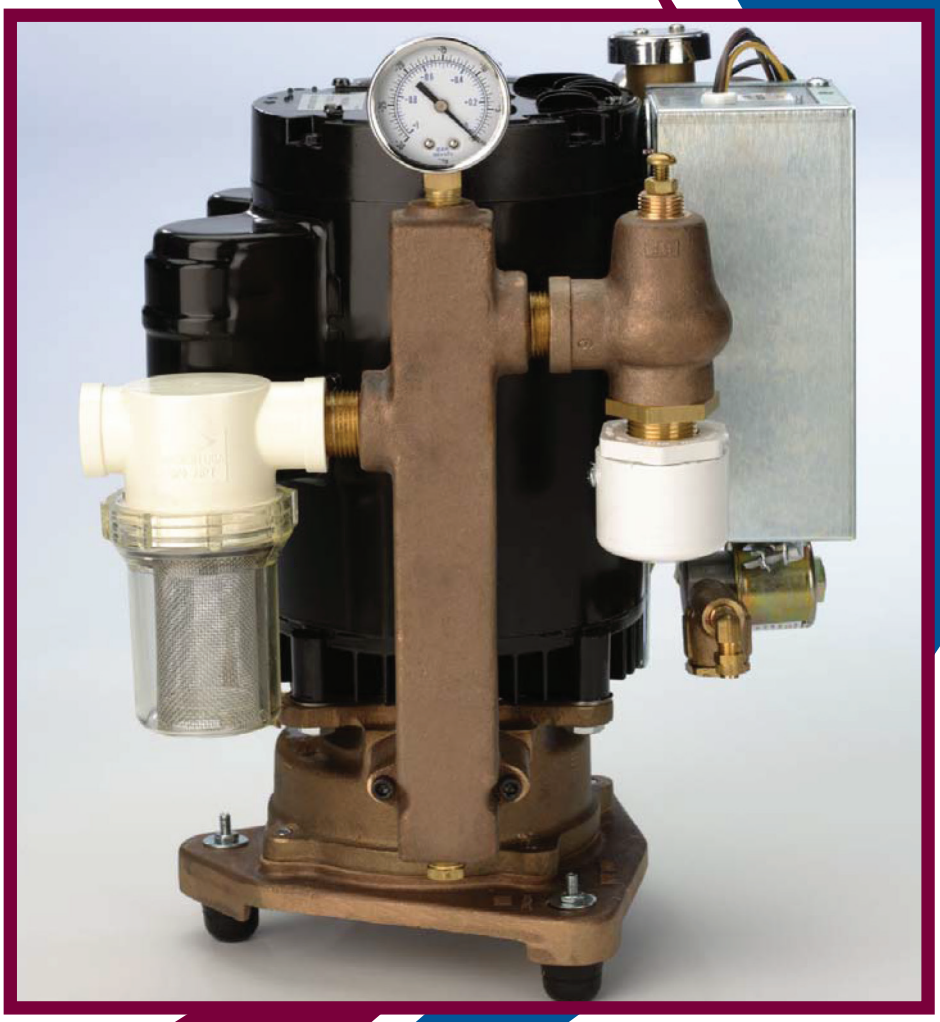
CustomAir

Single Wet Vacuum Pump

CV-101 FS (1HP) & CV-102 FS (2HP)



Installation, Operation & Care Manual

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CustomAir

This manual contains installation, operation, care and repair instructions and user service information for the CustomAir® Single Wet Vacuum Pump (CV-101 FS/CV-102 FS).

The Single Wet Vacuum Pump is designed to provide trouble-free service when installed, operated and cared for according to the procedures set forth in this manual.

⚠ WARNING

Do not modify this equipment. Modification will void the warranty and could result in serious injury.

Specifications

	CV-101 FS	CV-102 FS
Motor		
Power Rating:	1 HP	2 HP
Voltage:	115/208/230	
208/230		
Amps (each motor)**:**	15/7.5/7.5	15/15
Cycle:	60 Hz.	
Phase:	Single	
Running Speed:	3450 RPM	
Ambient Temperature Range:	10-40°C/50-104°F	
Wire Size:	12 GA.	
Vacuum		
Mercury Pull (Sealed Sys.)**:**	Approx. 20-25" Hg.	
Adjust.		
Usable CFM:	15	30
Use factor (Number of high-volume hoses open simultaneously)**:**	1.5	3
Gauge Accuracy: (+/- 3/2/3%)	ASME/ANSI B40.1 Grade B	
Water Requirements		
Gallons Per Minute:	1/2	1
Dimensions		
Height:	16"	20"
Width:	12"	14"
Depth:	9”	11”

Shipping Weight: 68 lbs. 78 lbs.

Approvals:

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. They are manufactured in a FDA Registered ISO 13485:2003 certified facility.

Classification

- Type of protection against electric shock: Class 1 Equipment
- Degree of protection against the ingress of water: Ordinary
- Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.
- Mode of operation: Continuous
- **Recommended Temperature ranges:**
  - Operating Temperature range within 10- 40° C/ 50-104° F
  - Operating Relative Humidity Range: 0-95%. No condensing moisture.
  - Operating Atmospheric pressure range: 63-105 kPa
  - Transport/storage temperature range within -40°C to 70°C/-40° to 158°F
  - Relative humidity range for transportation and storage within 10% to 100%
  - Atmospheric pressure range for transportation and storage within 50 - 105 kPa

Explanation of Symbols used on Equipment:

 = Attention, Consult Accompanying Documents

 = Protective Earth Terminal

 = Caution. Electrical Shock Hazard. Refer Servicing to Qualified Personnel

 = Hot Surface

CE = European Certification

The authorized European representative is:
DentalEZ (GB) Ltd., Cleveland Way
Hemel Hempstead, Hertfordshire, HP2 7DY, UK

The Wet Vacuum Pump labels include safety symbols with special meanings	
This means there is more information available in this User Guide.	This notifies handlers that the box must remain upright at all times.
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 this box should never be stacked.	This notifies handlers of the safe temperature range for the contents in box.
This warns handlers not to allow the box to be placed on an unlevel surface due to risk of tipping.	This notifies handlers of the safe humidity range of the contents in the box.

The following Pre-installation information will assist in making a quick, easy and quality installation. However, if there are any questions, contact a CustomAir technical service representative at **1-866-DTE-INFO**.

Site Requirements

⚠ WARNING

Not for use in an oxygen rich environment. Large concentrations may cause a fire in the vacuum unit and may cause an exhaust hazard.

⚠ WARNING

To avoid risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

⚠ WARNING

Electrician must provide a means to isolate the circuit electrically from the supply mains on all poles simultaneously.

Electrical Requirements

Volts	Model CV-101 FS*	Model CV-102 FS
115V	Wired direct by electrician as per local codes. Separate circuit with 20 amp breaker, single phase.	Cannot be connected to 115V line.
208/230V	Wired direct by electrician as per local codes. Separate circuit with 20 amp breaker, single phase.	Wired direct by electrician. Separate circuit with 20 amp breaker, single phase.

Before the Single Wet Vacuum Pump can be properly installed, the following utilities must be supplied:

Electrical

All electrical supply lines and control wiring should be supplied and installed by a licensed electrician according to local building codes.

*Model CV-101 FS is manufactured and shipped for 115V operation. This model may be converted to 230V operation by qualified installation technicians only following connection diagrams inside the pump control box.

Water

Water line must be installed by a plumber according to local building codes. Requirements: 1/2" gate valve reduced to 1/8" FIP.

Waste

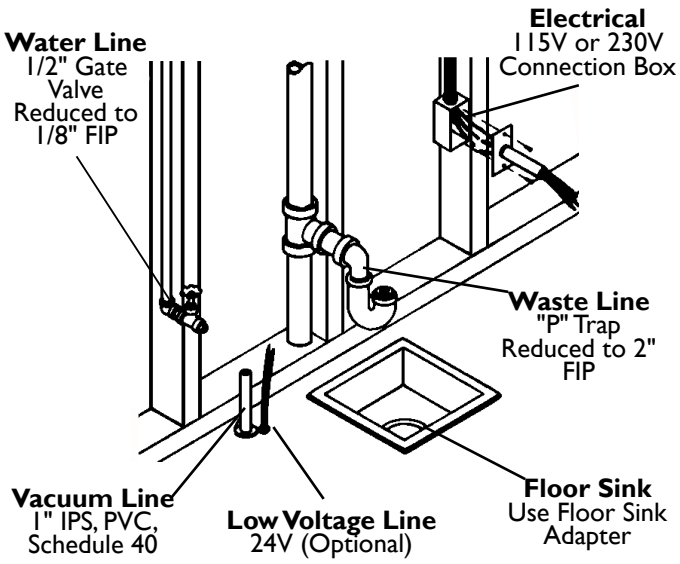
Waste line must be installed by a plumber according to local building and health codes. Requirements: reduce connection to 1" FIP or floor sink. When using floor sink, order a floor sink adapter.

Vacuum Lines

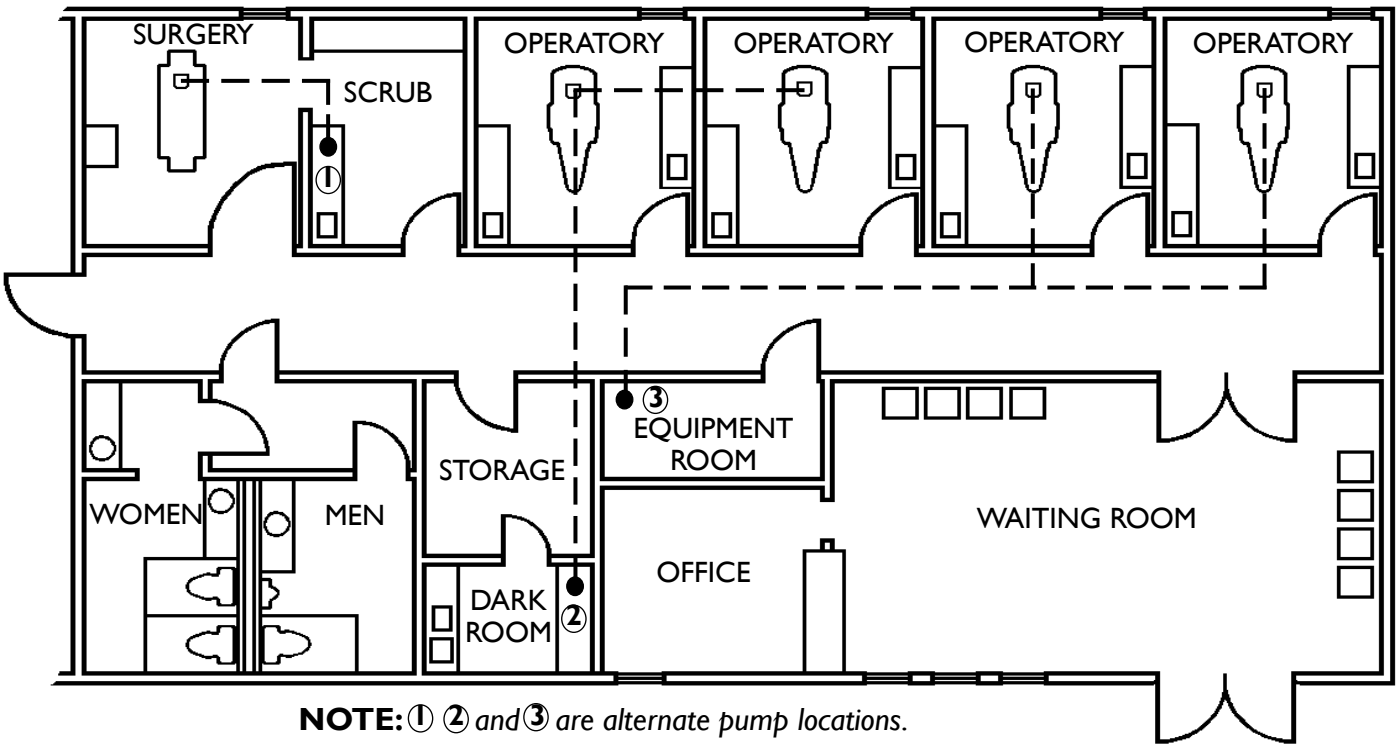
Vacuum lines must be installed by a plumber according to local building and electrical codes. Requirements: 1" IPS, PVC, Schedule 40.

Low Voltage Control Line (Optional)

If remote low voltage is desired, a licensed electrician should install 18-2 thermostat wire from the pump location to the operatory switches. (Use 18-3 thermostat wire for lighted switch.)

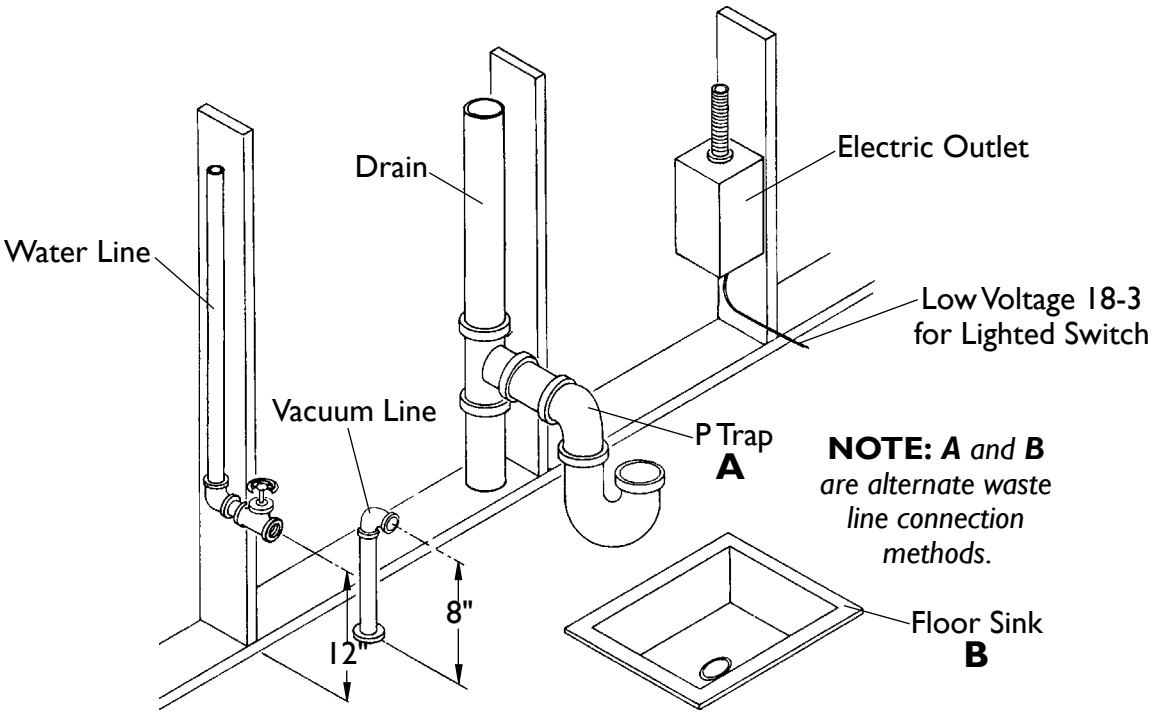


Suggested Pump Sites



NOTE: ① ② *and* ③ *are alternate pump locations.*

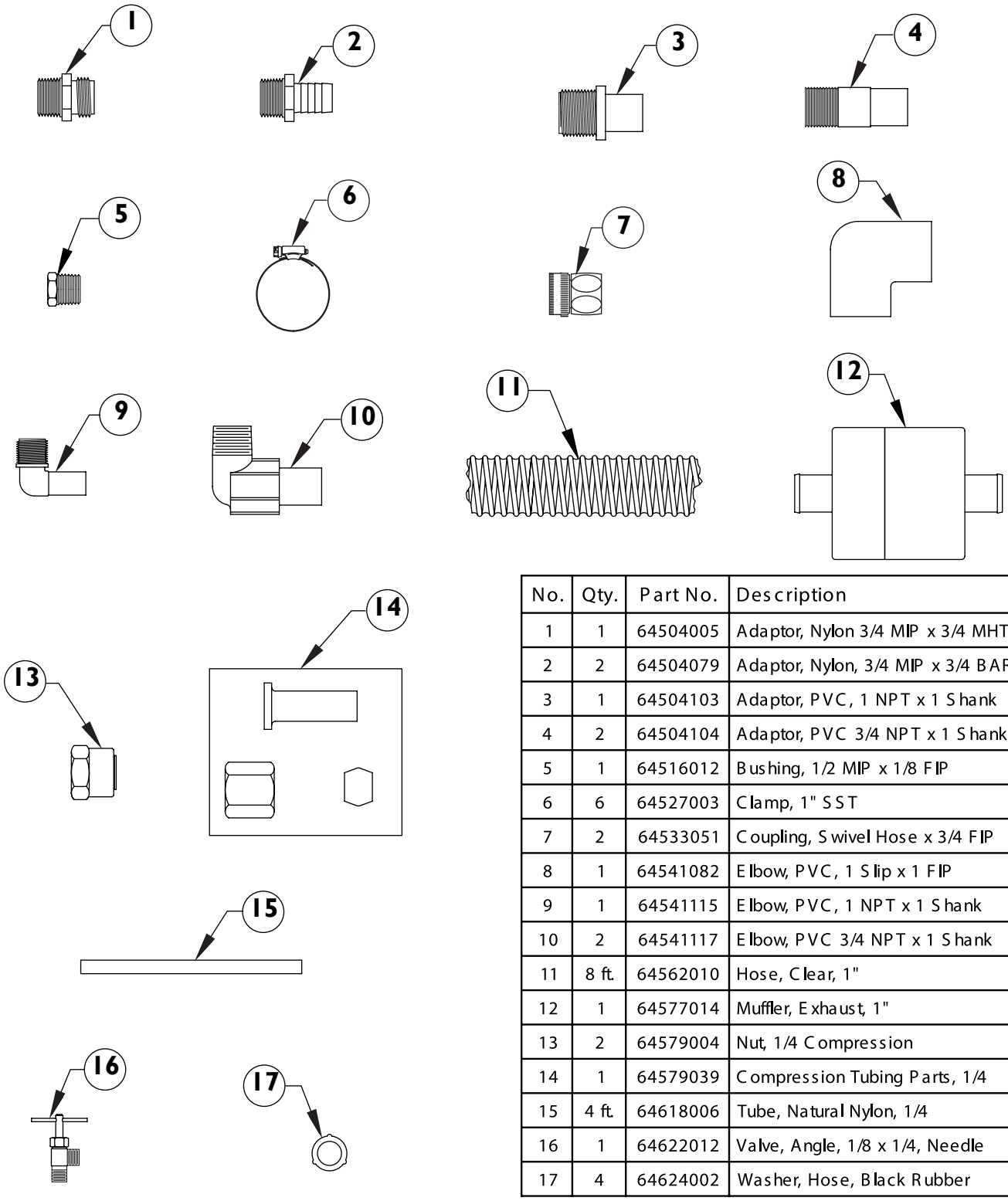
Typical Utility Locations and Measurements



Locations & measurements are approximate.

Installation Kit

Each vacuum pump is supplied with an installation kit *(PN: 64568036)*.



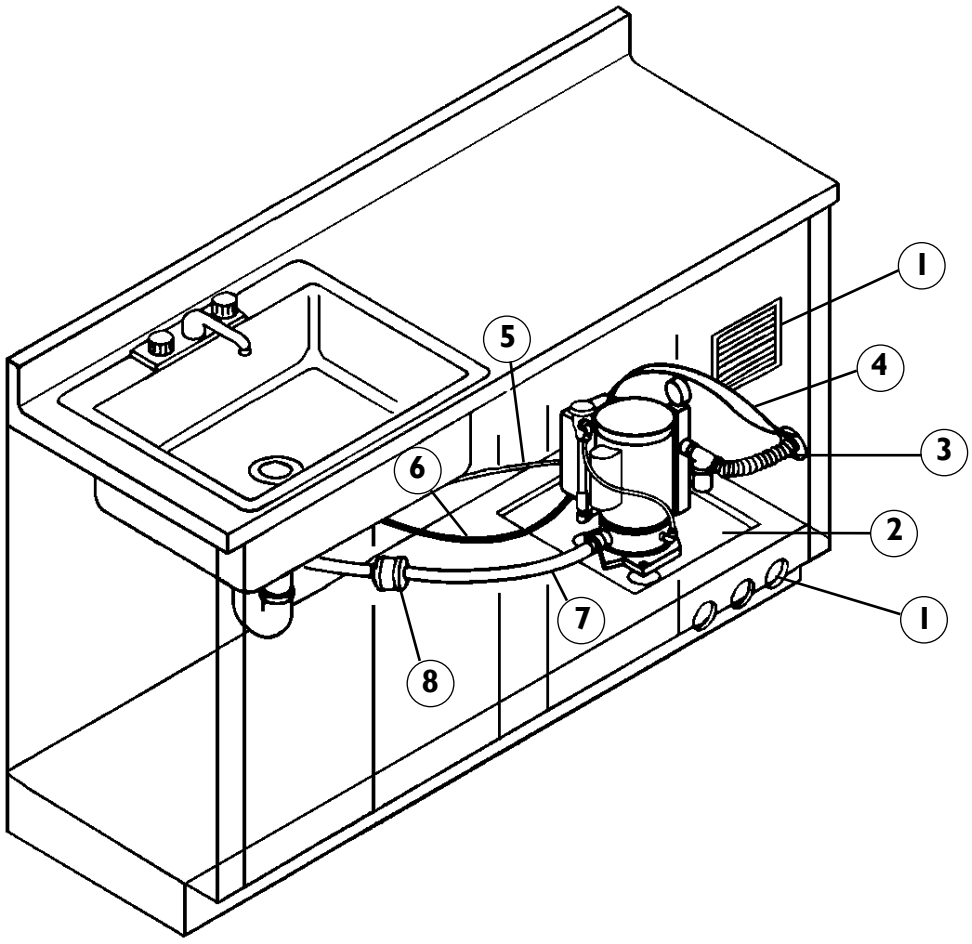
No.	Qty.	Part No.	Description
1	1	64504005	Adaptor, Nylon 3/4 MIP x 3/4 MHT
2	2	64504079	Adaptor, Nylon, 3/4 MIP x 3/4 BARB
3	1	64504103	Adaptor, PVC, 1 NPT x 1 Shank
4	2	64504104	Adaptor, PVC 3/4 NPT x 1 Shank
5	1	64516012	Bushing, 1/2 MIP x 1/8 FIP
6	6	64527003	Clamp, 1" SST
7	2	64533051	Coupling, Swivel Hose x 3/4 FIP
8	1	64541082	Elbow, PVC, 1 Slip x 1 FIP
9	1	64541115	Elbow, PVC, 1 NPT x 1 Shank
10	2	64541117	Elbow, PVC 3/4 NPT x 1 Shank
11	8 ft.	64562010	Hose, Clear, 1"
12	1	64577014	Muffler, Exhaust, 1"
13	2	64579004	Nut, 1/4 Compression
14	1	64579039	Compression Tubing Parts, 1/4
15	4 ft.	64618006	Tube, Natural Nylon, 1/4
16	1	64622012	Valve, Angle, 1/8 x 1/4, Needle
17	4	64624002	Washer, Hose, Black Rubber

Cabinet Installation

If a mechanical area is not available, the vacuum pump can be installed in a darkroom or laboratory, usually in the sink cabinet. In this type of installation, it is important to make sure the pump motor is properly ventilated. In most cases, venting in the door and toe board of the cabinet will supply enough cooling air to the motor. It is also necessary to cut a hole in the cabinet's flooring to allow the rubber pump pads to stand directly on the building's flooring. **Do not bolt the pump to the floor**. Quiet and vibration-free operation is assured when the pump is installed free-standing on the supplied rubber insulators.

Cabinet Illustration

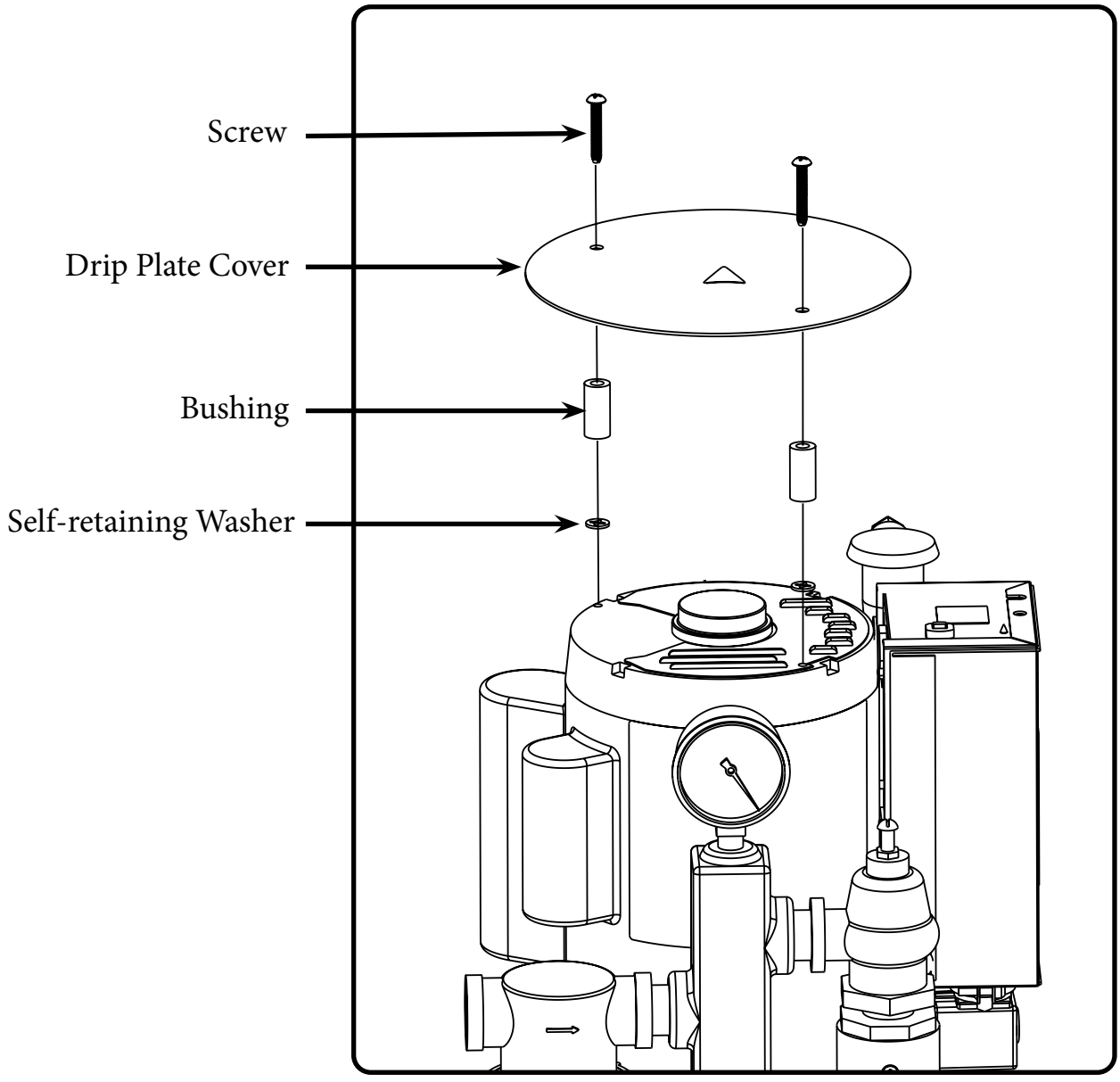
No.	Description
1	Air vents for proper motor ventilation. Upper and lower openings promote circulation.
2	Cut an opening in the cabinet floor to allow pump to rest directly on the building's flooring.
3	Intake hose to vacuum line
4	Low-voltage wire to operatory control switch (24V)
5	1/4" nylon water line
6	Power cord or direct wiring
7	Waste hose to "P" trap or floor sink
8	Waste muffler



Drip Plate Installation

Instructions

1. Locate two holes on top of the pump motor.
2. Place parts in order as shown below, insert screws and tighten.

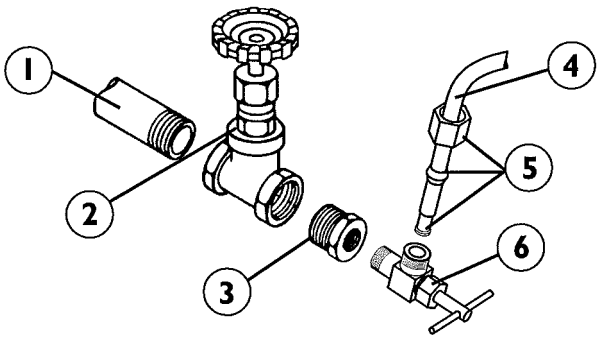


Water Supply Line

The water going to the unit acts as a pump sealant and cooling agent. When the vacuum pump is in operation, the water supply must be on at all times. There are two methods of installation:

1/8" MIP Angle Valve Installation

The plumber supplies the water line and installs a 1/2" brass gate valve on the water supply line. Connect the 1/4" nylon tubing and slide the nut and brass ferrule over the tubing. Push the tubing in the valve as far as possible. Make sure the tapered end of the ferrule is facing the end of the tubing and tighten the nut.

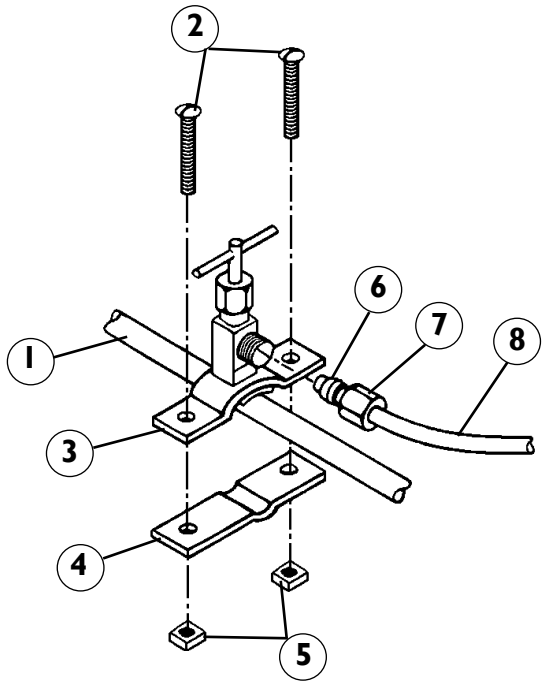


Angle Valve Installation			
No.	Qty.	Part No.	Description
1	1	*	Water Line
2	1	*	Valve, Gate, Brass, 1/2"
3	1	64516012	Bushing, Brass, 1/2" MIP x 1/8" FIP
4	4 ft.	64618006	Tube, Nylon, 1/4"
5	1	64579039	Compressions Tubing Parts, 1/4"
6	1	64622012	Valve, Angle, 1/8" x 1/4", needle

* Plumber Supplies

Saddle Valve Installation

A saddle valve may be tapped into an existing cold water line. Follow the instructions on the saddle valve package.



Saddle Valve Installation			
No.	Qty.	Part No.	Description
1	1	*	Water Line
2-7	1	*	Saddle Valve, 1/4", Complete Kit
8	4 ft.	64618006	Tube, Nylon, 1/4"

* Plumber Supplies

Vacuum Line

NOTICE

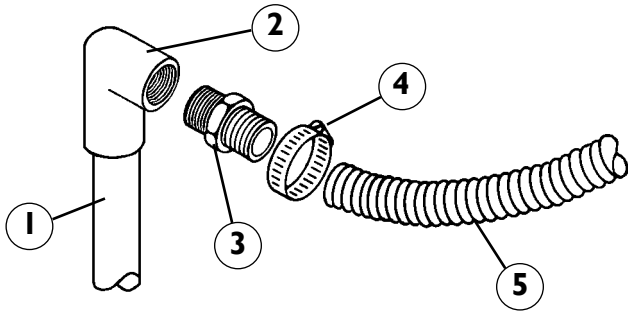
All vacuum systems must be installed according to local building and electrical codes.

Vacuum lines must be installed by a local plumber according to local building codes. All vacuum lines and risers are recommended to be IPS, PVC, SCH. 40. Type "M" copper should be used if local code does not allow the use of PVC.

Care should be taken to slope the lines 1" for every 20' of run toward the vacuum pump(s). This allows waste and liquids to flow with gravity, contributing to the efficiency of the vacuum system.

Make all connections using long radius sweep fittings. To promote unrestricted flow of air and waste liquids through the vacuum lines, directional flow connections should be used.

Using 45° elbows for turns or avoiding obstructions is best; however, do not make a trap in the line, doing so will decrease the efficiency of the system.



All elbows and tees should be sized for the main line and sized down with bushing reducers to accommodate smaller lines.

Avoid sagging lines, which cause the formation of traps in the system and prevent good air and waste liquid flow.

Connect the evacuation system to the vacuum line using the hose and fittings supplied in the installation kit.

No.	Qty.	Part No.	Description
1		*	Vacuum Line, IPS, PVC, SCH. 40
2	1	64541115	Elbow, 1" x 1"
3	1	64504103	Adapter, PVC, 1" x 1"
4	1	64527003	Clamp, Stainless Steel, 1"
5	4 ft.	64562010	Hose, Intake, 1"

* Supplied by Plumber

Waste Line

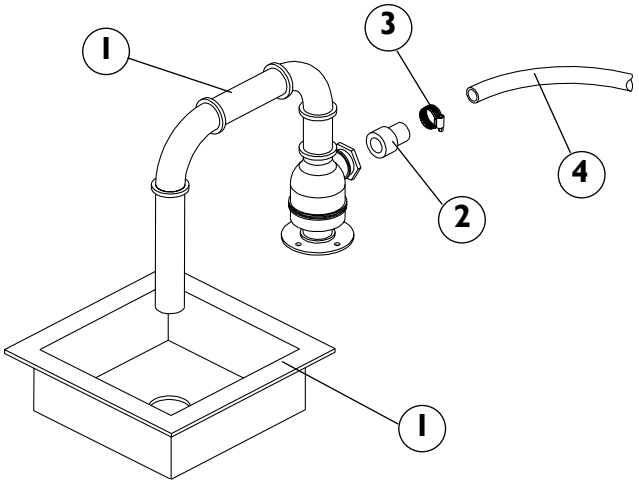
The waste line carries water from the pumps and liquid waste from the operatory to the building's sewer system.

The waste line should follow the most direct path to the sewer connection with a minimum of bends and elevations, and must be installed according to local building and plumbing codes.

The exhaust connection should be made by either of two methods, floor sink connection or direct connection to "P" trap, depending on local code and building facilities.

Floor Sink Connection

Use floor sink adapter SA-100. Install as illustrated.



No.	Qty.	Part No.	Description
1*	1	**	Adapter, PVC, Floor Sink, 1"
2*	1	64504102	Adapter, PVC, 1" MIP. x 1-1/2" shank
3	1	64527003	Clamp, Stainless Steel, 1"
4	3 ft.	64562010	Hose, Exhaust, 1"
5	1	Plumber Supplies	Floor Sink

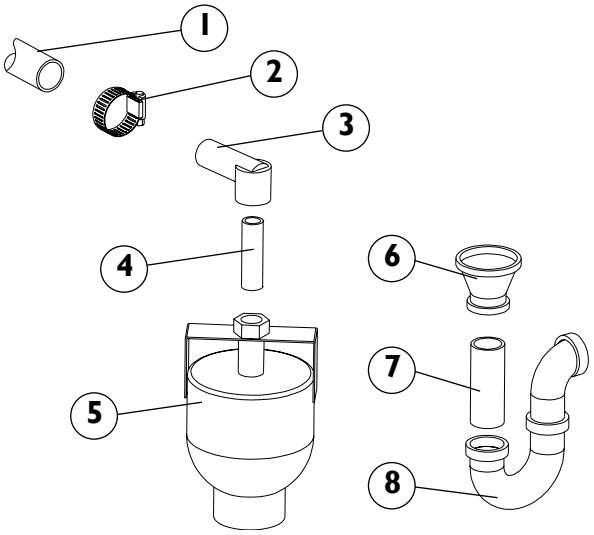
* Floor Sink Adapter Parts
* Supplied by Plumber

NOTICE

IMPORTANT: No part of the waste line should be more than three (3) feet above the level of the waste connection on the vacuum pump.

Direct Connection to "P" Trap

Use "P" trap-air gap, if required by local code. Install as illustrated.



No.	Qty.	Part No.	Description
1	1	64562010	Hose, Exhaust, 1"
2	1	64527003	Clamp, Stainless Steel, 1"
3	1	*	Elbow, Brass, 1" x/Nut
4	1	*	Bushing, PVC, 1" MIP x 1" FIP
5	1	*	Adapter, Air Gap, 2"
6	1	*	Reducer, Bell, 2" x 1-1/2", Galv.
7	1	*	Nipple, 1-1/2" x Close, Galv.
8	1	*	Trap, "P", 1-1/2"

* Supplied by Plumber

Water Recirculator (Optional)

⚠ WARNING

Before doing any work, turn OFF the main power.

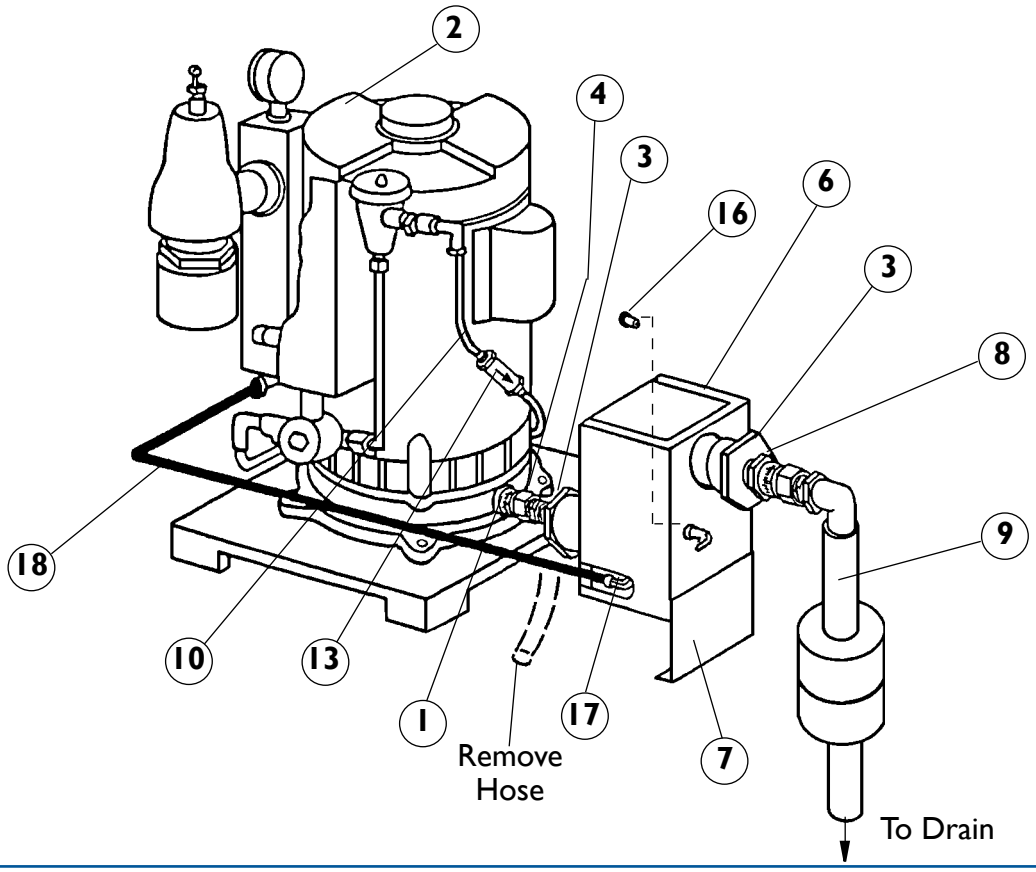
NOTE: *For convenience, refer to the itemized illustration below during installation.*

Mounting

1. Disconnect the vacuum pump exhaust hose **(9)** from the hose connector **(1)** on the pump **(2)**.
2. Install the reducing bushing **(3)** in the lower inlet opening of the recirculator assembly **(6)**.
3. Install the swivel connection adapter **(4)** in the reducing bushing **(3)** installed in the previous step.
4. Attach the swivel connection adapter **(4)** to the hose connector **(1)** on the pump and align the recirculator assembly **(6)** so that it is vertically in line with the vacuum pump **(2)**. Then securely tighten the swivel connection adapter **(4)**.
5. Align the support bracket **(7)** with the recirculator enclosure **(6)** until the foot pads on the support bracket contact the supporting surface below. Then secure using two #10 x 1/2 sheet metal screws and two #10 lock washers.

Pump Exhaust

1. Install a reducing bushing **(3)** in the upper exhaust opening of the recirculator assembly **(6)**.
2. Install a brass 3/4 MIP x G.H.T. **(8)** hose connection adapter in the reducing bushing **(3)** installed in the previous step.
3. Reconnect the existing 1" exhaust hose **(9)** and muffler to the hose connection adapter installed in the previous step.



Water Supply

NOTE: *For convenience, refer to the illustrations on this page for water supply installation.*

1. Assemble two poly tube connection adapters **(14)** to the correct rate flow restrictor valve **(13)** as follows: (View **C**)

- For a 1 H.P. pump, use a .12 G.P.M. valve.
- For a 2 H.P. pump, use a .25 G.P.M. valve.

2. Cut the 1/4" poly tubing **(10)** at its midpoint and slip a brass nut and brass sleeve over each cut end of the poly tubing. (View **C**)

3. With the flow direction arrow on the flow restrictor valve **(13)** pointing down toward the pump base, secure the cut ends of the 1/4" poly tubing **(10)** to the connection adapters on the flow restrictor valve.

4. Reconnect the remaining end of the 1/4" poly tubing **(10)** to the elbow **(11)**. (View **B**)

5. Remove the pipe plug from the manifold **(5)** and replace with poly tubing connection elbow **(15)**. (View **A**)

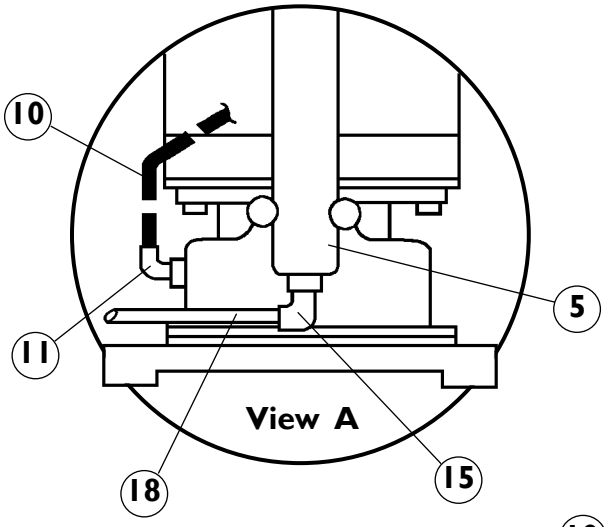
6. Connect the recirculator outlet **(17)** to the manifold elbow **(15)** using 1/4" poly tubing **(18)**. (View **A**)

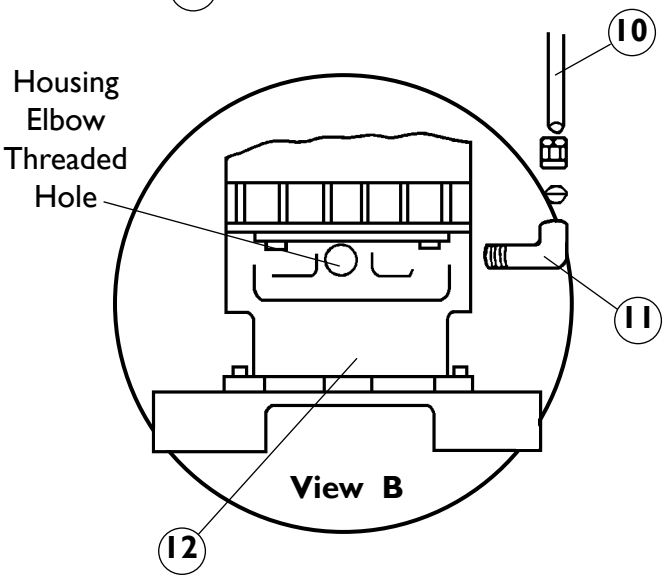
7. Fully insert the plug **(16)** into the unused recirculator outlet **(17)** on the opposite side of the recirculator assembly **(5)**.

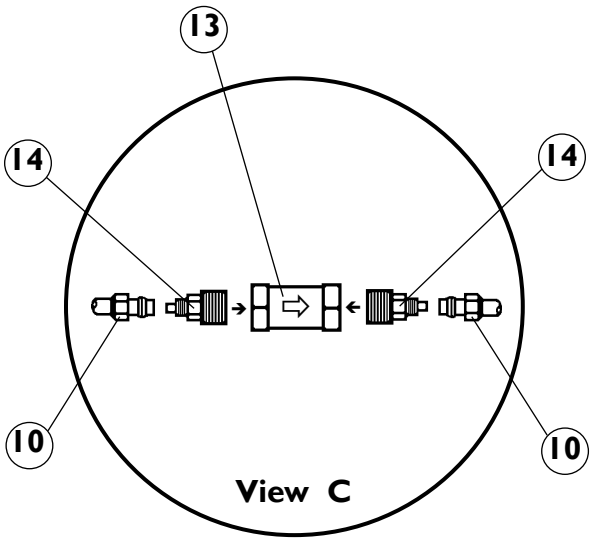
Operation Check

1. After installation is complete, operate the system and check all connections for leaks.

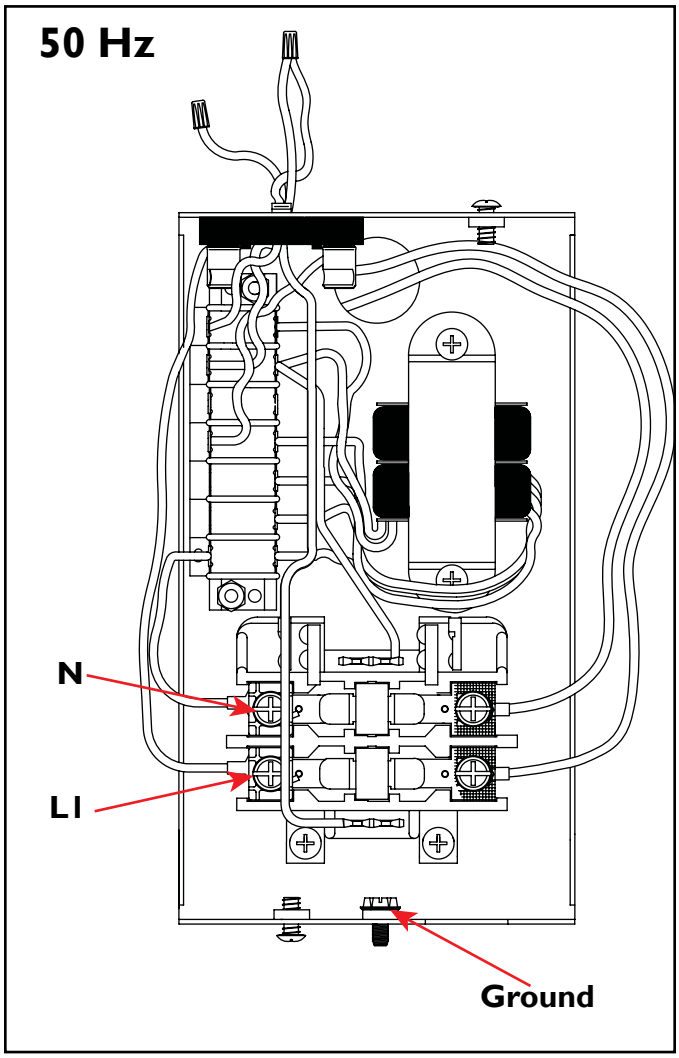
2. Correct leaks as required.

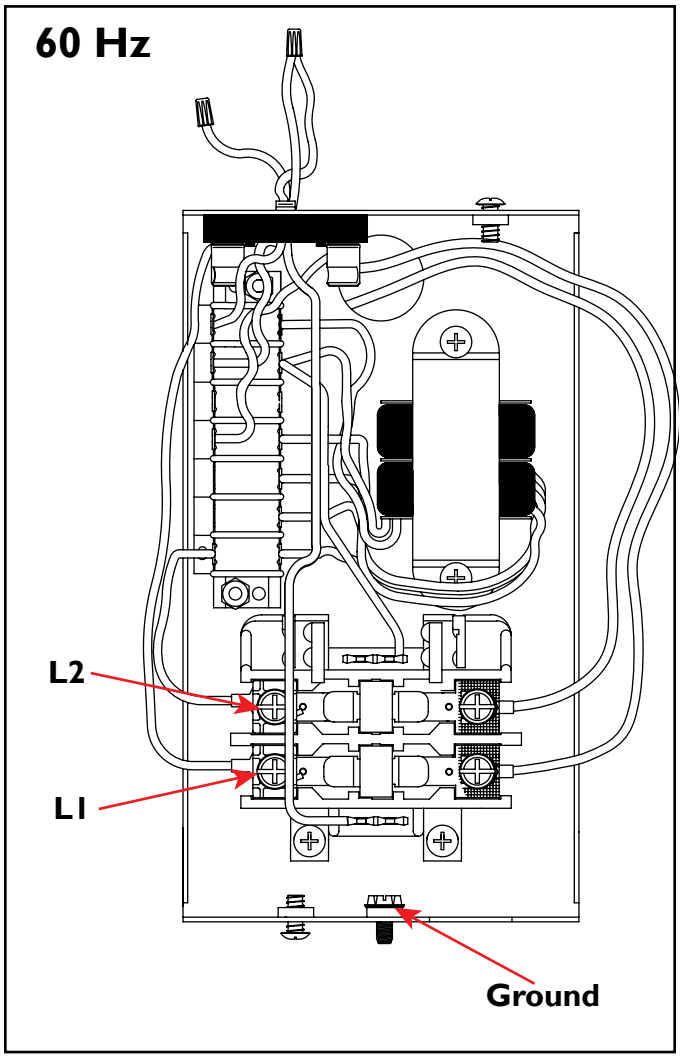






Electrical Connection





Complete the electrical hook-up per the electrical code to L1/L2 and ground as shown for the 60 Hz models. For 50 Hz units, connect mains supply to Neutral, L1 and Ground as shown.

General Operation

CustomAir® vacuum pumps are designed to provide a vacuum source for use by dental professionals in the dental operatory. The main purpose of the vacuum is to evacuate the oral cavity.

The Single Wet Vacuum Pumps can be operated from the operatory using an optional low-voltage conversion kit and low-voltage switches making a convenient way to turn the pumps on or off as needed, plus saving water and electricity.

In some installations, where two or more doctors are using the vacuum system, it may be necessary to leave the evacuator on throughout the working day. The pumps are designed to handle heavy work loads and are rated for continuous operation. If the evacuator operates for extended periods of time, proper ventilation is important.

Installations in small, confined areas should be supplied with a ventilation system capable of keeping the air temperature around the pump at 40ºC/104ºF or less.

Maintenance Schedule

⚠ WARNING

Prior to performing any maintenance, proper precautions should be taken to reduce the possibility of contact with infectious substances.

A minimum amount of maintenance is required to keep the Single Wet Vacuum Pump in top running condition. The motor and pump assemblies require no lubrication. For best performance results, adhere to the following maintenance schedule:

Daily Maintenance

Flush Vacuum Plumbing System

Before the system is turned off at the end of the day, it is recommended that the hoses in the operatory be flushed with fresh water and vacuum system cleaner.

NOTE: *SlugBuster™ cleaner is recommended for the Single Wet Vacuum Pump.*

⚠ CAUTION

Use of detergent-based or foaming-type solutions will greatly restrict vacuum performance and void the warranty.

When used daily as directed, SlugBuster will keep the system sanitary and fresh smelling. SlugBuster dissolves organic materials, such as blood and tissue, before they clog the vacuum lines. Its unique enzyme formula neutralizes odors within the evacuator system. SlugBuster is also ideal for cleaning organic material from surgical instruments prior to autoclave or cold sterilization.

NOTICE

SlugBuster is available in powder and liquid forms, which can be ordered through any authorized DentalEZ dealer.

SlugBuster user directions:

Add one (1) ounce SlugBuster to one (1) quart of water. Stir until completely dissolved. *One quart of solution is enough to clean four (4) hoses.*

Evacuate approximately one (1) quart of SlugBuster solution through all hoses in each operatory.

Turn Off Water Supply

NOTICE

IMPORTANT: At the end of each working day, turn off the water supply to the unit by closing the gate valve on the water supply line. Or, if an optional remote control panel is installed, push the water button to the OFF position. Then close the gate valve on the water supply line.

NOTE: *Although, the water supply to the vacuum system is normally turned off electrically when the system is turned off, it is possible that a solenoid valve may malfunction allowing water to flow through the valves and into the vacuum system.*

⚠ WARNING

Before starting cleaning procedures, make certain to put on eye protection, a mask and puncture-resistant nitrile gloves.

Shutdown Procedure

To terminate operation of the water ring pump press the designated switch on the low voltage panel. For maintenance or any physical interaction with the water ring pump or associated circuitry disable the unit using the local disconnect or wall panel breaker for electrical isolation. Utilization of a lock-out/tag-out procedure is recommended for safety.

Weekly Maintenance

Clean In-Line Filter

Turn **OFF** the pump motors.

Carefully unscrew the lower bowl from the filter top and lift out the screen.

Using water, flush the bowl assembly and any contaminated sediment.

Submerge the screen/bowl assembly into a high-level chemical disinfectant solution. *Follow the disinfectant manufacturer's recommendation for time interval required to achieve disinfection.*

Remove the screen/bowl assembly from the disinfectant solution and rinse using tap water.

Properly dispose of the contaminated sediment and disinfectant solution waste.

Replace the screen and make sure the gasket is in place before replacing the bowl.

Check all connecting vacuum, waste and water lines for tightness.

Inspect Operatory Filters

Check and clean all operatory and secondary filters weekly. *Follow the equipment manufacturer's recommendations.*

Inspect Vacuum System

Check the system weekly for water leaks and loose or broken connections.

Monthly Maintenance

Check Vacuum Level

The vacuum level of the CustomAir Single Wet Vacuum Pump is preset at the factory.

Recommended Operating Vacuum Levels:
10" Hg. General Dentistry
19" Hg. Surgery

The pressure gauge will indicate the vacuum level provided by the pump. If it becomes necessary to adjust this setting, the following steps can be taken:

NOTE: *The evacuator should be left **ON** when setting the vacuum level. Also, make sure all hoses in the operatory are closed.*

Turn the lock nut counterclockwise to loosen.

For greater vacuum level, turn the screw clockwise; for less vacuum level, turn screw counterclockwise.

Set to desired vacuum level and tighten locknut.

Cleaning Instructions

1. Always disconnect the power from the equipment prior to cleaning.
2. Some parts/components on the pump 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.

⚠ CAUTION

A free-flowing discharge system is required for proper operation of the vacuum system. The pump systems may leak at the anti-siphon valve if the discharge system is restricted. Ensure the vacuum system is installed and cleaned in accordance to the instructions in this manual.

Water Recirculator Cleaner Instruction

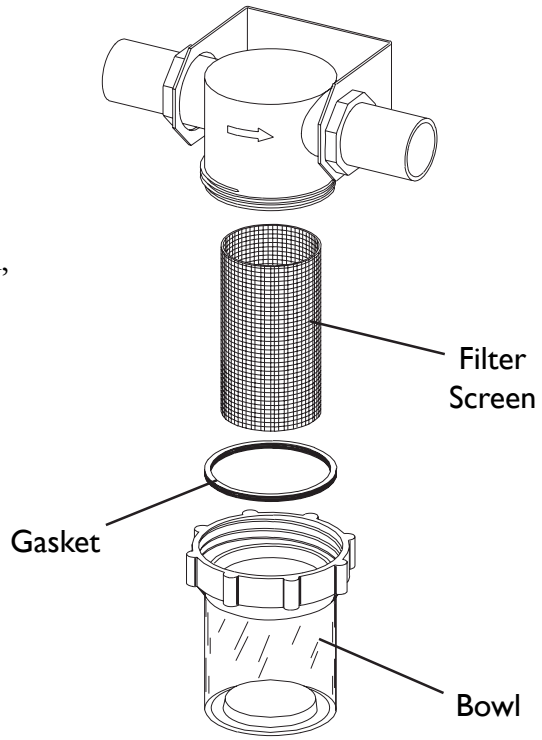
NOTICE

Failure to use the water recirculator cleaner as directed (sample included with recirculator) will **VOID** the manufacturers warranty!

(Reorder PN: 64568129)

NOTE: *This procedure should be performed once or twice a month depending on work load.*

1. Turn the vacuum pump off.
2. Remove the lower bowl of the filter at the pump location.
3. Separate and clean the filter screen, gasket and bowl.
4. Re-insert the gasket and screen into the bowl. Then empty the contents of one recycler cleaner package into the bottom of the bowl, inside screen filter.
5. Carefully replace the bowl assembly back into the filter head at the pump location.
6. Turn the pump ON and operate normally.



Service Instruction

The following troubleshooting charts should be used when attempting to isolate CustomAir Single Wet Vacuum Pump operational problems.

If the problem is not addressed in the trouble shooting chart or cannot be isolated by performing the suggested procedures, contact your local DentalEZ full-service dealership.

- Model Name _____
- Model Number _____
- Serial Number _____
- Installation Date _____

Vacuum Pump

Symptom	Possible Cause(s)	Solution
Pump will not run	Check all wires for loose or broken connections. Check fuse. Check low voltage leads *(yellow and black wires)* for 24 volts.	If voltage is not present, replace the transformer or fuse. *(Also see Electrical Problems Chart.)*
	Turn power on and off watching to see if relay breaker bar operates properly.	If relay not operating properly, and assuming all other parts are good, replace the relay. *(Also see Electrical Problems Chart.)*
	Test solenoid valve by loosening brass nut on right side. If water flows out with power on, turn power off. Water flow should stop. **Caution: Do not** operate the pump for an extended time, because running the pump without water could cause internal damage.	If water flow does not stop with power off, replace the solenoid valve.
Motor stops or will not start	Circuit breaker, main cut-off and low-voltage operatory switches are in the **OFF** position.	Place switches in **ON** position.
	Unit is not plugged in.	Plug in unit.
	Loose or broken wires.	Tighten, repair or replace wires.
	Motor hums indicating a bad capacitor.	Replace capacitor.
	Tight or noisy motor.	Check bearings. Make sure pump is properly shimmed to the motor. Or, remove any debris in the pump.
	Motor is overheating.	Make sure the vacuum relief valve is adjusted properly and the motor has sufficient ventilation and water supply. Check for low line voltage.

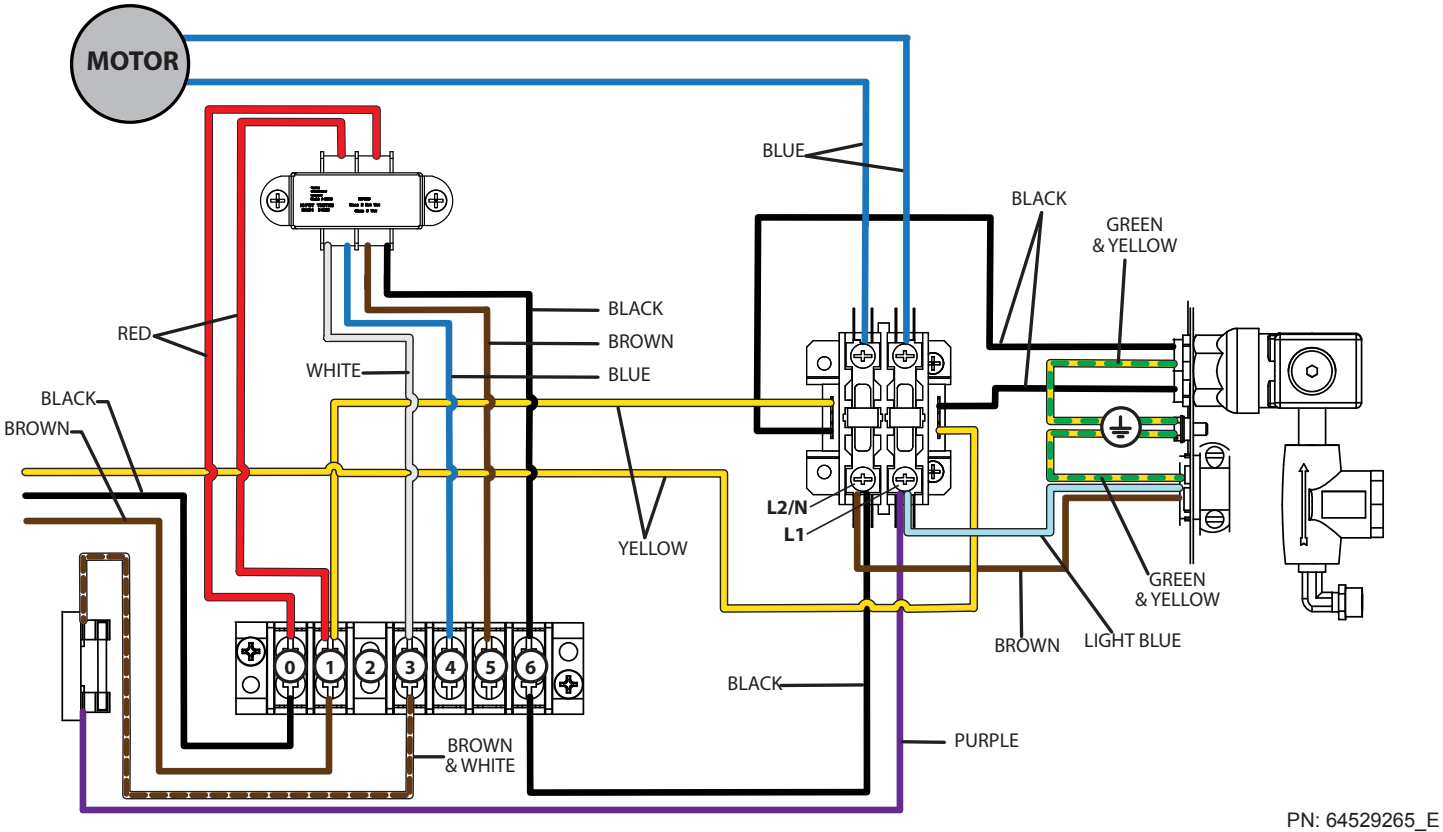
Vacuum Pump (Continued)		
Symptom	**Possible Cause(s)**	**Solution**
Low or no vacuum	Dirty filter	Clean operatory and secondary filters if necessary.
	Water control assembly clogged not allowing water to go through pump.	Turn pump **OFF** immediately to prevent internal damage. Then unclog water control assembly.
	Loose or broken vacuum line connections.	Tighten, repair or replace vacuum line connections.
	Swing check valves clogged allowing pump to suction through the other pump.	Take off the top of the valve and, if possible, remove debris. Otherwise, the valve should be replaced.
	Pump is worn out.	Refer to pump repair section.
	Insufficient water supply.	Check supply where it connects to the cabinet. Then, check the water control valve. The water control solenoid valve opens when the pump is turned on. Check this function by disconnecting the water line that enters the vacuum housing and by holding a container under the valve. Then, turn on the pump. There should be a steady stream of water. **CAUTION: DO NOT** LEAVE THE PUMP RUNNING WITHOUT WATER! If there is no water flow, replace the water control solenoid valve.

Electrical System		
Symptom	**Possible Cause(s)**	**Solution**
Pump not running because of suspect electrical problem	Main power supply has blown fuse or circuit breaker.	Replace blown fuse or reset circuit breaker.
	Power not reaching pump or incorrect voltage.	Check connection box on the side of the dual cabinet to verify power is reaching the pump and main power supply is the correct voltage.
	Blown fuse in the control box.	Replace the fuse with the same rated capacity as the one from the factory.
	Loose connections inside the control box.	Remove the control box cover and visually inspect for loose connections. *(Refer to the schematic inside the control box cover for the components and wiring scheme for that particular box.)*

Electrical System (Continued)

Symptom	Possible Cause(s)	Solution
Motor does not start by switch	Defective transformer or coil in the relay.	Using a non-conductive device, push in the tabs on the relay to determine if the motor will start. Then using electrical test equipment, verify the voltage coming out of the secondary side of the transformer. If it is less than 21V, replace the transformer. If it is more than 21V, replace the relay.

Relay Box



PN: 64529265_E

Fuse Replacement

115 Volt Pump

Fuse replacement: Use BUSS MDL or MDQ 3/10 A, Littlefuse 313 3/10 A Slo-blo.

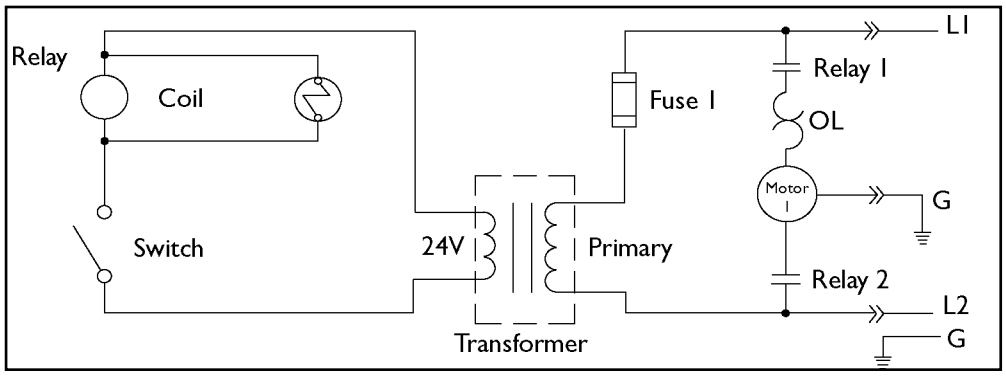
230 Volt Pump

Fuse replacement: Use BUSS MDL or MDQ 15/100 A, Littlefuse 313 15/100 A Slo-blo.

⚠ WARNING

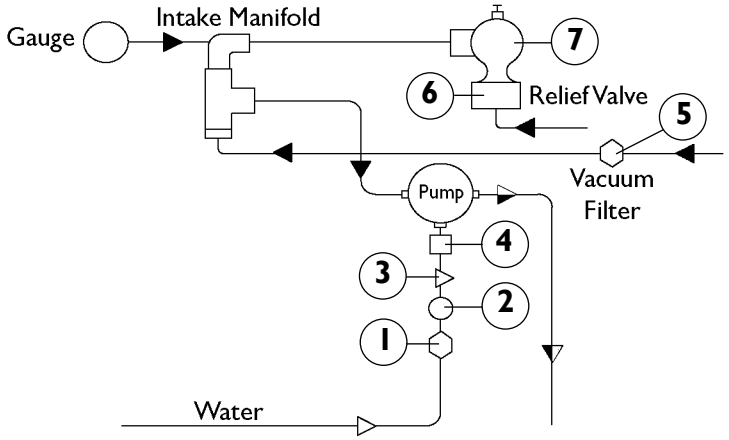
For continued protection against fire hazard: Correct fuse must be used.

Wiring Schematic



The Single Wet Vacuum electrical control system is a low-voltage (24V) circuit. This system also provides automatic control of the water supply system. The wiring schematic shows for electrical rough-in. *(Refer to the Installation section of this manual.) (See Pages 3 and 4 for further information on rough-in and final hook-up locations.)*

Air/Water Flow Circulation Diagram



The circulation diagram shows the relationship of all the major assemblies to the total system. All connecting lines are marked with a symbol to indicate their function: vacuum line, water line or waste line. The assemblies are individually broken down and further explained in other sections of this manual.

No.	Qty.	Part No.	Description
1	2	64568135	Filter, Water
2	2	64568156	Valve, Solenoid (Only)
3	2	64622011	Valve, Anti-Siphon
4A	2	64568192	Valve, Flow Regulator--1 HP
4B	2	64622010	Valve, Flow Regulator--2 HP

No.	Qty.	Part No.	Description
5	1	64545040	Filter, Vacuum
6	1	64568159	Muffler, Vacuum Relief
7	1	64622001	Valve, Vacuum Relief

Vacuum Pump System Repair Procedure

If the motor does not start after checking through the troubleshooting charts, the motor may be defective. If the pump must be removed for factory repair or replacement, perform the following vacuum pump system repair procedure:

Tools Required:

- Wire Stripper/Crimper
- 1/4", 5/16", 11/32" and 3/8" Nut Driver
- 7/16", 1/2", 9/16" and 15/16" Open-end Wrench
- 1-3/4" Socket and Torque Wrench
- 15/16" Socket with Ratchet
- Hammer
- Flat-blade Screwdriver
- Wire Cutter
- Needle-nose Pliers
- Channel-lock Pliers
- Paint Scraper
- Pump Motor Holding Fixture: DTE# 64546001
- Pop Riveter
- Bench Vise
- Bearing Seal Lubricant
- Red Loctite/Pipe Sealant: Item# 57141

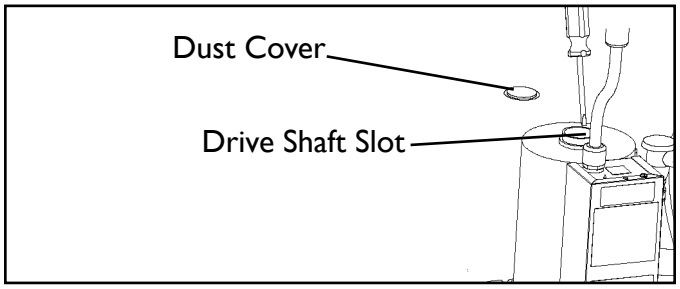
⚠ WARNING

Do not attempt these repairs in the dental office.

Test Procedure — Diagnostic

Determine if the required repair procedure is electrical or mechanical.

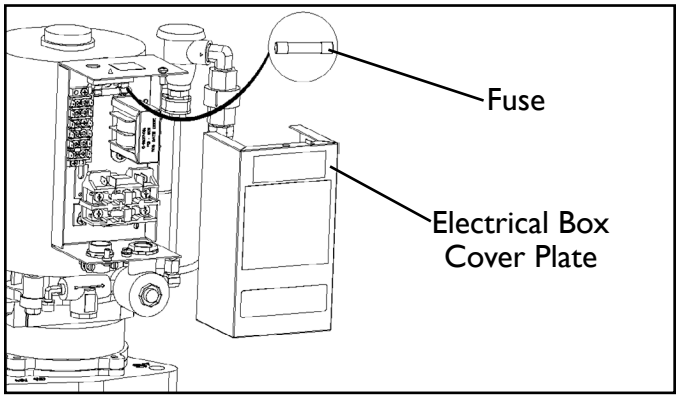
1. Unplug the electrical supply cord.
2. Using the manual valve, turn **OFF** the water supply.
3. Remove the dust cover located at the top center of the motor.



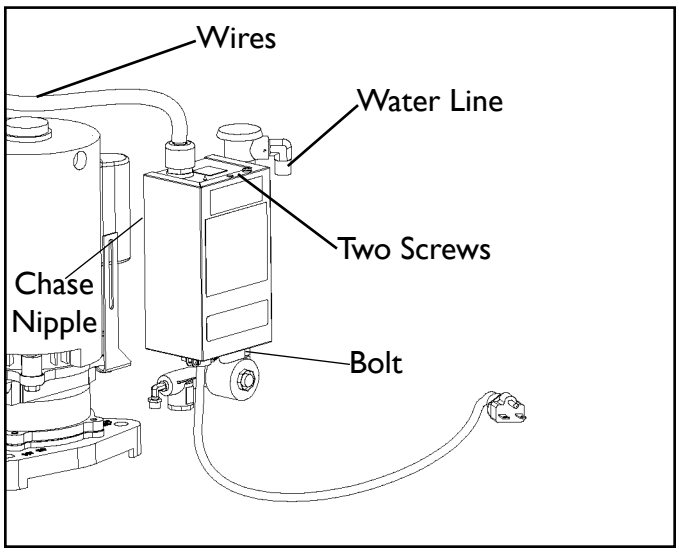
4. Using a flat-blade screwdriver, engage the slot in the drive shaft and rotate the shaft to check for free movement:
   - If the shaft moves smoothly, proceed to **Electrical Box Removal**.
   - If the shaft is difficult to turn or is jammed, proceed to **Pump Removal/Disassembly**.

Electrical Box Removal

1. Remove the electrical box cover plate.



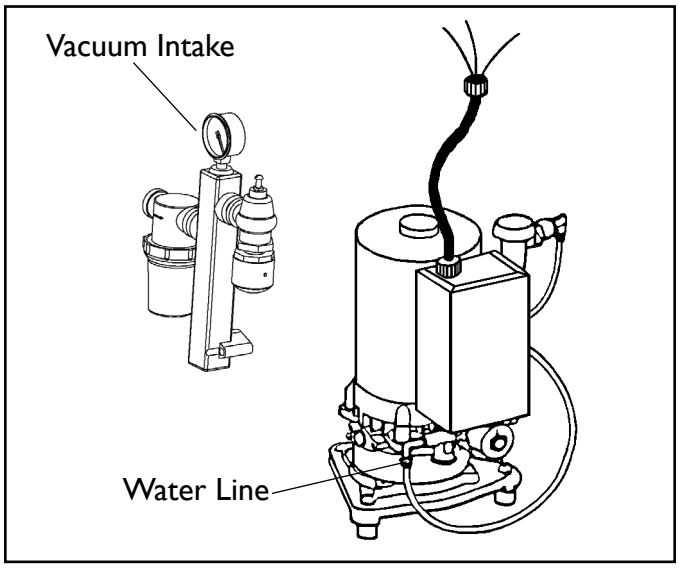
2. Check the wire leads to the motor for breaks or bad connections.
3. Check the fuse and check for loose or broken wires in the electrical box.
4. Disconnect the wires from the top of the motor and pull through the box.
5. Remove the water line from the pump housing.



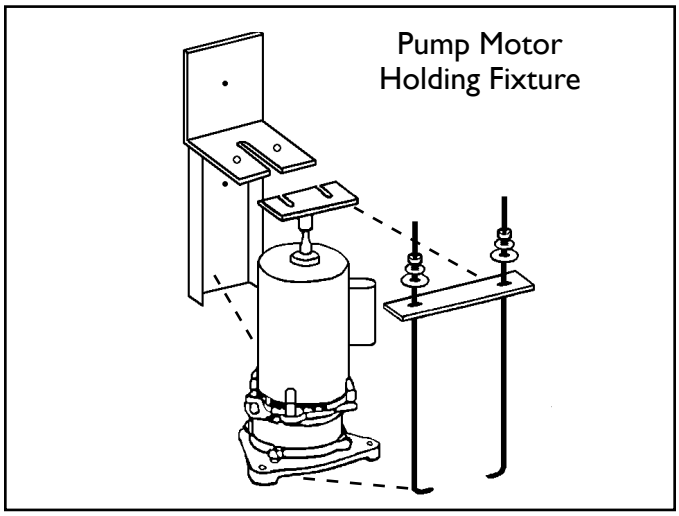
6. Remove the bolt from the bottom of the electrical box where the bracket is attached.
7. Remove the two screws and nuts from the terminal board located at the top of the electrical box *(old style)*.
8. Remove the chase nipple from inside the box where it screws to the motor.

Pump Removal/Disassembly

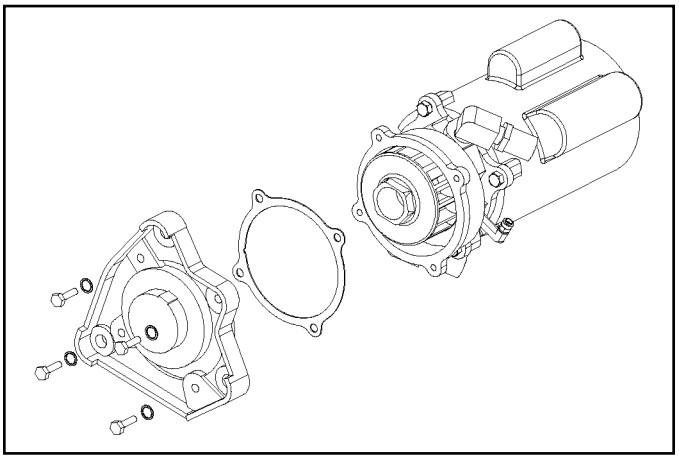
1. Remove the motor cover plate *(top of motor)*.
2. Shut **OFF** the valve supplying water to the pump.
3. Disconnect the vacuum and exhaust lines at the pump and install line closure plugs.
4. Disconnect the two motor wire leads from the electrical terminal.
5. Disconnect the waste and input lines from the pump and cap off the lines using the closure plugs provided.



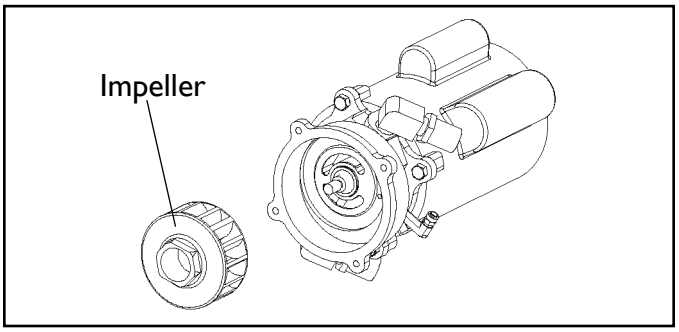
6. Disconnect the vacuum intake manifold.
7. Disconnect the water line at the pump.
8. Disconnect the low voltage wires from the remote switch circuit.
9. Mount the motor in the pump motor holding fixture by aligning the slot in the motor's shaft to the holding blade. Then connect the hold down brackets and tighten so the motor will not rotate in the fixture.
10. Take off the base by removing the bolts that secure it to the housing. Then inspect the base for excessive scoring or side wear.



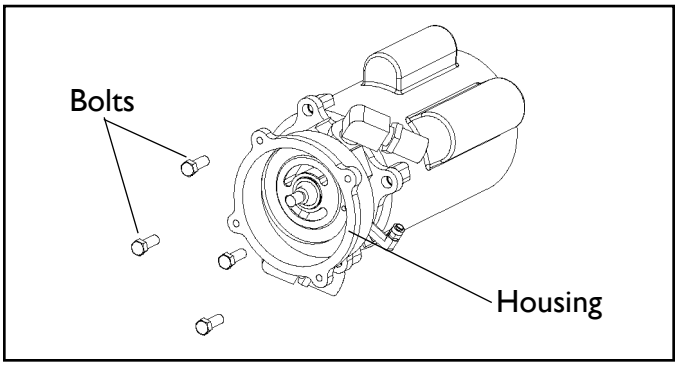
11. Remove the impeller by unscrewing counterclockwise. Then inspect the impeller for any pitting or scoring.



12. Remove the housing bolts and take off the housing by pulling it off the shaft.

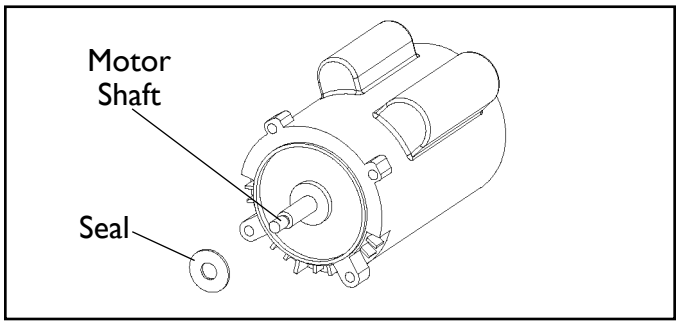


13. Remove the water seal spring assembly then inspect the housing for pitting or scoring.

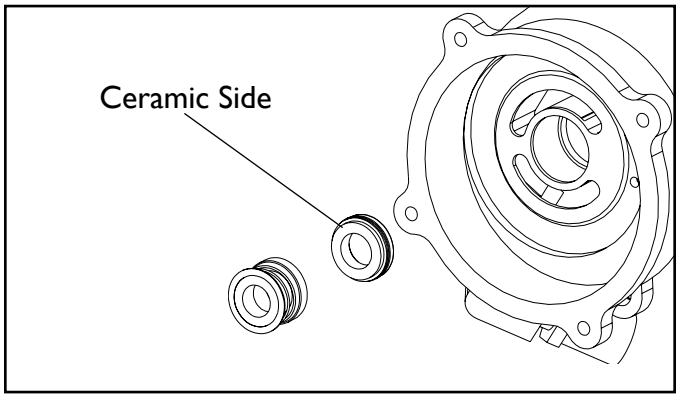


Pump to Motor Assembly

1. Apply lubricating oil to the motor shaft, seal and housing.



2. Press the seal into the housing with the ceramic side facing outward.



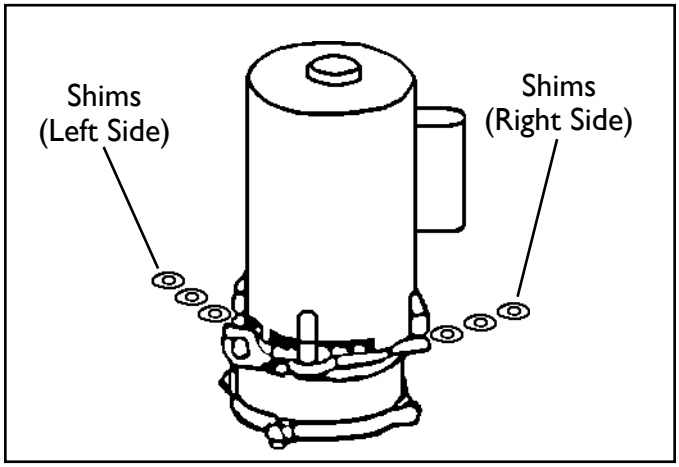
3. Carefully install the housing onto the motor shaft.
4. Install the black spring seal with the nylon side in contact with the ceramic washer.

NOTE: *Lubrication of shaft will ease installation.*

5. Apply loctite to the threads of the motor shaft.
6. Screw the impeller onto the shaft with the flat side facing the motor.
7. Torque the impeller to 27 in. lbs.
8. Align the housing so that the electrical box mounting hole is opposite of the small elbow in back of the pump housing.

Housing/Impeller Spacing

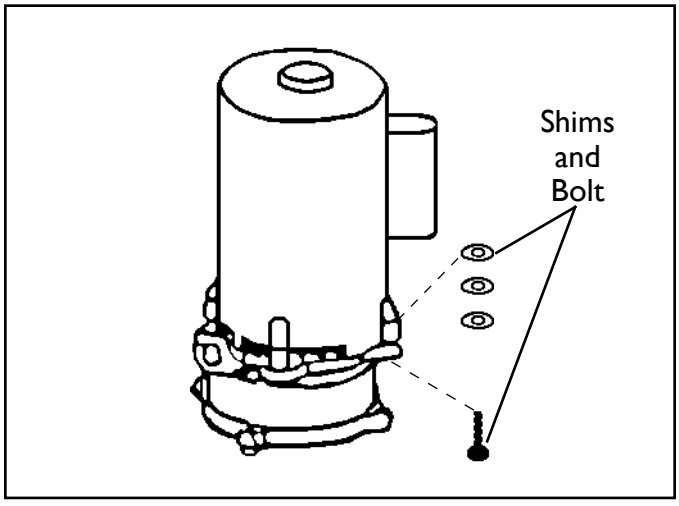
1. To properly space the impeller to the housing, slide two or three .031" shims between the housing and the motor at one corner.
2. Slide other shims of various sizes diagonally across from the corner in Step 1, until the impeller is snug with the housing.



3. Remove and add up all the sizes of the shims used. EXAMPLE: A total of .100" is used, divide that by 2 to obtain .050". Use this amount minus an additional .005" from 1 HP pumps and .010" from 2 HP for each corner.

NOTE: *For further explanation, see Shimming Procedure.*

4. Install the bolts and required shims.



SHIMMING PROCEDURE

A. Insert shims between the motor and the housing at two opposite mounting legs until snug.

B. Remove and add up the total thickness of the shims from both sides.

EXAMPLE:

Left Side Shims	+	Right Side Shims
.031		.031
+.015		+.031
+.015		+.005
.061		.067

.061 + .067 = **.128**

C. Divide the total by 2 and subtract:
.005 for 1 HP motor
.010 for 2 HP motor

EXAMPLE: .128 ÷ 2 = **.064**
.064 –.005 = **.059**

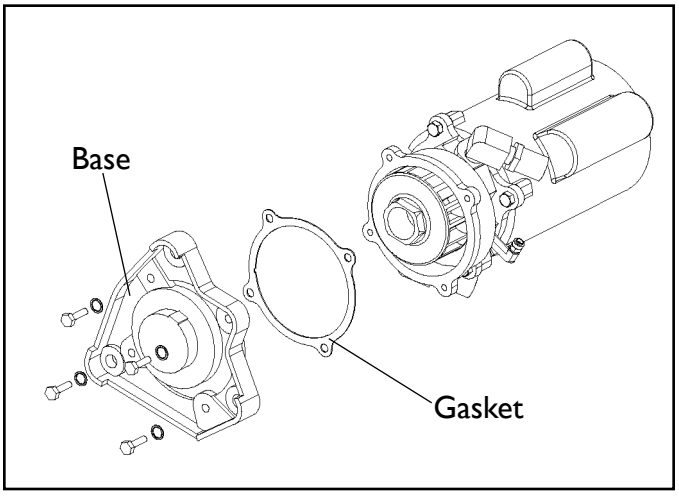
D. Use the best combination of shims for the required shim dimension.

EXAMPLE:

Required Shim Dimension	Combine Shims
.059	.031
	+.015
	+.010
	+.002
	.058

E. Install a bolt and equal shim combinations at all four locations.

5. Tighten and check for free spin of the impeller by removing the motor from the fixture and rotating the impeller. *(For proper fit, shims may need to be added or deleted.)*
6. Install the base with the gasket by aligning the intake and discharge ports. Then tighten the bolts *(**do not** over tighten)*.



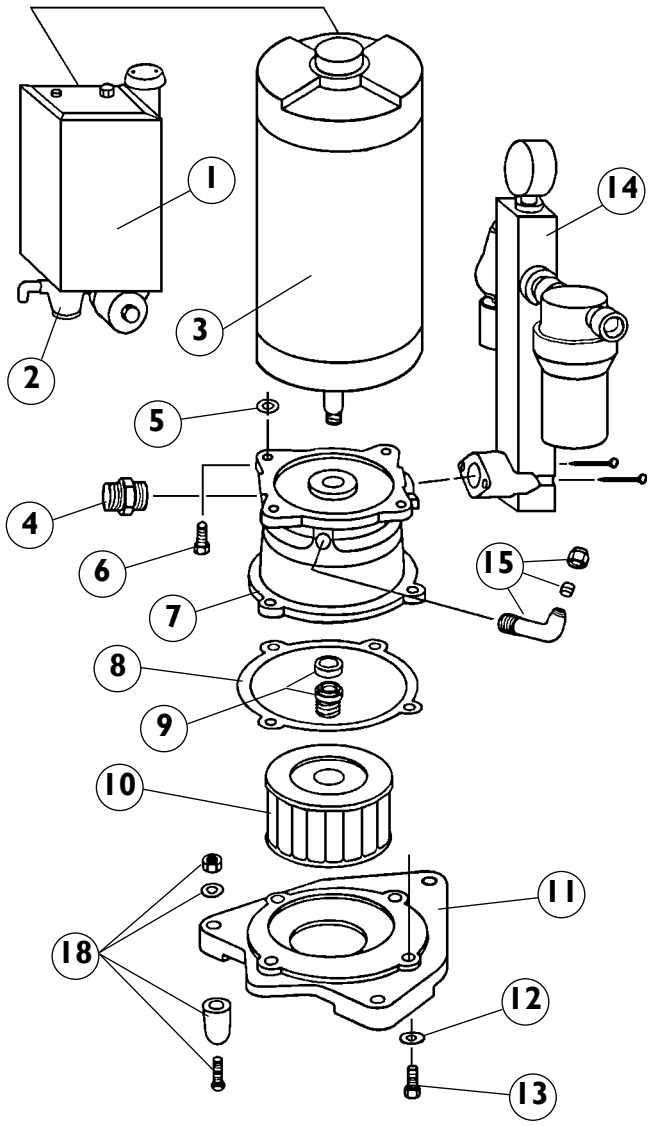
7. Set the pump upright and insert a screwdriver into the slot on top of the motor and check for free spin and smooth operation of the pump.

Vacuum Pump Operation Testing

1. To check for proper operation of the vacuum pump, connect to an electrical source, water and waste line.
2. Start the pump, then block the suction side of the pump and the vacuum relief valve. *The vacuum level should read between 20-25 in. hg. Shims may need to be added or deleted for proper vacuum reading. (Refer to the Housing/Impeller Spacing Section.)*
3. Set the vacuum level by unblocking the vacuum relief valve and adjusting the valve to 10-12 in. hg.
4. Operate the pump for approximately one hour continuously.
5. Check for any water leaks, electrical problems and consistent vacuum level.

1 HP Single Pump Assembly

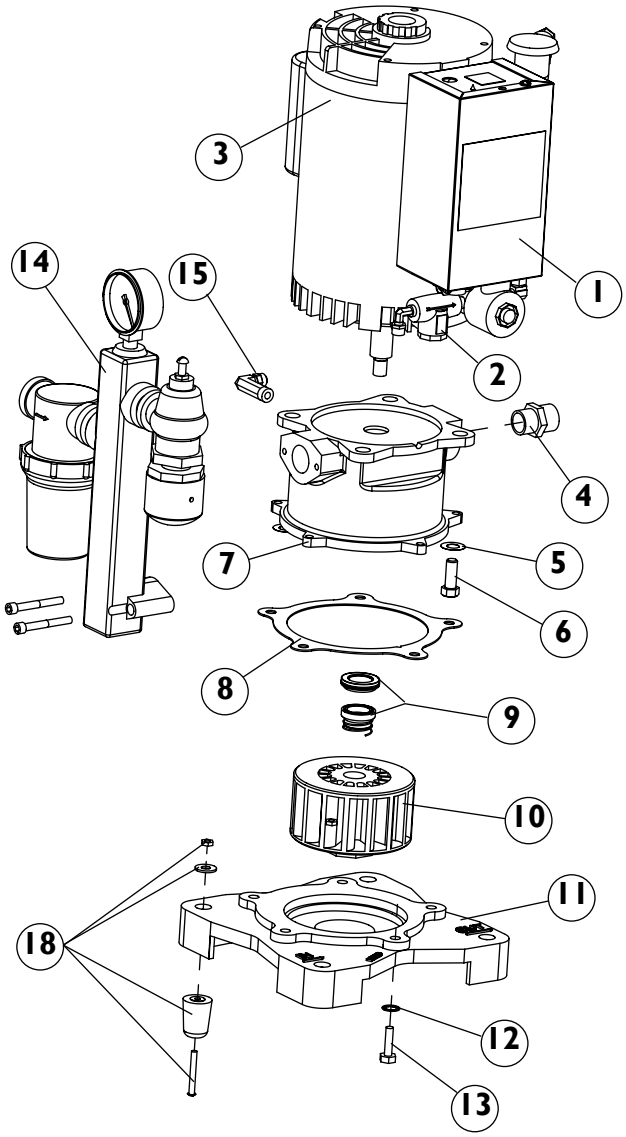
No.	Qty.	Part No.	Description
	1	64586101	Hi Vac, 1 HP
1	1	64501151	Relay Unit, 115V, 230V
2	1	64568196	Water Manifold, 1/2 gallon
3	1	SIB64568165	Motor, 1 HP, FS
4	1	64568146	Adaptor, Brass, 3/4" x 1/2"
5	4	1615-028	Cap Screw, 3/8" --16 x 1"
*6	As Req.	64604001 64604002 64604003 64604004 64604005	Shim, Steel .005 Thick Shim, Steel .031 Thick Shim, Steel .015 Thick Shim, Steel .002 Thick Shim, Steel .010 Thick
*7	1	64568199	Housing, Brass, 1 HP
*8	1	64568127	Housing Gasket, Fiber
*9	1	64568123	Housing Seal, Rotary
*10	1	64568198	Impeller, Brass, 1 HP
*11	1	64568167	Base, Brass, 1 HP
*12	4	64624016	Washer, Internal Star, 5/16"
*13	4	64611044	Screw, Cap, 5/16"-18 x 1"
*6-13	1	64568125	Lower Rebuild Kit, 1 HP
14	1	64568164	Manifold, Intake, w/Gauge and Valve
15	1	64568155	Elbow, 1/4" x 1/4"
16	1	64568150	Mounting Feet Kit, 1 HP
	1	64514054	Bracket, Electrical Box to Motor, Stabilizer



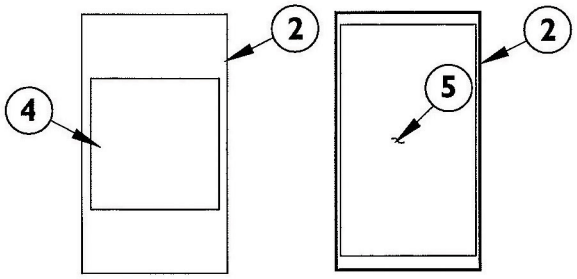
NOTE: *See the Operation/Maintenance section of this manual for detailed information on hookup and care of the Single Wet Vacuum Pump.*

2 HP Single Pump Assembly

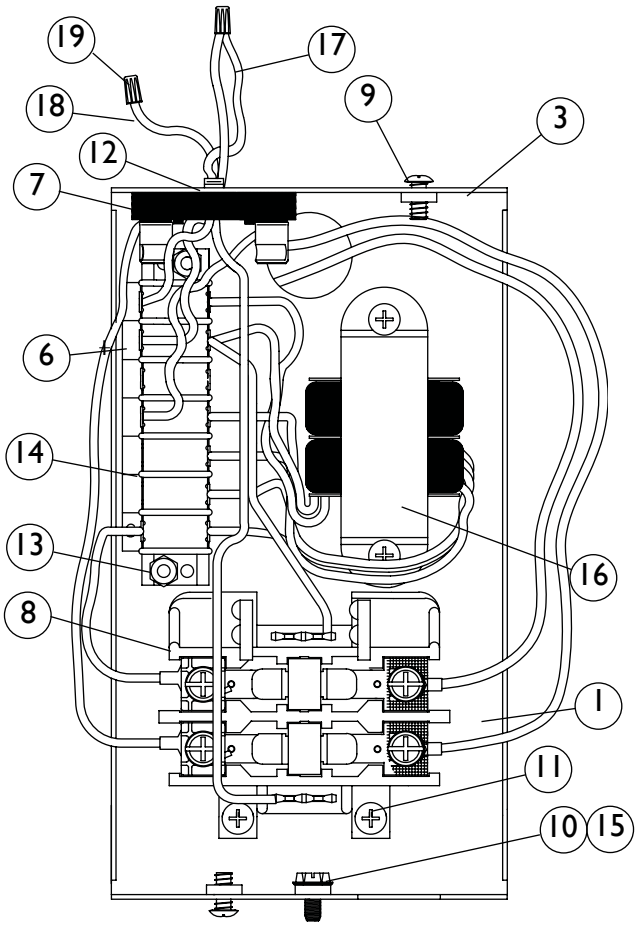
No.	Qty.	Part No.	Description
	1	64586102	Hi Vac, 2 HP
1	1	64501157	Relay Unit, 230V
2	1	64568197	Water Manifold, 1 gallon
3	1	SIB64568166	Motor, 2 HP, FS
4	1	64568147	Adaptor, Brass, 3/4" x 1/2"
5	4	1615-028	Cap Screw, 3/8" - 16 x 1"
*6	As Req.	64604001 64604002 64604003 64604004 64604005	Shim, Steel .005 Thick Shim, Steel .031 Thick Shim, Steel .015 Thick Shim, Steel .002 Thick Shim, Steel .010 Thick
*7	1	64568200	Housing, Brass, 2 HP
*8	1	64568128	Housing Gasket, Fiber
*9	1	64568124	Housing Seal, Rotary
*10	1	64568189	Impeller, Brass, 2 HP
*11	1	64568168	Base, Brass, 2 HP
*12	5	64624016	Washer, Internal Star, 5/16"
*13	5	64611044	Screw, Cap, 5/16"-18 x 1"
*6-13	1	64568126	Lower Rebuilt Kit, 2 HP
14	1	64568164	Manifold, Intake, w/Gauge and Valve
15	1	64568155	Elbow, 1/4" x 1/4"
16	1	64568151	Mounting Feet Kit 2 HP
	1	64514054	Bracket, Electrical Box to Motor, Stabilizer



Electrical Box



No.	Qty.	Part No.	Description
	1	64501150	Electrical Box Assembly, 115V or 230V
1	1	64513011	Control Box Chassis
2	1	64513011B	Control Box Cover
3	1	64529027	Decal, Low, 24V
4	1	64529174	Decal, Fire/Shock Warning
5	1	64529265	Decal, D V Elec. Diagram
6	1	64529185	Decal, D V Terminal Block
7	1	64561004	Fuse Clip Holder
8	1	64568133	Relay, 30 AMP Capacity
9	2	1623-054	Screw, 10-32 x 1/2"
10	1	64611060	Screw, 10-32 Green, Ground
11	4	64611085	Screw, 8-32 x 3/4" Phillips
12	1	64611119	Screw, 6-32 x 5/16", Fuse Holder
13	2	64611120	Screw, 6-32, Terminal Board
14	1	64619006	Terminal Brd, 7 Qk. Connect
15	1	1636-026	Lock Washer, #10 Int'l star
16	1	64568195	Primary Trans., 115/230V
17	1	64529025	Decal, Caution Low Volts
18	1	64529203	Tag, Wire Usage Warning
19	2	64626003	Wire Nut, Ideal, 71-B Gray
	1	64618068	Conduit, Black
	1	64624058	Washer, 7/8"
	2	64578001	Nipple, Chase, 1/2"
	1	64625073	Wire, 18 Ga., Purple, 6"
*	1	64501151	Electrical Box Assembly Kit, 115/230V (1HP)
*	1	64501157	Electrical Box Assembly Kit, 230V (2 HP)



No.	Qty.	Part No.	Description
	1	64532008	Cord, 230V
	1	64529186	Decal, Fuse Replacement 3/10A, 115V or
	1	64529187	Decal, Fuse Replacement 15/100A, 230V
	1	64529125	Decal, 230V, 7.5A, 60 Hz (1 HP Dual) or
	1	64529126	Decal, 230V, 15A, 60 Hz (2 HP)
	1	2679-497	Decal, Ground
	1	64531025	Connector, Snap-in, Black
	1	64579001	Nut, Locking, 1/2"
	1	64568131	Fuse, 3/10 Amp, Slo-Blo, 115V (pkg. of 4) or
	1	64568130	Fuse, 15/100 Amp, Slo-Blo, 230V (pkg. of 4)

***NOTE:** *Electrical Box Assembly Kits: Part Nos. 64501151, 115/230V (1 HP) and PN 64501157, 230V (2 HP) are complete with water manifold attached.*

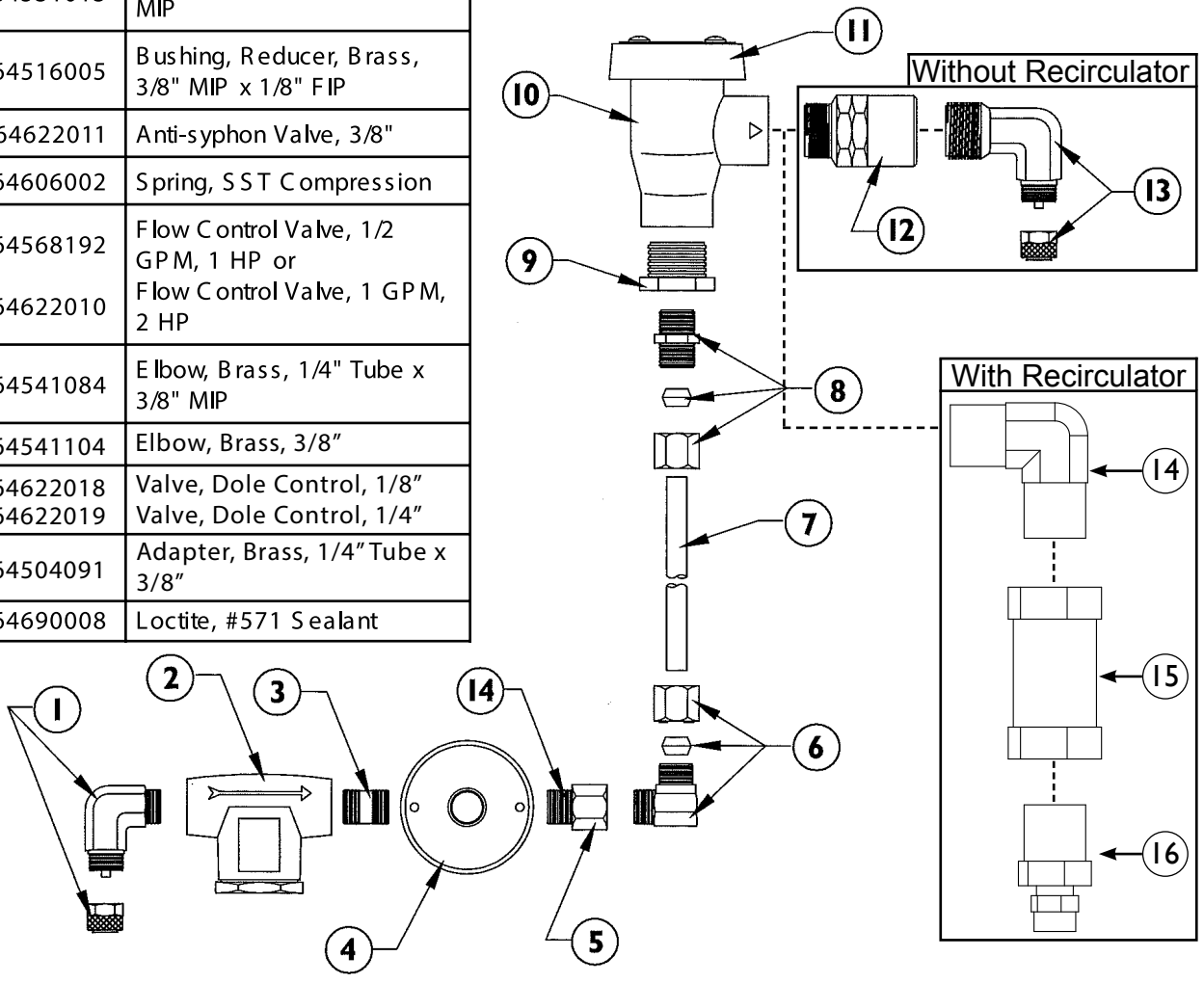
Water Control Assembly

No.	Qty.	Part No.	Description
	1 1	64568196 64568197	Water Control Assy., 1 HP Water Control Assy., 2 HP
1	1	64541004	Elbow, Brass, 1/4" Tube x 1/8" MIP
2	1	64568135	Water Filter, 1/8"
3	1	64578002	Nipple, Brass, 1/8" MIP
4	1	64568156	Solenoid Valve, 24v, 60hz
5	1	64504072	Adapter, Brass, 1/8" MIP x 1/8" FIP
6	1	64541106	Elbow, Brass, 1/4" Comp. x 1/8" MIP
7	1	64568154	Watertube, 6" Straight
8	1	64531013	Connector, 1/4" Tube x 1/8" MIP
9	1	64516005	Bushing, Reducer, Brass, 3/8" MIP x 1/8" FIP
10	1	64622011	Anti-syphon Valve, 3/8"
11	1	64606002	Spring, SST Compression
12	1 1	64568192 64622010	Flow Control Valve, 1/2 GPM, 1 HP or Flow Control Valve, 1 GPM, 2 HP
13	1	64541084	Elbow, Brass, 1/4" Tube x 3/8" MIP
14	1	64541104	Elbow, Brass, 3/8"
15	1 1	64622018 64622019	Valve, Dole Control, 1/8" Valve, Dole Control, 1/4"
16	1	64504091	Adapter, Brass, 1/4" Tube x 3/8"
17*	AR	64690008	Loctite, #571 Sealant

The water control system of the CustomAir Single Wet Vacuum Pump provides the pump with the water flow required for proper suction and supplemental cooling. Automatic and independent water control is provided for the pump. Filters protect the system from damage because of solid materials in the water supply. Flow valves control the amount of water supplied to the pump.

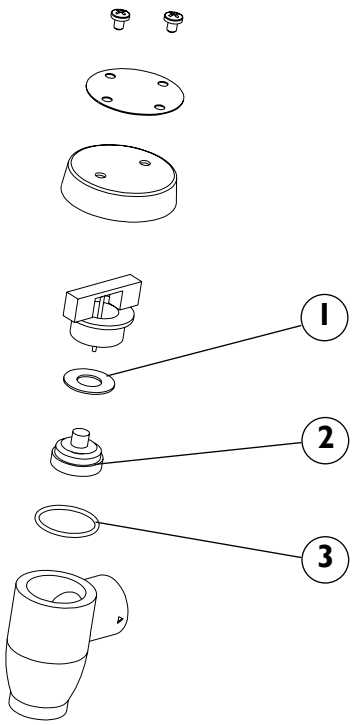
NOTE: *When ordering a replacement Part No. 7, Parts No. 5, 6, 8, and 9 have to be ordered as well.*

*** All Fittings to be sealed with liquid sealant unless fitting is pretreated from manufacturer with sealant.**



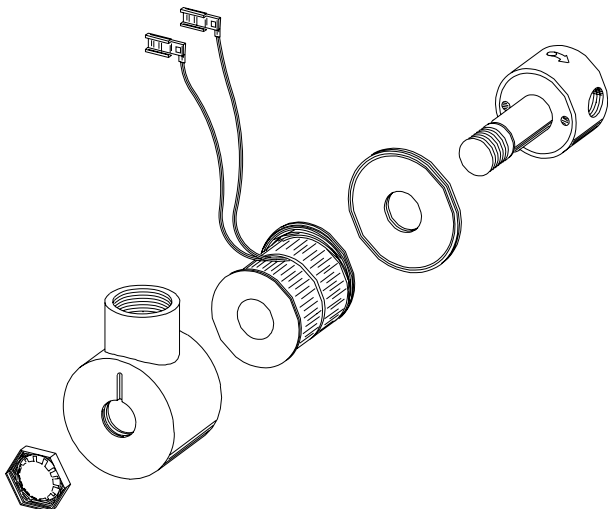
Anti-Siphon Valve Assembly

No.	Qty.	Part No.	Description
	1	64622011	Anti-Siphon Valve Assembly
1,2,3	1	64568016A	Anti-Siphon Repair Kit



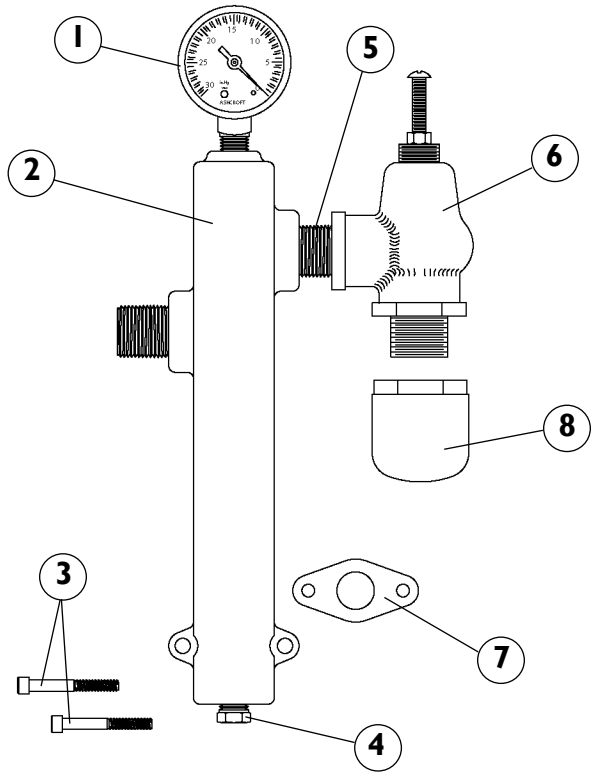
Water Solenoid Valve Assembly

No.	Qty.	Part No.	Description
	1	64568156	Water Solenoid Valve Assembly, 24V

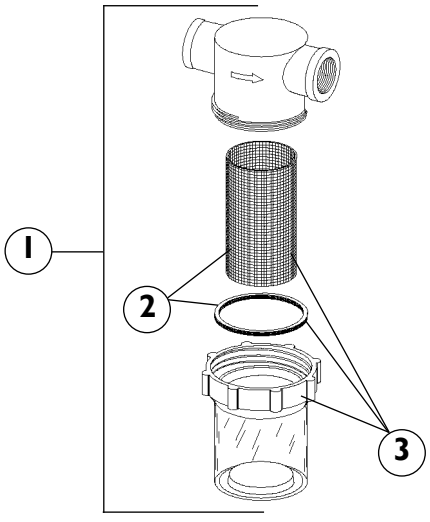


Intake Manifold Assembly

No.	Qty.	Part No.	Description
	1	64568164	Intake Manifold Assy, HiVac
1	1	64568188	Vacuum Gauge, HiVac
2	1	64572001	Intake Manifold, Brass
3	2	64611059	Socket Head Cap Screw, 1/4"-20 x 2"
4	1	64584009	Plug, 1/4" MIP, Brass
5	2	64578003	Nipple, 3/4" x Close, Brass
6	1	64622001	Vacuum Relief Valve, Brass
7	1	64568137	Manifold Gasket, Fiber
8	1	64568159	Vacuum Relief Muffler



Primary / Secondary Filter



No.	Qty.	Part No.	Description
1	1	64545040	Filter, Primary, 3/4", with clear bowl
2	1	64568119	Screen & Gasket
3	1	64568120	Bowl, Screen & Gasket

DentalEZ Group
CustomAir Division
Single Wet Vacuum Pumps

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 and have our own in-house repair facility to service our products.

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 the Single Wet Vacuum Pump to be free of defects in material and workmanship, under normal usage, for a period of two (2) years 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 time frame 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.

*****Provided conditions defined in the instruction manual are met.

EMC Info

The EUT is suitable for use in the specified electromagnetic environment. The customer and/or user of the EUT should ensure that it is used in an electromagnetic environment as described below.

Medical electrical equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the ACCOMPANYING DOCUMENTS.

Portable and mobile RF communications equipment can affect MEDICAL ELECTRICAL EQUIPMENT.

Include a list of all cables and maximum lengths of cables (if applicable), transducers and other ACCESSORIES with which the manufacturer of the EQUIPMENT or SYSTEM claims compliance with the requirements of 5.2.2.1 a) and 5.2.2.1 b). ACCESSORIES that do not affect compliance with the requirements of these subclauses need not be listed. ACCESSORIES, transducers and cables may be specified either generically (e.g. shielded serial cable, load impedance) or specifically (e.g. by manufacturer and model or part number).

Use of accessories, sensors, and cables other than those specified may result in increased emission and/or decreased immunity of the EUT.

The EUT should not be used adjacent to, or stacked with other equipment. If adjacent or stacked use is necessary, the EUT should be observed to verify normal operation in the configuration in which it is used.

There are minimum amplitudes for the EUT to measure physiological signals. Operation of the equipment below the minimum amplitudes may cause inaccurate results.

Portable and mobile RF communications equipment can affect MEDICAL ELECTRICAL EQUIPMENT.

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	

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 meters (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.

EMC Info

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**
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	Not Applicable Not Applicable	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	Not Applicable Not Applicable	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	Not Applicable Not Applicable	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 % UT (>95 % dip in UT) for 0,5 cycle 40 % UT (60 % dip in UT) for 5 cycles 70 % UT (30 % dip in UT) for 25 cycles <5 % UT (>95 % dip in UT) for 5 sec	Not Applicable Not Applicable Not Applicable Not Applicable	Mains power quality should be that of a typical commercial or hospital environment. If the user of the EUT requires continued operation during power mains interruptions, it is recommended that the EUT 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.			

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 Radiated RF IEC 61000-4-3	3 Vrms 150 kHz to 80 MHz 3 V/m 80 MHz to 2,5 GHz	3 Vrms 3 V/m	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 meters (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:
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.

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