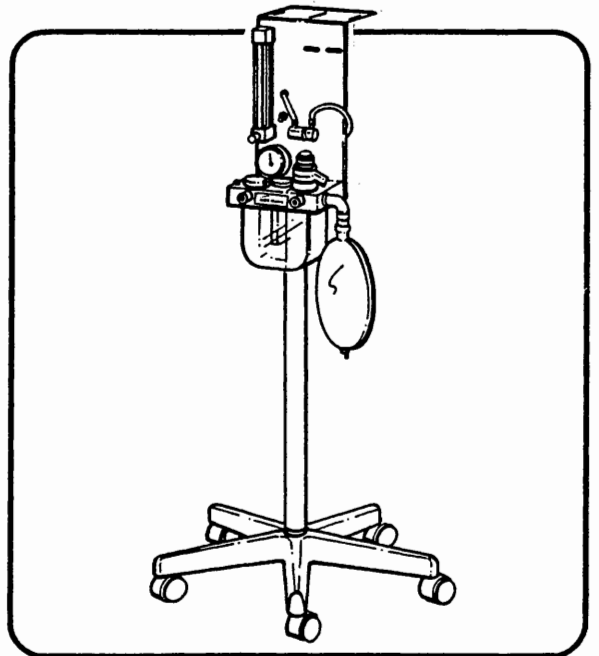


Matrix

*VME Small Animal
Anesthesia Machine*

Operation and Installation



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10400900 Rev. D

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Safety Warnings

WARNING: Operation of the Matrix VME Small Animal Anesthesia Machine is restricted to use by veterinary professionals trained in anesthesia practice.

WARNING: Analgesic compounds and oxygen administered through VME machines can be dangerous to patient and practitioner if stored, installed or administered improperly. Follow all protocols provided with these substances and associated delivery equipment.

Equipment Cautions

CAUTION: Over-tightening the canister knob can strip the canister mounting hole.

CAUTION: Over-tightening the flowmeter control knob will damage the flowmeter needle and seat.

CAUTION: Using the flowmeter, pressure gauge or pressure relief valve as handles when transporting VME units can result in damage to the components.

1.0 SHIPPING EXAMINATION

Examine both shipping cartons for any signs of external damage. The base and column are packaged in one carton and the upper assembly with accessories in another.

Remove the contents from the cartons and inspect for visible damage or missing parts. If any damage is discovered and/or parts are missing, notify your Matrix representative immediately.

2.0 DESCRIPTION AND COMPONENT IDENTIFICATION

The Matrix VME is a small animal anesthesia machine incorporating an oxygen flowmeter, an anesthetic vaporizer (not included), and a circle rebreathing system with a CO₂ absorber. Both isoflurane and halothane vaporizers are available from Matrix.

Identified in Figure 1, major VME components are:

Inhalation valve. One-way valve that controls direction of fresh gas mixture and recycled gases from the absorber to patient.

Exhalation valve. One way valve that controls direction of expired gases from patient to absorber.

CO₂ Absorber. This clear canister holds CO₂ absorbent material that removes CO₂ from expired gases before the gases recycle back to the patient. The decal on the canister gives filling instructions.

Pressure relief valve. Located on top of the exhalation valve, the pressure relief valve allows manual adjustment of breathing system pressure to the level desired for particular patient/procedure requirements. The valve is infinitely adjustable between full open and full closed. Turn knob (on top of valve) counterclockwise to decrease pressure. To scavenge exhaust gases, connect a scavenging device to the scavenging port of the pressure relief valve. Do not connect this port directly to a vacuum source; a scavenger interface is required.

Pressure Gauge monitors operating pressure in the breathing system as determined by the setting of the pressure relief valve. Both positive and negative pressure are indicated on the gauge scale. The gauge indicator can be zeroed by adjusting the screw in the recess above the zero marking on the dial.

Breathing bag is the reservoir in the breathing system for the gas mixture available to meet the patient's next inhalation demand. The bag also allows visual monitoring of the patient's respiratory pattern and can be used to assist patient respiration by manually squeezing the bag.

Flowmeter allows adjustment and monitoring of the volume of oxygen going into the breathing system. To increase flow rate, turn needle valve counterclockwise.

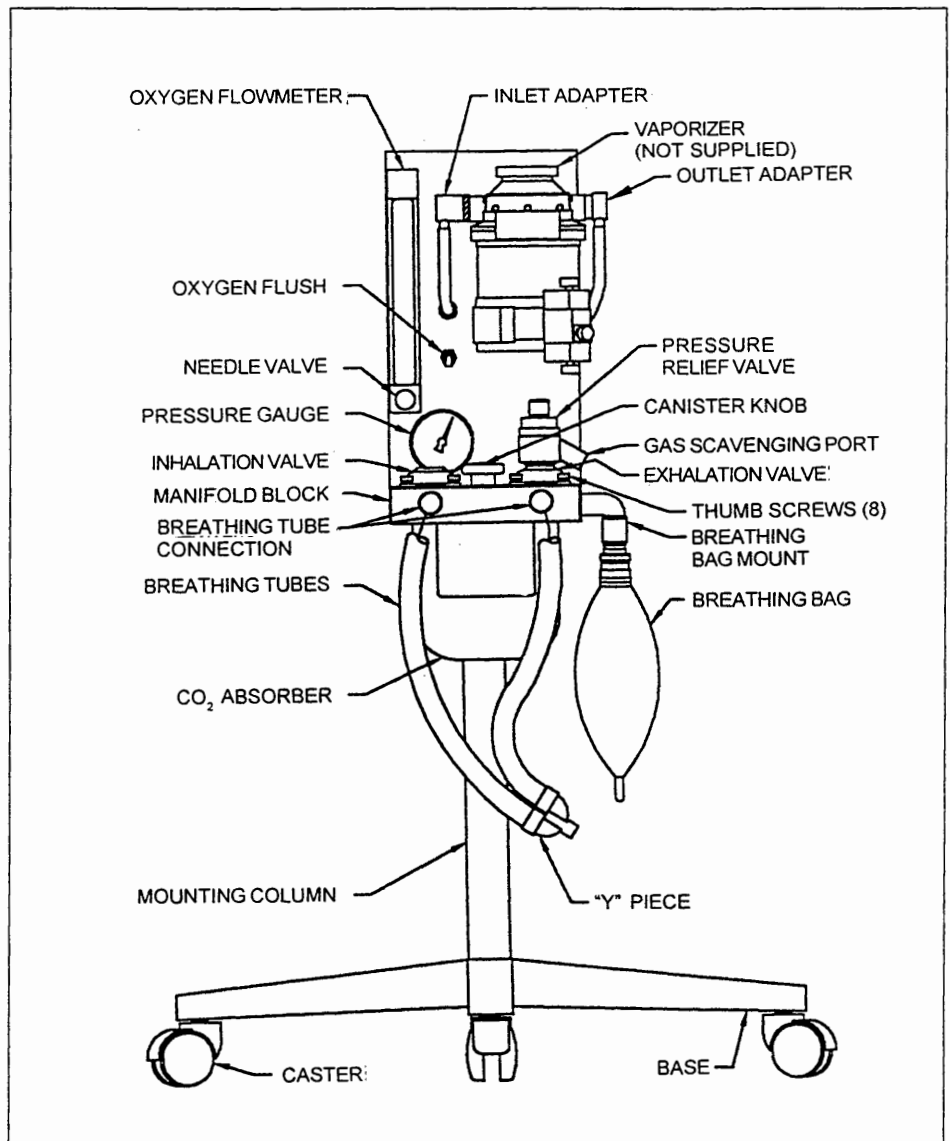


Figure 1. VME Component Identification

3.0 VME ASSEMBLY

Refer to Figure 2 and assemble the VME small animal anesthesia machine as follows:

1. Assemble the stand by inserting the tapered end of the column into the center hole of the base. Secure in place by pushing down on the column and twisting slightly.
2. Slide the upper assembly onto the top of the column. Secure by tightening the two set screws at the rear of machine with the hex wrench provided.
3. Attach loose end of black tubing to fitting on underside of block. see Figure 2.
4. Position the absorber canister with decal facing the front of machine as shown in Figure 3. Screw absorber knob into canister through top of manifold block. Hand tighten securely.

CAUTION: Do not over-tighten canister knob.

5. Connect breathing bag and breathing tubes as shown in Figures 1 and 2.

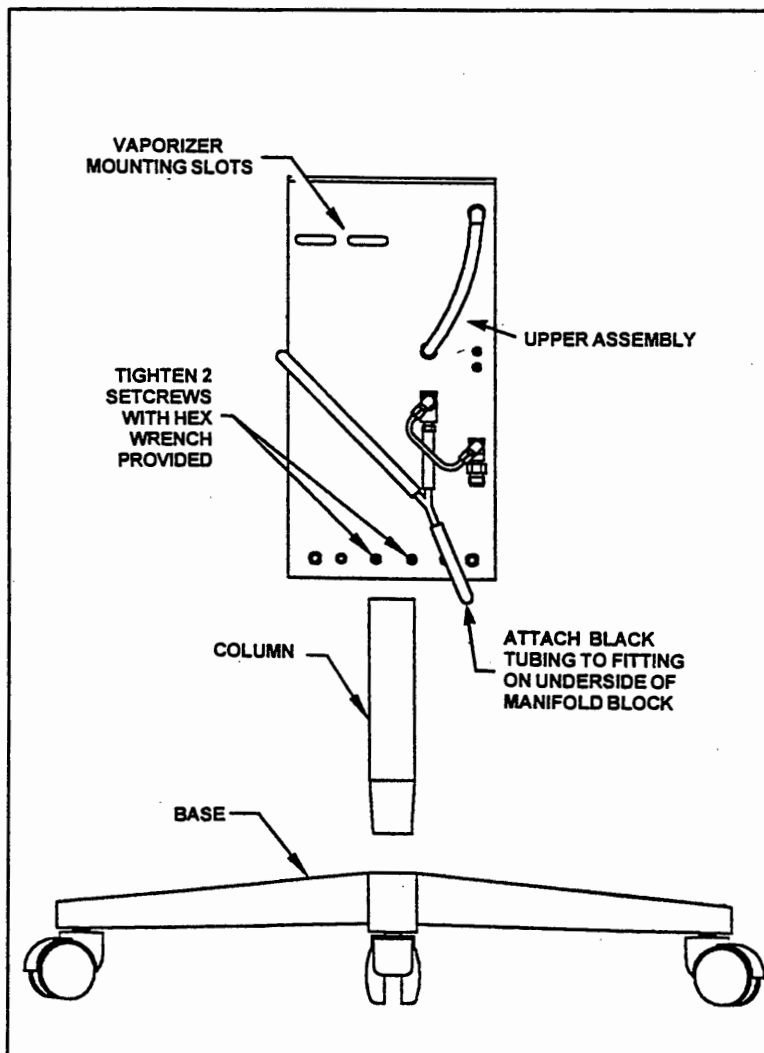


Figure 2. VME Small Animal Anesthesia Machine Assembly

3.1 Vaporizer Mounting

The vaporizer (not included) mounts to the panel of the VME upper assembly through two long slots shown in Figure 2. Mount vaporizer by:

1. Place two spacers (approximately 1/8" thick between the vaporizer and the mounting slots in the panel. Spacers are necessary to provide clearance for the vaporizer inlet and outlet adapters between the vaporizer and the panel.

NOTE: Optional vaporizer mounting kit (Matrx PN 9130 5187) provides the necessary spacers and vaporizer-mounting hardware.

2. Insert mounting screws and washers through slots from back of the panel as shown in Figure 4. From front of panel, place spacers on screws. Position vaporizer so mounting holes align with screws extending through panel. Tighten screws.
3. Connect inlet and outlet adapters to vaporizer.

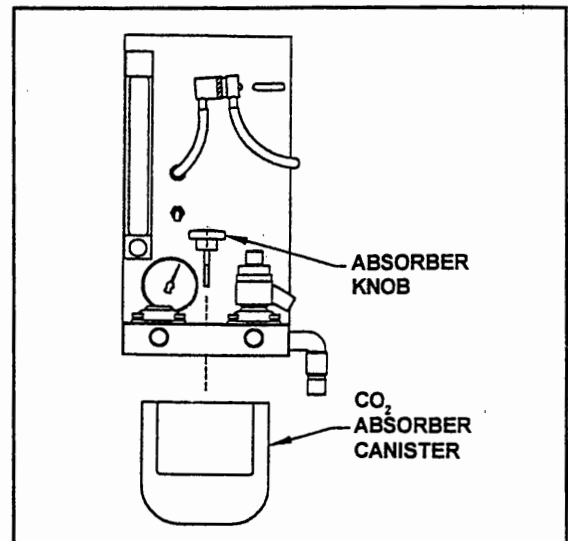


Figure 3. Absorber Assembly

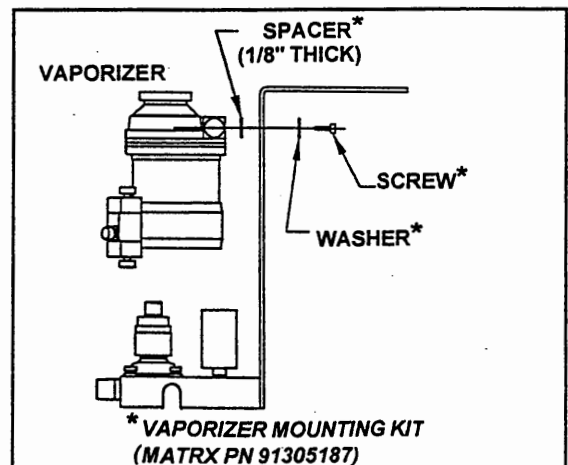


Figure 4. Vaporizer Mounting

4.0 FUNCTIONAL TESTING

The five functional tests that follow must be performed after completion of initial assembly and after maintenance procedures to ensure proper operation.

4.1 Leakage Test

Refer to Figure 5 and leakage test VME machine by:

1. Make sure the absorber canister knob and eight inhalation and exhalation valve dome thumbscrews are tight.

CAUTION: Over-tightening the canister knob can damage the canister.

2. Close flowmeter by turning its control knob clockwise until ball drops to zero.

CAUTION: Over-tightening the flowmeter control knob will damage the flowmeter needle and seat.

3. Close pressure relief valve by turning knob clockwise.
4. Connect an oxygen supply line to the inlet fitting on the rear of the machine. Tighten securely.
5. Place thumb over patient connection of "Y" piece.
6. Carefully activate flush valve until pressure gauge reads 20 cm/H₂O. Hold in this position for a few seconds. If there are no leaks, the pressure will hold steady. If the pressure drops, open the flowmeter until the pressure stabilizes. The flowmeter reading will determine the magnitude of the leak. **Leakage in excess of 300 ml/min. must be corrected.**
7. To locate leakage, "feel" at all connections, the breathing circuit and the bag while the system is pressurized. For hard-to-find leaks, wet your hand or use a soapy water solution over the connections.

4.2 Inhalation & Exhalation Valves

Check that valves are operating properly by observing movement during breathing cycles.

4.3 Pressure Relief Valve

Check the pressure relief valve for smooth operation by:

CAUTION: During this test, do not exceed 40 cm/H₂O pressure gauge reading and never fully close the pressure relief valve.

1. Fully open pressure relief valve.
2. With the breathing bag placed on the bag mount, connect a single breathing tube between the inhalation and exhalation breathing tube connectors.
3. Turn the oxygen flowmeter up to 4 LPM.
4. While slowly closing the pressure relief valve, verify smooth movement of the pressure gauge needle.

4.4 Flowmeter

To verify smooth movement of the flowmeter ball through the full range of settings:

1. Open the pressure relief valve fully.
2. Rotate the needle valve to insure that the full range of settings can be obtained.

4.5 Oxygen Flush

With the gas supply connected, activate the lever to ensure operation and shutoff.

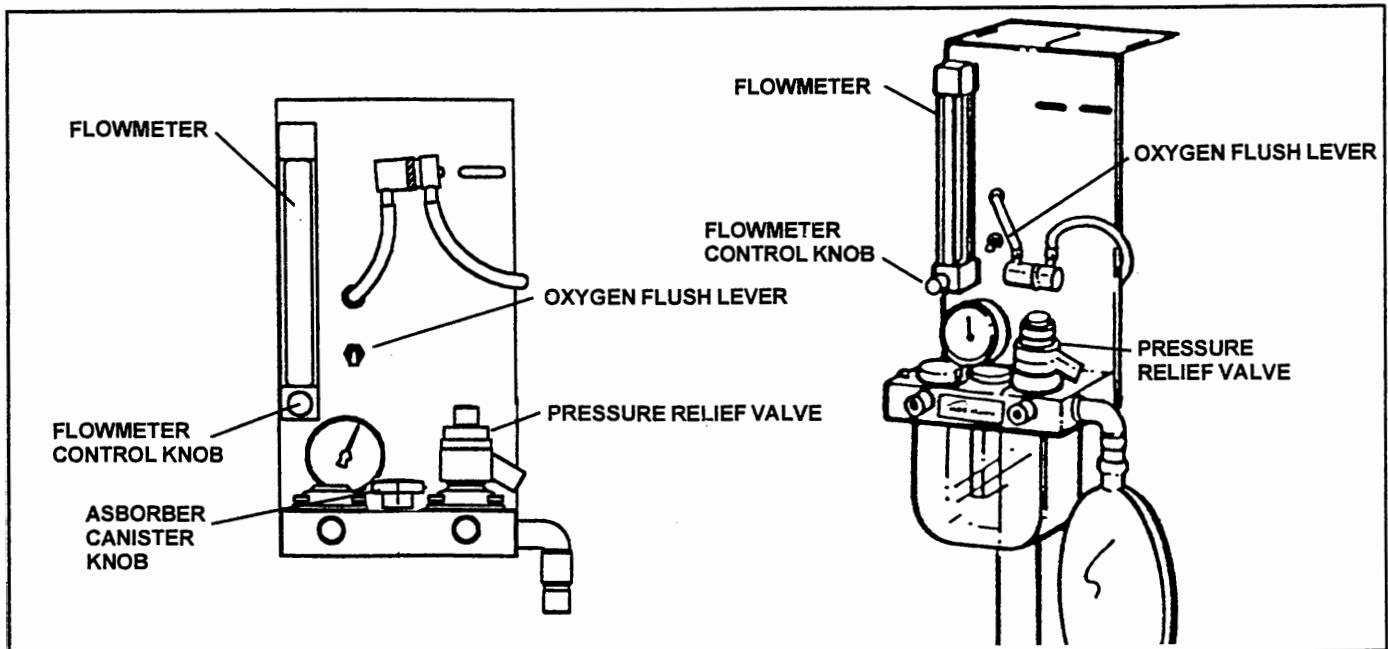


Figure 5. Functional Test Controls and Indicators

5.0 OPERATION

Procedure for operating the VME small animal anesthesia machine follows. Refer to Veterinary Anesthesia Checklist (page 9) for flow rate and set-up guidelines.

1. Cover threaded hole in CO₂ absorber canister either with a finger or by screwing the knob into the canister. Fill canister with absorbent material, following directions on canister decal.
2. Mount canister. Be sure canister and gasket mating surfaces are completely free of absorbent.
3. Connect breathing bag and breathing circuit.
4. Connect a 50 - 55 PSI oxygen supply hose to the inlet connection on the back of the unit.
5. Adjust flowmeter and vaporizer settings to meet the physiologic needs of the patient.
6. Open the pressure relief valve fully.
7. During anesthesia, monitor the pressure gauge, inhalation and exhalation valves and breathing bag. Make necessary corrections to flow rate, vaporizer setting and pressure relief valve.

WARNING: Pressure gauge readings should not exceed 4 cm/H₂O at end of the exhalation cycle.

5.1 Operating Precautions

1. Check that gas supply is turned on and is adequate.

NOTE: A full oxygen cylinder registers approximately 2000 PSI. Change cylinders when the cylinder pressure gauge drops below 200 PSI.

2. Check that the vaporizer is filled.
3. Ensure that the CO₂ absorbent is active. See discussion in Maintenance section below.
4. Never invert or tilt the vaporizer while it contains anesthetic agent.
5. Over-tightening the flowmeter knob will damage or break the flowmeter needle and seat.
6. Turn off the gas supply at source at close of day.
7. Faithfully perform the preventative maintenance recommended below.
8. Do not use the pressure relief valve as a handle when moving the VME machine.

6.0 MAINTENANCE

Change absorbent weekly. Select a day of the week for this to be done or refer to absorbent manufacturers directions. Do not wait for absorbent to totally change color.

NOTE: Color change is not uniform and will vary. When left in VME overnight, absorbent may appear rejuvenated. However the color quickly reappears during the first procedure.

Store absorbent properly. Moisture content of the absorbent must be maintained once packages are opened. Water is essential for the chemical reaction to take place and will be lost if the machine is not used or if packages are not properly resealed during storage.

Clean inhalation and exhalation valves periodically. Disassemble and wipe clean with cloth to remove accumulated water vapor. Clean both valve discs and seats. Valves may stick if not properly maintained. Remove eight thumbscrews (see Figure 6) to disassemble. Make sure that O-rings and clear dome surfaces are clean when reassembling the valves.

Monthly, inspect machine connections and rubber parts for looseness, damage or wear. Replace as needed.

Perform leakage and functional tests periodically to insure proper operation.

Clean outside of VME machine with a hard-surface disinfectant.

Routinely rinse breathing bag and hoses with warm water and hang to dry.

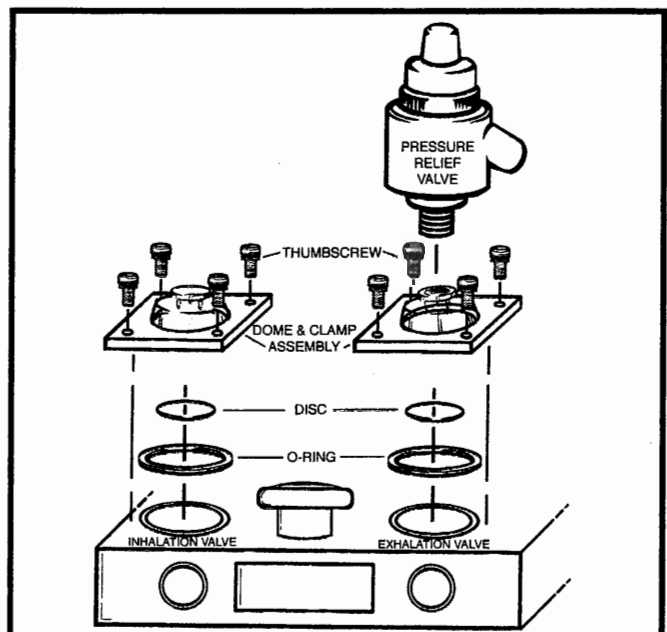


Figure 6. Inhalation & Exhalation Valve Disassembly

7.0 TROUBLESHOOTING

The following troubleshooting guide is helpful in analyzing problems. For any service questions, contact Matrix Technical Support at 1-800-847-1000 (extension 510) or your Matrix dealer.

Problem	Solution
<i>VME machine fails leakage test (page 4)</i>	Check that all eight exhalation and inhalation valve thumbscrews are tight.
	Check tightness of CO ₂ absorber canister knob.
	Make sure absorber canister and gasket surfaces are clean and threaded hole in canister is free of absorbent.
	Make sure pressure relief valve is fully seated to clear dome and is closed.
	Check breathing bag and hoses for leaks.
	Check all connections including vaporizer and filler cap (test with vaporizer turned Off).
	Check that inhalation and exhalation valve domes are properly seated and that O-rings under domes are in place and clean.
<i>Insufficient or no oxygen flow through flowmeter.</i>	Check oxygen supply and pressure.
	Check flowmeter needle valve operation.
<i>Desired depth of anesthesia not maintainable.</i>	Check vaporizer anesthetic agent level.
	Check flow rate.
	Replace CO ₂ absorbent.
	Check that exhalation valve is clean and not sticking in open position.
	Check unit for leaks.
	Check vaporizer connections and filler cap.
	Verify that vaporizer is working properly. Return for service if malfunctioning is suspected.
<i>Inhalation and exhalation valves not working properly.</i>	Check valve seats for damage.
	Valve discs may be dirty or warped. Clean or replace (Matrix PN 10049000) as necessary
<i>Breathing bag appears over-inflated (crease at top of bag not evident when pressure relief valve is fully open and gauge pressure is above 4 cm/H₂O at end of exhalation cycle).</i>	Fully open pressure relief valve. If pressure continues to rise and bag appears over-inflated, replace pressure relief valve (Matrix PN 93335195).
	Check for obstruction in scavenging device.
<i>Breathing bag does not inflate.</i>	Check for excessive draw if using active scavenging.
	Check oxygen flow.
	Check system for leaks.
	Check that tubing (Matrix PN 91315075) between flowmeter to vaporizer and vaporizer to underside of block are connected and in good condition. Replace if needed.

8.0 REPLACEMENT PARTS

The replacement parts identified in Figure 7 and listed below may be ordered from Matrix for the VME small animal anesthesia machine by contacting your veterinary distributor.

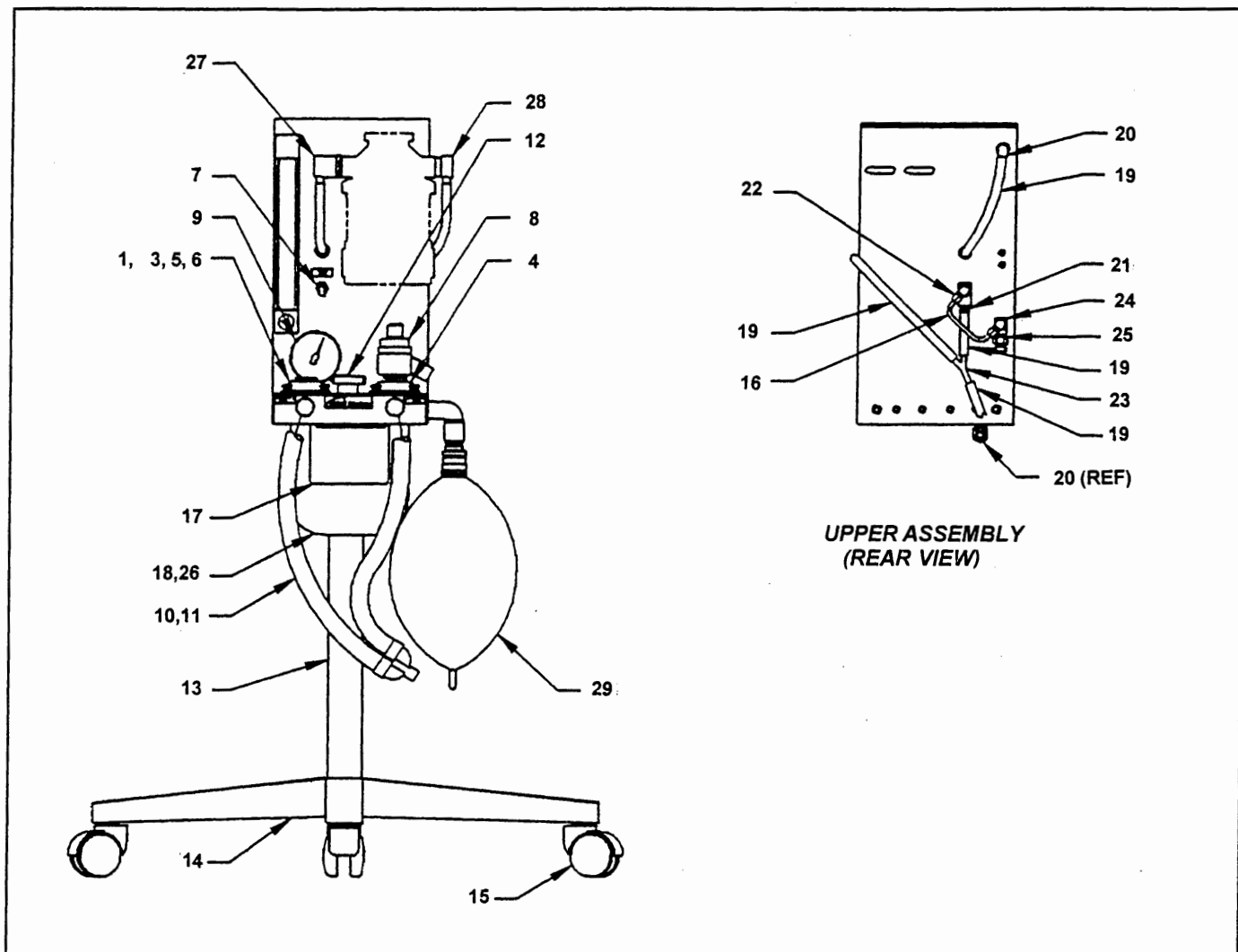


Figure 7. VME Small Animal Anesthesia Machine Replacement Parts

1	6592 7800	Thumb Screw	18	6295 6200	Absorber Canister Gasket
3	20182900	Clamp & Dome Sub-Assy (Coated)	19	9131 5075	1/4" ID Tubing (specify inches required when ordering)
4	20183600	Clamp & Dome Sub-Assy (Machined)	20	6291 7008	Elbow, 1/4 HB X 1/8 NPT
5	6320 0113	O-Ring	21	6190 0901	Connector, 1/4 HB X 1/8 MPT
6	1004 9000	Disc, Inhalation & Exhalation Valves	22	6290 1100	Tube Elbow, 1/8 NPT X 3/16
7	6592 8000	Flush Valve	23	6191 1000	'Y' Connector
8	9333 5195	Pressure Relief Valve	24	6290 0910	Pipe Tee, 1/8M X 1/8F X 1/8F
9	9231 5083	Pressure Gauge	25	9130 5040	O ₂ Male DISS, 1/8 MPT
10	9131 6419	Breathing Crct., Small, w 1L Bag	26	9131 6418	Absorber Canister with Decal
11	9131 6420	Breathing Crct., Adult	27	9230 5072	FS2A Inlet Adapter
12	6592 8200	Canister Knob	28	9230 5073	FS2 Outlet Adapter
13	6190 2507	Column	29	9131 6042	Breathing Bag, 2 L
14	6592 8300	Spider Base	NS	1040 0900	Instruction Manual
15	6592 8400	Caster	NS	6178 7200	Column/Head Assembly Wrench
16	1039 5800	O ₂ Tube	NS	9130 5187	Vaporizer Mounting Kit
17	6295 4900	Absorber Canister Decal	NS	7700 0799	Tank Restraint & Regulator Kit
			NS	6393 4800	Veterinary Anesthesia Checklist

9.0 SERVICE & WARRANTY

All repairs unless otherwise specified should be performed by an authorized Matrix service representative.

Call 1-800-847-1000 or 1-716-662-6650 for Customer and/or Technical Service.

9.1 Warranty Returns Procedure

Warranty returns of a product or part covered by the Matrix warranty must be made through an authorized Matrix dealer. Units for repair should be sent to Matrix and packaged in the original shipping container if possible. Enclose a letter detailing the difficulties experienced and the repairs you feel are necessary. Please contact our Customer Service Department prior to shipping the unit prepaid.

Ship to:

Matrix
145 Mid County Drive
Orchard Park, NY 14127
Attn: Service Department

For international returns, contact your local Matrix dealer.

9.2 WARRANTY

THIS WARRANTY IS GIVEN IN PLACE OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE.

No statement or claim about the product by any employee, agent, representative, or dealer of Matrix shall constitute a warranty by Matrix or give rise to any liability or obligation of Matrix.

Subject to the next sentence, Matrix warrants that each product or part shall be free from defects in workmanship and materials, under normal use and with appropriate maintenance for one year from the date of delivery to the customer. For plastic, rubber, disposable parts or items, Matrix warrants only that each such part and item shall be free from defects in workmanship and materials at the time of delivery to the customer.

Matrix's obligations for breach of this warranty, or for negligence or otherwise, shall be strictly and exclusively limited to Matrix's choice of repair or replacement of the product.

This warranty shall be void on a product or part on which the serial number has been altered, defaced or removed.

Matrix shall not be liable for any damage, injury or loss arising out of the use of the product, whether as a result of a defect of the product or otherwise, if, prior to such damage, injury, or loss, the product was one (1) damaged, misused or misapplied; (2) repaired, altered or modified by persons other than Matrix; (3) not installed in strict compliance with applicable codes and ordinances; or (4) not installed by Matrix or an authorized Matrix dealer.

UNDER NO CIRCUMSTANCES SHALL **MATRIX** BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES AS THOSE TERMS ARE DEFINED IN THE UNIFORM COMMERCIAL CODE.



1-800-847-1000

VETERINARY ANESTHESIA CHECKLIST

SET-UP

- Gas supply: Using tank wrench, turn knob on E tank(s) counter-clockwise and check pressure. (NOTE: A full oxygen tank will register approximately 2000 PSI and a nitrous oxide tank will register approximately 750 PSI.)
- When the pressure gauge registers lower than 200 PSI, the tank should be replaced with a full tank. If using a local source, (e.g., a G-tank or central supply), connect machine to outlet and check to make sure the attachment is secure.
- Place breathing bag* and breathing circuit** on machine.
- Turn on flowmeter(s) to check that the gas supply is operational. Return flowmeters to the off position, (Finger tight only. Over tightening knob will damage flowmeter valve.)
- Close and open the pressure relief valve to make sure it is working freely.
- Pressure check circuit by closing the pressure relief valve and place thumb over the patient connection of the Y-piece. Activate flush valve to fill system to a level of 20 cm H₂O registered on the circuit pressure gauge. Hold in this position a few seconds and if there are no leaks, the pressure will hold steady. However, if the pressure drops open the oxygen flowmeter until the pressure stabilizes at the 20 cm H₂O setting. (This will determine the magnitude of leak and if more than 300 ml/min, an indication the leak(s) must be fixed.)
- Place hand over all connections, the breathing circuit, and bag while system is pressurized, and "feel" for leaks. (For hard to find problems, wet hand or use soapy water solution over connections. Evidence of bubbles will help locate leaks.)

COMMON PLACES FOR LEAKS

- Breathing bag and/or breathing circuit
- Breathing circuit point of connection to machine
- Unidirectional breathing valves
- CO₂ absorber gasket(s)
- Pressure relief valve
- Vaporizer inlet and outlet connections; filler cap
- Fresh gas delivery hose and connection to machine

CARBON DIOXIDE ABSORBER

- Absorbent should be changed weekly. Select a day of the week for this to be routinely done.
- Refer to the absorber canister decal for absorbent volume. The usable volume of absorbent should be not less than 1.5 times the tidal volume which is estimated to be 5ml/lb., therefore a 1000 ml absorber filled with fresh absorbent will function properly for an animal up to about 100 lbs.
(As the absorbent is depleted, available chemicals will decrease as CO₂ is converted to HCO₃. If half of the absorbent in the canister has changed color, it is prudent to refill the canister especially if the unit is to be used for a 100 lb patient or larger.)
- Moisture content of absorbent must be maintained once package is opened.

(Water is essential for the chemical reaction to take place and will be lost if the machine is not used or if opened packages of absorbent are not properly resealed.)

Breathing valves should be cleaned periodically with a clean cloth to remove accumulated water vapor. (The exhalation valve especially may stick in the open position and lead to rebreathing of CO₂.)

*BREATHING BAG

Bag size is governed by being able to fully expand the lungs with bag compression. A smaller bag will better register respiratory movement during spontaneous breathing in small patients as compared to using a large bag. In general, use small bags for small patients and large bags for large patients.

PATIENT WEIGHT	BAG SIZE
15 lbs. or less	500 ml
15-30 lbs.	1 liter
30-60 lbs.	2 liter
60-100 lbs.	3 liter
100 + lbs.	5 liter

**BREATHING CIRCUIT	
Patients less than 5 lbs.	Semi-open system (eg. Bain, Ayres Circuits)
Patients more than 5 lbs.	Semi-closed circle * CO ₂ absorption system

* Pediatric breathing hoses are recommended for patients less than 35 lbs. when using a circle system. For larger patients, adult breathing hoses may be used.

FLOW RATES FOR BREATHING CIRCUITS

Semi-Open System: Minimum flow rate should be 300 ml/min. for patients 3 lbs. or less. Maintenance flow rate is 100 ml/lb. for patients with a normal breathing rate (avg. 30 breaths/min.). Flow rate must be increased to 1 liter/min. if breathing rate is more than 50 breaths/min.

Flow rates for semi-open system	
3 lbs. Or less	Min. 300 ml/minute
Normal 30 breaths/minute	100 ml/lb.
Normal > 50 breaths/minute	1 liter/minute

Semi-closed System: Guideline for maintenance flow rate is 500 ml/min for patients up to 50 lbs. Add 100 ml/min for each 10 lbs up to 100 lbs. Flow rate during induction* is double that used for maintenance.

Flow Rates for Semi-closed System		
PATIENT SIZE	INDUCTION*	MAINTENANCE
<50 lbs.	1 liter/minute	500 ml/minute
60 lbs.	1.2 liters/minute	600 ml/minute
70 lbs.	1.4 liters/minute	700 ml/minute
80 lbs.	1.6 liters/minute	800 ml/minute
90 lbs.	1.8 liters/minute	900 ml/minute
100 lbs.	2.0 liters/minute	1 liter/minute
125 lbs.	2.5 liters/minute	1.25 liters/minute
150 lbs.	3.0 liters/minute	1.5 liters/minute

*Induction of anesthesia is the initial delivery of inhalant following endotracheal intubation until loss of the palpebral reflex.

INFORMATION PROVIDED BY DONALD C. SAWYER DVM., PhD

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