



BADGER

DENTAL VACUUM SYSTEM



INSTALLATION, MAINTENANCE
AND USER MANUAL

Thank you for selecting an Badger Dental Vacuum System to serve your dental facility. The RAMVAC Badgers use proven oil-less technology to set new standards in dental vacuum system performance, durability and economy.

Invest a few minutes of your time and:

1. Read the “Maintenance” section in this guide. Use these simple preventive procedures that will allow your vacuum unit to reach its service-life potential.
2. Read the “Operation” section in this guide. Find out how to best control your vacuum unit and put its safety features to work for you.
3. Initiate the warranty. Check inside the back cover to review our warranty commitment to you ... and what you need to do to receive warranty coverage.

To initiate the warranty you must:

1. Complete and return the Installation Checklist to RAMVAC.
2. Visit our website at www.ramvac.com and complete the warranty initiation form.

All of us at RAMVAC® appreciate your business and take a personal interest in your satisfaction. Please let us know how the system is working for you. Just give us a call or stop by one of our dental show exhibits.









Safety and Regulatory Information

RAMVACs meet the most current and highest safety standards. RAMVAC Vacuum Units are certified to ANSI/AAMI, ES60601-1:2005(R2012) and certified to CAN/CSA Standard C22.2 No. 60601-1:08, and comply with NFPA 99c Level 3 vacuum requirements, and are manufactured in a FDA Registered ISO 13485:2003 certified facility.

Here’s what you need to do to insure the safety potential of this equipment is achieved:

- Make sure your equipment is installed according to our written instructions and the Installation Checklist is completed. If you have purchased your RAMVAC from an authorized dealer, the dealer is responsible for presenting you with the completed checklist.
- Exhaust from dental vacuum systems can be hazardous. Make sure the exhaust pipe is terminated outside your building according to our written instructions.
- Nitrous oxide and oxygen can be safely scavenged in the small concentrations typically encountered in dental analgesia. The additional air drawn into a properly installed and operated Vacuum Unit will dilute these agents. Never use your RAMVAC to remove pure nitrous oxide, oxygen or other oxidizing agents directly from storage vessels or supply hoses. Large concentrations may cause a fire in the Vacuum Unit and may cause an exhaust hazard.
- Never use this equipment in an OXYGEN RICH ENVIRONMENT. Large concentrations may cause a fire in the Vacuum Unit and may cause an exhaust hazard.
- Never use your RAMVAC for housekeeping functions.
- Never use your RAMVAC to collect lab dust.

The Badger labels include safety symbols with special meanings:

	This means there is more information available in this User Guide.		This notifies users to be aware of biohazardous materials that may be present.		Used to advise the operator to consult the accompanying documents.
	This notifies handlers that the box must remain upright at all times.		This notifies handlers that this box should never be stacked.		This notifies handlers of the safe temperature range for the contents in box.
	This notifies handlers of the safe humidity range of the contents in the box.		This warns handlers not to allow the box to be placed on an unlevel surface due to risk of tipping.		

Badger Overview

The Badger is a positive displacement, oil-less, dry vacuum system intended for use in a dental facility. Vacuum is supplied to the system by a durable oil-less rotary vane pump. A space-saving integrated separation tank keeps liquid and foam out of the pump. The E1 control provides precise electrical control over run-time and shutdown operations while vacuum is maintained at a uniform level by the RAMVAC Vacuum Level Control Valve.

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EMC Info

Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in this manual.

Portable and mobile RF communications equipment can affect Medical Electrical Equipment.

The use of Accessories, transducers, and cables other than those specified, with the exception of transducers and cables sold by the Manufacturer of this device as replacement parts for internal components, may result in increased Emissions or decreased Immunity of the RAMVAC Badger.

The RAMVAC Badger should not be used adjacent to or stacked with other equipment and that if adjacent or stacked use is necessary, the RAMVAC Badger should be observed to verify normal operation in the configuration in which it will be used.

GUIDANCE AND MANUFACTURER'S DECLARATION –ELECTROMAGNETIC EMISSIONS		
The EUT is intended for use in the electromagnetic environment specified below. The customer or the user of the EUT should assure that it is used in such an environment.		
Emissions test	Compliance	Electromagnetic environment – guidance
RF emissions CISPR 11	Group 1	The EUT uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The EUT is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations / flicker emissions IEC 61000-3-3	Complies	

Guidance and manufacturer's declaration –electromagnetic immunity			
The [EQUIPMENT or SYSTEM] is intended for use in the electromagnetic environment specified below. The customer or the user of the [EQUIPMENT or SYSTEM] should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air		Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±0.5 kV for power supply lines Not Applicable for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line(s) to line(s) ±2 kV line(s) to earth	±1 kV line(s) to line(s) ±2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0,5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 0,5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the [EQUIPMENT or SYSTEM] requires continued operation during power mains interruptions, it is recommended that the [EQUIPMENT or SYSTEM] be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A / m	Not applicable	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE U_T is the a.c. mains voltage prior to application of the test level.			

EMC Info

Recommended separation distances between portable and mobile RF communications equipment and the EUT

The EUT is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the EUT can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the EUT as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz	80 MHz to 800 MHz	800 MHz to 2,5 GHz
	$d = 1.2\sqrt{P}$	$d = 1.2\sqrt{P}$	$d = 2.3\sqrt{P}$
0,01	0.12	0.12	0.23
0,1	0.38	0.38	0.73
1	1.20	1.20	2.30
10	3.79	3.79	7.27
100	12.00	12.00	23.00

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

GUIDANCE AND MANUFACTURER'S DECLARATION –ELECTROMAGNETIC IMMUNITY

The EUT is intended for use in the electromagnetic environment specified below. The customer or the user of the EUT should assure that it is used in such an environment. .

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the [ME EQUIPMENT or ME SYSTEM], including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.2\sqrt{P}$ $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2,5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, ^a should be less than the compliance level in each frequency range. ^b Interference may occur in the vicinity of equipment marked with the following symbol:
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2,5 GHz	3 V/m	

NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the EUT is used exceeds the applicable RF compliance level above, the EUT should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the EUT.

b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Badger Specifications

Ambient Conditions

This utility room equipment is designed to operate in the temperature range designated below. The utility room environment may require additional ventilation and HVAC accommodations in order to maintain an acceptable environment. The operating temperature listed is to be maintained under worst case conditions taking into account seasonal temperature changes.

Part Number	BADG1.2.60.1
Voltage	208-230 VAC, Single Phase
Voltage Connection	Nema 6-20R receptacle
Frequency	60Hz only
Horsepower	1.5 HP
Full Load Amperes	6.7 Amps
Switching (low voltage)	12 VDC
Preset Vacuum Level	7" Hg
Maximum Vacuum Level	15" Hg
Dimensions (w x d x h)	18.7" x 25.1" x 22.7"
Floor to Drain Center Line	7.75"
Floor to Inlet Center Line	20.58"
Weight	152 lbs
Tank Capacity	5 Gallons
Operating Temperature	40° F to 110° F (4.4° C to 43.3° C)
Storage Temperature	0° F to 150° F (-17.8° C to 65.6° C)
Db Level	74 db
BTU Rating	900 btu/hr
Humidity in Operation	0% to 95% RH, no condensing moisture.
Altitude in Operation	50-105 kPa (equates to 18,000 to -1000 ft elevation range)

WARNING: NO MODIFICATION OF THIS EQUIPMENT IS ALLOWED. MODIFYING THIS EQUIPMENT WILL VOID MANUFACTURERS WARRANTY.

Low Voltage Switching

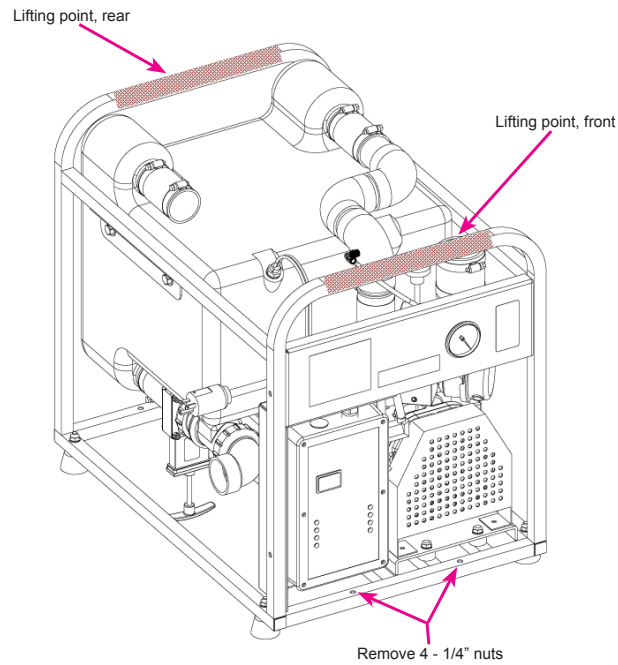
Note: The Badger™ Vacuum System must be switched by a low voltage switch. It cannot be switched with High Voltage.

Unpacking

NOTE: It is recommended to leave the unit attached to the shipping pallet during transport until final destination.

1. Carefully remove the shipping carton from the pallet containing the Badger.
2. Visually inspect the entire unit for damage. If shipping damage is found, immediately contact the freight carrier and supplier.
3. Remove the four 1/4" nuts that retain the unit to the shipping pallet.
4. To lift and handle the unit, grasp the frame rails shown in the figure below.

CAUTION: The unit is heavy. Never attempt to lift or handle alone.

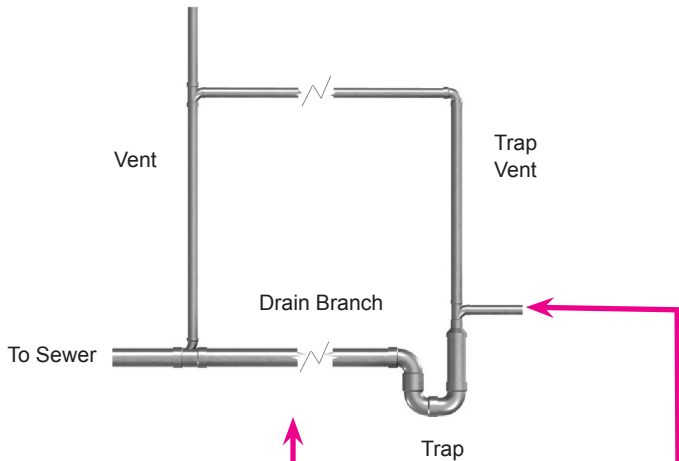
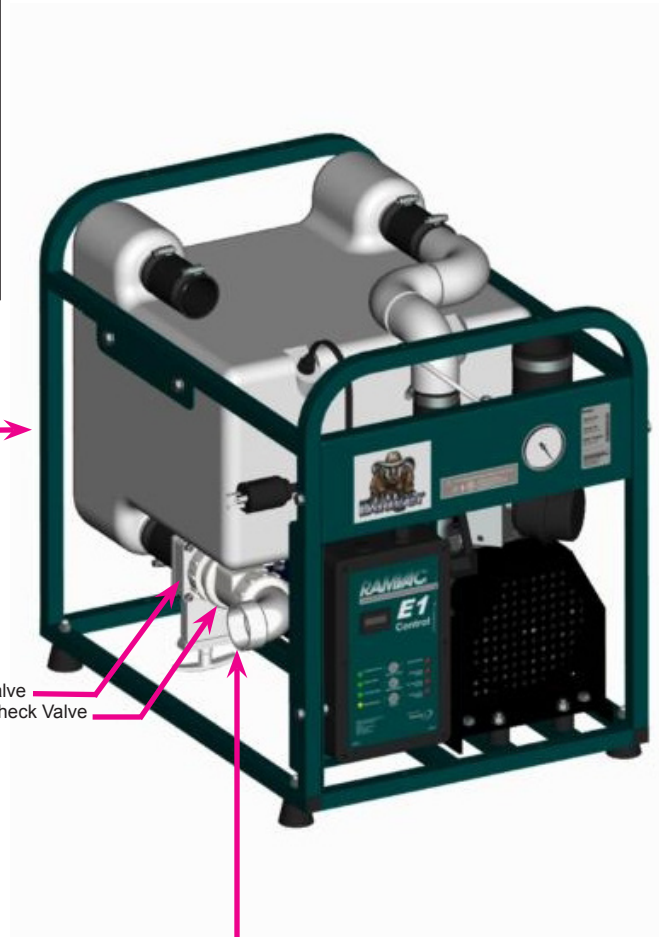


5. Verify additional parts shipped with the Badger Vacuum Unit for use at installation:
 - Plumbing Adapter Kit
 - Badger Installation Packet
 - Badger Doctors Packet
 - SlugBuster Powder, Single Box
 - 2 Gallon SlugBuster Mixing Jug
 - Badger Muffler Kit

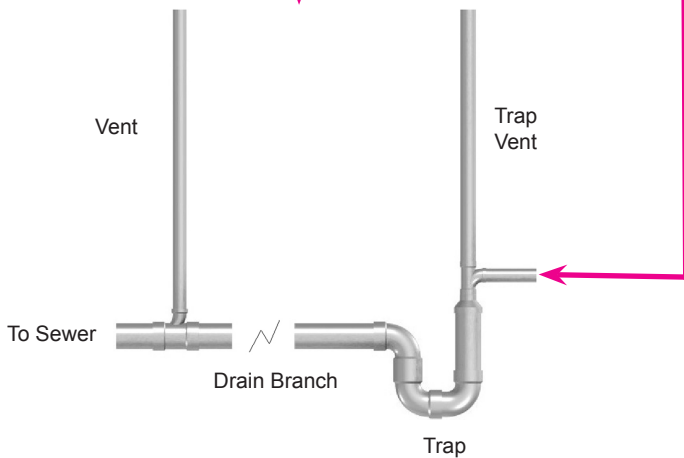
Vacuum and Drain Plumbing

Facility Vacuum Lines

- Build Like a Drain Line:
 - Use DWV Fittings
 - Minimum slope 1/4" per 10 ft (2 mm per 1m)
- Can be adapted to fit facility plumbing from 3/4" to 2"
- If an inline low spot is unavoidable, place it in a known location and incorporate a clean-out.
- For overhead piping, contact RAMVAC
- For nitrous oxide scavenging, contact RAMVAC
- Follow NFPA 99c Edition, RAMVAC Instructions, and local codes.



Drain Line Options
NFPA 99c Edition



Slide Valve
Drain Check Valve

Waste Pipe

Tank Drain Line

- Waste Pipe, Slide Valve, and Drain Check Valve
 - 1-1/2" PVC Schedule 40 with DWV fittings.
 - Min. slope 1/4" per 10 ft (2 mm per 1m).
 - Use only RAMVAC supplied 1 1/2" drain check valve.
- Trap and Drain Branch
 - Trap and branch line 2 sizes larger than waste pipe.
 - Trap seal minimum 4" deep.
- Vents
 - Trap vent size no less than half the trap and drain branch size.
 - Vents no smaller than drain check valve.
 - Vents must extend minimum of 6" above tank top before turning horizontal.
- Follow NFPA 99c Edition, RAMVAC Instructions, and local codes.

Exhaust Plumbing



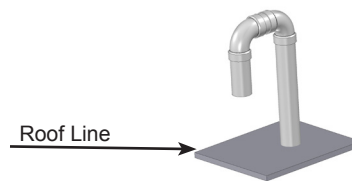
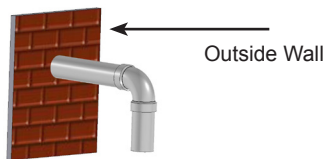
BIOHAZARD

Breathing Dental Vacuum System Exhaust May Be Harmful.
 Exhaust to Outside of Building.
 Follow NFPA 99c, RAMVAC Instructions, and local requirements.



Outside End *(Installer supplied)*

Turn outside end down toward ground and screen to prevent entry of water, debris, and creatures.
 Locate inconspicuously for sight and sound. Locate to prevent exhaust from entering building.



Run Dedicated Exhaust Lines for each RAMVAC unit installed:
“DO NOT connect to plumbing vents.”

Size: 2”

Type: Sch 80 CPVC, or metal (**NOT tar coated**).

Support Loosely:

DO NOT allow piping to touch ductwork.
DO NOT make solid attachment to building structure.

Seal: All joints must be glued with approved adhesive.

Installation

WARNING: THIS DEVICE SHOULD ONLY BE INSTALLED BY LICENSED ELECTRICAL AND PLUMBING CONTRACTORS TO ALL APPLICABLE FEDERAL, STATE OR LOCAL BUILDING CODES.

WARNING: TO AVOID RISK OF ELECTRICAL SHOCK, THIS DEVICE MUST ONLY BE CONNECTED TO A SUPPLY MAINS WITH PROTECTIVE EARTH.

ELECTRICAL

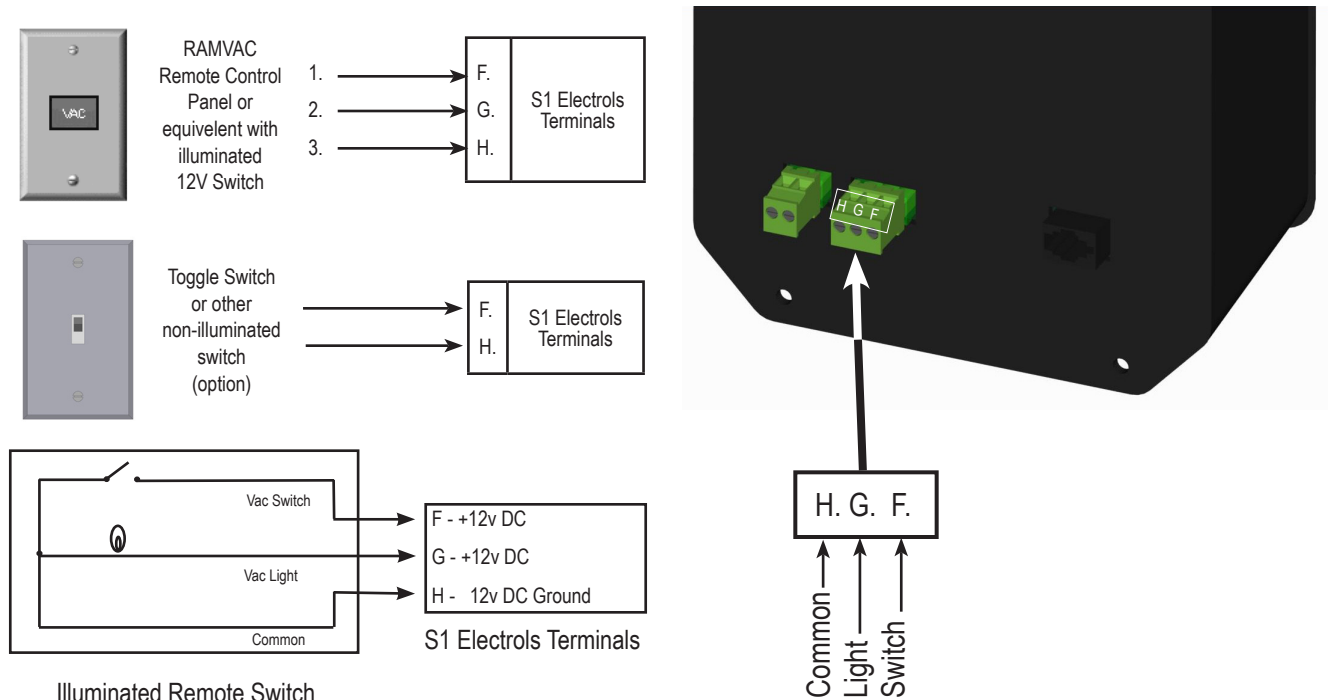
- Follow NEC, NFPA 99C, and all local codes.
- Vacuum pump is shipped with the appropriate electrical cord with plug.
- Qualified personnel must install a dedicated electrical circuit.
- Motor and E1 Control protection is provided by a 15 amp circuit breaker on each power leg in the E1.
- See “Specifications” for more electrical information.

WARNING: Electrical shock could occur as a result of improper grounding.

- This product must be grounded according to NEC regulations and local codes.

WARNING: Always turn off Vacuum pump and remove power plug from outlet when servicing.

CAUTION: Use of an extension cord is not advisable. An undersized extension cord will cause a drop in line voltage and loss of power. Overheating will result.

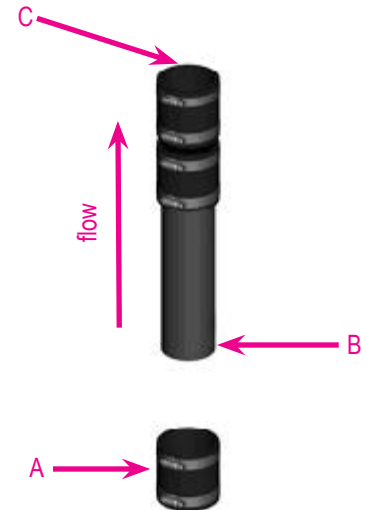


Silencer Kit for Single Unit Installation

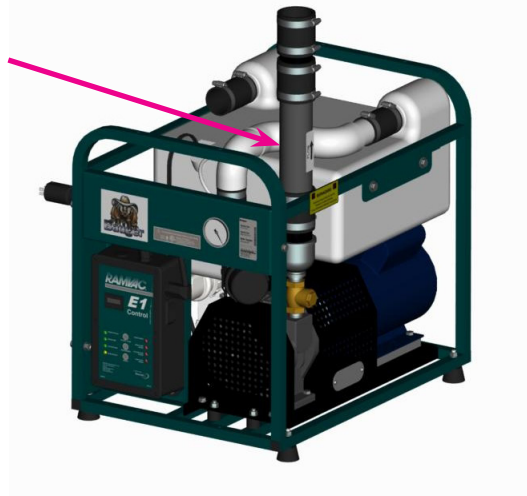
On Unit Installation

1. Disconnect the existing exhaust from Badger.
2. Remove the Inlet Coupling (A) and discard.
3. Insert inlet side (B) of Silencer into the exhaust coupling on the Badger and tighten clamp.
4. Insert the existing exhaust into the outlet coupler (C) of the Silencer and tighten clamp.

*Note direction of flow.



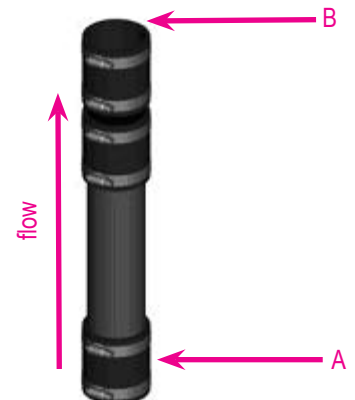
Silencer Kit Installed on the Badger



In-Line Installation

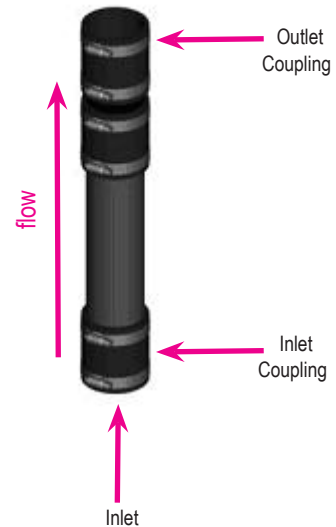
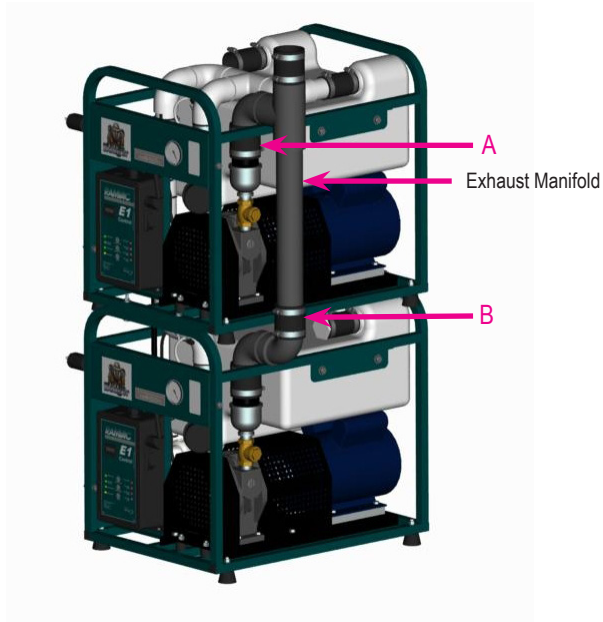
1. Remove a section of exhaust line between 13 and 14 inches in length.
2. Install existing exhaust line from the unit into the inlet coupling (A) of the Silencer and tighten clamp.
3. Install exhaust going to outside into the outlet coupling (B) of the Silencer and tighten clamp.
4. Verify the weight of the Silencer is properly supported.

*Note direction of flow.



Silencer Kit for Dual Unit Installation

Stacked Badgers without Silencer Kit

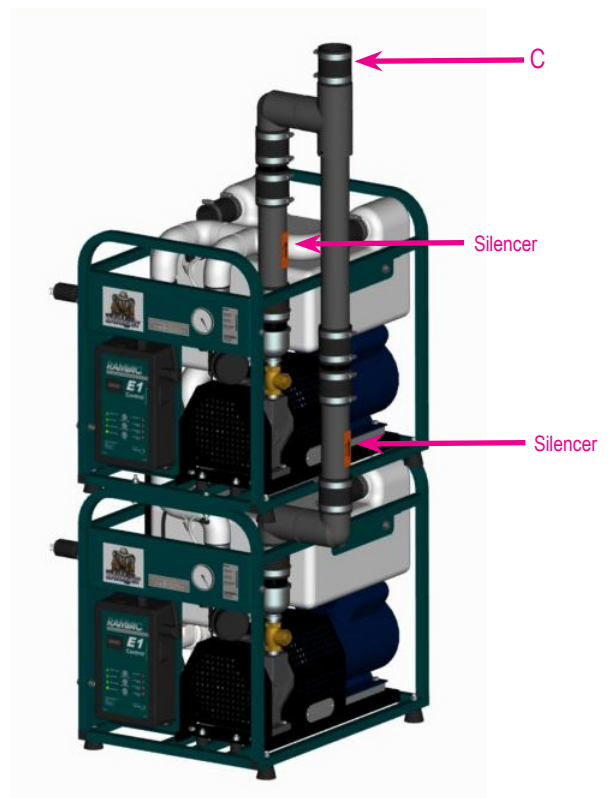


Stacked Badgers with Silencer Kits

1. Disconnect the existing exhaust manifold from exhaust coupling (A) and (B) on each Badger and set aside.
2. Remove the Inlet Coupling off of the Silencers and discard.
3. Insert inlet side of Silencers into each exhaust coupling on the Badger and tighten clamp.
4. Install the exhaust manifold that was set aside.

Note direction of flow

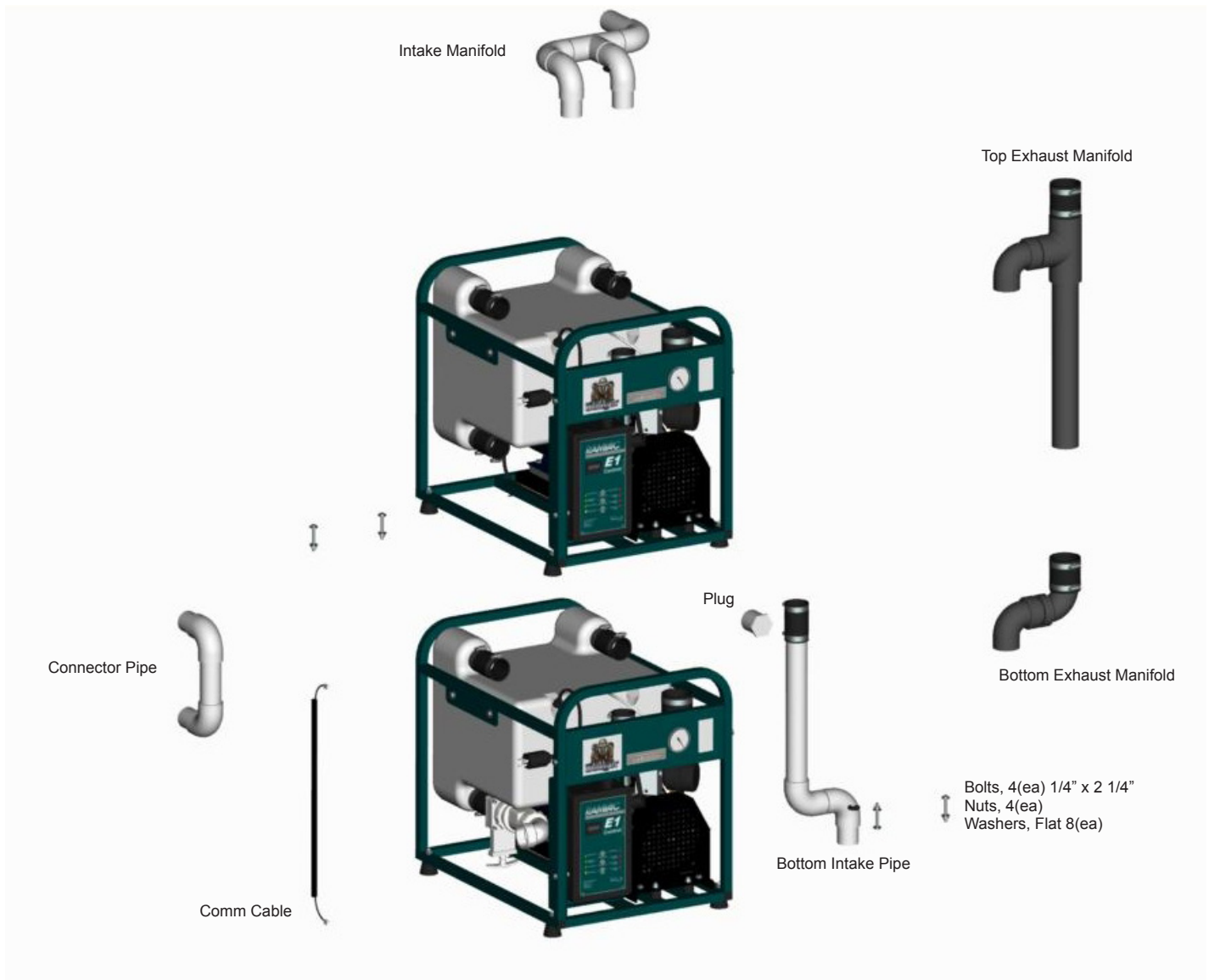
4. Insert the existing exhaust into the outlet coupler (C) and tighten clamps.



Stacking the Badger™

Increasing your vacuum capacity is easy with the Badger. A few simple steps and it is done.

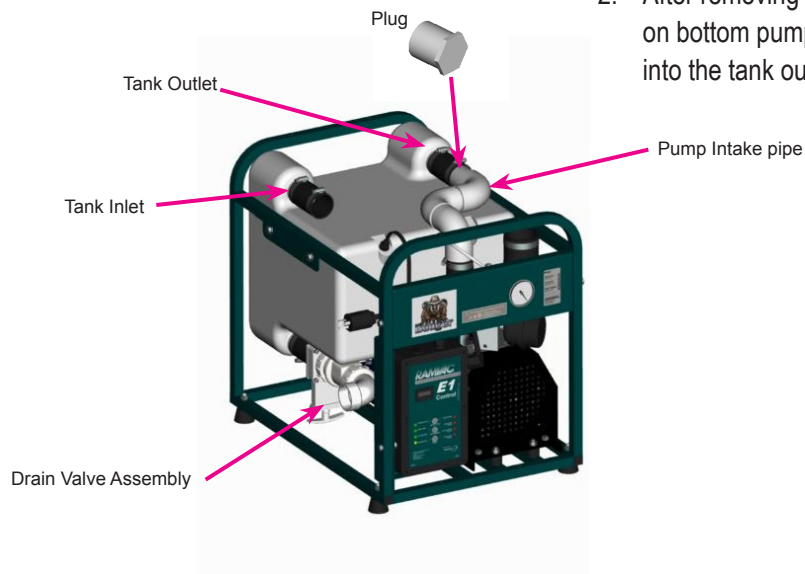
Dual Unit Kit



Badgers not included in the kit.

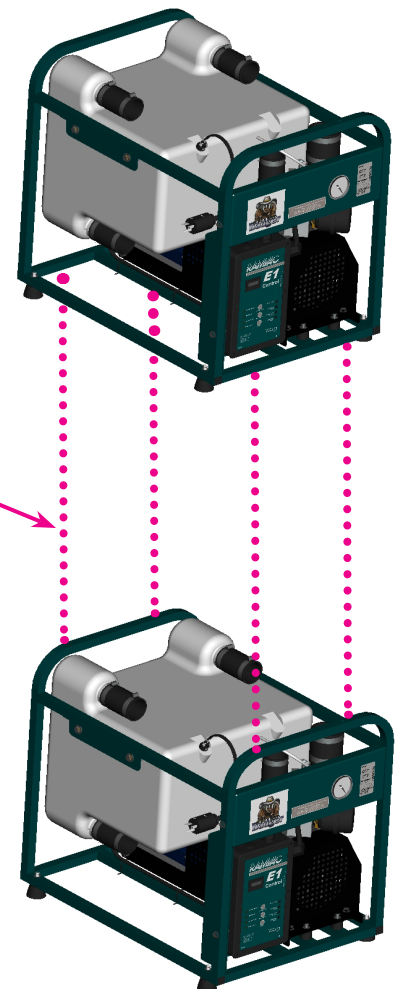
1. Remove the pump intake piping from both Badgers leaving the the tubing on the vacuum gauge fitting.

2. After removing the pump intake piping on bottom pump, install plug from kit into the tank outlet.

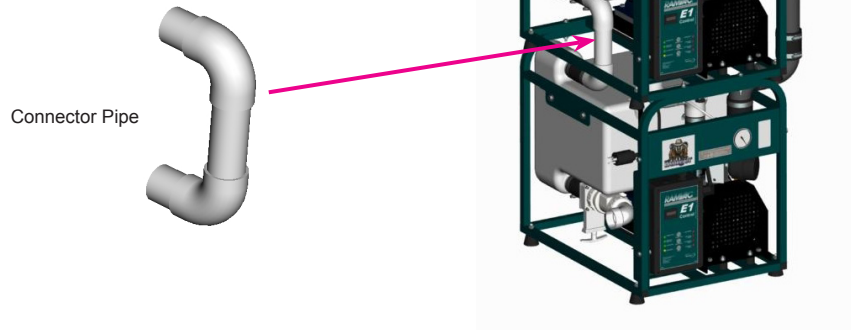


3. Stack the unit on top of the bottom unit matching the bottom frame of the top unit to the top frame of the bottom one, and secure using the 4 bolts and nuts included in the kit.

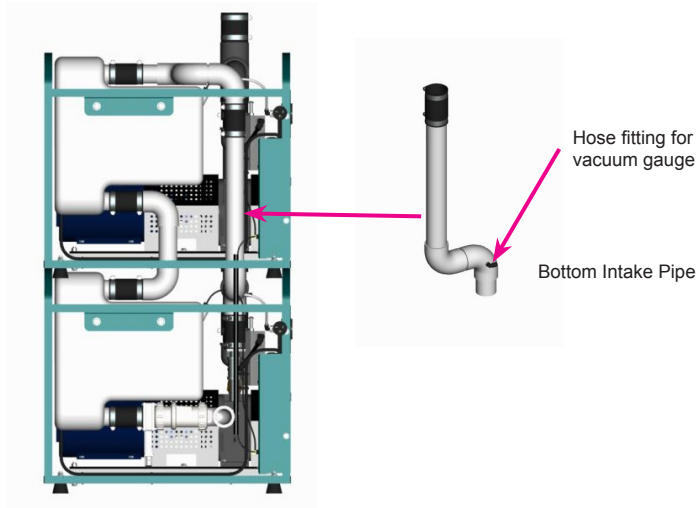
Use included bolts to secure Badgers together. 4(ea)



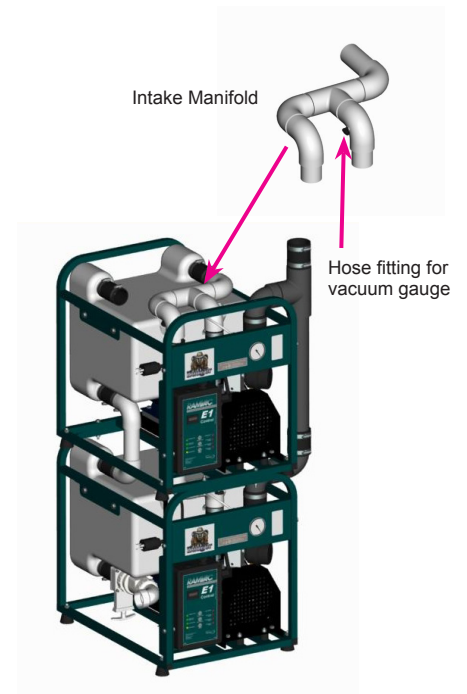
- Remove the existing drain valve assembly on the top Badger and using the connector pipe from the kit connect the drain of the top tank to the inlet of the bottom tank.

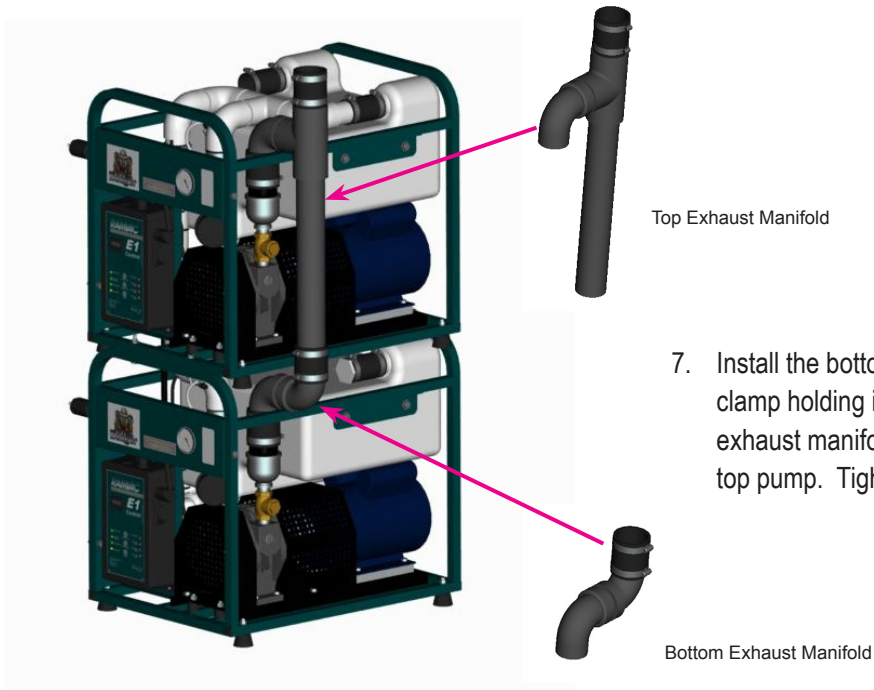


- Install the bottom intake pipe to the bottom pump intake and attach the 1/4" tube from the vacuum gauge to fitting on the bottom intake pipe.



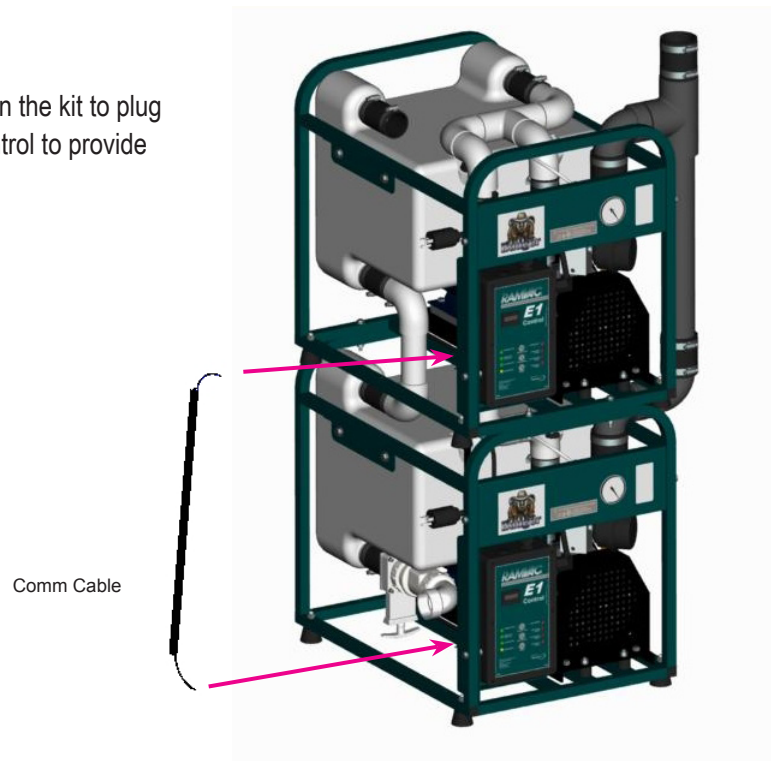
- Attach the intake manifold to the intake pipes from both pumps and the outlet of the top tank. Attach the 1/4" tube from the vacuum gauge to fitting on the intake manifold.





7. Install the bottom exhaust piece from the kit and tighten the clamp holding it on the the bottom pump. Install the top exhaust manifold to the bottom exhaust manifold and to the top pump. Tighten all clamps.

8. Use the coiled comm cable in the kit to plug into the back of each E1 control to provide the communications.



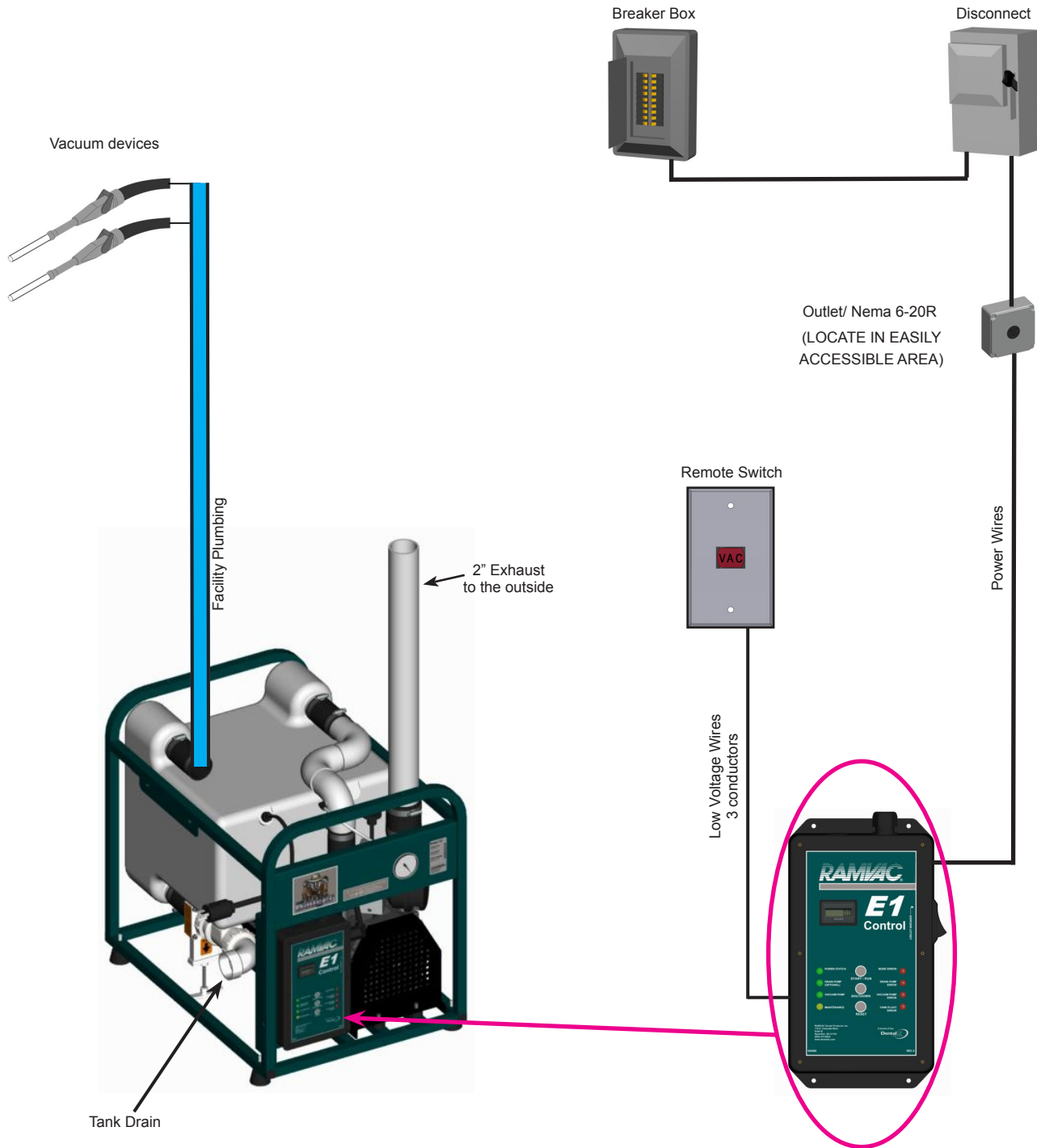
9. Set the mode switches in the E1 Electrols.

Important: Open the E1 on the top unit and set the Mode Switch C to the on position. All other switches are in the off position.

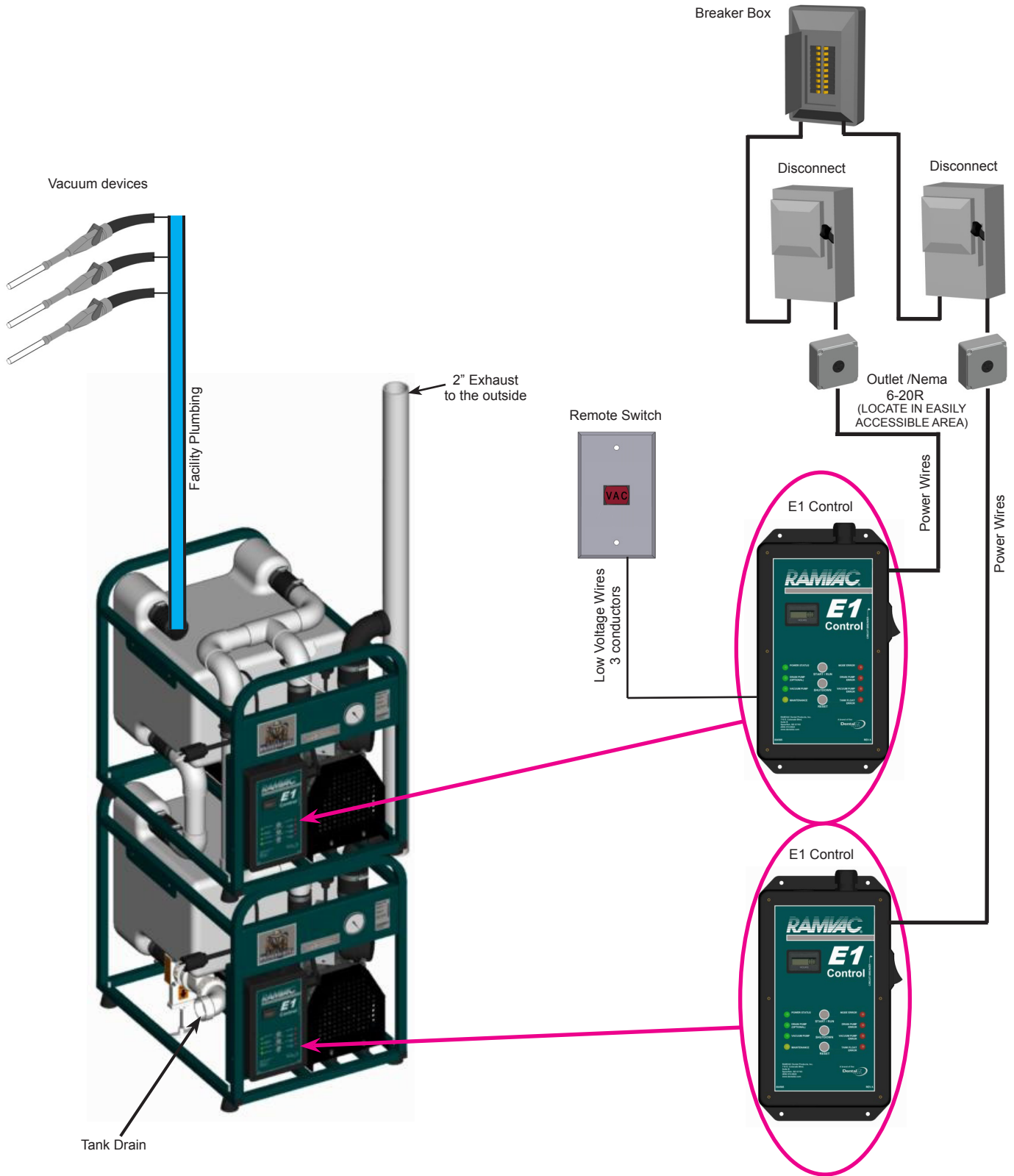
Open the E1 on the bottom unit and set the Mode Switch D to the on position. All other switches are in the off position.

10. Plug the remote switch connector into the back of the E1 on the top unit.

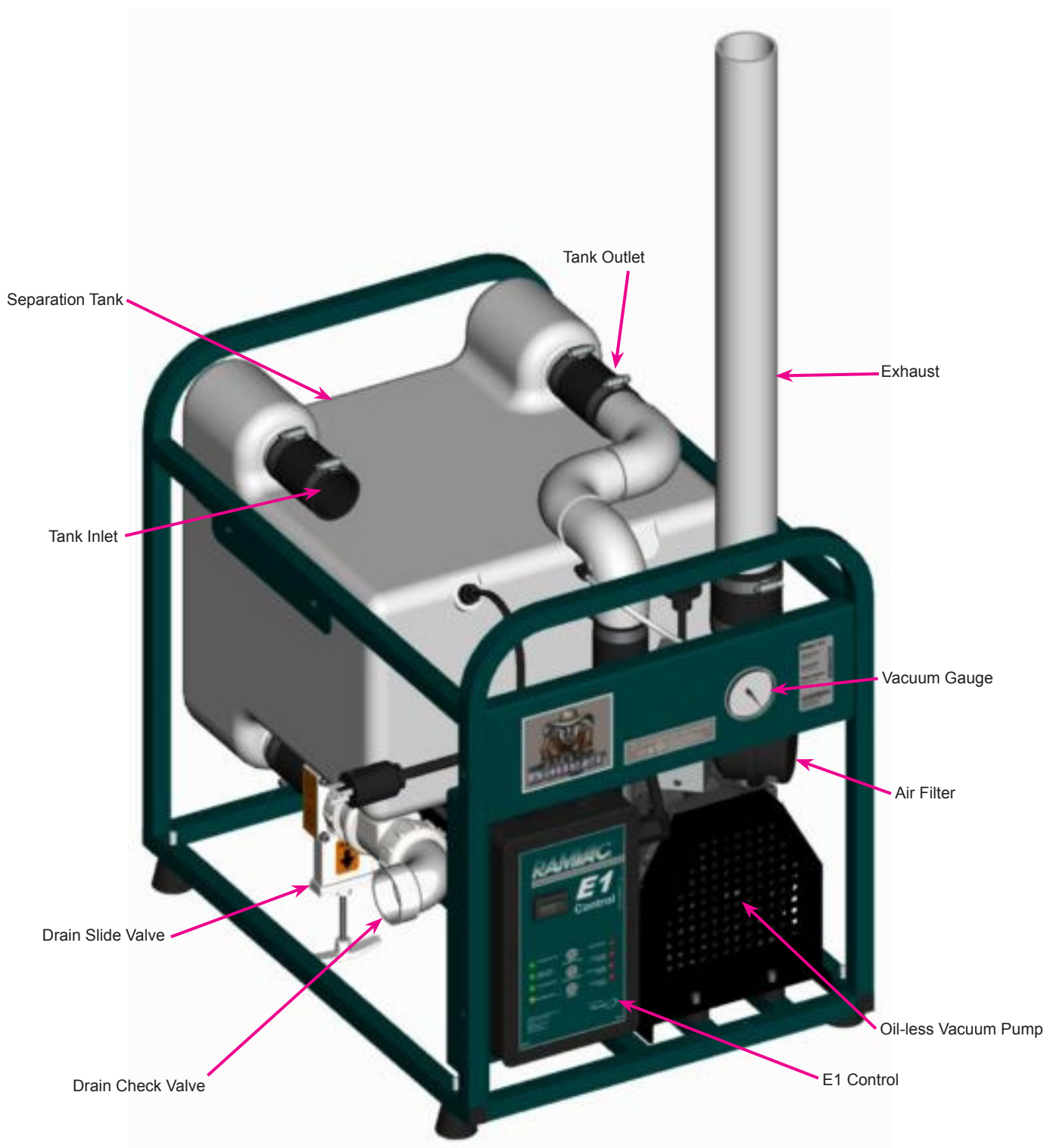
System Schematics - Single Unit



System Schematics - Dual Unit

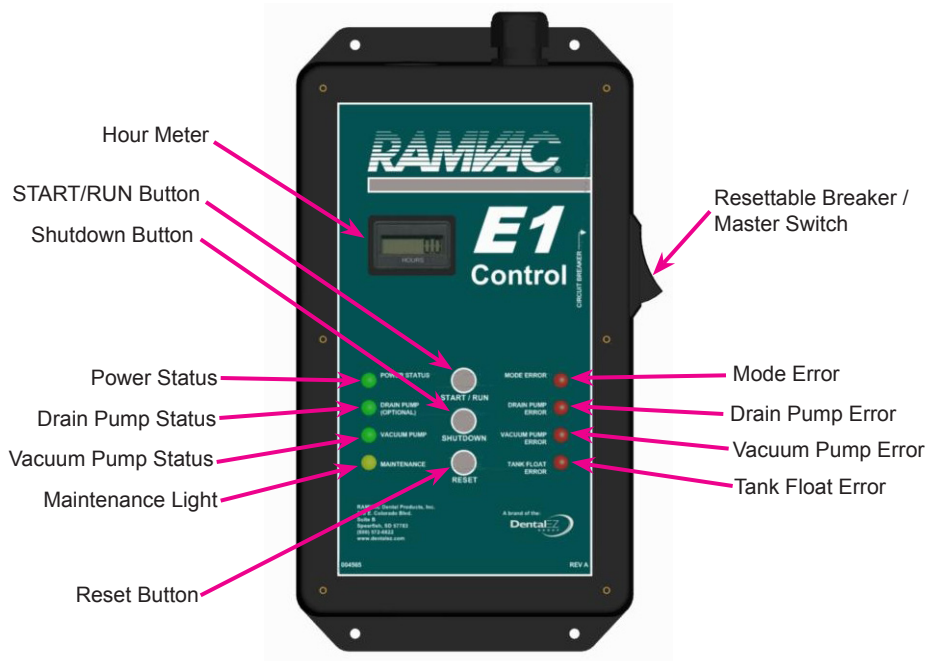


Badger™ Features



E1 Control Features

- Status Lights
 - Power Status – Green light is on when line voltage is present. Power Status light flashes while unit is performing a shutdown cycle. (See Shutdown Cycle Section)
 - Drain Pump Status – Green light is on when drain pump (optional accessory) is running.
 - Vacuum Pump Status – Green light is on when vacuum pump is running.
- Maintenance Light – Yellow light is on when preventive maintenance is due.
- Error Lights display fault information. (See Faults Section)
- Provides 12 VDC low voltage signal to the remote switch panel
- Accepts the remote switch input.
- Controls the tank draining sequence.
- Keeps track of run time hours.
- Protects system with a resettable 15 amp circuit breaker



E1 Faults

Faults:	System Status:	Corrective Action:
Maintenance	System runs normally. "Maintenance" LED is illuminated.	Perform "Preventive Maintenance".
Mode Error	System will not run. Remote switch indicator flashes. "Mode Error" LED is illuminated on E1.	See Troubleshooting Section
Drain Pump Error	System will not run. Remote switch indicator flashes. "Drain Pump Error" LED is illuminated on E1.	See Troubleshooting Section
Vacuum Pump Error	System will not run. Remote switch indicator flashes. "Vacuum Pump Error" LED is illuminated on E1.	See Troubleshooting Section
Tank Float Error	System will not run. Remote switch indicator flashes. "Tank Float Error" LED is illuminated on E1.	See Troubleshooting Section

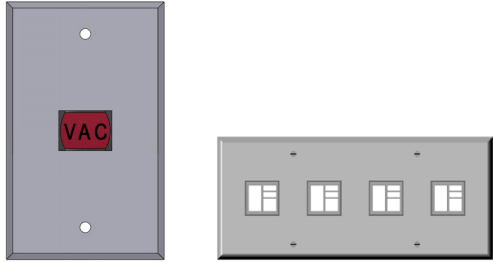
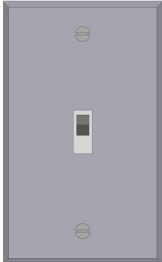

NOTE: An Error will cause the unit to shut down. This is to protect the system from damage. An Error Fault should only be cleared after the cause of the fault has been identified and corrected. To clear an Error Fault, press and release the Reset Button. The unit should automatically restart.

NOTE: No special skills are required by the operator to safely utilize this equipment. Contact the installing dealer or Ramvac if the following pages do not adequately answer all questions.

Turning the System ON/OFF

The RAMVAC can be run continuously throughout the workday. Avoid wasting electricity by turning off the RAMVAC if vacuum will not be needed for an hour or more.

No high voltage switching with the Badger.

Illuminated Remote Control Panel	Non-Illuminated Remote Panel	E1 Start/Run & Shutdown Pushbuttons
		
<p>Use this switch to turn system on and off from a remote location.</p> <ul style="list-style-type: none"> • Switch light is steady-on when system is running without "Fault". • Switch light flashes if a "Fault" has occurred. 	<p>Use this switch to turn system on and off from a remote location.</p> <ul style="list-style-type: none"> • Non-illuminated switches provide no indication for system status. 	<p>Use this switch to turn system on and off.</p> <ul style="list-style-type: none"> • If you have no remote switch. • If you want to turn the system on or off from the equipment's location.

Shutdown Cycle

NOTE: MAKE SURE ALL HVEs AND SALIVA EJECTORS ARE CLOSED BEFORE TURNING SYSTEM OFF.

Turn the unit OFF at the end of each day. When the unit is turned off, the power status light will blink, the tank will drain and the Vacuum Pump will RESTART and run for a period of 10 minutes. After this time has elapsed, the unit will automatically turn off. This cycle is utilized to prevent corrosion in the pump.

Vacuum Level

The vacuum level of the Badger is factory set at 7 in Hg (when all HVEs and SEs are closed). If adjustment is needed, please contact your authorized dealer or RAMVAC.

Separation Tank

The Badger contains an integrated separation tank the will collect fluids that are evacuated from the operatory room. If the fluid rises to an excessive level within the tank, the Badger will disrupt vacuum for approximately 60 seconds in order for the tank to drain. A dual unit Badger will disrupt vacuum for approximately 120 seconds in order for the tank to drain. After this drain time has elapsed, the unit will automatically restart and restore vacuum.

IMPORTANT: Fluids in the separation tank are hazardous. The Badger's drain must be properly connected to the facility's sewer plumbing.

Maintenance Overview

We recommend all maintenance and service be conducted by a qualified Dealer Service Technician.

Key points for trouble-free operation:

- Rinse vacuum lines daily with the recommended quantity of liquid and line cleaner.
- Check air filter on schedule.
- Exchange the pump head on schedule.

Preventative Maintenance Schedule

Daily	Rinse Vacuum Lines	See "Cleaning the Vacuum System"
Every 1,000 Hours*	Inspect Air Filters	See "Air Filters"
Every 10,000 Hours*	Exchange Pump Head	See "Pump Head Exchange"

- The "Maintenance" LED on the E1 Control will illuminate every 1,000 hours.
- To reset the "Maintenance" LED after maintenance has been performed, press and hold the "Reset" button for 10 seconds until the "Maintenance" LED begins blinking.

Cleaning the Vacuum System

Clean vacuum lines daily. Just before turning off the RAMVAC, rinse vacuum lines first with hot water -- approximately one quart through each high volume line and a few ounces through each saliva ejector line. Then aspirate a few ounces of a dental vacuum line cleaner through each vacuum line. SlugBuster™ is highly recommended. Cleaners should have these qualities:

- Non-Foaming
- De-Oderizing

Foam may cause damage to the pump. Avoid interruptions by insuring your cleaner is truly "non-foaming".

Test by shaking the mixed solution. True "non-foamers" will be bubble free.

Cleaning requirements will vary according to activity. After surgical procedures, aspirate a few ounces of an appropriate vacuum line cleaner, such as SlugBuster, through the lines.

For overhead plumbing, be sure to allow air to follow liquids before closing vacuum valves.

Clean treatment room solids separators routinely. Check the treatment room solids separator routinely and clean when dirty.

Cleaning the Vacuum Unit

1. Always disconnect the power from the equipment prior to cleaning.
2. Some parts/components on the vacuum unit get hot during operation. Provide the equipment ample time to cool prior to cleaning.
3. All components can be safely wiped down with a damp cloth, wet with water. We do not recommend using any cleaners or harsh chemicals to clean this equipment since their potentially harmful effects have not been evaluated.
4. Do not heavily wet electrical components
5. Allow equipment to air dry or dry with clean, soft cloth

Changing the Air Filter

Inspect air filter every 1000 hours. The Air Filter is accessed by twisting the end cap on the Air Filter Housing in a counter-clockwise motion.

Replace filters every 2,000 hours or when visibly dirty.

Pump Head Exchange

Exchange the Pump Head every 10,000 hours.

Pump Head Removal Procedure:

1. Remove the two bolts securing the Front Fan Guard and remove the Front Fan Guard.
2. Remove the Air Filter Housing and Air Filter from the Vacuum Controller.
3. Loosen the hose clamps securing the Exhaust Muffler Flexible Coupling to the Exhaust Plumbing.
4. Loosen the Bottom Hose Clamp on the Pump Intake Flexible Coupling.
5. Remove the four bolts securing the Pump Head to the Pump Base Plate.
6. Remove the Pump Head through the front of the unit by bringing the Pump Head out bottom-first.

Pump Head Installation Procedure:

1. Re-seat the rubber coupling on the motor shaft hub.
2. With the intake and exhaust assemblies already installed, insert the replacement pump head in the unit top first.
3. Slide flexible couplings onto intake and exhaust assemblies.
4. Slide the pump head towards the motor. Lightly turn the pump by the front fan until the shaft coupling seats in the hubs.
5. Re-install bolts to secure the Pump Head to the Base Plate, making sure the Pump is able to turn freely without binding in the shaft coupling.
6. Tighten the Hose Clamps securing the Pump Intake Flexible Coupling
7. Tighten the Hose Clamps Securing the Exhaust Muffler Flexible Coupling to the Exhaust Plumbing.
8. Re-install the Air Filter Housing and Air Filter on the Vacuum Controller.
9. Re-install the Front Fan Guard, making sure it does not come into contact with the Front Fan.

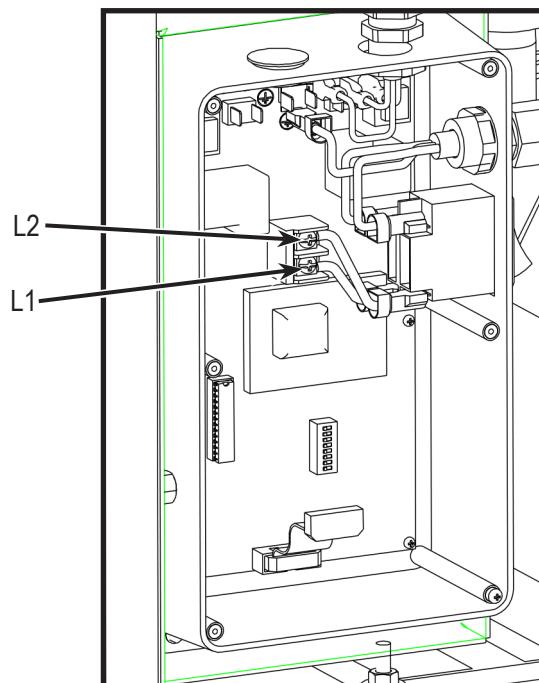
*** A detailed instruction sheet will be sent with the replacement pump. ***

Power Supply Cord Replacement

WARNING: POWER SUPPLY CORD SHOULD ONLY BE REPLACED BY A QUALIFIED TECHNICIAN AND MUST BE RE-INSTALLED WITH THE CORRECT CONNECTORS AND STRAIN RELIEF COMPONENTS.

1. Turn off breaker.
2. Disconnect power from the main circuit.
3. Isolate the unit from any electrical connections.
4. Disconnect wire terminals from L1, L2 and ground screws.
5. Remove old Power Supply Cord.
6. Route new Cord into E1
7. Attach wire terminals as described below:

BREAKER LINE 1 - BLUE
BREAKER LINE 2 - BROWN
GROUND - GREEN/YELLOW



Problem	Possible Cause	Corrective Action*
Low or No Vacuum (motor running okay)	Tank Drain Check Valve Blocked Open	Clean Tank Drain Check Valve
	Clogged Vacuum Line	Locate and remove clog
	Vacuum Controller Stuck Open	Repair or replace Vacuum Controller
	Vacuum Leaks	Locate and fix leaks
	Worn or Broken Vanes	Exchange Pump Head
Motor Does Not Run	“Tripped” Breaker	Reset Breaker
	“Tripped” Motor Overload	Reset Motor Overload
	Motor Failure	Replace Motor
	Failed Control Component	Replace failed component
	“Mode Error” Fault	See “Mode Error” Fault
	“Drain Pump Error” Fault	See “Drain Pump Error” Fault
	“Vacuum Pump Error” Fault	See “Vacuum Pump Error” Fault
Liquid Comes Out Exhaust	Unit Unleveled	Level Unit
	Foam In Tank	Use Non-Foaming Line Cleaner
“Mode Error” Fault	Incorrect Mode Setting	Correct Mode Setting
	Missing Or Disconnected Comm Cable	Install Or Connect Comm Cable (Dual Unit Only)
“Drain Pump Error” Fault	Incorrect Electrical Installation	Correct Installation
	Drain Pump Motor Failure	Replace Drain Pump
“Vacuum Pump Error” Fault	Incorrect Electrical Installation	Correct Installation
	Motor Failure	Replace Motor
	“Tripped” Motor Overload	Reset Motor Overload
“Tank Float Error” Fault	Separating Tank overfilled	Drain Separating Tank
	Separating Tank Drain Check Valve Stuck	Clean Separating Tank Drain Check Valve
	Clogged Drain Line	Locate and Remove Clog
	Drain Shut-Off Valve Closed	Open Drain Shut-Off Valve
	Tank Float Switch Stuck	Replace Tank Float Switch
	Facility Drain Elevated Above Tank Drain	Raise Unit or Install Power Drain
Maintenance Required	Preventive Maintenance Due	Perform Preventive Maintenance

* Abbreviated Information: For details contact your authorized dealer or RAMVAC. RAMVAC will make available upon request, circuit diagrams, calibration instructions, descriptions, or any other information which will assist a qualified technician to repair your RAMVAC.

RAMVAC® Product Support Services

The DentalEZ Group and its employees are proud of the products we provide to the dental community. We stand behind these products with a warranty against defects in material and workmanship as provided below.

In the event that you experience difficulty with the application or operation of any of our products, please contact our customer service department at our expense at (866) DTE-INFO.

If we cannot resolve the issue by telephone, we will arrange for a representative to contact you or suggest that the product be returned to our factory for inspection.

If product return or repair is required, we will provide you with a Return Authorization number and shipping instructions to return the product to the proper facility. If the product is under warranty we will ask you to provide proof of purchase such as a copy of your invoice. Please be sure to include the Return Authorization number on the package you are returning. Products returned without a return authorization number cannot be repaired.

Freight costs for product returns are the responsibility of the customer. Products under warranty will be repaired or replaced, at our sole discretion, and returned at our expense. Products outside the warranty limits will be repaired and returned with costs invoiced to the customer. We are not responsible for shipping damages. We will, however, help you file a claim with the freight carrier. Written repair estimates are available.

DentalEZ warrants all equipment and parts to be free of defects in material and workmanship, under normal usage, under the following terms:

RAMVAC Products:	Warranty Period:
RAMVAC® Lubricated Dental Vacuum System	2 Years from date of installation*
RAMVAC® Lubricated Vacuum Pumps only	10 Years from date of installation*
RAMVAC® Badger™ LubeFree™ Dental Vacuum System	5 Years from date of installation*
RAMVAC® OWL™	2 Years from date of installation*
CustomAir® by RAMVAC®	6 Years / 4200 hours from date of installation*

Please note the following additional terms of our warranty and return policy:

- Warranties cover manufacturing defects only and do not cover defects resulting from abuse, improper handling, cleaning, care or maintenance, normal wear and tear or non-observance of operating, maintenance or installation instructions. Failure to use authorized parts or an authorized repair facility voids this warranty.
- Liability is limited to repair or replacement of the defective product at our sole discretion. All other liabilities, in particular liability for damages, including, without limitation, consequential or incidental damages are excluded.
- This warranty is in lieu of all other warranties, expressed or implied, including ANY IMPLIED warranties of merchantability or fitness for a particular purpose. no employee, representative or dealer is authorized to change this warranty in any way or to grant any other warranty.

WARRANTY REPAIRS:

Parts repaired or replaced on a product that is in warranty will be warranted for the duration of that product's original warranty.

NON-WARRANTY REPAIRS:

The warranty on parts either repaired or replaced on an out-of-warranty product will cover the repaired part only and will be for the timeframe of a new parts warranty period.

PRODUCT RETURN:

Opened products or product returns more than a year old cannot be returned for credit. There will be a 15% (\$25.00 minimum) restocking charge on all items authorized for return.

*When installed, operated and maintained in accordance with written instructions.

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(800) 5-RAMVAC

Spearfish, SD 57783
FAX (605) 642-3776

www.ramvac.com

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SPEARFISH, SD 57783

TOLL FREE: 800-5-RAMVAC (800-572-6822)

PHONE: (605) 642-4614 • FAX: (605) 642-3776

e-mail: ramvac@ramvac.com

website: www.ramvac.com

A Brand of the

DentalEZ
GROUP
The Integrated Supplier
PHONE: (866-DTE-INFO)
www.dentalez.com