



GE SINGLE DIAPHRAGM GUZZLER PUMP



OPERATOR'S MANUAL FOR ...

GE-0401N

GE-0403N

GE-0404N

GE-0501N

GE-0503N

GE-0504N

for use as **Maple Sap Vacuum** pumps

WWW.THEBOSWORTHCO.COM

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IMPORTANT SAFETY INFORMATION

NEVER OPERATE YOUR GUZZLER® PUMP WITHOUT THE PUMP GUARD PROPERLY INSTALLED ON THE PUMP.

NEVER REACH INSIDE THE PUMP OR INSERT ANY OBJECTS INTO THE PUMP WHILE THE PUMP IS OPERATING. SERIOUS INJURY OR DAMAGE TO THE PUMP WILL RESULT.

ALWAYS CONNECT THE PUMP TO the **CORRECT POWER SOURCE USING PROPERLY INSULATED CONNECTORS**. OPERATING THE PUMP WITHOUT **PROPER ELECTRICAL CONNECTIONS** CAN CREATE A SERIOUS RISK OF ELECTRICAL SHOCK.

INTRODUCTION

Register Your Guzzler

To validate your Guzzler warranty, go to <https://thebosworthco.com/register> to register your pump. You will need to enter your pump’s serial number. Your pump’s **serial number** can be found on the side of the pump gearmotor, as shown in Figure 1.

Power Requirements

Model	GE-0x01D/GE-0x01N	GE-0x03D/GE-0x03N	GE-0x04D/GE-0x04N
Voltage	120 vac	12 vdc	24 vdc
Watts	90	100	100
Full load amps	1.44	15.0	5.0
Suggested Power Source	Household current or 1000 watt pure sine generator	One (1) 12 vdc battery; recommended minimum 60 amp-hr	Two (2) 12 vdc batteries in series; minimum 60 amp-hr each



Test the Pump

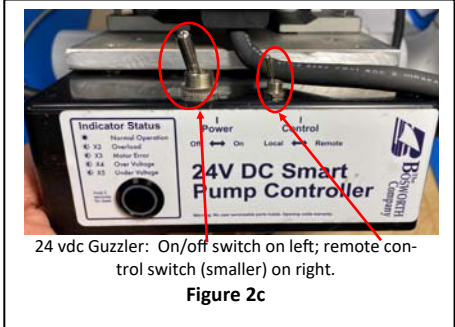
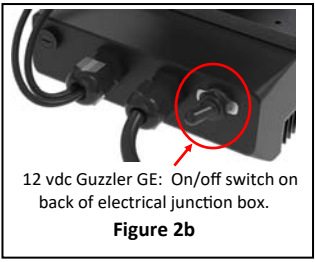
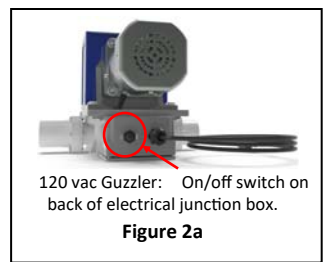
Test your pump before installation at a sugarbush.

1. Connect the pump to power

12 or 24 vdc pump: **Connect the positive (red wire) on the motor to the positive terminal on the battery/power supply; connect the negative (black wire) motor lead to the negative terminal.** Reversing these wires will blow the fuse located on the side of the junction box.

2. Turn the pump on

120 vac pump: On/off switch is on back side of electrical junction box. (See Figure 2a)



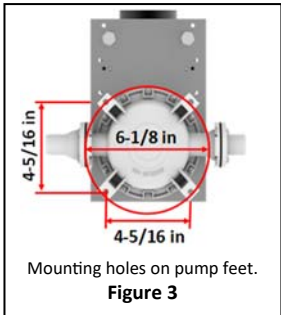
12 vdc pump: On/off switch is located on back of junction box. (Figure 2b).

24 vdc pump: On/off (“power”) switch is the larger of the two switches located at the top of the electrical junction box. For normal operation, ensure that the smaller switch labelled “Control” is set to “Local” (Figure 2c).

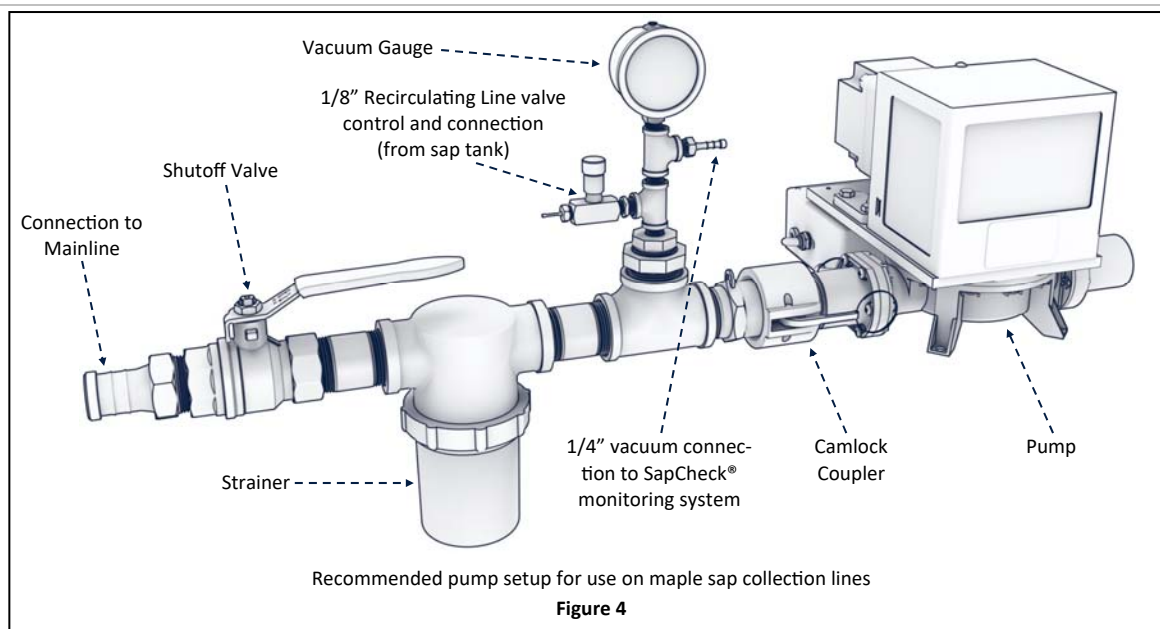
3. If you feel suction on your hand at the inlet port and exhaust pressure on your hand at the outlet port, the pump is operating properly.

PUMP SETUP

1) Securely Mount the Pump	Ensure that your pump is securely mounted. The pump feet have mounting holes that can be used to attach the pump to a mounting surface (Figure 3) The mounting holes accommodate 1/4” mounting screws or through-bolts.
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PUMP SETUP



Note: Refer to Figure 4 (above) in the following discussion on pump setup.

2) Protect the Pump from the Elements	Mount the pump in an enclosure that will prevent exposure to rain or snow.
3) Ventilate Pump to Keep from Overheating	If you install your pump in an enclosure, ensure that it provides adequate ventilation to prevent the pump motor from overheating.
4) Camlock Couplers between Guzzler and Mainline	Camlocks allow the pump to be easily disconnected from and reconnected to your mainline.
5) Install Shut-off Valve and Vacuum Gauge at Pump Inlet	Allows you to isolate the pump from your sap lines for trouble-shooting purposes.
6) Minimize Pump Back Pressure	Back pressure at the pump outlet will shorten diaphragm lifetime. To minimize back-pressure, install your Guzzler at or above your collection tank level. Avoid having the pump "push" sap up a vertical distance or through a long small-diameter (less than 1 inch) outlet hose/pipe or through right-angle bends.
7) Strainer to Keep Foreign Materials and Ice from Entering the Pump	Early sap runs may contain small wood or plastic shavings that can foul or tear the pump valves or diaphragm. Install a strainer to keep such material from being drawn into the pump. A strainer with a transparent cap allows you to see when the filter screen needs to be cleaned.
8) Recirculation Line for Best Vacuum	Guzzler pump valves seal best when wet. To achieve the best vacuum with your Guzzler, we recommend that you install a small (1/8") recirculation line from your collection tank back to the inlet of the Guzzler (Figure 4). Regulate this backflow of sap by installing a small shutoff valve where the line connects to the inlet. When the pump is running, open the valve to allow a small amount of sap to flow back from the collection tank into the pump. This ensures the valves remain wet and seal optimally. With a recirculating line, some users have increased vacuum to as much as 28 in Hg (25 in Hg in 24 vdc pumps*)

*Note: Higher vacuums are possible with 24 vdc pumps but may require charging systems (e.g. solar) that keep batteries operating on the range 25.0-26.0 vdc.

Remote Operation for 24 vdc Guzzlers

The 24-volt Guzzlers are equipped with a remote activation option. The pump can be turned on/off manually or it can be remotely controlled by supplying a 3.3-volt signal to the remote-control interface connector on the side of the pump control box (Figure 5). (Consult the factory for more detailed information on this interface.) There are two switches on the top of the pump control box; the larger is the pump power switch and the smaller is the remote-control switch (Figure 6).



Remote Control Interface on side of Controller Box
Figure 5

To manually turn the pump on/off, turn the **Control** switch to **Local** position and turn the **Power** switch to **On**. To turn the pump on/off using the remote-control interface, set the **Power** switch to **On** and turn the **Control** switch to **Remote**. The pump can now be turned on by an external device.

Bosworth's **SapCheck®** remote monitoring product can be used to supply this signal and remotely control the pump.

TIPS FOR BEST OPERATIONEliminate Leaks for Best Vacuum

Your Guzzler Pump can develop 19-28 in. of Hg vacuum, depending on whether the valves are dry or wet. Because the Guzzler is a low-cfm (cubic feet of air per minute) pump, even very small leaks can prevent the pump from delivering its rated vacuum. Maintain your tap lines to keep your system tight and address problems that can cause vacuum leaks.



Pump Control box showing manual and remote activation switches on top of box and fault status indicator on side
Figure 6

Isolate the Pump to Find Cause of Vacuum Loss

If you experience a loss of vacuum in your system – as registered by the gauge near the pump – slowly turn the shut-off valve to isolate the pump from your mainline. **DO NOT SHUT THE VALVE SUDDENLY, AS PUMP DAMAGE MAY RESULT.** If the gauge begins to return to normal operating vacuum, then the pump is working properly, and the source of the leak is somewhere in your sap lines or taps. If the pump fails to recover normal vacuum, then the pump is the source of the problem. Inspect the pump diaphragms and/or valves for any holes or tears. In the case of the valves, check for and remove any material that may have entered a pump body and lodged in the valve, preventing the valve from proper opening and closing.

Keep Ice from Forming Inside Pump

Sap can freeze within the pump body. If the pump is turned on when there is ice in a pump body, it will result in damage to various pump components, including the pump body, valves and diaphragm. If there is a risk of freezing conditions, disconnect the pump from your sap lines when the pump is not running and drain any excess sap from the pump. Alternatively, some users install a small heat lamp in the enclosure with the pump to prevent ice from forming when the pump is not operating.

Drain Sap if Removing Pump from Mainline

To shut off and disconnect the pump from the mainline, first slowly close the shut-off valve to isolate and maintain any vacuum in the mainline. Then, turn the pump off. Disconnect the pump from the mainline, using Camlock Couplers if you have used these for your pump-to-mainline connection. Turn the pump back on briefly to flush any remaining sap from it. Finally, tilt the pump to drain any remaining sap.

MAINTENANCE - CHANGING A DIAPHRAGM**MAINTENANCE - CHANGING A DIAPHRAGM**

Over time, the elastomer components of the pump (i.e., the diaphragm and valves) will fail. If a diaphragm fails, the pump may continue to develop some vacuum (depending on the size of the hole/tear), but it will be significantly reduced. You may see sap leaking from the diaphragm in and around the pump guard. If this happens, the diaphragm should be replaced.

When replacing the diaphragm, pay close attention to the orientation of various parts. The use of witness marks may be helpful during reassembly.

Tools Needed: Philips Head Screwdriver, Flat Head Screwdriver

Materials Needed: Blue Loctite 242

Removing a Diaphragm

1. Disconnect the pump power.
2. Turn the pump upside down so that it is resting on the pump guard and motor. With a pencil, mark the side of the mounting plate next to the pump inlet (the shorter of the two ports).
3. Remove the 10 screws holding the pump body to the aluminum mounting plate (Figure 7).
4. Remove the pump body to expose the diaphragm screw attaching the plastic "button" (a plastic support plate) to the diaphragm.
5. Remove the slotted head screw, washer, button, and diaphragm from the base of the plastic clevis (Figure 8).

Installing a Diaphragm

1. Place the new diaphragm onto the base of the plastic clevis. Make sure it is seated on the raised central boss. Install the button (rounded-edged toward diaphragm) and stainless steel washer, seating them on the boss as well.

Note: Be sure to place the diaphragm on the plastic clevis so that the ridge running along the diaphragm's circumference is facing toward you. The other side of the diaphragm's outer edge is flat.

Note: If you plan to change the valves, do so now. (See section **Maintenance – Changing Pump Valves.**)

2. Apply blue Loctite to the diaphragm screw. Secure the above with the diaphragm screw, tightening it to **35 in-lb** of torque. (Using blue Loctite on the screw helps ensure it does not loosen during pump operation, but will still allow you to remove the screw if the diaphragm needs to be replaced.)
3. Place the pump body up against the diaphragm and align it with the holes on the Intermediate Ring and Mounting Plate. Be sure that the diaphragm's outer lip sits in the groove running around the circumference of the pump body (Figure 9).

Note: Ensure the pump body is installed in the correct orientation, with the inlet next to the mounting plate witness mark made in Step 2, **Removing a Diaphragm.**)

4. Fasten the pump body to the mounting plate using the 10 screws and nuts. Start all screws and nuts before tightening them down. Tighten to a maximum of 30 in-lbs of torque. Tighten screws evenly (crisscross pattern). Do not completely tighten screws until everything is aligned.



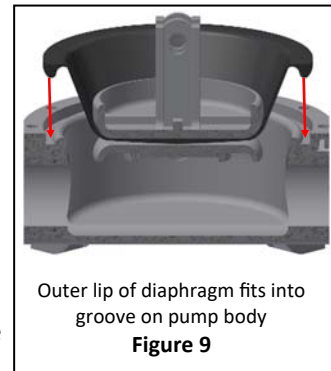
Remove pump body from aluminum mounting plate

Figure 7



Remove diaphragm

Figure 8



Outer lip of diaphragm fits into groove on pump body

Figure 9

MAINTENANCE - CHANGING PUMP VALVES

Pump Valve Types

A Guzzler pump has two valves; one between the pump body and the inlet port; the other, between the pump body and the outlet port. Your Guzzler pump may be equipped with either duckbill valves or umbrella valves, depending on the pump options chosen.

The duckbill valve is shaped like a bird's beak. Pressure on the outside of the beak forces the valve to close; pressure on the other end of the beak forces the valve to open so that fluid (or air) may pass. (Figures 10A-10B) The duckbill valve on the GE-050n series pumps is slightly larger than that on the GE-040n pumps.

The other kind of valve available for your pump is an umbrella valve. The umbrella valve features an elastomer with a flat round disk held under tension against a plastic plate (the "valve stop") that contains a number of holes or "pores". (Figure 11)

When pressure is applied to one side of the valve stop, it pushes the rubber disk away from the holes, like an umbrella turning inside out (Figures 12A-12B). When this happens, fluid or air can pass through the holes. When the pressure is reversed, the rubber disk is forced against the holes, making a tight seal to prevent any fluid or air from passing.

Either kind of valve can be fouled by material in the sap (e.g., wood shavings from taps, plastic shavings from tubing, etc.) that is too large to pass through the valve. When this happens, the pump will be unable to develop any vacuum. However, unlike the case of a diaphragm failure, valve malfunction will not result in any sap leaking from the pump. In the case of a valve failure, if you were to perform the simple pump check described on page 2, you would feel no vacuum pulling from the inlet port. To correct the problem, the valve should be removed, inspected and cleaned. Several of the steps involved in doing this are the same as the steps required to change a diaphragm.

Valves are typically replaced in pairs; i.e., the inlet and outlet valve of a given pump body are replaced at the same time.

When replacing a pair of pump valves, it is best that only one valve is removed and replaced before attempting to remove and replace the other valve. The orientation of the valves with respect to the pump body is important. If they are installed the wrong way, the pump will not function.

Changing the Valves

1. Follow steps 1-3 in **Removing a Diaphragm**.
2. On the GE-050n pump, remove the 6 screws holding the inlet flange to the pump body (Figure 13). (Note: 4 screws are used on the GE-040n pump). The umbrella valve is located between this flange and the pump body.
3. Inspect the valve for any tears. Inspect the valve pores and remove any dirt or material that may have become lodged in the pores. Inspect O-rings for any sign of wear and replace as necessary. Ensure that they are correctly installed in the valve stop grooves.



GE-040n Duckbill valve (left: Closed; right: Open)
Figure 10A



GE-050n Duckbill valve (left: Closed; right: Open)
Figure 10B

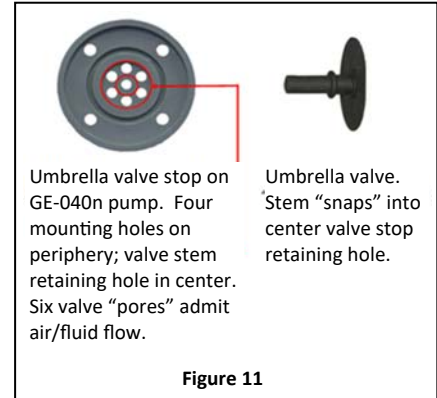
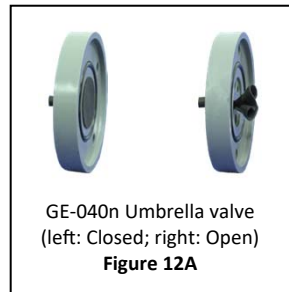
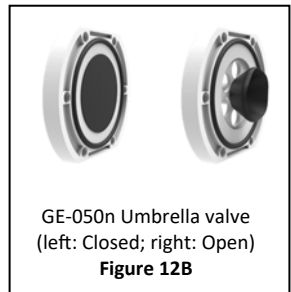


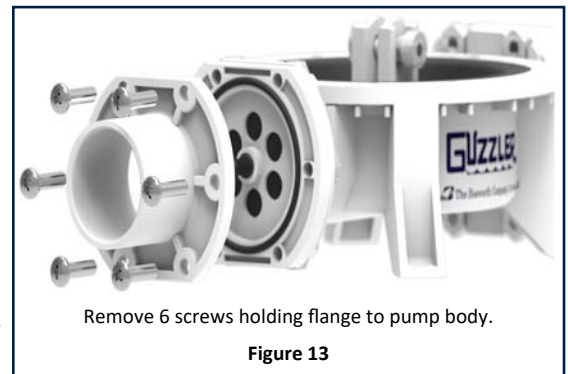
Figure 11



GE-040n Umbrella valve (left: Closed; right: Open)
Figure 12A



GE-050n Umbrella valve (left: Closed; right: Open)
Figure 12B



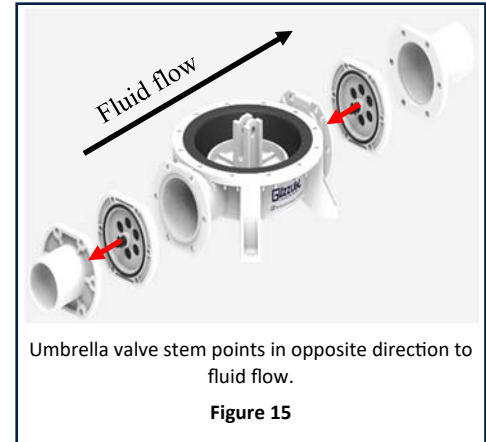
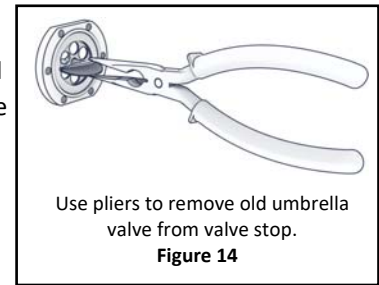
Remove 6 screws holding flange to pump body.

Figure 13

MAINTENANCE - CHANGING PUMP VALVES / TROUBLESHOOTING

Changing the Valves, continued

4. To replace the umbrella valve, use a pair of pliers to grasp the flat portion of the old umbrella valve and pull the entire valve through the valve stop center retaining hole (Figure 14). Insert the stem of the new valve into the valve stop retaining hole so that the flat portion of the valve is on the same side of the valve stop as the old valve. Use pliers to grasp the stem of the valve on the other side and pull it completely through until it snaps into place.
5. Position the new umbrella valve (or the inspected and cleaned old valve) between the pump body and the pump inlet flange, taking care to orient the valve as shown in Figure 15. Fasten the pump flange and the valve stop to the pump body using the flange screws.
6. Repeat steps 2-5, this time with the outlet side of the pump. Be sure to install the outlet valve so it is oriented as shown in Figure 15.
7. Re-install the pump body.



NOTE:

IF THE VALVES ARE NOT ORIENTED CORRECTLY IN THE PUMP FLANGES, THE PUMP WILL NOT FUNCTION PROPERLY AND COULD BE DAMAGED UPON OPERATION.

TROUBLESHOOTING

PROBLEM	WHAT TO DO
"I've got little or no vacuum on the gauge at my pump."	If you've installed a shut-off valve in front of the vacuum gauge, slowly turn the valve to the off position to isolate the pump from your sap lines. If the vacuum gauge goes back up, then the pump is operating properly and you should check your lines for a leak. If the vacuum gauge doesn't go back up, then inspect the pump to see if sap is leaking around the diaphragm. Leaking sap indicates a diaphragm is torn or has developed a hole. If the diaphragm is leaking, replace it. If no sap is leaking from the pump diaphragm, disconnect the pump from your sap lines. With the pump turned on, place your hand over the inlet/outlet of the pump to determine if you can feel pump suction at the inlet and exhaust pressure at the outlet. If you do not feel the suction and pressure for a pump, and there is no tear/hole in the diaphragm, then inspect the inlet and outlet valves. Remove any material that might be preventing the valves from opening/closing properly. If the valves are torn or worn, replace them.
"The pump was working fine and then stopped."	Inspect your power source to ensure that it is providing sufficient power. (For 24 vdc pumps, if the reset button is flashing, consult the 24 vdc Pump Motor Protection Fault Table for more specific information on the nature of the problem.) Ensure that you have provided adequate ventilation for the motor. The motor is thermally protected and will shut down if overheated. If this happens, allow the motor to cool down before restarting. Special note for 24 vdc pumps: These pump motors have built-in protection to guard against excessive load conditions, as can occur if the pump is pulling a vacuum in excess of 25 in Hg. Even if the batteries are fully charged, the motor controller may determine that there is insufficient voltage available to support the load on the motor. In some cases, keeping the batteries charged (as can be done, for example, with a solar recharging system) and operating on the range 25.0-26.0 vdc can provide sufficient power to support loads generated by vacuums on the range 26.0-28.0 in Hg. If this is not practical, then it is recommended to reduce the vacuum that the pump is pulling to a maximum of 25 in Hg so that the pump will continue to operate until the batteries have discharged to the point of providing only 18-20 vdc. Limit the maximum vacuum by using a vacuum/pressure relief valve as available from suppliers like Grainger (www.grainger.com, Item # 5Z763).

PROBLEM	WHAT TO DO
<i>"My motor is very hot. Is something wrong?"</i>	A properly operating motor can be uncomfortably hot to the touch. Even with adequate ventilation, the pump can develop a motor surface temperature that may exceed 160°F (70°C). This alone does not indicate anything is wrong.
<i>"My pump is frozen. Should I start it up?"</i>	Do not start a pump if you suspect there is ice in the pump body. Starting a pump when there is ice in the pump body could tear the pump diaphragm and/or damage the pump body. Allow the pump to thaw before restarting.
<i>"I'm only getting 19-20 in Hg vacuum at the pump. How can I get more?"</i>	Pump valves seal better when wet. When dry, the pump valves will generally produce 19-20 in Hg vacuum. If the valves are wet, their improved sealing can create up to 28 in Hg vacuum (25 in Hg for 24 vdc pumps) on leak-free sap lines. Installing a recirculation line from your sap tank back into the inlet of the pump will help keep the pump valves wet and maximize pump vacuum. (See Pump Setup—Recirculation Line for Best Vacuum).
<i>"I've got good vacuum at the pump and there's sap in the lines, but nothing's going into my tank."</i>	If you have installed a filter near the inlet of the pump, check the filter screen to ensure that it is not clogged with foreign material. A clogged filter will reduce or completely prevent sap flow through to the pump.
<i>"Sap occasionally sloshes back and forth in my sap lines. Is something wrong with the pump?"</i>	If you have good vacuum at the pump, this back-and-forth motion of the sap may be the natural result of the pressure inside the trees dropping to the point where it cannot push the sap out into your tap lines. This can happen as the temperature drops. When tree pressure increases, the sap will begin flowing toward the pump again, often surging for a period of time.
<i>"I'm trying to run my 120 vac Guzzler on my generator, but it keeps shutting off."</i>	The 120 vac Guzzlers can be run on a generator, but the generator must be providing a pure sine wave AC voltage signal. Many older generators truncate the signal. While some equipment can tolerate these distortions in power, the motors on the 120 vac Guzzlers will not. They can cause the motor to run inefficiently, resulting in overheating. The motor's internal thermal protection sensor will then automatically shut the motor off to prevent damage.
<i>"My battery is fully charged, but my 12 vdc pump won't turn on."</i>	The 12 vdc brushless motor is rated for operation at temperatures as low as 28 deg F. Below 28 deg F, the pump will not start. Be sure the motor is at or above that temperature before trying to start it.

24 vdc Pump Motor Protection Fault Table

Protection Function	Number of Reset Button Flashes	Possible Causes
Overload protection	2	When a load in excess of the rated motor torque is applied to the motor for approximately 5 seconds or more
Motor sensor protection	3	When the sensor cable in the motor cable is disconnected
Over-voltage protection	4	When voltage applied to the driver has exceeded the voltage setting (24 vdc) by 15% or greater
Insufficient voltage protection	5	When voltage applied to the driver is less than the voltage setting (24 vdc) by 25% or greater
Overspeed protection	6	When motor speed has reached an excess of 3500 rpm. Can also be triggered when pump is pulling excessive vacuum (>25 in Hg.)

REPLACEMENT PARTS

Guzzler replacement parts are available from authorized Guzzler pump dealers. Additionally, parts are available on the company website at www.thebosworthco.com.

Each pump has a replacement parts page that shows an exploded view of the pump along with a listing of all parts in the view. The following table provides the URL addresses of the various single diaphragm pump replacement parts pages, as well as their corresponding QR codes to scan for immediate access.

Pump Model	Replacement Parts Web Page	QR Code
GE-0401N	https://thebosworthco.com/products/replacement.php?baseid=GE-0401N-0&settab=2	
GE-0501N	https://thebosworthco.com/products/replacement.php?baseid=G2-0501N-0&settab=2	
GE-0403N	https://thebosworthco.com/products/replacement.php?baseid=GE-0403N-0&settab=2	
GE-0503N	https://thebosworthco.com/products/replacement.php?baseid=GE-0503N-0&settab=2	
GE-0404N	https://thebosworthco.com/products/replacement.php?baseid=GE-0404N-0&settab=2	
GE-0504N	https://thebosworthco.com/products/replacement.php?baseid=GE-0504N-0&settab=2	

TECHNICAL SUPPORT

For all technical inquiries, please refer to our website, www.thebosworthco.com, Maple Sap Pumps Application, or contact The Bosworth Company. Be sure to have your pump serial number readily available if contacting Technical Support. You can email us at info@thebosworthco.com or call 401-438-1110. Technical support is available Monday-Friday, 8AM-4:30 PM. After hours support is provided as resources are available.



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