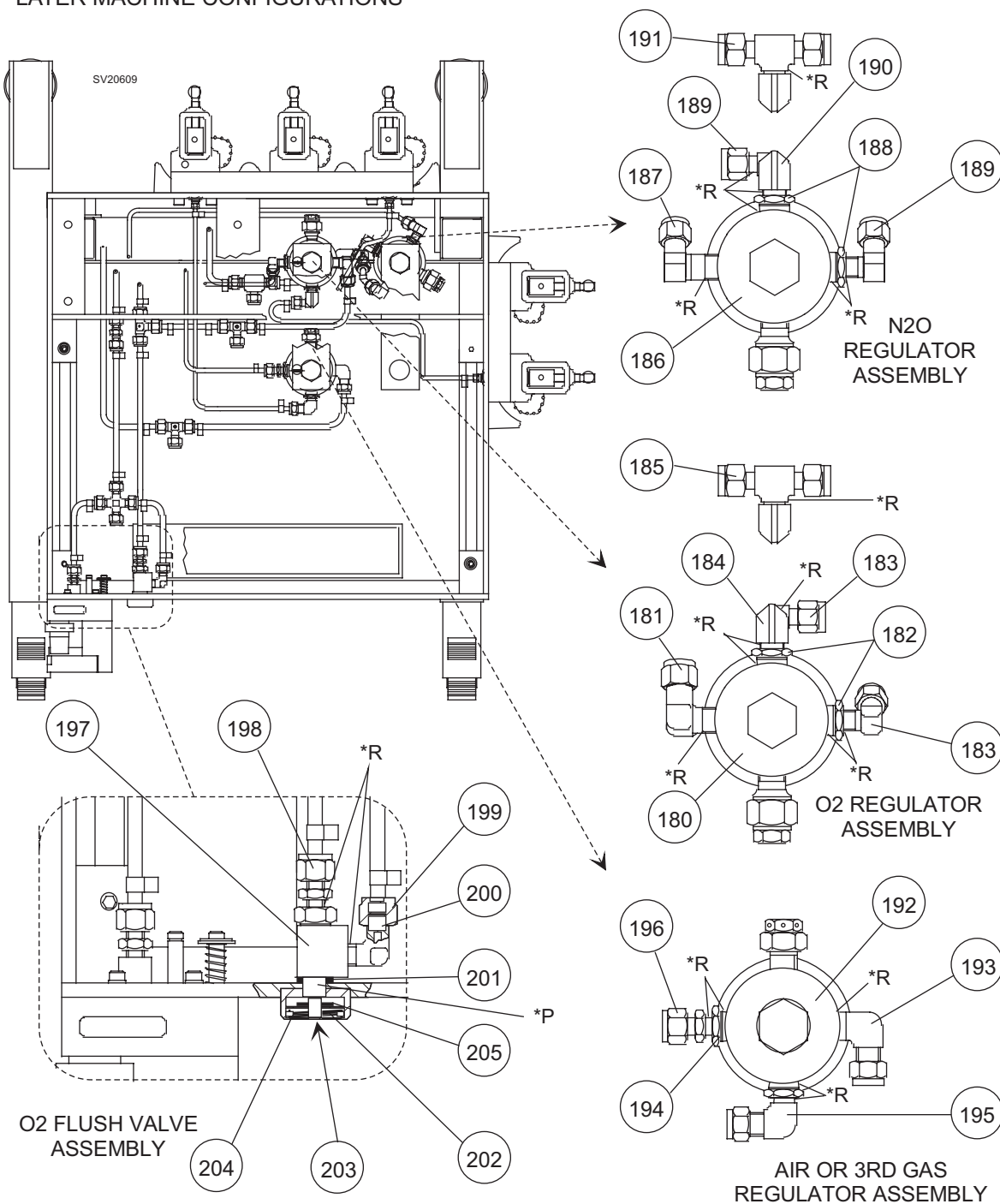
Figure 8-15. Flow Tubes, Restrictor Assemblies, Flow Control Valve

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

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 ₂ O, 1-10 l/min	4103420
	Later style w/o color band	4112562-001
	Flow Tube, N ₂ O, 0.6-10 l/min (Low Flow)	4105758
	Later style w/o color band	4112564-001
164.	Flow Tube, N ₂ O, 100-1000 ml/min	4103419
	Later style w/o color band	4112561-001
	Flow Tube, N ₂ O, 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 ₂ O Restrictor Housing	4111716
172.	N ₂ O 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



*P = LOCTITE #222 (PURPLE)

*R = LOCTITE #271 (RED)

Figure 8-16. Cyl. Regulator Assemblies, O2 Flush Valve and Related Parts

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

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 1/8 FPT (2x)	4102906
183.	Elbow Fitting, 3/16 Tube x 1/8 MPT (2x)	4109409
184.	Elbow Fitting, 1/8 MPT x 1/8 FPT	4103513
185.	Tee Fitting, 3/16 Tube x 3/16 Tube x 1/8 MPT [Replaces previous two items if machine has an additional O ₂ yoke]	4109404
*N ₂ O Regulator Assembly:		
186.	Regulator	4103591
187.	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
188.	Straight Fitting, ¼ MPT x 1/8 FPT (2x)	4102906
189.	Elbow Fitting, 3/16 Tube x 1/8 MPT (2x)	4109409
190.	Elbow Fitting, 1/8 MPT x 1/8 FPT	4103513
191.	Tee Fitting, 3/16 Tube x 3/16 Tube x 1/8 MPT [Replaces previous two items if machine has an additional N ₂ O 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 1/8 FPT (2x)	4102906
195.	Elbow Fitting, 3/16 Tube x 1/8 MPT	4109409
196.	Straight Fitting, 3/16 Tube x 1/8 MPT	4109415
O ₂ Flush Valve and Related Parts:		
197.	Valve, Clippard, 2 way	4103340
198.	Straight Fitting, ¼ Tube x 1/8 MPT	4109408
199.	Elbow Fitting, ¼ Tube x 1/8 MPT	4109410
200.	Restrictor	4101867
201.	Spacer	4110792-006
202.	Button, O ₂ FLUSH.	4103249
203.	Label, 5/8 Dot, O ₂ : Green (USA) White (UK, Canada) Blue (Germany)	4103178 4105981 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 ₂ O Cylinder Pressure	4103798
Regulator Assembly, Air Cylinder Pressure	4104603

LATER MACHINE CONFIGURATIONS

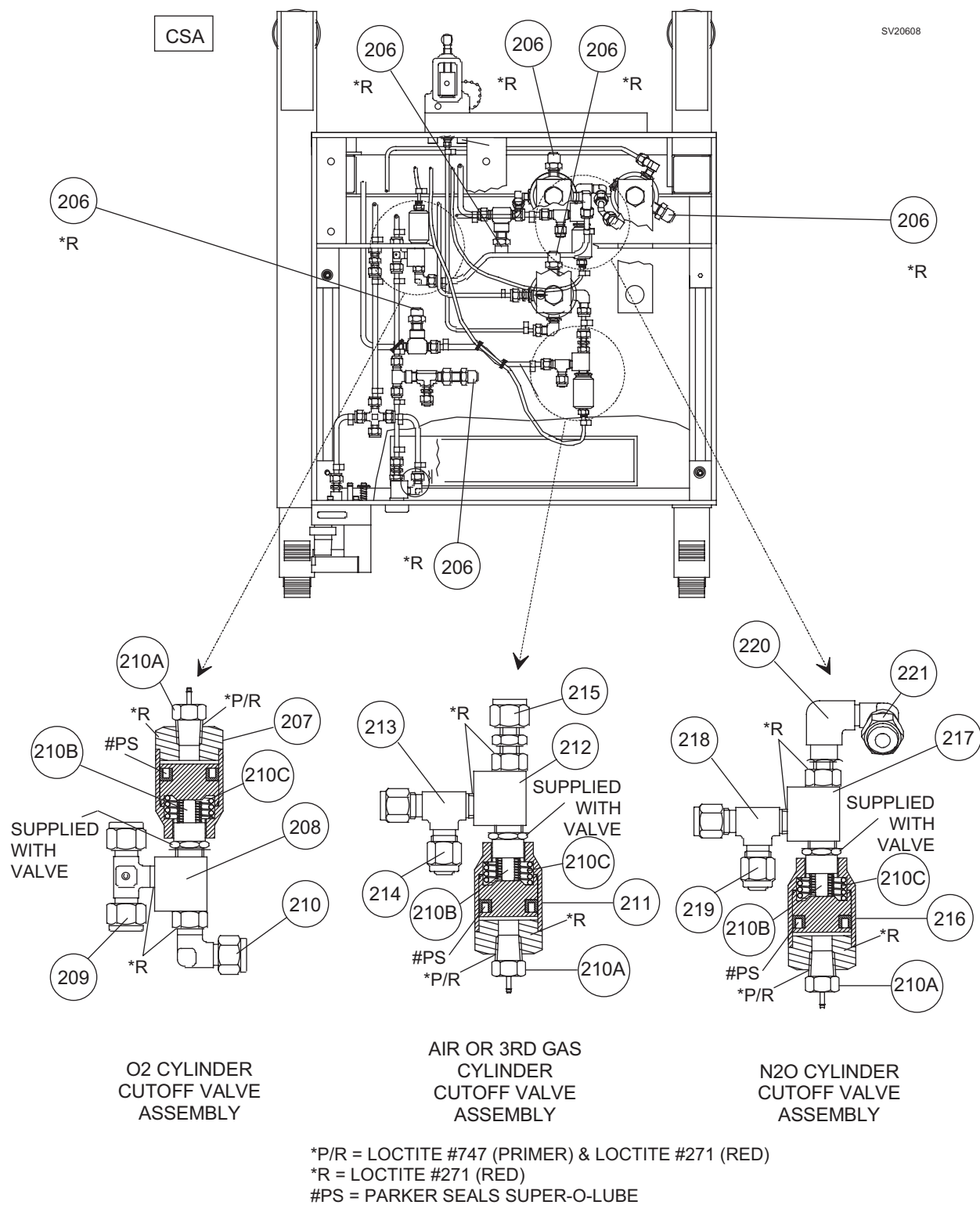


Figure 8-17. CSA Items: Relief Valve and Cylinder Cutoff Valves

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
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CSA Items:

206.	Relief Valve, 70 psi (Canada)	4110364
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*O₂ 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 1/8 MPT	4109406
210.	Elbow Fitting, ¼ Tube x 1/8 MPT	4109410
210A.	Straight Fitting, .075ID Hose X 1/8 MPT	4111771
210B.	Spring, .360 OD X .813 L	4110975-009
210C.	Spring, .72 X 7.8 L	4110975-008

*Air or 3rd Gas Cylinder Cutoff Valve Assembly (Canada)

211.	Pilot Actuator, Modified	4106498
212.	Clippard Valve, MJVO-2	4106218
213.	Tee Fitting, ¼ Tube x 1/8 MPT x ¼ Tube	4109407
214.	Plug, ¼ Tube	4103072
215.	Straight Fitting, ¼ Tube x 1/8 MPT	4109408
210A.	Straight Fitting, .075ID Hose X 1/8 MPT	4111771
210B.	Spring, .360 OD X .813 L	4110975-009
210C.	Spring, .72 X 7.8 L	4110975-008

*N₂O Cylinder Cutoff Valve Assembly (Canada)

216.	Pilot Actuator, Modified	4106498
217.	Clippard Valve, MJVO-2	4106218
218.	Tee Fitting, ¼ Tube x 1/8 MPT x ¼ Tube	4109407
219.	Plug, ¼ Tube	4103072
220.	Elbow Fitting, 1/8 MPT x 1/8 FPT	4103513
221.	Elbow Fitting, ¼ Tube x 1/8 MPT	4109410
210A.	Straight Fitting, .075ID Hose X 1/8 MPT	4111771
210B.	Spring, .360 OD X .813 L	4110975-009
210C.	Spring, .72 X 7.8 L	4110975-008

* 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 ₂ O (Canada).	4110161
	Cylinder Cutoff Valve Assembly, 3rd Gas (Canada).	4110162

	Regulator Assembly, O ₂ Cylinder Pressure (Canada)	4110656
	Regulator Assembly, N ₂ O Cylinder Pressure (Canada).	4110655
	Regulator Assembly, He/Air/N ₂ Cylinder Pressure (Canada).	4110568
	Regulator Assembly, CO ₂ Cylinder Pressure (Canada).	4110657

SV00538

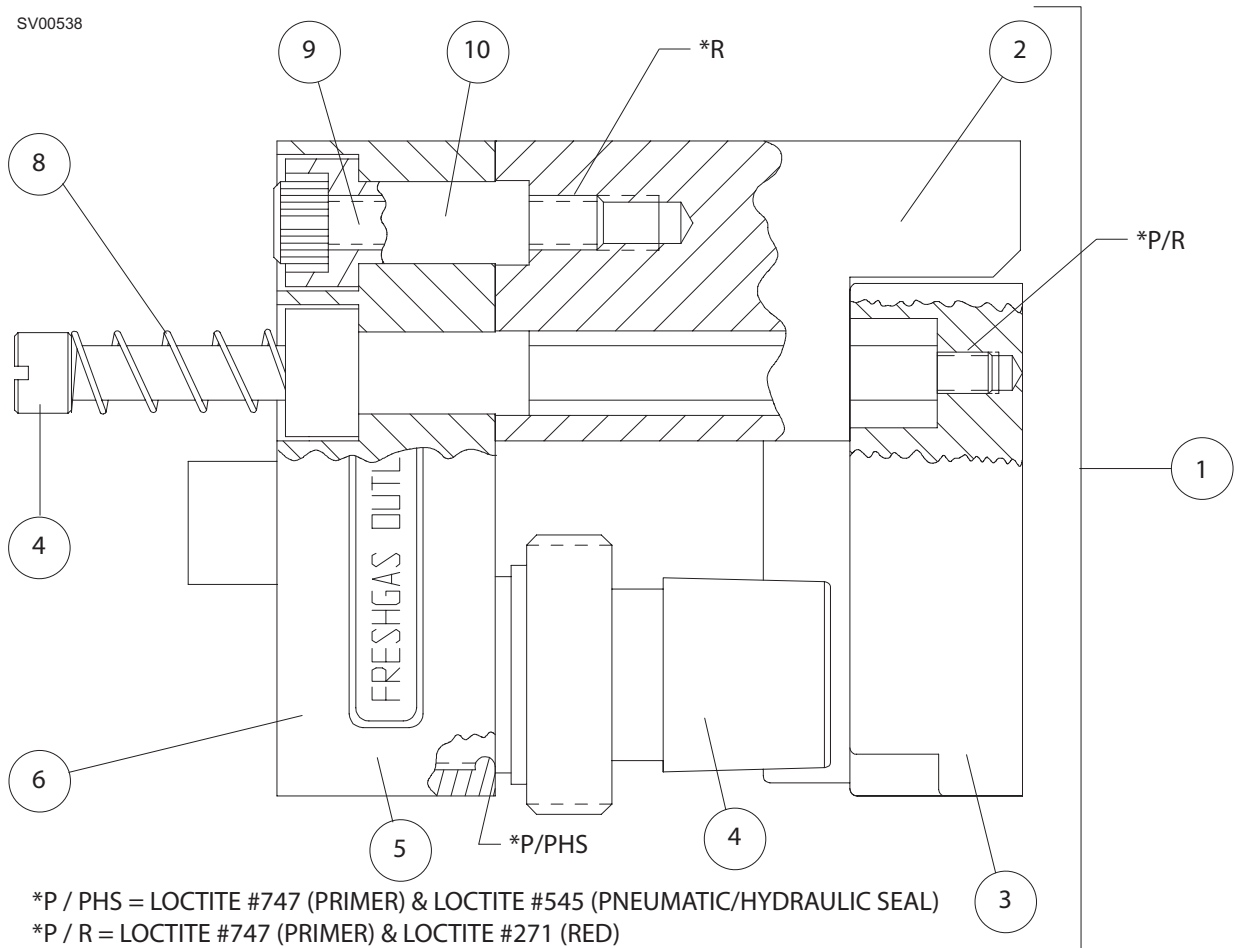
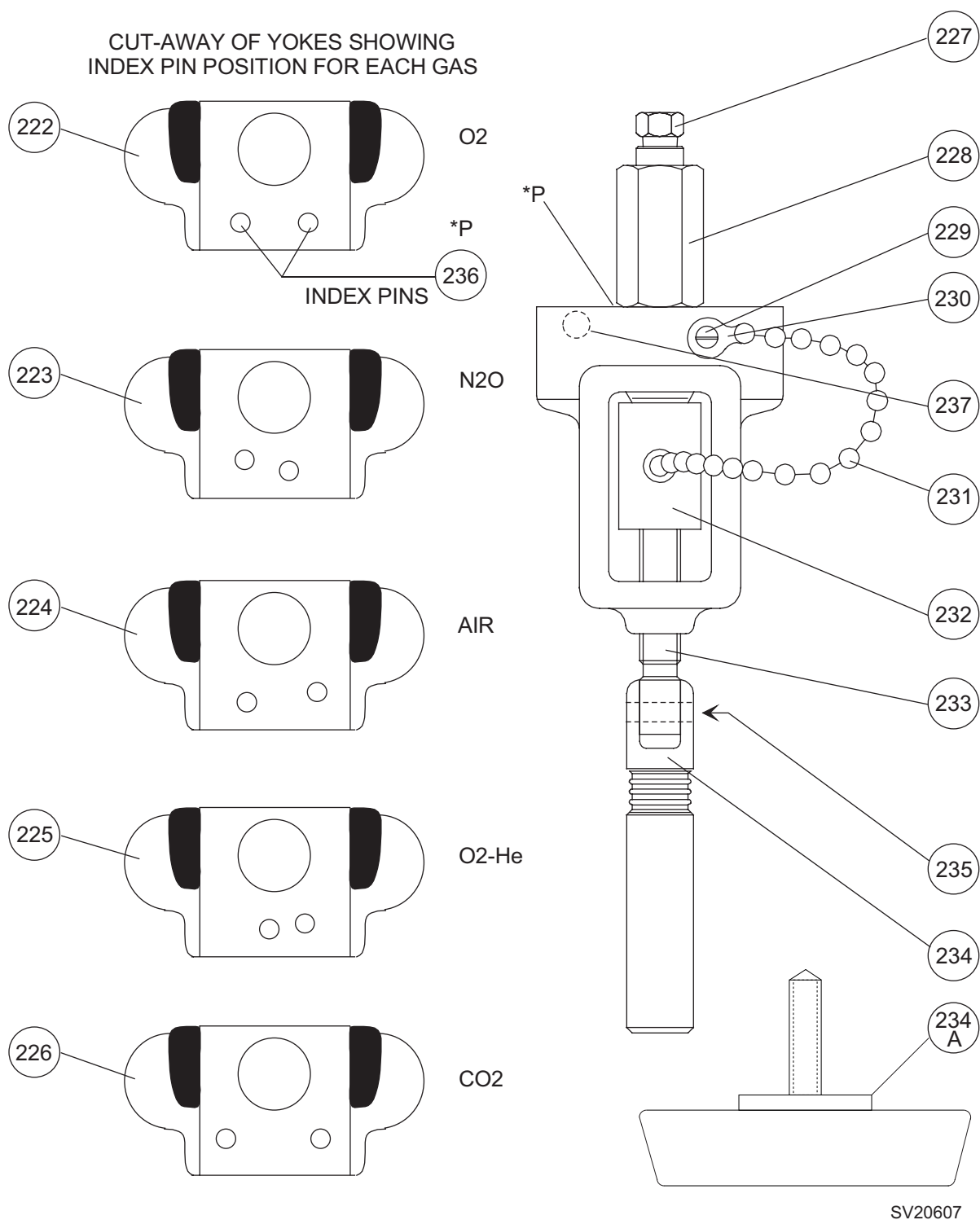


Figure 8-18. Canada Fresh Gas Outlet

NARKOMED 2B	SPARE AND REPLACEMENT PARTS (continued)
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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



*P = LOCTITE #222 (PURPLE)

Figure 8-19. Cylinder Yokes, Common Parts and Labels

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
222.	Yoke, O2*	1101620
223.	Yoke, N2O*	1101621
224.	Yoke, Air*	1101625
225.	Yoke, O2-He*	4110957
226.	Yoke, CO2*	1101624
	Parts Common to All Yokes:	
227.	Nut, 3/16 Tube	4104716
	Nut, 3/16 Tube	4109489
	3/16 Ferrule	4111038
228.	Check Valve Assembly	4111792
	Check Valve Assembly	4118190
229.	Screw, 10-32 x 3/8 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, O2, Green (USA)	1101768
	White (UK)	4103890
	Blue (Germany)	4111266-001
	Label, N2O, Blue (USA, UK, Canada)	1101619
	Gray (Germany)	4111266-003
	Label, Air, Yellow (USA, Germany)	4102742
	Black/White (UK)	4103826
	Label, O2-He, Green/Brown (USA)	4110950
	White/Brown (Canada)	4110942
	Label, CO2, 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, O2	1101640
Cylinder Yoke Assembly, O2 (Canada)	4109943
Cylinder Yoke Assembly, N2O	1101641
Cylinder Yoke Assembly, Air	1101645
Cylinder Yoke Assembly, Air (Canada)	4109944
Cylinder Yoke Assembly, CO2	1101644

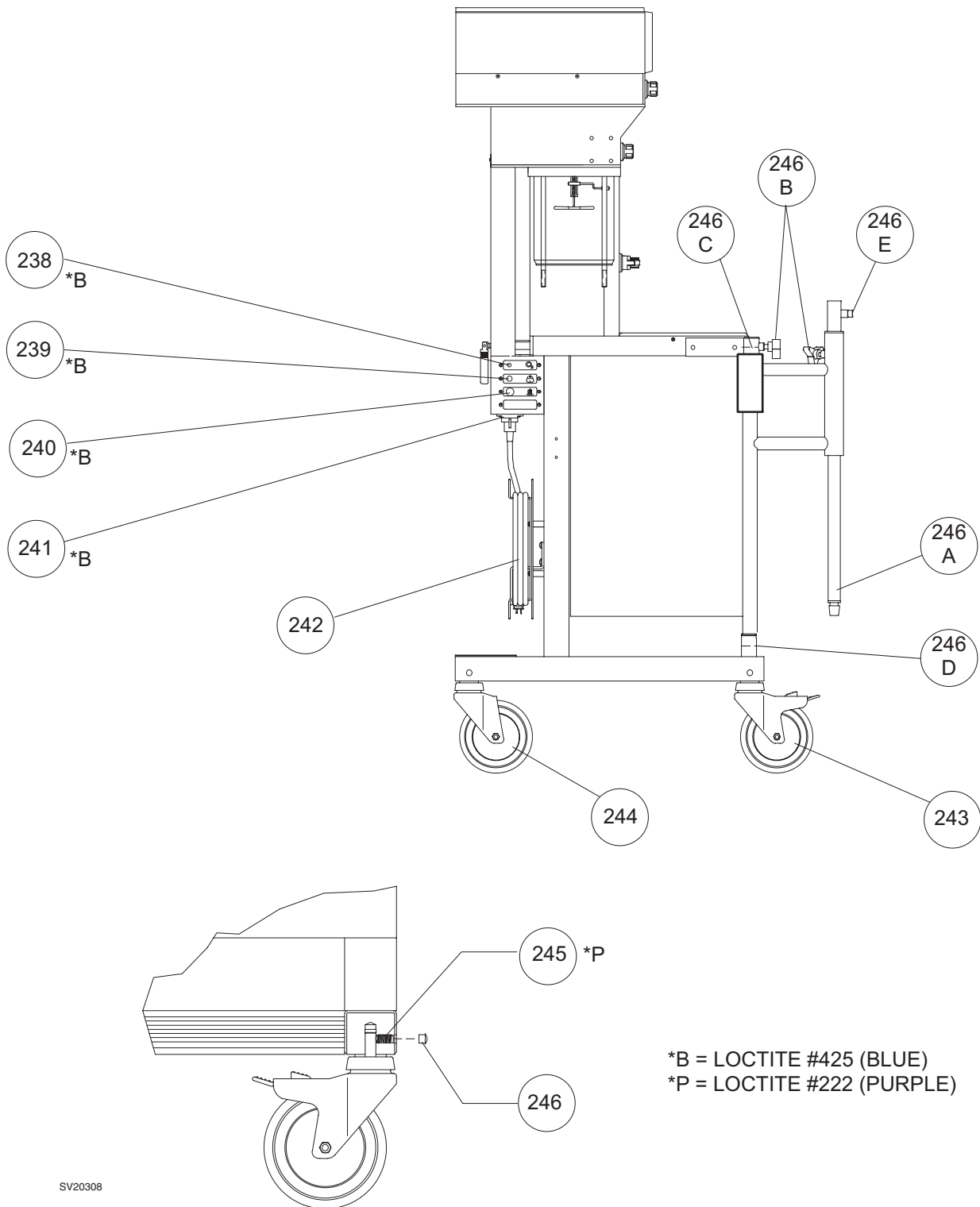


Figure 8-20. Sensor Interface Panel Asms., AC Power, Casters

NARKOMED 2B	SPARE AND REPLACEMENT PARTS (continued)
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ITEM	DESCRIPTION	PART NUMBER
238.	O2MED 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, 3/8 -16 x 1 in..	1100078
246C	Roll pin, lg.	HW75005
246D	Roll pin, sm.	HW75004
246E	Set screw	1101684

* There is a 1" difference in height between the two versions of 6" casters. The 4111849 and 4111850 have a 1" washer/spacer.

SPARE AND REPLACEMENT PARTS (continued)

NARKOMED 2B

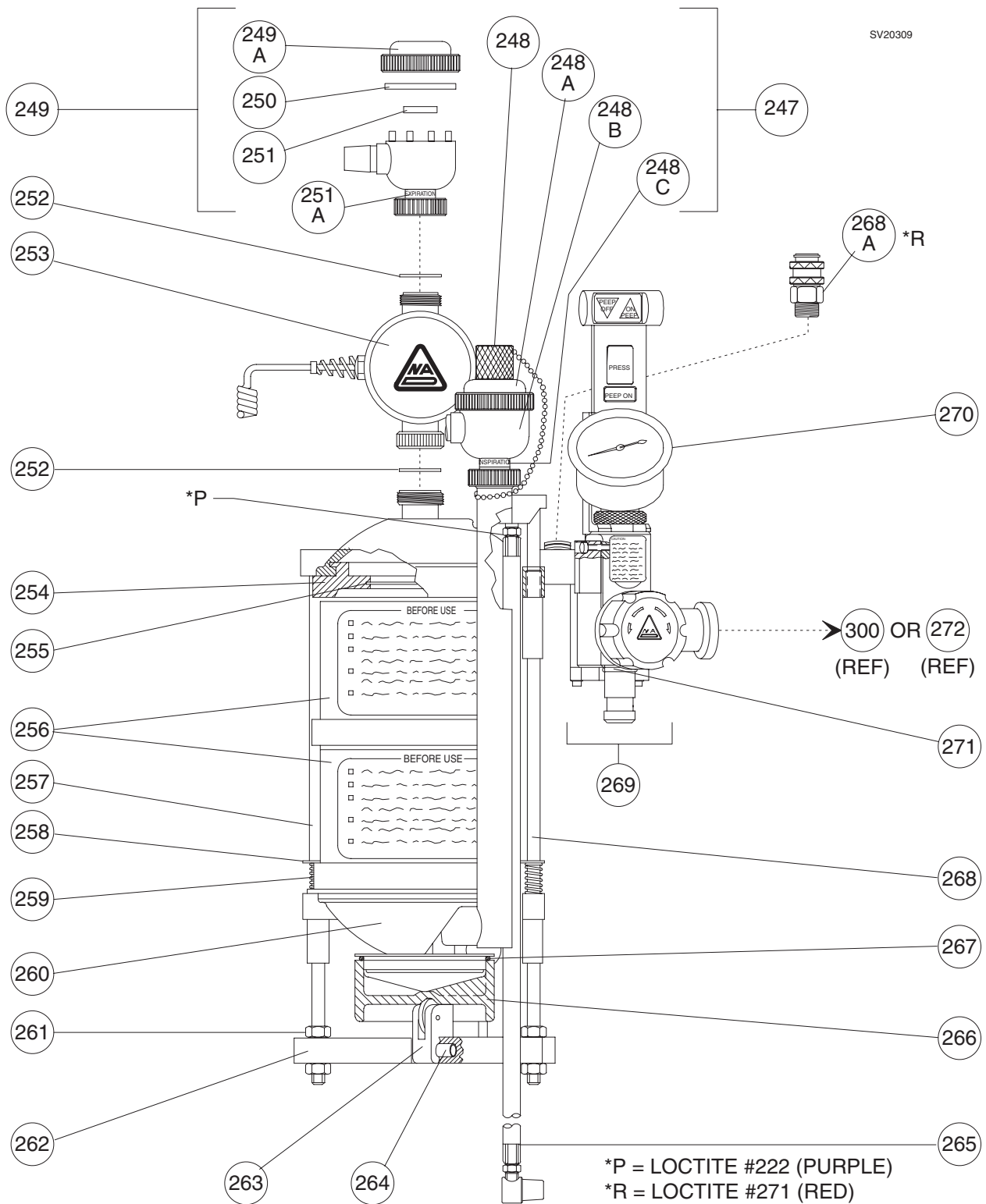


Figure 8-21. Absorber Assembly, Breathing Pressure Hoses, and Oxygen Sensor

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
	Absorber Assembly	4109430
	Absorber Assembly with PEEP and bypass valve	4109431
247.	Inspiratory Valve Assembly (incl. O2 sensor mount)	4112773-001
	Ref: Valve w/o O2 Sensor Mount (old no.)	2122810
248.	Plug Assembly, Oxygen Sensor	4106387
248A	Dome & Label, Inspiratory Valve	4108329
248B	Valve Assembly	4112151
248C	Label, Inspiration	1100559
249.	Expiratory Valve Assembly	4112150
249A	Dome	2109230
250.	Gasket, Valve Dome (Both Valves)	2109231
251.	Disk (Both Valves)	M23225
251A	Label, Expiration	1100565
252.	Gasket, Valve Mount	1101690
253.	Spiromed Sensor	4106362
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
	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
	O2 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)	410638

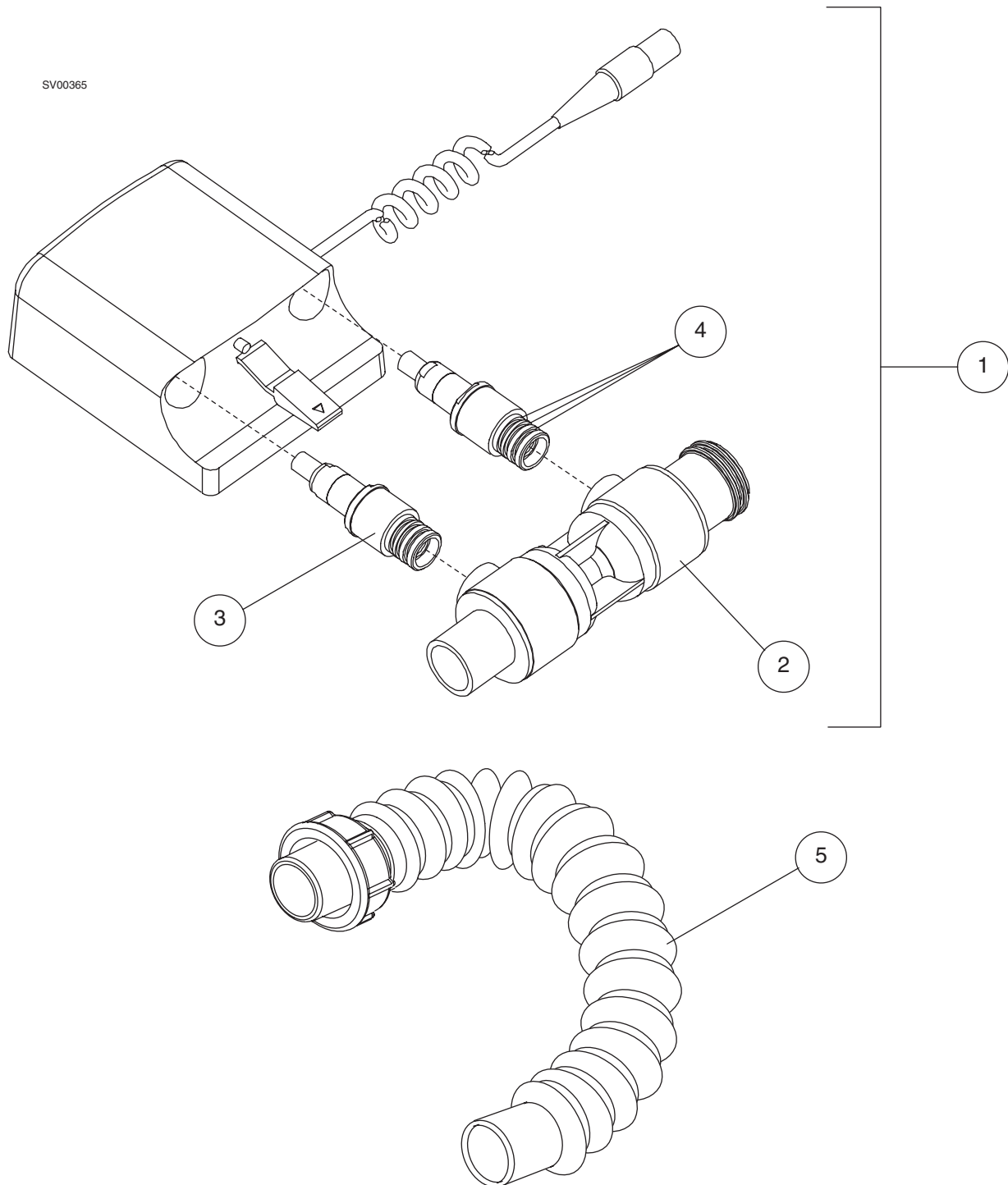
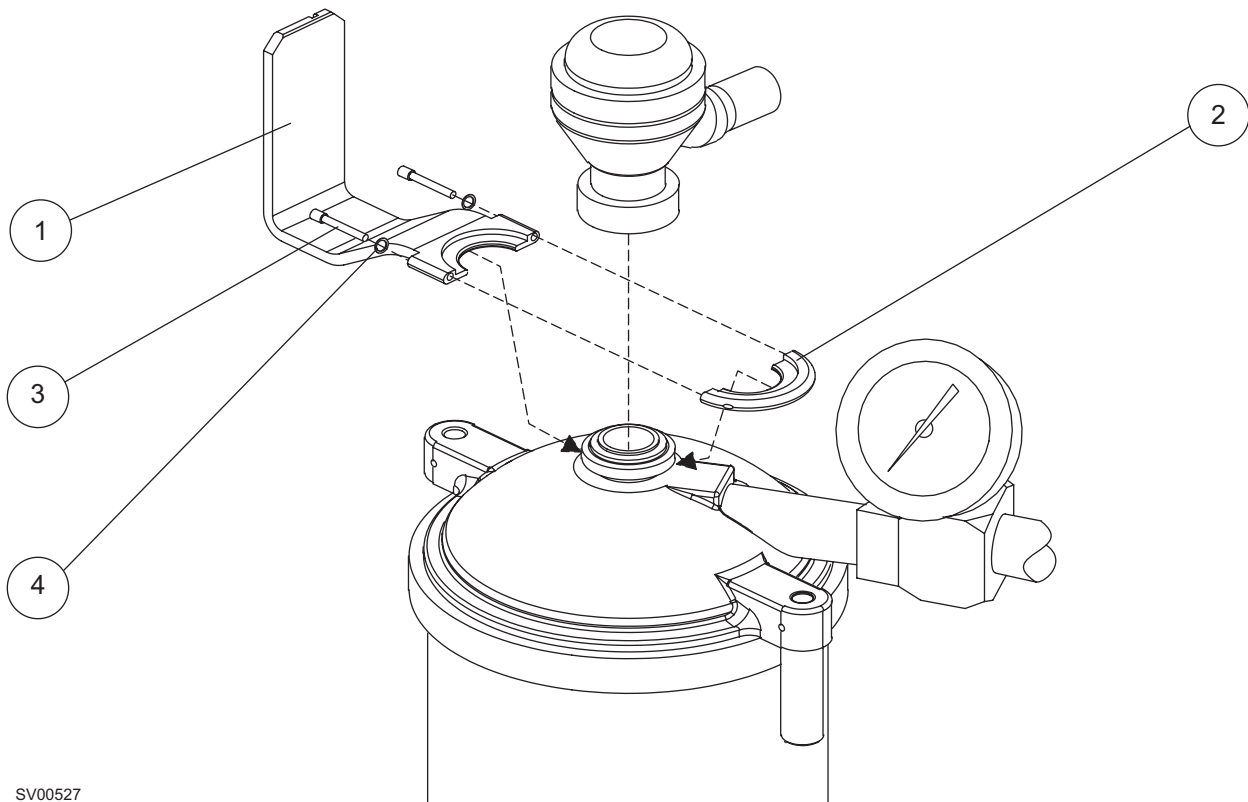


Figure 8-22. Ultrasonic Flow Sensor

NARKOMED 2B	SPARE AND REPLACEMENT PARTS (continued)
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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



SV00527

Figure 8-23. Ultrasonic Flow Sensor Mounting Bracket

NARKOMED 2B	SPARE AND REPLACEMENT PARTS (continued)
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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

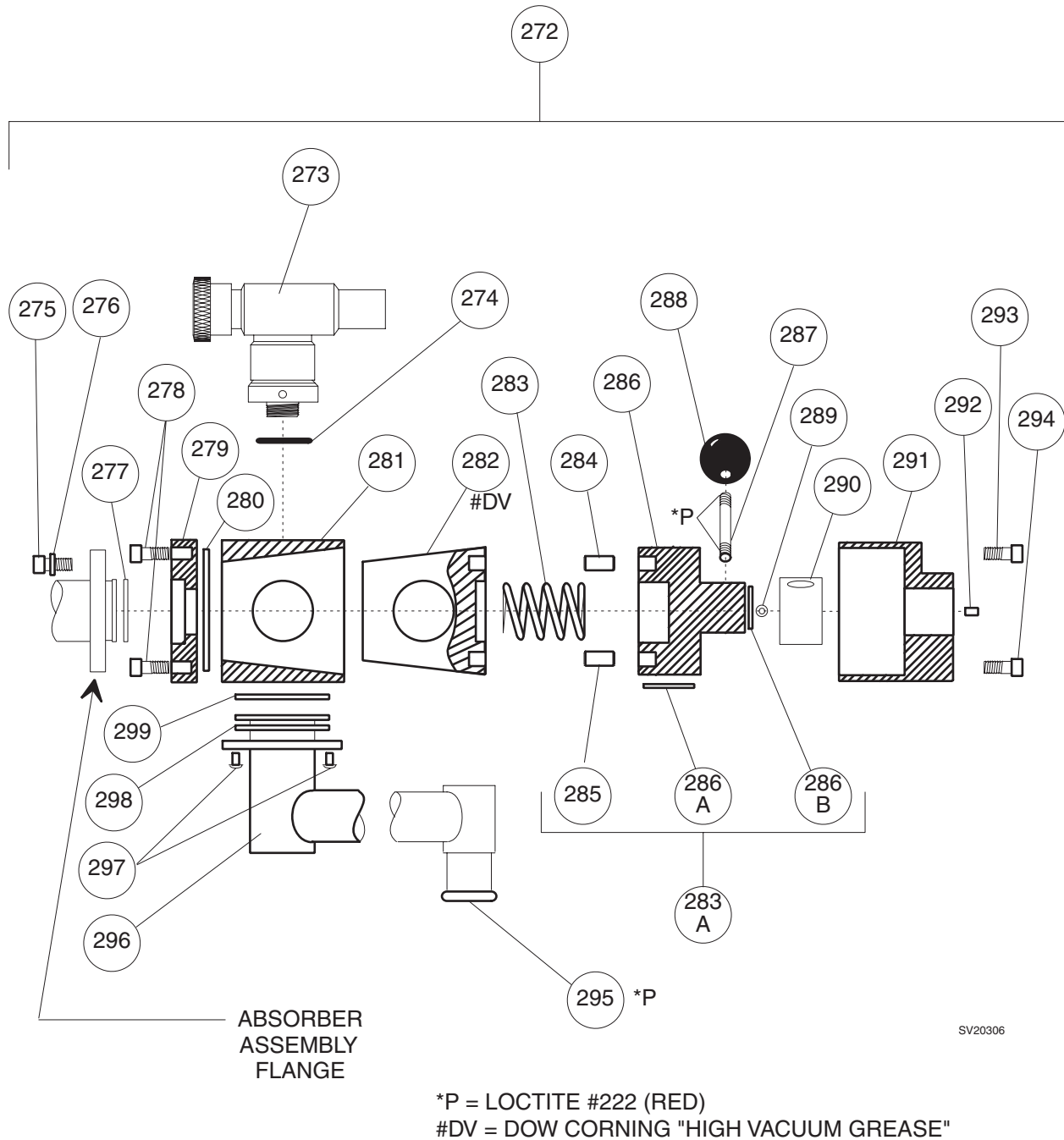
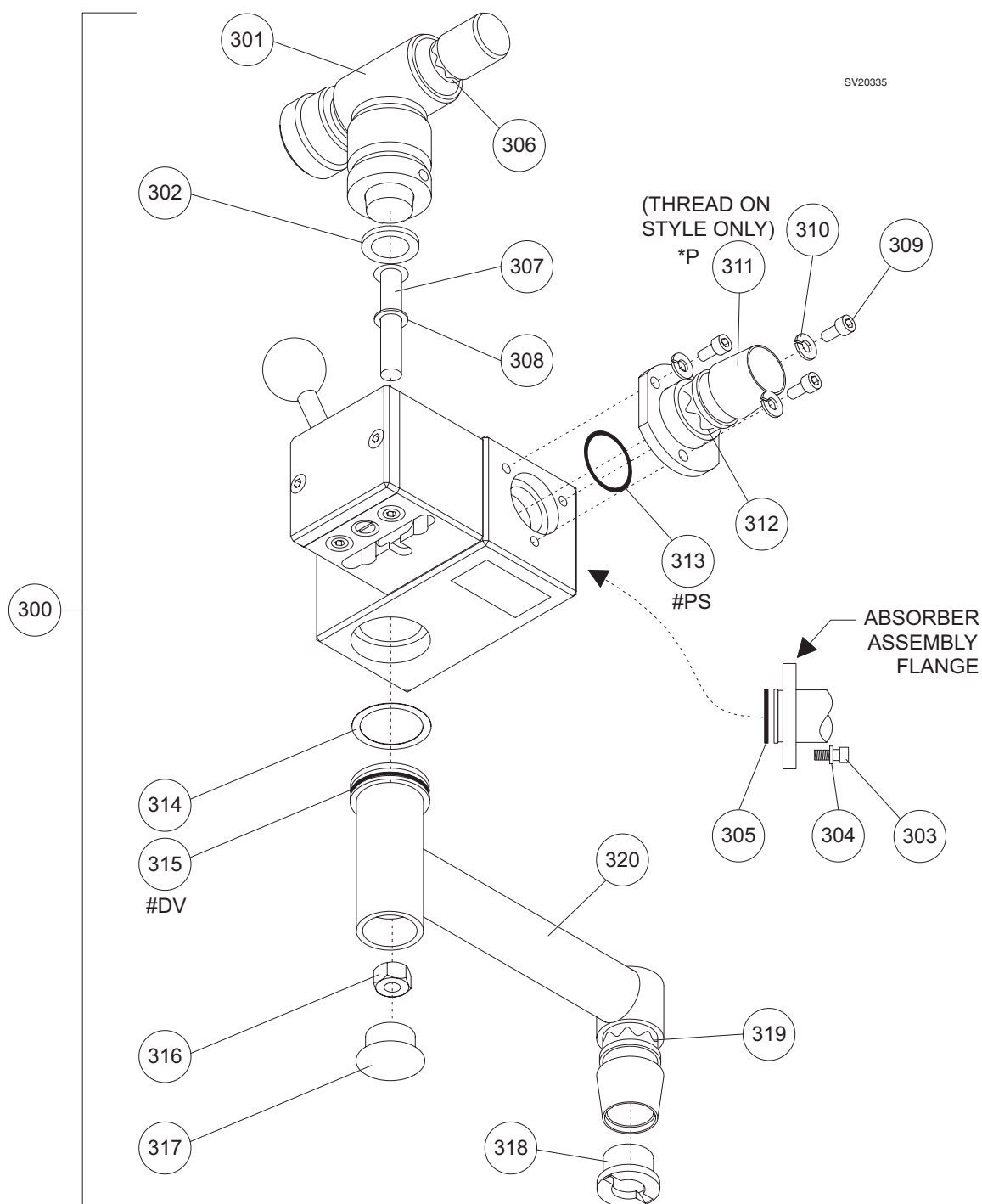


Figure 8-24. Man/Auto Selector Valve

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

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 1/2 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 3/4 in.	HW76002
285.	Dowel Pin, 0.250 x 5/8 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, 1/4-28 x 1/4 in. (2x)	HW04014
293.	Screw, Valve Switch Block Mounting, Upper, 8-32 x 1/4 in. (2x)	HW01019
294.	Screw, Valve Switch Block Mounting, Lower, 8-32 x 1/2 in. (2x)	HW01020
295.	Bag Connector	4102894
296.	Swivel Bag Mount Assembly	1101334
297.	Screw, Bag Mount, 8-32 x 3/8 in. (4x)	HW02015
298.	O-Ring, Silicon	4105868
299.	Glide Ring, Teflon	1101335



*P = LOCTITE #222 (PURPLE)
#DV = DOW CORNING "HIGH VACUUM GREASE"
#PS = PARKER SUPER-O-LUBE

Figure 8-25. Man/Auto Selector Valve (Later Design)

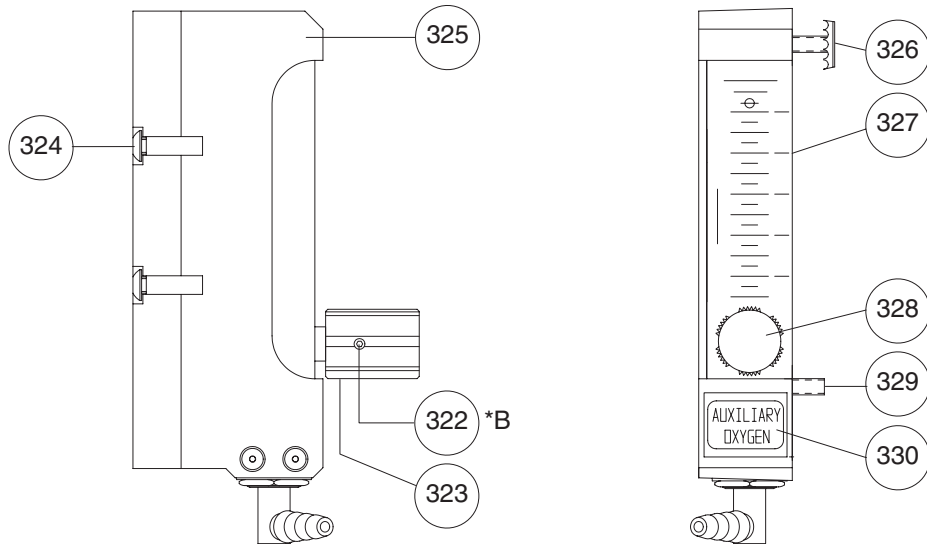
NARKOMED 2B	SPARE AND REPLACEMENT PARTS (continued)
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ITEM	DESCRIPTION	PART NUMBER
300.	Valve, Man/Auto Selector (later design)	4112217-001
	Service Exchange P/N	SE4112217-001
301.	APL Valve	4104839
302.	Fiber Washer (Supplied with APL Valve)	
303.	Screw, 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 (Bolt on Style)	4106744
	Connector - 22mm w/ spanner	4112918
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

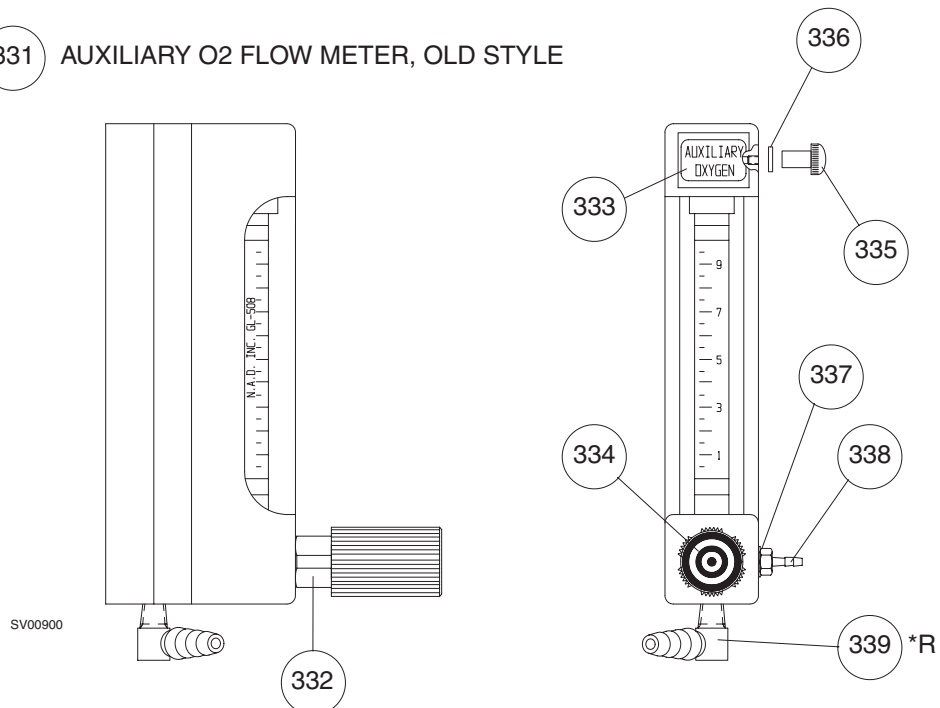
SPARE AND REPLACEMENT PARTS (continued)

NARKOMED 2B

321 AUXILIARY O2 FLOW METER, NEW STYLE



331 AUXILIARY O2 FLOW METER, OLD STYLE



*B = LOCTITE #425 (BLUE)

*R = LOCTITE #271 (RED)

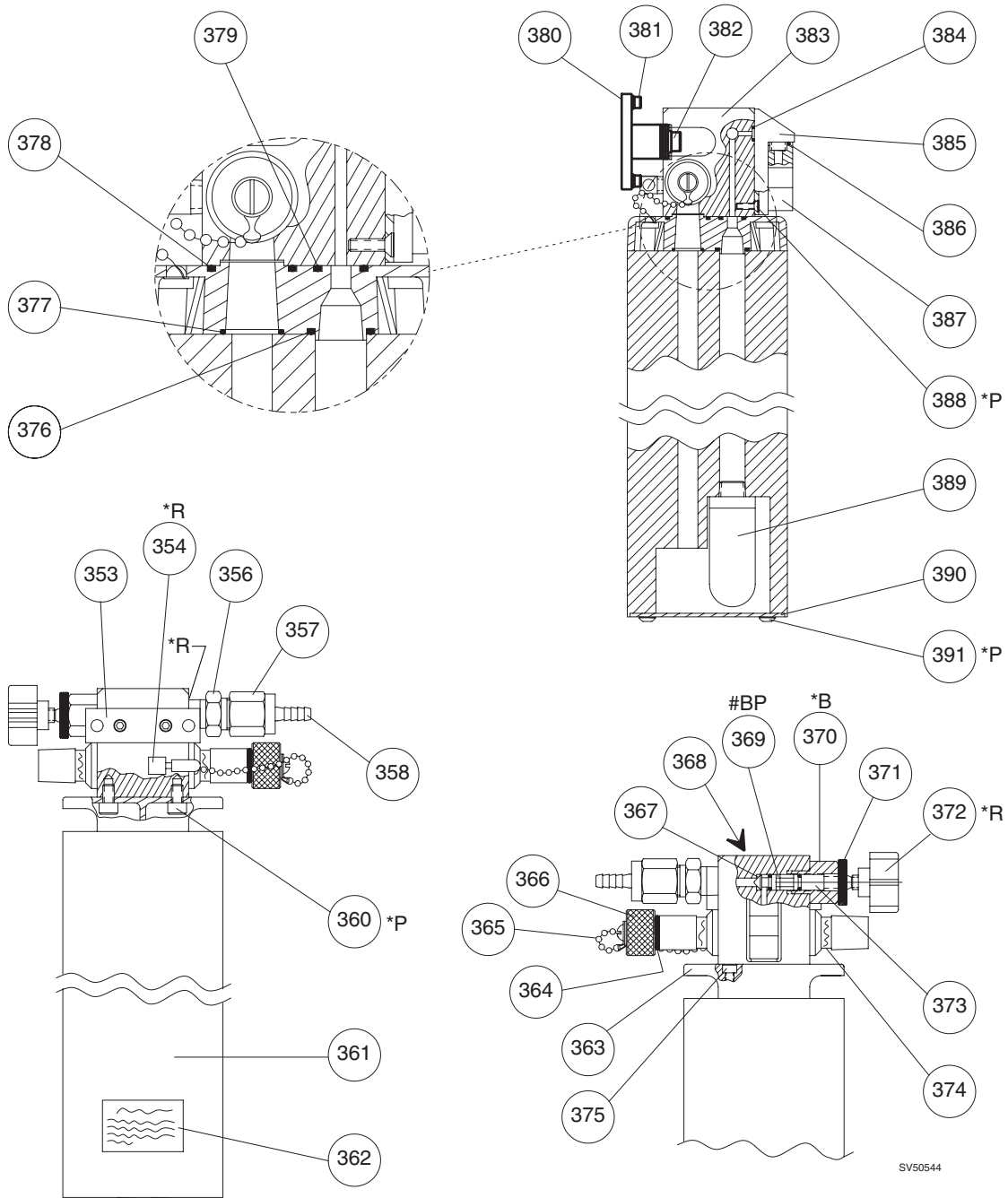
Figure 8-26. Auxiliary O2 Flowmeter Assembly

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
321.	Auxiliary O2 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 1/4 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, 5/8 w/dot and green & white rings	4109373
329.	Set Screw, cup point, 10-32 x 7/8 (2x) (used as mtg stud).	HW04011
330.	Label, AUXILIARY OXYGEN	4109381
331.	Auxiliary O2 Flow Meter Assembly, old style	4109391
332.	Valve, flow control, sub-compact.	S0B7271
333.	Label, AUXILIARY OXYGEN	4109381
334.	Label, 5/8 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
340.	Deleted	
341.	Deleted	
342.	Deleted	
343.	Deleted	
344.	Deleted	
345.	Deleted	
346.	Deleted	
347.	Deleted	
348.	Deleted	
349.	Deleted	
350.	Deleted	
351.	Deleted	
352.	Deleted	

ITEM	DESCRIPTION	PART NUMBER
------	-------------	-------------



OPEN RESERVOIR SCAVENGER - NEW STYLE

*B = LOCTITE #425 (BLUE)
*P = LOCTITE #222 (PURPLE)
*R = LOCTITE #271 (RED)
#BP = BELRAY PFET - 2 GREASE

Figure 8-27. Open Reservoir Scavenger

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly	4107624
353.	Mounting Bracket.	4109314
354.	Elbow, 1/8 M x 1/4 in. hose	4106881
355.	Deleted	
356.	Body, DISS VAC x 1/4 MPT.	4103669
357.	Nut, DISS VAC.	4103122
358.	Hose Barb Nipple	4103123
359.	Deleted	
360.	Screw, 1/4-20 x 3/8 in. skt hd (2x)	HW01033
361.	Reservoir	4110982
362.	Label, CAUTION	4104294
363.	Reservoir Top.	4110979
364.	O-ring #112 (neoprene)	4102141
365.	Chain, 8 1/4 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, 3/8-24	4112137
372.	Wing Nut	4105699
373.	Spindle	4112138
374.	Label, SCAVENGER HOSE (2x)	4104806
375.	Screw, 10-32 x 3/4 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 1/2 in. skt hd (2x)	HW01025
	Lock Washer, #10 split (2x)	HW65003
	Flat Washer, #10 (2x)	HW66003
382.	Screw, 1/4-20 x 1/2 in. skt hd (2x)	HW01034
	Lock Washer, 1/4 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 3/8 in. flat hd (2x)	HW05006
389.	Silencer	4110999
390.	Reservoir Cap	4111000
391.	Screw, 10-32 x 3/8 in. btn hd (4x)	HW09005

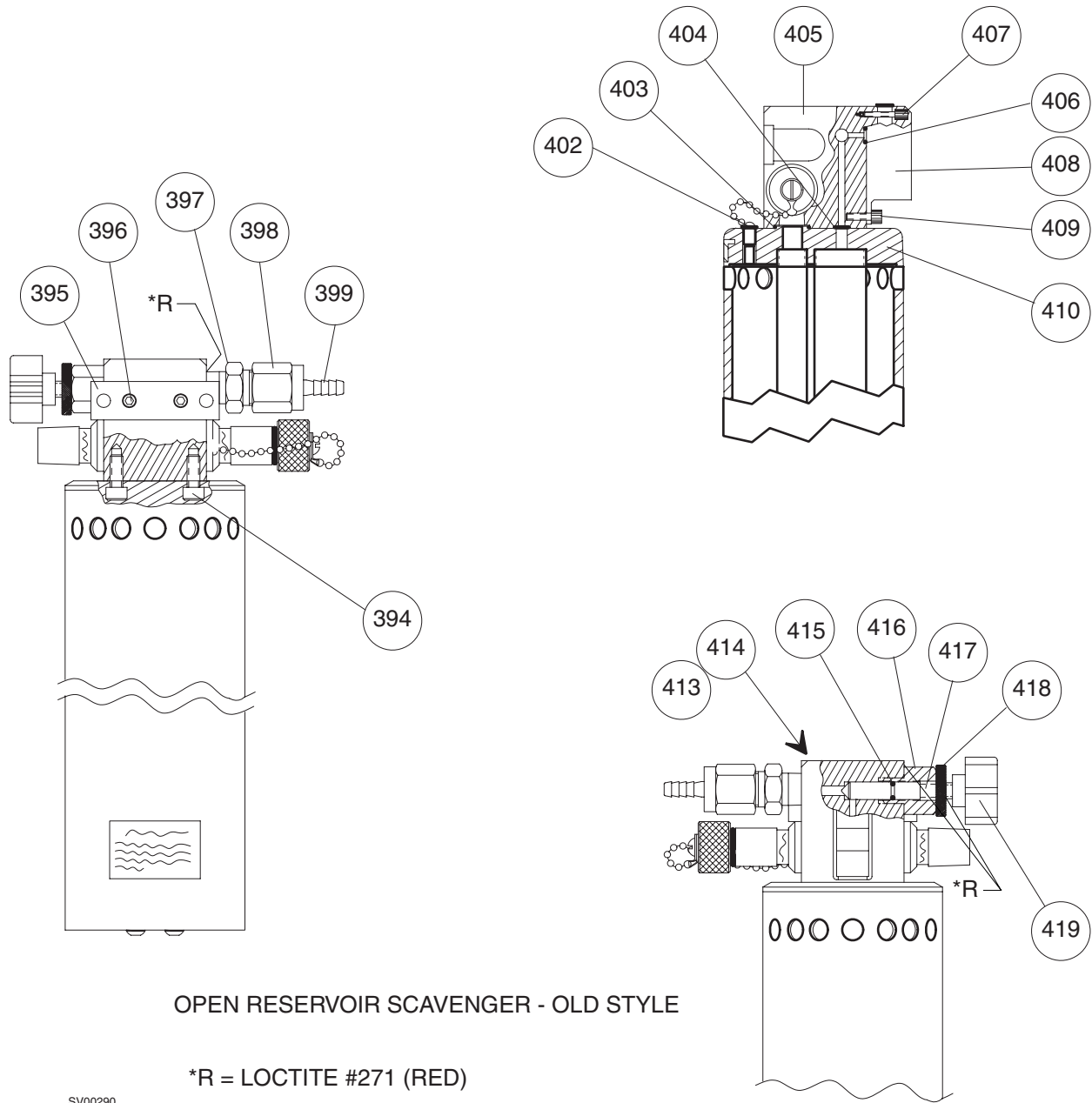
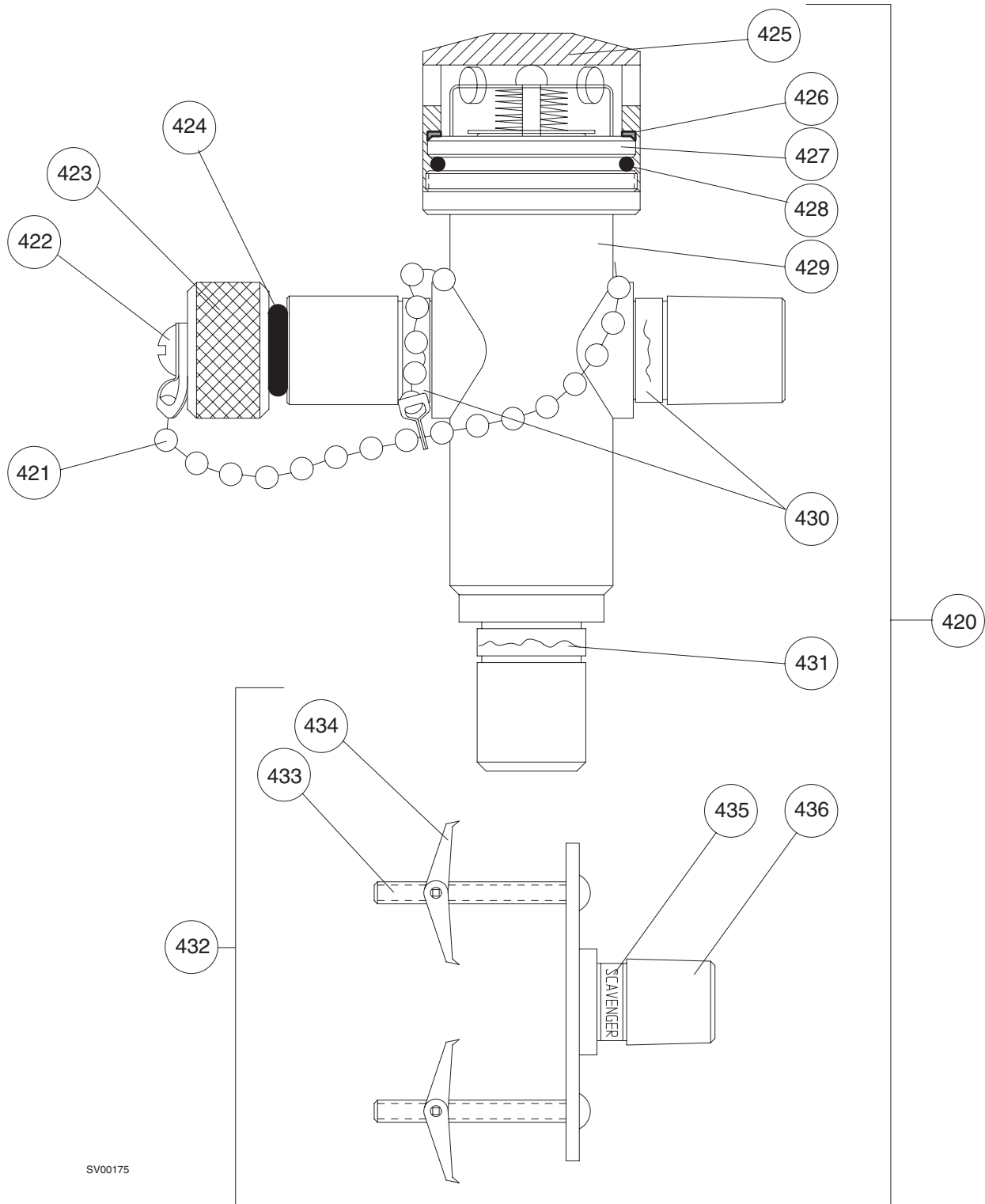


Figure 8-28. Open Reservoir Scavenger, Old Style

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly, old style	4109321
392.	Deleted	
393.	Deleted	
394.	Screw, cap skt hd, 1/4-20 x 3/4 in. (2x)	HW01036
395.	Mounting Bracket.	4109314
396.	Screw, flat hd, 8-32 x 3/4 in. (2x)	HW03026
397.	DISS body x 1/4 MPT	4103669
398.	DISS nut	4103122
399.	Hose barb	4103123
400.	Deleted	
401.	Deleted	
402.	Screw, btn hd, 10-32 x 3/8 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 5/8 in.	HW01067
408.	Flowmeter	4109306
409.	Screw, cap skt hd, 6-32 x 1/4 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, 3/8-24	4105990
419.	Wing nut.	4105699



SV00175

Figure 8-29. A/C Scavenger

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

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 H2O	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

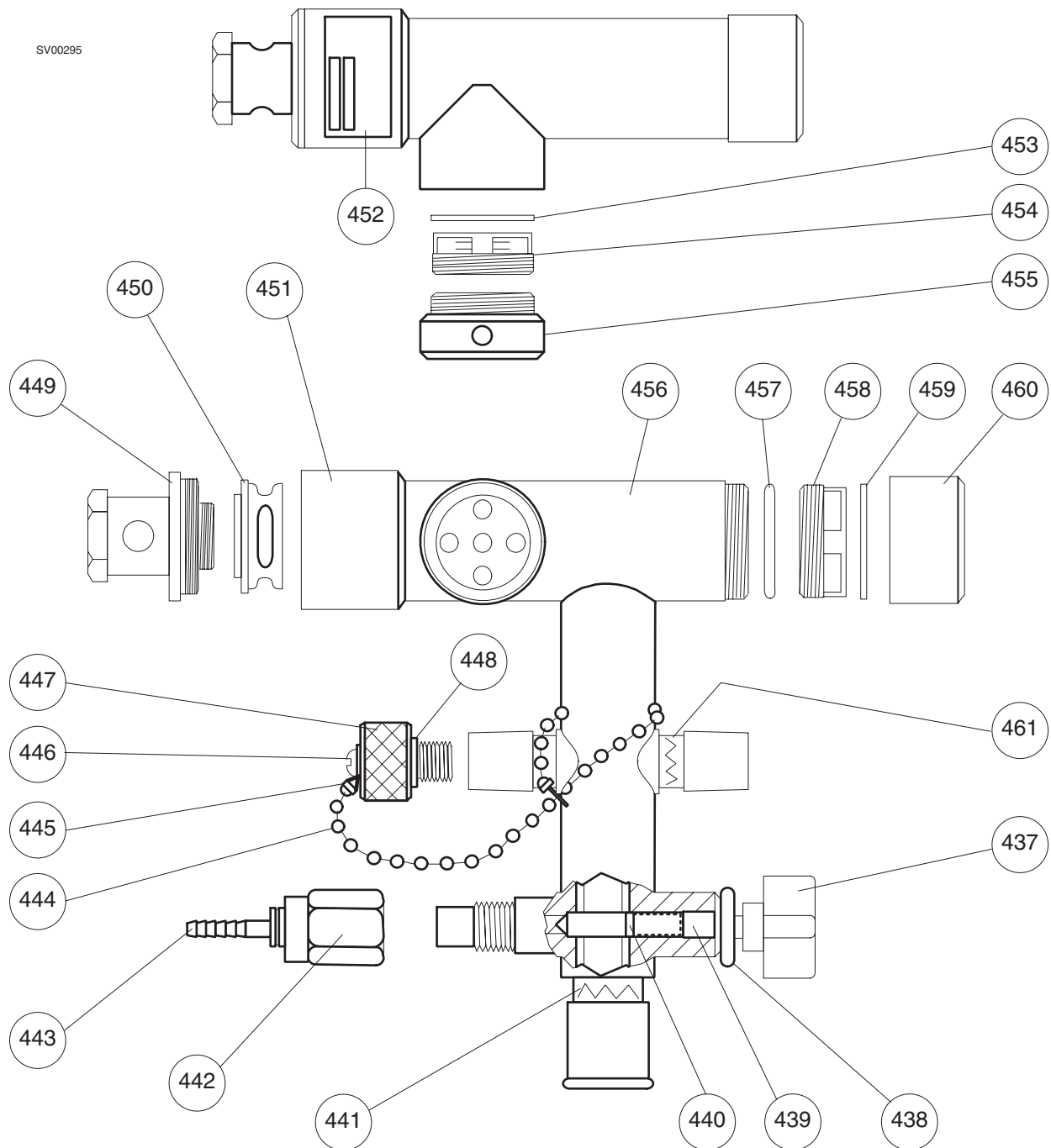


Figure 8-30. Suction Scavenger

NARKOMED 2B

SPARE AND REPLACEMENT PARTS (continued)

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 H2O	2116219
451.	Housing assembly	4104755
452.	Deleted	
453.	Seal, 'A' valve	4106321
454.	'A' Valve, 0.5 cm H2O	7264277
455.	Dust cap.	4102036
456.	Deleted	
457.	O-ring, #215 neoprene	4102038
458.	'A' Valve, 5 cm H2O.	2207032
459.	Spacer	4110792-007
460.	Dust cap.	4102035
461.	Label, SCAVENGER HOSE (2x).	4104806

SPARE AND REPLACEMENT PARTS (continued)

NARKOMED 2B

ITEM	DESCRIPTION	PART NUMBER
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Miscellaneous Items

Loctite #271 (Red)	4118558-003
Loctite #425 (Blue)	4118558-008
Loctite #222 (Purple)	4118558-001
Loctite #545 (Hydraulic/Pneumatic Seal)	4118558-010
Loctite #747 (Primer)	4118558-013
Dow Corning High Vacuum Grease	4105908
Belray Anti-Seize Molylube	4118636
Parker Seals Super-O-Lube	4118689

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Narkomed 2B Service Manual

PageDescription

Rev AF summary of changes

Cover..... Changed Rev and date
8-3.....Changed P/N of both Power Supply SE P/N's listed under item #13
8-43..... Changed P/N of item #251

Rev AE summary of changes

Cover..... Changed Rev and date
TOC..... Updated Section 8
6-1.....Changed P/N of Test Lung
6-4.....Changed P/N of Test Lung
Section 8 has been reformatted and will appear differently than the last revision released. The only technical changes made to this section are as follows:
8-1..... Revised TOC
8-4.....Added application details of Misc. Items to illustration
8-8.....Added application details of Misc. Items to illustration
8-10.....Added application details of Misc. Items to illustration
8-12.....Added application details of Misc. Items to illustration
8-14.....Added application details of Misc. Items to illustration
8-15..... Removed filter and connector listed under item #97
8-16.....Added application details of Misc. Items to illustration
8-20.....Added application details of Misc. Items to illustration
8-22.....Added application details of Misc. Items to illustration
8-26.....Added application details of Misc. Items to illustration
8-32.....Added application details of Misc. Items to illustration
8-34..... Added application details of Misc. Items to illustration,
added item #210A, 210B, and 210C, also resequenced item numbers
8-35..... Added item #210A, 210B, and 210C, resequenced item numbers
8-36.....Added application details of Misc. Items to illustration
8-38.....Added application details of Misc. Items to illustration
8-40.....Added application details of Misc. Items to illustration
8-42.....Added application details of Misc. Items to illustration
8-48.....Added application details of Misc. Items to illustration
8-50.....Added application details of Misc. Items to illustration
8-51..... Added second line to item #311
8-52.....Added application details of Misc. Items to illustration
8-54.....Added application details of Misc. Items to illustration
8-56..... Added application details of Misc. Items to illustration, deleted item #400 and 401
8-57..... Deleted item #400 and 401
8-62..... Added Miscellaneous Items list

Rev AD summary of changes

Cover..... Changed Rev and date
6-27..... Changed para 6.13.3
8-11..... Changed part number of item #81

Rev AC Summary of Changes

Cover..... Changed Logo, Rev. and Date
TOC..... Changed Logo
8-33..... Added new check valve information
Back Cover..... Changed Logo

Rev. AB Summary of changes

Changed Cover
Changed LOEP
Updated paragraph 4.13.11 on page 6-28 of PMC

Rev. AA summary of changes

Changed Cover
Changed LOEP
Changed TOC
Revised Section 6 to reflect new PMC procedures. All new pages reflect a new revision level of
- (Dash)

Rev. Z summary of changes

[8-17A, 8-17B](#)..... Deleted individual parts call-outs on interlock asm