Mallard Ventilator

AB Medical Technologies, Inc.

Instruction Manual

M601 Rev 07-1-26

Model 2200B-MRI Small Animal Anesthesia Ventilator

(For Veterinary Use Only)

20272 Skypark Drive, Redding, CA 96002 Telephone: (530) 605-2522
www.mallardmedical.com Email: support@mallardmedical.com

Index

INTRODUCTION

The Mallard Model 2200B-MRI Small Animal Anesthesia Ventilator system is designed to accomplish the task of continuous mechanical ventilation for anesthetized patients. Although it is a sophisticated tool for medical professionals, it is designed to be easy to use, learn and apply. It incorporates state-of-the-art technology to perform its functions in a way that should help maximize the effectiveness of the operator.

The purpose of this manual is to introduce the various functions of the unit to those skilled in the application of anesthesia ventilator support. Before using the device in an actual clinical situation, this manual should be carefully studied and understood by the operator. Practice sessions of ventilator application should be accomplished on a suitable test lung so that the function and effect of the various controls are thoroughly understood.

NOTE:

Before clinical use, the Performance Verification Procedure must be completed to confirm the system integrity of this device. It requires a pneumatic interface. The clinician should verify that the supply source and patient interface pneumatic connections are secure and meet the medical center's safety standards.

Product Warranty

AB Medical Technologies, Inc. (forthwith referred to as AB) warrants this product to meet the published specifications and to be free from defects in material and workmanship under normal use for a period of two (2) years from the date of purchase. THE FOREGOING IS IN LIEU OF ANY OTHER WARRANTY, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY.

The sole liability of AB under this warranty is limited to replacing, repairing, or issuing credit at the discretion of AB for the products, equipment, or parts that fail to meet the published specifications, or which become defective during the warranty period, and which are, upon examination by AB found not to meet the published specifications or which become defective in material or workmanship. AB's limited warranty, stated above, will not apply unless the following provisions are strictly complied with:

(a) AB is promptly notified, in writing, upon discovery of the failure of said product or equipment to meet the published specifications or of defects in material or workmanship.

(b) The defective product, equipment, or part thereof is returned to AB, and transportation charges are prepaid by the buyer.

(c) The defective part is received by AB for examination no later than one (1) month following the expiration of the warranty period and provided.

(d) That examination by AB of said product, equipment, or part shall disclose to AB's satisfaction that such defect has not been caused by improper usage, accident, neglect, alteration, abuse, improper installation, or unauthorized repair.

Products, equipment, or parts replaced under this warranty are warranted only through the terms of the original warranty. AB neither assumes nor authorizes any other person or entity to assume for it any other warranty, obligation, or liability in connection with its products or equipment whatsoever, and this warranty can only be changed in writing by a duly authorized representative of AB.

AB makes no representations or warranties whatsoever as to the fitness or usefulness of the products or equipment manufactured by it for any medical treatment, physical condition, or other purpose whatsoever. In no event shall AB be liable for personal injury, property damage, or any special or consequential damages to any buyer, user or any other person whomsoever, including, but not limited to, loss of profits, loss of use of the product or equipment, or for damages of any other kind whatsoever based on a claim for breach of warranty other than a refund of the purchase price of any defective product or equipment.

Any authorization for repair or alteration by the buyer must be in writing from AB to prevent the voiding of this warranty. In the event AB or its representatives render any technical advice or service of any kind to the buyer or anyone else in connection with the equipment or products covered by this warranty, the buyer hereby releases AB from all liability of any kind whatsoever as a result thereof: and the warranty as herein before set forth shall not be enlarged or affected by said action by AB.

AB Medical shall not have any responsibility in the event of loss or damage in transit.

Recommended preventative maintenance, as prescribed in the service manual, is the responsibility of the user and is not covered by this warranty.

This warranty does not extend to: Malfunction or damage caused by improper use or man-made failure. Malfunction or damage caused by unstable or out-of-range power input. Malfunction or damage caused by force majeure events, such as:

(i) flood, fire and earthquake or similar elements of nature or acts of God;

(ii) riots, war, civil disorders, rebellions, or revolutions in any country; or

(iii) any other cause beyond the reasonable control of AB Medical. Malfunction or damage caused by improper operation or repair by unqualified or unauthorized service people. Malfunction of the instrument or part whose serial number is not legible. Other malfunction or damage not caused by instrument or part itself.

The housing, bellows and cosmetic parts shall be free of defects at the time of shipment and, therefore, shall not be covered under these limited warranty terms.

Products operated outside published maximum ratings will not be covered or damage resulting from use of non-AB Medical approved accessories.

Warranty service must be obtained through either AB Medical or an authorized dealer in the AB Medical product line for which warranty service is requested.

Warranty Enactment Form

Model:

Serial Number:

Where is this equipment to be used?

_____

Institution:

_____

Street Address: Phone:

_____

City: State: Zip Code:

_____

Department:

_____

Supervisor:

_____

When received, did the device work properly?

Comments:

_____
_____
_____
_____
_____

Authorized Signature:

_____

Title:_____ Date:_____

Please send or email this form to:

AB MEDICAL TECHNOLOGIES, INC.
20272 SKYPARK DRIVE
REDDING CA 96002

support@mallardmedical.com

Cautions and Warnings

The Mallard Model 2200B-MRI Anesthesia Ventilator System is a regulated medical device designed exclusively for use by trained professionals under the supervision of a licensed veterinarian.

It is the responsibility of operators to carefully read and fully understand all provided product documentation. Specific statements within the documentation carry particular importance, as outlined below:

Summary of all Warnings and Cautions:

Warning

Whenever a patient is on a ventilator, qualified personnel must provide continuous monitoring. The Mallard Model 2200B-MRI is a fully pneumatic ventilator and contains no built-in alarm systems; it will not provide any audible or visual alert in the event of a malfunction in the ventilator or patient system. Direct, uninterrupted observation of the patient and of ventilator function — including bellows movement, delivered tidal volume, and supply pressure — is the sole means of detecting a malfunction, and certain issues may demand immediate action. The use of independent patient monitoring appropriate to the MR environment is strongly recommended.

Before using this device in a clinical setting, operating personnel must thoroughly familiarize themselves with the instructions provided in this manual.

The Mallard Model 2200B-MRI Anesthesia Ventilator is designed to meet the specifications and descriptions outlined in this manual and accompanying labels when properly assembled, operated, maintained, and repaired.

Do not assemble or operate this ventilator / anesthesia unit without first reading and fully understanding the instructions. The ventilator/anesthesia unit must be inspected periodically as outlined in this manual. A defective ventilator / anesthesia unit should never be used.

If repairs are needed, contact the authorized Mallard distributor who originally delivered the device. If you do not receive a suitable response within a reasonable time, reach out directly to our home office in Redding, California, U.S.A. This product must only be repaired in accordance with the manufacturer's written instructions and should not be modified in any way without written approval from the factory.

The user is solely responsible for any malfunction caused by improper use, inadequate maintenance, unauthorized or improper repairs, damage, or alterations made by anyone other than the manufacturer.

Warning
Always monitor oxygen concentrations with an accurate oxygen analyzer with high and low (FI02) alarms to be assured that the desired FI02 is being delivered to the patient.

Warning
Patient circuit compliance and subsequent compressed volume losses must be determined in order to adjust the volume control accordingly to assure an adequate tidal volume delivery to the patient.

Warning
Breathing circuit components provided by the manufacturer are shipped in a clean but not sterile condition. Refer to “Cleaning and Sterilization” section of this manual for guidelines on the sterilization and/or decontamination of breathing circuit components available.

Warning
The described methods of cleaning and sterilization are acceptable for the components, but the effectiveness for any particular bacteriological situation is the responsibility of the user.

Warning
Only use replacement parts provided, or approved, by the manufacturer.

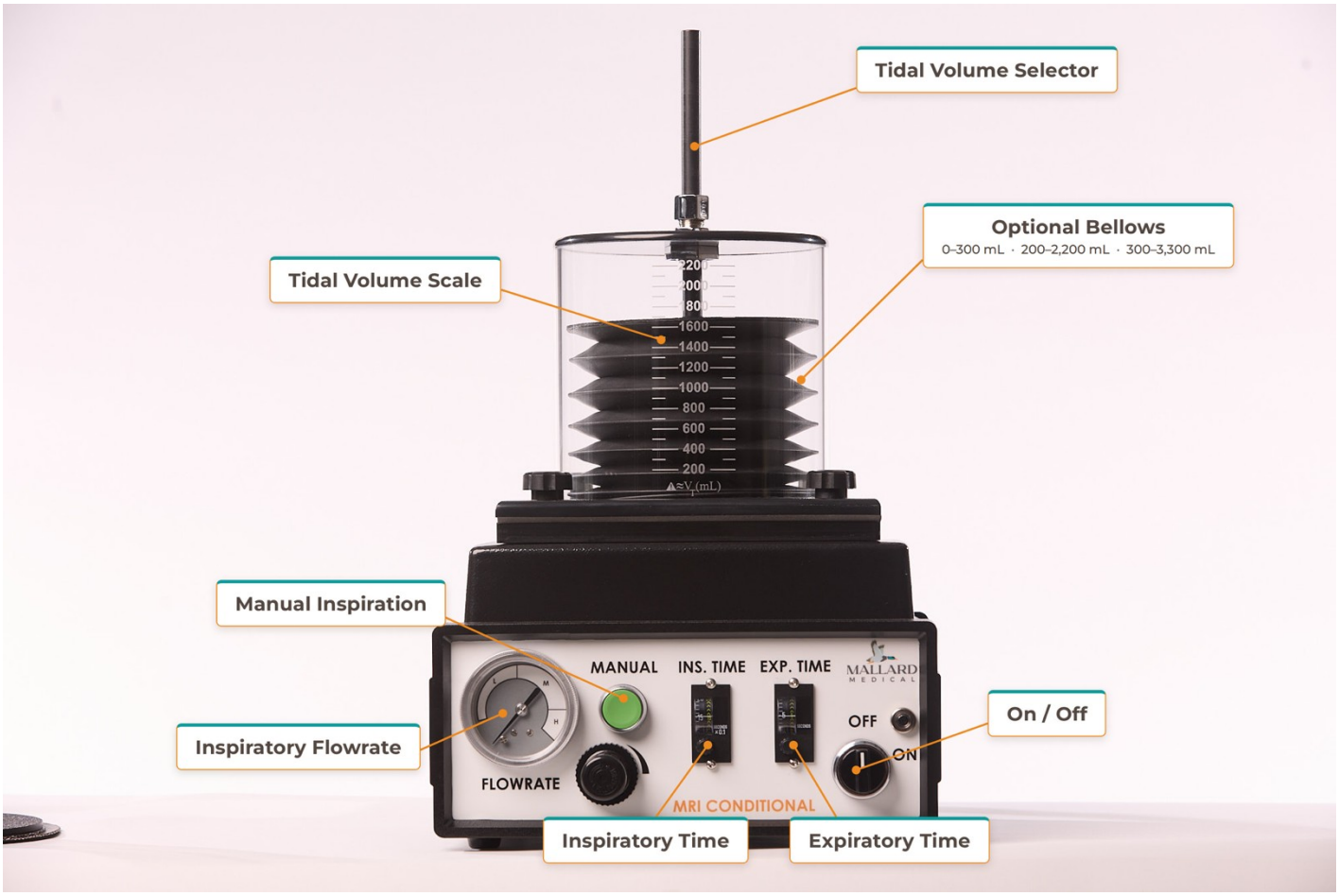
Warning
Oxygen vigorously accelerates combustion; to avoid an explosion hazard, do not use any service instruments or other equipment that may have been exposed to oil or grease contamination.

Caution
To ensure that the Mallard Model 2200B-MRI Anesthesia Ventilator continues to perform to all design specifications, the complete Performance Verification Procedure must be performed at least once a month by qualified service personnel.

Caution
Ethylene oxide is toxic. Parts thus sterilized must be properly aerated to dissipate the residual toxic gas absorbed by the material. Follow the sterilizer manufacturer’s recommendations for the specific aeration periods required.

Warning
The Mallard Model 2200B-MRI Anesthesia Ventilator should not be used in the presence of flammable anesthetic gases.

MALLARD
MODEL 2200B-MRI ANESTHESIA VENTILATOR



Operating Instructions

APPLICATION WITH ANESTHESIA MACHINE

Connect the gas source inlet to a gas supply providing 50 PSI at the female DISS connection. Plug the electrical power cord into a suitable outlet. Connect the gas scavenger hose to the outlet port labeled “scavenger”.

DESCRIPTION OF VENTILATOR

The Mallard Model 2200B-MRI Anesthesia Ventilator is a pneumatically time-cycled, volume-limited device. Tidal volume is selected by restricting the upward expansion of the bellows. At this point, excess anesthesia gas is vented from the bellows and directed to the gas scavenger port.

The control console, located beneath the bellows canister, provides the controls for mechanical ventilation and a mechanical gauge displaying patient airway pressure. The system is fully pneumatic, containing no electronic components, making it suitable for operation in the MR environment within its labeled conditions.

DESCRIPTION OF CONTROLS AND DISPLAYS

ON/OFF CONTROL

The ON/OFF switch is located on the front panel of the control console. This two-position selector allows for the selection of OFF and ON. The inspiratory time, expiratory time, tidal volume, and inspiratory flowrate may all be pre-selected prior to initiating mechanical ventilation by adjusting these controls before turning the switch to the ON position. When switched ON, the ventilator begins cycling at the pre-selected settings, indicated by rhythmic descent and rise of the bellows.

TIDAL VOLUME

Adult Bellows Included:	200ml to 2,200ml
Optional Pediatric Bellows:	50ml to 300ml
Optional Adult Bellows:	200ml to 3,000ml

Adjustment of this volume is achieved by positioning the vertical ½” diameter tube, extending from the canister top, to limit the upward expansion of the bellows. Loosen the chrome nut that grips the rod, located at the center of the top plate. Position the ½” diameter rod to the desired volume as indicated on the canister wall. Tighten the chrome nut once adjusted.

GAS BALANCE SYSTEM

This system functions in conjunction with the tidal volume rod height setting. As described above, the vertical ½" diameter adjustable tube limits the upward expansion of the bellows. This is accomplished by the opening of an umbrella valve located in the center of the bellows. The excess anesthetic gas is vented from inside the bellows and directed to the gas scavenger port.

INSPIRATORY TIME .1 TO 3 SECONDS

The inspiratory timer is located on the front panel and is labeled INS. TIME. It is a pneumatic timer with a mechanical dial display calibrated in tenths of a second (SECONDS × 0.1). Rotate the adjustment knob below the display window until the desired value appears; a displayed value of 15, for example, corresponds to an inspiratory time of 1.5 seconds. Inspiratory cycling can be confirmed visually by observing the compression of the bellows during each inspiratory phase.

Expiratory Timer 2 to 30 Seconds

The expiratory timer is located to the right of the inspiratory timer and is labeled EXP. TIME. It is a pneumatic timer with a mechanical dial display calibrated in whole seconds. Rotate the adjustment knob below the display window until the desired value appears. The expiratory time determines the interval between breaths and, together with the inspiratory time, establishes the respiratory rate.

Respiratory Rate

The 2200B-MRI does not have direct respiratory rate control. The respiratory rate is determined by the combined inspiratory and expiratory times:

Respiratory Rate (BPM) = 60 ÷ (Inspiratory Time + Expiratory Time)

For example, an inspiratory time of 1.5 seconds and an expiratory time of 2.5 seconds produces a respiratory rate of 15 breaths per minute.

I: E RATIO DISPLAY

The 2200B-MRI does not display the I:E ratio. It is set directly by the operator through the selection of inspiratory and expiratory times. The inspiratory time is given as a value of one, and the expiratory time is shown relative to it; an inspiratory time of 1.0 second with an expiratory time of 1.5 seconds yields an I:E ratio of 1:1.5. Inverse I:E ratios (inspiratory time exceeding expiratory time) should not be used unless clinically indicated and directed by the attending veterinarian.

INSPIRATORY FLOW RATE

The inspiratory flow rate control is the 1" (2.54 cm) diameter black control knob located below and slightly to the left of the green manual push button control. Turning it clockwise will increase the flow rate to the patient from minimum to maximum. Be sure the knob is pulled out / unlocked before turning to adjust. The 2¾" (6.985 cm) diameter display gauge, located above and to the left of this control, indicates the level of flow being delivered to the patient. The face of this gauge has low, medium, and high selection.

The maximum flow rate selectivity is limited by the maximum PSI at the ventilator inlet as indicated on the supply pressure gauge. Continuing to turn the flow rate control up after the needle has stopped will damage the control over time if done repeatedly. Once the needle stops, do not turn the flow rate up further before increasing the supply pressure to the ventilator. We designate 50 PSI (±10).

MANUAL BREATH PUSH BUTTON

Located on the front left side of the control console, this green push button may be used to develop inspiratory pressure whenever the gas supply is activated. The inspiratory pressure developed will be limited by the setting of the pressure relief valve. Inspiration will occur while the button is pushed and the bellows is descending. Do not continue to press once the bellows has fully descended.

Use of the manual breath control will not synchronize the pneumatic timing circuit. As a safety feature, in the event of a timing circuit malfunction, the manual breath push button can be used to provide mechanical ventilation for the patient for the duration of the surgery, provided supply gas pressure is maintained.

SAFETY PRESSURE RELIEF VALVE

This overpressure valve is located on the back of the control console and is factory set at 80 cm H_2O. This is the maximum amount of pressure developed within the patient breathing system. It is fully adjustable by inserting a 5/32" (0.396 cm) hex driver into the center of the relief valve. Turning clockwise increases the pressure; turning counterclockwise lowers pressure. We recommend keeping it at the factory setting.

Additionally, a standard steel hex key is ferromagnetic and a projectile hazard in the magnet room. We would require the relief valve to be adjusted outside the MR environment or using a non-ferromagnetic tool.

EXHALATION VALVE ASSEMBLY

Located inside the control console, the exhalation valve operates automatically. During the inspiratory phase, it is pneumatically closed to provide positive gas flow to the bellows chamber. During the expiratory phase, it automatically opens to vent positive pressure from the bellows chamber.

Excess anesthesia gases vented from the patient breathing circuit exit via the scavenger port. The gas scavenger tubing should be connected at this port. The gas scavenger system should create a slight sub-ambient pressure at this port to effectively remove excess gases from the room. The vacuum should be approximately −5 cm H_2O or slightly less to sufficiently evacuate excess scavenged gas.

SPONTANEOUS VENTILATION

The Mallard Model 2200B-MRI Ventilator System will accommodate patient-initiated breathing during all modes of operation. The inverted bellows will augment the patient's inspiratory effort. As the patient begins to expire, the bellows will rise, allowing the patient's tidal volume to be observed directly from the volume indicator on the canister. Hypopnea or apnea will be observed as limited or absent movement of the bellows.

INSPIRATORY TIME AND RESPIRATORY RATE

These two pneumatic timers regulate the length of inspiration and the interval between breaths. Inspiratory time is selectable from [0.1 to 3] seconds; the INS. TIME dial is calibrated in tenths of a second (SECONDS × 0.1). Expiratory time is selectable from [2 to 30] seconds; the EXP. TIME dial is calibrated in whole seconds. Each value is displayed in a mechanical dial window and adjusted by the control knob located directly below it.

Together, these two settings determine the respiratory rate: Respiratory Rate (BPM) = 60 ÷ (Inspiratory Time + Expiratory Time). The I:E ratio is likewise set directly by the operator through the selection of these two times. An inspiratory time longer than the expiratory time produces an inverse I:E ratio; the 2400V-MRI ventilator does not electronically limit or indicate inverse ratios, and they should not be used unless clinically indicated.

Monitoring Ventilator Function

The Mallard Model 2200B-MRI is a fully pneumatic ventilator and contains no electronic visual or audible alerts. The clinician monitors ventilator function by direct observation:

Cycling is confirmed by the rhythmic descent and rise of the bellows at the set rate. A failure to cycle is immediately evident as an absence of bellows movement; mechanical ventilation may then be provided using the manual breath push button, provided supply gas pressure is maintained.

The ventilator is designed to operate at a supply pressure of 50 PSI (±10). Supply pressure should be verified on the supply pressure gauge before and periodically during clinical application. A drop in supply pressure will reduce the delivered tidal volume, observable as reduced bellows excursion against the tidal volume scale.

In the event of a disconnection within the patient breathing circuit, the bellows will fall to its baseline position and remain there. This provides a definite indication that a tidal volume is not being delivered to the patient. Because the 2200B-MRI has no low-pressure or disconnect alarm, continuous direct observation of the bellows and the use of independent patient monitoring appropriate to the MR environment are required.

Mallard Model 2200B-MRI Ventilator Specifications

CLASSIFICATION

A pneumatic, time cycled, pressure limited, volume ventilator.

BELLOWS ORIENTATION

- Inverted

VOLUME

- Included Adult Bellows200-2200 mL
- Optional Pediatric Bellows 50-300 mL
- Optional Larger Bellows 200-3000 mL

CONTROLS

- Inspiratory Time .1-3 seconds
- Inspiratory Flow 1-120 LPM
- Inspiratory Pressure 10-80cm H_2O
- Expiratory Time 2-30 seconds
- Rate (derived) Determined by Inspiratory + Expiratory Time Settings
- Manual Push Button YES

DISPLAY

- Inspiratory Time Mechanical dial (seconds × 0.1)
- Expiratory Time Mechanical dial (seconds)
- Tidal Volume Graduated scale on bellows canister

ALARMS AND ALERTS

- None — fully pneumatic system. Ventilator function is monitored by direct observation of bellows movement and supply pressure gauge.

SAFETY SYSTEM

Overpressure Governor 80cm H_2O (factory set but adjustable)

GAS SCAVENGER

19mm port

DIMENSIONS

Height	19”	(48cm)
Width	12”	(30cm)
Depth	10”	(25cm)
Weight	10lbs	(4.5kg)

Performance Verification Procedure for Model 2200B Small Animal Anesthesia Ventilator

This Performance Verification Procedure provides a means of determining whether the Mallard Model 2200B-MRI Anesthesia Ventilator meets its design specifications. It is intended to be performed in a hospital by qualified technical personnel. **This procedure should be performed at least once a month** (or more frequently if desired). The checklist should be followed exactly. If the ventilator fails to meet any design specification, it should be removed from use; service may be required.

NOTE: It is recommended that hospital personnel responsible for the Performance Verification keep records documenting these activities and that all tested equipment be appropriately identified.

Following the instructions on Page 10 "Application with Anesthesia Machine," set up the Mallard Model 2200B-MRI Anesthesia Ventilator as described. Provide a flow of 4 to 6 liters per minute of air or oxygen from the gas machine to the anesthesia breathing circuit. Connect a standard test lung to the airway connector. Close the gas balance valves located within the gas machine flow with a standard wall outlet flow meter. Assure that the entire breathing circuit is leak free.

Select the following values for control settings on the Mallard Model 2200B-MRI Anesthesia Ventilator:

Tidal Volume:	1000ml
Inspiratory Flowrate:	12 o'clock position
Inspiratory Time:	1 second
Expiratory Rate:	5 seconds

Position the master switch to "ON". Observe that the mechanical test lung is being ventilated.

Inspiratory Time Control

Adjust the Inspiratory Time Control to a minimum and verify the timing of .1 second. Select inspiratory times of 5, 10 and 15 seconds and verify the accuracy of these values.

Inspiratory Flowrate Control

Select an inspiratory time of 1.5 seconds. Adjust the flowrate control to its minimum position (fully counterclockwise). The indicator needle will be below the "Low" white indicator and no flow will be generated from the ventilator. Turn the control knob clockwise and note that the indicator needle advances upward through the Low, Medium, and High areas of the display gauge. The flow rate should increase correspondingly.

Expiratory Rate Control

Select an inspiratory time of 10 which is equal to 1 second. Select the following expiratory rates: 2, 5, 7, 9 and 11. Verify the accuracy of the rate control.

Manual Control (Push Button)

Turn the On/Off switch to the "OFF" position. Select the minimum position of the inspiratory flowrate control. Depress the green push button and hold. Advance the control from Minimum to Maximum and observe a corresponding pressure rise on the absorber circuit manometer. Upon releasing the button, the pressure should return to baseline. Verify that the button does not stick in the depressed position and that it moves freely.

On/Off Switch (Pneumatic Control)

Place the switch in the "OFF" position. Connect the ventilator to a gas supply source regulated to 50 PSI (±10) and verify the supply pressure on the supply pressure gauge. Turn the switch to the "ON" position; the ventilator should begin cycling at the set inspiratory and expiratory times, indicated by rhythmic descent and rise of the bellows. Return the switch to "OFF" and verify that cycling stops completely.

Tidal Volume Selector

Position the Tidal Volume Rod at the following settings: 200 mL; 600 mL; 1,000 mL and 1,600mL. Verify that the bellows inflate to these volumes during the expiratory phase of ventilation.

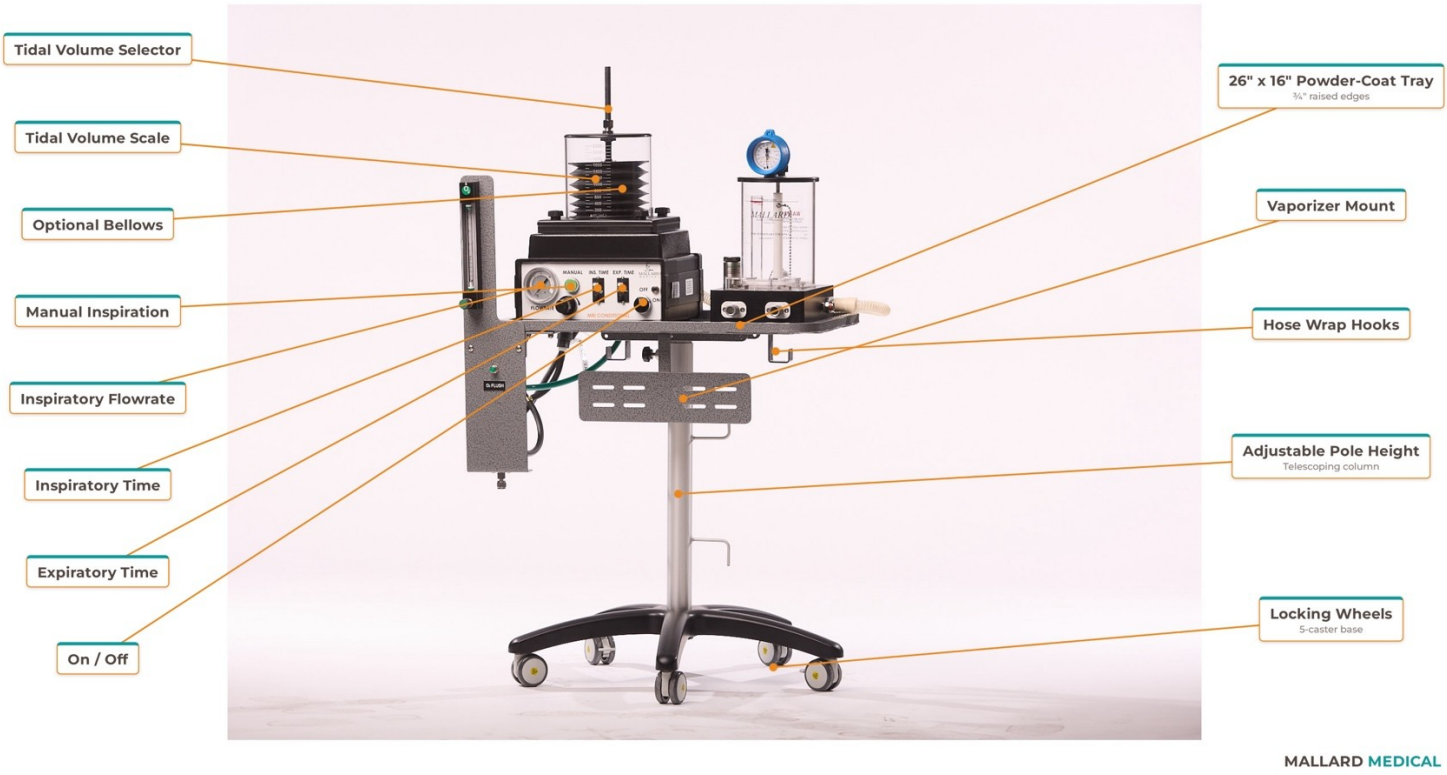
Stability of Controls and Displays

Allow the ventilator to mechanically ventilate the test lung for five minutes and observe that volumes delivered are consistent, cycling remains regular at the set inspiratory and expiratory times, and the timer dial settings do not drift.

Note: It is recommended that records be kept of this Performance Verification Procedure.

If a Mallard Model 2200B-MRI Ventilator System meets all the criteria of the above performance verification procedure, it can be considered suitable for clinical application. If the unit does not meet the criteria of this procedure, service may be required. Refer to the Trouble Shooting Guide for possible assistance.

MODEL 2200B-MRI SMALL ANIMAL ANESTHESIA VENTILATOR SYSTEM



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Overview of 2200B-MRI System Sub-assemblies

Complete Anesthesia ventilator System (Vaporizers sold separately)

1.) Model 2200B-MRI pneumatic, time-cycled, pressure-limited, volume ventilator.

2.) Absorber with 2 ½ liter canister for longer case times.

3.) Mounting panel for two standard size vaporizers.

4.) Panel with O_2 flush button and 0 to 4 LPM flow control regulator.

5.) Mobile cart with adjustable height capability, and all relevant hose connections.

Service Policy

A 2200B-MRI that does not meet the criteria of the Performance Verification Procedure should not be used until the unit has been checked again using this procedure or directly contacting Mallard Medical to determine that it is functioning according to specification.

To ensure safety and reliability, we recommend that any service of the Mallard Model 2200B-MRI Anesthesia Ventilator be performed by an Authorized Mallard Service Representative. Authorized service is available directly from the home office of Mallard, in Redding, California.

Routine maintenance, as defined by this manual, may be accomplished by competent individuals within your medical facility or authorized distributors. Parts designated in this manual should be replaced only with parts manufactured or sold by the manufacturer.

If it is necessary to send a component to the home office for service, it should be adequately packaged. Components returned to the home office for repair (except where our warranty applies) will be repaired at the current Mallard list prices for replacement parts, plus a reasonable labor charge.

Routine Maintenance

Cleaning and Sterilization

This ventilator is shipped clean but NOT in a sterile condition. Clean the components as required by your own sterilization practices & standards.

Recommendations for disinfecting used components:

1. White vinegar and water. One-part white vinegar (available at grocery store) with four parts water.

Avoid using phenols, alcohol or harsh abrasives.

Caution

Parts sterilized with ethylene oxide must be properly aerated to dissipate the residual toxic gas absorbed by the material.

Follow the sterilizer manufacturer's recommendations for the specific aeration periods required.

Bellows Disassembly

The bellows are located within the transparent canister above the control console. It is recommended that a bacteria filter be used to isolate the bellows from patient contamination. The design of the Mallard Model 2200B-MRI Ventilator allows for quick and convenient disassembly for cleaning. Follow the instructions below to remove the bellows from the canister.

Assure that the ventilator is "OFF" and unplugged. Carefully disconnect the mainstream hose from the back of the canister inlet port. Remove the four hold-down screws with knobs from the skirt of the canister. Lift the canister straight up to clear the bellows guidepost. Remove the bellows assembly from the bottom plate. Inspect the bellows for any irregularities that may prevent a positive pressure seal.

During reassembly, ensure that the bellows assembly (pediatric or adult) is centered on the bottom plate between the six threaded holes in the platform. The gas balance system should be centered over the outlet port of the bottom plate. Lower the tidal volume rod to about half-way and replace the canister with the volume indication numbers facing forward. **Be certain the volume selection tube is positioned over the vertical rod extending upward from the bellows.** Replace the four hold-down screws with knobs located on the canister. **Do not overtighten.** Only moderate pressure is required to create the proper seal.

Inject a volume of gas into the bellows, positioning the bellows at approximately 1,000 ml. Be certain the volume selector tube is positioned above this level. Block or cover the inlet tubing. The bellows should remain stable at the inflated level. Continue to inflate the bellows, until the volume tube is contacted with an inlet flow of 4 lpm. Excess gas should vent from the bellows with an increase in pressure not greater than 2 cm H_2O above baseline.

NOTE:

Maintenance should occur outside of the MRI suite. Disassembly/reassembly should be performed outside the magnet room — screwdrivers, test-lung fittings, and flowmeters brought in for the leak test are all potential projectile hazards.

Troubleshooting Guide

This troubleshooting guide is coordinated with the performance verification procedure. If a Mallard Model 2200B-MRI Anesthesia Ventilator does not meet a particular specification during the performance verification, refer to the appropriate section of the troubleshooting guide to determine what should be done.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Bellows not returning to selected volume during the expiratory phase	Leak within the patient's breathing system Lack of flow from the anesthesia machine Overpressure valve on the anesthesia machine is venting gas	Eliminate leak. Re-establish flow Close overpressure valve
The tidal volume delivered to the patient is low	Same as above	Same as above
No flow is being generated from the ventilator	Flowrate control turned off	Turn flow rate control on.
Flow rate is too low to deliver required volume	Flowrate control set too low	Increase flowrate setting to deliver desired tidal volume
Flow rate too high for laminar flow	Flowrate control set too high	Decrease flowrate setting to establish more laminar flow
Unable to generate sufficient inspiratory pressure	Leaks in the patient's breathing circuit Leaks in the exhalation valve	Correct leaks Correct leaks
Ventilator fails to cycle	On/Off switch in "OFF" position Supply source pressure below operating range Pneumatic timer malfunction	Turn switch to "ON" Verify supply pressure at 50 (±10); restore supply Service required; provide manual ventilation via the manual breath push button in the interim

Cycling rate is irregular or has drifted from the set rate	Supply source pressure fluctuating Pneumatic timer out of calibration	Verify and stabilize supply pressure at 50 PSI (±10) Service required
Delivered tidal volume gradually decreasing during use	Supply source pressure dropping (e.g., cylinder depleting)	Check supply pressure gauge; replace cylinder or restore pipeline supply
Manual inspiratory control nonfunctional	Inlet pressure line disconnected	Reconnect pressure line
Low flowrate from the ventilator	Leak within the pneumatic system	Examine pneumatics, correct leak
The bellows is low on volume.	Disconnection of the patient's breathing circuit	Reconnect the patient's breathing circuit and fill the bellows with the flush valve.

SPECIAL NOTE

Prior to clinical application, it is essential that the Performance Verification Procedure be performed to ensure the system integrity of this device. This device requires a pneumatic interface. The clinician operator should also ensure that both supply source and patient interface pneumatic connections are intact and in compliance with the existing medical center safety codes. Any discrepancies should be recorded and documented by the person performing the Verification Procedure and resolved prior to use.

Mallard Medical – Support Videos

https://mallardmedical.com/support/