RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

Dräger medical
A Dräger and Siemens Company

Technical Service Manual

Part Number: 4114210
Rev: T
Date: 4 May 2004

Narkomed MRI
Narkomed MRI-2
Anesthesia Systems

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

Dräger medical
A Dräger and Siemens Company

Narkomed MRI Service Manual Table of Contents

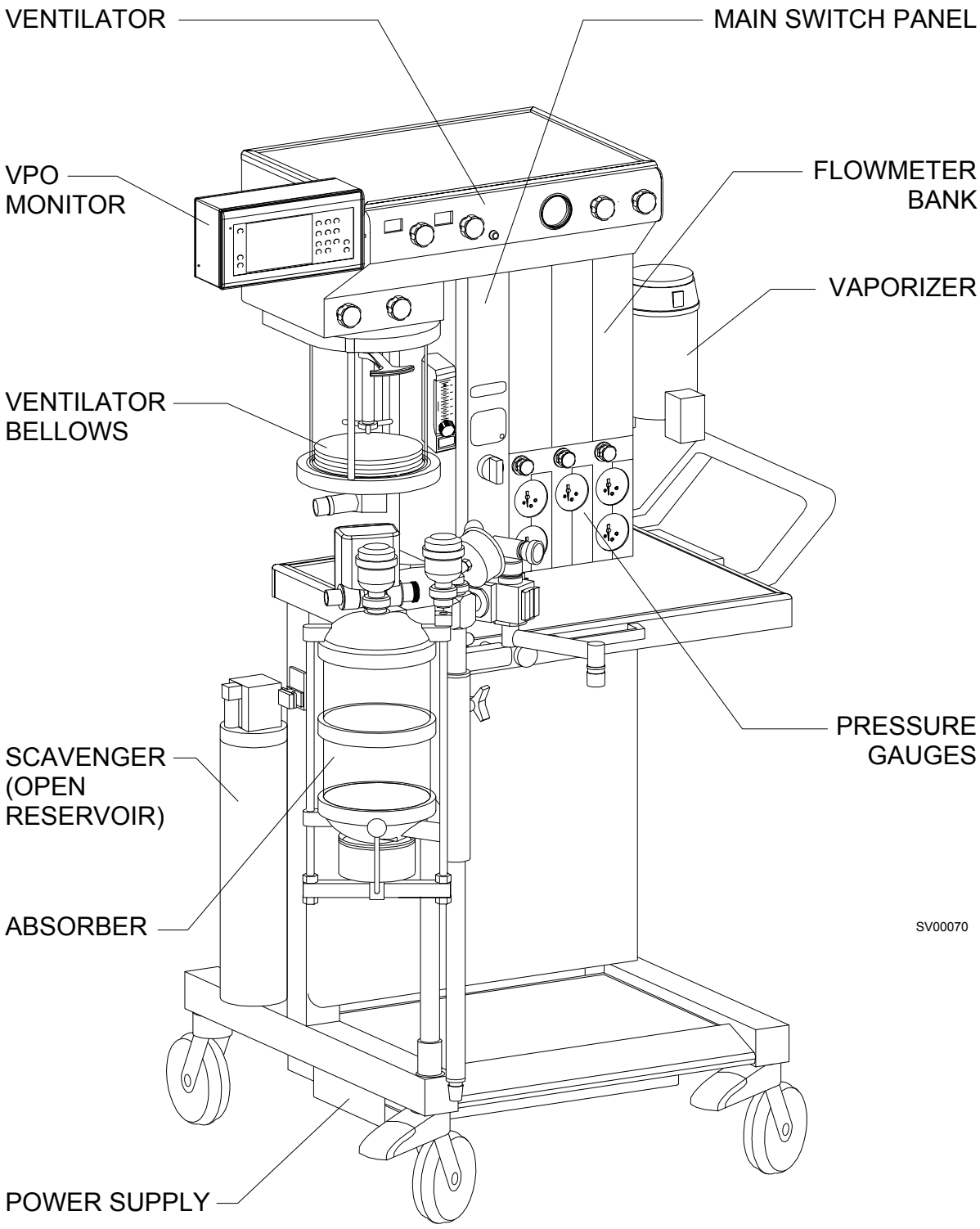
What's New in Rev. T

DESCRIPTION **PAGE**

DESCRIPTION **PAGE**

DESCRIPTION **PAGE**

Narkomed MRI Anesthesia System



1.0 INTRODUCTION

1.1 Recommendations

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

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

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

DrägerService
3124 Commerce Drive
Telford, PA 18969 U.S.A.
(Include RMA Number)

1.2 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 provides troubleshooting guides to assist the Technical Service Representative (TSR) in locating the source of a problem. The REPLACEMENT PROCEDURES section contains instructions for removal and replacement of the assemblies that are considered field-replaceable. The ADJUSTMENT AND CALIBRATION PROCEDURES section contains the field procedures needed to restore original system specifications. The Periodic Manufacturer's Service (PMS) PROCEDURE section outlines the steps required to verify the electrical, mechanical and pneumatic safety of the unit and also identifies components requiring periodic replacement.

1.3 General Troubleshooting Guidelines

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

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

The general arrangement of the Narkomed MRI 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.

1.4 General Warnings and Cautions

The following list of warnings and cautions apply to general operation and maintenance of the Narkomed MRI. Warnings and cautions about installing and operating specific parts appear with those topics.

WARNING: The user of this anesthesia machine must comply with warnings, cautions, and checkout procedures printed on the machine or on the pullout panel. Failure to do so may result in injury to the patient, operator, others, or equipment.

WARNING: Any person involved with the setup, operation, or maintenance of the Narkomed MRI anesthesia system must be thoroughly familiar with this instruction manual.

WARNING: Do not place any object on this machine unless it is specifically labeled to be used in an MRI scanning room and on the Narkomed MRI anesthesia system. Objects placed on this machine that are not designed for use with this anesthesia system may be strongly attracted to the magnet and may cause serious injury or death when the machine is used in an MRI scanning room.

WARNING: Always lock the casters after this anesthesia machine has been positioned in the MRI scanner room. Magnetic attractive forces between the magnet and the anesthesia machine may cause unintentional movement of the anesthesia machine if the casters are unlocked.

WARNING: The power supply charger assembly must not be taken into the magnet room. Damage to the equipment, MRI system, or personal injury could result.

WARNING: The Narkomed MRI has been tested only with magnets having field strengths of up to 1.5 tesla. Moving the machine near higher strength magnets (greater than 1.5 tesla) could result in machine malfunction or unmanageable attractive forces that could lead to serioius injury or death.

WARNING: The Narkomed MRI-2 has been tested with magnets having field strengths of up to 3.0 tesla. Moving the machine near higher strength magnets (greater than 3.0 tesla) could result in machine malfunction or unmanageable attractive forces that could lead to serious injury or death.

WARNING: This anesthesia system will not respond automatically to certain changes in patient condition, operator error, or failure of components. The system is designed to be operated under the constant surveillance and control of a qualified operator.

WARNING: Use only nonmagnetic (aluminum) E-cylinders with this machine. Steel cylinders can cause serious injury or death if brought into an MRI scanning room.

WARNING: No third-party components shall be attached to the anesthesia machine, ventilator, or breathing system (except for certain approved exceptions). Contact DrägerService® for further information. DrägerService® is a division of Draeger Medical, Inc.

WARNING: Not for use with flammable anesthetics. To avoid explosion hazards, do not use flammable anesthetic agents such as diethyl-ether and cyclopropane with this machine. Only anesthetic agents which comply with the requirements for non-flammable anesthetic agents per IEC standard or national equivalent shall be used with this anesthesia machine.

CAUTION: When moving the machine, be sure to set the absorber to its lowest position on the absorber pole. To avoid personal injury or damage to the unit, do not use the absorber pole to push or pull the machine. It is recommended that two people move the machine to aid in maneuverability on inclines, around corners, and over raised thresholds.

CAUTION: The Narkomed MRI is designed for MRI use only as a system. The user should not assume that individual components of the system can be safely used with MRI scanners.

CAUTION: Although the Narkomed MRI is designed to minimize the effects of ambient radio-frequency interference, machine functions may be adversely affected by the operation of electrosurgical equipment or short-wave or microwave diathermy equipment in the vicinity.

The following messages appear in French on the Narkomed MRI:

ATTENTION: Lors du déplacement de l'appareil, veiller à placer l'absorbeur le plus bas possible sur le montant. Pour éviter tout risque de blessure corporelle ou endommagement de l'appareil, ne pas pousser ou tirer sur le montant de l'absorbeur pour déplacer l'appareil. Il est recommandé que deux personnes déplacent l'appareil sur des plans inclinés, dans des angles et pour passer des seuils surélevés.

AVERTISSEMENT: L'utilisateur de l'appareil d'anesthésie doit se conformer aux avertissements, mises en garde et procédures de vérification imprimés sur l'appareil ou sur le panneau rétractable. Négliger de faire cela risque de provoquer des blessure chez le patient, l'opérateur ou d'autres personnes et risque également d'endommagement l'appareil.

AVERTISSEMENT: Toute personne chargée de la préparation, de l'utilisation ou de l'entretien de l'appareil d'anesthésie Narkomed MRI doit très bien connaître le contenu de ce manuel d'utilisation.

AVERTISSEMENT: Ne placer aucun objet sur cet appareil à moins qu'il n'ait été spécifiquement approuvé pour l'utilisation dans une salle IRM avec un appareil d'anesthésie Narkomed MRI. Tout objet non conforme déposé sur cet appareil pourrait être fortement attiré par l'aimant et pourrait occasionner des blessures graves ou fatales lorsque l'appareil d'anesthésie est utilisé dans la salle IRM.

AVERTISSEMENT: Toujours bloquer les roues après avoir placé cet appareil d'anesthésie à l'endroit voulu dans la salle IRM. Les forces d'attraction magnétique entre l'aimant et l'appareil d'anesthésie peuvent provoquer un déplacement imprévu de ce dernier si les roues ne sont pas bloquées.

AVERTISSEMENT: Ne pas amener le chargeur de batterie dans la salle IRM car cela présenterait un risque d'endommagement du matériel et du système IRM, ou de blessure corporelle.

AVERTISSEMENT: Cet appareil d'anesthésie Narkomed MRI a été vérifiée avec des aimants possédant des champs magnétiques jusqu'á 1,5 tesla. Installé l'appareil prés d'un aimant plus puissant (plus de 1,5 tesla) pourrait amener l'appareil á mal monctionner ou produire des forces d'attractions incontrôlables qui pourait causer des blessures sérieuses ou la mort.

AVERTISSEMENT: Cet appareil d'anesthésie Narkomed MRI-2 a été vérifiée avec des aimants possédant des champs magnétiques jusqu'á 3,0 tesla. Installé l'appareil prés d'un aimant plus puissant (plus de 3,0 tesla) pourrait amener l'appareil á mal monctionner ou produire des forces d'attractions incontrôlables qui pourait causer des blessures sérieuses ou la mort.

AVERTISSEMENT: Ce système d'anesthésie ne réagit pas automatiquement à certains changements de l'état physiologique du patient, aux erreurs de l'opérateur ou aux défaillances des composants. Il a été conçu de manière à être utilisé sous le contrôle permanent de l'opérateur.

AVERTISSEMENT: Utiliser uniquement des bouteilles de type E non magnétiques (en aluminium) avec cet appareil. L'utilisation de bouteilles en acier dans la salle IRM pourrait occasionner des blessures graves ou mortelles.

AVERTISSEMENT: Ne pas utiliser de composants en provenance d'autres fabricants avec l'appareil d'anesthésie, le ventilateur ou le circuit d'anesthésie, à moins qu'ils n'aient été approuvés au préalable. Contacter le service technique de Draeger Medical, Inc. pour des informations complémentaires.

AVERTISSEMENT: Ne pas utiliser l'appareil d'anesthésie avec des anesthésiques inflammables. Pour éviter tout risque d'explosion, ne pas utiliser d'anesthésiques inflammables tels que l'éther et le cyclopropane. Seuls les anesthésiques conformes aux exigences relatives aux anesthésiques ininflammables de la norme CEI ou toute norme nationale équivalente pourront être utilisés avec cet appareil.

AVERTISSEMENT: Lors du déplacement de l'appareil d'anesthésie, enlever tous les moniteurs et autre matériel de l'étagère supérieure, retirer l'absorbeur et n'utiliser que les poignées ou les barres de poussée/traction. L'appareil d'anesthésie ne doit être déplacé que par des personnes suffisamment fortes pour en supporter le poids. Draeger Medical, Inc. recommande que deux personnes déplacent l'appareil d'anesthésie afin de le manouvrer plus facilement. Veiller à ce que l'appareil ne bascule pas lors du déplacement sur des plans inclinés, dans des angles et au passage de seuils (portes et ascenseurs, par exemple). Ne pas faire passer l'appareil sur des tuyaux, des fils électriques ou d'autres obstacles se trouvant sur le sol.

ATTENTION: L'appareil d'anesthésie Narkomed MRI doit être utilisé uniquement en tant que système pour l'imagerie à résonance magnétique. L'utilisateur ne doit pas présumer que chaque composant du système peut être utilisé seul pour l'IRM sans présenter de risques.

ATTENTION: Bien que l'appareil d'anesthésie Narkomed MRI soit conçu de manière à minimiser le parasitage électromagnétique, son fonctionnement peut être affecté par l'utilisation de générateurs d'électrochirurgie ou d'appareils de diathermie à ondes courtes ou d'appareils à micro-ondes se trouvant aux alentours.

ATTENTION: Ne pas placer plus de 23 kg (50 livres) sur l'appareil.

. . . . . .

Copyright

Trademark Notices

Disclaimer

The content of this manual is furnished for informational use only and is subject to change without notice. Draeger Medical, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in this manual.

2.0 DIAGNOSTICS

The Narkomed MRI anesthesia system includes a volume, pressure, and oxygen monitor.

If your system is equipped with an Omicron (Core-M) monitor, refer to the *NAD Omicron Monitor Instructions for Operation* (Part No. 4114448) for power-up diagnostic indications, calibration, and setting of alarm parameters. Power to the monitor is supplied by the Narkomed MRI anesthesia system. A description of the power distribution scheme along with a troubleshooting guide is given in the next section.

The descriptions that follow apply to systems equipped with a VPO monitor.

2.1 Power-up Diagnostics

The VPO monitor contains a diagnostic system that monitors certain system functions and records their operational status. Following a brief System Startup display at power up, the diagnostics screen shown in Figure 2-1 appears. This display includes one of three messages at the completion of the diagnostics:

FUNCTIONAL:	This message indicates that the Narkomed MRI has passed all power-up tests and is fully functional. The machine will proceed to the MACHINE MONITOR screen after a short delay.
CONDITIONALLY FUNCTIONAL:	This message indicates that a minor problem has been detected. The Narkomed MRI will retain this display until any key is pressed, then the MACHINE MONITOR screen will be displayed.
NON-FUNCTIONAL:	This message indicates that a serious problem has been detected. The machine will not proceed into the MACHINE MONITOR or SYSTEM MONITOR screen.

The PREVENTIVE MAINTENANCE DUE message will appear on the screen if the current date exceeds the Periodic Manufacturer's Service due date stored in the machine.

Further diagnostic functions are available through service screens that can be called up at the display panel. The following paragraphs provide a description of each service screen that can be accessed at the display. If no display is present upon system power-up, refer to Section 3 of this manual for troubleshooting assistance.

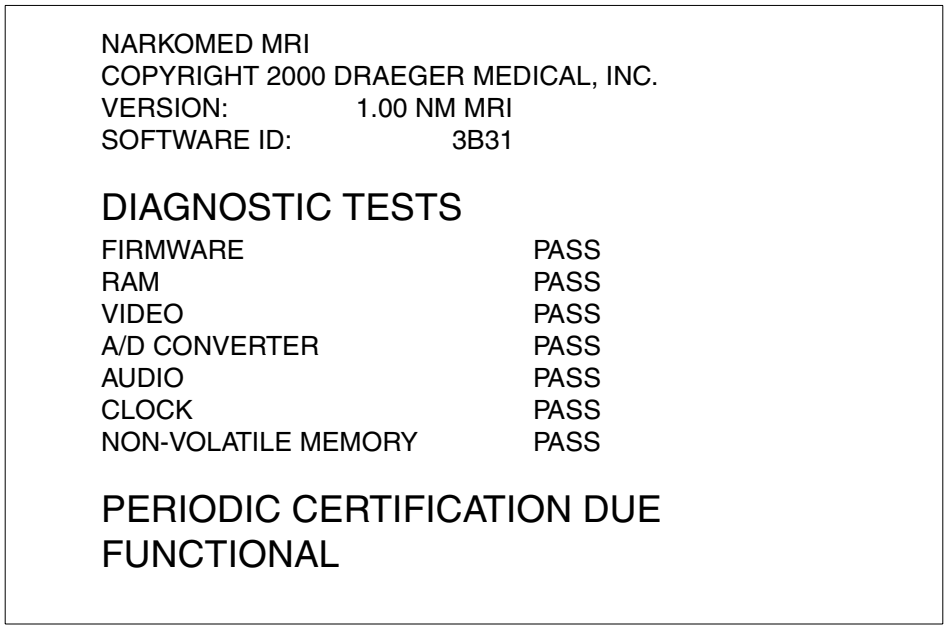


Figure 2-1. Power-up Diagnostics Screen

2.2 Main Service Screen

2.2.1 View Mode

The Main Service Screen displays the machine serial number, the last service date, hours run since last service and total hours run.

To access the Main Service Screen, press and hold the Oxygen High Limit and Volume Low Limit keys, and press the ▲ key. The View Mode service screen shown in Figure 2-2 will then appear.

Press the ▲ key to proceed to the Service Mode (described in the next paragaph), or press the key next to EXIT to return to the monitoring screen.

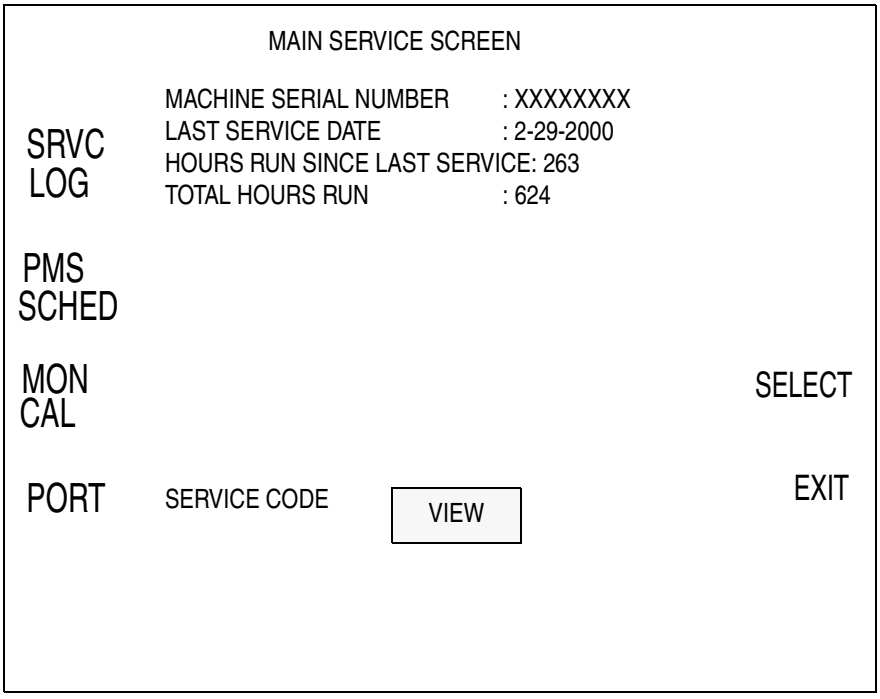


Figure 2-2. Main Service Screen, View Mode

2.2.2 Service Mode

In this screen, the Service Code Changes to SRVC.

Press the key next to SELECT to enable the Technical Service ID entry as described on the next page.

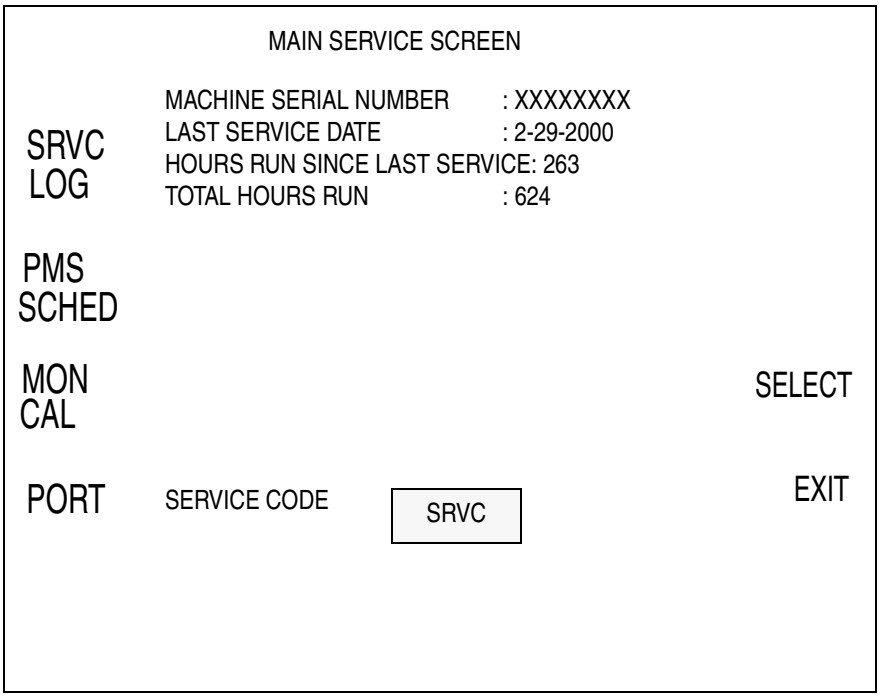


Figure 2-3. Main Service Screen, Service Mode

2.2.3 Service Mode: I.D. Entry

The Service Mode screen appears as shown in Figure 2-4. Press the key next to SELECT. Enter the first digit of your service code by using the ▲ and ▼ keys to display the desired character. Press the key next to SELECT to advance to the next digit, and enter the next and remaining I.D. characters in the same manner.

When this screen is entered, an entry is made in the Service Log.

To access any of the other service screens described on the following pages, press the key next to the desired function on the left side of the screen: Service Log, PMS Schedule, Monitor Calibration, or Port communication settings.

Pressing the key next to RESET will reset the HOURS RUN SINCE LAST SERVICE to zero, and the LAST SERVICE DATE to the current date.

If desired, press the key next to EXIT to return to the monitoring screen.

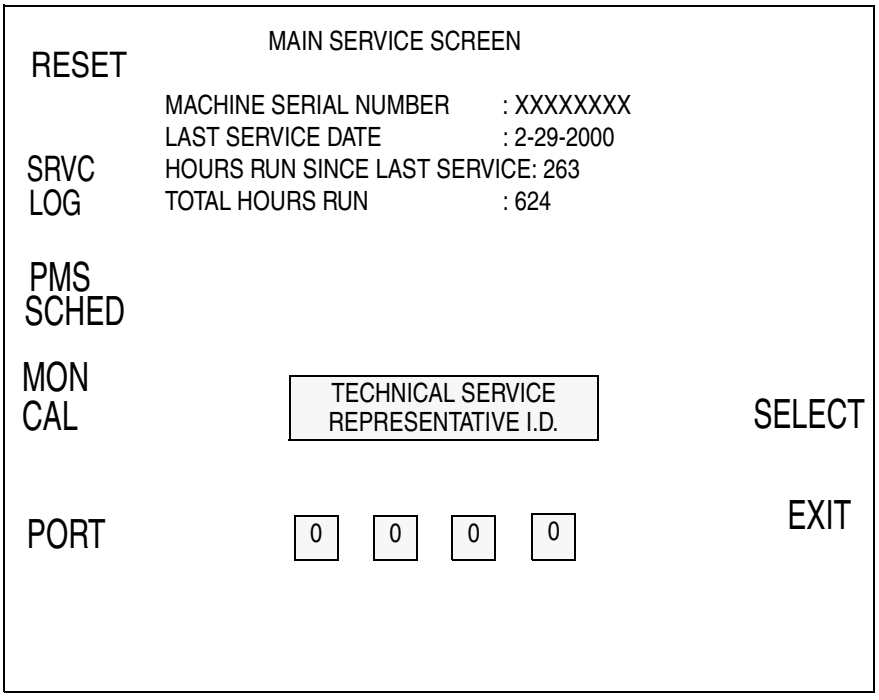


Figure 2-4. Main Service Screen, Service Mode

2.3 Service Log

From the Service Screen (described earlier), press the key next to SRVC LOG.

Figure 2-5 shows an example of the screen that will appear. This screen allows you to view the events recorded in the machine's service log. Use the ▼ and ▲ keys to scroll down or up through the log entries.

Press the key next to EXIT to return to the Main Service Screen.

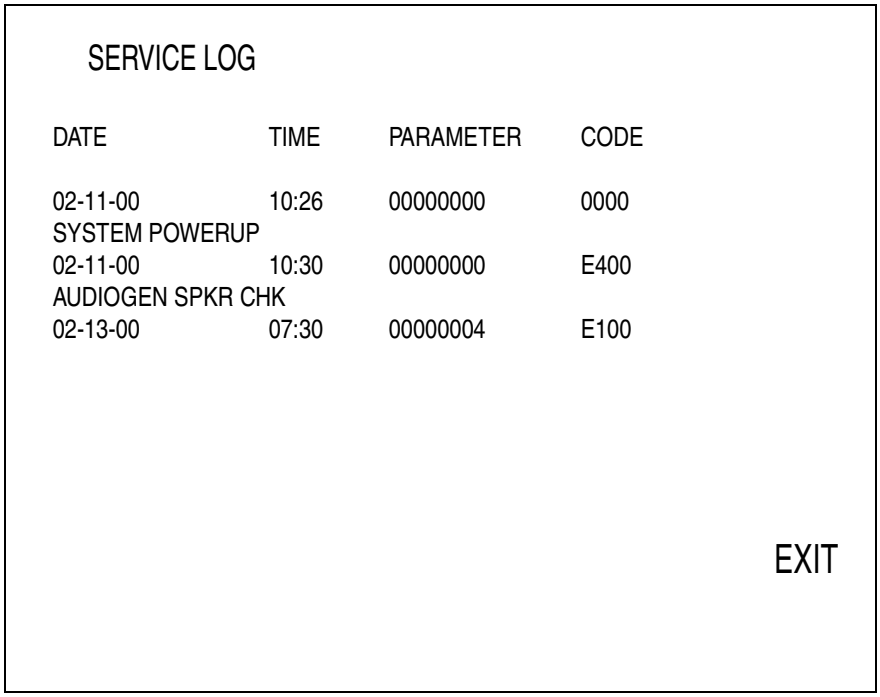


Figure 2-5. Service Log

2.4 PMS Criteria Screen

The PMS Criteria Screen allows you to select the month when the PREVENTIVE MAINTENANCE DUE message appears on the power-up diagnostics screen.

From the Service Screen (described earlier), press the hidden key next to PMS SCHED.

Figure 2-6 shows an example of the screen that will appear. Use the ▲ and ▼ keys to set the desired month.

Press the key next to EXIT to return to the Main Service Screen.

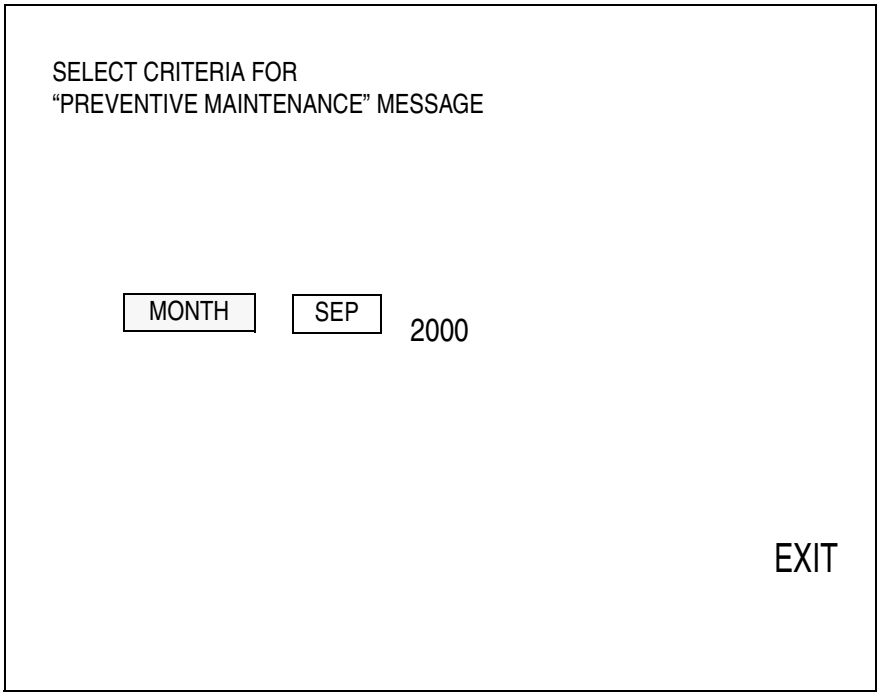


Figure 2-6. PMS Criteria Screen

2.5 Oxygen Monitor Service Screen

The Oxygen Monitor Service Screen shown in Figure 2-7 displays current readings for the O_2 cells, a zero calibration procedure, and the stored calibration values.

From the Service Screen (described earlier), press the key next to MON CAL.

To perform a zero calibration, follow the calibration procedure shown on the screen. Pressing the key next to ZERO stores the current values as the new zero calibration.

To proceed to the Pressure Monitor Service Screen, press the key next to PRES MON. To return to the Main Service Screen, press the key next to EXIT.

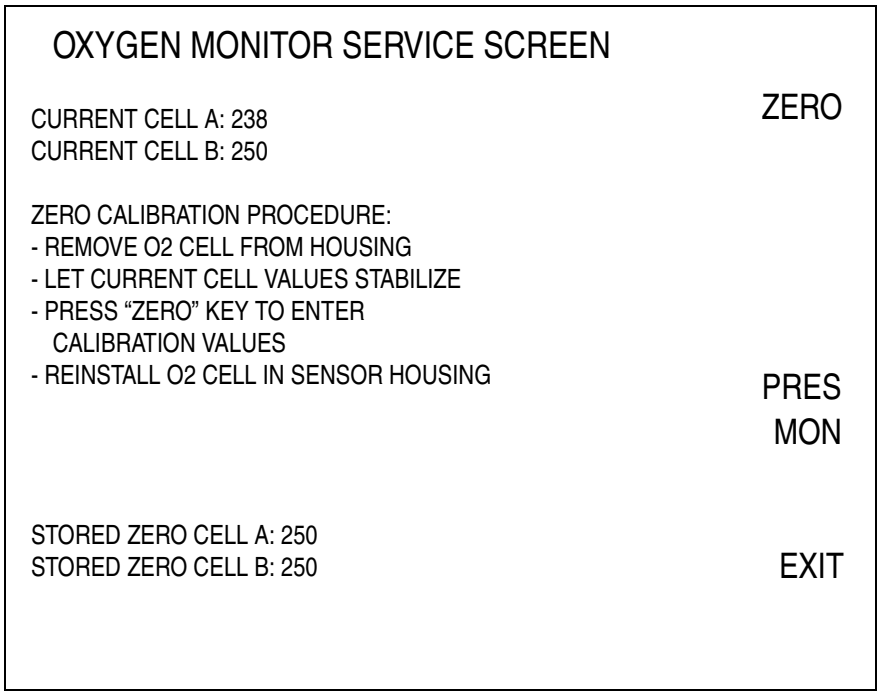


Figure 2-7. Oxygen Monitor Service Screen

2.6 Pressure Monitor Service Screen

The Pressure Monitor Service Screen shown in Figure 2-8 displays the current reading for airway pressure, a procedure for zero and span calibration, and the stored calibration values.

To enter the Pressure Monitor Service Screen from the Oxygen Monitor Service Screen (described earlier), press the key next to PRES MON (ref. Figure 2-6).

To perform a zero calibration, follow the procedure shown on the screen. Pressing the key next to ZERO stores the current value as the new zero calibration.

To perform a span calibration, follow the procedure shown on the screen. Pressing the key next to SPAN stores the current value as the new span calibration.

To return to the Oxygen Monitor Service Screen, press the key next to OXY MON. To return to the Main Service Screen, press the key next to EXIT.

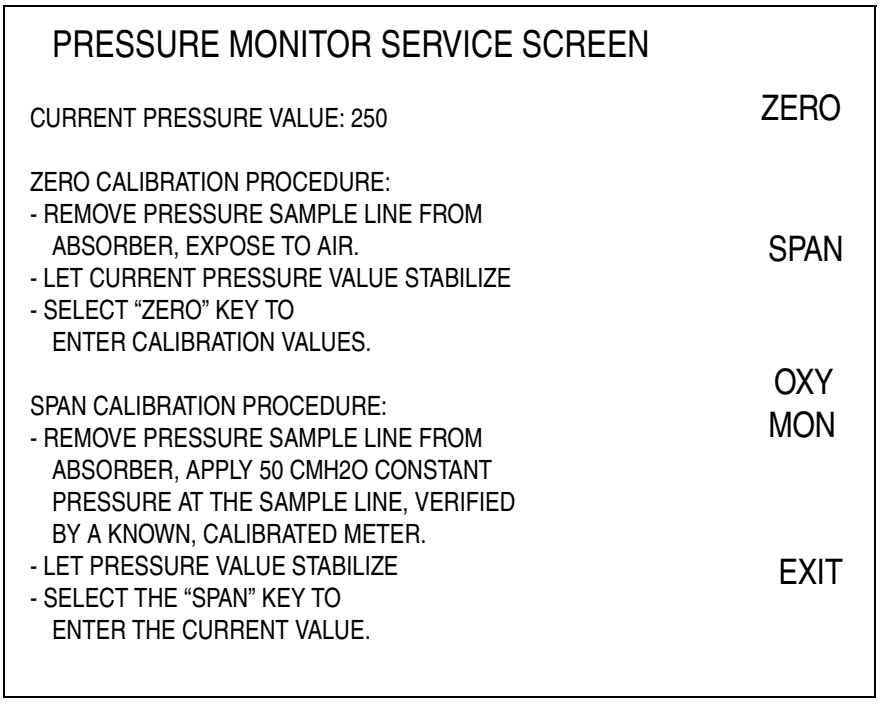


Figure 2-8. Pressure Monitor Service Screen

2.7 Deleted

3.0 TROUBLESHOOTING

This section contains information to assist the DrägerService® qualified Technical Service Representative (TSR) in locating electrical faults affecting the Narkomed MRI anesthesia system. 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

Power is distributed from the battery box PCB assembly to the alarm channel, monitor, and flow sensor electronics module on machines with a VPO monitor. Power for the ventilator controller is obtained from the alarm channel. Table 3-1 lists the test points and acceptable ranges for each voltage; Figures 3-1 and 3-2 show test point locations. Simplified electrical block diagrams are shown in Figures 3-3 and 3-4.

TABLE 3-1: TEST POINTS AND ALLOWABLE RANGES

BATTERY BOX PCB (Machines with Core-M monitor)	VOLTAGE	ACCEPTABLE RANGE
J1-1	+ 13.8 VDC input*	13.6 to 14.0 VDC
J4-1	+ 9 VDC to monitor	8.45 to 9.55 VDC
J3-1	+ 8 VDC to alarm channel	7.55 to 8.45 VDC
J1-2, J4-2, J3-14	Common	
BATTERY BOX PCB (Machines with VPO monitor)	VOLTAGE	ACCEPTABLE RANGE
J7-1	+ 8 VDC to monitor	7.72 to 8.36 VDC
J4-1	+ 12 VDC to Gill flow sensor	11.61 to 12.54 VDC
J7-2, J4-2	Common	
ALARM CHANNEL	VOLTAGE	ACCEPTABLE RANGE
J3-9 (Wht)	+ 8 VDC to vent controller	7.55 to 8.45 VDC
J3-3 (Orn)	Common	

* Applies to early models, measured with battery fully charged and System Power switch at STANDBY.

On later models with Jerome power supply including machines with VPO monitor, input voltage is measured at DC power cable Pins 1& 2, with cable unplugged. Range: 13.6 to 14.5 VDC.

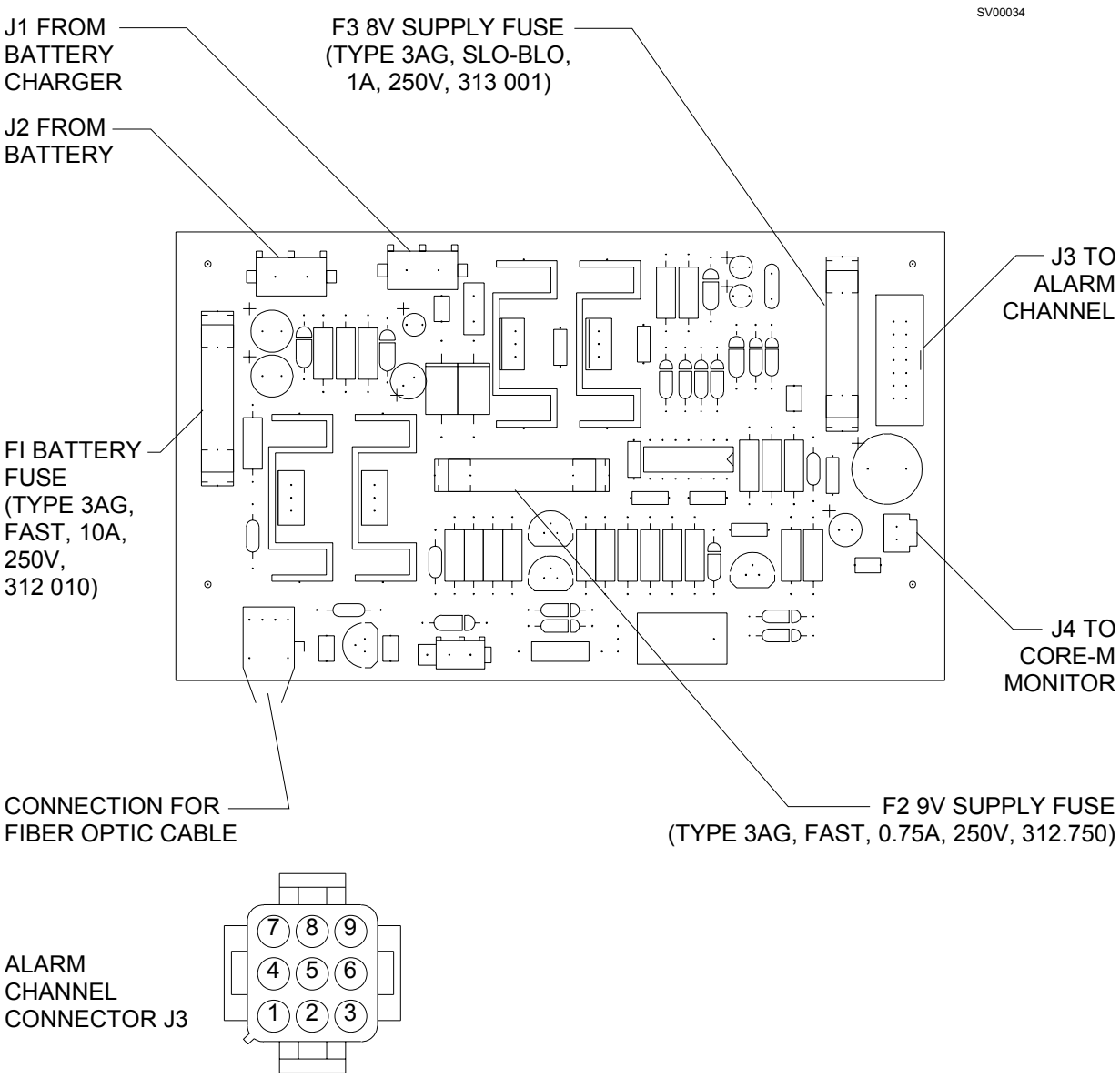


FIGURE 3-1. Power Supply Voltage Test Points: Machines with Core-M Monitor

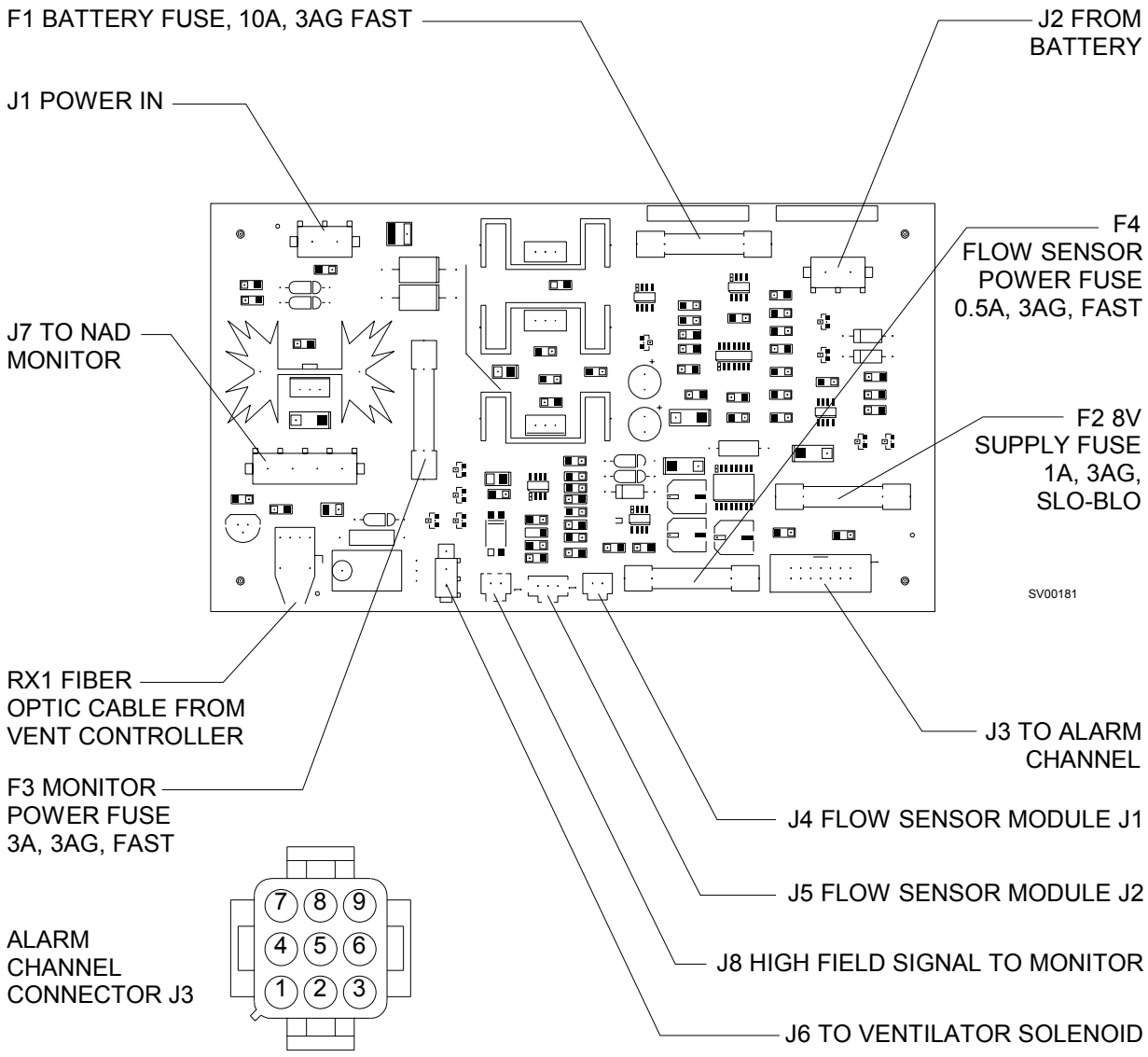


FIGURE 3-2. Power Supply Voltage Test Points: Machines with VPO Monitor

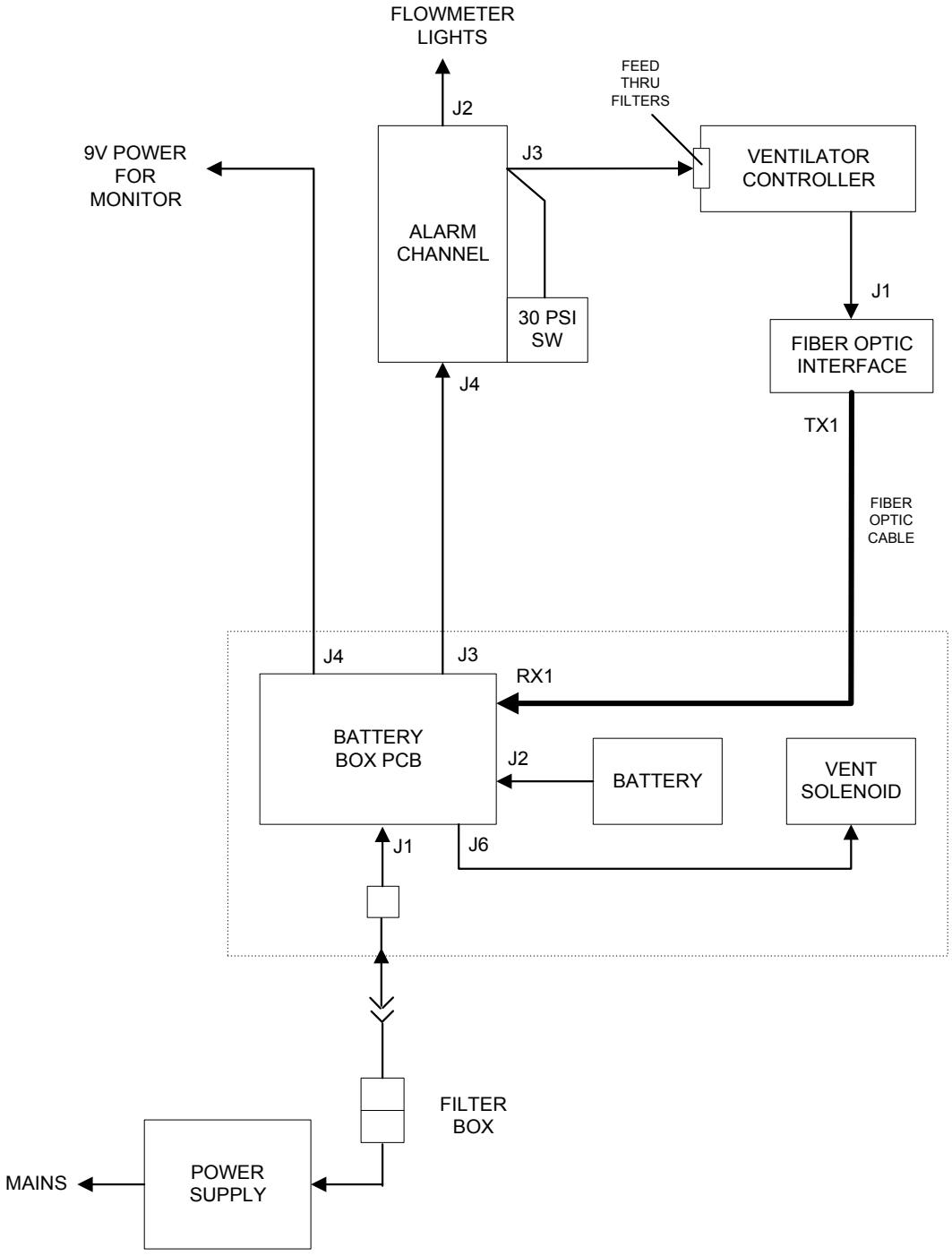


FIGURE 3-3. Narkomed MRI Block Diagram: Machines w/Core-M Monitor

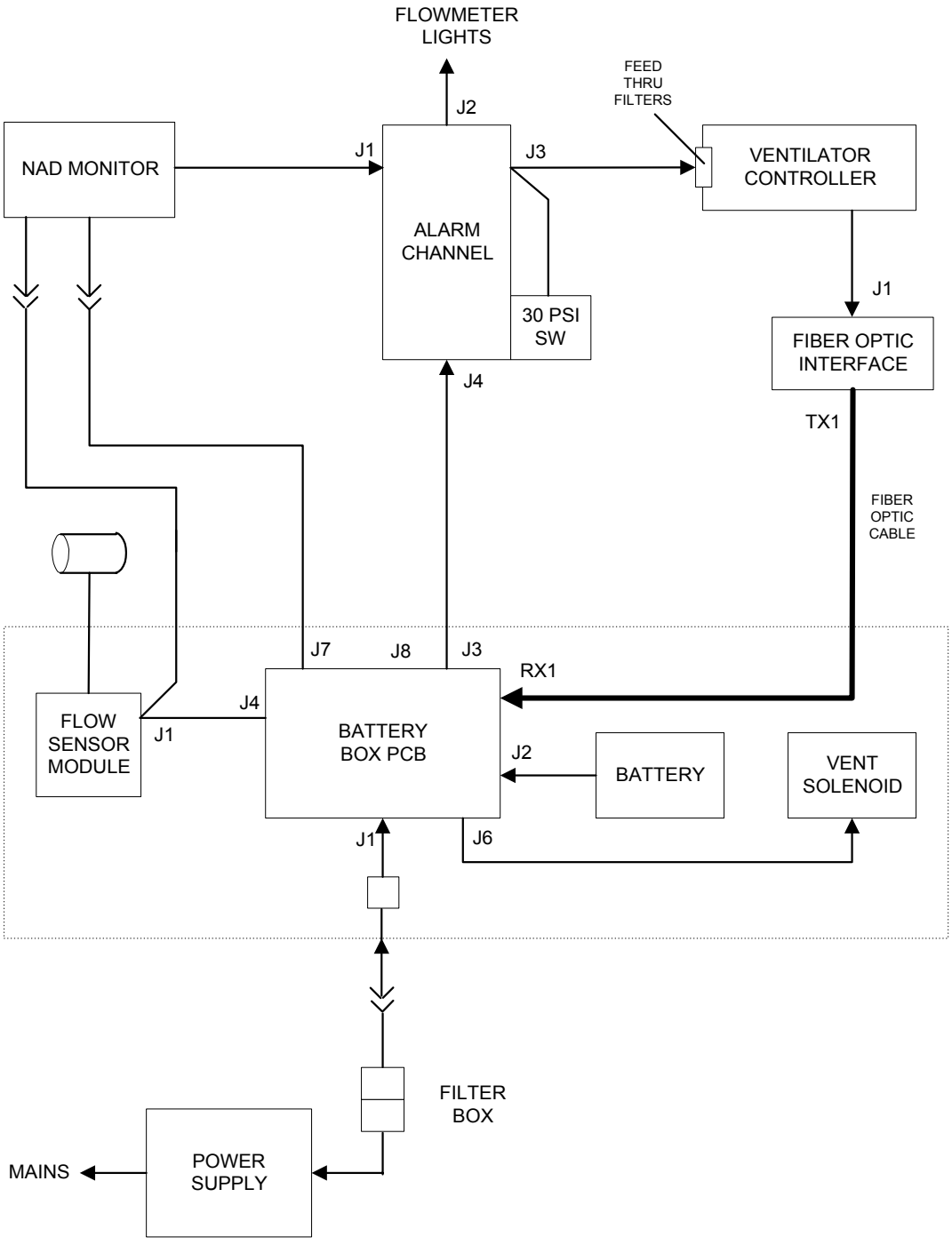


FIGURE 3-4. Narkomed MRI Block Diagram: Machines w/VPO Monitor

3.2 Battery

With the System Power switch at STANDBY and the power supply/charger box disconnected, the battery voltage at full charge should be within the range of 12.5 to 13.2 VDC. Battery voltage can be measured at J2 on the battery box PCB. During battery operation, the low battery cutoff voltage should be within the range of 10.7 to 11.3 VDC.

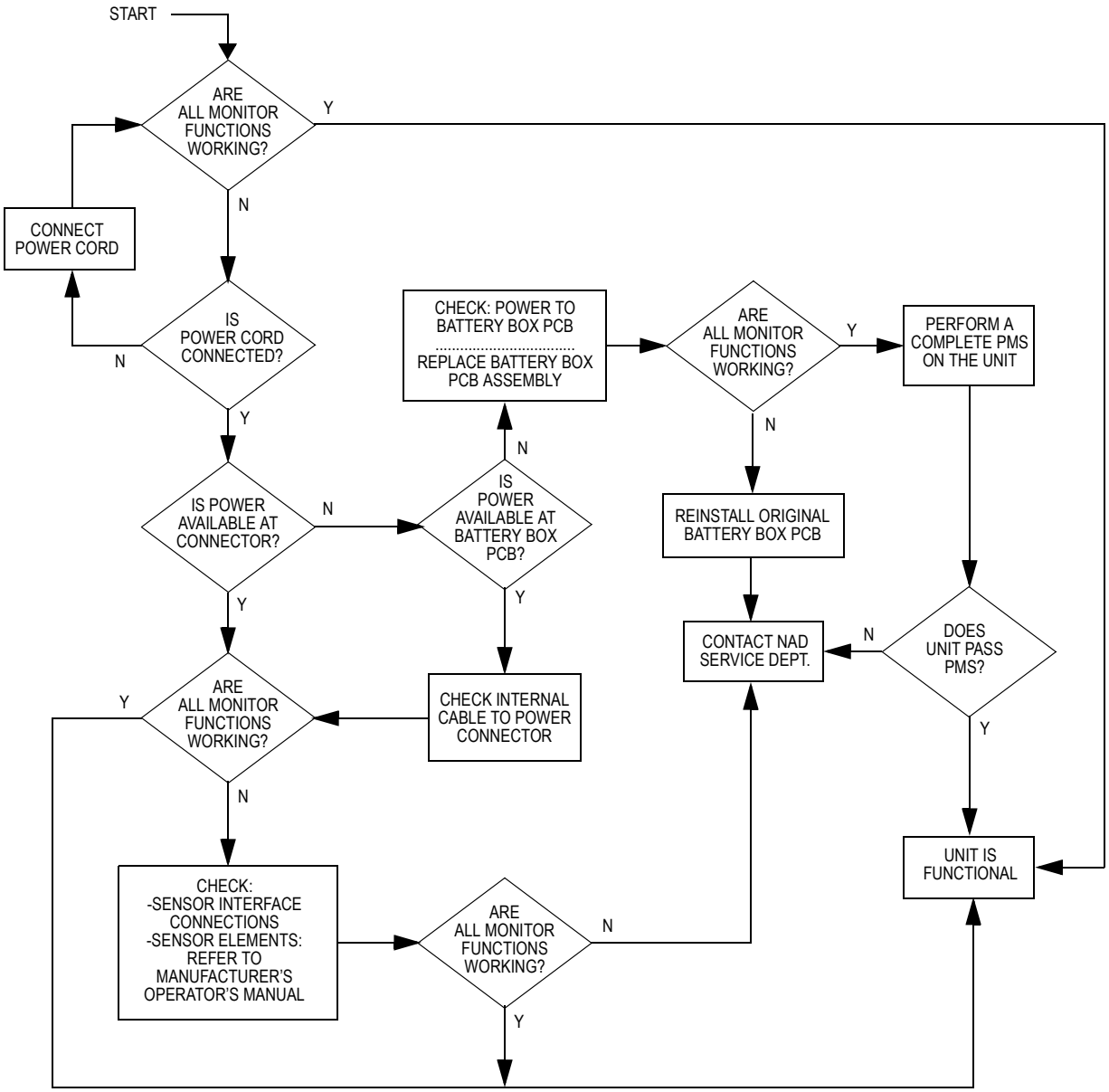
3.3 Troubleshooting Guides

Table 3-2 lists common failure modes and symptoms (excluding simultaneous multiple faults) for the Narkomed MRI. Each failure mode or symptom is keyed to a troubleshooting guide flow chart at the back of this section to assist the TSR 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.

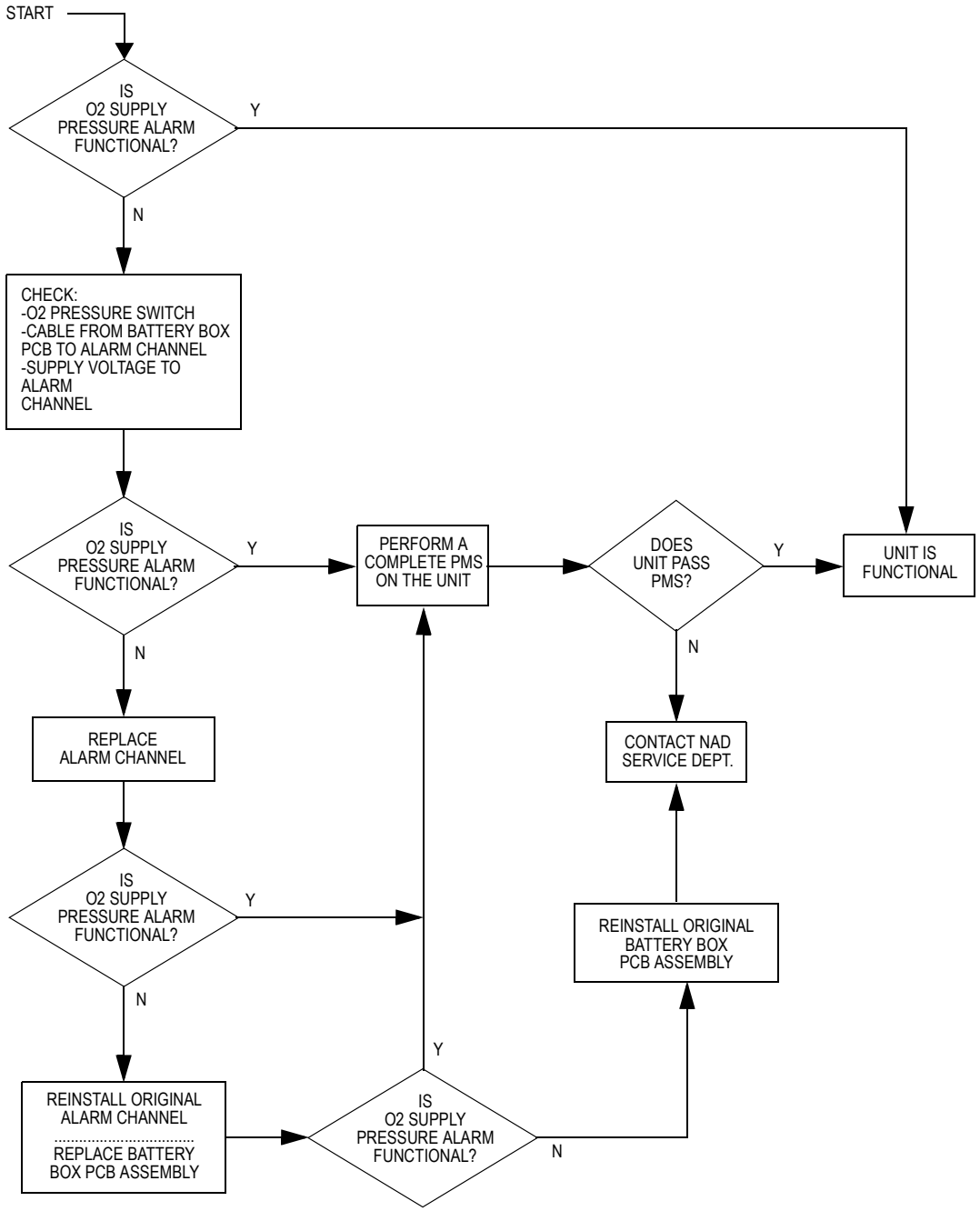
TABLE 3-2: NARKOMED MRI FAILURE MODE AND SYMPTOM LIST

FAILURE MODE / SYMPTOM	CORRECTIVE ACTION
Monitor Inoperative (Core-M Monitor)	Guide 1
No O_2 Supply Pressure Alarm	Guide 2
Ventilator Inoperative	Guide 3
No Audio Alarms, Display Blank, Keypad Inoperative (VPO Monitor)	Guide 4
Serial Port Communication Failure (VPO Monitor)	Guide 5
Loss of Breathing Pressure Monitor (VPO Monitor)	Guide 6
Loss of Respiratory Volume Monitor (VPO Monitor)	Guide 7

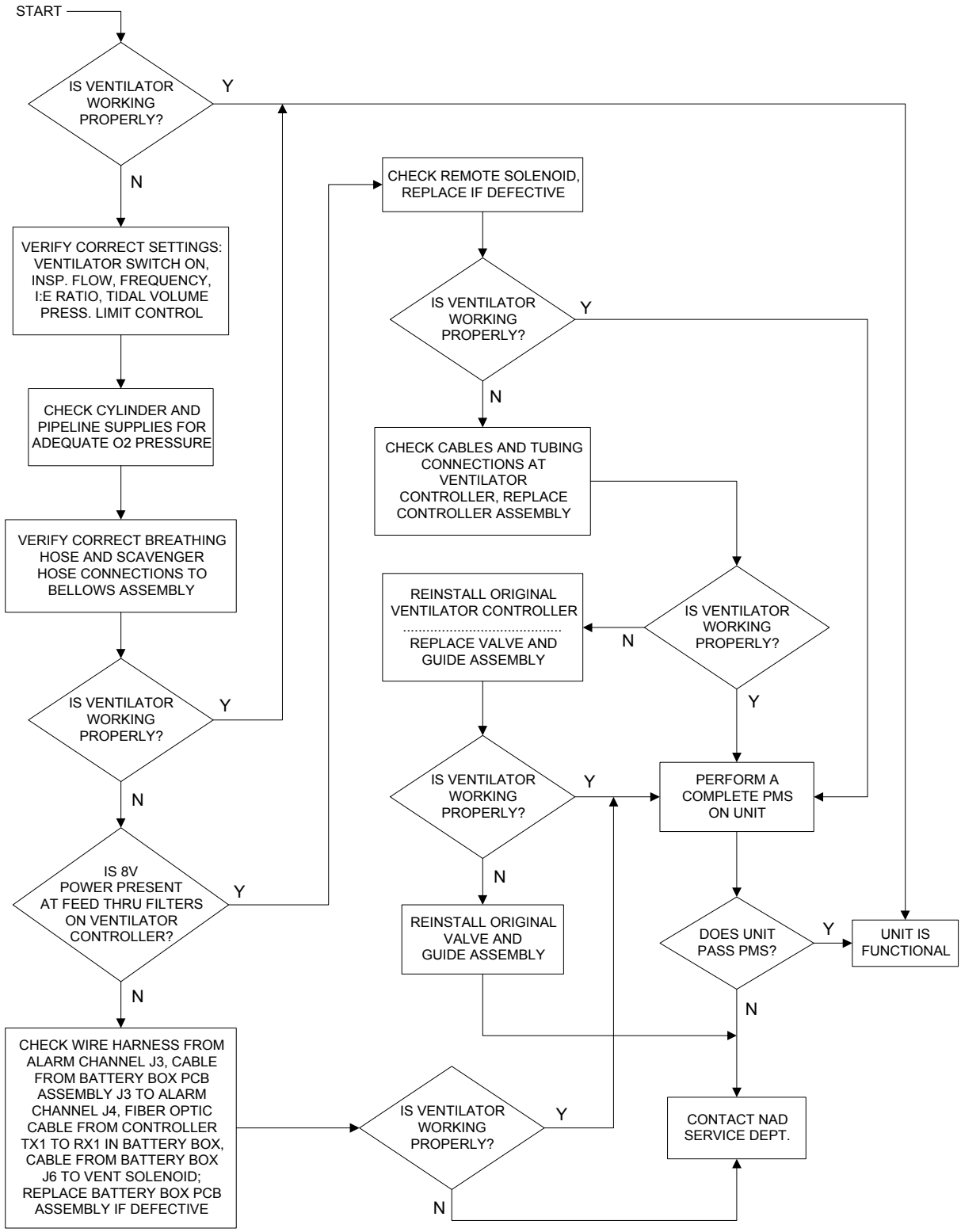
GUIDE 1: Monitor Inoperative (Core-M Monitor)



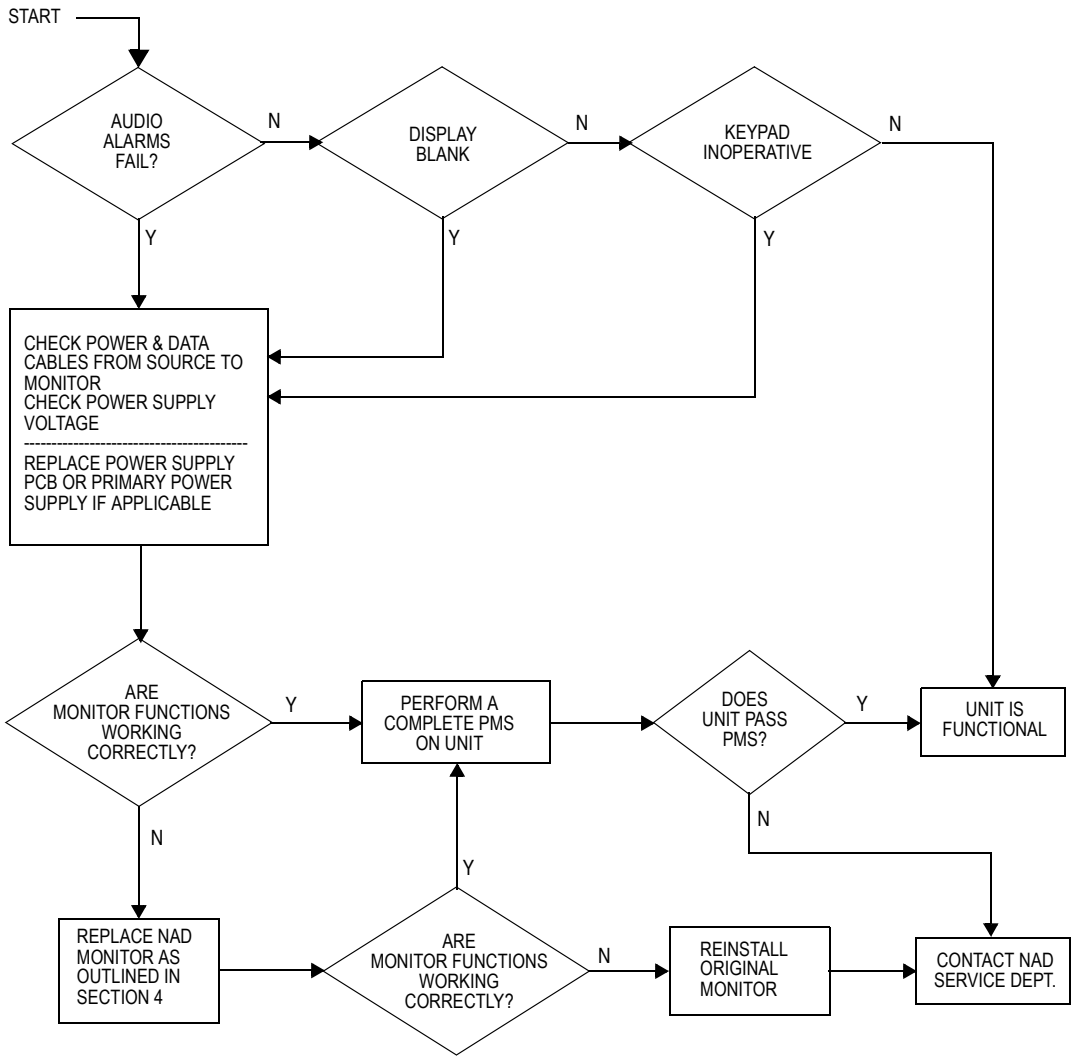
GUIDE 2: No O_2 Supply Pressure Alarm



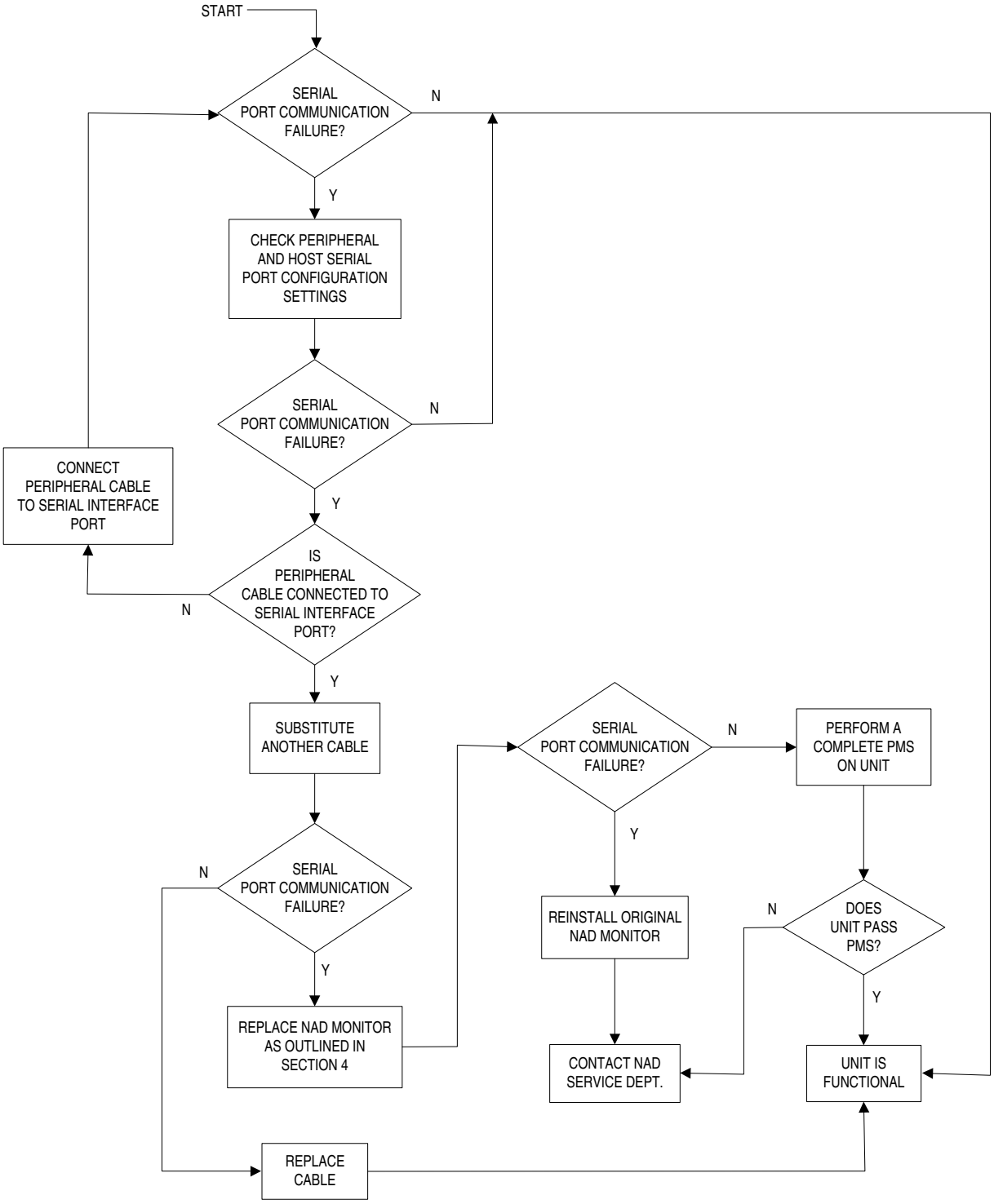
GUIDE 3: Ventilator Inoperative



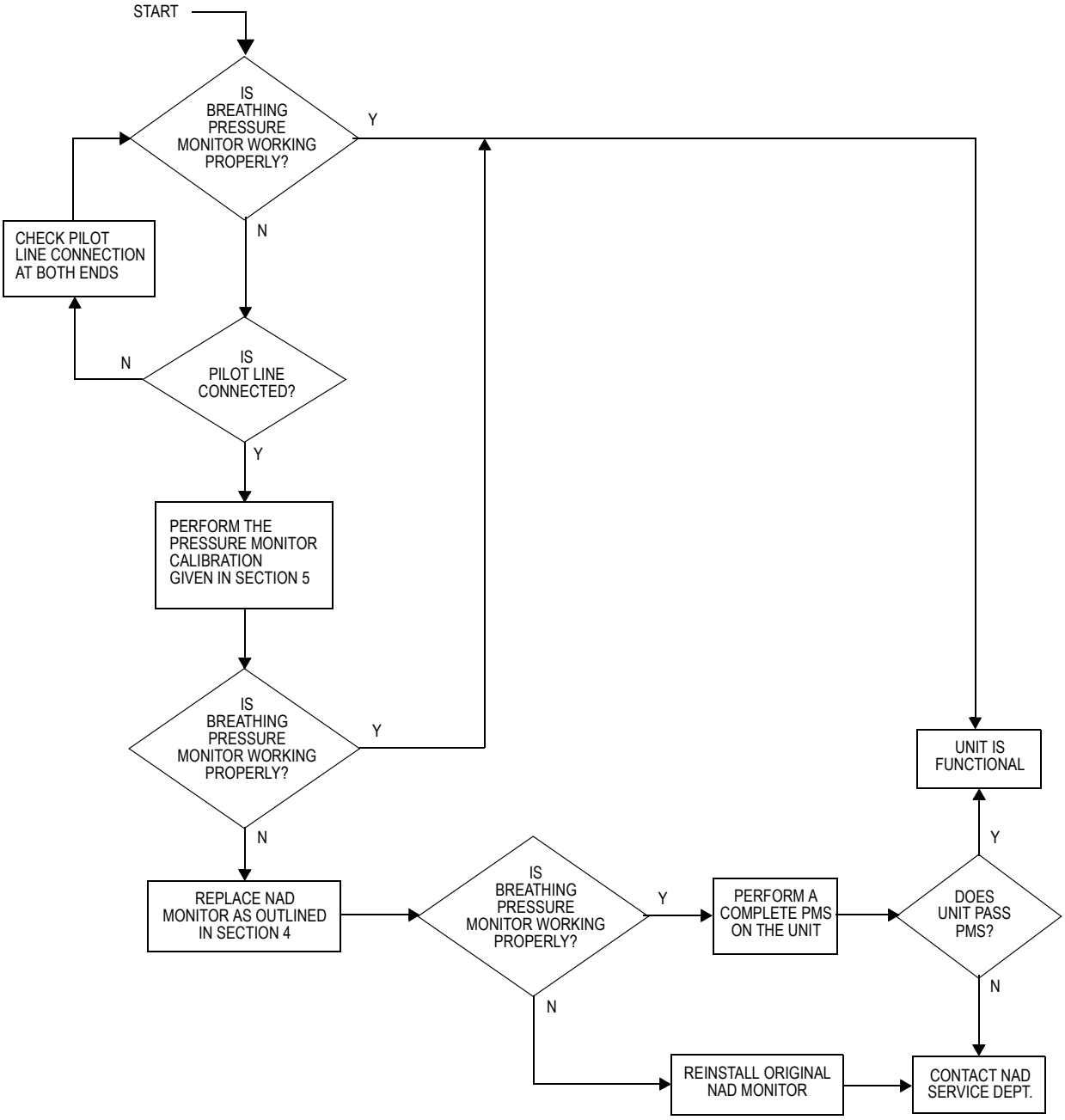
Guide 4: No Audio Alarms, Display Blank, Keypad Inoperative (VPO Monitor)



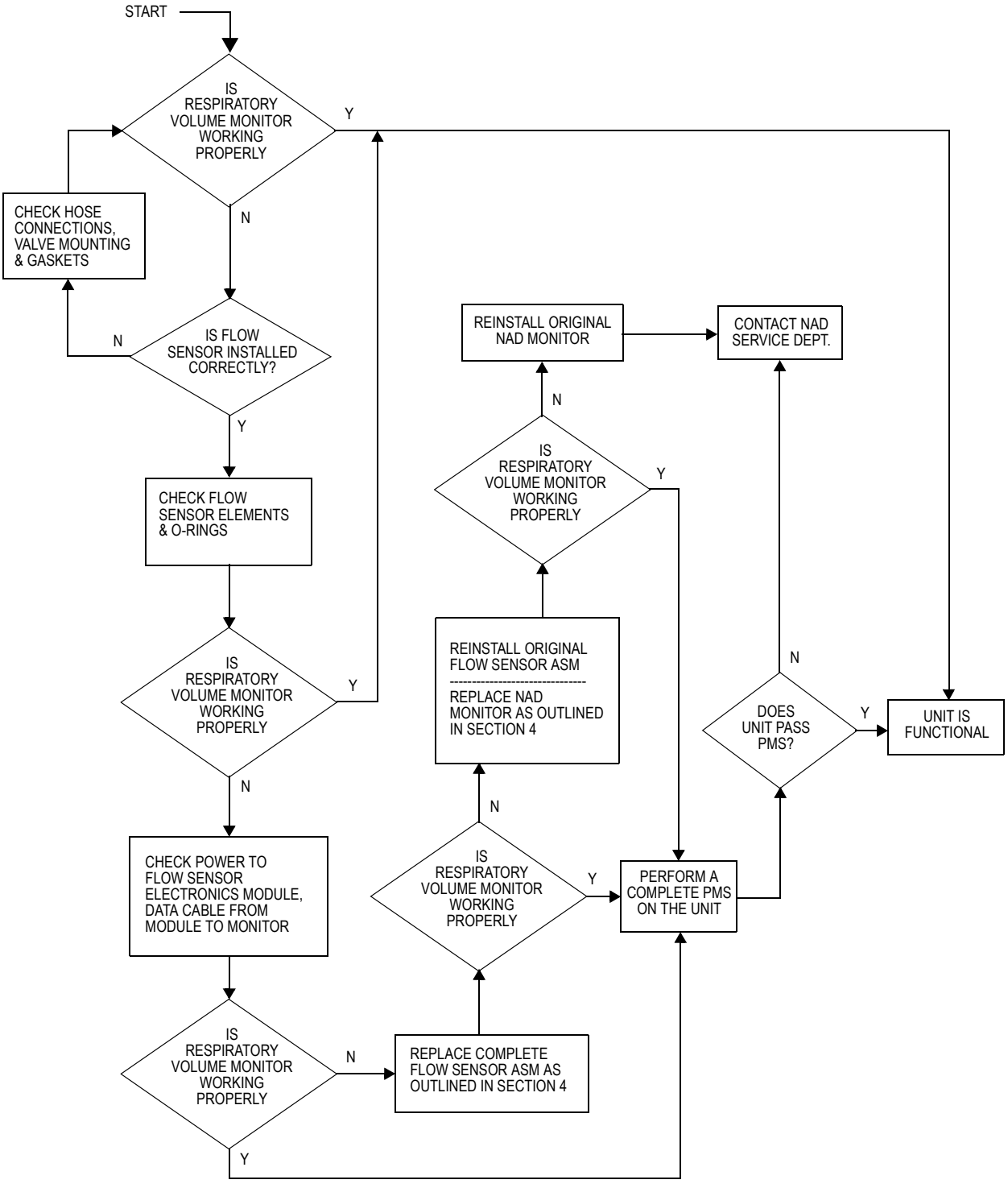
Guide 5: Serial Port Communication Failure (VPO Monitor)



Guide 6: Loss of Breathing Pressure Monitor (VPO Monitor)



Guide 7: Loss of Respiratory Volume Monitor (VPO Monitor)



RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

4.0 REPLACEMENT PROCEDURES

This section outlines removal and replacement procedures for the field-replaceable assemblies of the Narkomed MRI 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 Draeger Medical, Inc.'s Technical Service Department.

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

WARNING: Do not place any object on this machine unless it is specifically labeled to be used in an MRI scanning room and on the Narkomed MRI anesthesia system. Objects placed on this machine that are not designed for use with this anesthesia system may be strongly attracted to the magnet and may cause serious injury or death when the machine is used in an MRI scanning room.

WARNING: Always lock the casters after this anesthesia machine has been positioned in the MRI scanner room. Magnetic attractive forces between the magnet and the anesthesia machine may cause unintentional movement of the anesthesia machine if the casters are unlocked.

WARNING: The power supply charger assembly must not be taken into the magnet room. Damage to the equipment, MRI system, or personal injury could result.

WARNING: The anesthesia machine must be removed from the MRI scanner room before servicing the machine. Do not enter the MRI scanner room with any tools or instruments. These items may be strongly attracted to the magnet and may cause serious injury or death when brought into an MRI scanning room.

4.1 Cylinder Yoke Assemblies

Each cylinder yoke contains a replaceable filter and check valve assembly. 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 and the table bottom cover be removed from the machine.

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

4.1.2 Close all cylinder valves except the O_2 valve.

4.1.3 Set the oxygen flow to 5 liters per min.

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

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

4.1.6 Turn the System Power switch to STANDBY.

4.1.7 Remove the cylinder where the yoke is to be replaced. Store the cylinder in a safe place and lay it on its side.

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

4.1.9 Remove the screws securing the table bottom cover to the machine frame, and remove the bottom cover. (These screws are accessible after the table top is removed.)

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, verify that the pin indexing arrangement and the label are in agreement with the gas designation stamped on the mounting surface of the yoke. Refer to the parts list section for parts identification.

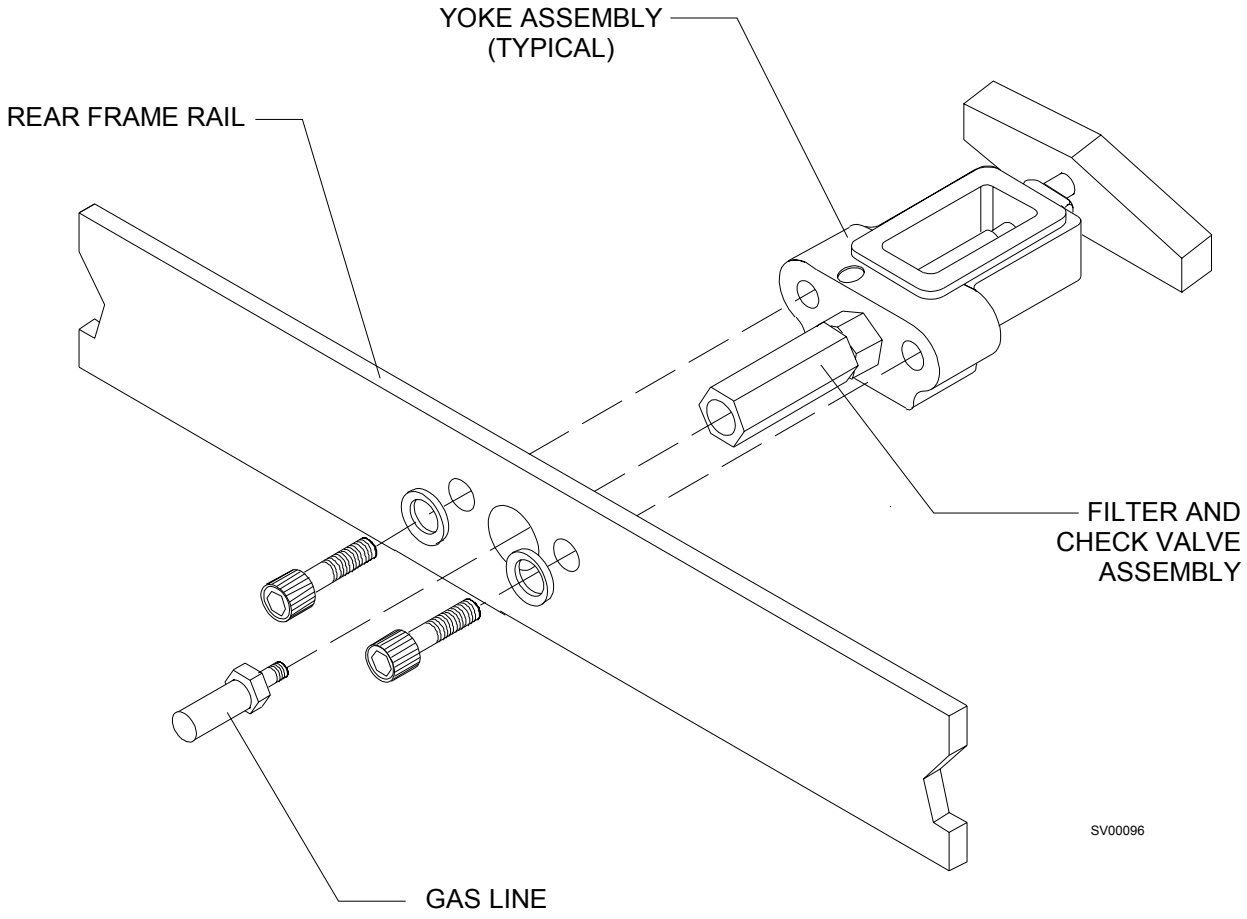


FIGURE 4-1. Cylinder Yoke Assembly

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

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

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

4.1.15 Perform the following leak test on the yoke assembly:

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

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

O_2: 1000 Psi
N_2O: 700 Psi

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 Reinstall the cylinder in the yoke.

4.1.17 Reinstall the table bottom cover.

4.1.18 Reinstall the table top and tighten its retaining screws.

4.1.19 Reconnect the pipeline hoses.

4.1.20 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.1.21 Perform the PMS Procedure given in Section 6.

4.2 Cylinder Pressure Regulators

Access to the cylinder pressure regulators requires removal of the table top and the table bottom cover 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 turn the System Power switch to ON.

4.2.2 Close all cylinder valves except the O_2 valve.

4.2.3 Set the oxygen flow to 5 liters per min.

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

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

4.2.6 Turn the System Power switch to STANDBY.

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

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

4.2.9 Remove the screws securing the table bottom cover to the machine frame, and remove the bottom cover. (These screws are accessible after the table top is removed.)

4.2.10 Disconnect the 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 section for parts identification.

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

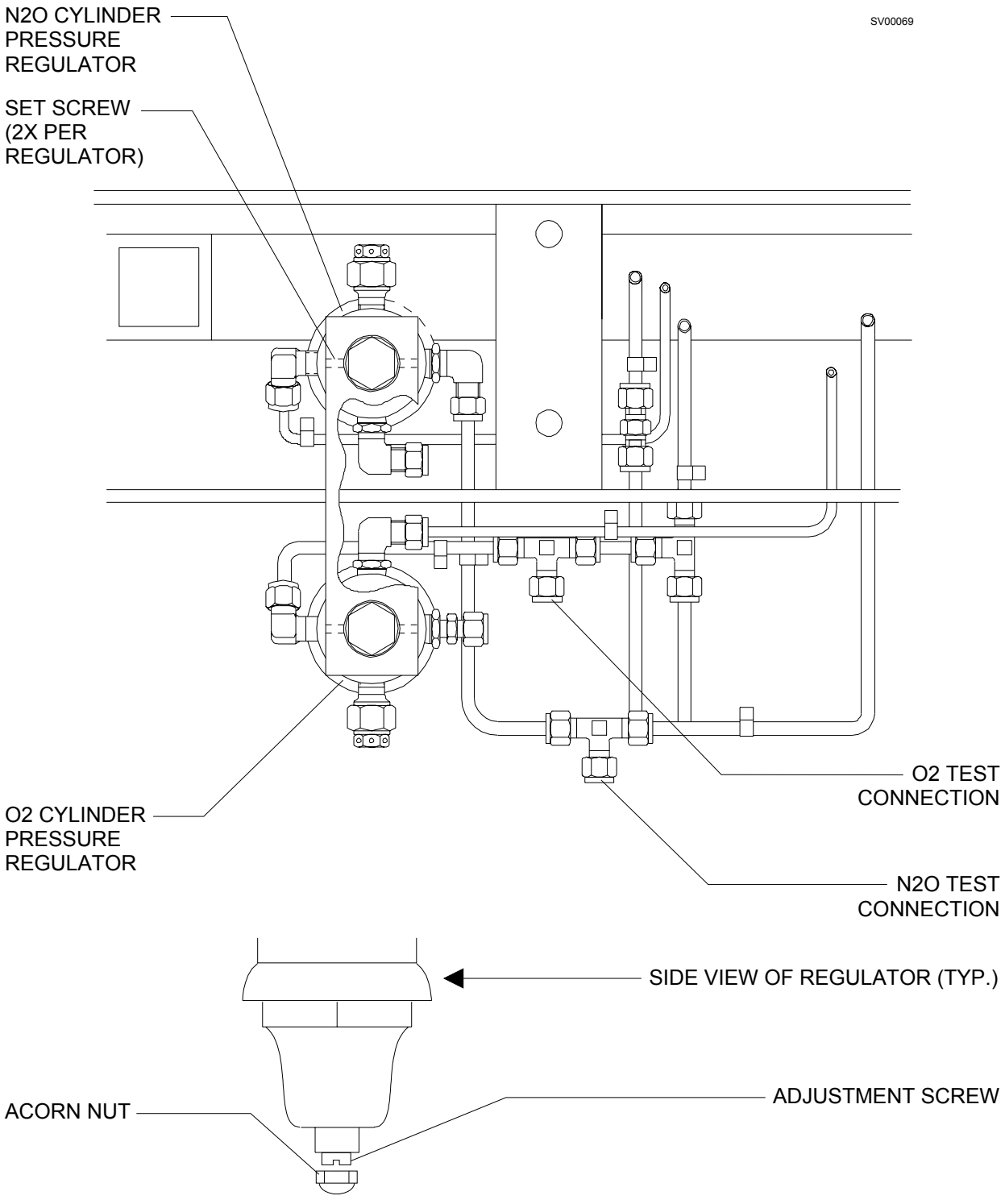


FIGURE 4-2. Cylinder Pressure Regulators

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

4.2.15 Tighten the compression fittings.

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

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

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

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

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

O_2: 1000 Psi
N_2O: 700 Psi

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 Reinstall the cylinder in the yoke.

4.2.20 Reinstall the table bottom cover.

4.2.21 Reinstall the table top and tighten its retaining screws.

4.2.22 Reconnect the pipeline hoses.

4.2.23 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.2.24 Perform the PMS Procedure given in Section 6.

4.3 Cylinder Cutoff Valves (Canada)

Access to the cylinder cutoff valves requires removal of the table top and the table bottom cover from the anesthesia machine. Figure 4-3 shows the locations of the cutoff valve assemblies. The instructions apply to all assemblies.

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

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

4.3.2 Close all cylinder valves except the O_2 valve.

4.3.3 Set the oxygen flow to 5 liters per min.

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

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

4.3.6 Set the System Power switch to STANDBY.

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

4.3.8 Remove the screws securing the table bottom cover to the machine frame, and remove the bottom cover. (These screws are accessible after the table top is removed.)

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

4.3.10 Disconnect the flexible tubing from the cutoff valve assembly at the point marked A on the illustration.

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 the hose clamp.

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

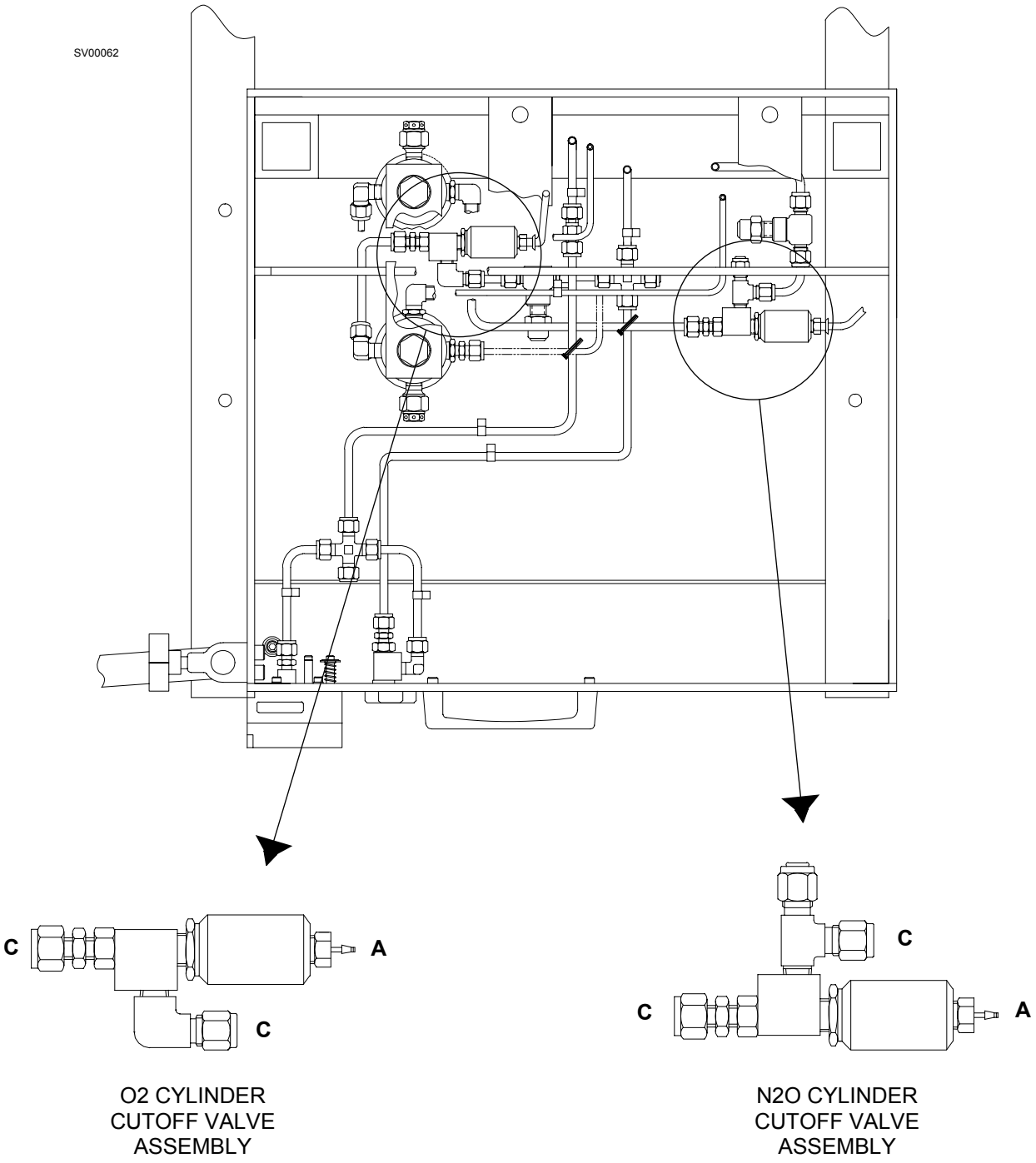


FIGURE 4-3. Cylinder Cutoff Valves (Canada)

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 N_2O: 745 PSI

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

4.3.15 Reinstall the table bottom cover.

4.3.16 Reinstall the table top and tighten its retaining screws.

4.3.17 Connect the pipeline hoses.

4.3.18 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.3.19 Perform the PMS Procedure given in Section 6.

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

4.4 Cylinder and Pipeline Pressure Gauges

Replacement of the cylinder and pipeline pressure gauges requires that the plexiglass front flowmeter cover be removed, and also the flowmeter housing rear cover for access to the gauge connections. Figure 4-4 shows gauge mounting and connection details.

NOTE: The gauges used in the Narkomed MRI are non-magnetic and are not interchangeable with gauges from the other Narkomeds.

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

4.4.2 Close all cylinder valves except the O_2 valve.

4.4.3 Set the oxygen flow to 5 liters per min.

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

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

4.4.6 Set the System Power switch to STANDBY.

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

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

4.4.9 Remove the screws holding the angled plate at the top of the flowmeter shield, and remove the plate.

4.4.10 Remove the oxygen 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.

4.4.12 Carefully remove the plexiglass cover from the front of the flowmeter housing.

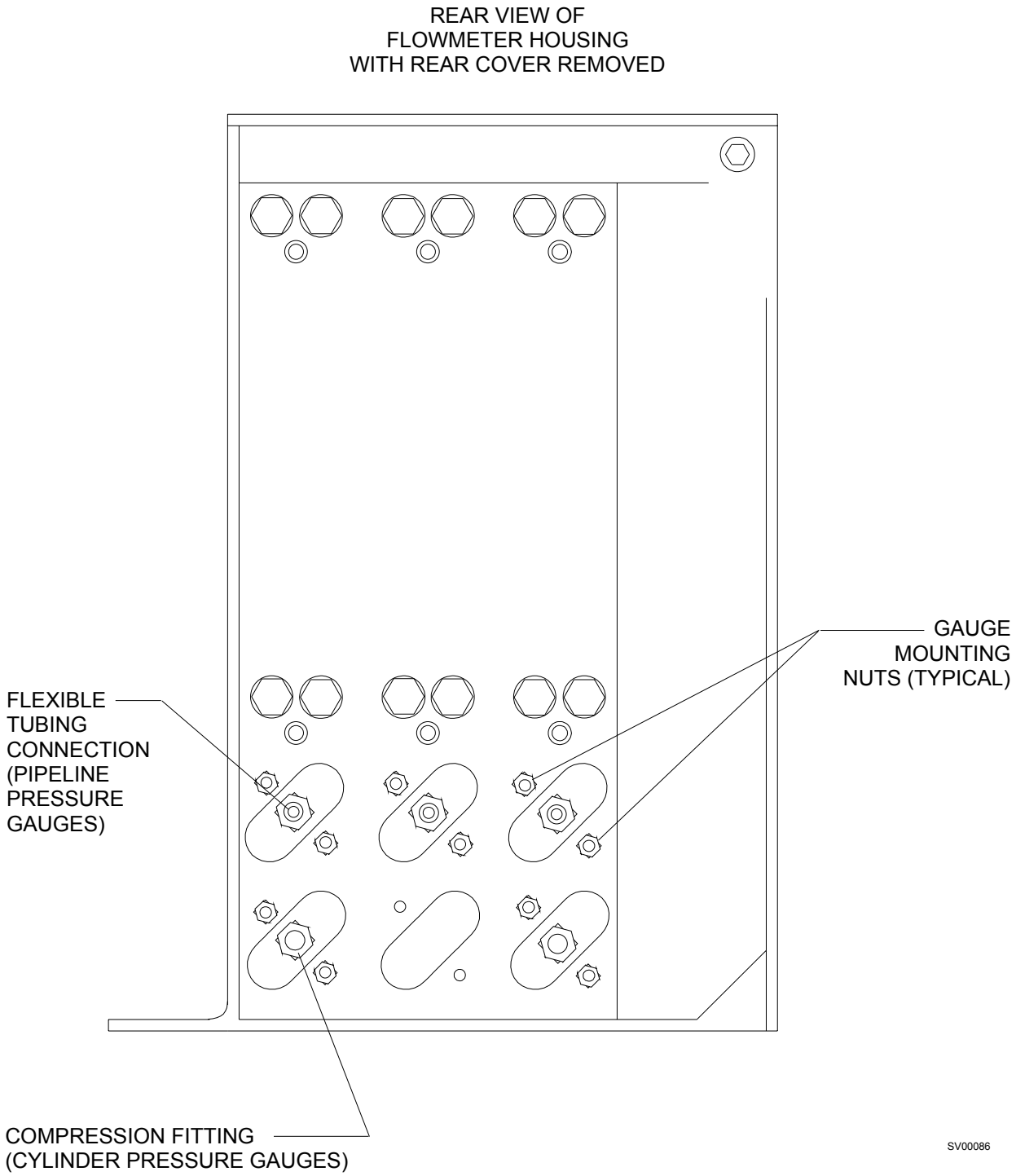


FIGURE 4-4. Cylinder and Pipeline Pressure Gauges

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.

4.4.13 A: 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.

4.3.13 B: For the pipeline pressure gauges:

Locate the flexible tubing connecting the gauge to the pipeline inlet assembly and disconnect the tubing.

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

Disconnect the flexible tubing from the gauge.

Connect a new length of tubing to the replacement gauge and secure it with a hose clamp.

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

Place a hose clamp on the other end of the flexible tubing; connect the tubing to the pipeline inlet assembly and secure it with the hose clamp.

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

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

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

O_2: 1000 Psi
N_2O: 700 Psi

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 Re-install the cylinder in the yoke.

4.4.16 Place the plexiglass cover over the gauges and flow tubes, and ensure that the cover is fitted properly over the flow control valves.

4.4.17 Place the knob guard over the flow control valves and install its two retaining screws.

4.4.18 Install the oxygen flow control knob and tighten its setscrews. If the knobs are installed properly, their labels will be straight when the knobs are against their clockwise stops.

4.4.19 Replace the angled 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 Reinstall the table top and tighten its retaining screws.

4.4.22 Connect the pipeline hoses.

4.4.23 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.4.24 Perform the PMS Procedure given in Section 6.

4.5 Flowmeters

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

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

4.5.2 Close all cylinder valves except the O_2 valve.

4.5.3 Set the oxygen flow to 5 liters per min.

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

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

4.5.6 Set the System Power switch to STANDBY.

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

4.5.8 Remove the screws holding the angled plate at the top of the flowmeter shield, and remove the plate.

4.5.9 Remove the oxygen 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.

4.5.10 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.5.11 Carefully remove the plexiglass cover from the front of the flowmeter housing.

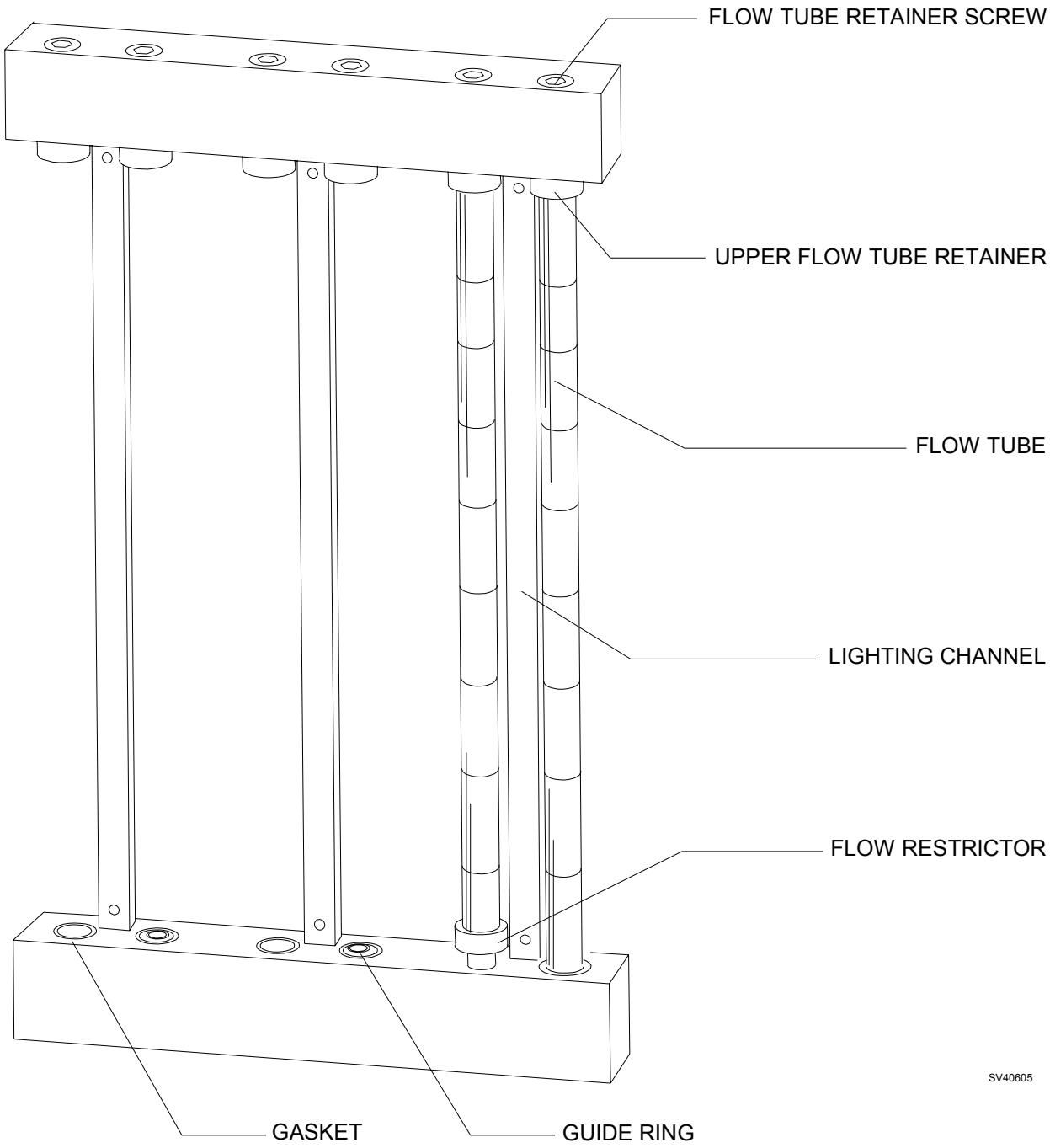


FIGURE 4-5. Flowmeters

NOTE: The upper flow tube retainer screws can be loosened from the front of the machine with a modified (short) allen wrench. Alternatively, the retainer screws can be reached through a slot in the bottom of the ventilator box. This requires removal of the top cover and the ventilator controller assembly to expose the slot.

4.5.12 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.

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

4.5.14 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.

4.5.15 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.

4.5.16 Perform the following leak test on the system:

4.5.16.1 Disconnect the absorber hose from the fresh gas outlet. Ensure that all flow control valves are closed.

4.5.16.2 Connect a test gauge and B.P. bulb to the fresh gas outlet, and pressurize the system to 50 cm H_2O.

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

4.5.17 Disconnect the test gauge and re-connect the absorber hose to the fresh gas outlet.

4.5.18 Replace any lighting channels that were previously removed.

4.5.19 Place the plexiglass cover over the gauges and flow tubes, and ensure that the cover is fitted properly over the flow control valves.

4.5.20 Place the knob guard over the flow control valves and install its two retaining screws.

4.5.21 Install the oxygen flow control knob and tighten its setscrews. If the knobs are installed properly, their labels will be straight when the knobs are against their clockwise stops.

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

4.5.23 Reinstall the table top and tighten its retaining screws.

4.5.24 Connect the pipeline hoses.

4.5.25 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.5.26 Perform the PMS Procedure given in Section 6.

4.6 Flow Control Valves

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

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

4.6.2 Close all cylinder valves except the O_2 valve.

4.6.3 Set the oxygen flow to 5 liters per min.

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

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

4.6.6 Set the System Power switch to STANDBY.

4.6.7 Remove the oxygen flow control knob.

4.6.8 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.6.9 Remove the knob (if not already removed) from the valve that is being replaced, and 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 body.

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.

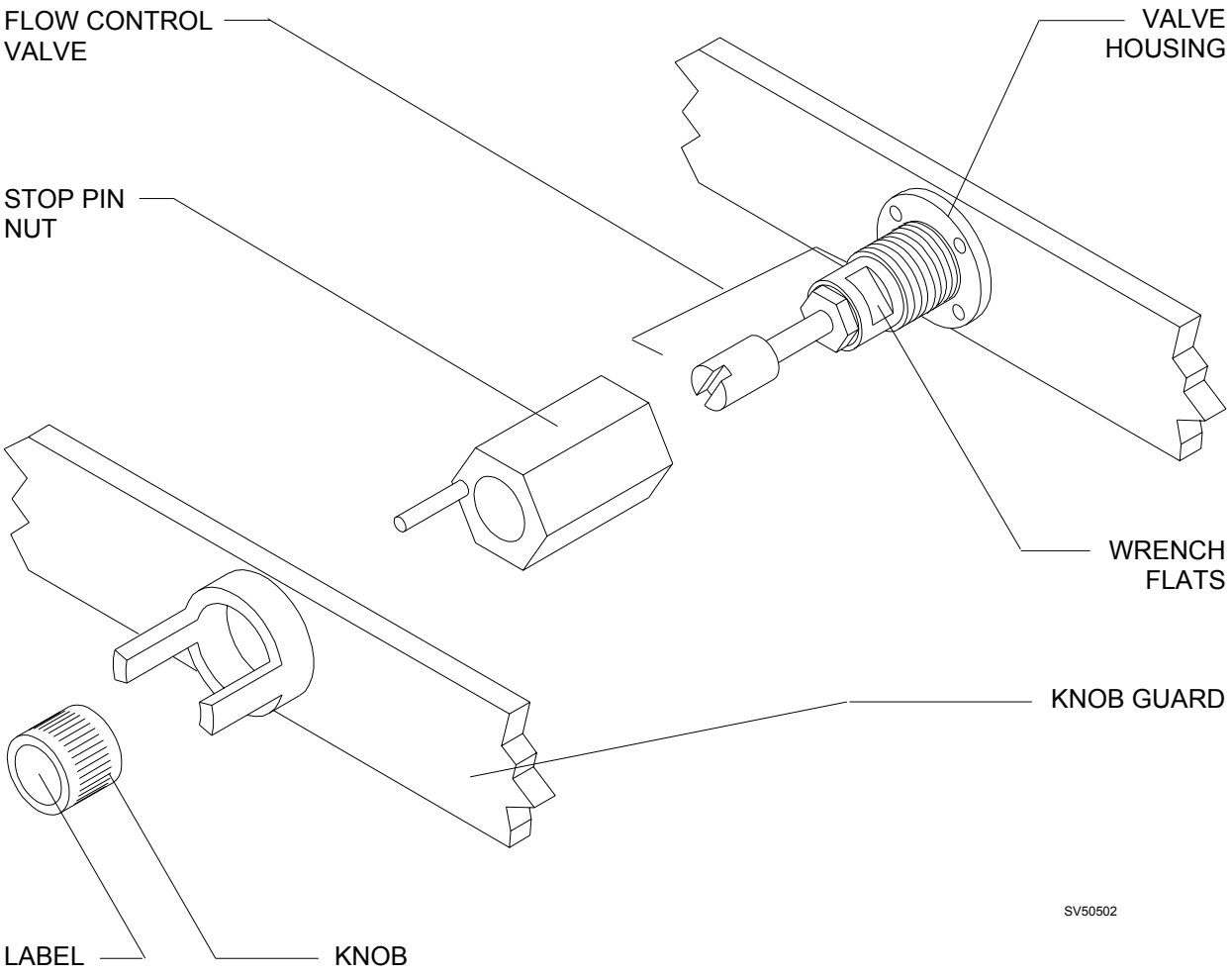


FIGURE 4-6. Flow Control Valves

4.6.14 Turn the System Power switch to ON.

4.6.15 A: For the O_2 flow control valve:

Open the oxygen cylinder valve.

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

4.5.15 B: 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 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.6.21 Perform the PMS Procedure given in Section 6.

4.7 Auxiliary Oxygen Flow Meter

The auxiliary oxygen flowmeter is attached to the side of the machine's flowmeter housing by a stud and nut arrangement accessible from inside the housing. A flexible O_2 supply tube from the flowmeter connects to a hose barb fitting at the system power switch. Figure 4-7 shows the mounting and tubing arrangement.

4.7.1 Disconnect all pipeline hoses and close all cylinder valves.

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

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

4.7.4 Remove the back cover from the flowmeter housing.

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

4.7.6 Remove the nuts securing the auxiliary O_2 flowmeter, and remove the flowmeter.

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

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

4.7.9 Reinstall the flowmeter housing back cover.

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

4.7.11 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.7.12 Perform the PMS Procedure given in Section 6.

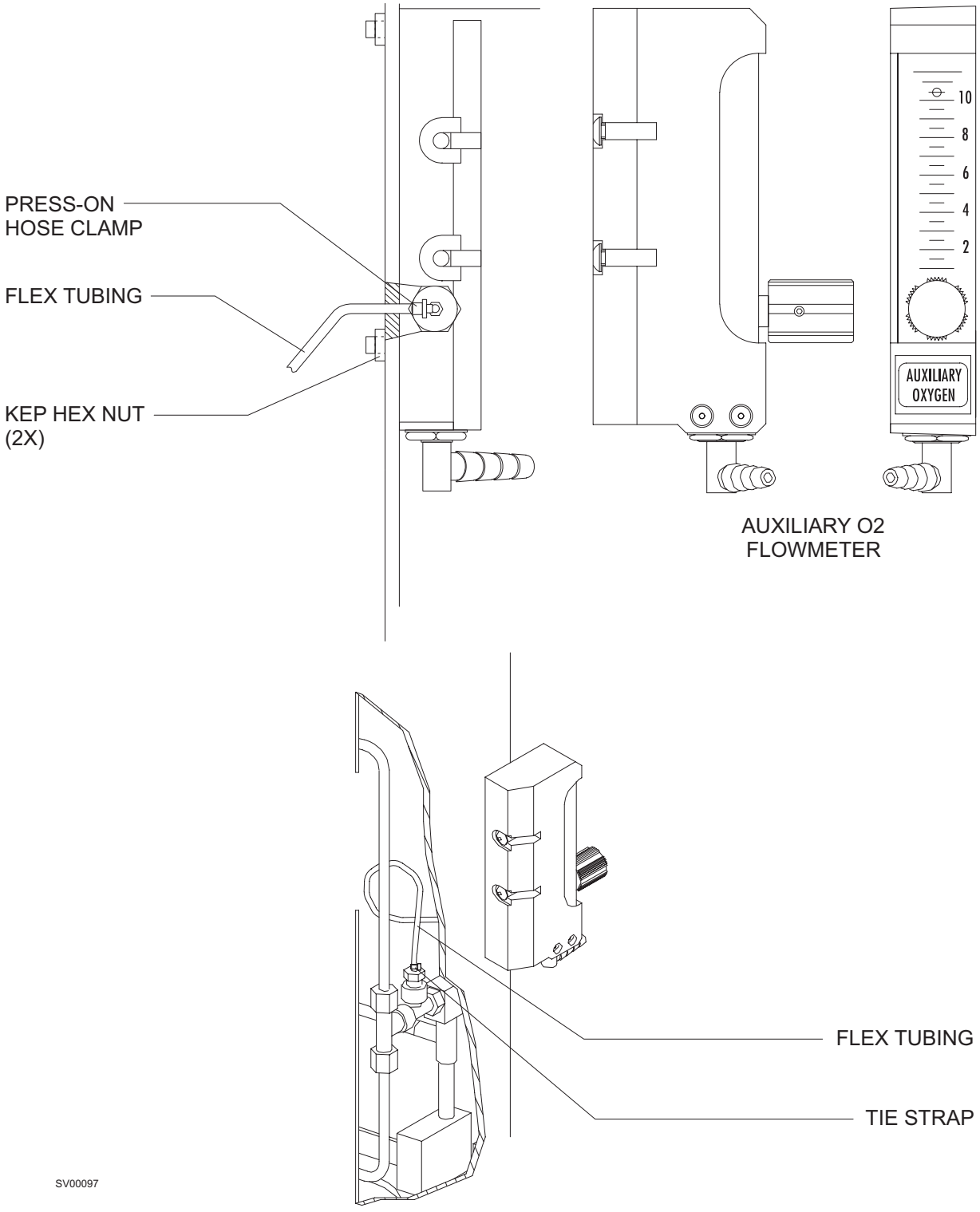


FIGURE 4-7. Auxiliary O2 Flowmeter

4.8 Oxygen Supply Pressure Failure Protection Device

The oxygen supply failure protection devices (failsafe assemblies) are located within the flowmeter housing. Access to these assemblies requires removal of the rear cover. Figure 4-8 shows a typical arrangement of a failsafe assembly and its connections.

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

4.8.2 Close all cylinder valves except the O_2 valve.

4.8.3 Set the oxygen flow to 5 liters per min.

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

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

4.8.6 Set the System Power switch to STANDBY.

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

4.8.8 Disconnect the flexible O_2 control line.

4.8.9 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). Fittings are listed in parts section.

NOTE: Canadian machines have a relief valve in the right side (viewed from the back of the machine) port of the Air failsafe assembly.

4.8.10 Install the replacement failsafe assembly, and tighten the three compression fittings.

4.8.11 Connect the flexible tubing to the control port, and secure the connection with the hose clamp.

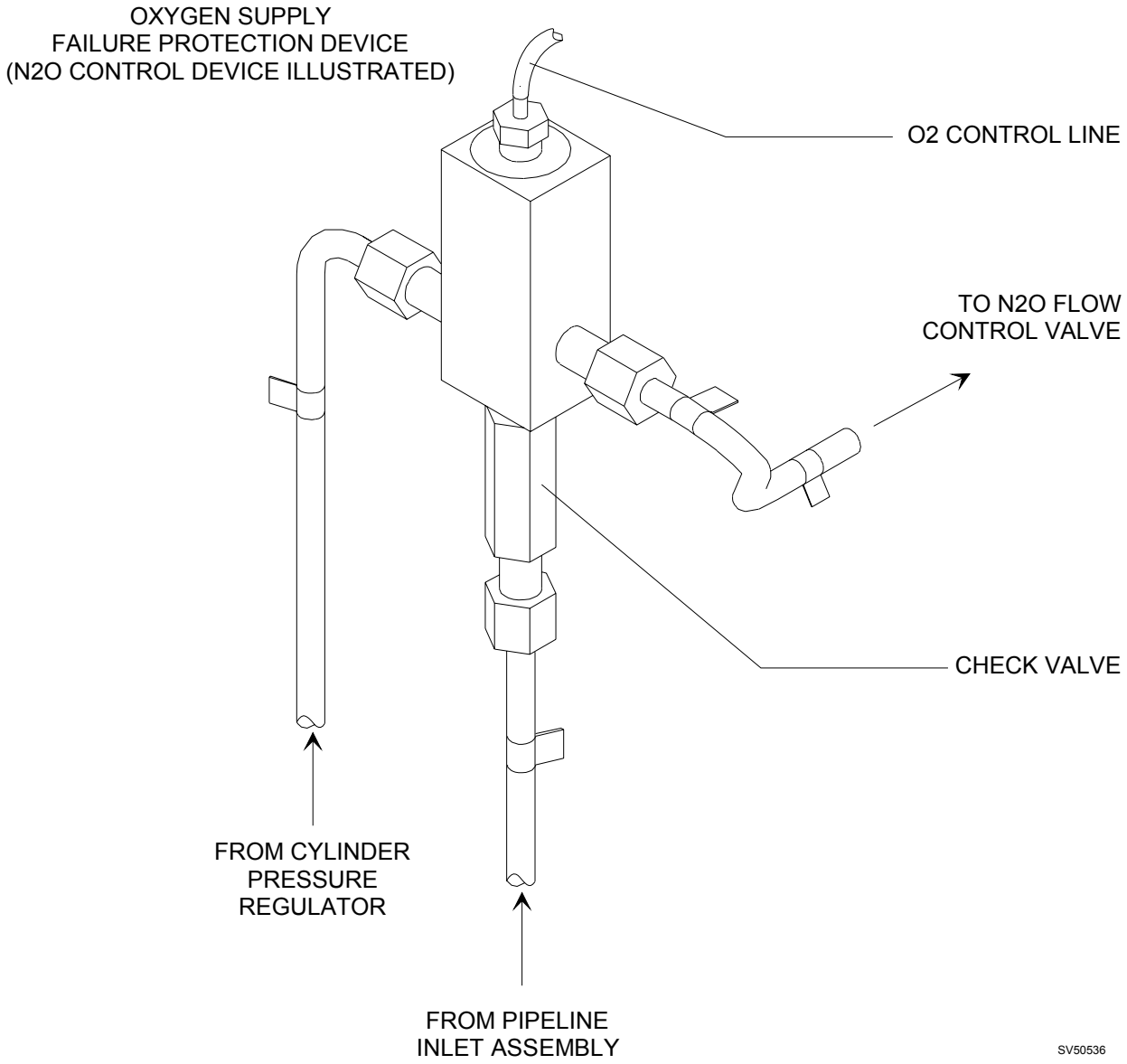


FIGURE 4-8. Oxygen Supply Failure Protection Device

4.8.12 Perform the following test:

4.8.12.1 Open the cylinder valves.

4.8.12.2 Set the System Power switch to ON.

4.8.12.3 Set the oxygen flow to five liters per minute.

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

4.8.12.5 Close the oxygen cylinder valve.

4.8.12.6 As the oxygen flow decreases, the other gas flow should stop.

4.8.12.7 Set the System Power switch to STANDBY.

4.8.13 Reinstall the rear cover and its retaining screws.

4.8.14 Connect the pipeline hoses.

4.8.15 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.8.16 Perform the PMS Procedure given in Section 6.

4.9 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.

NOTE: Service replacement alarm channel assemblies are supplied without the O_2 supply pressure alarm switch and wire harness.

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 angled plate from the front of the machine, and removal of the flowmeter housing rear cover. The alarm channel assembly is held in place by two screws from the back. Figure 4-9 shows a rear view of the assembly and its connections.

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

4.9.2 Close all cylinder valves except the O_2 valve.

4.9.3 Set the oxygen flow to 5 liters per min.

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

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

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

4.9.7 Remove the cover from the battery box (ref. Battery Replacement Procedure) and disconnect the battery wire harness from the PCB.

4.9.8 Remove the screws holding the flowmeter shield and vapor box front cover panel, and remove the panel.

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

4.9.10 Loosen the screws holding the table top, and lift out the table top.

4.9.11 Disconnect the cables from J2, J3 and J4 on the alarm circuit board. On later machines with VPO monitors, disconnect the cable from J1; disconnect the floating grounds as needed.

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

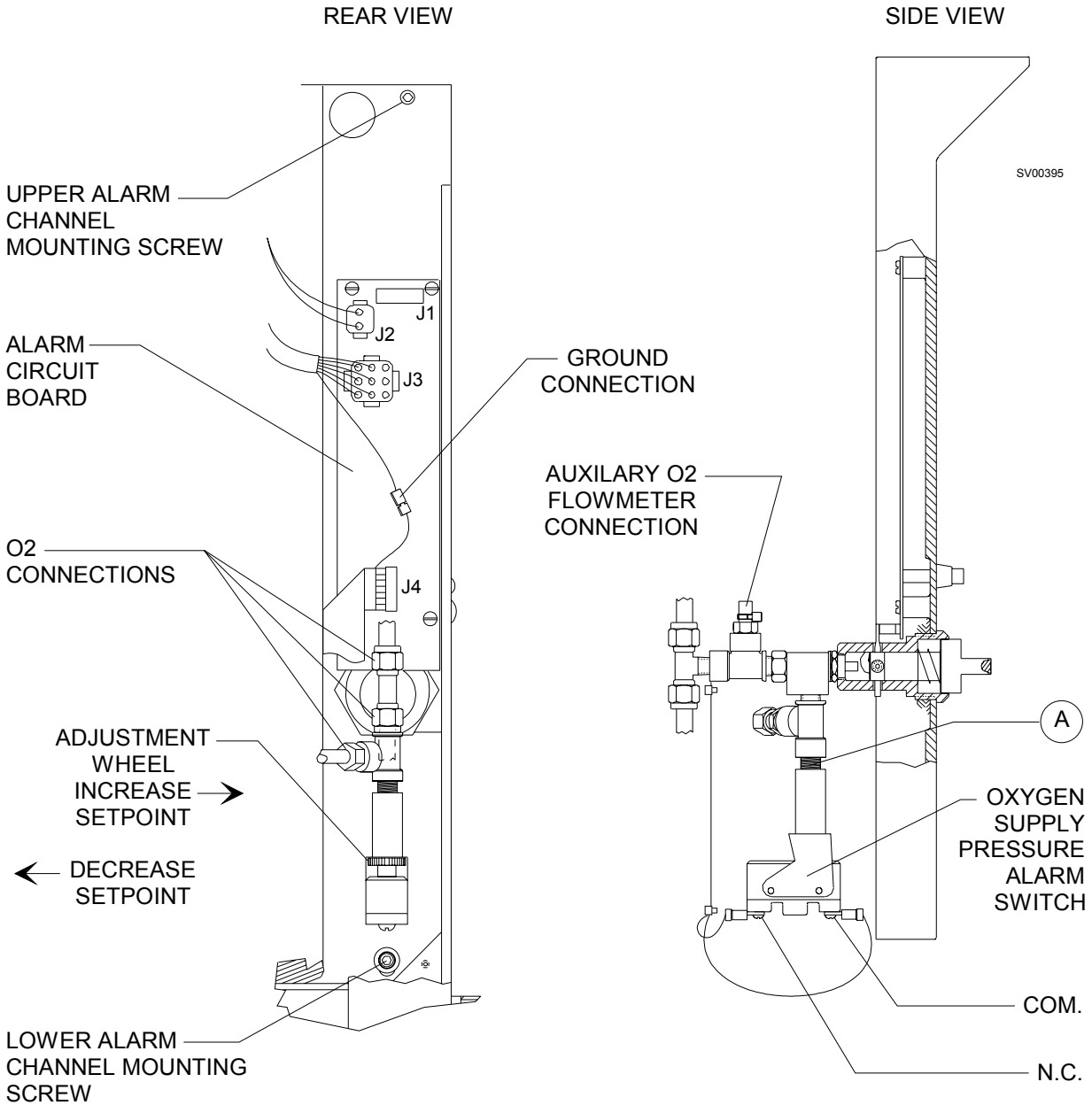
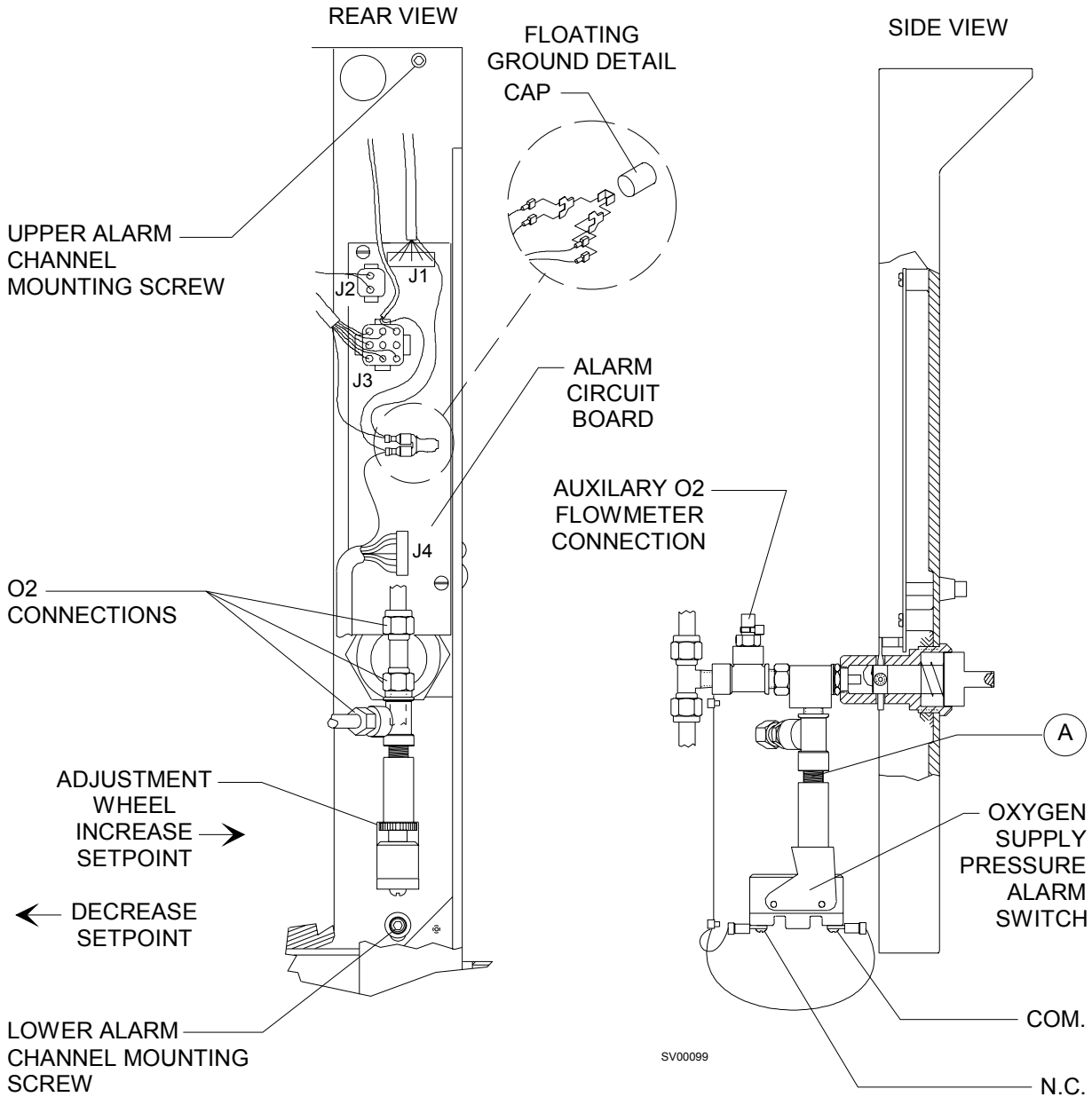


FIGURE 4-9. Alarm Channel (Core-M Version) and O2 Supply Pressure Alarm Switch



Alarm Channel (VPO Version) and O2 Supply Pressure Alarm Switch

This page intentionally left blank

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

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

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

4.9.16 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.

4.9.17 Disconnect the yellow and purple wires from the oxygen supply pressure alarm switch.

4.9.18 The following steps apply to replacement of the oxygen supply pressure alarm switch.

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

4.9.20 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.

4.9.21 Connect the yellow and purple wires to the replacement switch in the same manner as the original.

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

4.9.23 Install the upper and lower alarm channel mounting screws.

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

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

4.9.26 Reconnect the cables to J1 (if applicable), J2, J3 and J4 on the alarm circuit board. If applicable, ensure that the floating ground connectors are assembled as shown in the illustration, and the cover cap is in place.

4.9.27 Reinstall the front flowmeter cover with the screws that were previously removed.

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

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

4.9.30 Reconnect the battery wire harness in the battery box, and reinstall the battery box cover.

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

4.9.32 Set the oxygen flow to five liters per minute.

4.9.33 Close the oxygen cylinder valve.

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

4.9.35 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.

4.9.36 Turn the System Power switch to STANDBY.

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

4.9.38 Reinstall the table top and tighten its retaining screws.

4.9.39 Reinstall the flowmeter housing rear cover and its retaining screws.

4.9.40 Connect the pipeline hoses.

4.9.41 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.9.42 Perform the PMS Procedure given in Section 6.

4.10 Oxygen Ratio Controller

The Oxygen Ratio Controller (ORC) is part of the N_2O flowmeter sub-assembly and is located within the flowmeter housing. The ORC is accessible by removing the rear flowmeter housing cover. Figure 4-10 shows a typical ORC location and mounting arrangement, with a detail of the O-rings and filter.

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

4.10.2 Close all cylinder valves except the O_2 valve.

4.10.3 Set the oxygen flow to 5 liters per min.

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

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

4.10.6 Set the System Power switch to STANDBY.

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

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

4.10.9 Install the 6 in. length of flexible tubing with a blue N_2O label on the replacement ORC (see detail view in illustration) Secure each connection with a press-on hose clamp.

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

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

4.10.11 Open the O_2 and N_2O cylinder valves.

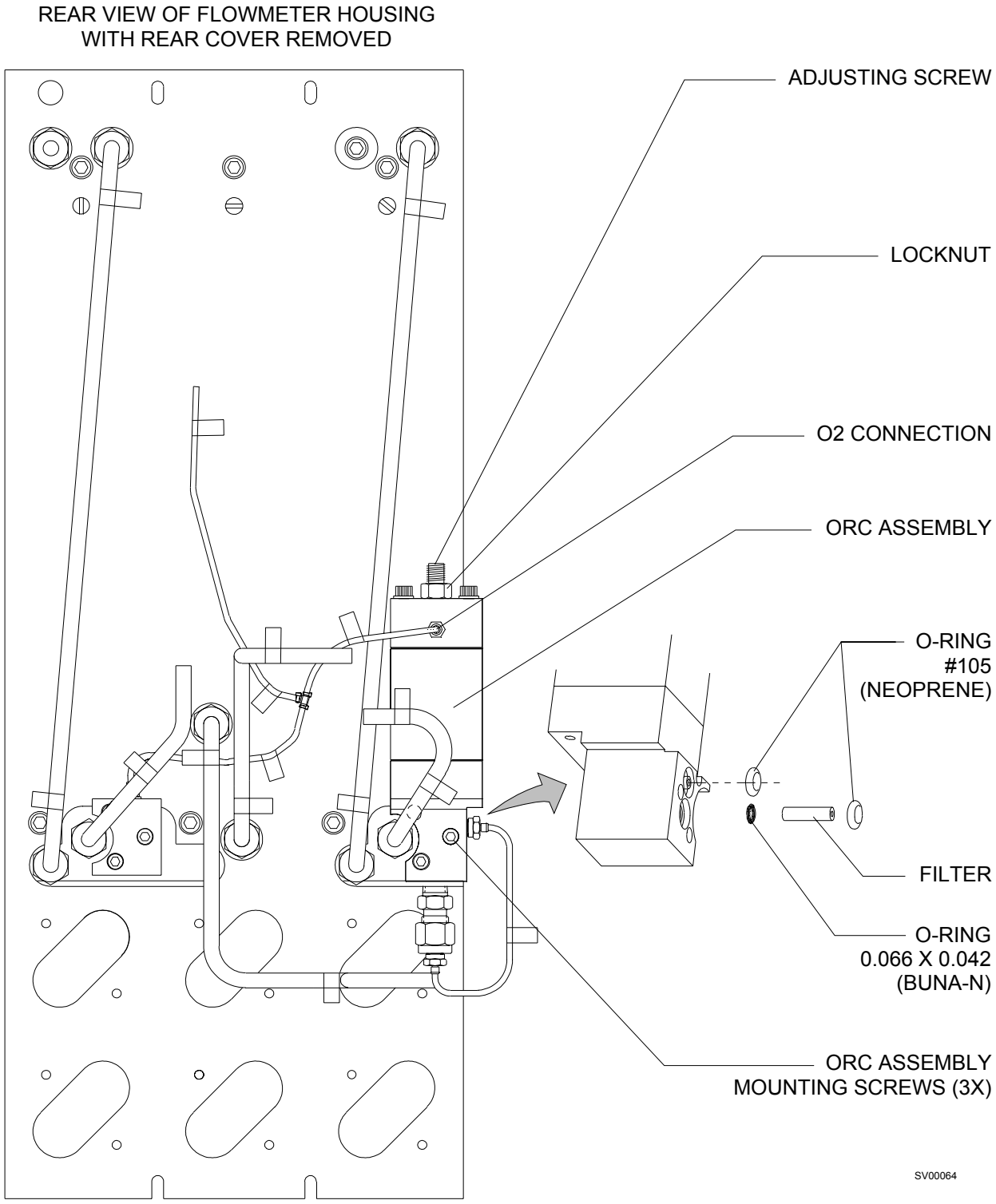


FIGURE 4-10. Oxygen Ratio Controller

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

4.10.13 Reinstall the flowmeter housing rear cover.

4.10.14 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.10.15 Perform the PMS Procedure given in Section 6.

4.11 Vaporizers

The vaporizer is held to the machine by two metric sized hex screws. These screws are located at the back of the vaporizer mounting block as shown in Figure 4-11. Before removing the 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.

4.11.1 Turn the System Power switch to ON.

4.11.2 Set the vaporizer handwheel to its Zero or OFF position.

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

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

4.11.4 Turn the vaporizer handwheel to the maximum concentration setting.

4.11.5 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 unauthorized personnel present.

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

4.11.7 Turn the oxygen flow off, and turn the System Power switch to STANDBY.

4.11.8 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.

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

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

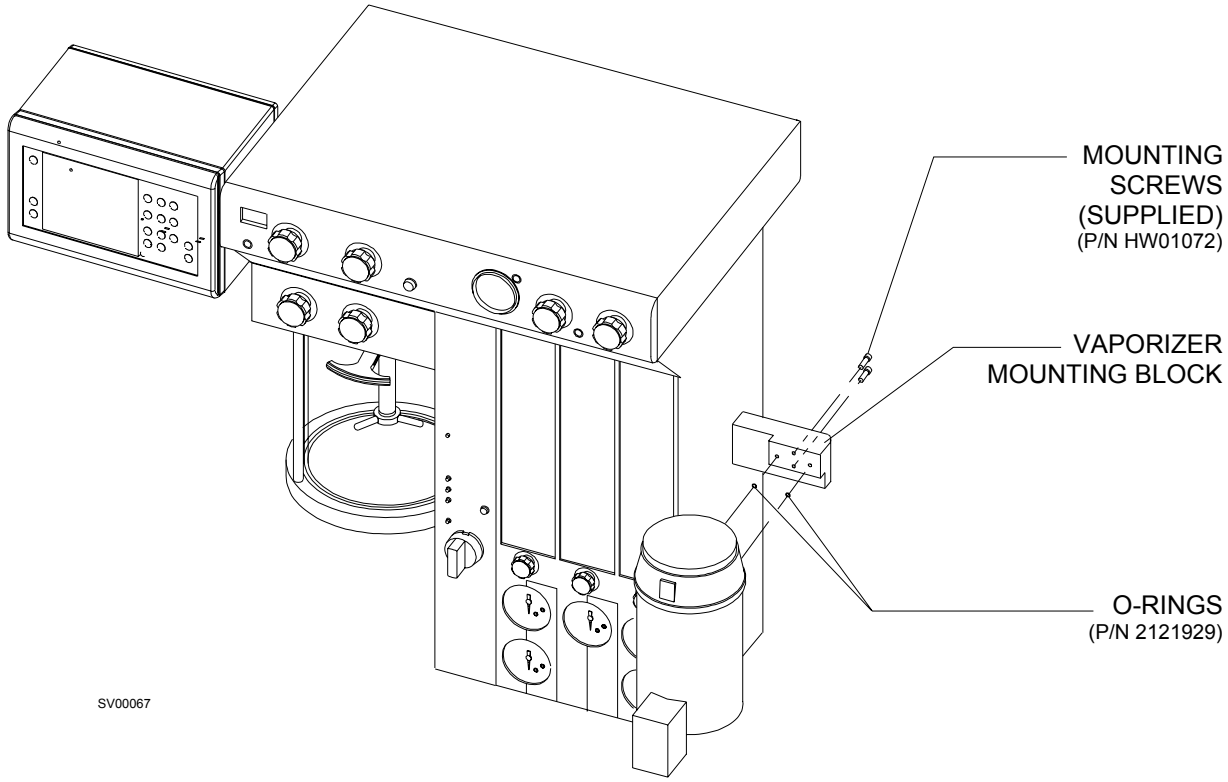


FIGURE 4-11. Vaporizer Installation

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.

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

4.11.11 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.

4.11.12 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.11.13 Perform the PMS Procedure given in Section 6.

4.12 O2 Flush Valve

The O_2 flush valve is located at the front of the machine next to the fresh gas outlet. Access to the flush valve requires removal of the table top and the table bottom cover. Figure 4-12 shows the mounting and assembly details of the flush valve.

4.12.1 Turn the System Power switch to STANDBY.

4.12.2 Disconnect all pipeline hoses.

4.12.3 Close the O_2 cylinder valve.

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

4.12.5 Loosen the screws holding the table top to the machine and lift out the table top.

4.12.6 Remove the screws securing the table bottom cover to the machine frame, and remove the bottom cover. (These screws are accessible after the table top is removed.)

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

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

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

4.12.10 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.

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

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

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

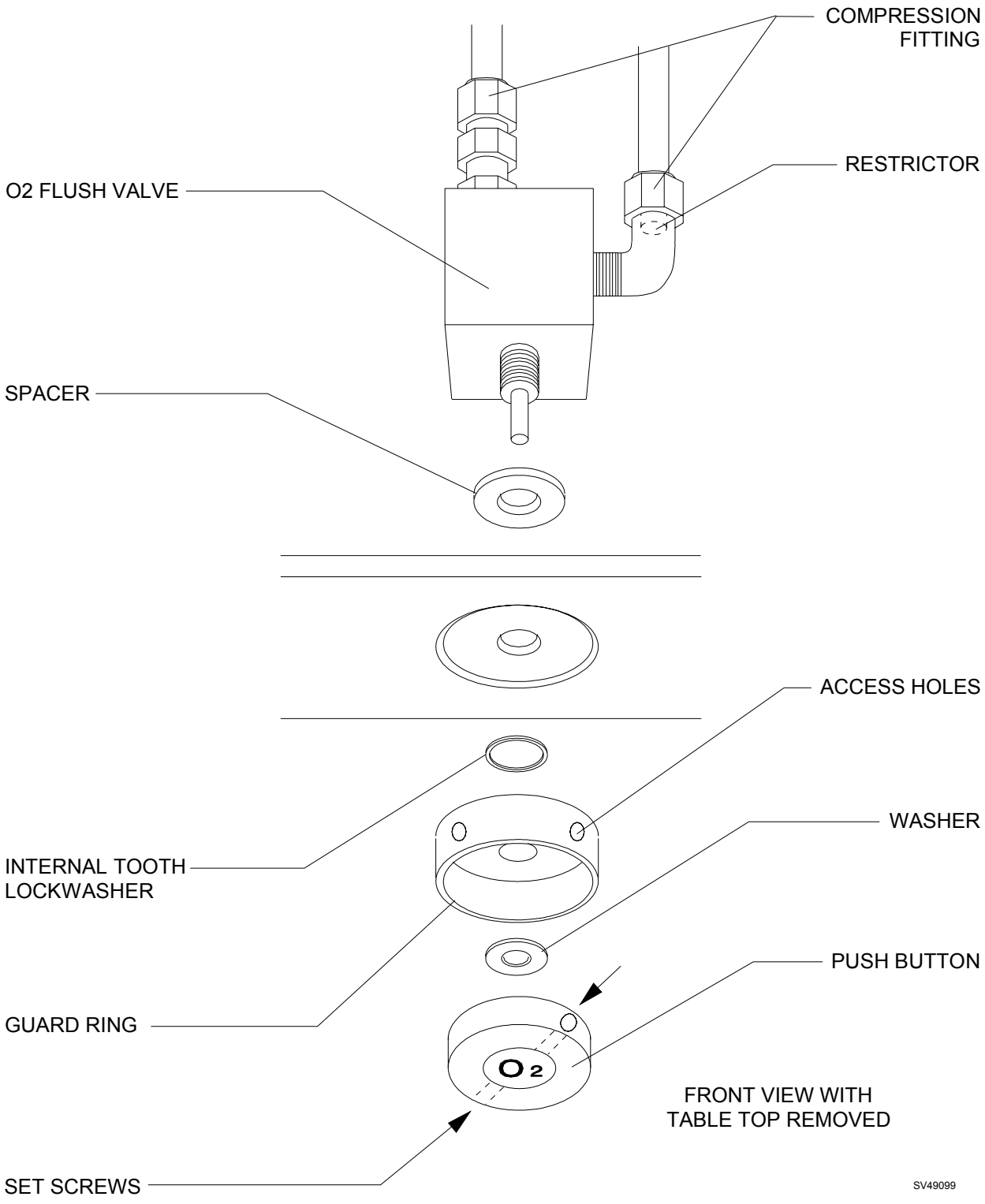


FIGURE 4-12. O2 Flush Valve

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

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

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

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

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

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

4.12.16.4 Increase the pressure to 50 cm H_2O.

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

4.12.16.6 Disconnect the test gauge from the fresh gas outlet.

4.12.16.7 Close the oxygen cylinder valve.

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

4.12.16.9 Connect a volumeter to the fresh gas outlet, and reset the volumeter to zero.

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

4.12.16.11 Disconnect the volumeter from the fresh gas outlet.

4.12.17 Connect the absorber fresh gas hose to the fresh gas outlet.

4.12.18 Reinstall the table bottom cover.

4.12.19 Reinstall the table top and tighten its mounting screws.

4.12.20 Connect the pipeline hoses.

4.12.21 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.12.22 Perform the PMS Procedure given in Section 6.

4.13 Core-M Monitor

The monitor is attached to the left side of the ventilator box. Access to the attaching hardware requires removal of the ventilator box top cover. Figure 4-13 shows the mounting and power connection arrangement for the monitor.

NOTE: The monitor is replaced as a complete unit when necessary. It is not to be serviced internally.

4.13.1 Turn the System Power switch to STANDBY.

4.13.2 Disconnect all sensor inputs at the back of the monitor.

4.13.3 Disconnect the external monitor power cable by unscrewing its retaining ring and pulling out the cable.

4.13.4 Remove the ventilator box top cover.

4.13.5 While holding the monitor, remove its two mounting screws at the left inside wall of the ventilator box.

4.13.6 Position the replacement monitor at the left side of the ventilator box, and attach the monitor to the side of the ventilator box with the hardware that was previously removed.

4.13.7 Reinstall the ventilator box top cover.

4.13.8 Connect the external monitor power cable and secure it with the retaining ring.

4.13.9 Restore all sensor connections to the monitor and verify that it is working correctly.

4.13.10 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.13.11 Perform the PMS Procedure given in Section 6.

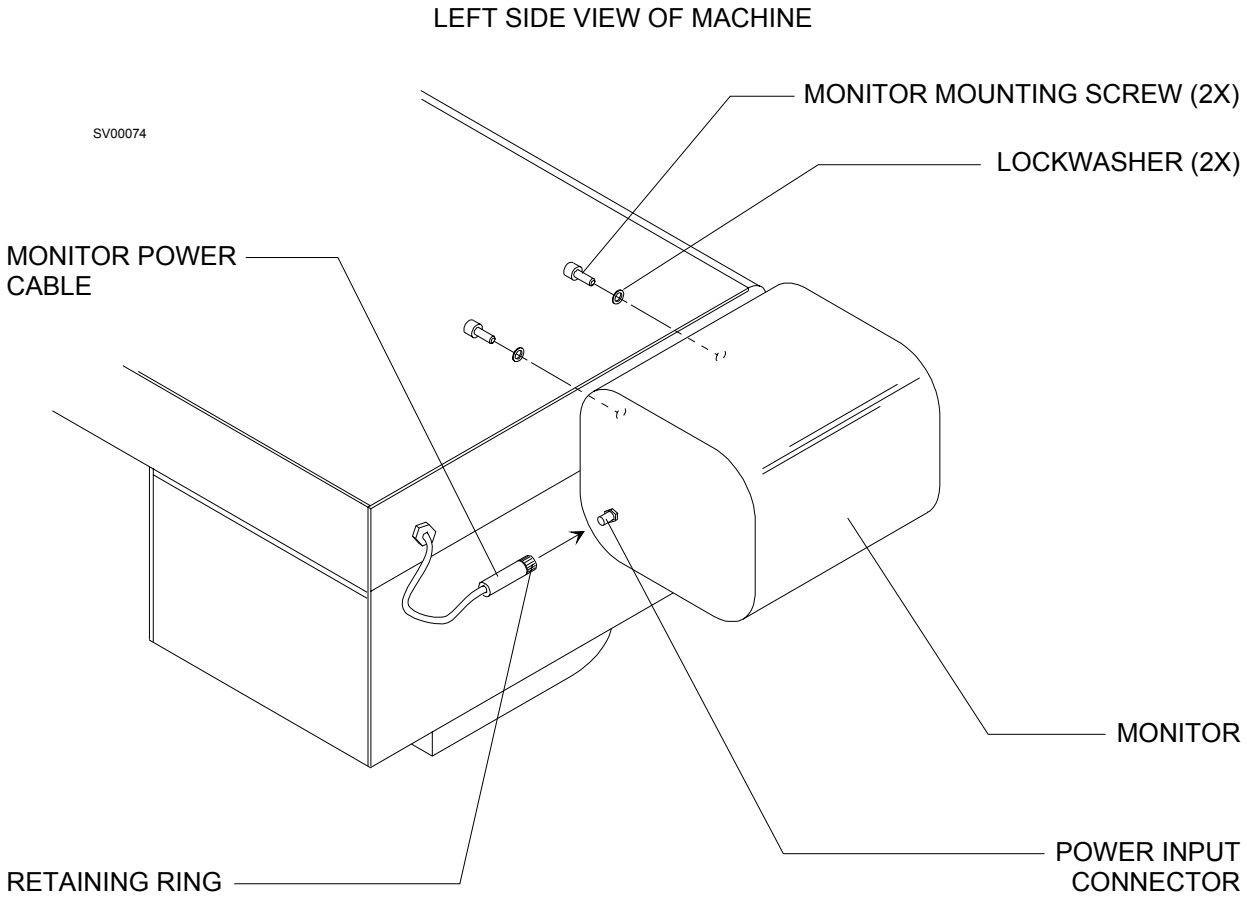


FIGURE 4-13. Core-M Monitor Replacement

4.13A VPO Monitor

The VPO monitor is attached to the left side of the ventilator box with two kep nuts. Access to the attaching hardware requires removal of the ventilator box top cover. The monitor is supplied with cables attached. Two of the cables have flying connectors in the ventilator ventilator box; the ribbon cable connects to J1 on the alarm channel PCB. You will need to remove the flowmeter housing back cover for access to the alarm channel connector. Figure 4-13A shows the mounting and connection arrangement for the monitor.

NOTE: The monitor is replaced as a complete unit when necessary. It is not to be serviced below this level.

4.13A.1 Turn the System Power switch to STANDBY.

4.13A.2 Disconnect all sensor inputs at the back of the monitor.

4.13A.3 Remove the ventilator box top cover, and the flowmeter housing back cover.

4.13A.4 Disconnect the cable from J1 on the alarm channel PCB and from the floating ground assembly. Feed the cable end up into the ventilator box.

4.13A.5 Disconnect the flying connectors on the monitor cables in the ventilator box.

4.13A.6 While supporting the monitor, remove its two mounting nuts at the left inside wall of the ventilator box. Carefully feed the attached monitor cables out through the side of the ventilator box.

4.13A.7 Position the replacement monitor at the left side of the ventilator box, feed the attached cables into the ventilator box and attach the monitor to the side of the ventilator box with the nuts that were previously removed.

4.13A.8 Feed the alarm channel cable down through the opening in the floor of the ventilator box and connect it to J1 on the alarm channel PCB. Connect its ground lead to the floating ground assembly. Ensure that the cover cap is in place.

4.13A.9 Join the remaining monitor cables to their flying connectors in the ventilator box.

4.13A.10 Reinstall the ventilator box top cover, and the flowmeter housing back cover.

4.13A.11 Restore all sensor connections to the monitor.

4.13A.12 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.13A.13 Perform the PMS Procedure given in Section 6.

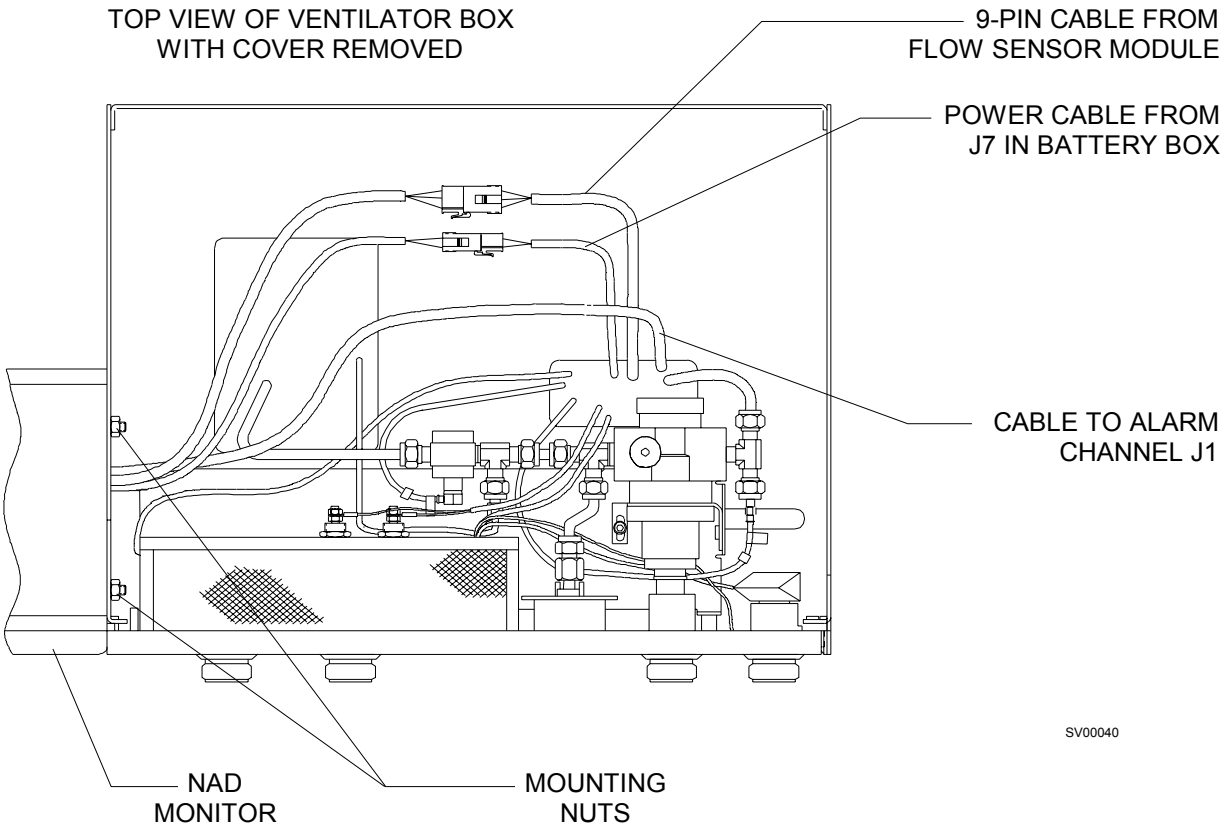


Figure 4-13A. VPO Monitor Replacement

4.14 AV2+ Ventilator Controller Assembly (MRI)

The Ventilator Controller assembly is retained in the ventilator box by two screws at the left side of the bezel. Access to these screws requires removal of the monitor from the ventilator box. Figure 4-14 shows the mounting arrangement, along with the electrical and pneumatic connections to the controller.

NOTE: In the MRI system, the ventilator solenoid is remotely located in the battery box at the bottom of the machine. Refer to the Ventilator Solenoid Assembly replacement procedure if needed.

NOTE: The AV2+ ventilator shall not be serviced below this level, with the exception of the following: knobs, pressure regulator, gauge and gauge cover. Please refer to Section 8: Spare and Replacement Parts, for part numbers.

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

4.14.2 Disconnect batteries by removing bottom plate over battery box, then remove connector J2 from the battery box PCB.

4.14.3 Disconnect all pipeline hoses and close all cylinder valves.

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

4.14.4 Remove the top cover from the ventilator box.

4.14.5 Remove the writing tray.

4.14.6 Remove the monitor from the machine. Refer to the Core-M or VPO Monitor replacement procedure - whichever applies.

4.14.7 Remove the battery box corner access plate.

4.14.8 Disconnect the red and white wires from the feed-thru filters on the rear bulkhead of the shield box. Note the arrangement of these wires so they can be connected to the replacement assembly in the same manner.

4.14.9 Disconnect the black ground wire from the stud on the shield box bulkhead.

NOTE: If the ground wire is not connected to the stud but is clamped under the aluminum block (see dotted line in the illustration), pull the ground wire out, straighten it, and install the ring terminal supplied with the service exchange AV2+ controller assembly (P/N SE4113132-006) on the wire.

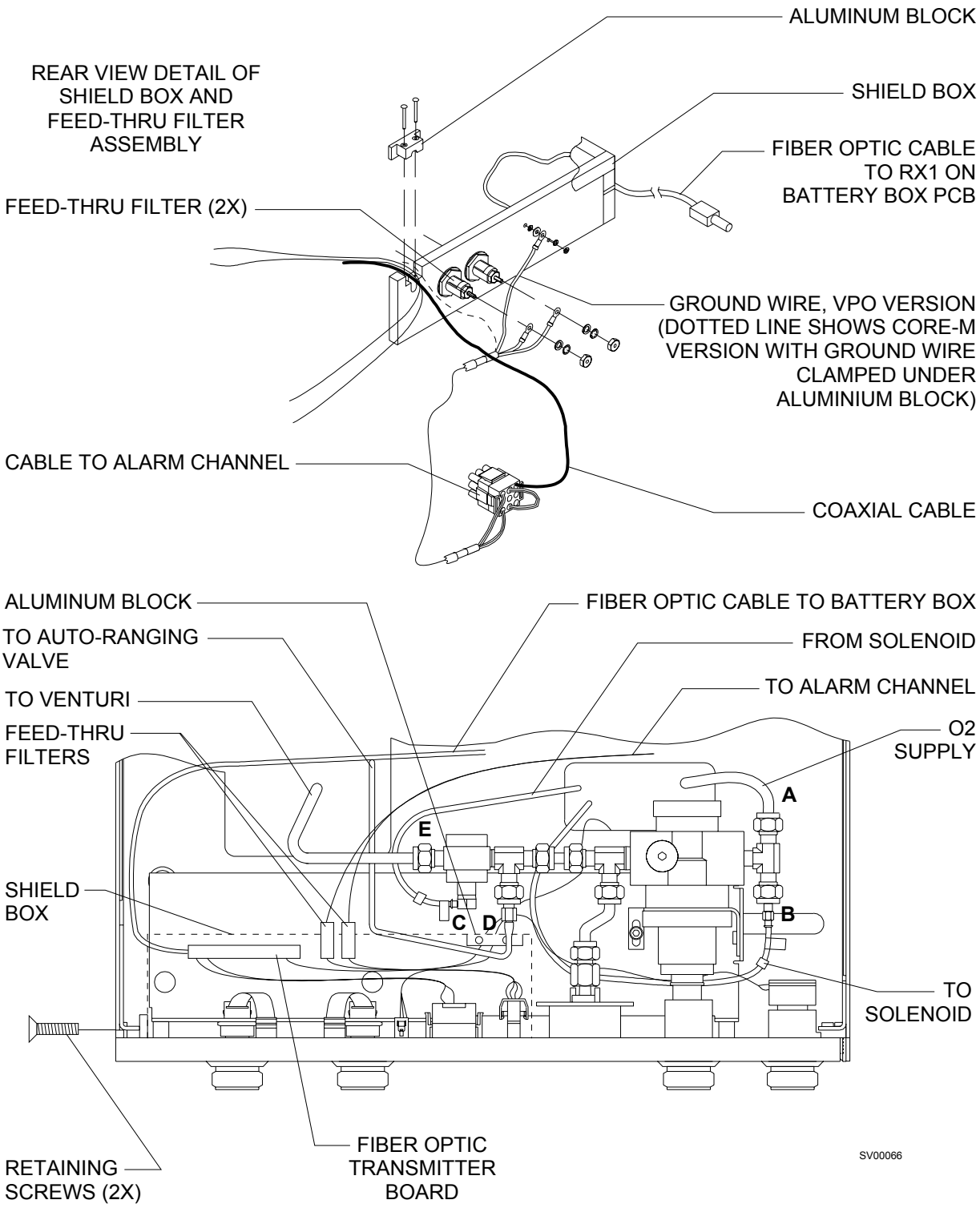


FIGURE 4-14. AV2+ Ventilator Controller (MRI) Assembly

4.14.10 Disconnect the fiber optic cable from RX1 on the battery box PCB. (See illustration.)

4.14.11 Feed the fiber optic cable up from the battery box to the AV2+ controller. Carefully coil the fiber optic cable and secure it to the AV2+ controller.

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

4.14.13 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

NOTE: Skip the next step if your machine has a Core-M monitor.

4.14.14 For later version machines with a VPO monitor, disconnect the cable from J3 on the alarm channel PCB. Remove the coaxial cable from this 9-pin connector using the white end of the pin extraction tool supplied with the service exchange unit. Disconnect the coaxial cable's shield from the ground wire assembly.

4.14.15 Disconnect the following large and small diameter pneumatic tubing (the letters are keyed to the letters in Figure 4-14):

A: O_2 supply tube
B: Tube to remote solenoid
C: Tube from solenoid
D: Tube to auto-ranging valve
E: Tube to venturi

4.14.16 Remove the controller assembly from the machine.

4.14.17 Position the replacement controller assembly in the ventilator box.

NOTE: Ensure that the mylar shield between the controller and the machine head is in position.

4.14.18 Reconnect the red and white wires to the two feed-thru filters on the rear of the shield box box in the same manner as original. Reconnect the pneumatic lines.

4.14.19 Slide the replacement 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.

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

4.14.21 Connect the ground wire to the stud on the rear of the shield box.

4.14.22 Feed the fiber optic cable from the ventilator controller down through the flowmeter housing and down through the frame leg and into the battery box area.

4.14.23 Secure the fiber optic cable in the cable hold-down in the battery box assembly.

4.14.24 Connect the fiber optic cable to RX1 on the battery box PCB.

NOTE: Skip the next step if your machine has a Core-M monitor.

4.14.25 For later version machines with a VPO monitor, reinstall the coaxial cable in the 9-pin connector as shown in the illustration, and plug the connector into J3 on the alarm channel. Connect the coaxial cable's shield to the floating ground wire assembly.

4.14.26 Reinstall the monitor.

4.14.27 Reinstall the ventilator box top cover.

4.14.28 Reinstall the writing tray.

4.14.29 Reinstall the battery box top cover.

4.14.30 Reinstall battery box corner access plate.

4.14.31 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.14.32 Perform the PMS Procedure given in Section 6.

4.14.33 Perform the Imaging Test Protocol (ITP) procedure given in Section 7 of the *Narkomed MRI Setup and Installation Manual*.

4.14.34 Complete the ITP form and associated checklist, Service Report, and return them to Draeger Medical, Inc. Service Department.

NOTE: For machines with a VPO monitor: Return the pin extraction tool with the AV2+ controller unit to DrägerService.

This page intentionally left blank

4.15 Ventilator Solenoid Assembly

The ventilator solenoid is remotely located within a double shielded housing in the battery box at the bottom of the machine. The solenoid and housing are replaced as a complete assembly. Figure 4-15 shows the pneumatic and electrical connections, and the mounting arrangement of the solenoid housing.

4.15.1 Turn the System Power switch to STANDBY.

4.15.2 Remove the top cover from the battery box at the bottom of the machine. On later machines with the ultrasonic flow sensor carefully remove the flow sensor cable strain relief bushing from its slot in the cover.

4.15.3 Disconnect the O_2 In and O_2 Out tubing from the hose barbs at the back of the housing.

4.15.4 Disconnect the solenoid cable.

4.15.5 Remove the screws securing the solenoid housing to the battery box, and lift out the assembly.

4.15.6 Install the replacement assembly in the battery box and secure it with the hardware that was previously removed.

4.15.7 Reconnect the solenoid cable, and reconnect the O_2 In and O_2 Out tubes to the hose barbs at the back of the housing.

4.15.8 Reinstall the battery box top cover. On later machines be sure that the flow sensor cable strain relief bushing is in the slot in the cover.

4.15.9 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.15.10 Perform the PMS Procedure given in Section 6.

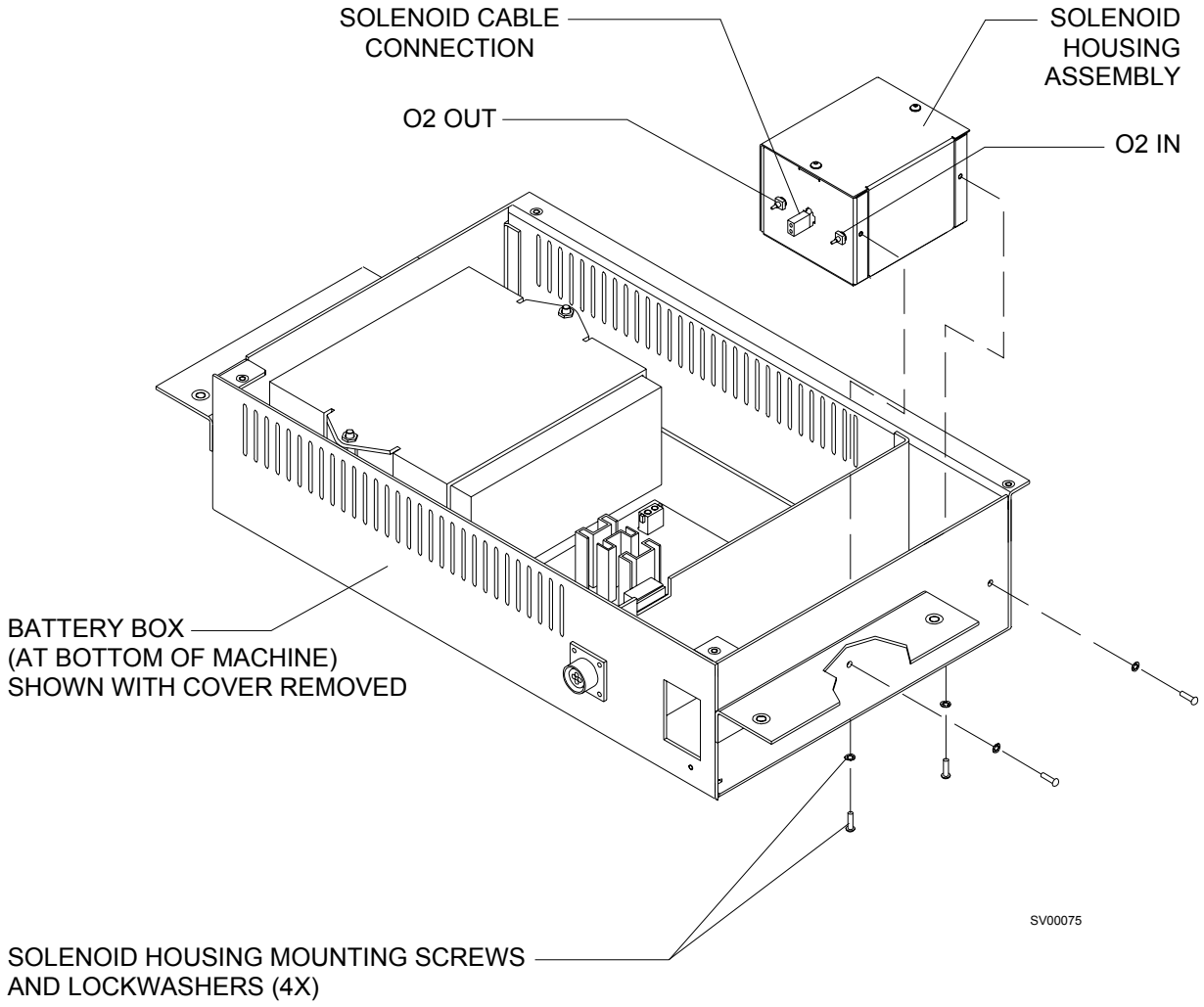


FIGURE 4-15. Ventilator Remote Solenoid & Housing

4.16 Ventilator Bellows Valve and Guide Assembly with Pressure Limit Control

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. Figure 4-16 shows the pneumatic connections and the mounting arrangement of the components.

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

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

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

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

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

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

4.16.7 Unscrew the bellows adjustment tube from the bellows valve assembly.

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

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

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

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

4.16.12 Carefully remove the assembly from the machine.

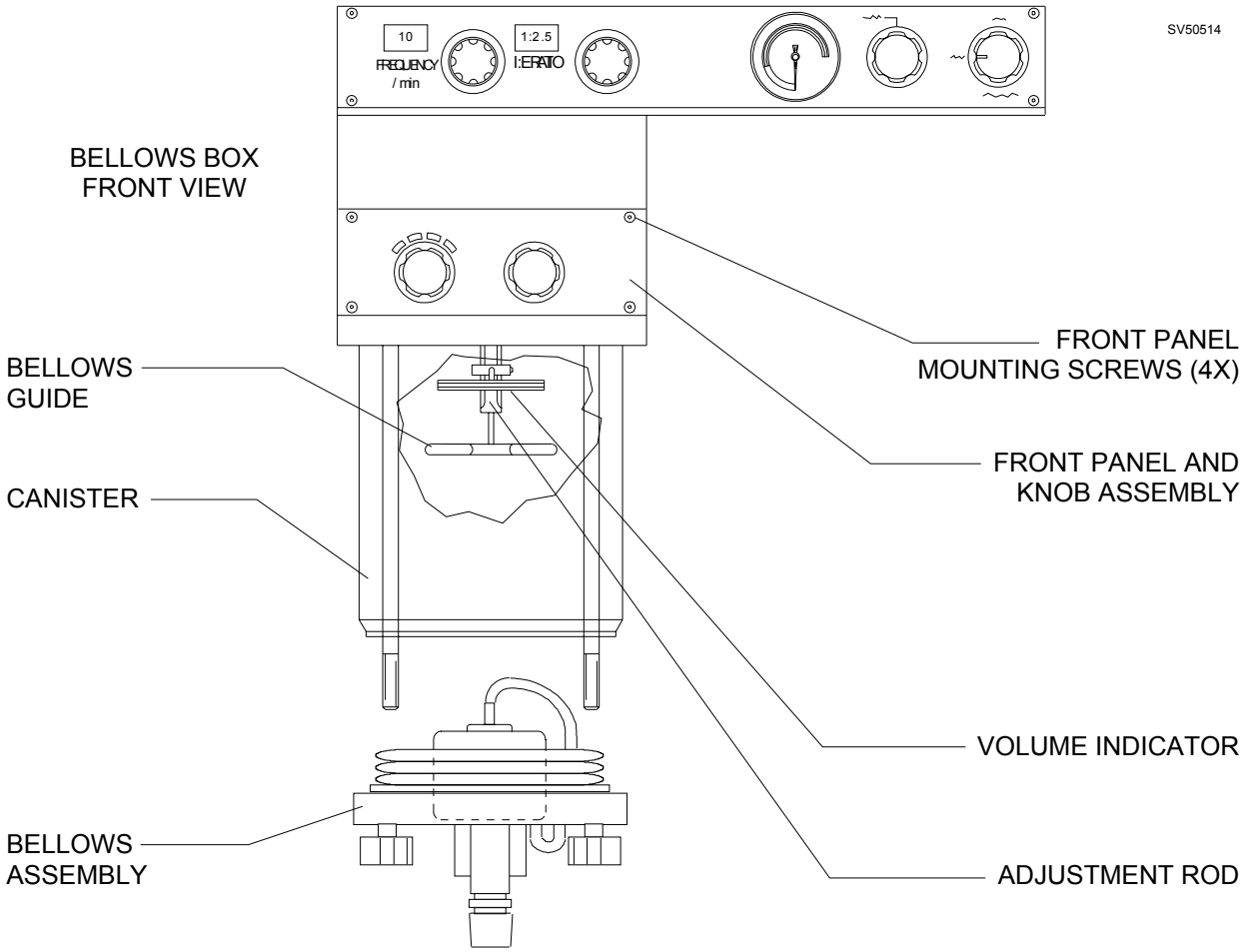


FIGURE 4-16. Tidal Volume Adj. & Valve Case Assembly

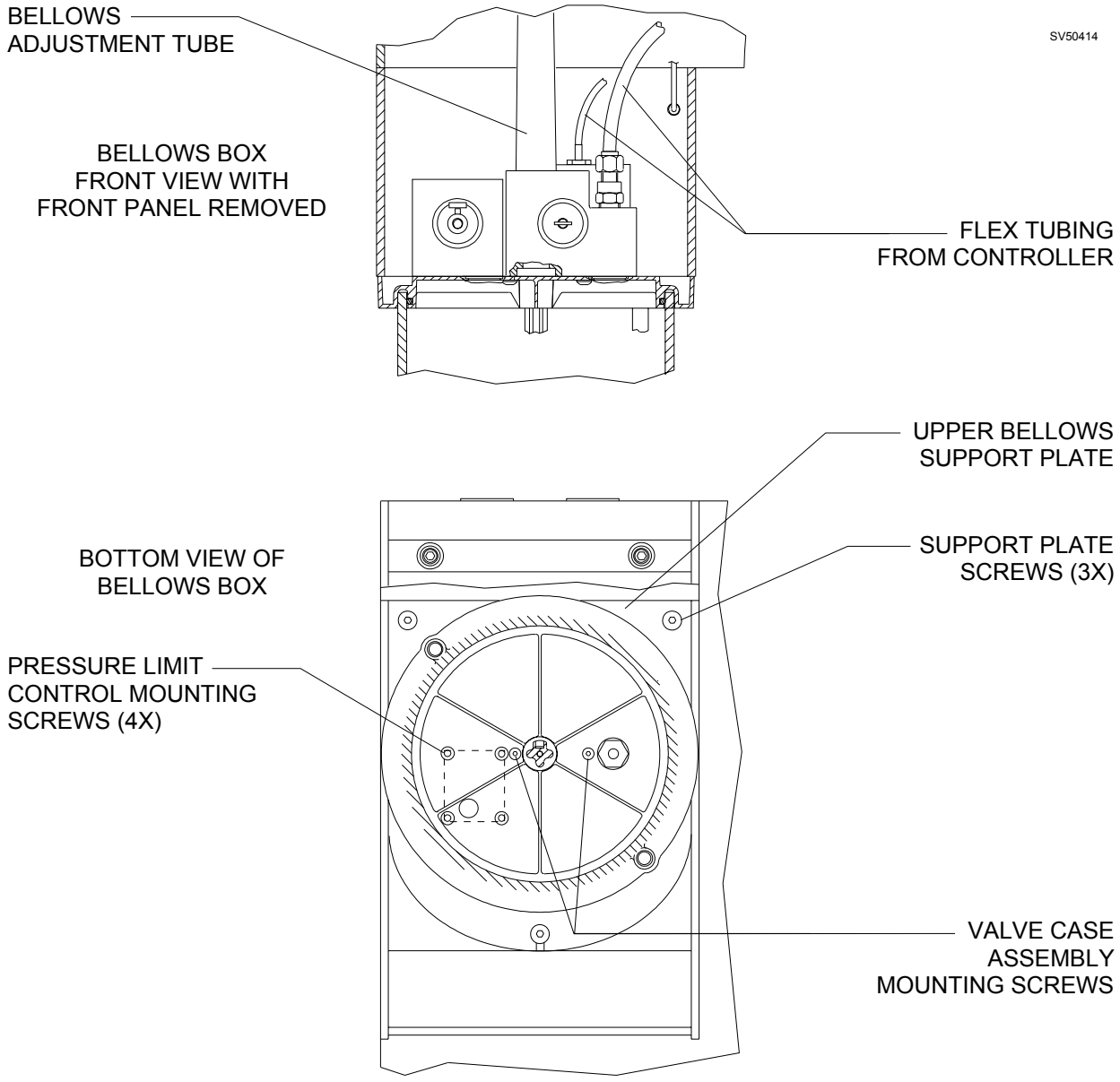


Figure 4-16. Tidal Volume Adj. & Valve Case Assembly (continued)

4.16.13 Unscrew the bellows adjustment tube from the replacement bellows valve.

4.16.14 Position the support plate in the bellows box and reconnect the large and small diameter tubing that was previously removed.

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

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

4.16.17 Reinstall the bellows adjustment tube on the bellows valve.

4.16.18 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.

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

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

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

4.16.22 Reconnect the pipeline hoses and AC power cord.

4.16.23 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.16.24 Perform the PMS Procedure given in Section 6.

4.17 Caster

The casters are threaded into the legs of the machine frame. A typical arrangement is shown in Figure 4-17. 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.

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

4.17.2 Remove all unsecured equipment and accessories from the machine.

4.17.3 Lock the front casters.

4.17.4 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.

4.17.5 Un-screw the caster from the frame using a caster wrench P/N S010055.

4.17.6 Apply an ample amount of Loctite #242 to the stem of each replacement caster, then thread the replacement caster into the frame leg and tighten the caster.

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

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

4.17.9 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

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

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

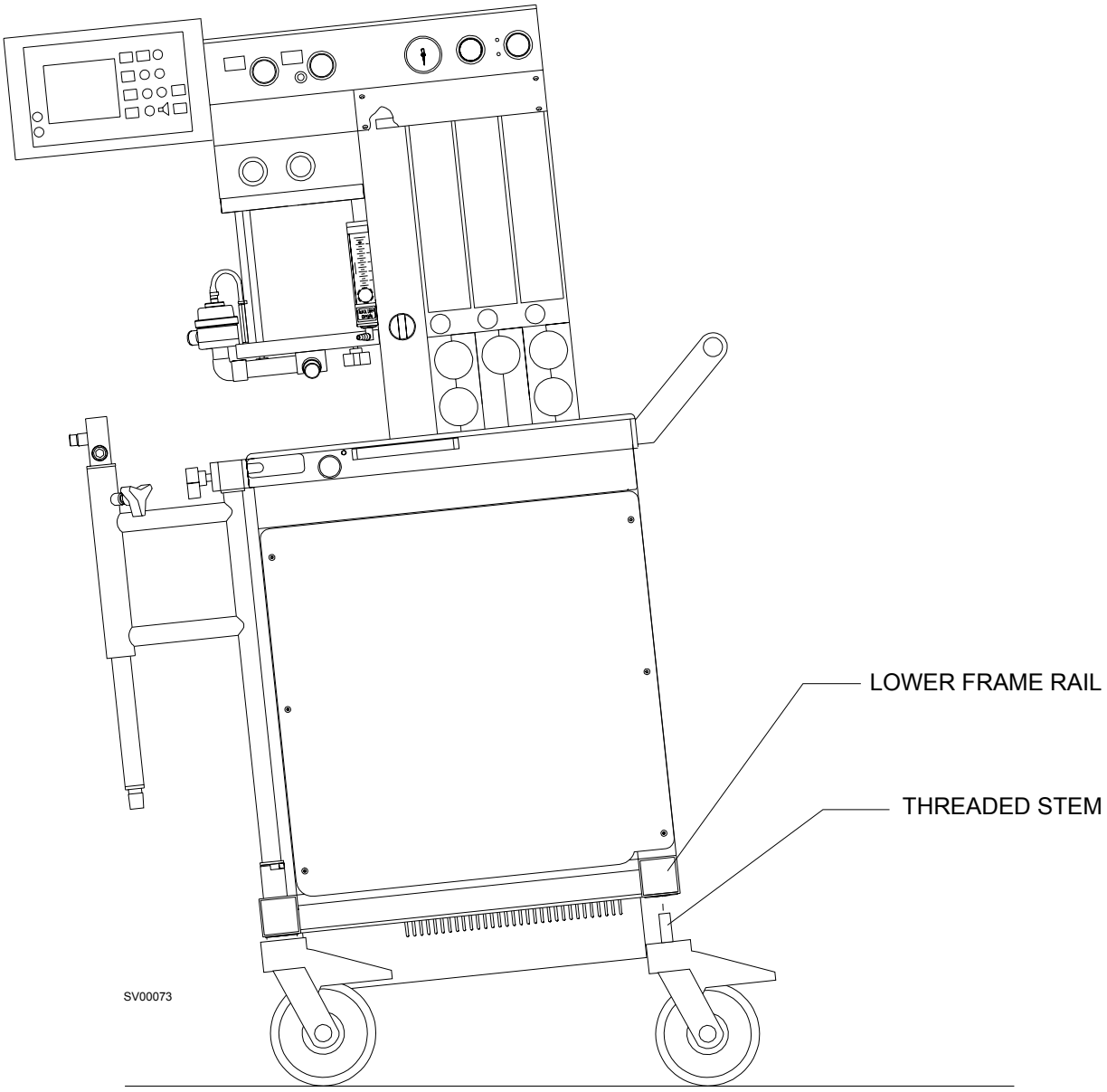


FIGURE 4-17. Caster Replacement

4.18 Battery

The backup battery is located in the battery box at the bottom of the machine. Access to the battery requires removal of the battery box cover. Figure 4-18 shows the battery connection and mounting arrangement on early machines. Figure 4-18A shows the battery connection and mounting arrangement on later machines with the VPO monitor.

4.18.1 Turn the System Power switch to STANDBY and remove the power cable from the back of the battery box.

4.18.2 Remove the top cover from the battery box. On later machines with the ultrasonic flow sensor carefully remove the flow sensor cable strain relief bushing from its slot in the cover.

4.18.3 Disconnect the battery wire harness from J2 on the PCB.

4.18.4 Remove the two retainer nuts, and remove the battery retainer.

4.18.5 Remove the battery from the battery box.

4.18.6 If needed, transfer the wire harness to the replacement battery (yellow wire to (+) terminal, black wire to (-) terminal) and ensure that the replacement battery is wrapped in a protective bag in the same manner as the original.

4.18.7 Place the replacement battery in the battery box, oriented as shown in the illustration.

4.18.8 Record the installation date on the battery.

4.18.9 Reinstall the battery retainer and the two retainer nuts.

4.18.10 Reconnect the battery wire harness to J2 on the PCB.

4.18.11 Reinstall the battery box top cover. On later machines be sure that the flow sensor cable strain relief bushing is in the slot in the cover.

4.18.12 Reconnect the power cable to the connector on the back of the battery box.

4.18.13 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.18.14 Perform the PMS Procedure given in Section 6.

End of Life Battery Disposal:

Dispose of a spent rechargeable, sealed lead-acid battery in conformance with local waste disposal regulations.

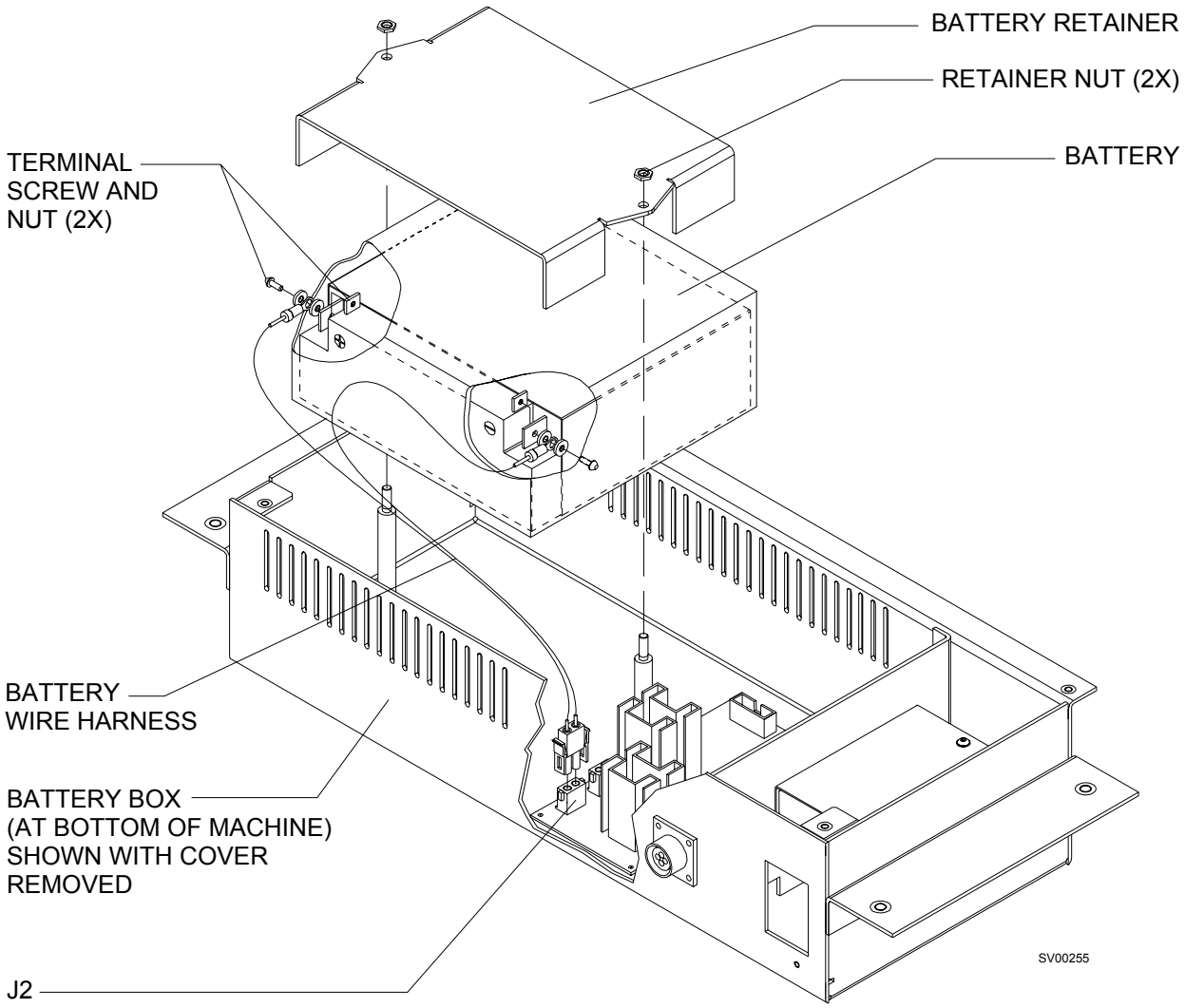


FIGURE 4-18. Battery Replacement: Core-M Version

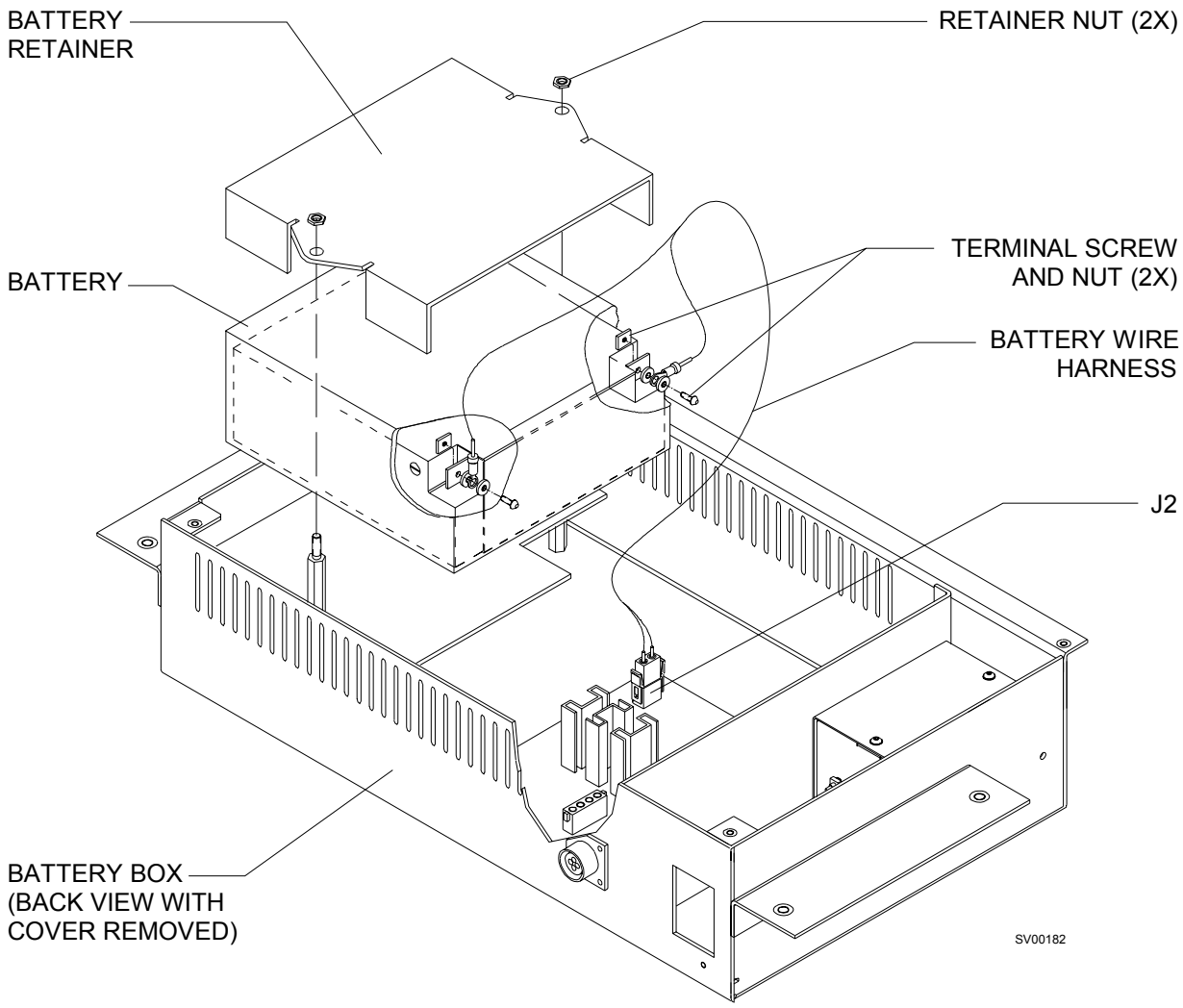


Figure 18A. Battery Replacement: Later Machines with VPO Monitor

This page intentionally left blank

4.19 Power Supply PCB

The power supply PCB is located in the battery box at the bottom of the machine. Access to the PCB requires removal of the battery box cover. Figure 4-19 shows the power supply PCB connection and mounting arrangement on early machines. Figure 19A shows the power supply PCB connection and mounting arrangement on later machines with the VPO monitor.

4.19.1 Turn the System Power switch to STANDBY and remove the power cable from the back of the battery box.

4.19.2 Remove the top cover from the battery box. On later machines with the ultrasonic flow sensor carefully remove the flow sensor cable strain relief bushing from its slot in the cover.

4.19.3 Disconnect the following from the PCB:

Machines with Core-M Monitor		Machines with VPO Monitor	
J1	Power in	J1	Power in
J2	Battery	J2	Battery
J3	Alarm Channel	J3	Alarm Channel
J4	Power to Monitor	J4	Flow Sensor Module J1
RX1	Fiber Optic Cable	J5	Flow Sensor Module J2
J6	Solenoid	J6	Solenoid
		J7	Monitor Power
		J8	Monitor hi field signal
		RX1	Fiber Optic Cable

4.19.4 Remove the four screws securing the PCB, and lift the PCB from the battery box.

4.19.5 Install the replacement power supply PCB in the battery box with the hardware that was previously removed. Be sure the board is oriented as shown in the illustration.

4.19.6 Re-connect all cables and wire harnesses to the PCB.

4.19.7 Reinstall the battery box top cover. On later machines be sure that the flow sensor cable strain relief bushing is in the slot in the cover.

4.19.8 Reconnect the power cable to the connector on the back of the battery box.

4.19.9 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.19.10 Perform the PMS Procedure given in Section 6.

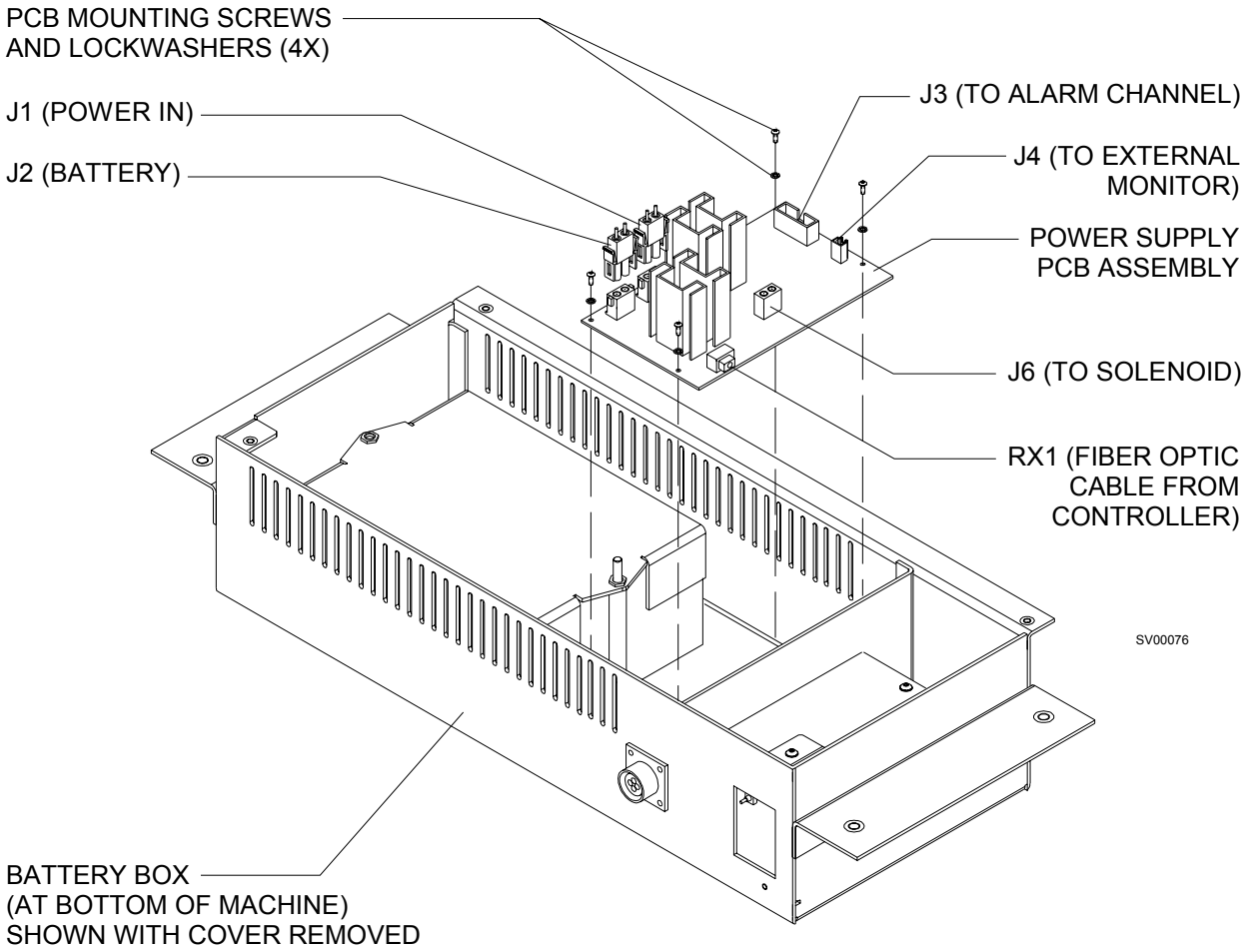


FIGURE 4-19. Power Supply PCB Assembly Replacement

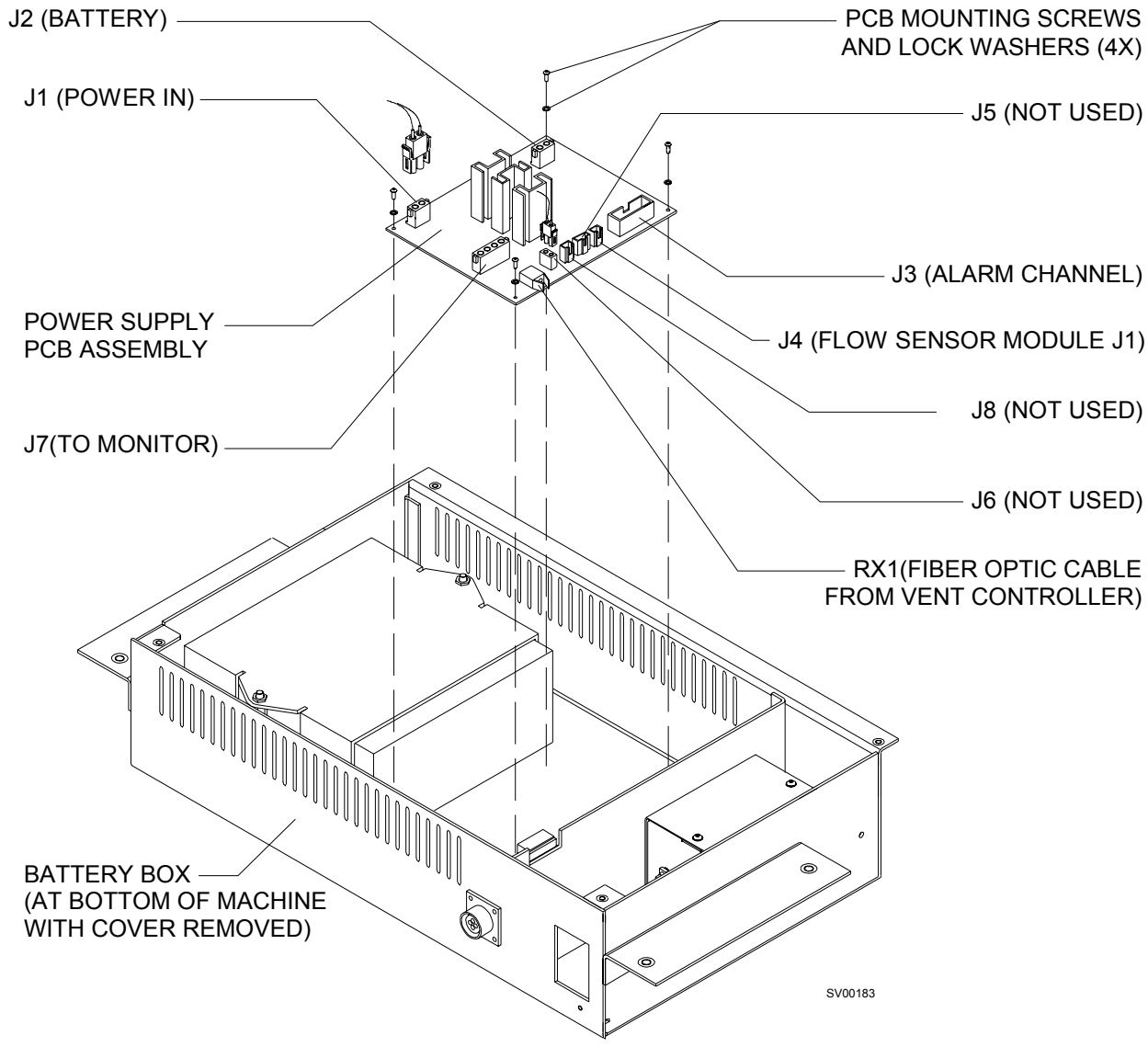


Figure 4-19A. Power Supply PCB Assembly: Later Models with VPO Monitor

This page intentionally left blank

4.20 Primary Power Supply (early design)

The primary power supply in the MRI system is located outside the MRI room. Figure 4-20 shows the primary power supply.

NOTE: This power supply can not be repaired. When needed, it should be replaced with the later design power supply shown in Figure 4-20A.

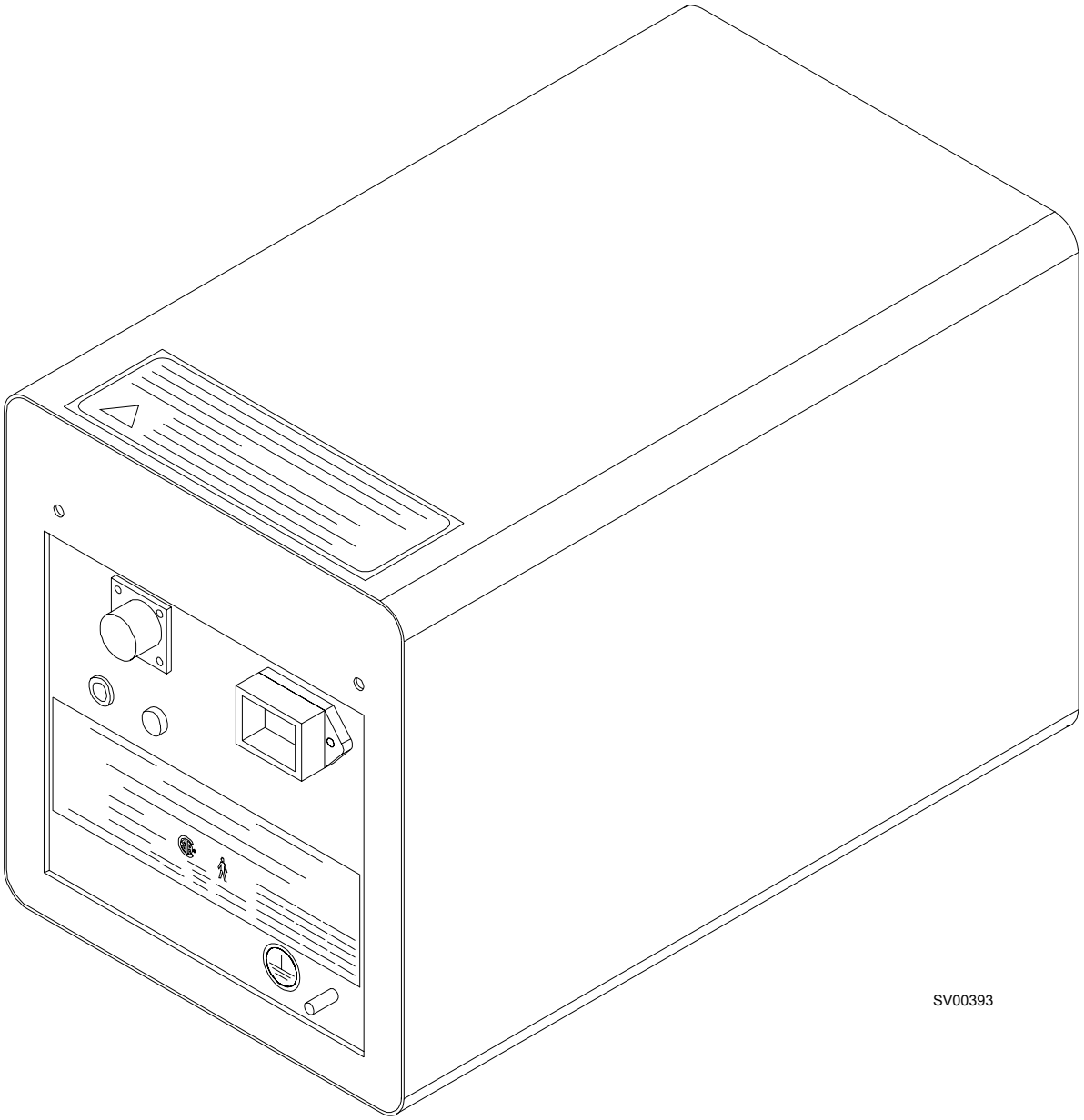


FIGURE 4-20. Primary Power Supply Replacement (early models)

4.20A Primary Power Supply (later design)

The later design primary power supply is installed on an outside wall of the MRI facility, and connects to a through-the-wall filter as shown in Figure 4-20A. The power supply is not servicable in the field and is replaced as an assembly if needed.

4.20A.1 Turn the System Power switch to STANDBY and disconnect the AC power cord from the wall outlet.

4.20A.2 Disconnect the AC power cord, and the output cable from the power supply.

4.20A.3 Remove the screws securing the power supply to the wall.

NOTE: Contact the appropriate hospital personnel regarding wall location for reinstallation of the power supply.

4.20A.4 Install the replacement power supply in the same orientation as the original. Use the mounting screws that were previously removed.

4.20A.5 Connect the output cable, and connect the AC power cord to the power supply.

4.20A.6 Carefully inspect the work area and the machine to verify that no loose screws, washers, or tools are left on, in, or near any part of the machine.

4.20A.7 Perform the PMS Procedure given in Section 6.

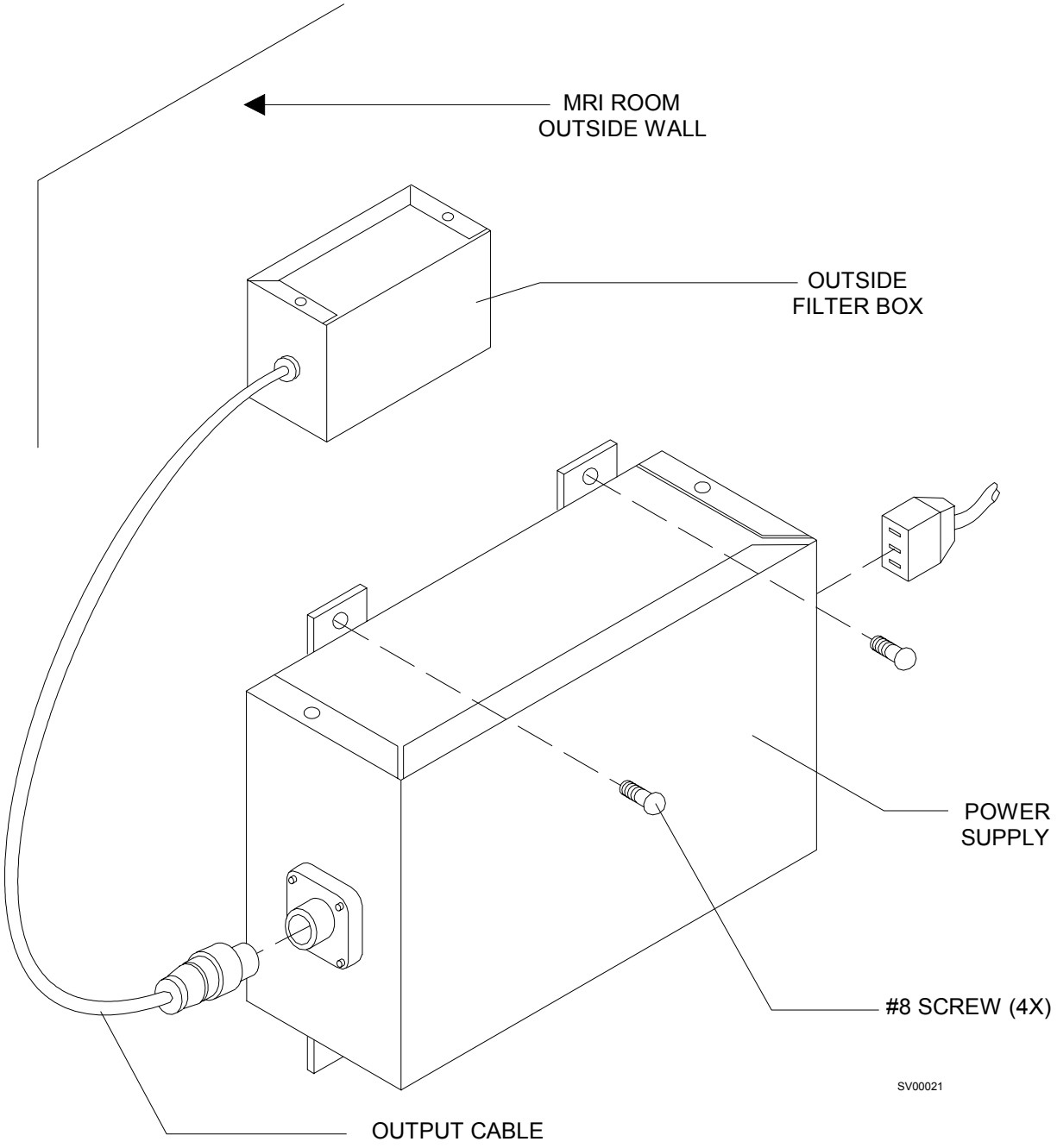


FIGURE 4-20A. Primary Power Supply Replacement (later design)

4.21 Power Supply Filter

The power supply filter is a double box through-the-wall assembly as shown in Figure 4-21, typically installed in an access panel in the MRI facility.

4.21.1 Turn the System Power switch to STANDBY and remove AC power from the system.

4.21.2 Disconnect the outside box cable from the power supply, and disconnect the inside box cable from the machine cable.

4.21.3 Remove the box covers. Make a note of the orientation of the boxes and the wire colors.

4.21.4 At the inside box, disconnect the red and black wires from the filters, then remove the ½-28 nut from each filter bushing. Separate and remove the assembly from each side of the wall.

NOTE: Replacement filters are supplied assembled. You will have to take apart the filter assembly in order to install it through the wall.

4.21.5 Remove the box covers from the replacement assembly, disconnect the red and black wires from the inside box filter terminals. Do Not disturb the ground stud wiring.

4.21.6 Remove the ½-28 nuts and lock washers from the filter bushings, and separate the boxes.

4.21.7 Reassemble the boxes as shown in the illustration - oriented in the same manner as the original assembly. Secure the assembly with the lock washers and ½-28 nuts on the filter bushings.

4.21.8 Reconnect the red and black wires to the inside box filter terminals.

4.21.9 Verify that the red wire on the inside box is connected to the same filter element as the red wire in the outside box.

4.21.10 Install the covers on both boxes.

4.21.11 Connect the power supply cable, and the machine cable.

4.21.12 Carefully inspect the work area and the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

4.21.13 Perform the PMS Procedure given in Section 6.

4.21.14 Perform an Imaging Test Protocol (ITP) procedure as given in Section 7 of the *Narkomed MRI Setup and Installation Manual*.

4.21.15 Complete the ITP form, associated checklist and Service Report, and return them to the Draeger Medical, Inc. Service Department.

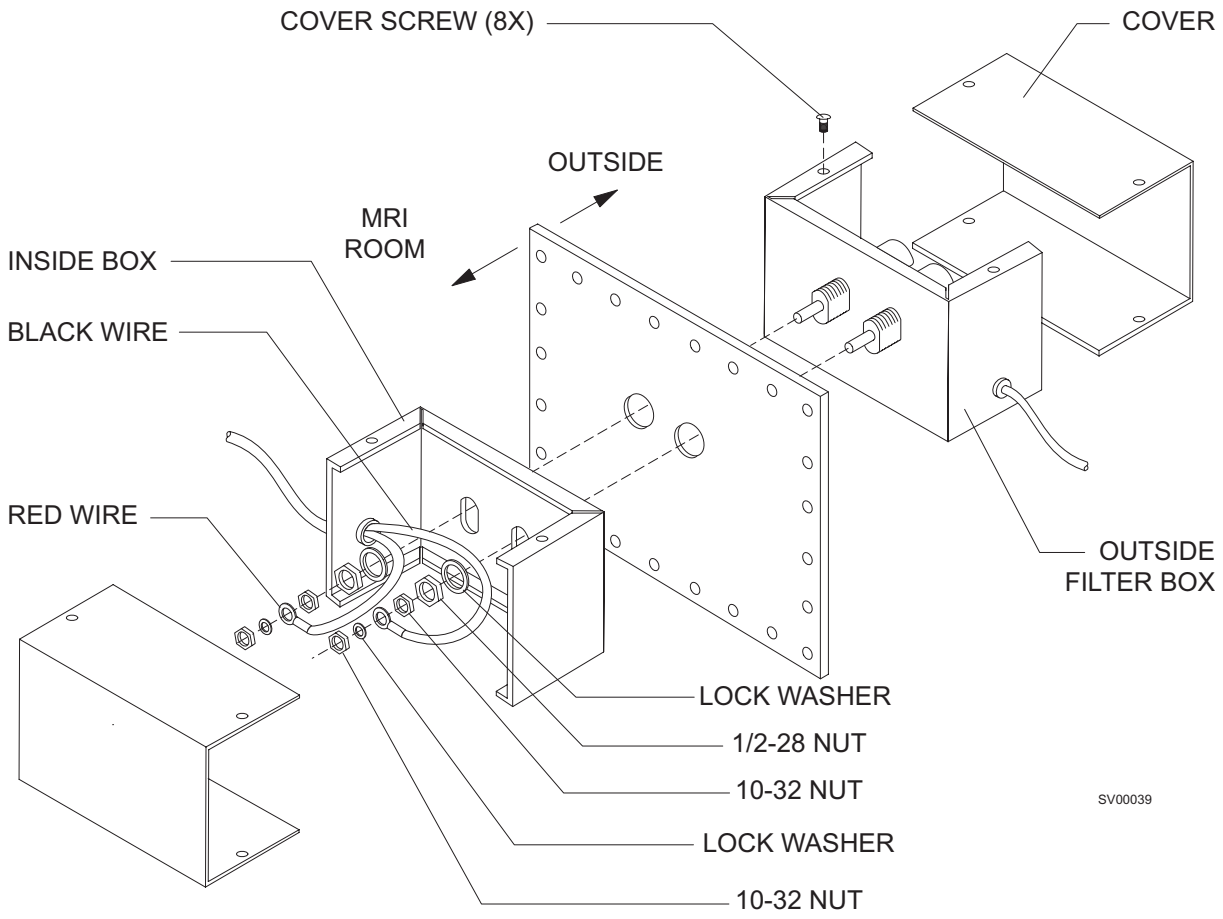


FIGURE 4-21. Power Supply Filter Replacement

4.22 Flow Sensor Replacement: Machines with VPO Monitor

The ultrasonic flow sensor assembly in the Narkomed MRI comprises the transducer unit at the absorber, its electronics module located in the battery box, and a permanently joined interconnecting cable. Access to the electronics module requires opening the battery box and removing the battery. Connections and mounting arrangement are shown in Figure 4-22.

4.22.1 Turn the System Power switch to STANDBY and remove the power cable from the back of the battery box.

4.22.2 Disconnect the hoses from the flow sensor and remove the flow sensor from the absorber.

4.22.3 Remove the top cover from the battery box - carefully remove the flow sensor cable strain relief bushing from its slot in the cover.

4.22.4 Disconnect the battery wire harness from J2 on the PCB.

4.22.5 Remove the two retainer nuts, and remove the battery retainer.

4.22.6 Remove the battery from the battery box.

4.22.7 Unscrew the two spacers holding the battery mounting plate, and remove the plate.

4.22.8 Disconnect the cables from the electronics module.

4.22.9 Disconnect the ground wire from the electronics module, and remove the module from the battery box.

4.22.10 Disconnect the ground clamp attached to the flow sensor cable.

4.22.11 Position the replacement module in the battery box as shown in the illustration.

4.22.12 Reconnect the ground clamp onto the flow sensor cable at the cutout of the braided shield.

4.22.13 Connect the ground wire to the module, and connect the cables.

4.22.14 Install two self-adhesive foam strips (P/N 4109748) on top of the module as shown in the Figure 4-22.

4.22.15 Reinstall the battery mounting plate, spacers, battery and retainer.

4.22.16 Connect the battery wire harness to J2 on the PCB.

4.22.17 Reinstall the battery box cover - be sure that the flow sensor cable strain relief bushing is in the slot in the cover.

4.22.18 Install the flow sensor on the absorber and re-connect the hoses.

4.22.19 Re-connect the power cable to the machine.

4.22.20 Perform the PMS Procedure given in Section 6.

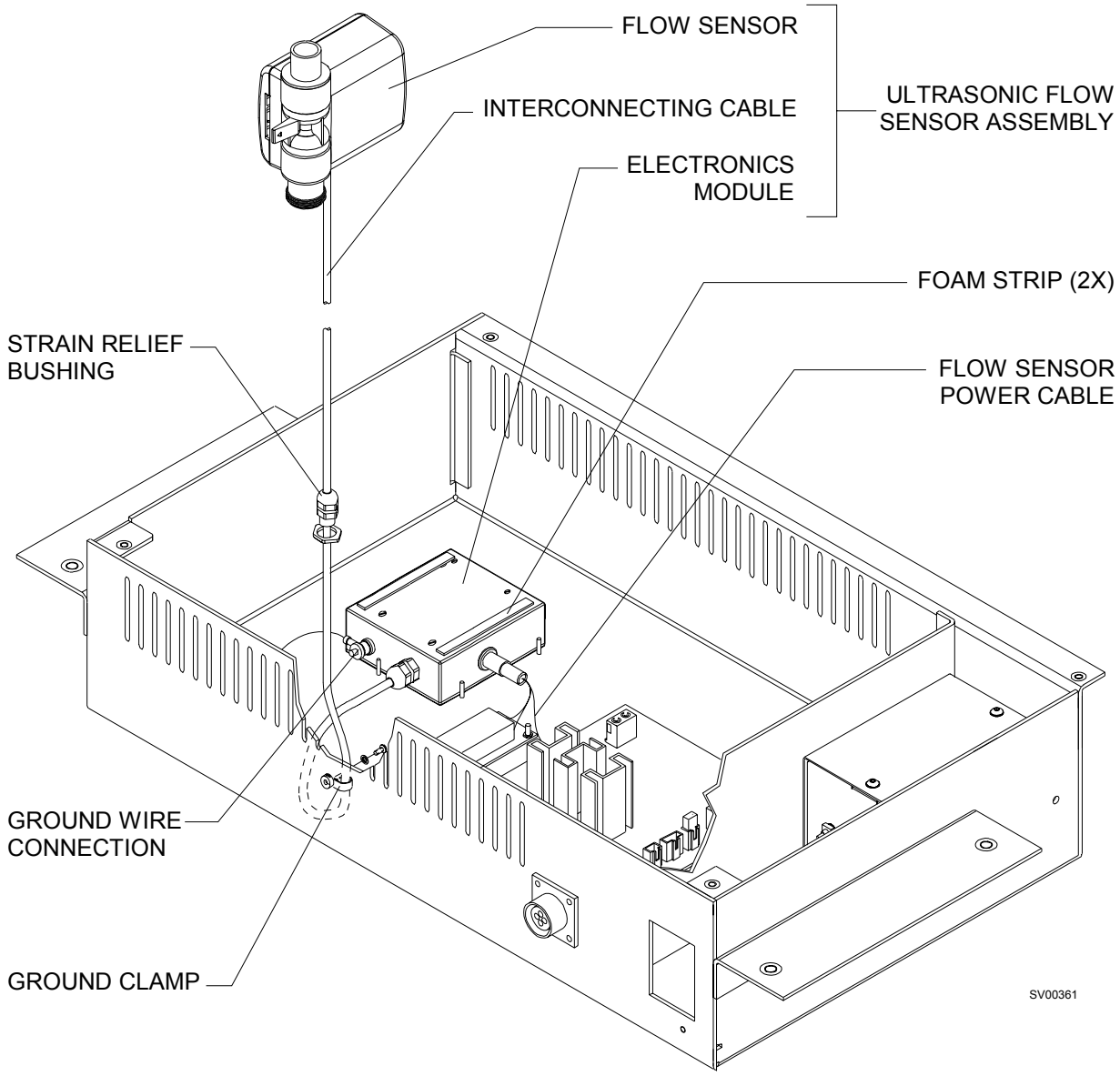


FIGURE 4-22. Flow Sensor Replacement

5.0 ADJUSTMENT AND CALIBRATION PROCEDURES

Equipment Required:

--Test Gauge for setting cylinder pressure regulators, NAD Part No. S000063A

--Oxygen Monitor for adjusting Oxygen Ratio Controller

If your system is equipped with an Omicron (Core-M) monitor, refer to the *NAD Omicron Monitor Instructions for Operation* (Part No. 4114448) for further information on calibration and testing of the monitor functions.

WARNING: Do not place any object on this machine unless it is specifically labeled to be used in an MRI scanning room and on the Narkomed MRI anesthesia system. Objects placed on this machine that are not designed for use with this anesthesia system may be strongly attracted to the magnet and may cause serious injury or death when the machine is used in an MRI scanning room.

WARNING: Always lock the casters after this anesthesia machine has been positioned in the MRI scanner room. Magnetic attractive forces between the magnet and the anesthesia machine may cause unintentional movement of the anesthesia machine if the casters are unlocked.

WARNING: The power supply charger assembly must not be taken into the magnet room. Damage to the equipment, MRI system, or personal injury could result.

WARNING: The anesthesia machine must be removed from the MRI scanner room before servicing the machine. Do not enter the MRI scanner room with any tools or instruments. These items may be strongly attracted to the magnet and may cause serious injury or death when when brought into an MRI scanning room.

5.1 Cylinder Pressure Regulator Adjustment

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

5.1.2 Close all cylinder valves except the O_2 valve.

5.1.3 Set the oxygen flow to 4 liters per min.

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

5.1.5 Close all of the flow control valves.

5.1.6 Close the O2 cylinder valve and press the O_2 Flush valve to drain oxygen pressure from the system.

5.1.7 Turn the System Power switch to STANDBY.

5.1.8 Loosen the screws holding the table top to the machine and lift out the table top.

5.1.9 Remove the screws securing the table bottom cover to the machine frame, and remove the bottom cover. (These screws are accessible after the table top is removed.)

NOTE: Later design machines have access holes in the bottom cover for regulator adjustment.

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

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

5.1.11 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.

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

5.1.13 Set the O2 flow to 4 liters per min. (also set the N2O or other gas flow to 4 L/min. if these regulators are being adjusted).

5.1.14 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 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 Low 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.

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

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

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

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

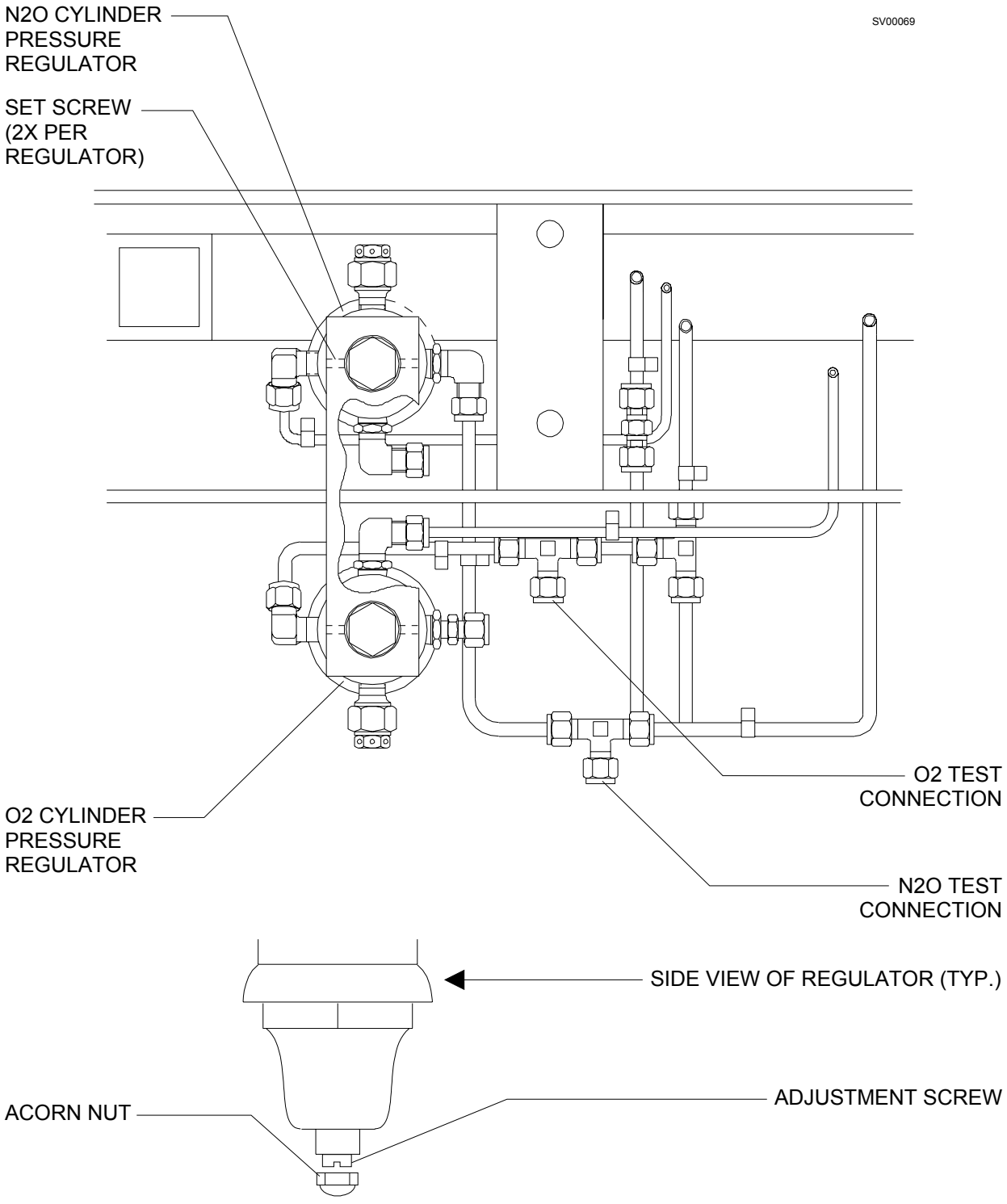


FIGURE 5-1. Cylinder Pressure Regulator Adjustment

5.1.19 Reinstall the table bottom cover.

5.1.20 Reinstall the table top and tighten its retaining screws.

5.1.21 Connect the pipeline hoses.

5.1.22 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

5.1.23 Perform the PMS Procedure given in Section 6.

5.2 Oxygen Supply Pressure Alarm Switch Adjustment

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

5.2.2 Close all cylinder valves except the O_2 valve.

5.2.3 Set the oxygen flow to 5 liters per min.

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

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

5.2.6 Turn the System Power switch to STANDBY.

5.2.7 Remove the rear cover from the flowmeter housing, and remove the table top.

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

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

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

5.2.11 Set the oxygen flow to 5 liters per min.

5.2.12 Close the oxygen cylinder valve.

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

5.2.14 If the alarm activates when the pressure is below 34 psi 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.

5.2.15 Turn the System Power switch to STANDBY.

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

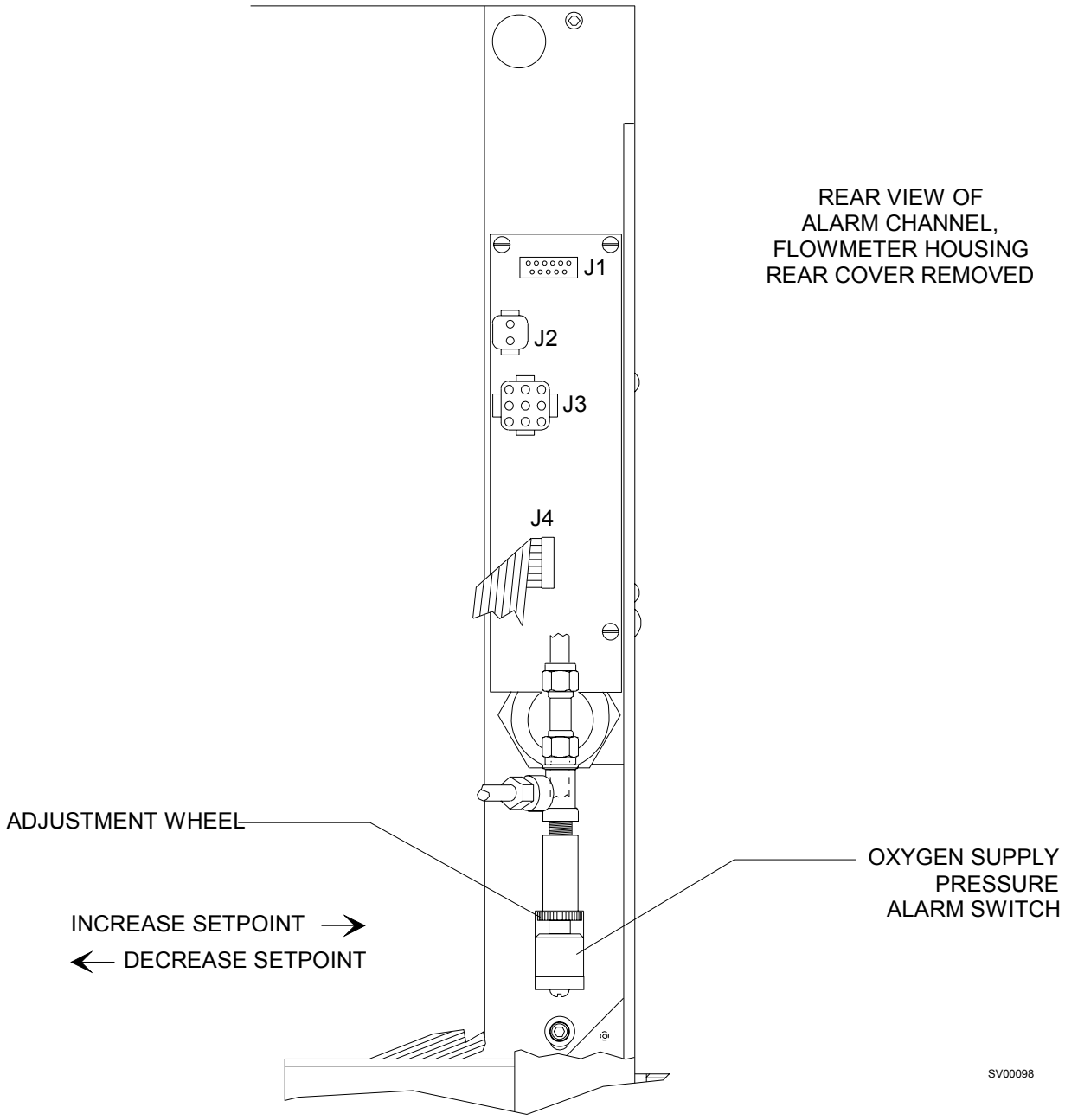


FIGURE 5-2. Oxygen Supply Pressure Alarm Switch

5.2.17 Reinstall the table top and tighten its retaining screws.

5.2.18 Reinstall the rear cover and its retaining screws.

5.2.19 Connect the pipeline hoses.

5.2.20 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

5.2.21 Perform the PMS Procedure given in Section 6.

5.3 Oxygen Ratio Controller (ORC) Adjustment

5.3.1 Remove the rear cover of the flowmeter housing.

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

5.3.3 Disconnect the pipeline hoses.

5.3.4 Pinch the N_2O bypass line on the ORC. See Figure 5-3.

5.3.5 Open the oxygen and nitrous oxide cylinder valves.

5.3.6 Set the System Power switch to ON.

5.3.7 Close the O_2 and N_2O flow control valves.

5.3.8 Set the O_2 flow control valve to 10 L/min.

5.3.9 Set the N_2O flow control valve to 10 L/min.

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

5.3.11 Decrease the oxygen flow rate.

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

5.3.13 Repeat steps 5.3.7 thru 5.3.12 until no further adjustment is needed.

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

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

5.3.16 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.

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

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

5.3.19 Un-pinch the N_2O bypass line on the ORC.

5.3.20 Close the O_2 flow control valve, and fully open the N_2O flow control valve. Verify that the O_2 concentration is >21%.

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

5.3.22 Reconnect the pipeline hoses.

5.3.23 Replace the flowmeter housing rear cover.

5.3.24 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

5.3.25 Perform the PMS Procedure given in Section 6.

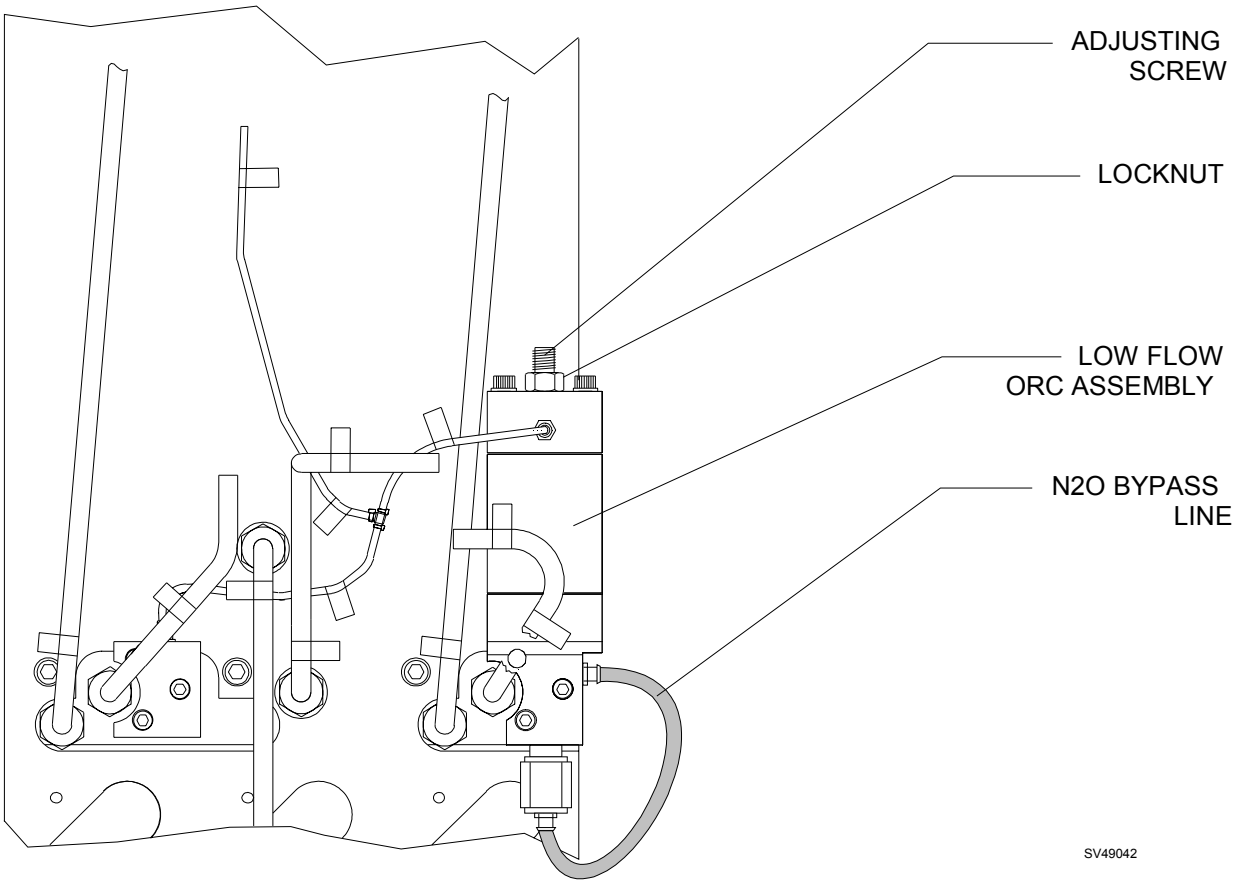


FIGURE 5-3. Oxygen Ratio Controller Adjustment

5.4 Oxygen Monitor Calibration: Core-M Monitor

5.4.1 Turn the System Power switch to ON.

5.4.2 Expose the O_2 sensor to room air.

5.4.3 Press the O_2 key on the monitor.

5.4.4 Press the "21% O_2 CAL" key to calibrate the O_2 monitor.

5.4.5 The oxygen concentration should be 20 to 22%.

5.4.6 Place the sensor into the valve dome, set the oxygen flow to 4 L/min., set the Man/Auto selector to BAG, close the APL valve, attach a 12 inch hose to the inspiratory valve and occlude the bag mount. Press the O_2 Flush button for 5 seconds.

5.4.7 Allow a few moments for the sensor to purge, and press the "100% CAL" key.

5.4.8 The oxygen concentration should be 97 to 100.

5.4.9 Close the oxygen flow control valve.

5.5 Flow and Pressure Calibration: Core-M Monitor

5.5.1 Adult

NOTE: A "FLOW CAL" message must appear on the display prior to continuing with testing. This message appears after the 15 minute warm up period has completed.

5.5.1.1 Verify that a flow sensor is attached to the volume sensor pilot line.

5.5.1.2 Remove the flow sensor from the absorber system, and expose the sensor to room atmosphere.

5.5.1.3 Press the FLOW CAL key.

5.5.1.4 Verify that the flow calibration has successfully completed.

5.6 Oxygen Sensor Calibration: VPO Monitor

5.6.1 Turn the System Power switch to ON.

5.6.2 Enter the Main Service Screen and select the Service Mode (ref. Section 2).

5.6.3 Enter the Oxygen Monitor Service Screen.

5.6.4 Zero Calibration

5.6.4.1 Remove the oxygen sensor capsule from its housing and allow several minutes for the displayed offset readings to stabilize.

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

5.6.4.2 Press the key next to ZERO to store the current values as the new zero calibration.

5.6.4.3 Reinstall the sensor capsule in its housing.

5.6.5 21% Calibration

5.6.5.1 Expose the sensor to ambient air only (away from any open part of the breathing system) and allow it to stabilize for several minutes.

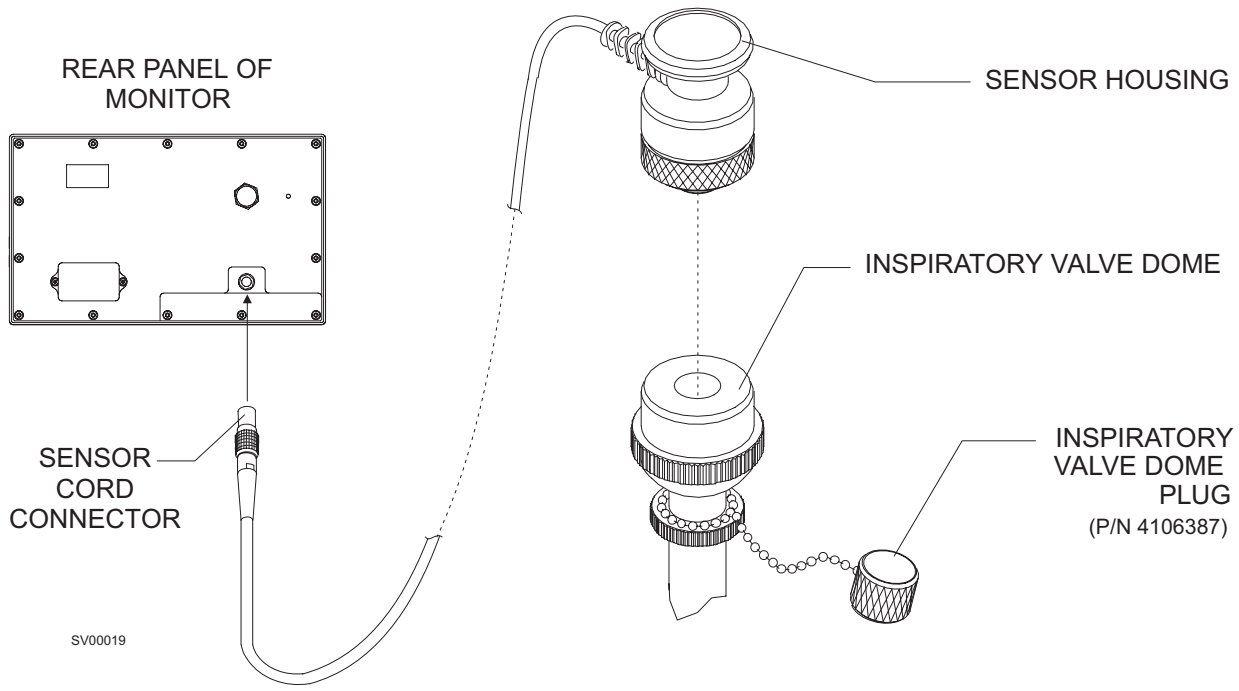
5.6.5.2 Press the key next to EXIT to return to the Main Service Screen. Press the key next to EXIT again to return the display to normal operation.

5.6.5.3 Press the CAL key to initiate the 21% O_2 calibration.

During calibration, the LED next to the CAL key lights, and the label CAL appears in the oxygen monitor window. Following successful calibration, the currently sensed oxygen concentration appears in the oxygen monitor window.

5.6.5.4 When calibration is complete, reinstall the sensor assembly in the inspiratory valve dome.

NOTE: If the O_2 sensor will not calibrate properly, refer to The Oxygen Monitoring section of the *Narkomed MRI Operator's Instruction Manual* for further information.



OXYGEN MONITOR SERVICE SCREEN

CURRENT CELL A: 238
CURRENT CELL B: 250

ZERO

ZERO CALIBRATION PROCEDURE:
- REMOVE O2 CELL FROM HOUSING
- LET CURRENT CELL VALUES STABILIZE
- PRESS "ZERO" KEY TO ENTER CALIBRATION VALUES
- REINSTALL O2 CELL IN SENSOR HOUSING

PRES MON

STORED ZERO CELL A: 250
STORED ZERO CELL B: 250

EXIT

Figure 5-4. Oxygen Monitor Service Screen

5.7 Breathing Pressure Monitor Calibration: VPO Monitor

5.7.1 Turn the System Power switch to ON.

5.7.2 Enter the Main Service Screen and select the Service Mode (ref. Section 2).

5.7.3 Proceed to the Pressure Monitor Service Screen.

5.7.4 Zero Calibration

5.7.4.1 Disconnect the pressure sample line from the absorber and let the current pressure value stabilize.

5.7.4.2 Press the key next to ZERO to store the current value as the new zero.

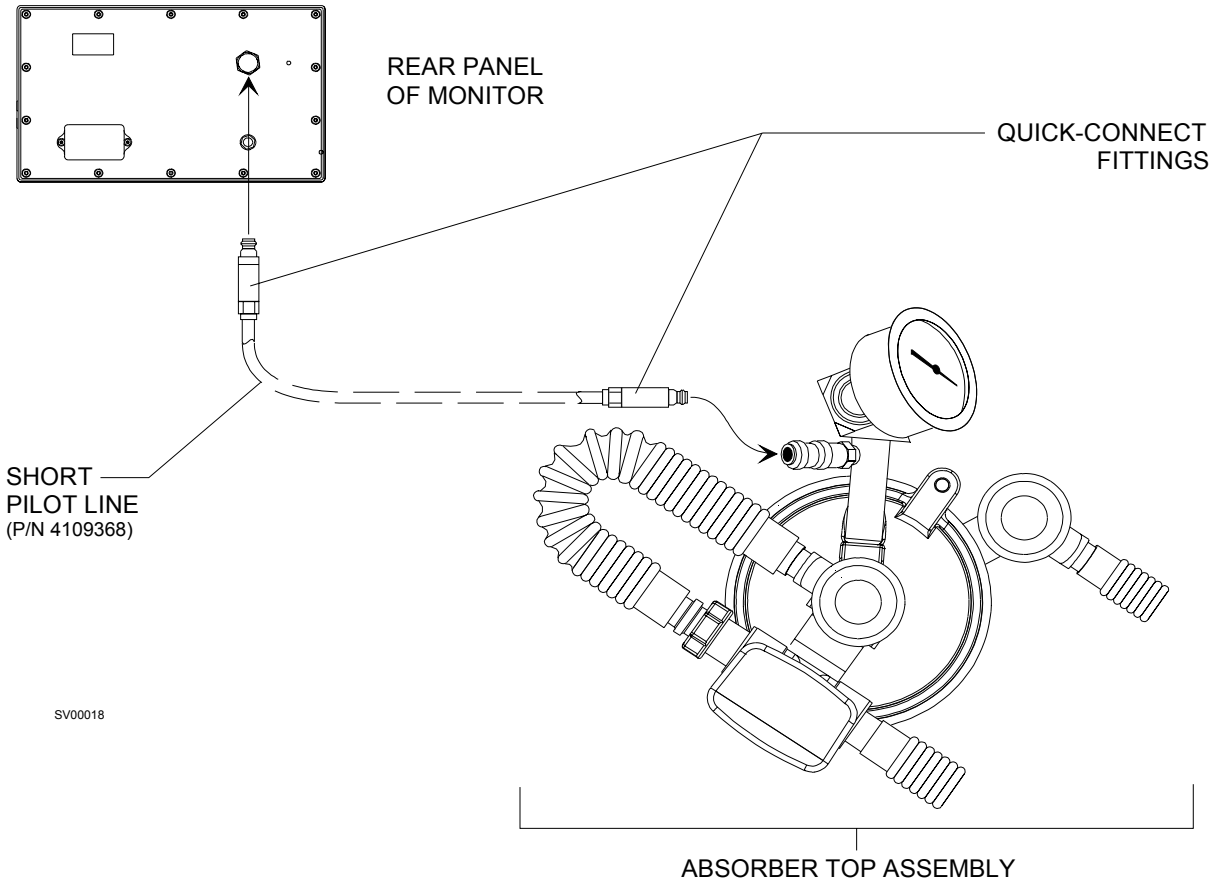
5.7.5 Span Calibration

5.7.5.1 With a test fixture connected as shown in Figure 5-6, apply a pressure of 50 cm H_2O to the pressure sample line.

5.7.5.2 When the displayed current value is stabilized, press the key next to SPAN to store the current value as the new span calibration.

5.7.6 Disconnect the test fixture.

5.7.7 Press the key next to EXIT to return to the Main Service Screen.



PRESSURE MONITOR SERVICE SCREEN

CURRENT PRESSURE VALUE: 250

ZERO CALIBRATION PROCEDURE:
- REMOVE PRESSURE SAMPLE LINE FROM ABSORBER, EXPOSE TO AIR.
- LET CURRENT PRESSURE VALUE STABILIZE
- SELECT “ZERO” KEY TO ENTER CALIBRATION VALUES.

SPAN CALIBRATION PROCEDURE:
- REMOVE PRESSURE SAMPLE LINE FROM ABSORBER, APPLY 50 CMH2O CONSTANT PRESSURE AT THE SAMPLE LINE, VERIFIED BY A KNOWN, CALIBRATED METER.
- LET PRESSURE VALUE STABILIZE
- SELECT THE “SPAN” KEY TO ENTER THE CURRENT VALUE.

ZERO
SPAN
OXY MON
EXIT

Figure 5-5. Pressure Monitor Service Screen

5.8 Vaporizer Interlock Adjustment (MRI-2 machines only)

5.8.1 Turn the System Power switch to STANDBY, and turn each vaporizer handwheel to its Zero position.

5.8.2 Turn the upper vaporizer handwheel ON. The lower vaporizer should now be locked in its zero position. If the lower vaporizer does not lock, remove the cover from the exclusion system (see Figure 5-6) and adjust the lower set screw on the interlock bar until the lower vaporizer handwheel locks properly.

5.8.3 Turn the upper vaporizer handwheel to zero, and turn the lower vaporizer handwheel ON. The upper vaporizer handwheel should now be locked. If not, adjust the upper set screw on the interlock bar until the upper vaporizer handwheel locks properly.

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

5.8.4 Test operate each vaporizer to ensure that its handwheel operates properly while the other vaporizer is locked at Zero.

5.8.5 Reinstall the exclusion system cover when all adjustments are completed.

5.8.6 Set all vaporizers to their Zero position.

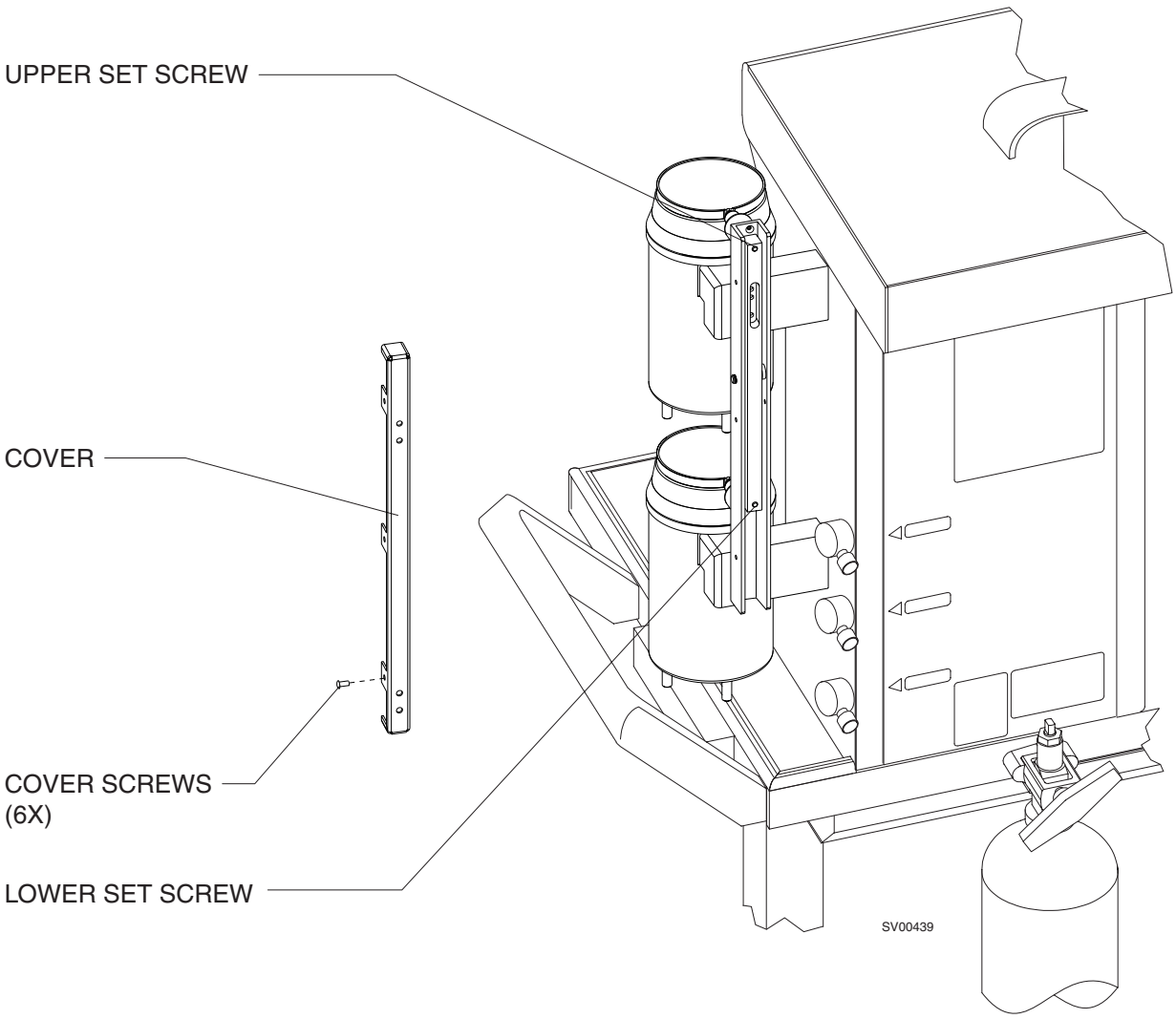


FIGURE 5-6. Vaporizer Interlock Adjustment

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

6.0 PMC Procedure, Narkomed MRI

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 4114551, available from the Draeger Medical, Inc. Technical Service Department, shall be completed by the Technical Service Representative each time a PMC is performed. Space is also provided on the PMC checklist form to record the results of a vapor concentration test.

NOTE: Test equipment listed below with an asterisk (*) requires calibration at a maximum interval of one year. Verify the dates on test equipment calibration labels. DO NOT USE any test equipment with 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 EL number of all calibrated test equipment used. Also record the calibration due dates.

Test Equipment Required:

*-- Multi-Meter (Fluke or Equivalent)

*-- Electrical Safety Analyzer (Biotek 501 Pro or Equivalent)

*-- Test Pressure Gauge, P/N S000063

-- Fresh Gas Outlet Volume Test Device, P/N S010158

-- Fresh Gas Leak Test Device, P/N 4113119

-- Adapter Assembly, Test Terminal, P/N 4104389

*-- Flowmeter Test Stand (Capnomed), P/N S000081

-- Breathing System Leak Test Device, P/N S010159

-- Dow Corning High Vacuum Grease, P/N S4105908

-- Tube, Corrugated, 22 mm x 12 in. long, P/N 9995112

-- Breathing Bag, 3 liter, P/N 9995330

-- Baromed Pressure Test Fixture

*-- Test Minute Volume Meter, P/N 2212300 (or Equivalent)

*-- Digital Pressure Manometer (SenSym PDM 200CD or Equivalent)

*-- Riken Gas Indicator, Model 18

-- Stop Watch

-- Test Lung (P/N 8401892)

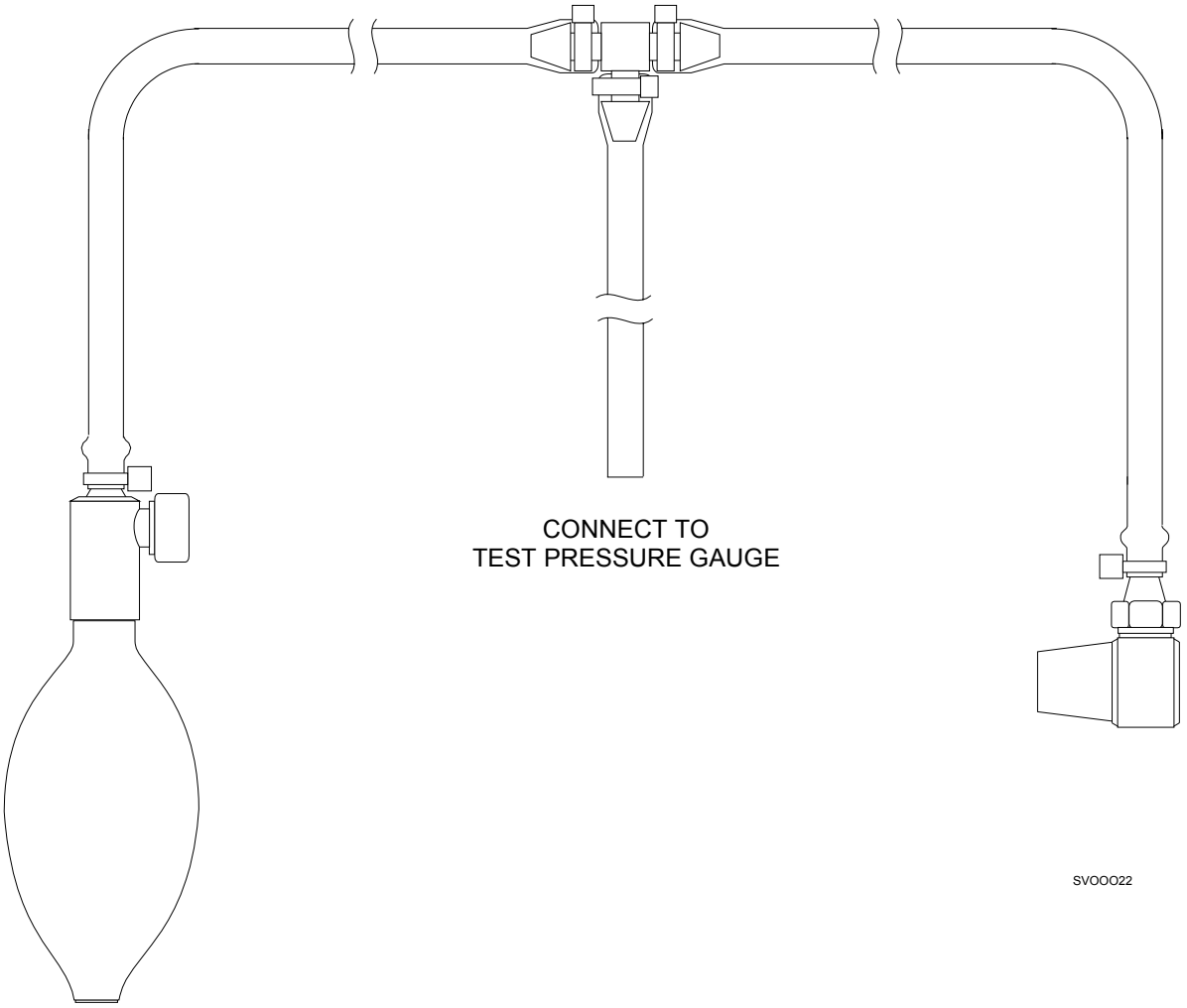
Test equipment illustrations are shown on following pages.

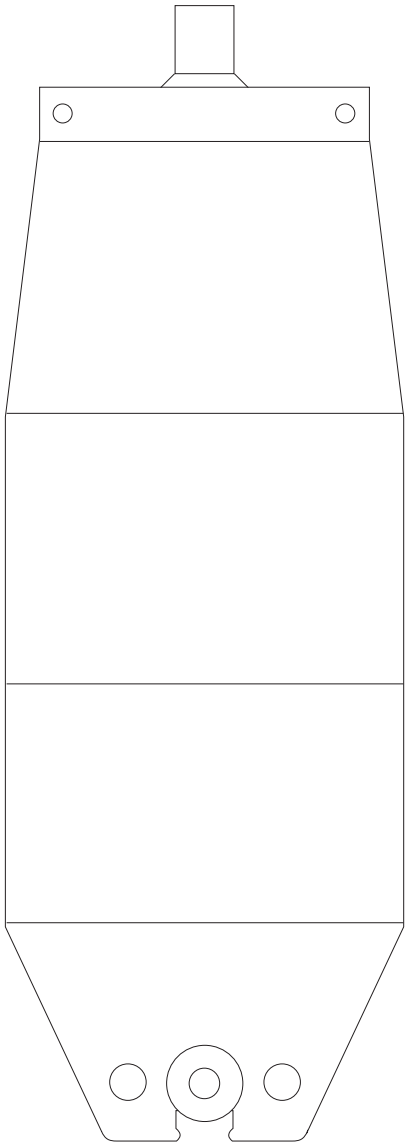
WARNING: Always lock the casters after this anesthesia machine has been positioned in the MRI scanner room. Magnetic attractive forces between the magnet and the anesthesia machine may cause unintentional movement of the anesthesia machine if the casters are unlocked.

WARNING: The power supply charger assembly must not be taken into the magnet room. Damage to the equipment, MRI system, or personal injury could result.

WARNING: The anesthesia machine must be removed from the MRI scanner room before servicing the machine. Do not enter the MRI scanner room with any tools or instruments. These items may be strongly attracted to the magnet and may cause serious injury or death when brought into an MRI scanning room.

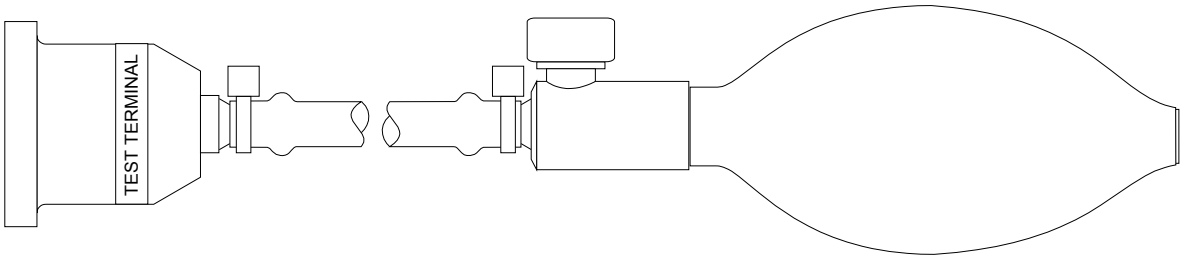
4113119
FRESH GAS LEAK TEST DEVICE



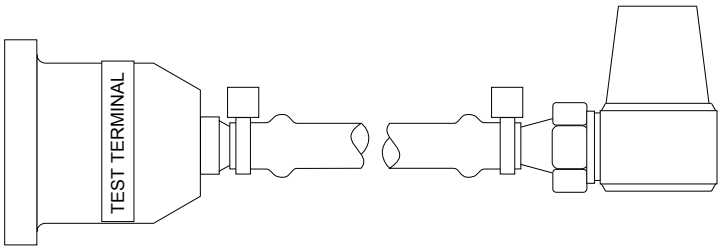


8401892
SIEMENS TEST LUNG

SV00025



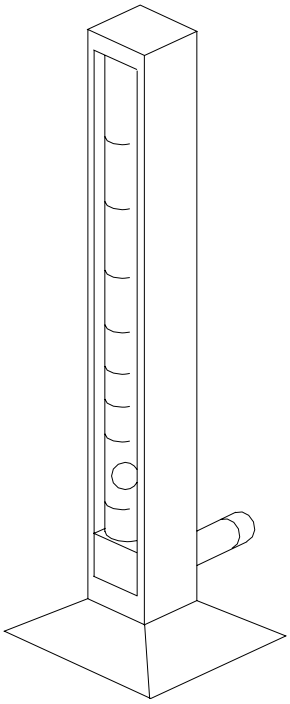
S010159
BREATHING SYSTEM LEAK TEST DEVICE



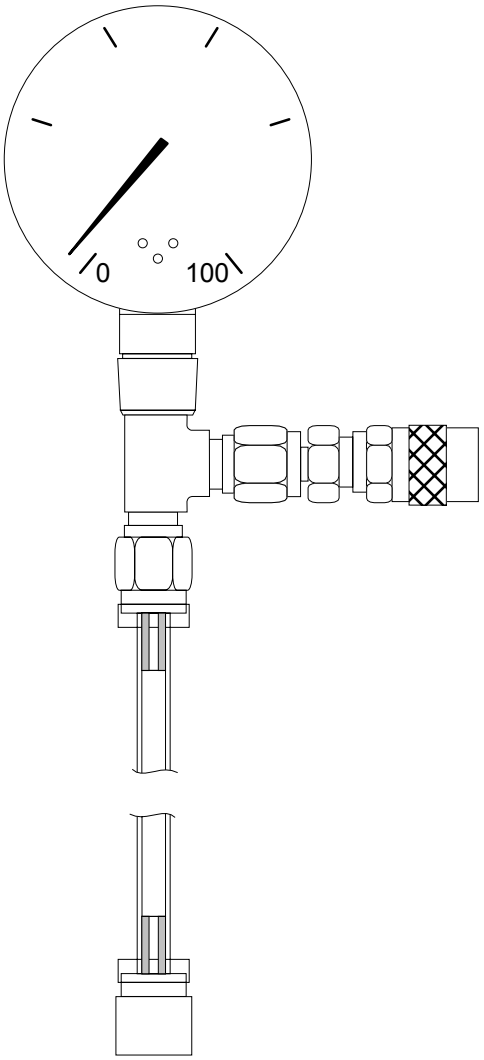
SVOOO23

S010158
FRESH GAS OUTLET VOLUME TEST DEVICE

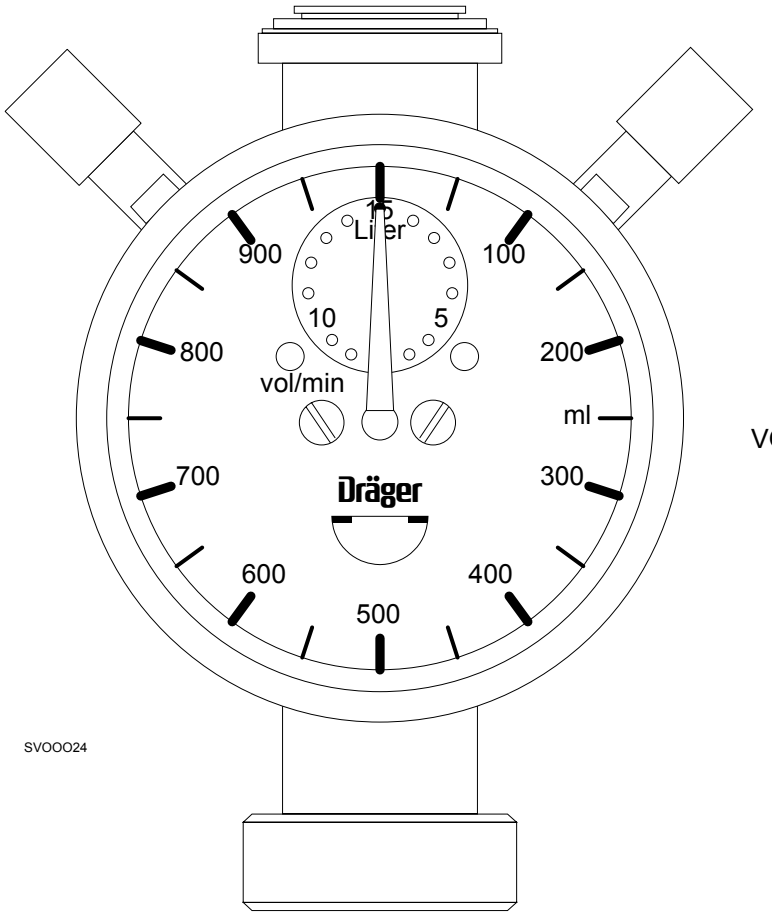
SVOOO27



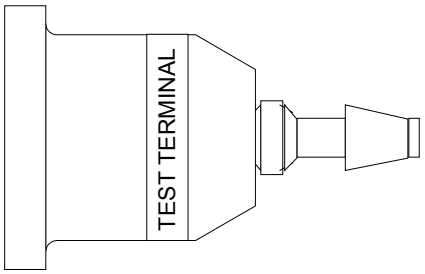
S000081
FLOW METER
TEST STAND



S000063
REGULATOR TEST
PRESSURE GAUGE



2212300
MINUTE
VOLUMETER



4104389
TEST TERMINAL
ADAPTER

Periodic Manufacturer's Certification General Instructions

The purpose of these procedures is to provide detailed instructions for performing a Periodic Manufacturer's Certification (PMC) inspection the Narkomed MRI 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 recommendations apply to machine being inspected. (Only item number 33 - "No Recommendations" shall apply for this certification level.)

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

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

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

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

For example:

A **Narkomed 3** could have recommendation number 21 and failure code 61.1 apply.
21 - No ventilator pressure limit control. Code is B.
61.1 - Enflurane agent is unavailable to test. Code is BC.
Correct certification for this machine is BC, which means CONDITIONALLY CERTIFIED WITH RECOMMENDATIONS.

A **Narkomed 4** could have recommendation numbers 14 and 21 apply.
14 - CO2/Agent monitor exhaust port is not properly connected to the waste gas scavenger. Code B.
21 - No ventilator pressure limit control. Code B.
The correct certification for this machine is B, which means “CERTIFIED WITH RECOMMENDATIONS”.

A **Narkomed 2B, 2C** or **GS** could have recommendation 30 apply.
30 - Anesthesia machine is equipped with inhalation anesthesia vaporizers without an agent analyzer in the breathing system. Code B.
The correct certification for this machine is B, which means “CERTIFIED WITH RECOMMENDATIONS”.

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

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

PM Certification Procedure for Narkomed MRI Anesthesia System

1. Use the PM Certification form for Narkomed MRI Anesthesia Systems (P/N 4114551).

2. Completely fill in the header information.

3. Replace the VENTILATOR RELIEF VALVE DIAPHRAGM in accordance with SP 00075. Place a check mark and the replacement date at “VENT VALVE REPLACEMENT” line on the Periodic Manufacturer’s Certification form.

4. Check all vapor 19 and 19.1 vaporizers for correct labeling. All vaporizers must have a label stating "THE CONCENTRATION OUTPUT OF THIS VAPORIZER SHALL BE VERIFIED AFTER IT HAS BEEN ATTACHED TO THE ANESTHESIA MACHINE" (part # S010015). This label shall be attached to the rear of the vaporizer directly below the mount.

5. All Key Index Safety Systems vaporizers, (K.I.S.S.) must have a label stating "CAUTION: AFTER FILLING HAS BEEN COMPLETED, REINSERT PLUG INTO UPPER FILLER PORT AND TIGHTEN LOCKING SCREW" (part # 4112520-001). This label shall be attached to the vaporizer directly above the keyed filler. Place a check mark at "K.I.S.S. LABEL" on the PM Certification form.

6. 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” writen 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.

7. Perform the vapor concentration test on all Dräger vapor vaporizers in accordance with SP00073. For every vaporizer tested, fill out a "VAPOR VAPORIZER CALIBRATION CHECK" label (part # S010016). Information on this label shall include your signature, type of agent, date tested, test results @ 1%, 2.5%, 4%, and a PASS or FAIL indication. This label shall be attached to the upper right side of the vaporizer. If vaporizer fails the concentration test, check "NO" in the "RECOMMENDED FOR USE" section on the PM Certification form.

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

PM Certification Procedure for Narkomed MRI Anesthesia System

8. 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.

9. Based on the "EQUIPMENT CONDITION" inspect the machine for any "DMI RECOMMENDATIONS" that would apply. Use the Narkomed MRI section of the "DMI 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.

10. Determine the correct certification level of the machine based on the combined lowest common denominator of "Equipment Conditions" and "Failure Codes". If the machine is at least conditionally certified fill out the "PM CERTIFICATION" label. Check the box(s) on the validation label where appropriate. Write the month and year, (three months from date of PM Certification) next to "NEXT VISIT DUE:" If certification level is "D", machine shall not receive a "PM CERTIFICATION" label. Any machine not receiving a PM Certification label shall receive a "WARNING NOT CERTIFIED" label. This label shall be placed at a prominent location on the left side of the machine after all other previous PMC and Vigilance Audit Validation labels have been removed.

11. 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.

12. If applicable, remove the previous PM CERTIFICATION VALIDATION label and attach the new label (P/N S010006 w/phone #, or P/N S010007 w/o phone #) in a prominent location on the rear of the anesthesia machine.

13. Check the appropriate boxes on the "PM CERTIFICATION NOTICE" label, (part # S010011). If the machine is not certified, the last box of this notice label shall be marked. Attach this notice to the flow shield of the anesthesia machine.

14. Have the customer sign each PM Certification form or the Executive Summary, and review the equipment conditions and the recommendations with the customer.

15. Return top copy to Draeger Medical, Inc. Service Department, keep middle copy for service organization records, give bottom copy to customer.

6.1 Safety Testing

6.1.1 Circuit Isolation Test

6.1.1.1 Turn the System Power switch to STANDBY, remove the AC power cord from the outlet.

6.1.1.2 Set a multimeter to its highest resistance range, and carefully check for continuity between Pin 1 of the machine power connector located at the rear of the machine and any exposed unpainted surface of the machine chassis. There shall be no continuity between these points.

6.1.1.3 Reconnect the power cable to the machine power connector.

6.1.2 Protective Ground Continuity Test

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

6.1.2.1 Plug the Biotec 501 Pro power cord into a live receptacle; place the power switch of the Biotek 501 Pro to the “1” or ON position and ensure that the keys marked GROUND, NEUTRAL and POLARITY are in the NORMAL position.

NOTE: If the corresponding red LEDs for GND, NEU and POL are not lighted, they are in the normal position.

6.1.2.2 Attach the ground lead from the red Test Lead input to the ground hole of the AC test receptacle on the Biotec 501 Pro. Select the Single Lead condition by ensuring that the SINGLE/DUAL key is not illuminated. Press the gray key marked RESIST, then press the blue key marked CAL. When the word CAL is no longer shown in the display window of the Biotec 501 Pro, you may proceed.

6.1.2.3 Remove the red lead from the ground hole of the AC test receptacle and attach the alligator clip to the free end, leaving the other end plugged into the red Test Lead input of the Biotec 501 Pro with the Single Lead and Resistance conditions still selected. Attach the alligator clip to any exposed unpainted surface of the machine chassis.

6.1.2.4 Plug the charger cord into the test receptacle of the 501 Pro. The resistance reading then shown on the Biotec 501 Pro display is the Chassis Resistance. Bend and exercise the power cord to check for intermittent readings. Record the reading on the PMC form. (≤0.1 ohm)

6.1.3 Chassis Leakage Current Test

6.1.3.1 Press the gray Leakage key. Leave all other selections from the previous test the same.

6.1.3.2 Set the white keys on the Biotec 501 Pro labeled GROUND, NEUTRAL and POLARITY for normal polarity. Record the reading on the PMC form. (0 µA)

6.1.3.3 Set the white keys for NORMAL ground, OPEN neutral and NORMAL polarity. Verify reading is zero. (0 µA)

6.1.3.4 Set the white keys for OPEN ground, NORMAL neutral and NORMAL polarity. Record the reading on the PMC form. Note: Old power supply: ≤150 µA but not zero. New power supply: ≤120 µA but not zero.

6.1.3.5 Set the white keys for NORMAL ground, NORMAL neutral and REVERSE polarity. Record the reading on the PMC form. (0 µA)

6.1.3.6 Set the white keys for NORMAL ground, OPEN neutral and REVERSE polarity. Verify reading is zero. (0 µA)

6.1.3.7 Set the white keys for OPEN ground, NORMAL neutral and REVERSE polarity. Record the reading on the PMC form. Note: Old power supply: ≤150 µA but not zero. New power supply: ≤120 µA but not zero.

6.1.3.8 Return the white keys on the Biotec 501 Pro to their Normal positions.

6.2 Self-Diagnostics: Core-M Monitor

6.2.1 Connect the pipeline supply or open the cylinders.

6.2.2 Turn the System Power switch to ON.

6.2.3 Verify that the Omicron monitor LCD display and LED lamps performs a self-diagnostic test.

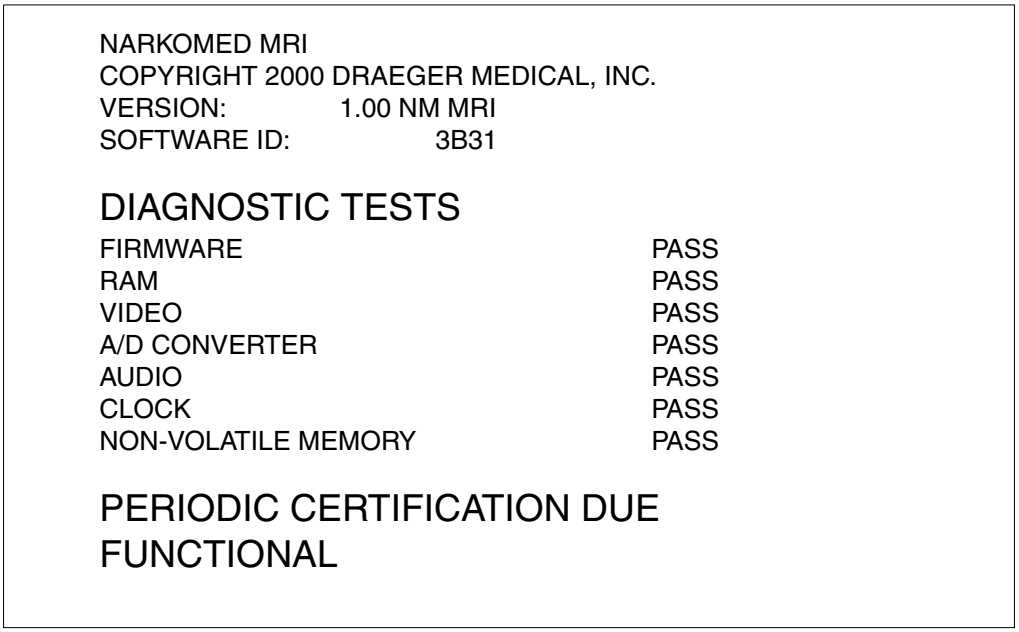
6.2.4 Verify that the green "Power" LED activates.

6.2A Self-Diagnostics: VPO Monitor

6.2.A.1 Connect the pipeline supply or open the cylinders.

6.2.A.2 Turn the System Power switch to ON.

6.2.A.3 Verify that the following is displayed:



(✓) 6.2.A.4 Record the machine software version on the header of the checklist form.

6.2B CONFIGURATION: VPO Monitor

6.2B.1 Press the CONFIG key.

6.2B.2 The CONFIGURE screen is displayed.

6.2B.3 Verify the correct Time and Date.

6.2C SERVICE DATA: VPO Monitor

6.2C.1 Press and hold the Oxygen High Limit key and the Volume Low Limit key, and then press the ▲ key.

6.2C.2 The Main Service Screen appears.

(✓) 6.2C.3 Record the Last Service Date on the PMC form.

(✓) 6.2C.4 Record the Hours Run Since Last Service on the PMC form.

(✓) 6.2C.5 Record the Total Hours Run on the PMC form.

6.2C.6 Select and enter the Service Log.

6.2C.7 Verify any pertinent information from the Service Log. Contact the Draeger Medical, Inc. Technical Service Department if necessary.

6.2C.8 Press EXIT to return to the Main Service screen.

6.2C.9 Select the SRVC Service Code.

6.2C.10 Select and enter your Technical Service Rep. I.D. number.

(✓) 6.2C.11 Press the RESET key. This resets the last service date to the current date and resets the hours run since last service to zero.

6.2C.12 Press the PMS SCHED key.

(✓) 6.2C.13 Select and enter the month of the next service due date. The internal clock of the machine limits the amount of date advance to a maximum of six months from the current service date.

6.3 Battery Circuit Test

6.3.1 Deleted

6.3.2 If needed, replace the battery as outlined in the Battery Replacement Procedure in Section 4 of this manual/

6.3.3 Is "ON" LED lighted? __ (Y)

6.3.4 With the System Power switch ON, unplug the AC power cord.

6.3.5 Is yellow "AC PWR FAIL" LED lighted as long as the power cord is unplugged? __ (Y)

6.3.6 Press and hold the "BATTERY TEST" button.

6.3.7 Is green Battery Test LED lighted as long as "BATTERY TEST" button is depressed? __ (Y)

6.3.8 Release the "BATTERY TEST" button.

6.3.9 Restore AC power to the machine.

6.3.10 Does the "AC PWR FAIL" LED extinguish? __ (Y)

6.4 High Pressure Leak Test

6.4.1 Yoke Assemblies

6.4.1.1 Turn the ventilator off.

6.4.1.2 Turn the System Power switch to STANDBY.

6.4.1.3 Disconnect the pipeline supply or close the cylinders.

6.4.1.4 Remove cylinder or yoke plug from each yoke assembly.

6.4.1.5 Do all the yoke handles adjust smoothly? ___ (Y)

6.4.1.6 Are the two (2) yoke pins installed securely in each yoke? ___ (Y)

6.4.1.7 Is there only one (1) cylinder washer on each yoke assembly? ___ (Y)

6.4.1.8 Is there a yoke plug attached to each yoke assembly? ___ (Y)

6.4.1.9 Is the proper gas I.D. label affixed to each yoke assembly? ___ (Y)

6.4.1.10 Attach a cylinder to each yoke assembly, open the cylinder valve, let the pressure stabilize, close the cylinder valve, and remove the cylinder from the yoke assembly.

6.4.1.11 Does the yoke check valve assembly prevent the escape of excessive pressure? ___ (Y)

6.4.1.12 Attach the cylinders to the yokes.

6.4.2 Oxygen High Pressure Leak Test

6.4.2.1 Disconnect the pipeline supplies.

6.4.2.2 Turn the System Power switch to STANDBY.

6.4.2.3 Open the oxygen cylinder valve.

6.4.2.4 Let the pressure stabilize.

6.4.2.5 Close the oxygen cylinder valve and remove the cylinder.

6.4.2.6 Observe the oxygen cylinder pressure gauge.

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

6.4.2.8 Attach the cylinder.

6.4.3 Nitrous Oxide High Pressure Leak Test

6.4.3.1 Turn the System Power switch to ON.

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

6.4.3.3 Adjust the oxygen flow to 8 l/min.

6.4.3.4 Let the pressure stabilize.

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

6.4.3.6 Observe the nitrous oxide cylinder pressure gauge.

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

6.4.3.8 Attach the cylinder.

6.4.3.9 Close the oxygen flow control valve.

6.5 High Pressure Regulator Test

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

6.5.2 Close all cylinder valves except the O_2 valve.

6.5.3 Set the oxygen flow to 5 liters per min.

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

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

6.5.6 Set the System Power switch to STANDBY.

6.5.7 Remove the table top from the machine.

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

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

NOTE: Two test gauges are required to avoid contamination of the O_2 circuit from the other gases: a dedicated test gauge for O_2, and a second test gauge for the other gases.

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

6.5.11 Set the oxygen flow to 4 liters per min.

6.5.12 On the test gauge, what is the regulator output pressure? ___PSI (42-48)

NOTE: Leave the dedicated O_2 test gauge connected for later use in the Oxygen Supply Pressure Alarm Test.

6.5.13 Set the System Power switch to STANDBY.

6.5.14 For the other pressure regulators, locate their corresponding TEE fittings in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting (one at a time).

6.5.15 Connect the second test gauge to the TEE fitting.

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

6.5.17 Set the corresponding flow to 4 l/min. (900 ml/min. for CO_2).

6.5.18 On the second test gauge, what is the regulator output pressure? ___ PSI (42 - 48), (27 - 33 for CO_2)

6.5.19 Depressurize the gas circuit.

6.5.20 Remove the test gauge and replace the plug in the TEE fitting.

6.5.21 Repeat the test for all other gases.

6.6 Gauges

6.6.1 Cylinder Gauges

6.6.1.1 Are the pressure gauges correct for the gases indicated by the flowmeters? ___ (Y)

6.6.1.2 Is the gauge closest to the table top for cylinder supply pressure? ___ (Y)

6.6.1.3 Bleed all pressure from the cylinder circuit.

6.6.1.4 Are the cylinder gauges at zero (0) PSI? ___ (Y)

6.6.1.5 Open the cylinder valves.

6.6.1.6 Do the cylinder pressure gauges respond properly? ___ (Y)

6.6.1.7 Are the gauges labeled "Non-Magnetic"? ___ (Y)

6.6.2 Pipeline Gauges

6.6.2.1 Are the gauges below the flowmeters for pipeline supply pressure? ___ (Y)

6.6.2.2 Are the pipeline pressure gauges at zero (0) PSI? ___ (Y)

6.6.2.3 Connect the pipeline supply.

6.6.2.4 Do the pipeline pressure gauges respond properly? ___ (Y)

6.6.2.5 Are the correct gas identification labels affixed at each of the pipeline inlets? ___ (Y)

6.6.2.6 Does the back panel identify each of the pipeline inlets properly? ___ (Y)

6.6.2.7 Are the gauges labeled "Non-Magnetic"? ___ (Y)

6.7 Oxygen Supply Failure Protection

6.7.1 Nitrous Oxide O.F.P. Device

6.7.1.1 Disconnect the pipeline supplies.

6.7.1.2 Open and close the oxygen cylinder valve.

6.7.1.3 Open the nitrous oxide cylinder valve.

6.7.1.4 Set the O_2 and N_2O flows to 4 l/min.

6.7.1.5 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ___ (Y)

6.7.1.6 Connect the O_2 pipeline supply.

6.7.1.7 Close the nitrous oxide cylinder valve and bleed the pressure from the circuit.

6.7.1.8 Connect the N_2O pipeline supply.

6.7.1.9 Disconnect the O_2 pipeline supply.

6.7.1.10 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ___ (Y)

6.7.1.11 Close the nitrous oxide flow control valve.

6.7.2 Air O.F.P. Device - If Applicable

6.7.2.1 Connect the air pipeline supply.

6.7.2.2 Open one (1) oxygen cylinder valve.

6.7.2.3 Set the air flow to 4 l/min; set the oxygen flow to 4 l/min.

6.7.2.4 Close the oxygen cylinder valve.

6.7.2.5 Does the flow of air cease when the oxygen pressure is depleted? ___ (Y)

6.7.2.6 Close the air flow control valve.

6.7.3 Oxygen Supply Pressure Alarm

6.7.3.1 If not already connected, connect a dedicated O_2 test gauge to the TEE fitting in the O_2 regulator output line.

6.7.3.2 Open and close an oxygen cylinder.

6.7.3.3 Set the oxygen flow to 2 l/min.

6.7.3.4 What is the pressure on the dedicated O_2 test gauge when the "O2 SUPPLY PRESSURE" LED turns on? ___ PSI (34-40)

6.7.3.5 Close the flow control valve.

6.7.3.6 Remove the test gauge from the TEE fitting in the O_2 regulator output line and replace the plug.

6.8 Flowmeter Test

6.8.1 Oxygen Flowmeter Test

6.8.1.1 Open the O_2 cylinder valve.

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

6.8.1.3 Close the O_2 cylinder valve and bleed the pressure.

6.8.1.4 Connect the O_2 pipeline supply.

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

6.8.1.6 Close the oxygen flow control valve.

6.8.1.7 What is the minimum flow of oxygen? ___ ml (100-200) ml/min

6.8.2 Nitrous Oxide Flowmeter Test

6.8.2.1 Set the oxygen flow to 4 l/min.

6.8.2.2 Open the nitrous oxide cylinder valve.

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

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

6.8.2.5 Connect the N_2O pipeline supply.

6.8.2.6 Is the correct flow control knob and label attached to the N_2O flow control valve? ___ (Y)

6.8.2.7 Close the oxygen and nitrous oxide flow control valves.

6.8.3 Air Flowmeter Test

6.8.3.1 Connect the Air pipeline supply (if applicable) and verify operation of the air flowmeter.

6.8.3.2 Close the air flow control valve and disconnect the Air pipeline supply.

6.8.3.3 Is the correct flow control knob and label attached to the air flow control valve? ___ (Y)

6.8.4 Auxiliary Oxygen Flowmeter Test - If Applicable

6.8.4.1 Close the flowmeter flow control valve.

6.8.4.2 Connect a cm H_2O pressure manometer to the outlet.

6.8.4.3 Is there an increase in pressure? ___ (N)

6.8.4.4 Remove the gauge and test fixture.

6.8.4.5 Is it possible to adjust the flow over the full range of the flowmeter? ___ (Y)

6.8.4.6 Set the flow rate to 5 l/min.

6.8.4.7 Hold the sensor from a calibrated O_2Med at the flowmeter outlet.

6.8.4.8 After 90 seconds, what is the oxygen concentration? ___ % (97-100)

6.8.4.9 Remove the O_2Med sensor.

6.8.4.10 Close the flowmeter flow control valve.

6.9 Freshgas Leak Test

6.9.1 Turn the System Power switch to STANDBY.

6.9.2 Remove the 15 mm connector from the FRESHGAS OUTLET.

6.9.3 Is the common gas outlet assembly in good condition? ___ (Y)

6.9.4 Connect a digital pressure manometer and Fresh Gas Leak Test Device to the freshgas outlet.

6.9.5 Apply 50 cm H_2O of pressure to the system.

6.9.6 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

6.9.7 Turn on the left mounted vaporizer to the first graduated marking.

6.9.8 Apply 50 cm H_2O of pressure to the system.

6.9.9 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

6.9.10 Turn off the vaporizer.

6.9.11 Remove the test equipment from the Fresh Gas Outlet.

6.9.12 Turn the System Power switch to ON.

6.9.13 Open the O_2 flow control valve to 5 l/min., purge the system for 5 seconds, then close the O_2 flow control valve.

6.9.14 Turn the System Power switch to STANDBY.

6.9.15 Connect the 15 mm connector from the breathing system.

6.9.16 Is the FRESHGAS OUTLET label on the freshgas outlet? ___ (Y)

6.10 Absorber System

6.10.1 Absorber System Inspection

6.10.1.1 Remove the inspiratory and the expiratory valve domes.

6.10.1.2 Is there a broken or bent pin on the valve assembly?
Inspiratory ___ (N) Expiratory ___ (N)

6.10.1.3 Is there a broken pin on the valve domes?
Inspiratory ___ (N) Expiratory ___ (N)

6.10.1.4 Is the valve disc in good condition?
Inspiratory ___ (Y) Expiratory ___ (Y)

6.10.1.5 Are the valve dome washers in good condition? ___ (Y)

6.10.1.6 Reinstall the inspiratory and expiratory valve domes.

6.10.1.6A Remove the ultrasonic flow sensor connector hose - if applicable.

6.10.1.6B Is the connector hose, connector, and O-ring in good condition? ___ (Y) - if applicable.

6.10.1.6C Remove the ultrasonic flow sensor from the mounting bracket - if applicable.

6.10.1.6D Remove the flow housing/transducer assembly from the electronics housing - if applicable.

6.10.1.6E Remove both transducers from the flow housing; examine each O-ring and condition of all components, then reassemble - if applicable.

6.10.1.7 Remove the inspiratory and expiratory valve assemblies.

6.10.1.8 Are the two (2) washers in good condition? ___ (Y)

6.10.1.9 Reinstall the inspiratory valve.

6.10.1.10A Reinstall the expiratory valve and the connector hose between the expiratory valve and the ultrasonic flow sensor - if applicable.

6.10.1.10 Are the two (2) spring clips on the absorber rods?___ (Y)

6.10.1.11 Inspect the following: canisters and gaskets, dust cup and O-ring, condition of soda lime.

6.10.1.12 Are the canisters and dust cup in good condition?___ (Y)

6.10.1.13 Is the cm H_2O gauge at zero (0)? ___ (Y)

6.10.1.14 Verify that the gauge is labeled "Non-Magnetic."

6.10.1.15 Remove the O_2Med sensor plug from the inspiratory valve dome adapter and examine the two O-rings at the bottom of the plug.

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

6.10.1.17 Reinstall the O_2Med sensor plug into the inspiratory valve dome adapter.

6.10.2 Absorber System Leak Test

6.10.2.1 Turn the System Power switch to STANDBY.

6.10.2.2 Close all flow control valves.

6.10.2.3 Short-circuit the inspiratory and expiratory valves with a 12-inch hose.

6.10.2.4 Attach a test terminal with a cuff inflation bulb (P/N S01059) to the bag mount.

6.10.2.5 Set the Man/Auto selector valve to BAG.

6.10.2.6 Close the APL valve.

6.10.2.7 Apply 50 cm H_2O pressure to the absorber system.

6.10.2.8 After 30 seconds, what is the pressure in the absorber system? ___ cm H_2O ($\geq$30)

6.10.3 APL Valve Test

6.10.3.1 Open the APL valve to its stop.

6.10.3.2 Turn the SYSTEM POWER switch to ON.

6.10.3.3 Set the oxygen flow to 8 l/min.

6.10.3.4 What is the pressure on the absorber pressure gauge? ___ cm H_2O ($\leq$3)

6.10.3.5 Close the oxygen flow control valve, turn the System Power switch to STANDBY, and remove the test terminal from the bag mount.

6.10.4 Absorber Flow Direction and Leak Test

6.10.4.1 Expiration Valve Leak Test

6.10.4.1.1 Close the APL valve.

6.10.4.1.2 Connect a 22mm hose between the inspiration valve and the bag mount.

6.10.4.1.3 Connect a test terminal to the expiration valve or expiratory hose terminal on the ultrasonic flow sensor, it applicable.

6.10.4.1.4 Connect a Capnomed flowmeter to the test terminal.

6.10.4.1.5 Turn the System Power switch to ON, turn up the oxygen flow until the system pressurizes to 30 cmH_2O.

6.10.4.1.6 Verify that the value indicated on the flowmeter is _60ml/min.

6.10.4.1.7 Remove all test equipment, and turn the System Power switch to STANDBY.

6.10.4.2 Inspiratory valve leak test

6.10.4.2.1 Connect a test terminal to the inspiratory valve.

6.10.4.2.2 Connect a tee adapter and calibrated pressure meter to the test terminal.

6.10.4.2.3 Connect a pressure bulb to the open port of the tee adapter.

6.10.4.2.4 Connect another test terminal to the bag connector.

6.10.4.2.5 Connect a Capnomed flowmeter to the test terminal on the bag mount.

6.10.4.2.6 Pressurize the system to 30 cmH_2O.

6.10.4.2.7 Verify that the flow meter indicates _60 ml/min.

6.10.4.2.8 Remove all test equipment.

6.10.4.2.9 Open the APL valve.

6.10.4.3 Flow Direction Test

6.10.4.3.1 Attach a breathing circuit with a 3-liter bag at the Y-piece to the inspiration valve and expiration valves or the expiratory hose terminal on the ultrasonic flow sensor, if applicable.

6.10.4.3.2 Attach a 3-liter bag to the swivel bag mount.

6.10.4.3.3 Turn the System Power switch to ON.

6.10.4.3.4 Set the O_2 flow to 4 l/min.

6.10.4.3.5 Inflate the simulated lung by briefly using the O_2 Flush.

6.10.4.3.6 Partially close the APL valve.

6.10.4.3.7 Squeeze the breathing bag attached to the bag mount at a rate of approximately 10 BPM. Readjust the APL valve if required to properly ventilate the simulated lung.

6.10.4.3.8 Observe the operation of each unidirectional valve disc at eye level and make sure the inspiratory valve disc raises only during the inspiration phase, and the expiratory valve raises only during the exhalation phase. Watch the valves until satisfied that both valves operate correctly, and move freely without sticking.

6.10.4.3.9 Open the APL valve.

6.10A Bain Circuit Adapter - if applicble

6.10A.1 Close the APL valve by turning the knob fully clockwise.

6.10A.2 Insert the O_2 sensor plug into the O_2 sensor inlet on the Bain Circuit.

6.10A.3 Attach a test terminal with a cuff inflation bulb (P/N S010159) to the Breathing Bag port on the Bain Circuit.

6.10A.4 Attach a cmH_2O digital pressure meter to the female quick connect connection on the Bain Circuit.

6.10A.5 Occlude the expiration port on the Bain Circuit.

6.10A.6 Apply 50cmH_2O to the Bain Circuit via test terminal and inflation bulb.

(✓) 6.10A.7 After 30 seconds, what is the pressure on the cmH_2O digital pressure meter? (45 to 50 cmH_2O)

6.10A.8 Verify that the pressure indicated on the cmH_2O gauge is within 3 cmH_2O of the digital pressure meter reading.

6.10A.9 Open the APL valve by turning the knob fully counter-clockwise.

6.10A.10 Connect a test hose from the fresh gas outlet to the Expiration port of the Bain Circuit.

6.10A.11 Set the O_2 flow to 10 L/min.

(✓) 6.10A.12 What is the pressure on the cmH_2O digital pressure meter? (_ 3 cmH_2O)

6.10A.13 Verify that the pressure indicated on the cmH_2O gauge is within 3 cmH_2O of the digital pressure meter reading.

6.10A.14 Remove the test terminal and inflation bulb from the Breathing Bag port.

6.10A.15 Return all controls to their original positions.

6.10B Vapor Exclusion System (if applicable)

6.10B.1 Set all vapors to (0).

6.10B.2 Adjust the handwheel on the upper vapor (viewed from the front of the machine) to any concentration above zero (0).

6.10B.3 Is it possible to adjust the lower vapor? ___ (N)

6.10B.4 Set the handwheel on the upper vapor to zero (0).

6.10B.5 Adjust the handwheel on the lower vapor to any concentration above zero (0).

6.10B.6 Is it possible to adjust the upper vapor? ___ (N)

6.10B.7 Return the handwheel on the lower vapor to zero (0).

6.11 Flow and Pressure Calibration: Core-M Monitor

NOTE: A "FLOW CAL" message must appear on the display prior to continuing with testing. This message appears after the 15 minute warm up period has completed.

6.11.1 Deleted

6.11.2 Verify that a flow sensor is attached to the volume sensor pilot line.

6.11.3 Remove the flow sensor from the absorber system.

6.11.4 Press the "FLOW CAL" key with the flow sensor exposed to room atmosphere.

6.11.5 Verify that the flow calibration has successfully completed.

6.11A Flow and Pressure Calibration: VPO Monitor

6.11A.1 To bring up the Oxygen Monitor Service Screen, press the Mon Cal key.

6.11A.2 Remove the oxygen sensor from the valve dome adapter, and remove the oxygen sensor capsule from the oxygen sensor housing.

(✓) 6.11A.3 When the CURRENT CELL A and CURRENT CELL B readings have stabilized, press the ZERO key and verify that the new offset values are stored.

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

6.11A.4 Put the oxygen sensor capsule into the oxygen sensor housing.

6.11A.5 Press the PRESS MON key.

6.11A.6 Disconnect the Baromed breathing pressure sensor line from the absorber and expose it to air.

6.11A.7 Let the Current Pressure Value stabilize and press the ZERO key to store the value.

6.11A.8 Connect a test fixture and a calibrated digital pressure manometer to the breathing pressure sensor line.

6.11A.9 Pressurize the circuit to 50 cm H_2O and allow the Current Value to stabilize.

(✓) 6.11A.10 Press the SPAN key and verify that the new span values are stored.

6.11A.11 Release the pressure, disconnect the manometer and test fixture, and reconnect the breathing pressure sensor line to the absorber.

6.11A.12 Press EXIT to return to the Main Service screen.

6.11A.13 Press EXIT to return to normal operation.

6.12 Oxygen Cal and Alarm Test: Core-M Monitor

6.12.1 Expose the O_2 sensor to room air.

6.12.2 Press the "O_2" key on the monitor.

6.12.3 Press the "21% O_2 CAL" key for 3 seconds.

6.12.4 What is the oxygen concentration? ___% (20-22)

6.12.5 Set the oxygen low alarm limit to 30, and pres the O_2 monitor key.

6.12.6 Verify that the "O_2 LO LMT" and "Hi Alert" audible and visual alarms activate within 5 seconds.

6.12.7 Press the Alarm Silence key and verify that the audible alarm stops.

6.12.8 Set the oxygen low alarm limit to 18.

6.12.9 Place the sensor into the valve dome, set the oxygen flow to 4 l/min., set the Man/Auto selector to BAG, close the APL valve, attach a 12 inch hose to the inspiratory valve and occlude the bag mount. Press the O_2 Flush button for 5 seconds.

6.12.10 Allow a few moments for the sensor to purge, and press the "100% CAL" key.

6.12.11 What is the oxygen concentration? ___% (97 to 100)

6.12.12 Set the oxygen high alarm limit below 100, and press the O_2 monitor key.

6.12.13 Verify that the "O_2 HI LMT" and "Low Alert" audible and visual alarms activate within 5 seconds.

6.12.14 Set the oxygen high limit to 100 (blank equals 100) and restore all controls to their original positions.

6.12A O2 MED: VPO Monitor

6.12A.1 Disconnect the oxygen sensor cable from the Oxygen Sensor interface.

6.12A.2 The following message shall appear on the display: O2 SENS DISC.

6.12A.3 Reconnect the O_2 Med sensor.

6.12A.4 The following message shall appear on the display: CAL O2 SENSOR.

6.12A.5 Press the Cal key.

NOTE: Make sure that the sensor has stabilized in ambient air for several minutes.

(✓) 6.12A.6 After calibration is completed, what is the oxygen concentration? ___ % (21)

6.12A.7 This step intentionally left blank.

6.12A.8 The warning INSP O2 LOW shall appear on the display and the warning heading shall be flashing. There shall be a continuous audible alarm.

6.12A.9 What is the low oxygen alarm default? ___ % (30)

6.12A.10 This step intentionally left blank.

6.12A.11 Select the OXYGEN LOW alarm limit. Does a box appear around the low alarm limit? ___ (Y)

6.12A.12 Verify that the low alarm limit has a range from 18 to 99%.

6.12A.13 Place the oxygen sensor into the inspiratory valve dome adapter, set the Man/Auto selector BAG, close the APL valve. Attach a 12-inch hose to the inspiratory valve and occlude the bag mount.

6.12A.14 Set the oxygen flow to 4 l/min.

6.12A.15 Set the low limit to 18, and verify that the INSP O2 LOW message has cleared.

6.12A.16 Select the OXYGEN HIGH alarm limit. Does a box appear around the high alarm limit? ___ (Y)

6.12A.17 What is the high oxygen alarm default? ___ % (100)

6.12A.18 Verify that the high alarm limit has a range from 100 to 19%.

6.12A.19 Set the high alarm limit to 95.

6.12A.20 The message INSP O2 HIGH shall appear as an Advisory.

6.12A.21 Return the high alarm limit to 100.

6.12A.22 The INSP O2 HIGH message shall disappear.

(✓) 6.12A.23 Within 3 minutes, what is the oxygen concentration? ___ % (97-100)

6.13 Pressure Accuracy Test: Core-M Monitor

6.13.1 Interconnect the inspiratory and expiratory valves with a 12 inch hose with 22 mm ends (P/N 9995112).

6.13.2 Connect a pressure meter to the breathing pressure pilot line fitting on the absorber.

6.13.3 Attach a test terminal (P/N 4104389) with a cuff inflation bulb and hose assembly (P/N 4109398) to the bag mount.

6.13.4 Set the Man/Auto selector valve to BAG, and close the APL valve.

6.13.5 Press the PRES key on the monitor.

6.13.6 Pressurize the system to 30 cmH_2O on the pressure meter.

6.13.7 Depressurize the absorber system and verify that the monitor display indicates 28 to 32 cmH_2O.

6.13.8 Set the Pressure Hi Limit to 50, and press the PRES key on the monitor.

6.13.9 Pressurize the system above 50 cmH_2O on the pressure meter and verify that the pressure "Hi Limit" and "Hi Alert" audible and visual alarms activate within 5 seconds.

6.13.10 Remove the pressure meter from the absorber system, and disable all alarms by pressing the APNEA STBY key.

6.13A BAROMED: VPO Monitor

6.13A.1 Disconnect the breathing pressure sensor line from the absorber.

6.13A.2 Connect a test pressure gauge and syringe to the breathing pressure sensor line.

6.13A.3 Select the THRESHOLD PRES alarm limit. Does a number appear to the left of the threshold line on the waveform? ___ (Y).

6.13A.4 What is the threshold alarm default? ___ cm H_2O (12)

6.13A.5 Verify that the threshold alarm limit has a range from 5 to 30 cm H_2O.

6.13A.6 Adjust the threshold to 10 cm H2O.

6.13A.7 Select the PRESSURE HIGH alarm limit. Does a box shall appear around the High Pressure Alarm Limit? ___ (Y)

6.13A.8 What is the high alarm limit default? ___ cm H_2O (50)

6.13A.9 Verify that the high alarm limit has a range from 30 to 120 cm H_2O.

6.13A.10 Set the high alarm limit to 65 cm H_2O, and exit from the set up menu.

6.13A.11 Increase the pressure to 25 cm H_2O, then decrease the pressure to 20 cm H_2O. (You must perform this step within 10 seconds, otherwise a continuing pressure condition will prevail and will prevent completionof the test.)

6.13A.12 Does the THRESHOLD LOW message appear in the Advisory column? ___ (Y)

6.13A.13 Set the Man/Auto valve to AUTO, and turn the ventilator ON.

6.13A.14 Bleed the pressure and start a stopwatch.

NOTE:Apnea Pressure alarm times are valid only with ventilator ON.

(✓) 6.13A.15 What is the time when APNEA-PRESSURE appears in the Caution column? ___ sec (13-17)

(✓) 6.13A.16 What is the time when the APNEA-PRESSURE appears in the Warning column? ___ sec (26-34)

6.13A.17 After the APNEA-PRESSURE alarm is displayed as a Warning, slowly increase the test pressure.

(✓) 6.13A.18 At what pressure does the APNEA-PRESSURE alarm deactivate? ___ cm H_2O (7-13)

6.13A.19 Adjust the threshold to 18 cm H_2O.

6.13A.20 Increase the pressure to 20 cm H_2O, maintain the pressure, and start a stopwatch.

(✓) 6.13A.21 What is the time when CONTINUOUS PRES appears as a Warning? ___ sec (12-18)

(✓) 6.13A.22 Decreasing the pressure slowly, what is the pressure at which the CONTINUOUS PRES alarm deactivates? ___ cm H_2O (15-21)

6.13A.23 Slowly increase the pressure.

(✓) 6.13A.24 At what pressure does the VENT PRESSURE HI alarm activate? ___ cm H_2O (62-68)

6.13A.25 Bleed the pressure.

6.13A.26 Slowly create a sub-atmospheric pressure.

(✓) 6.13A.27 At what pressure does the SUB ATM PRESSURE alarm activate? ___ cm H_2O (-7 to -13)

6.13A.28 Disconnect the test gauge and syringe; reconnect the breathing pressure sensor line to the absorber.

6.13A.29 Does the SUB ATM PRESSURE alarm deactivate? ___(Y)

6.13A.30 Press the Breathing Pressure OFF key.

6.13A.31 Verify that the APNEA ALARM cannot be selected to OFF when the ventilator switch is ON.

6.14 Apnea and Volume Alarm Test: Core-M Monitor

6.14.1 Attach a patient circuit with a 3L breathing bag to the absorber system.

6.14.2 Insert a test minute volumeter between the flow sensor and the expiratory valve.

6.14.3 Set the Man/Auto selector to AUTO.

6.14.4 Set the ventilator FREQUENCY to 10 BPM.

6.14.5 Set the I:E RATIO to 1:2.

6.14.6 Set the Tidal Volume to 1000 ml.

6.14.7 Adjust the O_2 flow to 500 ml/min.

6.14.8 Inflate the bellows by momentarily pressing the O_2 Flush button.

6.14.9 Turn the ventilator ON and allow the ventilator to cycle.

6.14.10 Turn the ventilator OFF and start a timer.

6.14.11 What is the time when the "APNEA VOL" and "Mid Alert" audible and visual alarms activate? ___sec (13 to 17)

6.14.12 What is the time when the "APNEA VOL" and "Hi Alert" audible and visual alarms activate? ___sec (26 to 34)

6.14.13 Turn the ventilator ON.

6.14.14 Does the "APNEA VOL" alarm deactivate? (Y)

6.14.15 Press the MIN VOL key and set the minute volume low limit above the current displayed value.

6.14.16 Press the MIN VOL key and verify that the "MINUT LOW" and "Low Alert" audible and visual alarms activate within 13 to 17 seconds.

6.14.17 Adjust the MIN VOL LO limit to the original setting.

6.14.18 Adjust the MIN VOL HI limit below the current displayed value.

6.14.19 Press the MIN VOL key and verify that the "MINUT HI" and "Mid Alert" audible and visual alarms activate within 13 to 17 seconds.

6.14.20 Adjust the MIN VOL HI limit to the original setting.

6.14.21 Are the displayed minute volumes on the monitor and test volumeter within 15% of each other? (Y)

6.14.22 Press the TIDAL VOL key and set the tidal volume low limit above the current displayed value.

6.14.23 Press the TIDAL VOL key and verify that the "TIDAL LOW" and "LOW ALERT" audible and visual alarms activate within 5 seconds.

6.14.24 Adjust the tidal volume low limit to the original position.

6.14.25 Press the TIDAL VOL key and set the tidal volume high limit below the current displayed value.

6.14.26 Press the TIDAL VOL key and verify that the "TIDAL HI" and "HI ALERT" audible and visual alarms activate within 5 seconds.

6.14.27 Adjust the tidal volume high limit to the original position.

6.14.28 Are the displayed tidal volumes on the monitor and test volumeter within 15% of each other? (Y)

6.14.29 Press the RR key and verify that the monitor displays a respiratory rate of 9 to 11 BPM.

6.14.30 Adjust the RR HI limit below the current displayed respiratory rate.

6.14.31 Press the RR key and verify that the "RATE ALRM" and "Hi Alert" audible and visual alarms activate within 13 to 17 seconds.

6.14.32 Adjust the RR HI limit to 60 BPM.

6.14.33 Remove the test volumeter.

6.14A Ultrasonic Flow Sensor: VPO Monitor

6.14A.1 Press the Breathing Volume LOW LIMIT key. Does a box appear around the Minute Volume Alarm Limit? ___(Y)

6.14A.2 What is the low minute volume alarm default? ___ (1.0)

6.14A.3 Verify that the minute volume has a low alarm limit range from at least 0.2 to 10.0 by increments of 0.1.

6.14A.4 Adjust the low minute volume alarm to 2.0 liters. Turn on the ventilator (with the breathing circuit open) and start a stop watch.

6.14A.5 This step intentionally left blank.

(✓) 6.14A.6 What is the time when APNEA-VOLUME appears as a Caution? ___ sec (26-34)

(✓) 6.14A.7 What is the time when APNEA-VOLUME appears as a Warning? ___ sec (52-68)

(✓) 6.14A.8 Within one (1) minute, does the MINUTE VOLUME LOW message appear as a Caution? ___ Y

6.14A.9 Insert a test minute volumeter in between the absorber and the exhalation valve.

6.14A.10 Reconnect the ventilator hose to the Ventilator Hose terminal.

6.14A.11 Adjust the FREQUENCY to 6 BPM.

6.14A.12 Adjust the I:E RATIO to 1:2.

6.14A.13 Adjust the flow to the maximum of the LOW zone.

6.14A.14 Adjust the oxygen flow to 2 l/min.

6.14A.15 Adjust the Tidal Volume to 200 ml.

6.14A.16 After the first breath is detected, do the APNEA-VOLUME Warning message and the MINUTE VOLUME LO Caution message deactivate? ___ (Y)

6.14A.17 Adjust the low alarm limit above the indicated minute volume.

6.14A.18 Does the MINUTE VOLUME LO message appear as a Caution? ___ (Y)

6.14A.19 Adjust the low alarm limit below the indicated minute volume.

6.14A.20 Does the MINUTE VOLUME LO Caution message deactivate? ___ (Y)

6.14A.21 Increase the tidal volume to 1000 ml and the frequency to 10 BPM.

6.14A.22 Press the O_2 Flush momentarily to inflate the bellows.

6.14A.23 Readjust the inspiratory flow as necessary to fully collapse the bellows.

(✓) 6.14A.24 Are the tidal and minute volumes on the machine and on the test volumeter within 20% of each other? ___ (Y)

6.14A.25 Create a reverse flow by loosening the expiratory valve dome. Remove the breathing hose from the flow sensor. Connect a test terminal and a Riken aspirator (negative pressure squeeze bulb) to the 22 mm male port of the flow sensor. Disconnect the hose attached to the exhalation valve. Compress and release the aspirator.

(✓) 6.14A.26 Each time a reverse flow greater than 20 ml is detected, does the REVERSE FLOW message appear as an Advisory? ___ (Y)

6.14A.27 Tighten the expiratory valve dome. Remove the test terminal and aspirator from the flow sensor and reconnect the patient circuit hose. Reconnect the hose between the expiratory valve and the flow sensor.

6.14A.28 Disconnect the respiratory volume sensor cord from the VOLUME SENSOR interface.

6.14A.29 Do the VOL SENSOR DISC appear as an Advisory, and is LED illuminated in the Breathing Volume OFF key? ___ (Y)

6.14A.30 Connect the respiratory volume sensor cord to the VOLUME SENSOR interface and verify that the alarms clear.

6.15 Ventilator Test

6.15.1 Set the Man/Auto selector to BAG.

6.15.2 Set the FREQUENCY to 10 BPM.

6.15.3 Set the I:E RATIO to 1:2.

6.15.4 Set the Tidal Volume to 1000 ml.

6.15.5 Attach a patient circuit to the absorber system.

6.15.6 Adjust the O_2 flow to 3 l/min.

6.15.7 Turn the ventilator on.

6.15.8 Verify the FAULT indicator turns on (Y)

6.15.9 Set the Man/Auto selector switch to AUTO.

6.15.10 Verify the FAULT indicator turns off (Y)

6.15.11 Adjust the INSPIRATORY FLOW to the maximum of the LOW zone.

6.15.12 Occlude the Y-piece with your thumb.

6.15.13 What is the peak inspiratory pressure? ___ cm H_2O (>30 cm H_2O)

6.15.14 Attach a 3-liter bag to the Y-piece.

6.15.15 Using a stopwatch, time the inspiratory phase.

6.15.16 What is the inspiratory time? ___ seconds (1.8 - 2.2)

6.15.17 Using a stopwatch, time the expiratory phase.

6.15.18 What is the expiratory time? ___ seconds (3.6 - 4.4)

6.15.19 Press and hold the EXTENDED RANGE switch and scroll the I:E ratio dial counter clockwise and verify the extended I:E ratio values increment (2:1, 3:1 and 4:1); return the I:E ratio to 2:1.

6.15.20 Using a stopwatch, time the inspiratory phase.

6.15.21 What is the inspiratory time? ___ seconds (3.6 - 4.4)

6.15.22 Using a stopwatch, time the expiratory phase.

6.15.23 What is the expiratory time? ___ seconds (1.8 - 2.2)

6.15.24 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
11	1:1	66	1:3.5
22	1:1.5	77	1:4
33	1:2	88	1:4.5
44	1:2.5	99	1:4.5
55	1:3		

6.16 Bellows Drive Gas Leak Test

6.16.1 Remove the ventilator hose from the VENTILATOR HOSE terminal on the bellows.

6.16.2 Attach a test terminal to the bellows assembly ventilator hose terminal.

6.16.3 Connect a flowmeter test stand (P/N S000081) to the test terminal.

6.16.4 Set the FREQUENCY to 1 BPM.

6.16.5 Set the I:E RATIO to 1:1.

6.16.6 Set the INSPIRATORY FLOW to the maximum.

6.16.7 Turn the ventilator on.

6.16.8 What is the flow that is indicated during the inspiratory phase? ___ (<50 ml)

6.16.9 Remove the test terminal and flowmeter test stand. Reconnect the ventilator hose to the VENTILATOR HOSE terminal.

6.17 "F" Bellows Test

6.17.1 Set the FREQUENCY to 10 BPM.

6.17.2 Set the I:E RATIO to 1:2.

6.17.3 Adjust the O_2 flow to 300 ml.

6.17.4 Adjust the INSPIRATORY FLOW to MED.

6.17.5 Adjust the Tidal Volume to 200 ml.

6.17.6 What is the Tidal Volume on the Omicron monitor? ___ ml (125-250)

6.17.7 Adjust the Tidal Volume to 1000 ml.

6.17.8 What is the Tidal Volume on the Omicron monitor? ___ ml (900-1100)

6.17.9 Adjust the INSPIRATORY FLOW to HIGH.

6.17.10 Adjust the O_2 flow to 5 l/min.

6.17.11 Adjust the Tidal Volume to maximum.

6.17.12 What is the Tidal Volume on the Omicron monitor? ___ ml (_1400)

6.18 Ventilator Relief Valve Test

6.18.1 Adjust the O_2 flow to 10 l/min.

6.18.2 Adjust the INSPIRATORY FLOW to MED.

6.18.3 Adjust the I:E RATIO to 1:3, and the FREQUENCY to 10.

6.18.4 Adjust the Tidal Volume to 1200 ml.

6.18.5 What is the PEEP? ___ cm H_2O ($\leq$3)

6.18.6 Adjust the O_2 flow to 500 ml.

6.18.7 Does the ventilator deliver the full Tidal Volume during the inspiratory time? ___ (Y)

6.18.8 Does the bellows stop adjust smoothly? ___ (Y)

6.19 Inspiratory Pressure Limit Test

6.19.1 Set the Inspiratory Flow to the middle of the medium range.

6.19.2 Set the oxygen flow rate to 4 l/min.

6.19.3 Set the Pressure Limit Control to its MIN position.

6.19.4 Occlude the Y-piece with your thumb.

6.19.5 What is the peak pressure? ___ cm H_2O (<15)

6.19.6 Adjust the Pressure Limit Control to 30.

6.19.7 What is the peak pressure? ___ cm H_2O (27-33)

6.19.8 Turn the pressure limit control clockwise to the MAX setting.

6.19.9 What is the peak pressure? ___ >40 cm H_2O

6.19.10 Remove your thumb from the Y-piece.

6.19.11 Set the Inspiratory Flow to the maximum of the LOW zone.

6.19.12 Close the oxygen flow control valve.

6.19.13 Turn the ventilator OFF. NOTE: The inspiratory flow gauge will not return to the stop position when the ventilator is turned off.

6.20 Oxygen Concentration Test

6.20.1 Oxygen + Nitrous Oxide Concentration Test

6.20.1.1 Turn the SYSTEM POWER switch to ON.

6.20.1.2 Disconnect the pipeline supplies

6.20.1.3 Open the APL valve.

6.20.1.4 Connect a 12-inch hose between the inspiratory valve and the expiratory valve.

6.20.1.5 Set the Man/Auto selector to BAG.

6.20.1.6 Occlude the bag mount.

6.20.1.7 Insert the sensor from a calibrated Omicron monitor into the valve dome adapter on the inspiratory valve.

6.20.1.8 Close all the flow control valves.

6.20.1.9 Open one (1) cylinder valve for each gas.

6.20.1.10 Depress the O_2 FLUSH button for 15 seconds.

6.20.1.11 Set the oxygen flow to 4 l/min.

6.20.1.12 Does the Omicron monitor read 97-100% within 3 minutes? ___ (Y)

6.20.1.13 Set the nitrous oxide flow to 2 l/min.

6.20.1.14 What is the oxygen concentration after 3 minutes? ___ % (64-70)

6.20.1.15 Close the nitrous oxide flow control valve.

6.20.2 Oxygen + Air Concentration Test - If Applicable

6.20.2.1 Depress the O_2 FLUSH button for 15 seconds.

6.20.2.2 Does the Omicron monitor read 97-100% within 3 minutes? ___ (Y)

6.20.2.3 Set the air flow to 2 l/min.

6.20.2.4 What is the oxygen concentration after 3 minutes? ___ % (71-77)

6.20.2.5 Close the air flow control valve.

6.21 Oxygen Ratio Control (ORC) Test

6.21.1 Open the oxygen and nitrous oxide cylinder valves.

6.21.2 Depress the O_2 FLUSH for 15 seconds.

6.21.3 Set the oxygen flow to 1000 ml.

6.21.4 Open the nitrous oxide flow control valve to the stop position.

6.21.5 What is the oxygen concentration after 3 minutes? ___ % (21-29)

6.21.6 Adjust the oxygen flow to 1.5 l/min.

6.21.7 What is the oxygen concentration after 3 minutes? ___ % (21-29)

6.21.8 Adjust the oxygen flow to 2 l/min.

6.21.9 What is the oxygen concentration after 3 minutes? ___ % (21-29)

6.21.10 Adjust the oxygen flow to 4 l/min.

6.21.11 What is the oxygen concentration after 3 minutes? ___ % (21-29)

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

6.21.13 Slowly close the oxygen flow control valve.

6.21.14 What is the oxygen concentration with the O_2 flow control valve closed? ___% (>21%)

6.21.15 What is the flow of nitrous oxide? ___ ml/min. (375-750 ml/min.)

6.21.16 Close the nitrous oxide flow control valve.

6.22 Oxygen Flush and 100% O2 Final Test

6.22.1 Close the nitrous oxide cylinder valve.

6.22.2 Turn the SYSTEM POWER switch to ON.

6.22.3 Set the oxygen flow rate to 5 l/min.

6.22.4 Fully open the nitrous oxide flow control valve.

6.22.5 After the nitrous oxide flow stops, close the N_2O flow control valve.

6.22.6 Close the oxygen flow control valve.

6.22.7 Close the additional gas(es) cylinder valves.

6.22.8 Bleed the gas from the additional gas circuit(s).

6.22.9 Turn the SYSTEM POWER switch to STANDBY.

6.22.10 Press and release the O_2 FLUSH button.

6.22.11 Does the flow of oxygen stop immediately? __ (Y)

6.22.12 Connect a test minute volumeter (P/N 2212300) to the common gas outlet, using the Fresh Gas Outlet Volume Test Device (P/N S010158).

6.22.13 Press and hold the O_2 FLUSH button for 6 seconds.

6.22.14 What is the oxygen flush flow rate? ___ l/min. (4.5-6.5)

6.22.15 Remove the test minute volumeter and test fixture, and reconnect the fresh gas hose.

6.22.16 Turn the SYSTEM POWER switch to ON.

6.22.17 Insert the calibrated sensor into the inspiratory valve dome.

6.22.18 Press the O_2 FLUSH button.

6.22.19 What is the O_2 concentration after 3 minutes? ___ % O_2 (97-100)

6.22.20 Remove the sensor and install the plug.

6.22.21 Close the oxygen cylinder valve.

6.22.22 Bleed the oxygen circuit by pressing the O_2 FLUSH button.

6.23 Scavenger Interface, A/C

6.23.1 Remove all scavenger hoses one at a time, and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace any worn hoses.

6.23.2 Remove the safety relief valve housing by unscrewing it in a counterclockwise direction.

6.23.3 Inspect the rubber O-ring and replace if worn.

6.23.4 Remove the safety relief valve from its housing by twisting it out in a counterclockwise direction. The tips of needle-nose pliers can be used to turn the valve. Be careful not to damage the valve disk.

6.23.5 Remove any accumulated lint or dust from the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen. The scavenger body can be cleaned with a moist cloth.

6.23.6 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.

6.23.7 Make sure that the interior of the valve body is completely dry. Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.23.8 Perform the following Pre-use Checkout procedure:

6.23.8.1 Connect a 19 mm scavenger hose between the bottom of the absorber pole and the right-hand port on the scavenger. Connect a short 19 mm scavenger hose between the APL valve and the port on the rear of the absorber pole. Connect a 19 mm scavenger hose between the ventilator relief valve and the left-hand port on the scavenger.

6.23.8.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber.

6.23.8.3 Set the Man/Auto valve to the AUTO position.

6.23.8.4 Set the oxygen flow to 10 l/min. and occlude the 19 mm scavenger terminal labeled EXHAUST.

6.23.8.5 After the ventilator bellows inflates, the flow of oxygen will exit the system through the positive pressure safety relief valve. At this point, the absorber system breathing pressure gauge shall indicate a pressure of 10.0 cm H_2O or less.

6.24 Open Reservoir Scavenger

6.24.1 Remove all scavenger hoses one at a time and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace any worn hoses.

6.24.2 Disconnect the hospital vacuum source from the scavenger.

6.24.3 Remove the scavenger mounting screws.

6.24.4 Remove the two screws securing the access panel at the bottom of the scavenger canister.

6.24.5 Remove and inspect the silencer; replace if needed.

6.24.6 Remove the reservoir canister from the scavenger body by unscrewing the four socket head cap screws located at the top of the canister.

6.24.7 Remove the flowmeter from its housing by turning it counterclockwise. Inspect the tube and clean with compressed air if needed.

6.24.8 Reassemble the scavenger assembly, and reactivate the vacuum source.

6.24.9 Perform the following negative pressure relief test:

6.24.9.1 Connect a 19 mm scavenger hose between the bottom of the absorber pole and the right-hand port on the scavenger. Connect a 19 mm scavenger hose between the APL valve and the rear port on the absorber pole. The left-hand scavenger port may be capped for this test, or may be connected to the ventilator relief valve. Connect a DISS vacuum hose to the threaded terminal on the left side of the scavenger. Alternatively, an adapter can be used to attach a wall suction hose to the hose barb fitting on the adapter.

6.24.9.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber. Set the Man/Auto selector valve to the BAG position. Turn the APL valve control knob fully counterclockwise.

6.24.9.3 Verify that the suction waste gas disposal system is active.

6.24.9.4 Adjust the scavenger needle valve until the flowmeter indicates between the white lines. Close all flow control valves on the anesthesia machine. Occlude the absorber breathing bag terminal.

6.24.9.5 Install a scavenger adapter with a hose barb between the 19 mm hose terminal of the scavenger, and the scavenger hose. Connect a test pressure monitor to the hose barb on the adapter and observe the pressure reading on the test gauge. The gauge shall indicate a pressure of 0 cm H_2O.

6.24.10 Perform the following positive pressure relief test:

6.24.10.1 Connect a 19 mm scavenger hose between the bottom of the absorber pole and the right-hand port on the scavenger. Connect a 19 mm scavenger hose between the APL valve and the rear port on the absorber pole. The left-hand scavenger port may be capped for this test, or may be connected to the ventilator relief valve. Connect a DISS vacuum hose to the threaded terminal on the left side of the scavenger. Alternatively, an adapter can be used to attach a wall suction hose to the hose barb fitting on the adapter.

6.24.10.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber. Set the Man/Auto selector valve to the BAG position. Turn the APL valve control knob fully counterclockwise.

6.24.10.3 Verify that the suction waste gas disposal system is active.

6.24.10.4 Turn the scavenger needle valve fully clockwise (closed).

6.24.10.5 Open the oxygen flow control valve on the anesthesia machine to a flow of 10 l/min. and occlude the absorber breathing bag terminal.

6.24.10.6 The flow of oxygen shall now exit the system through the relief ports around the top of the canister. The test pressure gauge shall indicate a pressure less than 1.0 cm H_2O.

6.24.10.7 After the test, adjust the scavenger needle valve for a flowmeter indication halfway between the two white lines.

6.25 Suction Regulator (if applicable)

6.25.1 Verify that the suction bottle is attached to the suction regulator.

6.25.2 Verify that vacuum is attached to the ¾ in. DISS vacuum connection.

6.25.3 Set the vacuum on/off valve to the OFF (vertical) position.

6.25.4 Connect a digital pressure meter to the collecting inlet stem of the suction bottle.

6.25.5 Set the digital pressure meter to the mmHg scale.

6.25.6 Turn the vacuum control knob fully counter-clockwise.

6.25.7 What is the vacuum indicated on the digital pressure meter? (0)

6.25.8 Turn the vacuum control knob fully clockwise and verify that the vacuum control knob stops.

6.25.9 Set the vacuum on/off valve to the ON position.

6.25.10 Set the regulator to indicate 250 mmHg.

6.25.11 What is the vacuum indicated on the digital pressure meter? (200-300 mmHg)

6.25.12 Return all controls to their original positions.

6.26 Final Check

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

6.26.2 Verify that the APL valve knob is turned completely counterclockwise, fully open.

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

6.26.4 Verify that the oxygen sensor is removed from the valve dome adapter.

6.26.5 Verify that the valve dome is plugged.

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

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

6.26.8 Carefully inspect the machine to verify that no loose screws, washers, or tools are left on or in any part of the machine.

7.0 SOFTWARE UPDATE PROCEDURE

This section outlines the software installation procedure, including the equipment needed and its connections.

Software updates to the Narkomed MRI anesthesia system are done through a serial port connection to an external PC using the batch file LOADMRI.BAT.

7.1 SOFTWARE TRANSFER TO PC VIA MODEM

Equipment required:

--Interface Cable, NAD Part No. 4109882 P (9-pin to 25-pin
or 4110328 A (9-pin to 9-pin)

--IBM® PC or IBM PC Compatible configured with:

- PC-DOS or MS-DOS V3.3 or higher
- RS-232C Serial Port connected to COM 1
- Hard Drive or Floppy Drive
- Modem (or external modem)

7.1.1 Download the software to the hard disk or use Drive A (floppy drive) on the PC.

7.2 INSTALLING NM MRI SOFTWARE FROM A PC

7.2.1 Set the System Power switch on the Narkomed MRI to STANDBY, and the power switch on the PC to OFF.

7.2.2 Remove the serial interface port cover from the back panel of the monitor. See Figure 7-1.

7.2.3 Connect the appropriate interface cable (9-pin or 25-pin) to COM 1 on the PC, and connect the other end of the cable to the NM MRI serial interface Port.

7.2.4 Power up the PC and wait for the DOS prompt to appear on the screen.

7.2.5 Set the PC to read the drive holding the software. For example: if the software was downloaded to drive A, type A: and press ENTER.

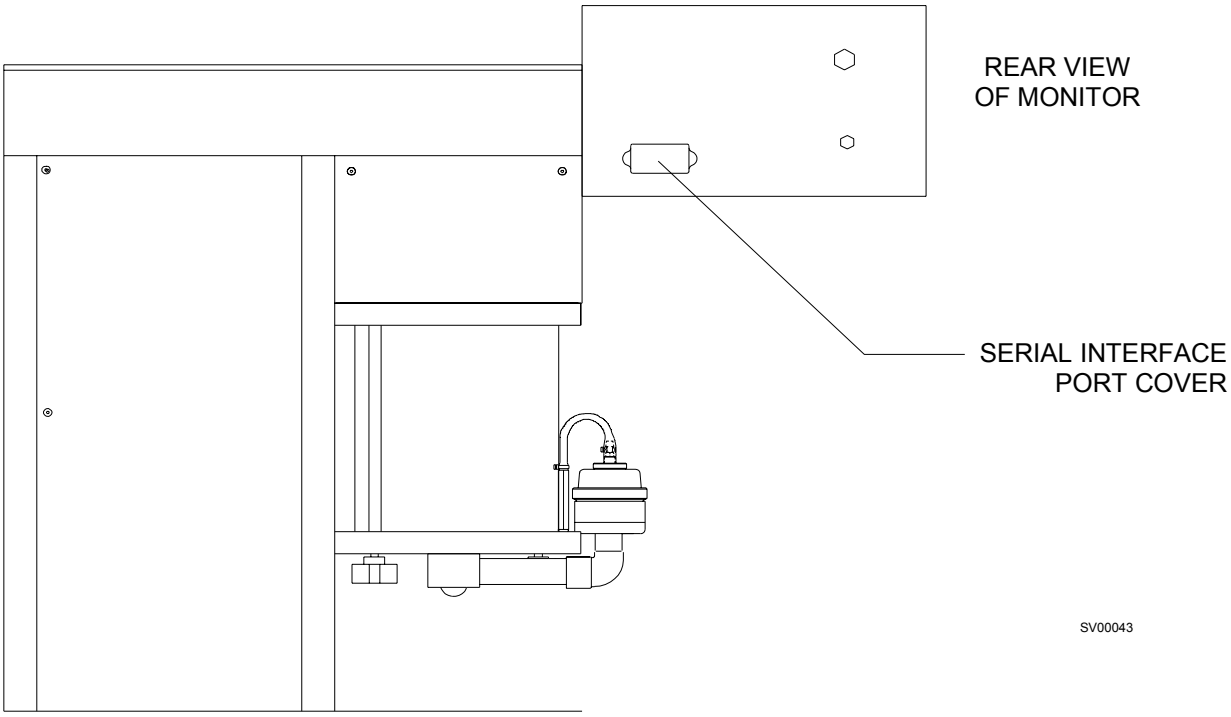


FIGURE 7-1. Narkomed MRI Serial Port Location

7.2.6 Type LOADNMMRI and press ENTER.

7.2.7 Turn the System Power switch to ON.

7.2.8 As the software is downloading, the incremental number of bytes sent will be displayed on the PC screen. When the download is complete, the PC screen will display

```
\       Bytes sent:    0    Images sent:    1
```

Software installation is complete when the machine resets.

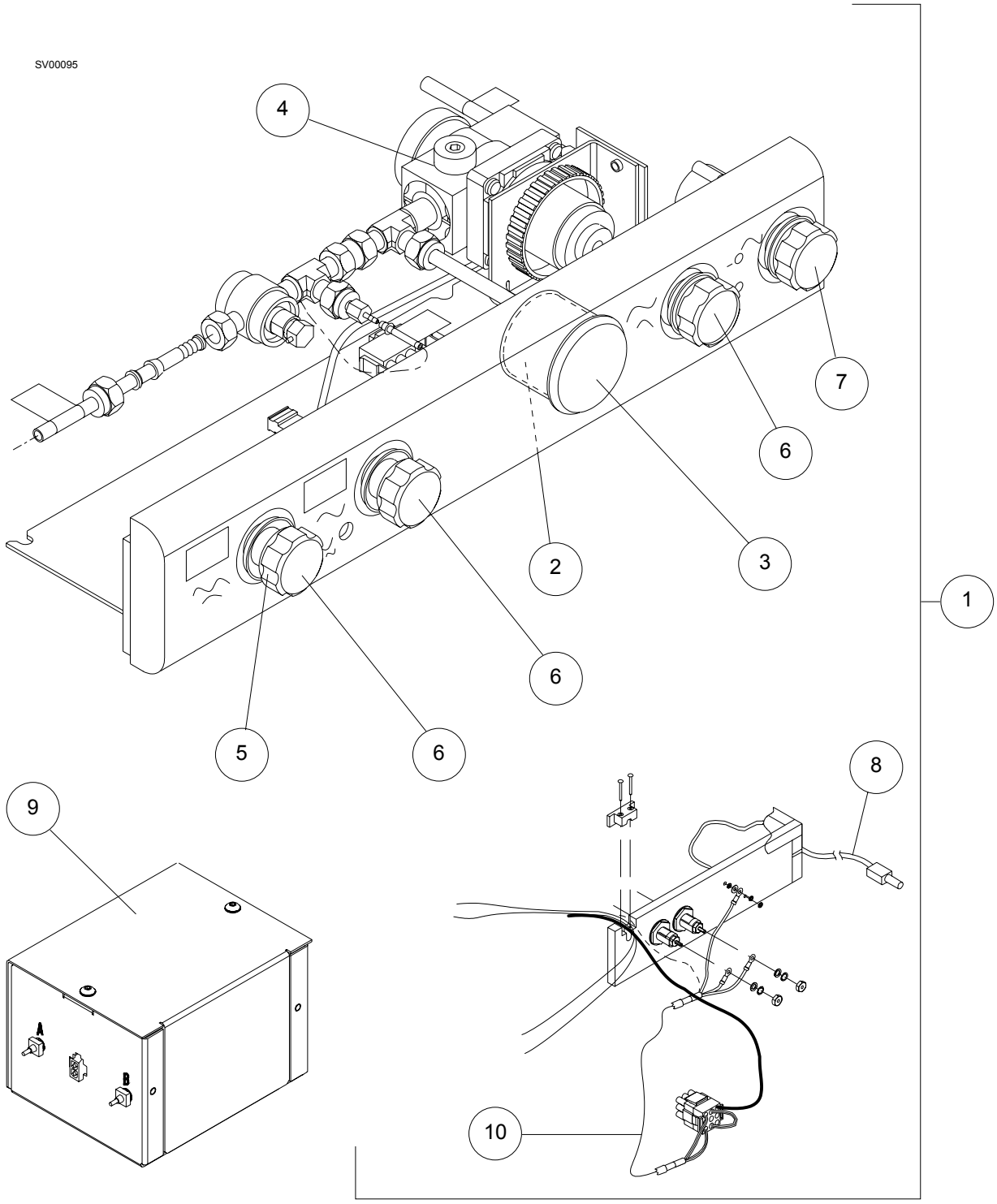
7.2.9 Set the System Power switch on the NM MRI to STANDBY, and the power switch on the PC to OFF. Disconnect the interface cable and reinstall the serial interface port cover on the monitor.

8.0 SPARE AND REPLACEMENT PARTS

Part numbers for field-replaceable items on the Narkomed MRI anesthesia system are listed on the following pages, along with part numbers for related hardware and cables.

The item numbers are keyed to the accompanying illustrations to aid in identifying the item and its location.

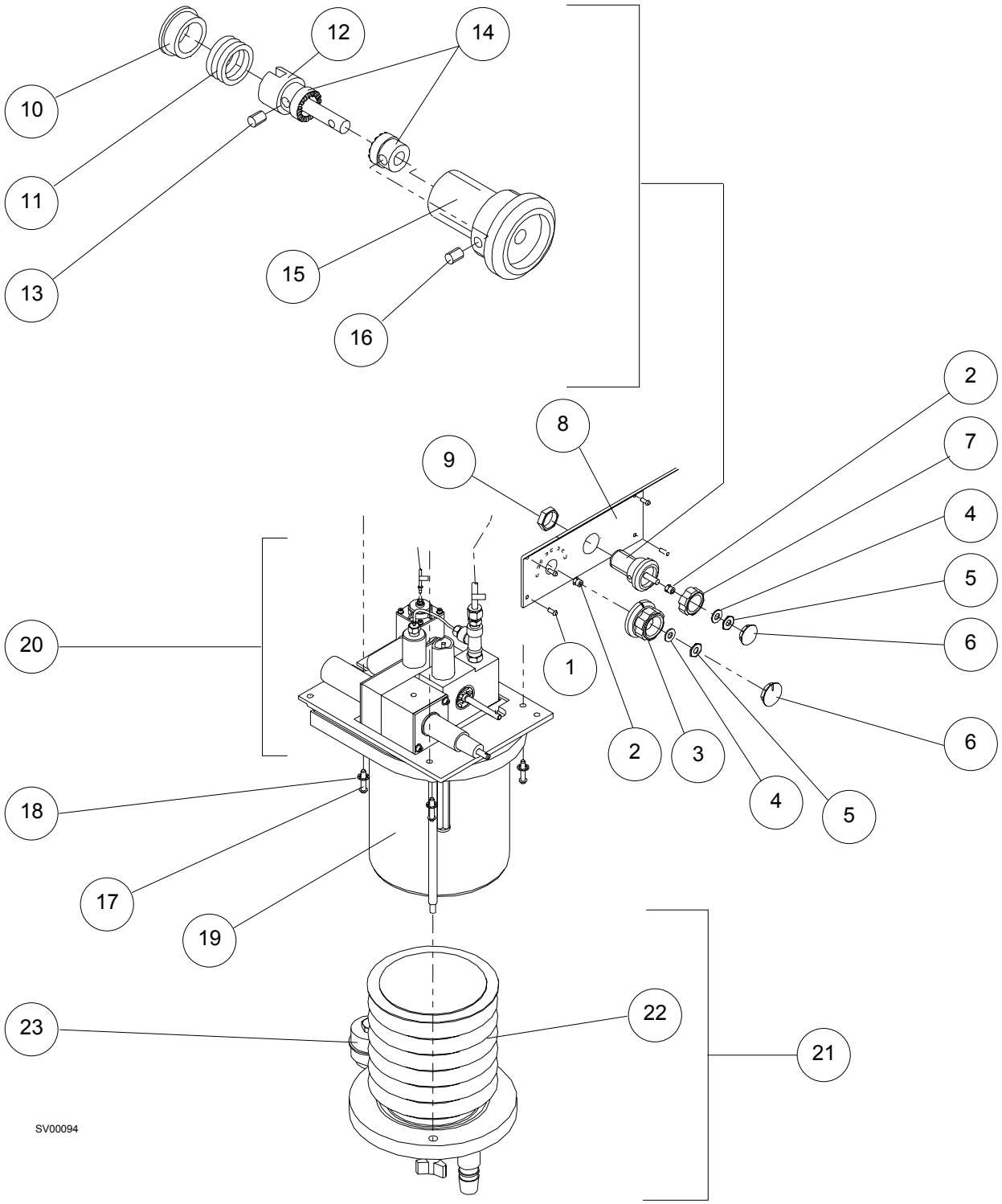
ASSEMBLY/PART PAGE


SV00095
4
7
6
2
3
1
6
5
6
8
9
A
B
10

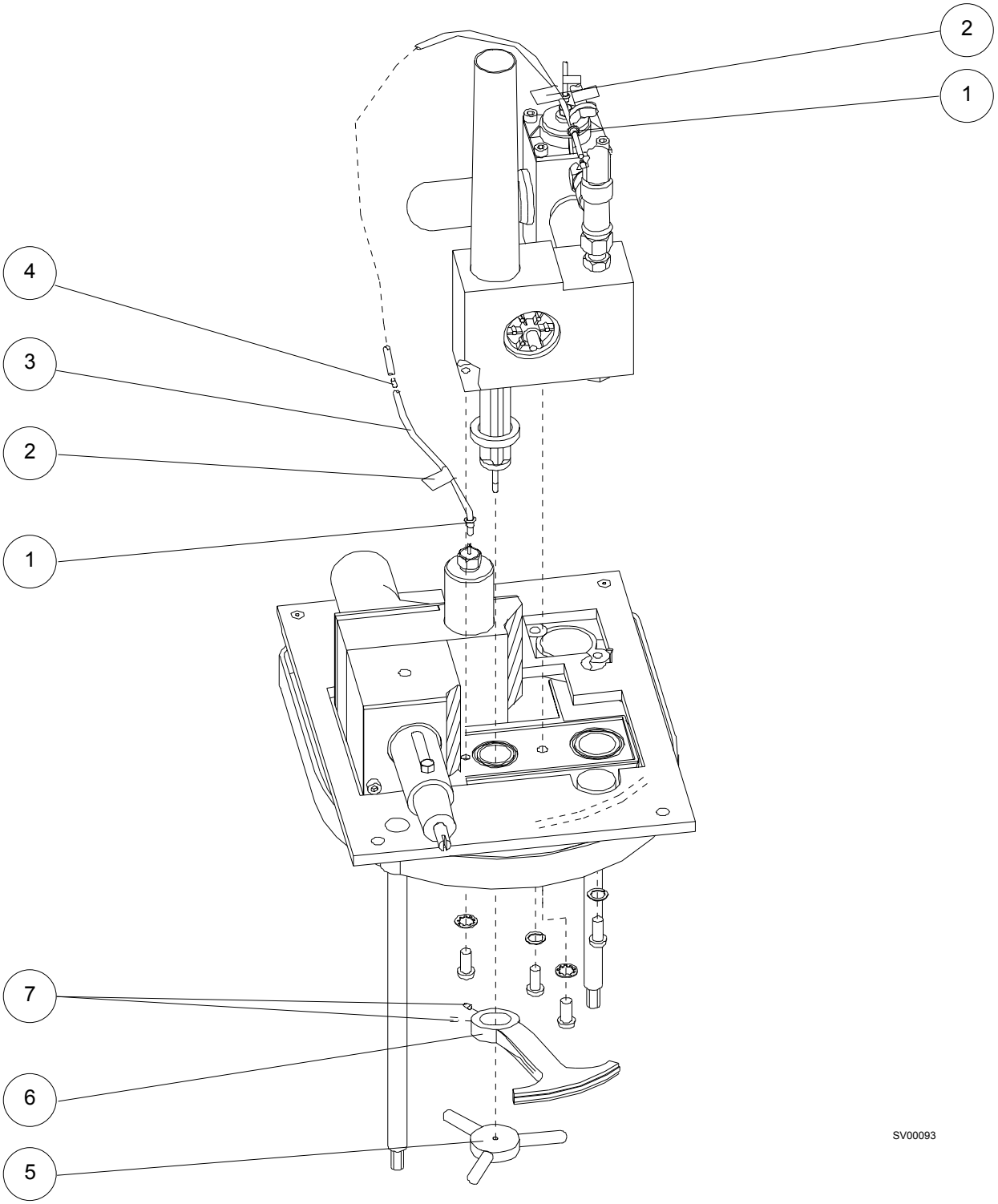
ITEM	DESCRIPTION	PART NUMBER
1	*AV2+ Ventilator Controller (Bezel) Asm., EMI shielded (Core-M version)	SE4113132-004
	*AV2+ Ventilator Controller (Bezel) Asm., EMI shielded (VPO version)	SE4113132-006
	*AV2+ Ventilator (Bezel) Asm., EMI shielded (Invivo- VPO version)	SE4113132-007
2	Gauge	4113859
3	Lens, Gauge	4112213
4	Pressure Regulator	4114252
5	Knob (4x)	4113281
6	Knob Cover (3x) (all except ON-OFF switch)	4113278-002
7	Knob Cover (ON-OFF switch)	4113278-003
8	Deleted	

Shown for reference:
9 Solenoid and Housing Assembly (part of Battery Box Assembly)
10 Cable Assembly, feed-thru filters to alarm channel (part of alarm channel)

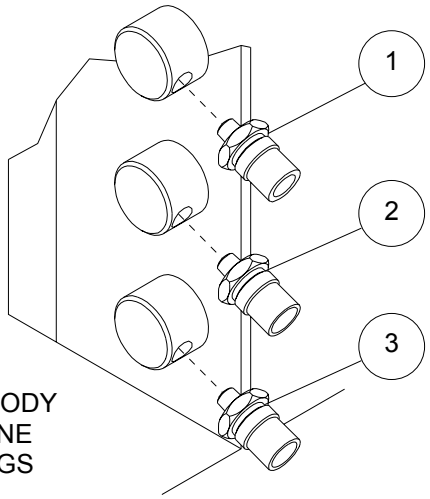
* These three bezel assemblies are not interchangeable. Verify version before ordering.


10
11
12
13
14
15
16
2
7
8
9
4
5
6
1
2
3
4
5
6
20
18
17
19
23
22
21
SV00094

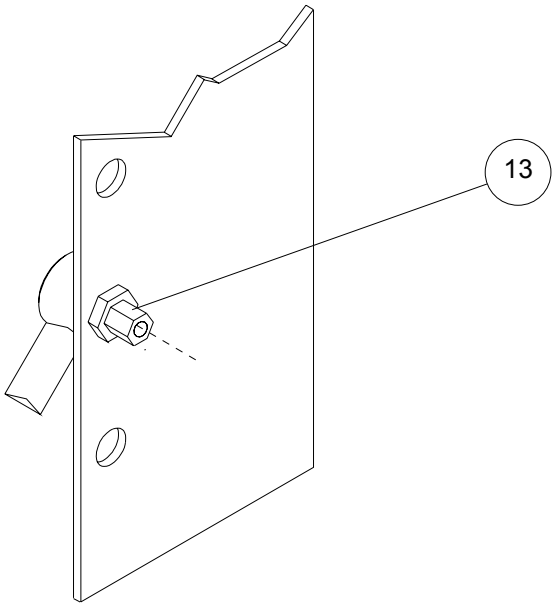
ITEM	DESCRIPTION	PART NUMBER
1	Screw, 6-32 x ¼ in. Btn Hd Skt (4x)	HW09004
2	Collet (2x)	4112167
3	Knob, PLC Adj.	4113279
4	Flat Washer, #10 (2x)	HW66003
5	Hex Nut, M5 x 0.5 (2x)	4112066
6	Knob Cover (2x)	4113278-002
7	Knob	4113280
8	Front Plate, Bellows Box	4112230-001
	Front Plate, Bellows Box- Invivo	4112230-002
9	Panel Nut	4107460
10	Spring Retainer	4107546
11	Spring	4110975
12	Shaft	4112175
13	Set Screw, 6-32 x 3/16 in.	HW07002
14	Clutch	4107544
15	Housing	4112467
16	Set Screw, 6-32 x ¼ in.	HW04003
17	Screw, ¼-20 x 1 in. Btn Hd Skt (3x)	HW09057
18	Lock Washer, ¼ int-t (3x)	HW67017
19	Canister	4106948
	Tidal Volume Indicator	4108276
	Bellows Guide	4110735
20	Bellows Valve Assembly (Parts Breakdown listed on a subsequent page)	4112272
21	Bellows Assembly, Adult	4114102
22	Urethane (Non-Latex) Bellows Sub-assembly, Adult	4106930-001
	O-ring #217 (neoprene)	4101817
23	Relief Valve Assembly	4108050
	Diaphragm Assembly	4110960

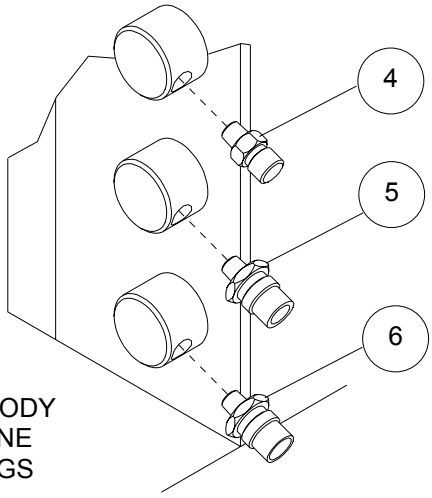

2
1
4
3
2
1
7
6
5
SV00093

ITEM	DESCRIPTION	PART NUMBER
	Bellows Valve Assembly	4112272
1	Press-on Hose Clamp (2x)	4104161
2	Label, O_2 Tubing (2x)	4109871
3	Hose, 0.075 I.D.	ML08003
4	Restrictor	4107639
5	Bellows Top Guide	4110735
6	Volume Indicator	4108276
7	Set Screw, 6-32 x ¼ in. cup point (2x)	HW04003



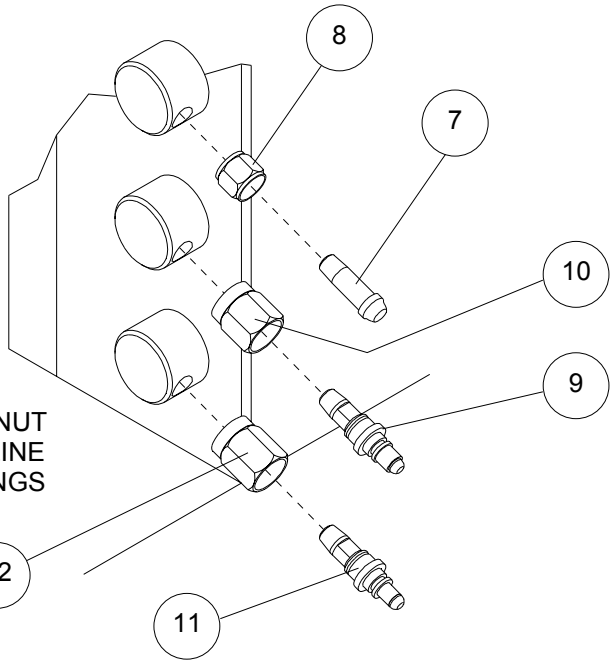
DISS BODY
PIPELINE
FITTINGS





NIST BODY
PIPELINE
FITTINGS

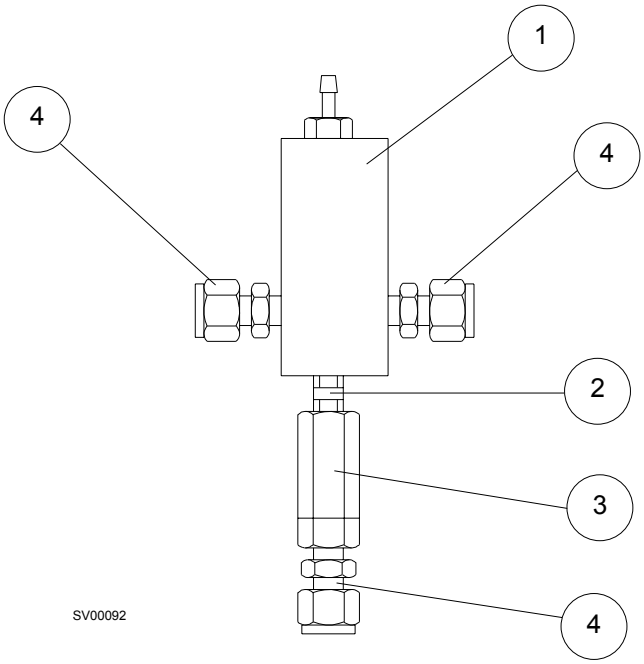
SV00091



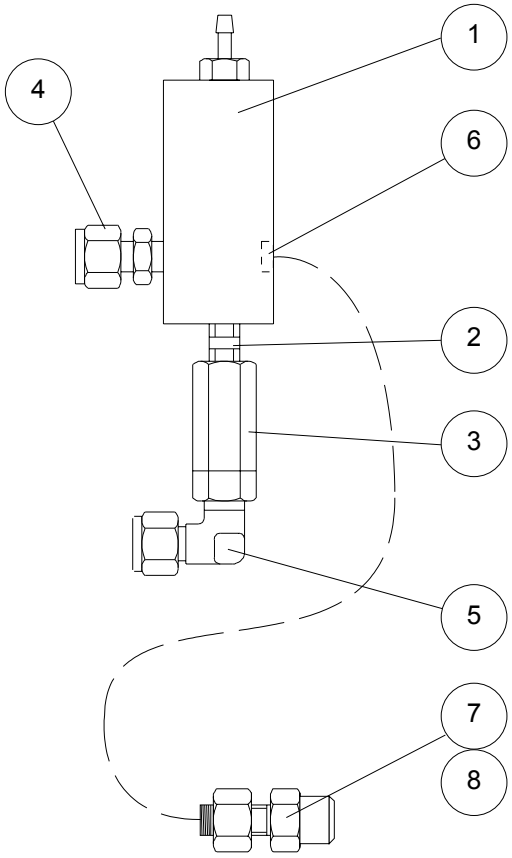
DISS NUT
PIPELINE
FITTINGS

ITEM	DESCRIPTION	PART NUMBER
	DISS Body Pipeline Fittings:	
1	O_2 DISS Fitting	4102563
2	Air DISS Fitting	4102886
3	N_2O DISS Fitting	4111384
	NIST Body Pipeline Fittings:	
4	O_2 Male NIST Connector	4110388
5	Air Male NIST Connector	4110386
6	N_2O Male NIST Connector	4111382
	DISS Nut Pipeline Fittings:	
7	O_2 DISS Nipple	4103877
8	O_2 DISS Nut	4102848
9	Air DISS Nipple	4111385
10	Air DISS Nut	4103120
11	N_2O DISS Nipple	4111383
12	N_2O DISS Nut	4102850
13	Pipeline Inlet Filter Asm (Typ., All Inlets)	4106198
	Filter	4102532
	Connector	4106897
	O-ring for N_2O DISS Nipple	4113494
	Pipeline Inlet Housing (new part w/o recess for label)	4113974

N2O FAILSAFE
ASSEMBLY



AIR
FAILSAFE ASSEMBLY

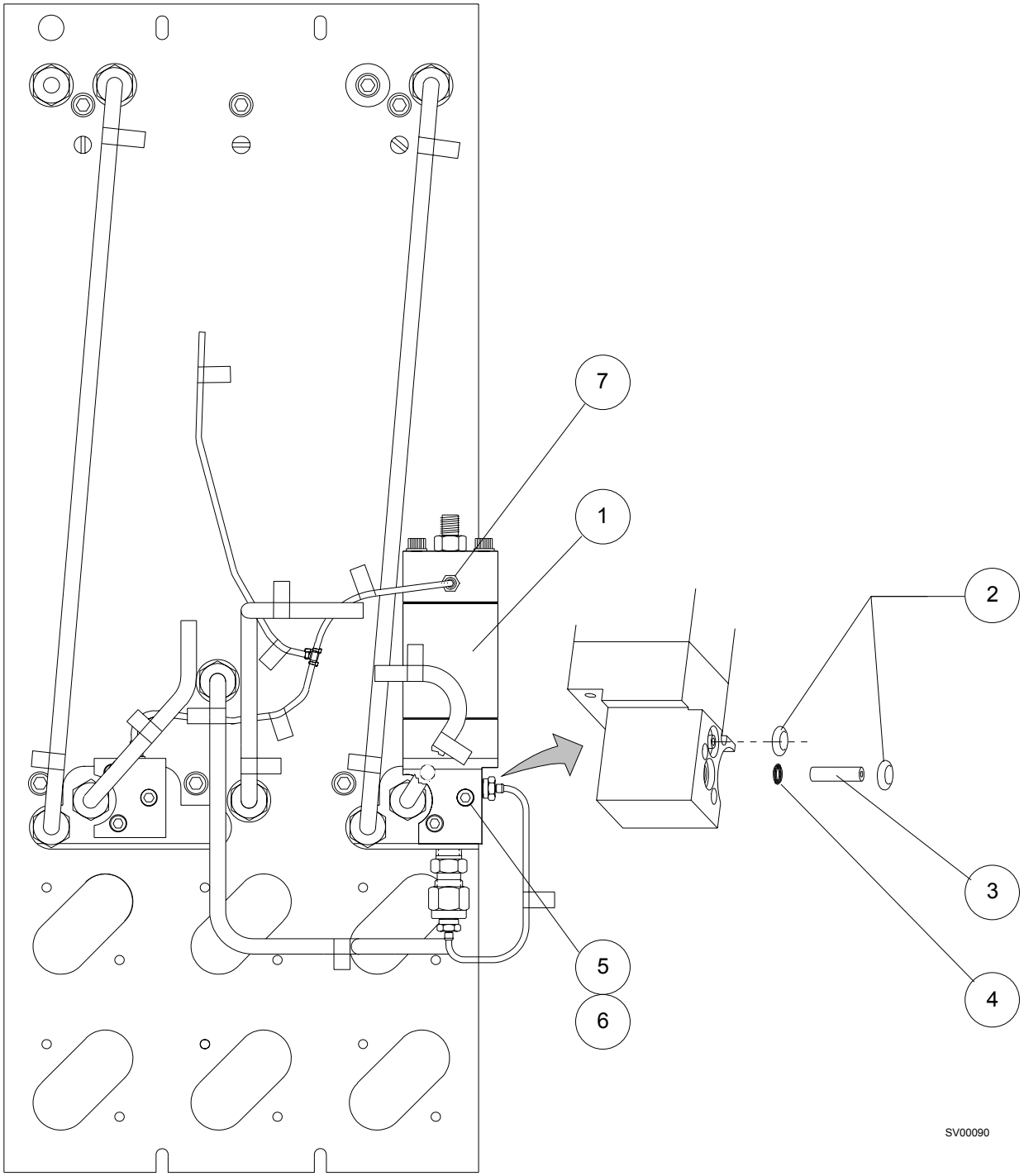


ITEM	DESCRIPTION	PART NUMBER
	N_2O Failsafe Assembly:	
1	Failsafe Block Asembly	4112043
2	Nipple, ⅛ NPT x ¾ in.	4102784
3	Check Valve, MJCV-1	4105815
4	Straight Fitting, ¼Tube x ⅛ MPT (3x)	4109408
	Air or 3rd Gas Failsafe Assembly:	
1	Failsafe Block Asembly	4112043
2	Nipple, ⅛ NPT x ¾ in.	4102784
3	Check Valve, MJCV-1	4105815
4	Straight Fitting, ¼Tube x ⅛ MPT (2x)	4109408
5	Elbow Fitting, ¼Tube x ⅛ MPT	4109410
6	Plug, ⅛ NPT skt hd (USA)	4105382

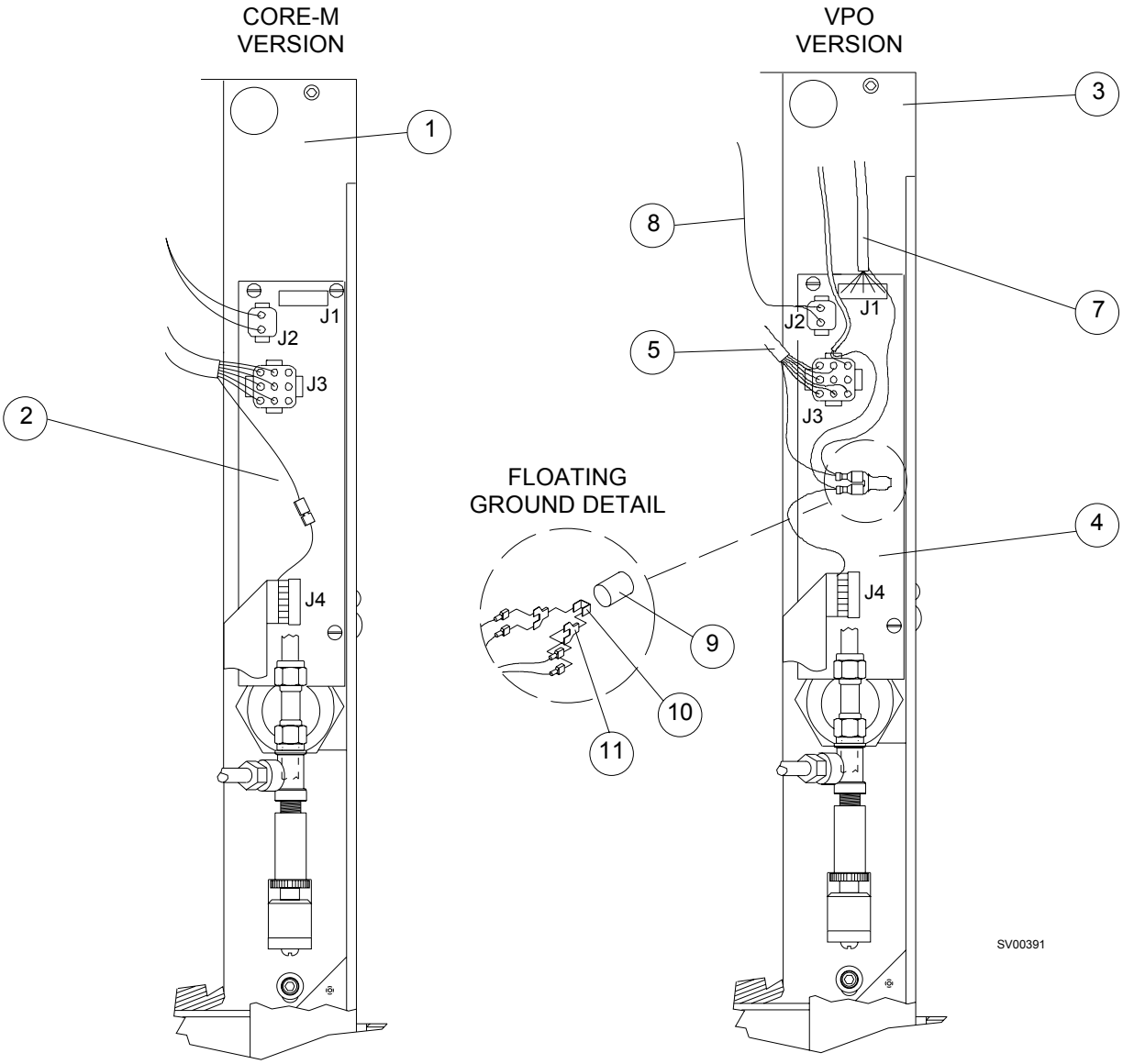
CSA Items: (Used in place of Item 6)

7	Relief Valve, 70 psi (Canada)	4110364
8	Straight Fitting, ¼ FPT x ⅛ MPT (Canada)	4103640

REAR VIEW OF FLOWMETER HOUSING
WITH REAR COVER REMOVED

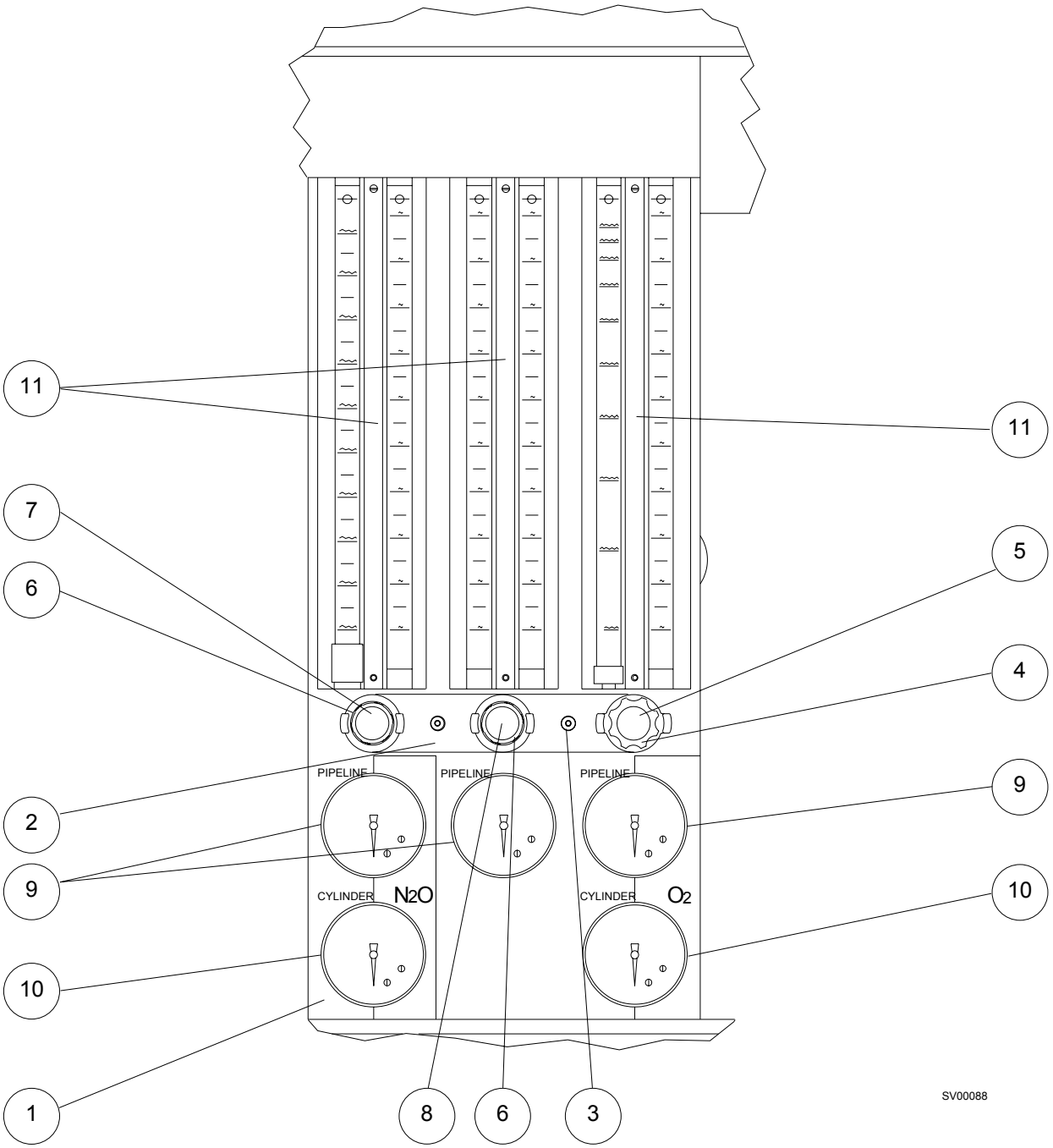


ITEM	DESCRIPTION	PART NUMBER
1	ORC Assembly (low flow design)	4113329-001
2	O-ring, #105 (Neoprene) (2x)	4111893
3	Filter	4111805
4	O-ring, 0.066 x 0.042 (Buna-n)	4111894
5	Screw, 8-32 x 1½ in. skt hd (3x)	HW01020
6	Lock Washer, #8 split (3x)	HW65001
7	Hose Clamp, Press-on (3x)	4104161

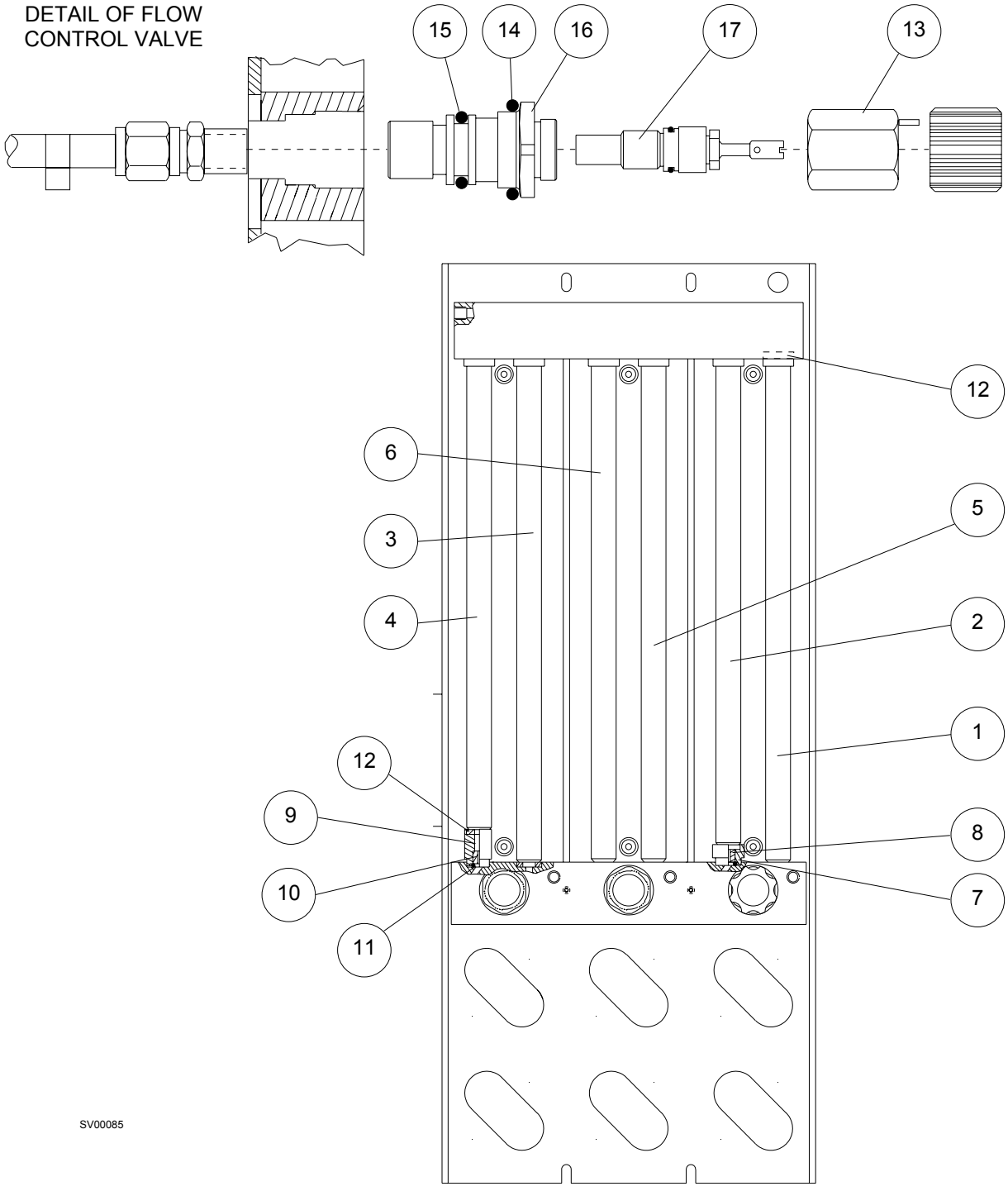

CORE-M
VERSION
VPO
VERSION
1
2
3
4
5
7
8
9
10
11
J1
J2
J3
J4
FLOATING
GROUND DETAIL
SV00391

ITEM	DESCRIPTION	PART NUMBER
	Machines with Core-M monitor:	
1	*Alarm Channel Assembly (Core-M version)	SE10029-001
2	PCB assembly	4111777
	Machines with VPO monitor:	
3	*Alarm Channel Assembly (VPO version)	4112125-002
	Alarm Channel Assembly Service Exchange part number	SE4112125-002
	*Alarm Channel Assembly- Invivo- Service Exchange part number	SE4112125-003
4	PCB assembly	4116588
5	Cable Assembly, vent controller feed-thru filters to alarm channel	4115815
6	Oxygen Supply Pressure Alarm Switch	4106037
7	Cable, Alarm Channel J1 to monitor	4116297
8	Wire Harness, Flowmeter Lights to Alarm Channel J2	4108594
9	Cap	4116405
10	Double adapter	4107069
11	Double male adapter (2x)	4116404
	Common parts not shown:	
	Housing, Push Button	4106046
	Cap, Push Button	4106047
	Clippard valve, 3-way	4103588

* These three alarm channels are not interchangeable. Verify version before ordering.


11
11
7
6
5
4
2
9
9
10
10
1
8
6
3
PIPELINE
PIPELINE
PIPELINE
CYLINDER
N2O
CYLINDER
O2
SV00088

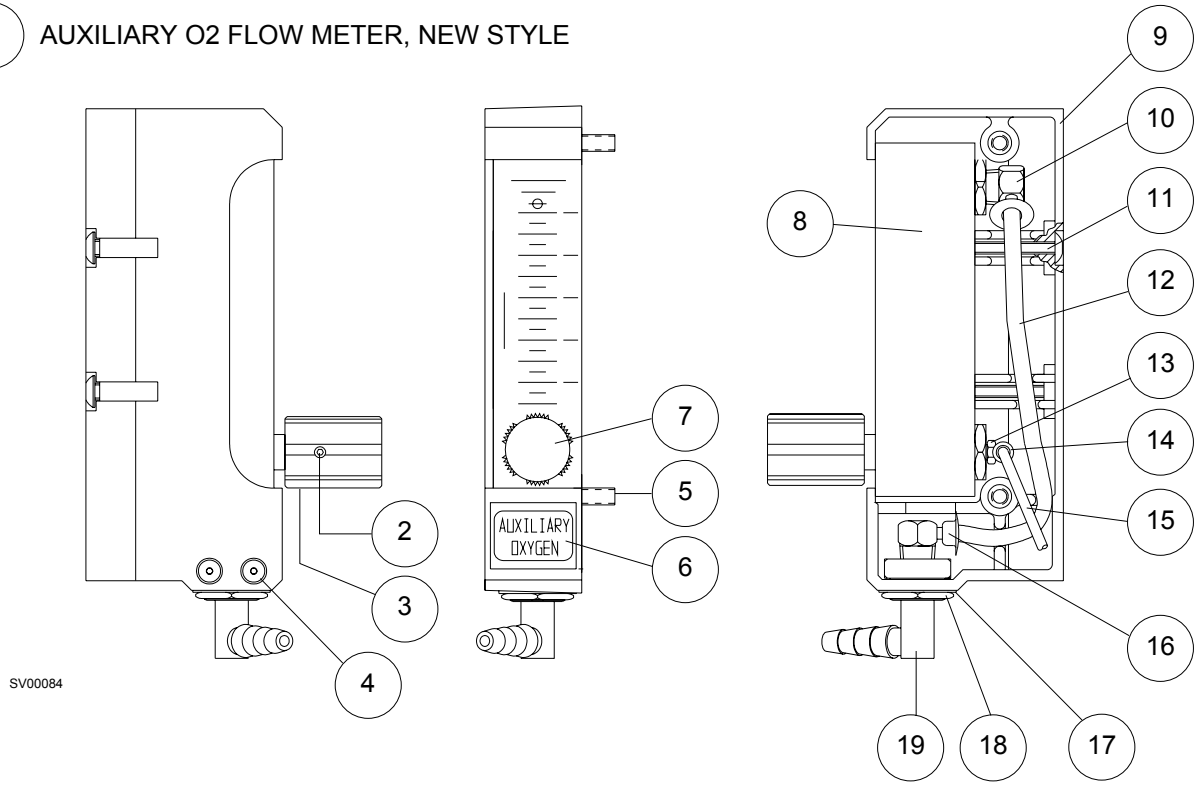
ITEM	DESCRIPTION	PART NUMBER
1	Shield, Flowmeter, 3 Gas Air, Domestic	4111830-001
	Shield, Flowmeter, 3 Gas Air, Canada	4111830-002
	Shield, Flowmeter, 3 Gas, Export, 5 Gauge	4111827
2	Knob Guard, 3 Gas	4110574
3	Screw, 6-32 x 7/16 btn hd (2x)	HW09017
4	Knob, O_2	4103156
5	Label, O_2 Flow Control Knob,Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
6	Knob, Flow (2x)	4103736
7	Label, N_2O Flow Control Knob,Blue (USA, UK, Canada)	4103904
	Gray (Germany)	4111266-004
8	Label, Air Flow Control Knob,Yellow (USA, Germany)	4103905
	Black/White (UK, Canada)	4105982
9	Gauge, 100 psi (3x)	4113867-001
10	Gauge, 3000 psi (2x)	4113867-002
11	Flowmeter Light Circuit Assembly	4107370



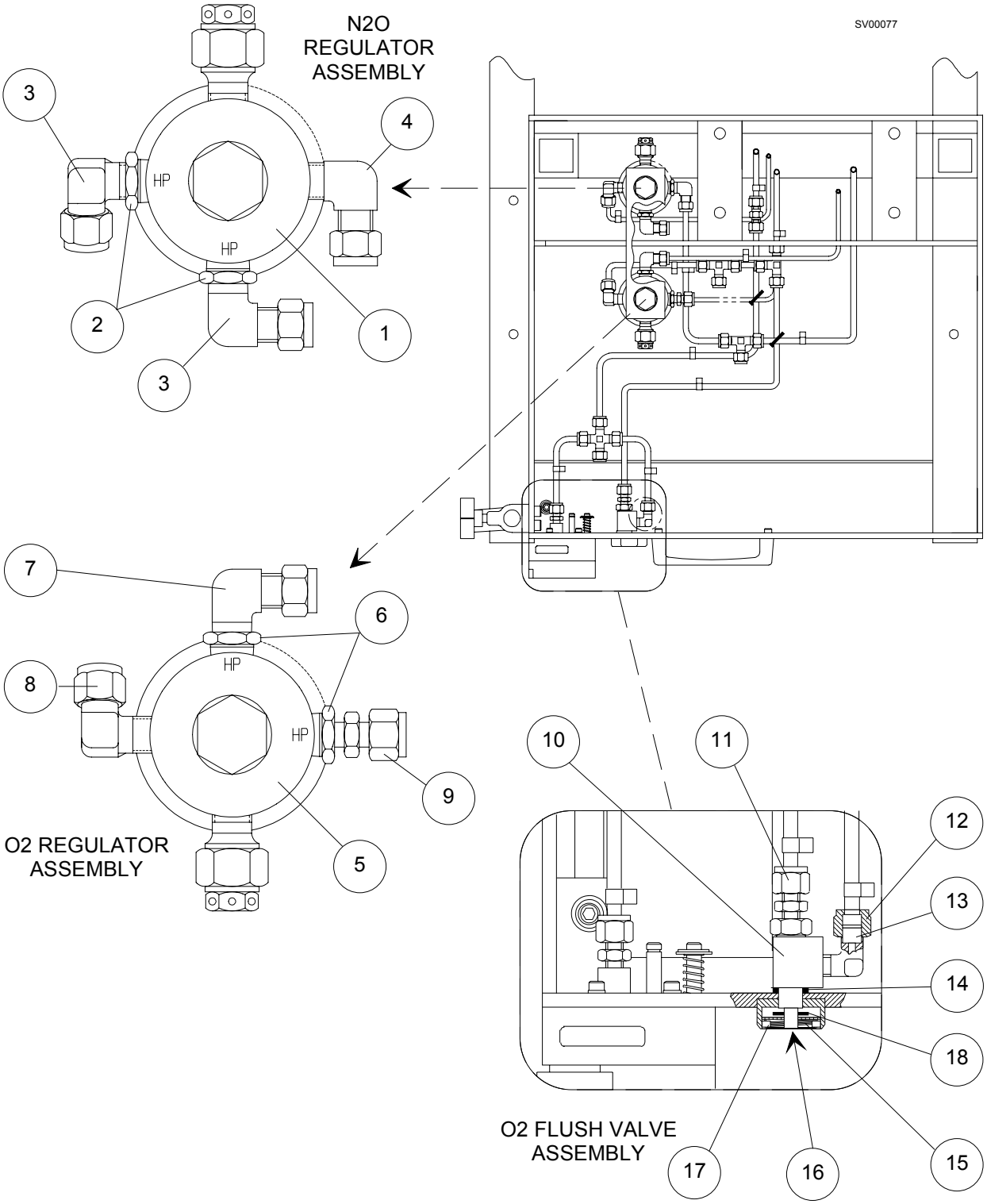
3 GAS MACHINE

ITEM	DESCRIPTION	PART NUMBER
1	Flow Tube, O_2, 1-10 l/min	4112560-001
	Flow Tube, O_2, 0.6-10 l/min (Low Flow)	4112568-001
2	Flow Tube, O_2, 100-1000 ml/min	4112559-001
	Flow Tube, O_2, 20-500 ml/min (Low Flow)	4112567-001
3	Flow Tube, N_2O, 1-10 l/min	4112562-001
	Flow Tube, N_2O, 0.6-10 l/min (Low Flow)	4112564-001
4	Flow Tube, N_2O, 100-1000 ml/min	4112561-001
	Flow Tube, N_2O, 20-500 ml/min (Low Flow)	4112563-001
5	Flow Tube, Air, 1-10 l/min	4112566-001
6	Flow Tube, Air, 100-1000 ml/min	4112565-001
7	O_2 Restrictor Housing	4103440
8	O_2 Restrictor, Red	4110738-003
9	N_2O Restrictor Housing	4111716
10	N_2O Restrictor, Black	4110738-005
11	O-ring, #010, Neoprene (one per each restrictor housing)	4101872
12	Gasket, Large, 2x per Flow Tube	4102724
	Parts common to all flow control valves:	
13	Stop Pin Nut	4103382
14	O-ring, #018, Neoprene	4102336
15	O-ring, #112, Neoprene	4102141
16	Insert, Flow Control Valve	4111819
17	Valve, Flow Control	4103352
	New part number	4115871

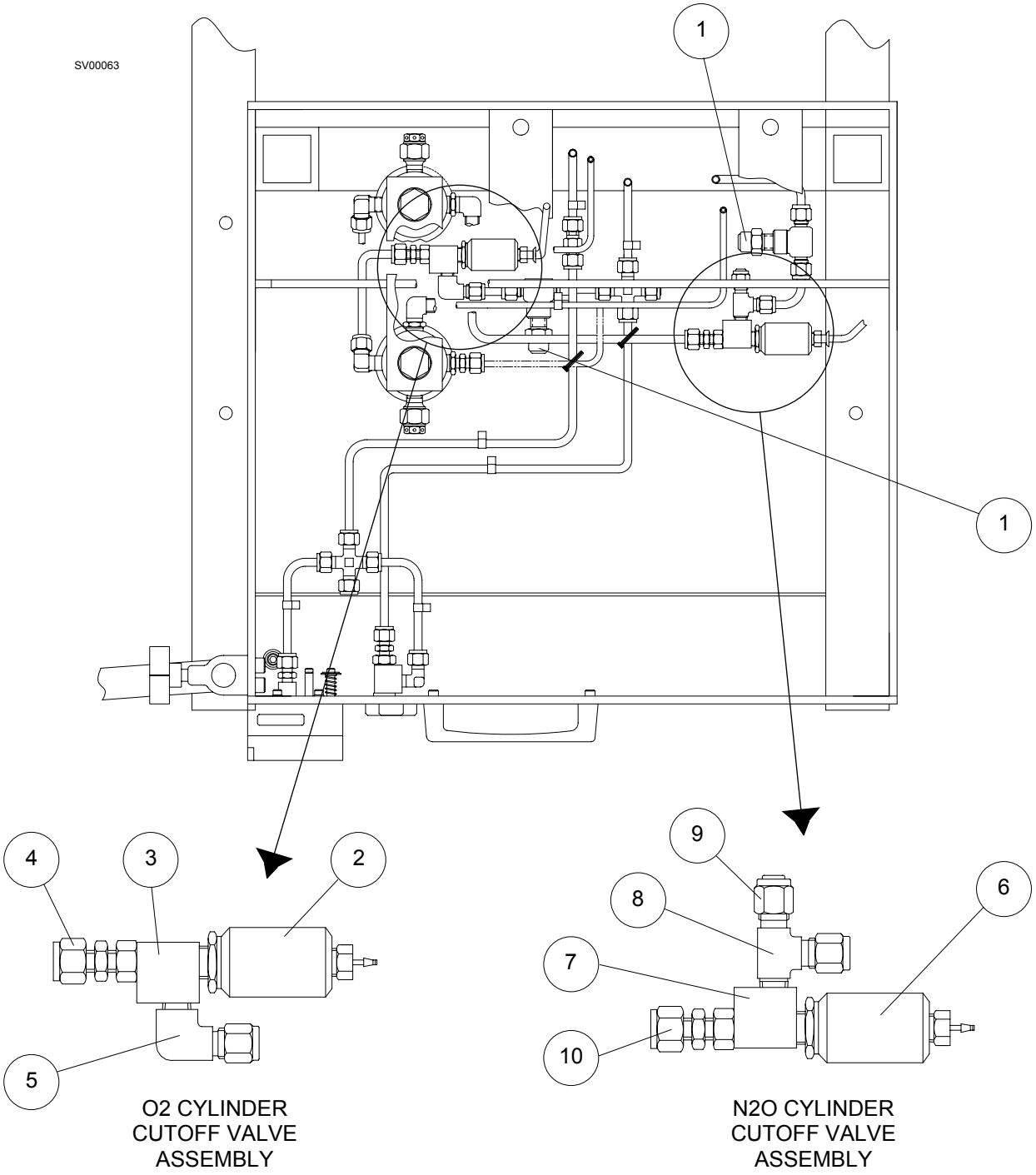
1 AUXILIARY O2 FLOW METER, NEW STYLE



ITEM	DESCRIPTION	PART NUMBER
1	Auxiliary O_2 Flow Meter Assembly, new style	4109310
2	Set Screw, cup point, 6-32 x ¼ in.	HW04003
3	Knob	4111442
4	Screw, 6-32 x ¼ in., btn hd (2x)	HW09004
5	Set Screw, cup point, 10-32 x ⅞ (2x) (used as mtg stud)	HW04011
6	Label, AUXILIARY OXYGEN	4109381
7	Label, ⅝ w/dot and green & white rings	4109373
8	Flowmeter (incl. tube & valve)	4111460
9	Housing	4111053
10	Ell, ⅛ hose x ⅛ MPT (2x)	4111445
11	Screw, 10-32 x 1 1/16 in. btn hd (2x)	HW09043
12	Hose, 0.13 in. I.D., 4.63 in.	ML08007
13	Ell, 1/16 hose x 8-32M	4110173
14	Press-on hose clamp	4104161
15	Hose, 0.075 in. I.D., 7 in.	ML08003
16	Press-on hose clamp (2x)	4111495
	Label, O_2 tubing (2x) (not shown)	4109871
17	Lock washer, ⅝ int-t	4111444
18	Panel nut, ⅝-32	4111443
19	Bulkhead & hose barb asm	4111440


N2O
REGULATOR
ASSEMBLY
SV00077
HP
HP
3
4
2
1
3
7
6
8
HP
HP
9
5
O2 REGULATOR
ASSEMBLY
10
11
12
13
14
18
15
17
16
O2 FLUSH VALVE
ASSEMBLY

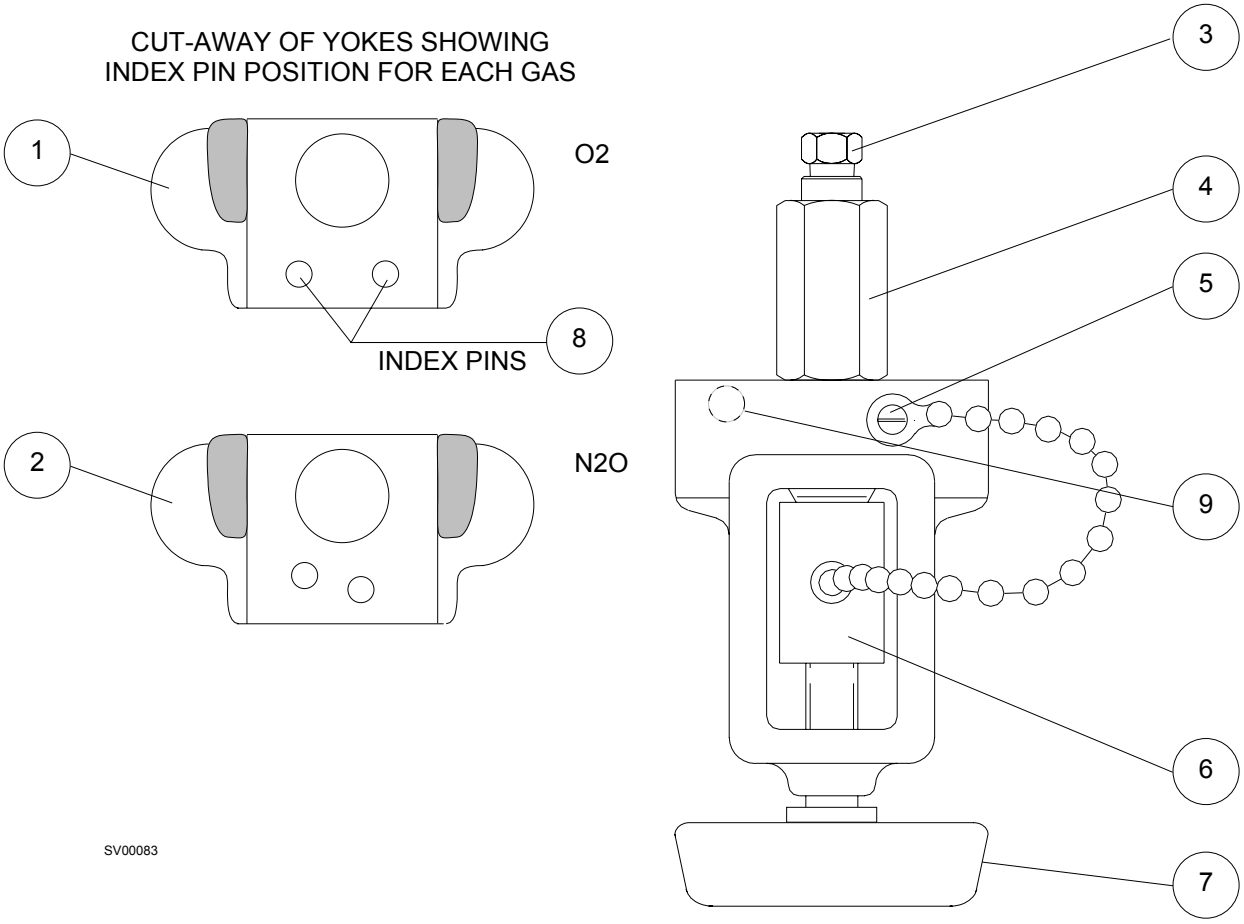
ITEM	DESCRIPTION	PART NUMBER
	N_2O Regulator Assembly:	
1	Regulator	4103591
2	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
3	Elbow Fitting, 3/16 Tube x ⅛ MPT (2x)	4109409
4	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
	O_2 Regulator Assembly:	
5	Regulator	4103590
6	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
7	Elbow Fitting, 3/16 Tube x ⅛ MPT	4109409
8	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
9	Straight Fiting, 3/16 Tube x ⅛ MPT	4109415
	O_2 Flush Valve and Related Parts:	
10	Valve, Clippard, 2 way	4103340
11	Straight Fitting, ¼ Tube x ⅛ MPT	4109408
12	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
13	Restrictor	4101867
14	Spacer	4110792-006
15	Button, O_2 FLUSH	4103249
16	Label, ⅝ Dot, O_2, Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
17	Set Screw, 3-48 x 3/16 (2x)	HW04020
18	Washer	4110792-021


SV00063
1
1
4
3
2
5
O2 CYLINDER
CUTOFF VALVE
ASSEMBLY
9
8
7
10
6
N2O CYLINDER
CUTOFF VALVE
ASSEMBLY

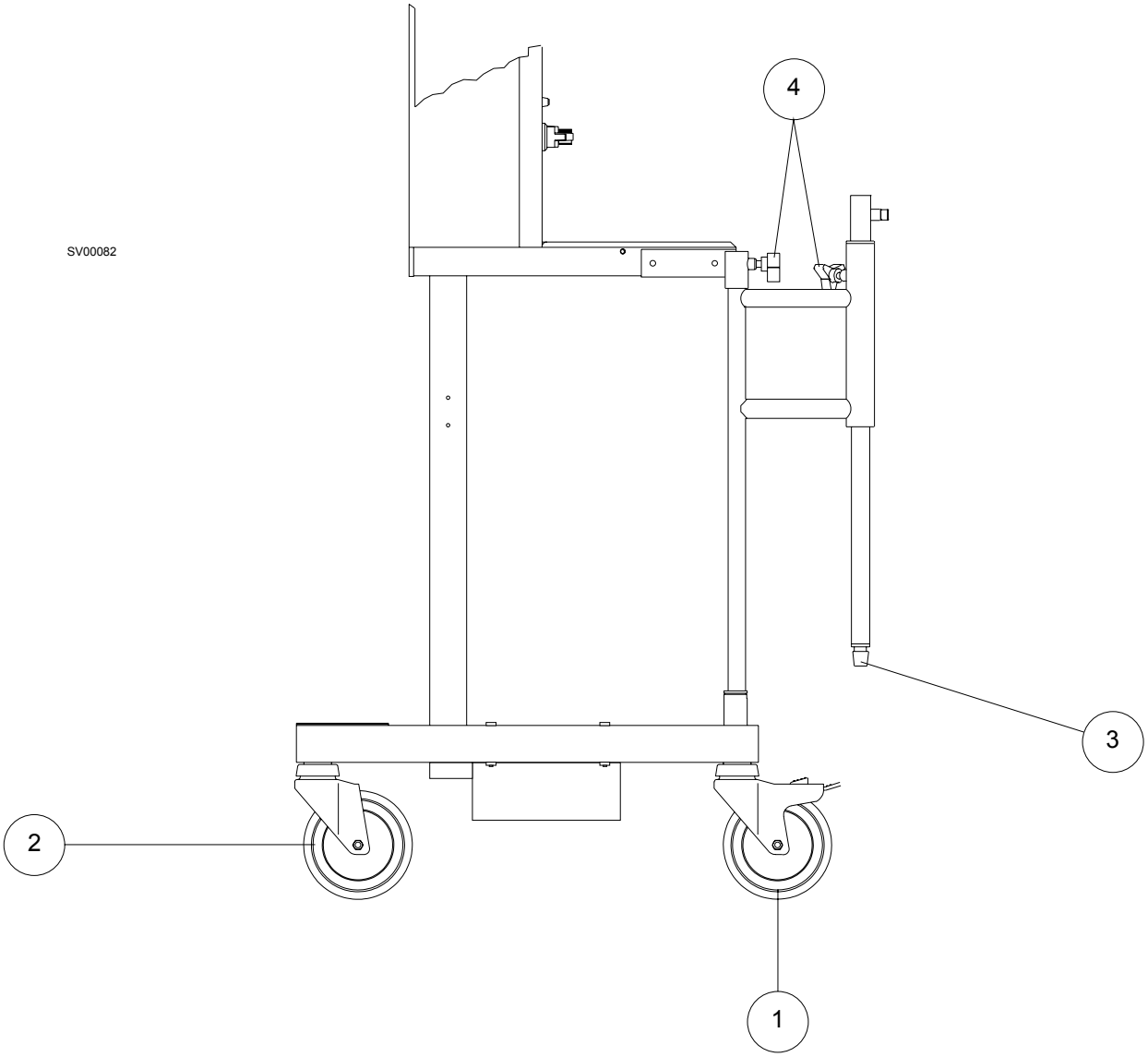
ITEM	DESCRIPTION	PART NUMBER

CSA Items:

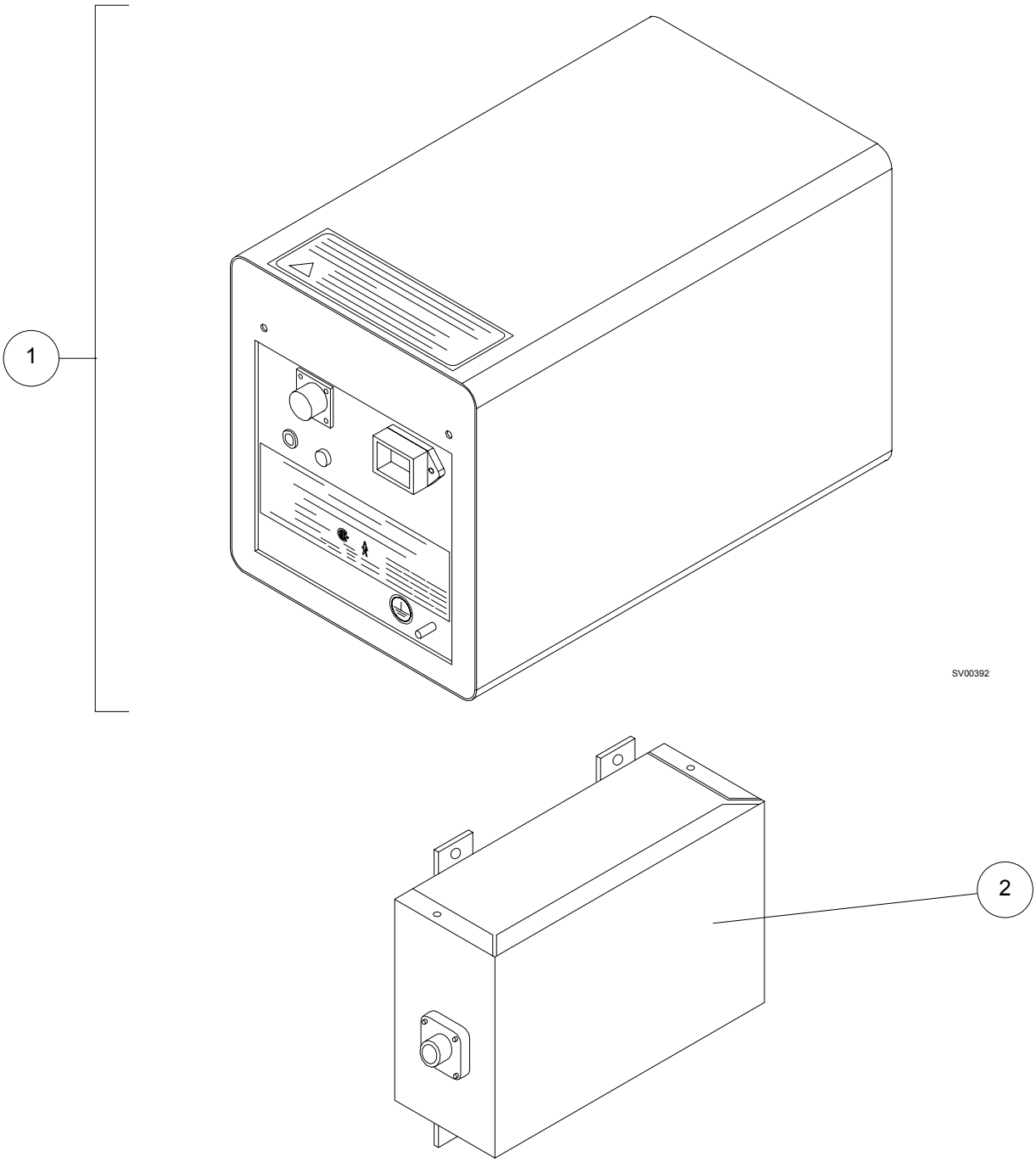
1	Relief Valve, 70 psi (Canada)	4110364
	O_2 Cylinder Cutoff Valve Assembly (Canada)	
2	Pilot Actuator, Modified	4106498
3	Clippard Valve, MJVO-2	4106218
4	Straight Fitting, ¼ Tube x ⅛ MPT	4109408
5	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
	N_2O Cylinder Cutoff Valve Assembly (Canada)	
6	Pilot Actuator, Modified	4106498
7	Clippard Valve, MJVO-2	4106218
8	Tee Fitting, ¼ Tube x ⅛ MPT x ¼ Tube	4109407
9	Plug, ¼ Tube	4103072
10	Straight Fitting, ¼ Tube x ⅛ MPT	4109408


CUT-AWAY OF YOKES SHOWING
INDEX PIN POSITION FOR EACH GAS
1
O2
8
INDEX PINS
2
N2O
SV00083
3
4
5
9
6
7

ITEM	DESCRIPTION	PART NUMBER
1	Yoke, O_2	1101620
2	Yoke, N_2O	1101621
	Parts Common to All Yokes:	
3	Nut, 3/16 Tube	4104716
	Nut, 3/16 Tube	4109489
	3/16 Ferrule	4111038
4	Check Valve Assembly	4111792
	Check Valve Assembly	4118190
5	Screw, 10-32 x ⅜ in. rd hd	HW06006
6	Plug assembly	4112755-001
7	Plastic T-handle & bolt	4113536
8	Screw (Index Pin) (2x per yoke)	4105929
9	Yoke Labels:	
	Label, O_2, Green (USA)	1101768
	White (UK)	4103890
	Blue (Germany)	4111266-001
	Label, N_2O, Blue (USA, UK, Canada)	1101619
	Gray (Germany)	4111266-003


SV00082
4
3
2
1

ITEM	DESCRIPTION	PART NUMBER
1	Caster W/Brake (2x)	4113874-001
2	Caster W/O Brake (2x)	4113874-002
3	Absorber Pole	1101724
4	Wing Screw, ⅜-16 x 1 in. (2x)	1100078

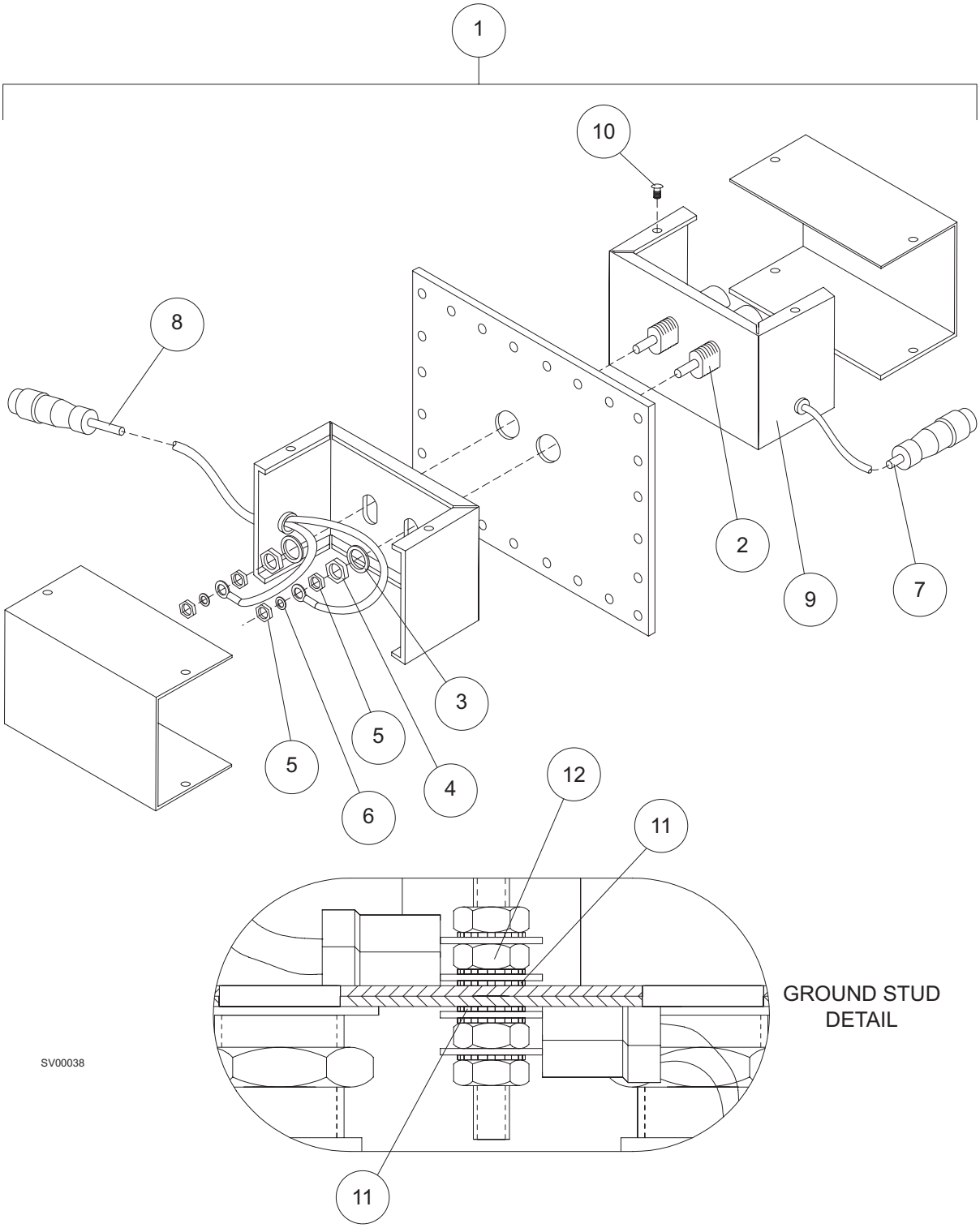

1
SV00392
2

ITEM	DESCRIPTION	PART NUMBER

NOTE: Item 1 is listed for reference only. This power supply can not be repaired. When needed, it should be replaced with the later design power supply, Item 2.

1 Power Supply Assembly (early models) 4113875

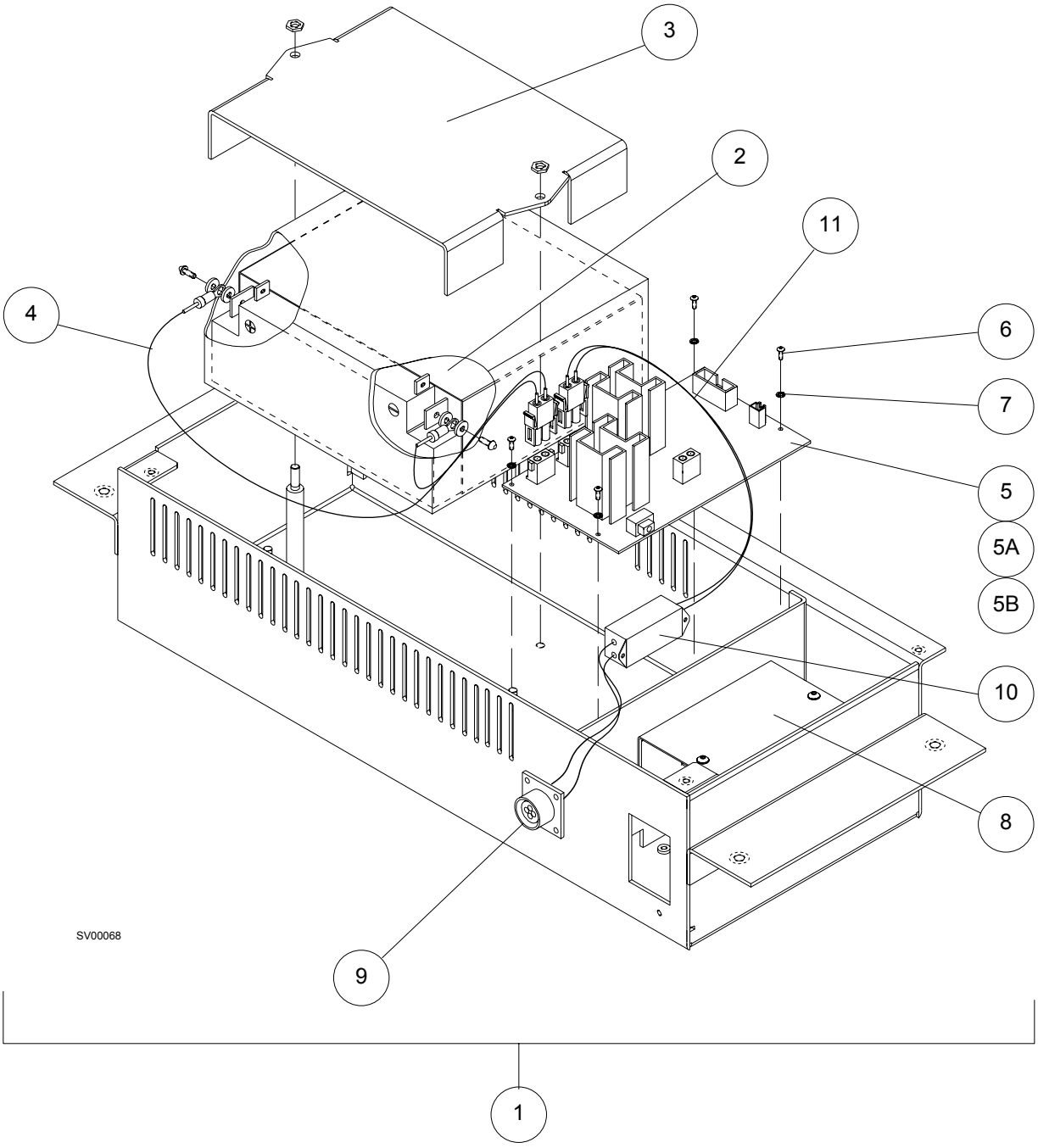
2 Power Supply (later design) (incl. label & cord) 4116068


1
10
8
2
9
7
3
5
5
4
6
12
11
GROUND STUD
DETAIL
SV00038
11

ITEM	DESCRIPTION	PART NUMBER
1	Filter (Power Supply Relocate) Assembly	4114946
2	Filter, high current feedthru (incl. mtg, & connecting hardware) (2x)	4114894
3	Int-t lock washer	supplied with filter
4	Hex nut, 1/2 - 28	supplied with filter
5	Hex nut (4x each filter)	supplied with filter
6	Lock washer, #10 split (4x)	HW65003
7	Power supply cable assembly	4114891
8	Output cable assembly	4114892
9	Box (incl. covers & screws) (2x)	4114895
10	Screw, #6 pan hd self-tap (4x per box)	HW13005

Ground stud parts:

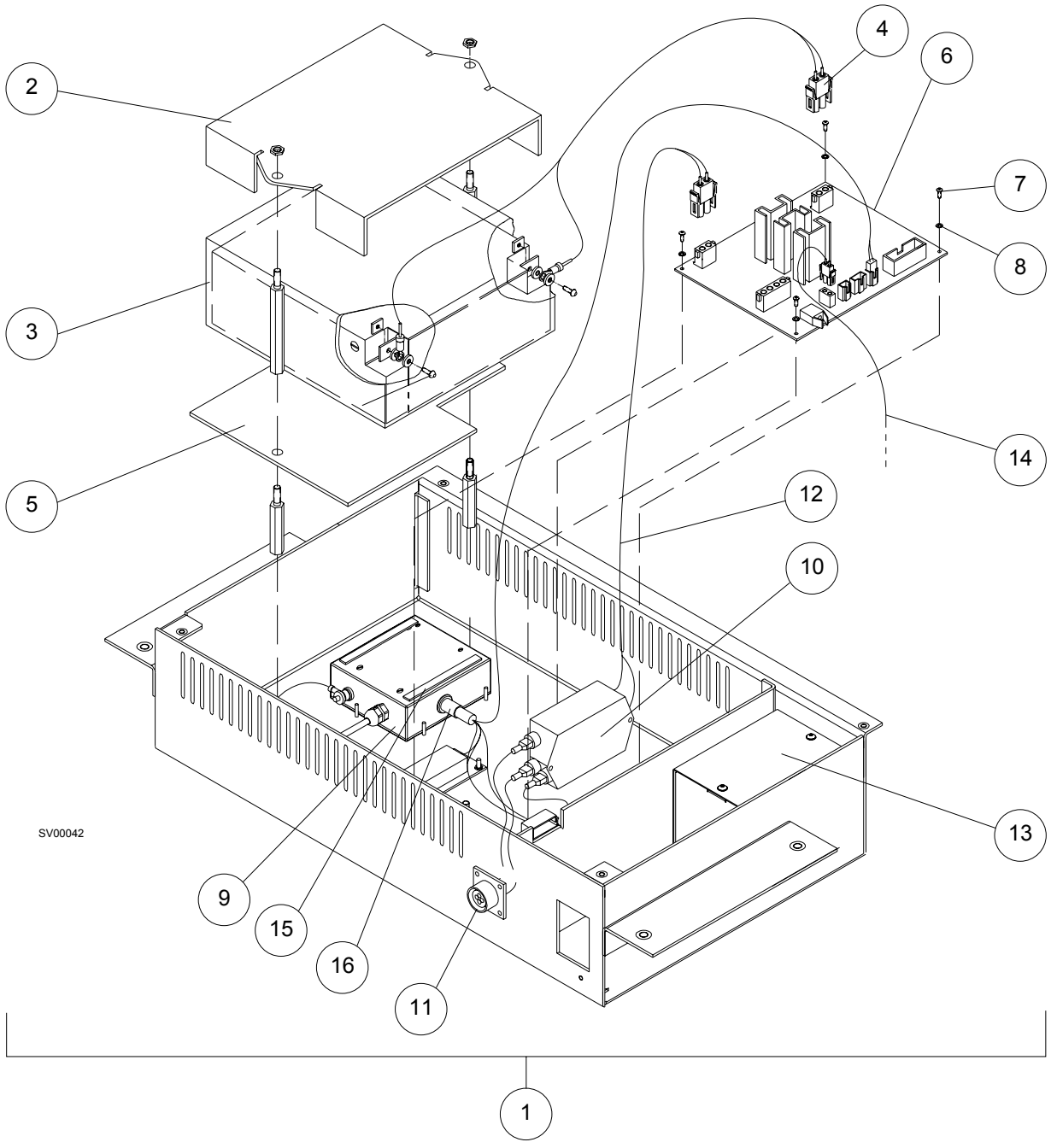
11	Lock washer, #6 ext-t (2x)	HW68000
12	Kep nut, 6-32 (4x)	HW55003



Core-M Version

ITEM	DESCRIPTION	PART NUMBER
1	Battery Box Assembly (early machines w/Core-M monitor)	4113876
2	Battery, 12 V Rechargeable	4111957
3	Battery retainer bracket	4113898
4	Battery Wire Harness	4113883
5	*PCB Assembly (Core-M version)	4113869
5A	Fuse (F1) 3AG, Fast, 10A 250V 312010	EC00365-001
5B	Fuse (F3) 3AG SLO-BLO, 1A 250V 313001	EC00365-003
	Fuse (F2) 3AG Fast, 0.75A 250V 312.750	EC01072
6	Screw, 6-32 x 3/16 in. btn hd skt (4x)	HW09026
7	Lock washer, #6 int-t (4x)	HW67007
8	Solenoid and Housing Assembly	4113962
9	Cable Assembly, power connector to filter	4113882
10	Filter	4115817
11	Cable Assembly, filter to PCB	4115819
	Filter mounting hardware:	
	Screw, 8-32 x ¼ in. btn hd (2x)	HW09010
	Kep nut, 8-32 (2x)	HW55001

* Not interchangeable with VPO version. Verify version before ordering.



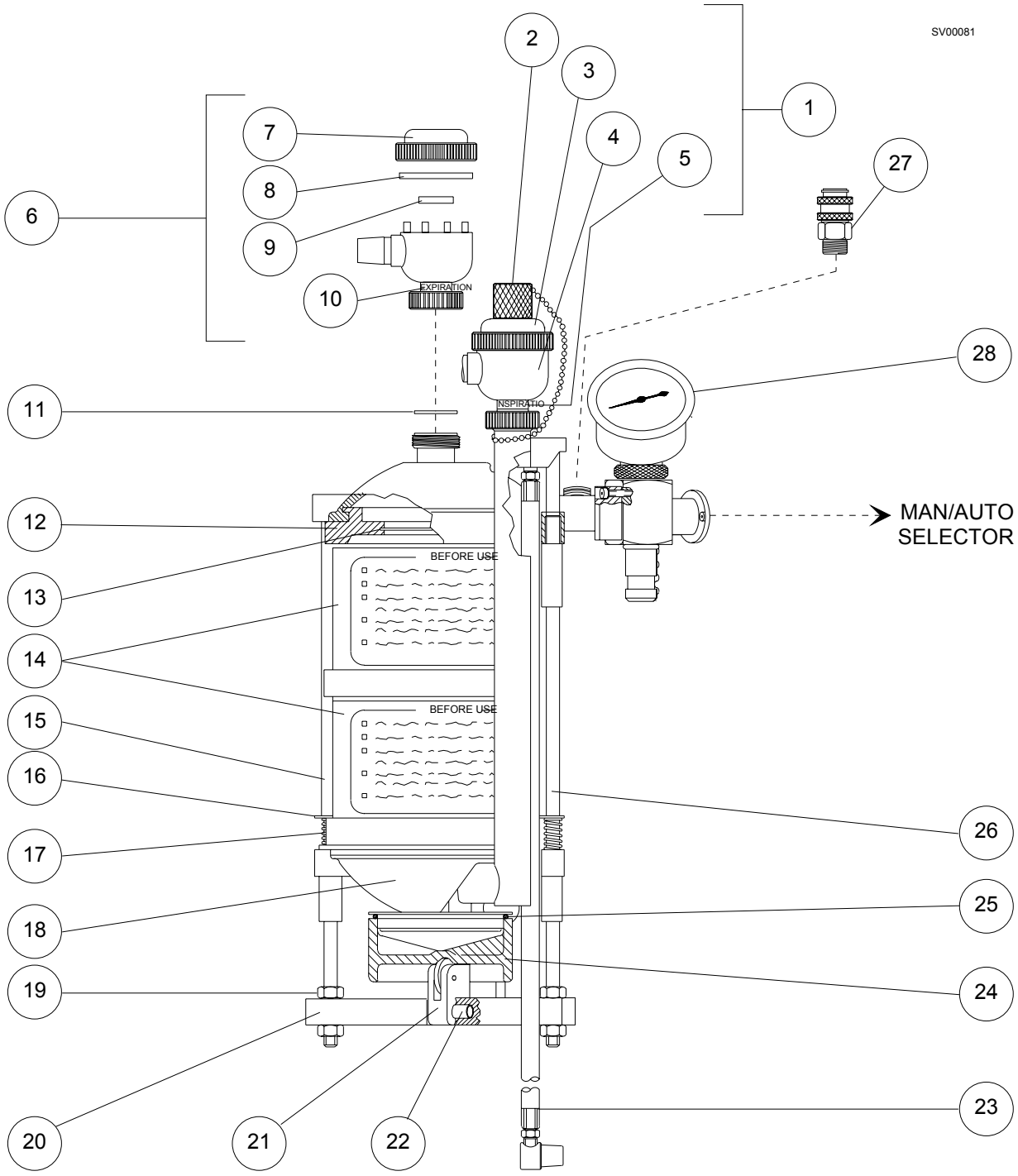
VPO Version

ITEM	DESCRIPTION	PART NUMBER
1	*Battery Box Assembly (later machines w/VPO monitor)	4116235
	*Battery Box Assembly (Invivo w/VPO monitor)	4116235-001
2	Battery retainer bracket	4113898
3	Battery, 12 V Rechargeable	4111957
4	Battery Wire Harness	4113883
5	Plate	4116310
6	*PCB Assembly (VPO version)	4115095
	Service Exchange part	SE4115095
	Fuse F1, 10A, 3AG, fast	EC00365-001
	Fuse F2, 1A, 3AG,slo-blow	EC00365-003
	Fuse F3, 3A, 3AG, fast	EC00365-006
	Fuse F4, 0.5A, 3AG, fast	EC00365-005
7	Screw, 6-32 x ¼ in. btn hd skt (4x)	HW09004
8	Lock washer, #6 int-t (4x)	HW67007
9	Flow sensor assembly (complete assembly shown on another page)	4116236
10	Filter	4115817
11	Cable Assembly, power connector to filter	4113882
12	Cable Assembly, filter to PCB	4116311
13	Solenoid and Housing Assembly	4113962
14	Cable, solenoid to PCB	4115791
15	Foam strip, self-adhesive, 4 7/8 in. (2x)	4109748
16	Cable Assembly, flow sensor module J1 to PCB J4 and monitor (incl. filter)	4116299

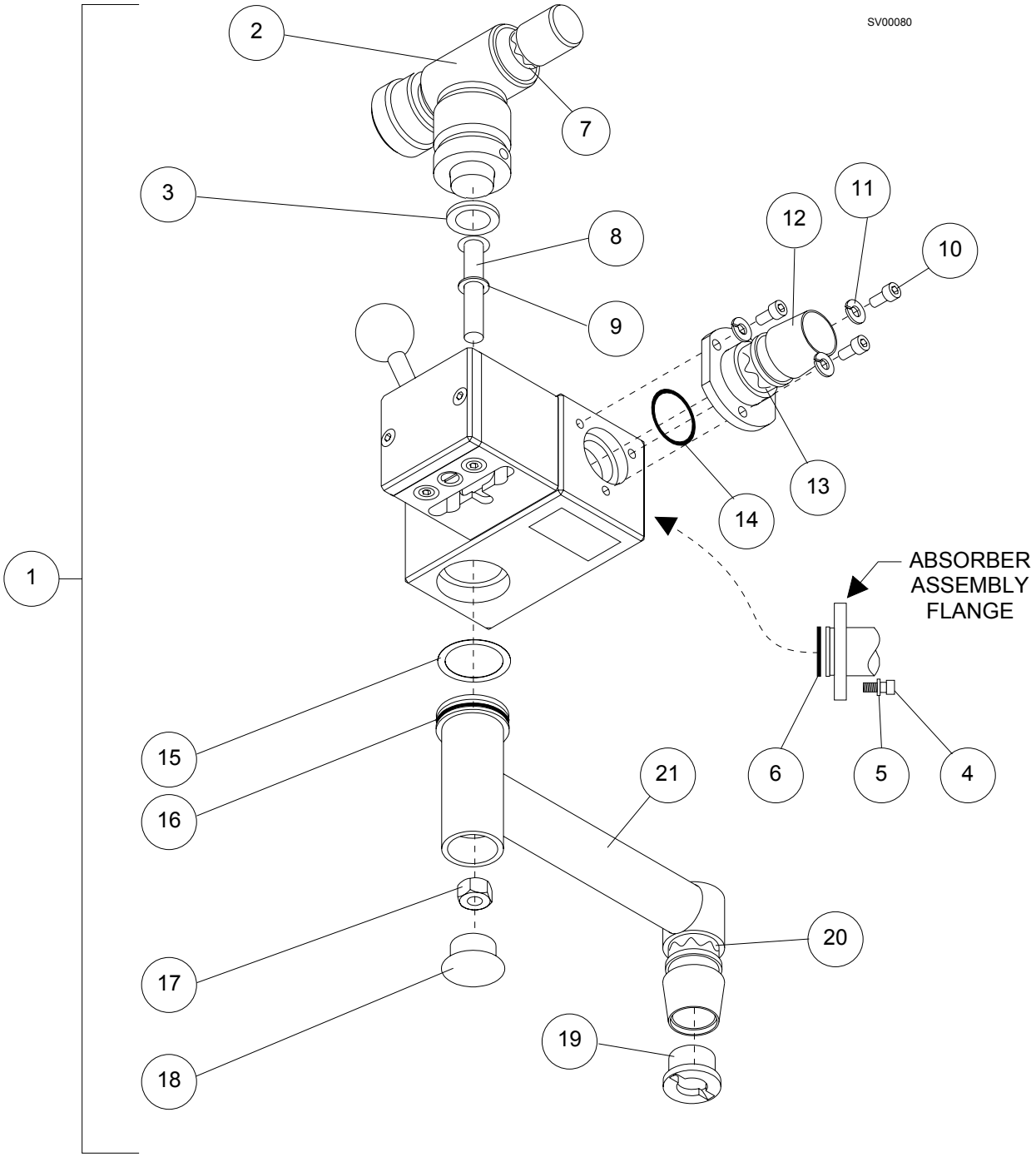
Other cables not part of battery box assembly:

PCB J3 to alarm channel J4	4116392
PCB J7 to monitor (power)	4116313

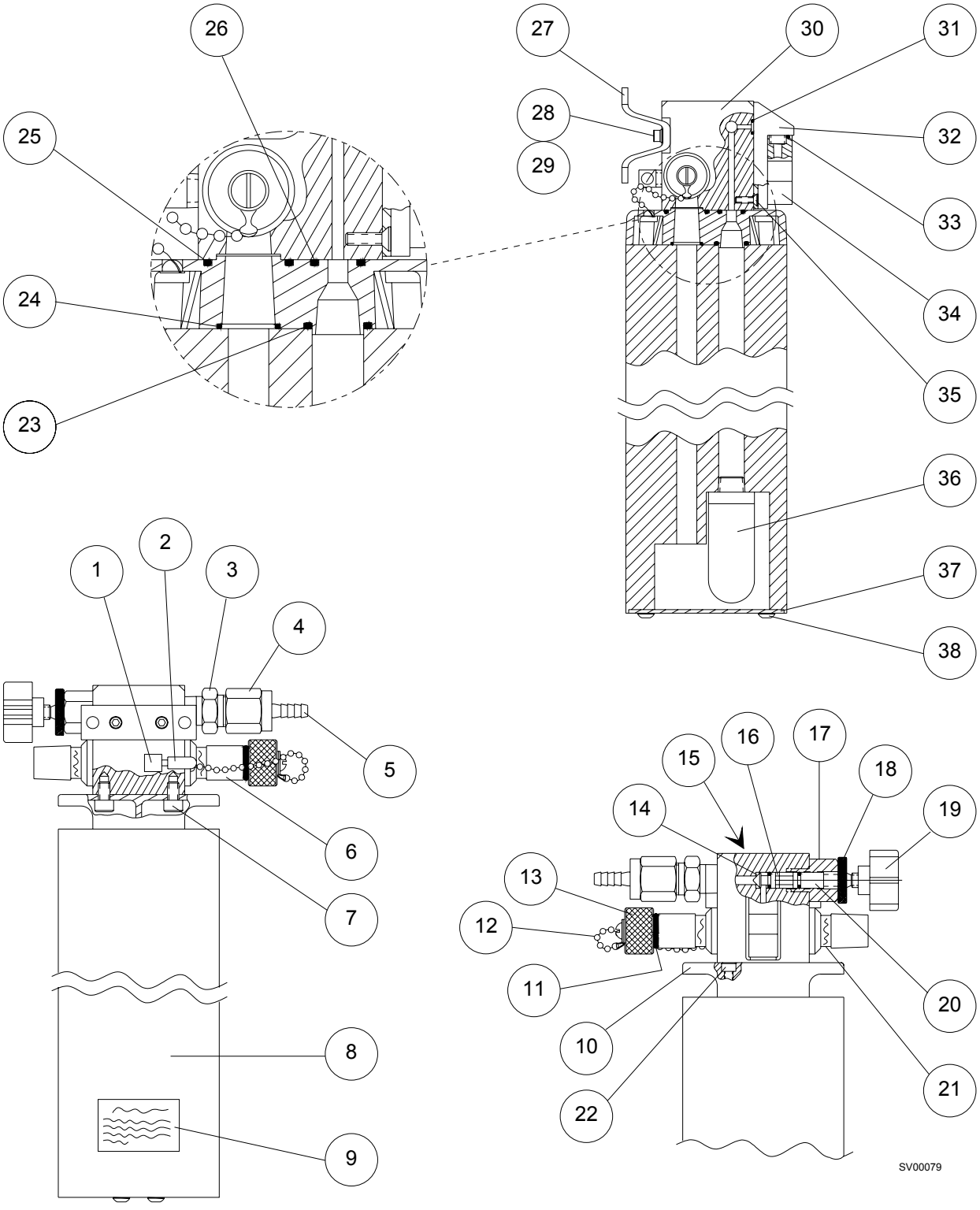
* Not interchangeable with Core-M version. Verify version before ordering.


SV00081
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
EXPIRATION
INSPIRATIO
BEFORE USE
BEFORE USE
MAN/AUTO
SELECTOR

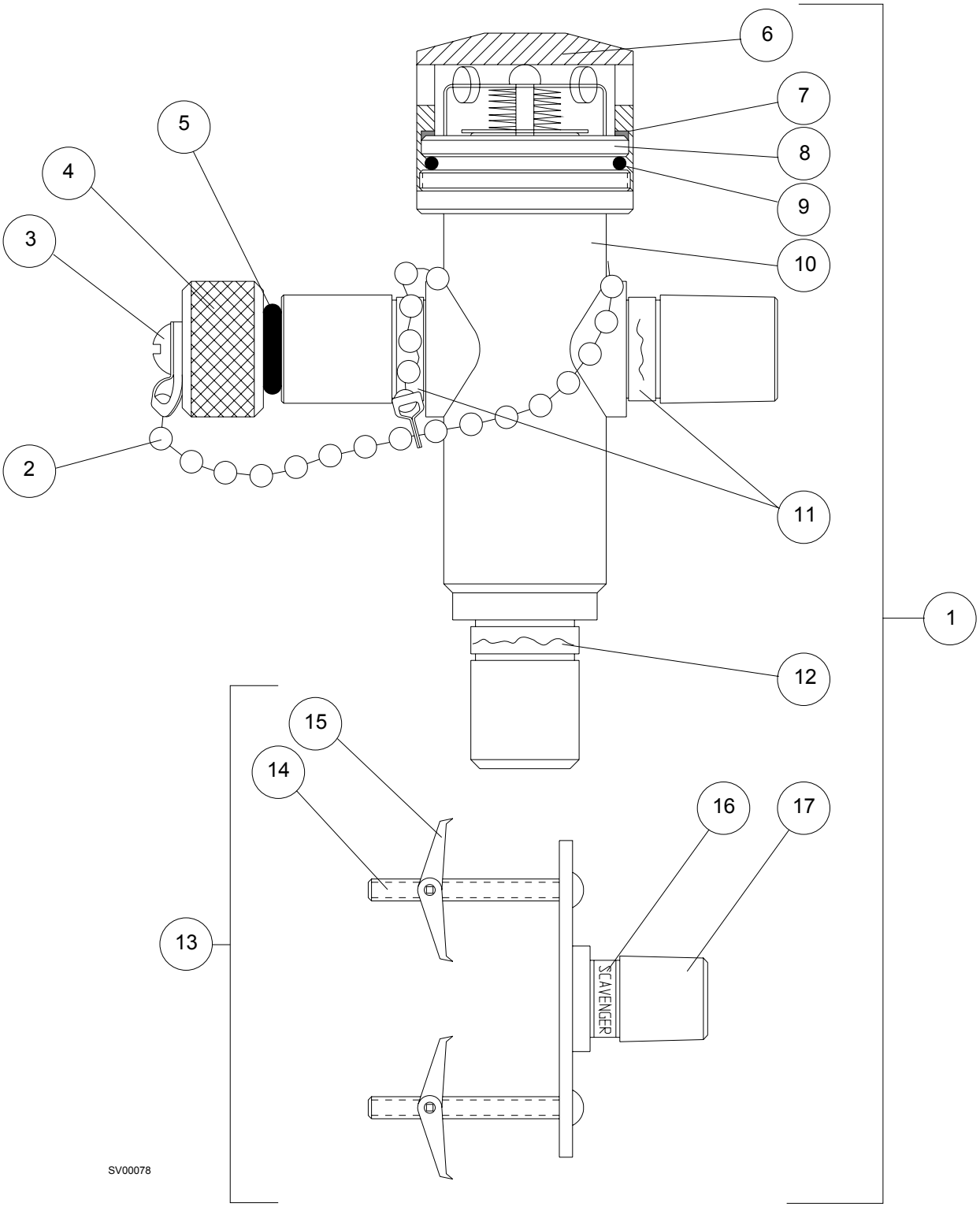
ITEM	DESCRIPTION	PART NUMBER
	Absorber Assembly, MRI	4109430-001
1	Inspiratory Valve Assembly w/O_2 sensor mount	4112773-001
2	Plug Assembly, Oxygen Sensor	4106387
3	Dome & Label, Insp. Valve	4108329
4	Valve Asm	4112151
5	Label, Inspiration	1100559
6	Expiratory Valve Assembly	4112150
7	Dome	2109230
8	Gasket, Valve Dome (Both Valves)	2109231
9	Disk (Both Valves)	M23225
10	Label, Expiration	1100565
11	Gasket, Valve Mount	1101690
12	Gasket, Canister Top	4105848
13	Screen, Canister	1100022
14	Canister Assembly (2x)	4105851
15	Rod, Left	1101356
16	Clip, E-Ring (2x)	1100097
17	Spring (2x)	4110975-010
18	Bottom Sub-Assembly	4112932
	Gasket, absorber bottom (not shown)	1101001
19	Nut, ⅜-16 SS (4x)	HW50010
20	Cam Bar (2x)	1101018
21	Cam Assembly	1101015
22	Dowel Pin	1101017
23	Hose Assembly, Fresh Gas	4108577
24	Dust Cap	4106874
25	O-Ring	4102940
26	Rod, Right	1101355
27	Quick Disconnect Fitting (Breathing Pressure)	4108139
28	Gauge Assembly, Breathing Pressure (Incl Mtg Ring and O-Ring)	4105853-001
	Breathing Pressure Gauge	4113863


SV00080
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
ABSORBER
ASSEMBLY
FLANGE

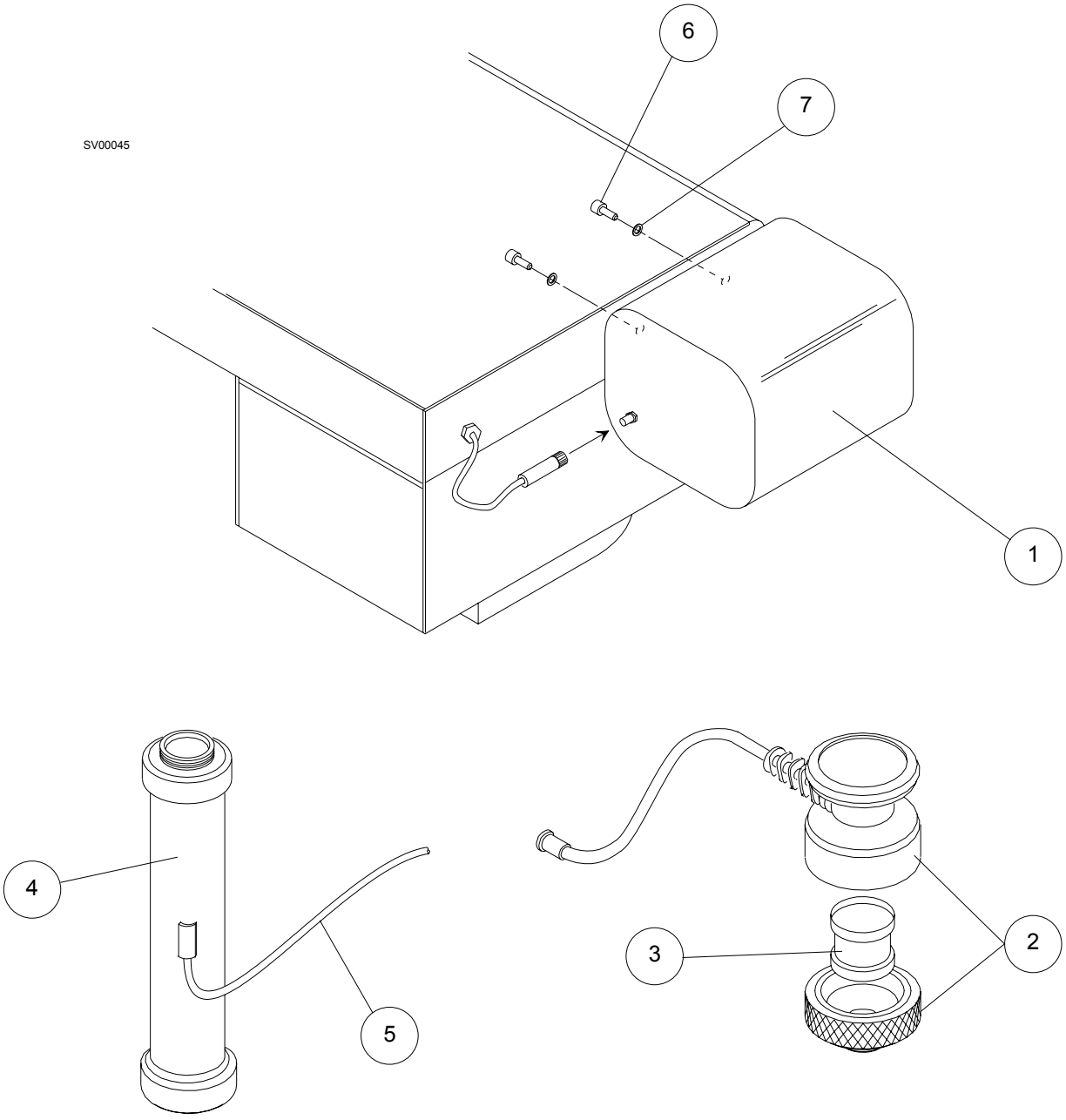
ITEM	DESCRIPTION	PART NUMBER
1	Valve, Man/Auto Selector	4112217-001
2	APL Valve	4104839
3	Fiber Washer	(Supplied with APL Valve)
4	Screw, Selector Valve Mounting, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
5	Lock Washer, Selector Valve Mounting, #8 int-t (3x)	HW67000
6	O-Ring, #117 (silicone)	4105766
7	Label, "Scavenger Hose"	4104806
8	Screw, 5/16-18 x 3¾ in. Rd Hd	HW06023
9	Spacer	4110792-070
10	Screw, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
11	Lock Washer, #8 split (3x)	HW65011
12	Connector Assembly, 22mm	4106744
13	Label, "Ventilator Hose"	1100563
14	O-Ring, #117 Silicone	4105766
15	Spacer	4110792-071
16	O-Ring, #120 EPDM	4112629-001
17	Nut, 5/16-18 Hexseal	4112613-001
18	Hole Plug, 3/16 in. dia.	4111663-001
19	Bag Connector	4102894
20	Label, "Breathing Bag"	1100561
21	Bag Mount Assembly	4112622-001


26
25
24
23
27
28
29
30
31
32
33
34
35
36
37
38
1
2
3
4
5
6
7
8
9
16
17
15
18
14
19
13
12
11
10
22
20
21
SV00079

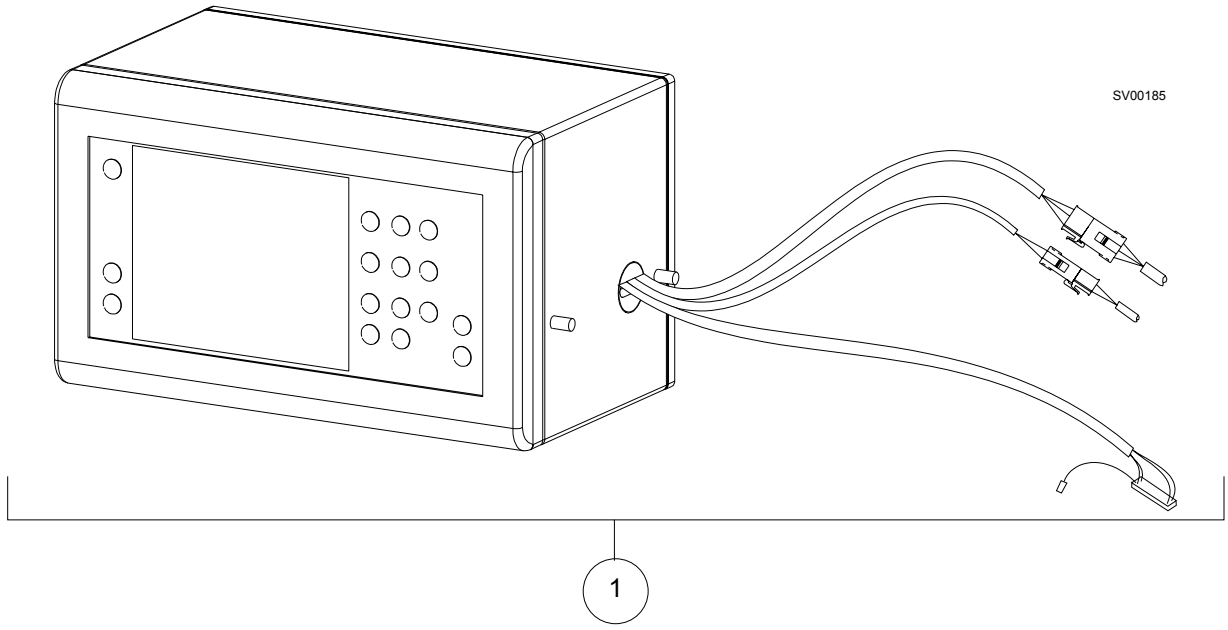
ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly	Euro color 4107624-003
1	Elbow, ⅛ M x ¼ in. hose	4106881
2	Cap, Vinyl	4110045
3	Body, DISS VAC x ¼ MPT	4103669
4	Nut, DISS VAC	4103122
5	Hose Barb Nipple	4103123
6	19 mm Connector (2x)	4109315
7	Screw, ¼-20 x ⅜ in. skt hd (2x)	HW01033
8	Reservoir	Euro color 4110982-001
9	Label, CAUTION	Euro color 4104294-001
10	Reservoir Top	Euro color 4110979-001
11	O-ring #112 (neoprene)	4102141
12	Chain, 8¼ lg	4112495-005
13	Plug	4102140
14	O-ring #008 (neoprene)	4102022
15	Label, ACTIVATE HOSP VAC	Euro color 4109305-001
16	Retaining Ring	4110997
17	Nut, Valve Stem Retainer	4109316
18	Lock Nut, ⅜-24	4112137
19	Wing Nut	4105699
20	Spindle	4112138
21	Label, SCAVENGER HOSE (2x)	4104806
22	Screw, 10-32 x ¾ in. skt hd (4x)	HW01028
23	O-ring #019 (neoprene)	4106458
24	O-ring #015 (neoprene)	4104602
25	O-ring #019 (neoprene)	4106458
26	O-ring #013 (neoprene)	4102234
27	Bracket	4114204
28	Screw, 8-32 x ½ in. skt hd (2x)	HW01014
29	Lock Washer, #8 int-t (2x)	HW67000
30	Block	Euro color 4111002-001
31	O-ring, #008 (neoprene)	4102022
32	Flowmeter Housing	4110980
33	O-ring, #012 (neoprene)	1101523
34	Flowmeter	4112289
35	Screw, 6-32 x ⅜ in. flat hd (2x)	HW05006
36	Silencer	4110999
37	Reservoir Cap	4111000
38	Screw, 10-32 x ⅜ in. btn hd (4x)	HW09005
	Upper mounting screw hardware: Screw, 10-32 x ½ in. skt hd	HW01025
	Lock Washer, #10 split	HW65003
	Flat Washer, #10	HW66003
	Lower mtg screw pre-assembly: Screw, 10-32 x ½ in. skt hd	HW01025
	Flat Washer, #10	HW66003
	Spacer	4110791-037


6
7
8
9
10
5
4
3
2
11
1
12
15
14
16
17
13
SCAVENGER
SV00078

ITEM	DESCRIPTION	PART NUMBER
1	Scavenger, A/C, MRI	4106161-002
	Scavenger, A/C, MRI-INVIVO	4106161-003
2	Chain assembly, 8¼ in.	4112495-006
3	Screw, round hd, 10-32 x ½ in.	HW06007
4	Plug	4102140
5	O-ring, #112 neoprene	4102141
6	Dust cover	1101527
7	Spacer	4110792-007
8	Valve 'A' 5 cm H_2O	2207032
9	O-ring, #027 neoprene	4101871
10	Body, solder assembly	4102105
11	Label, SCAVENGER HOSE (2x)	4104806
12	Label, EXHAUST	4106878
	Mounting hardware for scavenger:	
	Screw, 10-32 x ½ in. cap skt hd (2x)	HW01025
	Lock Washer, #10 split (2x)	HW65003
	Flat Washer, #10 (2x)	HW66003
	Scavenger Bracket	4114027
	Scavenger Bracket-INVIVO	4114027-001
	Bracket Clamp	1101301-001
	Bracket Clamp-INVIVO	1101301-002
	Screw, ¼-20 x 1 in. rd hd sltd (2x)	HW06010
13	Vent Grill Adapter (for 19 mm hose)	1101312
14	Screw, round hd, 10-24 x 3 in. (2x)	HW06012
15	Toggle nut (2x)	4101862
16	Label, SCAVENGER HOSE	4104806
17	Adapter assembly, 19 mm	1101609
	Hose Barb Adapter	4108114


SV00045
6
7
1
4
5
3
2

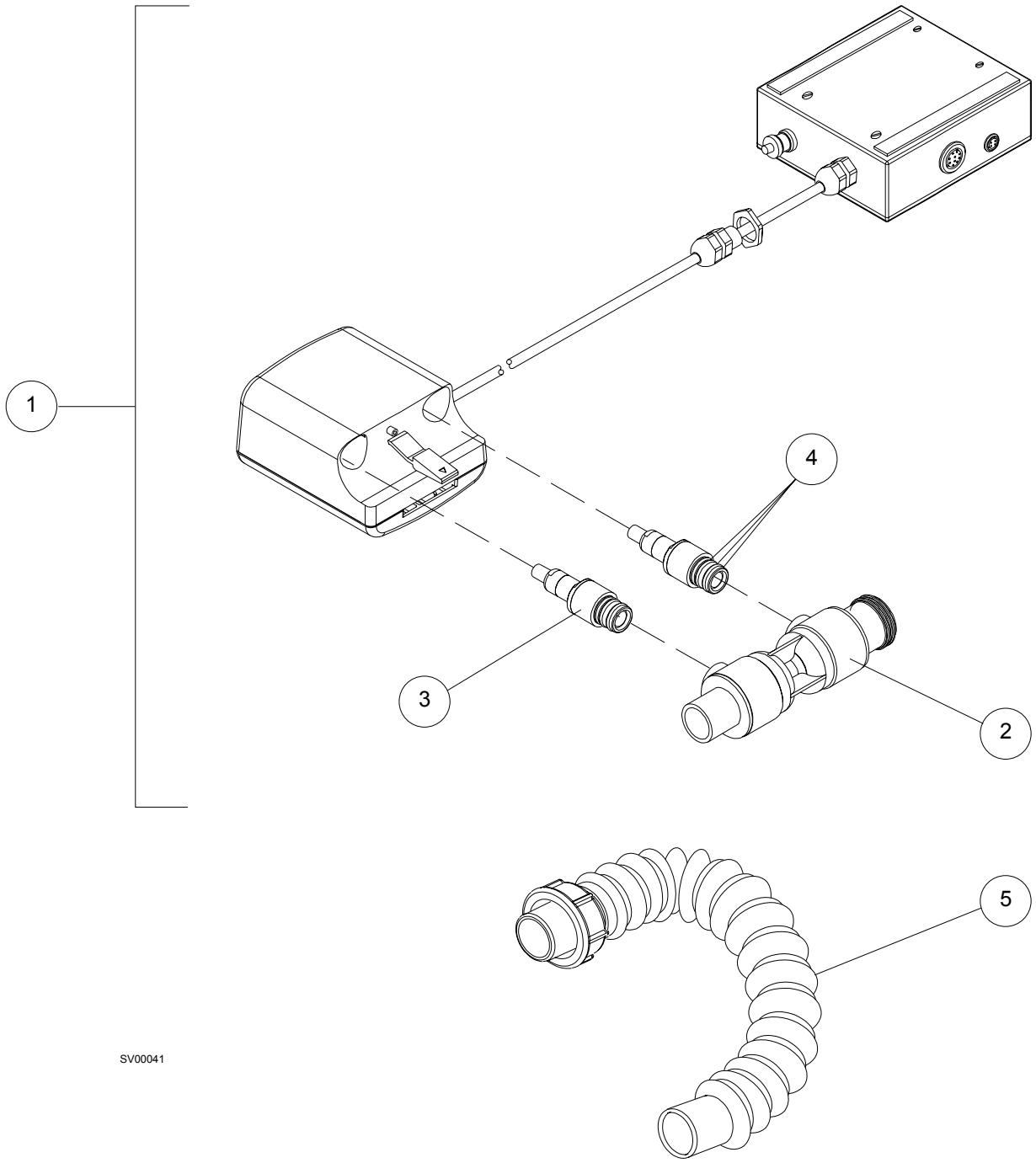
ITEM	DESCRIPTION	PART NUMBER
1	Core-M Monitor (Service Exchange)	4115353
2	O2 Sensor Cable Assembly, EMI Shielded	4115364
3	O2 Sensor capsule	6850645
4	Adult Respiratory Volume Sensor, Omicron	4114450
5	Volume Sensor Pilot Line	4114451
6	Screw, 10-32 x ½ in. cap skt hd (2x)	HW08020
7	Lock washer, #10 split (2x)	HW65003
	Touch-up paint: Euro white	7900380
	Touch-up paint: Euro blue	7901261


SV00185
1

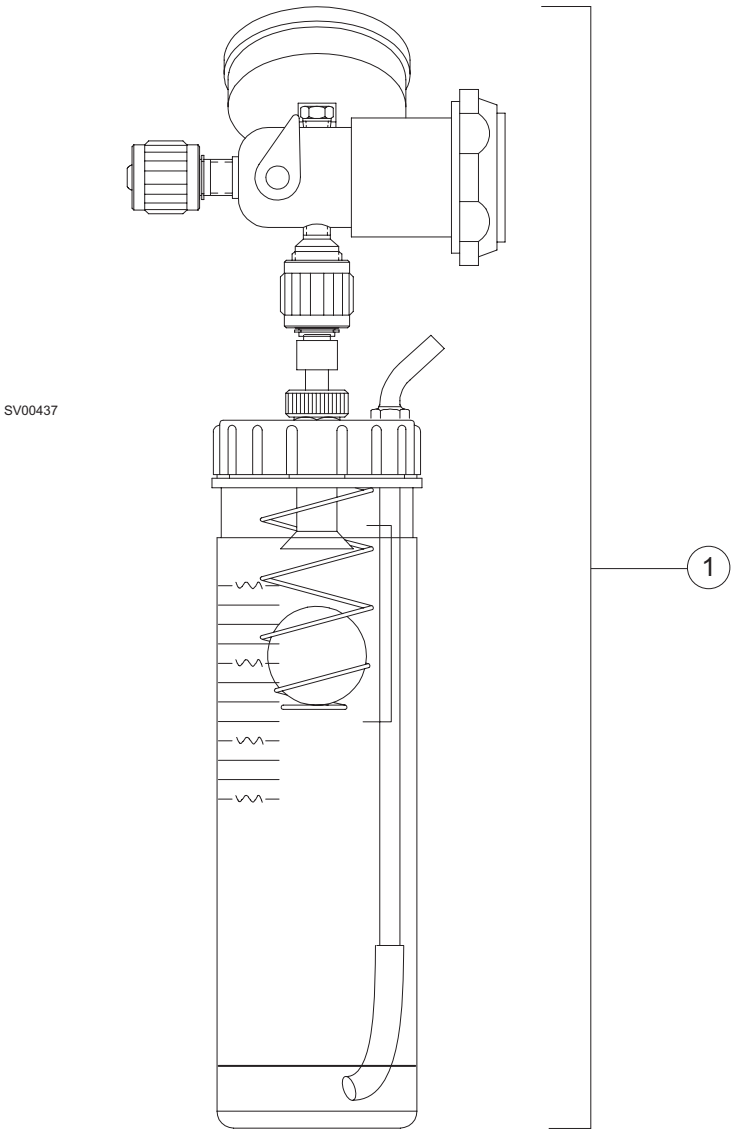
ITEM	DESCRIPTION	PART NUMBER
1	VPO monitor	4116091
	Service Exchange part	SE4116091
	VPO Monitor- Invivo- Service Exchange	SE4116091-001

Not shown:

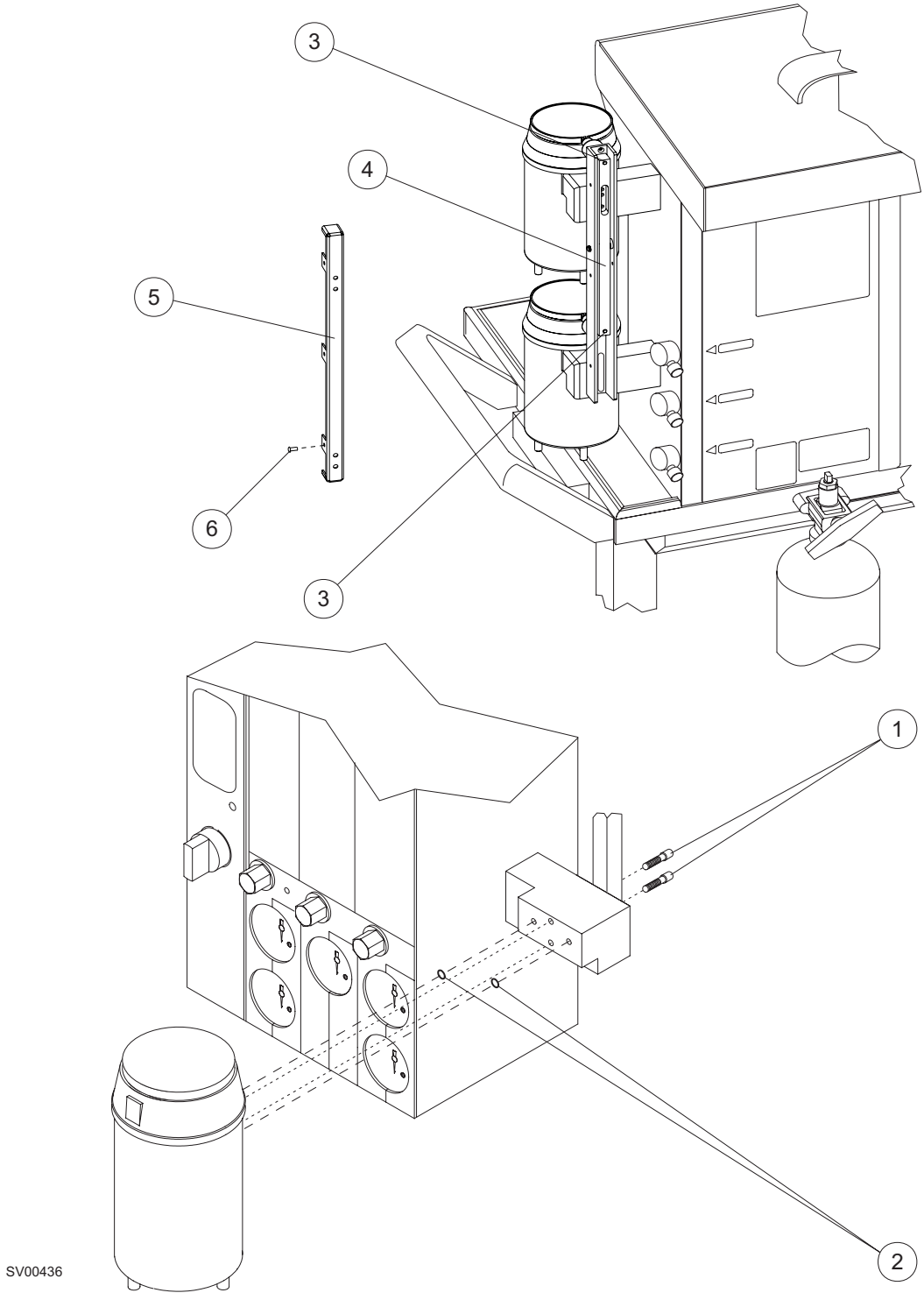
	Mounting nuts, KEP ¼-20 (2x)	HW55004
	O2 Sensor Support Bracket-VPO	4117023
	O2 Sensor Support Bracket-VPO Invivo	4117023-001


1
2
3
4
5
SV00041

ITEM	DESCRIPTION	PART NUMBER
1	Ultrasonic flow sensor assembly, MRI	4116236
	Service Exchange part	SE4116236
2	Flow housing	4114444
3	Transducer - set of two, incl. O-rings	4114445
4	O-ring, set of six.	4115147
5	Connector hose	4114912


SV00437
1

ITEM	DESCRIPTION	PART NUMBER
1	Suction Assembly with re-usable canister (MRI)	4106328-002


3
4
5
6
3
1
2
SV00436

ITEM DESCRIPTION PART NUMBER

Items 1 and 2 are listed for reference and apply to both MRI and MRI-2 machines. (MRI-2 illustrated on the facing page)

1 Vaporizer mounting screws, M4-0.7 x 1 3/16 cap skt hd (2x per vaporizer) HW01072
2 O-rings, #127 (Viton) (2x per vaporizer) 2121929

The following items apply to MRI-2 machines:

3 Set screw, cup pt w/nylon insert(2x) HW10005
4 Exclusion bar 4114960
5 Cover, exclusion system 4114962
Cover, exclusion system- Invivo. 4114962-001
6 Cover screws, 4-40 x 3.16 in. btn hd skt (6x) HW09007

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

Dräger medical

A Dräger and Siemens Company

DrägerService is a division of
Draeger Medical, Inc.
3122 Commerce Drive
Telford, PA 18969
Tel: (215) 721-5402
(800) 543-5047
Fax: (215) 721-5784
Web: www.draegermedical.com
Printed in the U.S.A.

Narkomed MRI Service Manual

Rev. T summary of changes

Page

Cover . . . . . Changed Rev., and Date
8-39 . . . . . Change P/N of item # 9

Rev. S summary of changes

Page

Cover . . . . . Changed Rev., and Date
1-6 . . . . . Change Copyright Date
6-1 . . . . . Added Test Lung and P/N
6-2B . . . . . Changed P/N of Test Lung
8-31 . . . . . Removed SE P/N from item #2

Rev. R summary of changes

Page

Cover . . . . . Changed Logo, Rev., and Date
TOC . . . . . Changed Logo
8-27 . . . . . Added new check valve information
8-37 . . . . . Added new part number for PCB J3 to alarm channel J4
8-45 . . . . . Added new scavenger information
Back Cover . . . . . Changed Logo

Rev, P summary of changes

Page

1-6 . . . . . Added Fabius GS as a trademark name
Section 8
8-3 . . . . . Added Invivo Service Exchange P/N for item no. 1
8-5 . . . . . Added Invivo Service Exchange P/N for item no. 8
8-15 . . . . . Added Invivo Service Exchange P/N for item no. 3
8-37 . . . . . Added Invivo Service Exchange P/N for item no. 1
8-47 . . . . . Corrected P/N for item no. 2

8-49Added Invivo Service Exchange P/N for item no. 1 and added two additional item (O2 Sensors) to Not Shown list
8-55Added Invivo Service Exchange P/N for item no. 5

Rev. N summary of changes

PageDescription

Section 1Updated introduction to include MRI-2 reference
6-4, 6-24, 6-26Removed reference to Omicron per ECN
6-21ARevised time spec. for Apnea volume - Caution and Warning times

Rev. M summary of changes

PageDescription

6-1, 6-2F thru 6-2K, 6-3, 6-4Revised to reflect PMC nomenclature

8-47Revised P/N for O2 sensor cable assembly