

LAVC-2000-D ANAESTHETIC MACHINE

USER MANUAL



Item no. 21320201

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Eickemeyer®

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INTRODUCTION

CAUTION – This equipment is for veterinary use only. The equipment described herein is only for use by or on the order of a licensed veterinarian or doctor.

This equipment can cause serious injury or exposure to anesthetic agents if used improperly. Please read the manual thoroughly before operating.

Please contact EICKEMEYER® for questions, repair or replacement parts, or service needs.

The EICKEMEYER® LAVC-2000 Series Anesthesia Machines allow for simple, safe and controlled delivery of anesthetic agents.

1. SPECIFICATIONS

1. Modified Mark 7 Servo, modified for use in large animals
2. Oxygen Flowmeter, 0–10 lpm glass tube precision flow control
3. Absorber Canister, durable CO₂ absorber canister with stainless-steel screen and drainage system
4. Absorber Seals, durable silicone flat gaskets
5. Bellows Canister, durable bellows canister with 1 l–20 l volume indicator label
6. Bellows, durable rubber bellows
7. Lightweight aluminum frame with 5 locking wheels
8. Oxygen Flush, 60 lpm
9. Included Accessories: 1.69" breathing circuit, breathing wye with CO₂ lure adapter, 15 l rebreathing bag, 30 l rebreathing bag, adapter to be used with smaller breathing bags, cook adapter, four endotracheal tube adapters, manual
10. Warranty, 2 years

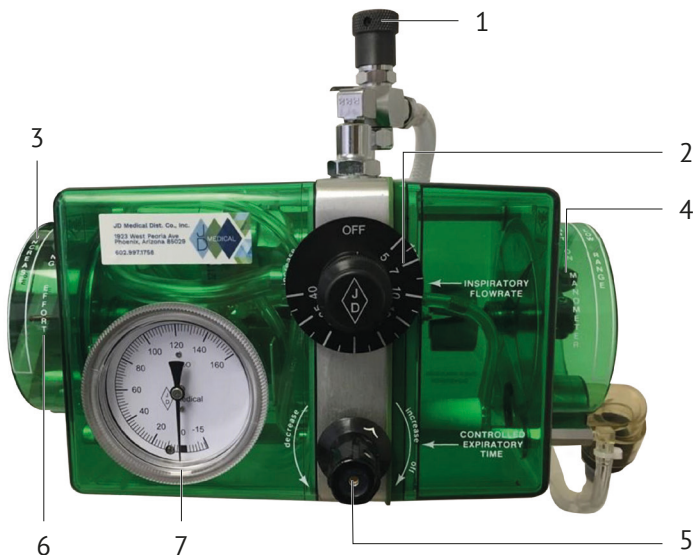
2. OPTIONAL ACCESSORIES

1. New Tec 3 Isoflurane or Sevoflurane Vaporizer (Refurbished vaporizer options or other vaporizer types available upon request)
2. Equine Demand Valve
3. Foal Conversion Kit
4. Oxygen Supply Hose, 10' DISS x DISS with desired Quick Connect
5. Oxygen E-Cylinder setup with regulator
6. Scavenger setups: High vacuum, WAGD, low-flow or f/air setup
7. F/Air canister
8. Nitrous Oxide or Air Flowmeter
9. Bellows Dryer

3. OPTIONAL CONFIGURATIONS

1. Monitor Shelf
2. MRI Compatibility – CTFE-coated Aluminum Frame with MRI-compatible Wheels
3. Custom configurations available upon request

4. OPERATING INSTRUCTIONS FOR MODIFIED MARK 7 SERVO



The modified Mark 7 Servo has been chosen as the ventilator support mechanism for the EICKEMEYER® LAVC-2000 series large animal anesthesia machine because of its total capabilities. The Servo has individual controls to determine flowrate (inspiratory time); pressure (patient pressure); sensitivity (effort require to trigger the Servo to deliver gas to the patient); expiratory timer (length of time between breaths).

The picture correlates with the numbered parts below.

1. On/Off Switch

This is the on/off switch for the oxygen to flow into the Modified Mark 7 Servo. Depending on the model of the Mark 7 this switch can either be a lever style or a rotary style.

2. Inspiratory Flowrate Knob

During anesthesia it is preferable to equate the normal breathing pattern of the large animal to insure minimum embarrassment to the respiratory system. The flowrate enables the operator to determine the amount of time it will take the device to fill patient lungs with gas. Care should be taken to deliver the gas at a rate that is as close as possible to the normal breathing rate of the patient.

3. Sensitivity Control Lever (Starting Effort)

This is the black control lever located on the left-hand side of the Servo. It determines the amount of inspiratory effort that the patient must exert to trigger on the Servo. After the Servo has cycled on, it then delivers the pressure set as outlined above.

Note: Special care should be taken with this control. It is the control that is used to assist the patient in breathing. If set to high (making it more difficult for the patient to cycle on the machine) the patient will have a decreased breathing rate and possible more serious circumstances could result. The sensitivity can be set to low causing the Servo to auto-cycle at a rapid rate. The sensitivity should be adjusted so that a negative deflection on the manometer (located on the Servo) indicates approximately -2/-3 cmH₂O before the Servo cycles on. The size and condition of the patient should be taken into consideration as the larger animal, in most cases, can exert more inspiratory effort than the smaller animal. Higher numbers increase the amount of effort required to cycle on the machine.

4. Inspiratory Pressure Lever

This control is located on the right side of the Servo and is clearly marked. The normal setting for clinical evaluation should be 15–20 cmH₂O. It is impossible to determine a setting that is sufficient for all patients. The operator should perform a clinical evaluation by monitoring the chest excursion. Care should be taken not to over-inflate the lungs.

Note: Many leading large animal practitioners recommend that after a patient has been ventilated for 15–30 minutes a sigh, or a deep breath, be administered. This is accomplished by increasing the pressure setting. For example, if the preset pressure is 20 cmH₂O, after 15–30 minutes of ventilation the patient should be given a sigh breath of 25 cmH₂O. Some large animal practitioners elect to increase the sigh breath to 45–50 cmH₂O. EICKEMEYER® recommends a 25 cmH₂O sigh breath from 20 cmH₂O normal setting.

5. Expiratory Timer or Apnea Control

This is the control that enables the clinician to dial in a rate of breathing. If the patient becomes apneic, the operator will open this control in counter-clockwise direction to start the automatic timer. Opening the knob counter-clockwise increases the breathing rate. Turning clockwise slows the breathing rate. This control allows a rate selection of approximately 2 breaths per minute to 30 breaths per minute.

The expiratory timer has several additional functions that offer many safety features to the anesthetic process, such as:

- a. If the operator is using the ventilator in the assist mode, the patient must exert an effort to cycle on the machine.
- b. When the machine is used in the assist mode and the expiratory timer is adjusted to the minimum number of breaths, a margin of safety is added to the spontaneously breathing patient; i.e., if the normally breathing patient can exert an inspiratory effort the Servo senses it and cycles off. But, if the patient becomes apneic and the operator had adjusted the apnea control prior to the procedure (slightly open position), the machine now is in an automatic function mode that will take over if the patient fails to exert the inspiratory effort before the automatic interval takes over.
- c. The operator also has the choice of complete control over the patient by increasing the sensitivity to a point just above the maximum amount of effort the patient is able to exert and using the apnea control to give the patient the selected number of breaths per minute.

6. Hand Timer

The hand timer is located in the center of the sensitivity control. It is a small red plastic shaft protruding one half inch from the left side of the modified Mark 7 Servo. This control is used to deliver a breath at any time that the operator wishes. Push in the red shaft; when the Servo reaches the preset pressure, the shaft will return to the off, or out, position.

7. Manometer

The manometer is located on the face of the modified Mark 7 Servo. It measures in both cmH₂O and mmHg. The manometer is connected directly to the patient breathing circuit and monitors the inspiratory pressure delivered to the patient.

5. OPERATING INSTRUCTIONS

5.1 Side-Mount

The LAVC-2000 Side Mount was designed for when two vaporizers are used, or when an optional breathing bag is desired. This created the LAVC-2000-D Series.

When the absorber assembly is moved to allow additional mounting of vaporizers, several changes take place. The LAVC-2000-D gives the user the ability to operate the machine as a passive machine or a complete anesthesia ventilator.

The addition of a third directional valve enables you to choose between assisted or controlled ventilation and passive breathing through the anesthesia bag.

5.2 Set Up for Anesthesia Delivery Not Using the Ventilator

The short hose attached to the top of the bellows should be removed and the hose should be attached to the back of the valve located to the left side of the absorber canister. The short hose will then run from the bottom of the absorber canister to the back of the sidemount valve. The breathing hoses are then attached at the valve located on top of the absorber and to the sidemount valve located on top of the bag assembly. When the hoses are in this set up this renders the ventilator out of the circuit and all gas will move through the bag and the absorber only, converting the machine to a passive setup. In this configuration you will use the manual pop-off valve located on the top of the absorber. Remember to **OPEN** the pop-off valve when using this configuration.

5.3 Set up for Anesthesia Delivery Using the Ventilator

The short hose attached to the bottom of the absorber should be attached to the back of the valve on top of the bellows canister. The short hose will then run from the bottom of the absorber canister to the top of the bellows canister. The breathing hoses are attached to the valve located on the top of the absorber and to the front side of the valve located on top of bellows canister. When the hoses are in this set up the bag assembly is eliminated from the circuit. When using the Servo ventilator, the pop-off valve on top of the absorber canister must be **CLOSED**. If it is not closed there will be a leak in the system and the desired ventilator pressure will not be achieved.

5.4 Bag Selection

The LAVC-2000-D is provided with a 15-liter anesthesia bag and a 30-liter anesthesia bag. An adapter for using smaller bags is also provided. The standard fitting on the anesthesia machine will allow you to use the 15-liter or 30-liter breathing bag.

5.5 Bottom Plate Valve

Located in the center of the bottom plate of the anesthesia machine you will find a brass colored valve with a small stainless-steel valve-stem pointed upright. This valve is the sensing valve that is activated by the bellows assembly descending in the chamber and actuating the valve releasing the line pressure which in turn opens the exhalation valve on the top of the bellows.

Note: It is important to periodically check this valve, making sure that the valve is not bent. After continued use the valve may tend to lean to one side and could malfunction. Check this valve and if it is not centered and straight, simply replace with the spare valves shipped with your machine. A tool is provided for easy removal and replacement. Make sure the valve is tight and do not use any other valve except the valves that are supplied by EICKEMEYER® as they are designed for this application only.

Your new machine includes three additional valves and a valve removal tool. To reorder these valves please call EICKEMEYER® or email us (contact information on the back).

E213200634 Bottom Plate Valve
E213200634A Bottom Plate Valve Tool

5.6 Passive Breathing Mode

For the LAVC-2000 **ONLY**

There is a gray cap on the bottom left hand corner of the machine, this caps the channel of gases between ambient and the canister. If the operator wishes to have the patient breath passively (without ventilation assist or control) remove the cap. This breaks the seal between the bellows chamber and the Servo. This is intended as an emergency/backup mode of operation and is not intended for regular operation.

Note: When the operator wishes to return to the ventilator function (either assist or control) the cap must be replaced hand tight only. If a break occurs in this seal, the patient breathing effort is lost to ambient and the signal will not be transmitted to the Servo, which is the heart of the ventilator.

5.7 Drainage System

The LAVC-2000-D has an integrated moisture drain system that facilitates the collection of moisture with an integral valve that allows the user to see the collected moisture in the absorber and eliminate it using a ¼ turn valve. The drain assembly is installed underneath the absorber and prevents moisture from accumulating on the plates or remaining in the absorber. The funnel component of the absorber directs all moisture into the drain assembly which can be eliminated by opening the drain valve until the drain is empty. EICKEMEYER® recommends draining moisture between cases and operating the drain valve when the machine is not in use.

Note: Older models of the LAVC-2000-D that have the original style absorber without the built-in funnel and moisture drain system can be upgraded to incorporate the moisture drain system. Please contact EICKEMEYER® for to obtain a quote on upgrading your existing machine.

6. LEAK AND PRESSURE CHECK INSTRUCTIONS

Checking the anesthesia ventilator for leaks is an important part of any anesthetic procedure setup. The machine should be checked for leaks prior to every use to insure proper functioning of the machine. The most efficient way to check the ventilator for leaks is a simple process, outlined below.

1. Make sure the ventilator is off, as well as the flowmeter.
2. Remove the breathing hoses and patient Y from the machine.
3. Remove one breathing hose from the Y piece (it doesn't matter which one)
4. Connect the single breathing hose between the expiratory valve on top of the absorber canister and inspiratory valve on top of the bellows canister.
5. Make sure that the short sidemount hose is connected between the bottom of the absorber and the back of the inspiratory valve on top of the bellows canister. Also check to make sure the pop-off valve (21) is closed.
6. With the machine plugged in to its oxygen source, press the flush valve to fill the bellows. When the bellows are full (when they touch the bottom), check to make sure that the bottom plate valve is properly operating. This is achieved by holding the flush so the bellows touch the bottom and actuate the valve (33). This relieves pressure in the line that closes the exhalation valve assembly (21) on top of the bellows top plate and you should feel gas coming out of the exhaust of the exhalation valve assembly (21). If you feel gas only when the bellows strikes the bottom plate, this system is working properly.
7. Turn the Expiratory Time valve (5) on the Servo off (all the way clockwise).
8. Set the Sensitivity Control (Starting Effort) Lever is at 20 (12 O'clock position)
9. Set the Inspiratory Pressure Lever at 20 cm/H₂O to start (12 O'clock position)
10. Set the Inspiratory Flowrate Knob (2) between 5 and 10. We recommend using the lowest possible Inspiratory Flowrate possible which can vary depending on the age of the machine. New machines should cycle reliably at 5, older machines may need to be set between 5 and 10.
11. Manually trigger a breath by pressing the Hand Timer (6). The bellows should not move significantly because there is very little volume in the circuit. If the bellows climb up to the top and the triggered breath does not stop, then there is a leak. The needle on the manometer (7) should move up to the set pressure in a smooth arc. As long as the breath is achieved and the bellows returns to the bottom after completing one breath cycle, move on to step 12. If the bellows have moved up or the cycle does not complete normally, check to make sure all the absorber and bellows wingnuts are tight, the pop-off valve is closed, and that all the tubes are properly connected. Significant leaks can be felt when the inspiratory cycle is triggered, so you can open the Expiratory Timer Valve to have the machine cycle on its own so you can attempt to feel any leaks around common leak areas such as around the absorber canister, directional valves, and bellows canister. If a leak cannot be found, please contact EICKEMEYER®.
12. Once the 20 cm/H₂O cycle has completed successfully, move the Inspiratory Pressure Lever to the notch (~ 60 cm/H₂O). The lever will click into the notch and will not move past it unless you pull the lever out and choose to do so.
13. Manually trigger a breath again by pressing the Hand Timer (6). The needle on the manometer (7) should move to 60 cm/H₂O in a smooth arc without faltering. Once it hits 60 cm/H₂O, the breath should stop, and the bellows should return to the bottom. If the cycle does not complete or the needle falters or hangs at a lower pressure, this is an indicator of a leak in the system which should be addressed as above. If the cycle completes properly, proceed to step 14.
14. Now that the cycle has completed at 60 cm/H₂O, the system is operating normally. To check for smaller leaks, you can open the Expiratory Timer Valve (5) to roughly 4 seconds of expiratory time and let the machine cycle. Over the course of a few minutes, the bellows should remain close to the bottom and should not move significantly up to the top of the bellows canister.

7. PRIMARY COMPONENTS

7.1 Oxygen Flowmeter 0 – 10 L/Min

The flowmeter delivers oxygen through the vaporizer to the induction chamber and/or patient through a specific rate of liters per minute. The oxygen flowmeter knob is opened, oxygen flows through the vertical tube that is labeled liters per minute. The flow of oxygen causes an indicator (ball) to rise and the flow rate is read at the center of the ball. When operating the flowmeter, the knob should not be overtightened; doing so will damage the flowmeter knob.

7.2 Vaporizer

The vaporizer can be either ISOFLURANE or SEVOFLURANE. The fresh gas from the flowmeter flows to the vaporizer to deliver the indicated amount of anesthetic agent.

Vaporizers have a dial with numbers from 0–5 for ISOFLURANE and 0–8 for SEVOFLURANE. These numbers represent volume percent and indicate the concentration in percent delivered at the output of the vaporizer. As with any anesthesia deliver system, flows and percentages may vary somewhat due to varying factors, but with the EICKEMEYER® system you are assured of having total control and will always be operating within the manufacturers specification guidelines of ($\pm 15\%$) of settings and control. It is extremely important to have EICKEMEYER® confirm the calibration of the vaporizer yearly.

Vaporizers must be filled with the appropriate anesthetic agent. The liquid agent should be poured into the vaporizer fill spout until it reaches the desired level on the vaporizer indicator window. Care must be taken to not overfill the vaporizer. The indicator window will help to prevent overfilling of the vaporizer and will also indicate when the liquid level is low. All vaporizers have a drain plug to allow the vaporizer to be drained. This plug is usually in the center of the funnel fill device. Continuous removing of the cap to fill the vaporizer may cause the drain plug to become loose and may result in agent leaking from the drain. The drain plug should be checked periodically to ensure that it is tight.

7.3 Inspiratory Valve

The inspiratory valve allows the fresh gases to flow only to the patient and not back to the vaporizer.

7.4 Expiratory Valve

The expiratory valve allows the exhaled gases from the patient to flow only into the anesthetic machine and not back to the patient.

7.5 Absorber Canister

The absorber canister is filled with sodasorb or CO₂ absorbent which removes carbon dioxide from the rebreathing circuit. It is important to change the sodasorb after 12 hours of anesthetic use. The absorber canister on the LAVC-2000-D and LAVC-2000-D-2 is designed with a drainage system to remove excess moisture.

7.6 Rebreathing Bag

When used during passive setup the rebreathing bag allows the accumulation of fresh and expired gas during exhalation so that a reservoir of gas is available for the next breath.

7.7 Popoff Valve

The popoff valve is an adjustable pressure limiting valve. The fresh gas flow rate is higher than the patient absorption rates, so the excess gas is removed through the popoff valve and exits the system through the scavenger set up or f/air canisters. It is very important to keep the valve open or partially open unless positive pressure is being used to inflate the lungs. If the valve remains closed, pressure will continue to build in the system. When the Mark 7 is being used this valve must be closed.

7.8 Pressure Manometer

The pressure manometer, located on the Mark 7, is used to monitor the internal pressure within the anesthesia system. The pressure on the manometer correlates with the same pressure being exerted against the patient's lungs.

7.9 Flush Valve

The oxygen flush valve is indicated by a green colored ring surrounding the button. The flush valve is provided for flushing the patient circuit with 100 % oxygen. This flow bypasses the vaporizer which will quickly increase the amount of oxygen and decrease the amount of anesthetic agent within the patient system.

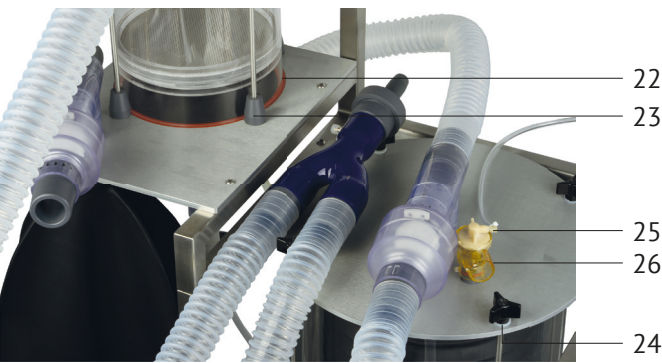
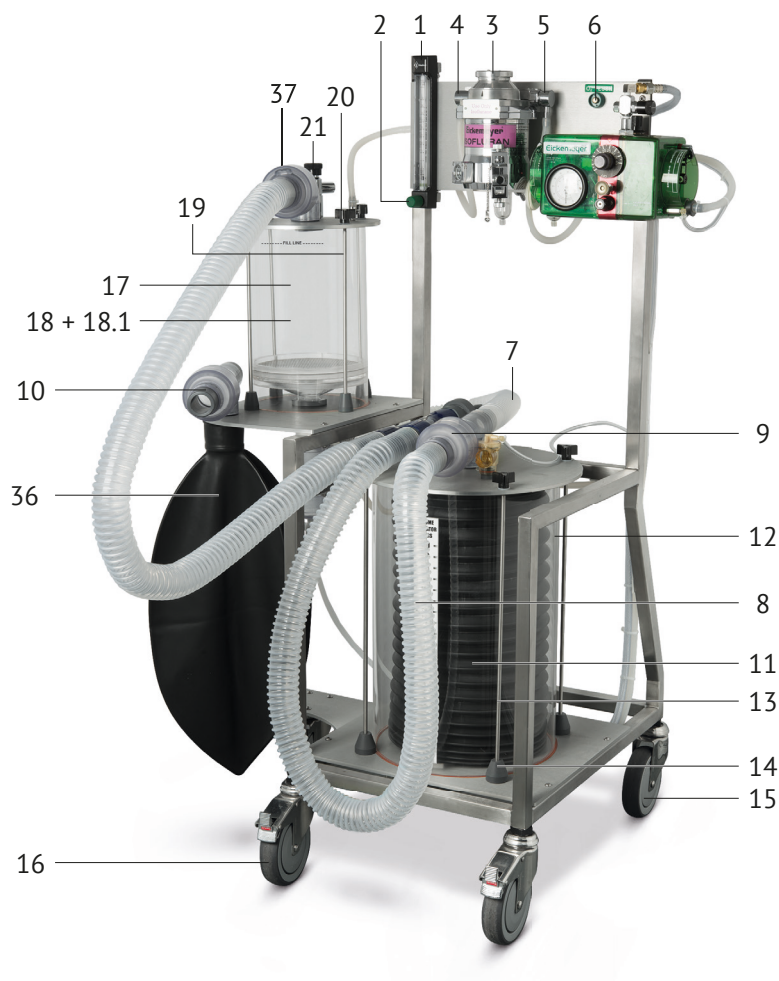
7.10 Monitor Shelf

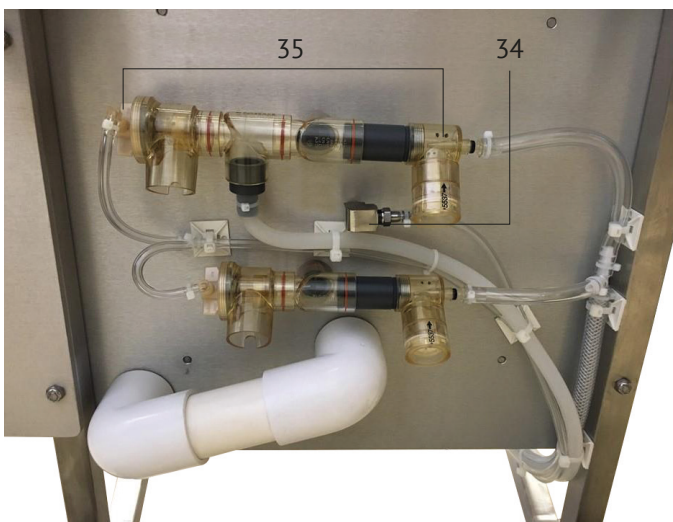
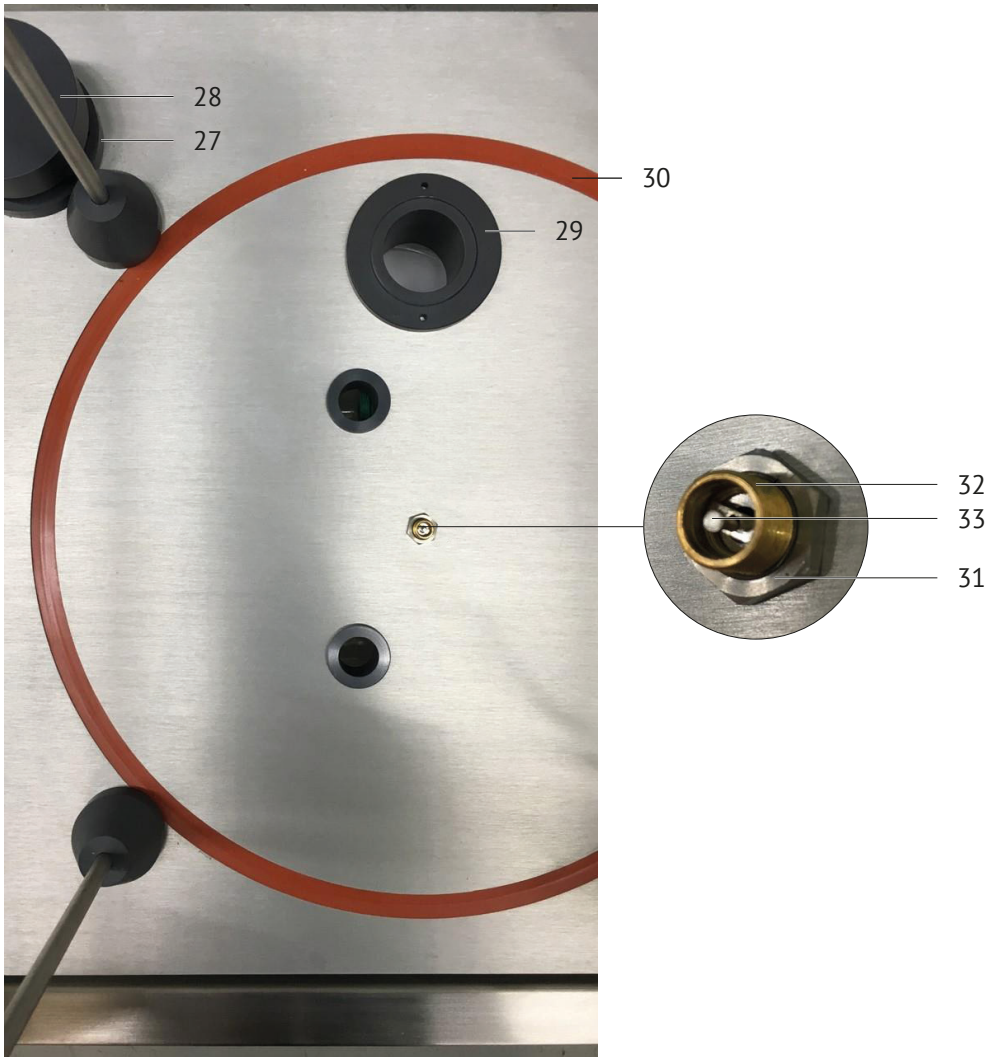
The monitor shelf is an optional feature of the LAVC-2000-D. Used for placing a monitor above the anesthesia unit, storage or mounting a ventilator.

7.11 Wheels

5 locking wheels installed.

8. STANDARD REPLACEMENT PARTS AND PART NUMBERS

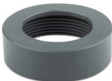




USER MANUAL LAVC-2000-D ANAESTHETIC MACHINE

1. 213211 Flowmeter, 0 – 10 lpm O₂
2. E213200192 Flowmeter Valve O₂, 0 – 10 lpm
3. Varies Multiple Vaporizer Options Available
4. E213200215 Vaporizer Inlet Connector
5. E213200217 Vaporizer Outlet Connector
6. E213200190 Flush Mechanism
7. 215711 Hose, Clear Sided
8. 215710 Hose, Clear Circuit, 1,690" (Single) 60" OAL
9. E213200170 Inspiratory Directional Valve (on top of bellows)
- E213200170C Inspiratory Directional Valve (on top of bellows) CLEAR
10. E213200169 Inspiratory Directional Valve w/bag mount nut
- E213200169C Inspiratory Directional Valve w/bag mount nut CLEAR
11. 213209 Bellows Assy
12. E213200182 Canister, Bellows
13. E2132000189 Bellows Hold Down Rod stainless steel (each)
14. E213200231 Cone Nut for Hold Down Rod
15. E2132004522R Caster – Pin Mount
16. E2132004522RB Caster – Pin Mount w/Brake
17. 213208 Absorber 6,500cc Standard Complete w/Screen
18. E213200332A Same as 213208 with Moisture Drain System (Gen2)
- 18.1 E213200332B Gen 2 Absorber Interface Setup
19. E213200320 Rod, Absorber Hold-Down stainless steel (each)
20. E213200321 Absorber Canister Rod Wingnuts, Small 22.
21. E2132001126 Valve, Adjustable Popoff for Sidemount
22. E213200323 Removable Absorber Seal
23. E213200322 Bellows Canister Rod Wing Nuts, Large
24. E2132000323 Washer, Nylon for hold-down rods (1 each) 2000-323D
25. E2132001741 Servo Connector (straight)
26. E2132002575 Exhalation Valve, Bird
27. E213200557 Nut for Directional Valve .350
28. E213200706 U Tube Cap for LAVC/LAV-Models
29. E213200558 Nut for U Tube .220
30. E213200503G Bellows Replacement Plate Seal
31. E213200636 Retainer Nut for Valve
32. E213200635 Sensor Valve – Complete Sensor Valve Assy, Includes E213200634
33. E213200634 Bottom Plate Valve Insert
- E213200634A Insert Tool for E213200634 – NOT PICTURED
34. E213200637 Valve Mount Assembly
35. E21320011378 Venturi Drive Assy Complete
36. 215130 Rebreathing Bag – Equine
37. E213200172 Exhalation valve
- 213205 Stainless Steel Shelf – NOT PICTURED

9. ACCESSORIES AND PART NUMBERS

Item No.	Description	Picture
E213200159	Large Animal Blue Wye for 1.69" hose, with Lure	
214525	Cook Adapter	
E21320001	Endo Tube Adapter Locking Ring	
214518	Endo Tube Adapter, 18 mm	
214519	Endo Tube Adapter, 20/22 mm	
214521	Endo Tube Adapter, 26 mm	
214522	Endo Tube Adapter, 30 mm	
215115	Rebreathing Bag, 15 L	
215130	Rebreathing Bag, 30 L	

Additional sizes of Endo Tube Adapters are available.
Additional (smaller) sizes of rebreathing bags are available.

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