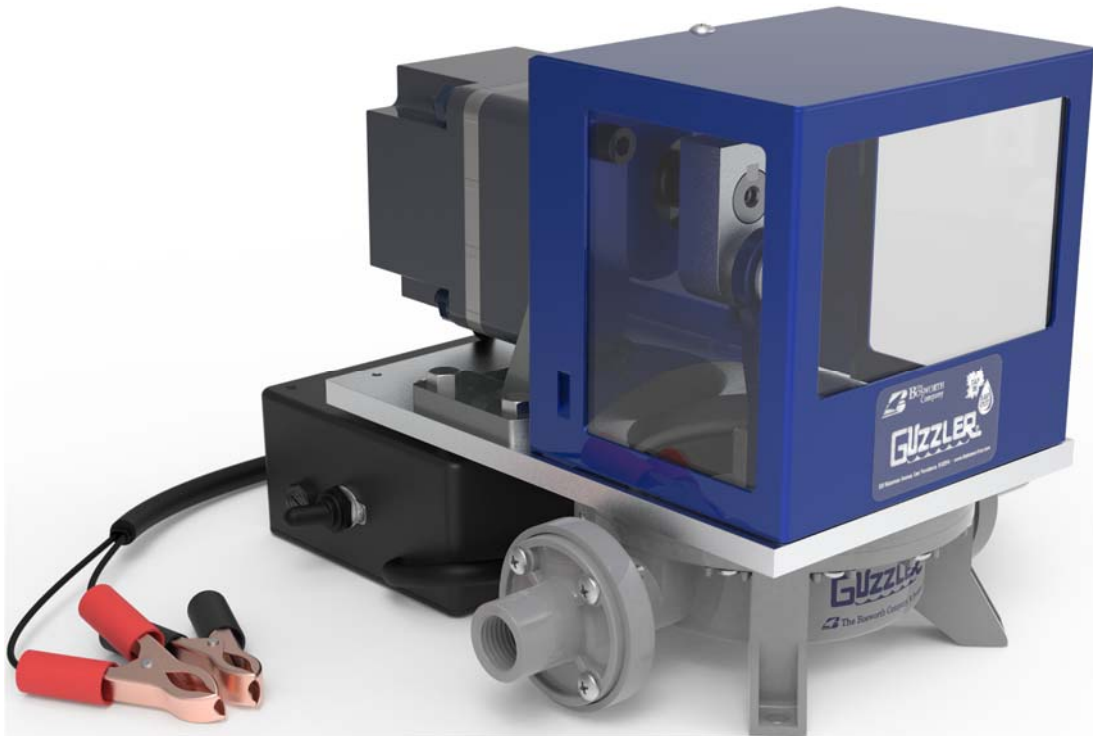




## 24 VDC SINGLE DIAPHRAGM PUMP

GUZZLER® GE-0404N / GE-0504N



## OPERATOR'S MANUAL

for use as Maple Sap Vacuum pumps

[WWW.THEBOSWORTHCO.COM](http://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 A 24 vdc POWER SOURCE USING PROPERLY INSULATED CONNECTORS. OPERATING THE PUMP WITHOUT PROPER ELECTRICAL CONNECTIONS CAN CREATE A SERIOUS RISK OF ELECTRICAL SHOCK.**

## INTRODUCTION

Your Guzzler® GE-0404N/GE-0504N 24 vdc diaphragm pump ships fully assembled. Included with the pump is a spare diaphragm. Additional diaphragms can be purchased through your maple equipment dealer or directly online from The Bosworth Company at [www.thebosworthco.com](http://www.thebosworthco.com).

Your pump's **serial number** can be found on the side of the pump gearmotor, as shown in Figure 1.

### Power Requirements

The GE-0404N/GE-0504N pumps require 24 vdc power. The pump motor is a 100 watt motor that draws 4-5 amps at full load. Connecting your pump to two 60 amp-hour 12 vdc deep-discharge batteries wired in series should provide 30-50 hours of pump operation before requiring recharging.

The pump on/off 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 "Remote" is set to "Off" (Figure 2).

### Testing the Pump

Before installing the pump in your sugarbush, test your pump by connecting it to power and turning the Power switch to On and the Remote switch to Off. **Be sure to connect the positive (red wire) lead from the motor to the positive terminal on the battery/power supply; connect the negative (black wire) motor lead, to the negative terminal.** Connecting the power leads incorrectly will blow the inline fuse on the power cable. Your pump ships with a spare fuse.

Carefully cover the inlet port with your hand. Then move your hand to cover the outlet port of the pump. If you can feel vacuum at the inlet port (sucking your hand in) and positive exhaust pressure at the outlet port (pushing your hand away), the pump is operating properly.

### Fault Status Indicator/Reset Button

The 24 volt Guzzler®s feature an illuminated reset button on the side panel of the pump control box. (Figure 2) When the pump is operating properly, this dial is illuminated with a solid light. If a fault condition occurs that prevents the pump from operating, this dial will begin flashing. The rate of flashes encodes the cause of the problem. The **Pump Motor Protection Fault Table** in the **Troubleshooting** section shows the number of flashes and the corresponding problem cause. Once the problem has been corrected, simply press and hold this reset button for 3 seconds to restart the pump.

## PUMP SETUP

Figure 4 shows a recommended installation setup for the Guzzler motorized pump when used for vacuum production on a maple sap collection line. The topics below refer to that figure in more detail.

### Protect the Pump from the Elements

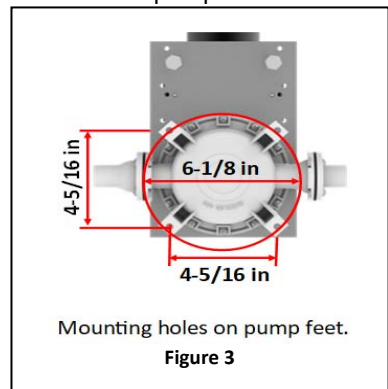
However you deploy your pump, ensure it is protected from the elements and securely mounted. The pump feet have mounting holes that can be used to secure the pump to a mounting surface (Figure 3).



Pump serial number on side of motor  
Figure 1

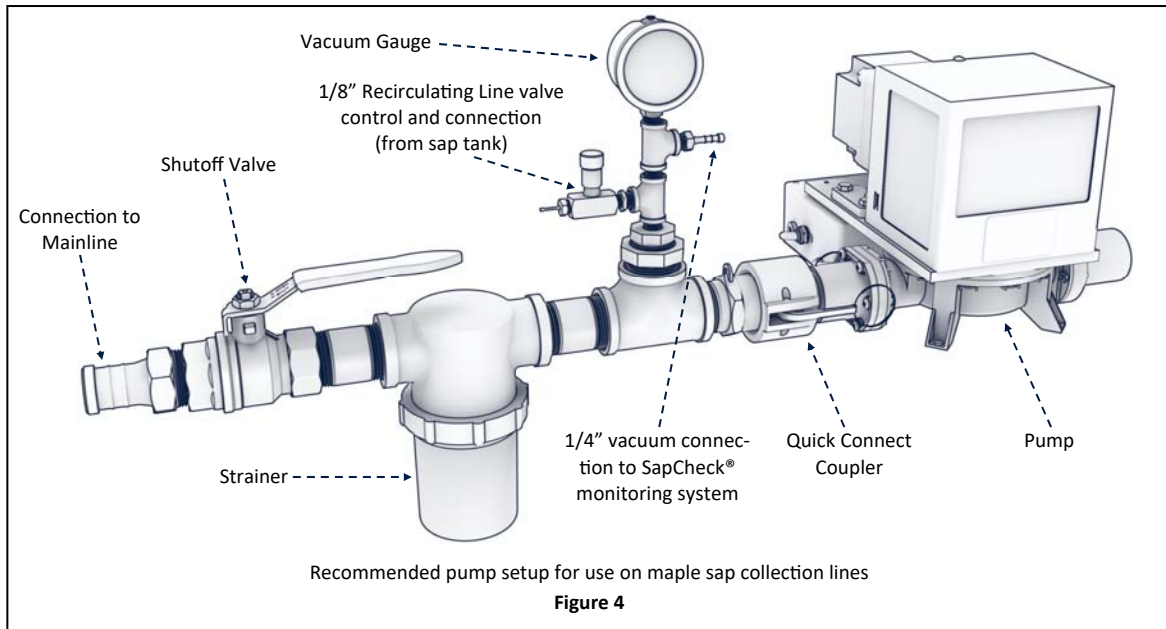


Pump Control box showing fault status indicator/reset button on left.  
Figure 2



Mounting holes on pump feet.  
Figure 3

## PUMP SETUP



### Ventilate Pump to Keep from Overheating

When operating, the pump can develop a motor surface temperature that may exceed 160°F (70°C). If you install your pump in an enclosure, ensure that it provides ventilation so that the pump motor has adequate airflow during operation to prevent overheating.

### Quick Connect Couplers between Guzzler and Mainline

We recommend the use of Quick Connect Couplers between the pump inlet and mainline so that the pump can be easily disconnected from and reconnected to your mainline.

### Install Shut-off Valve and Vacuum Gauge at Pump Inlet

We recommend that you install a shut-off valve and a vacuum gauge – in that sequence – “in front of” the pump, i.e., just before your connection to the pump’s inlet port (Figure 4). This will allow you to isolate the pump from your sap lines for trouble-shooting purposes.

### 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 outlet hose/pipe. Avoid the use of right-angle bends in the pump’s outlet path, as these can add substantially to back pressure.

### Use a Strainer to Keep Foreign Materials and Ice from Entering the Pump

Early in the season, sap may contain small wood or plastic shavings that can foul or tear the pump valves or diaphragm. (Even sharp ice chips, upon entering the pump, can create the same problem.) We recommend installing a strainer to keep such material from being drawn into the pump. A strainer with a transparent cap will allow you to see when the filter screen needs to be cleaned so that it does not obstruct sap flow into the pump.

### 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 25 in Hg.\*

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

Remote Operation

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 **Remote** switch to **Off** 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 **Remote** switch to **On**. 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 OPERATION**

Eliminate Leaks for Best Vacuum

Your Guzzler Pump can develop 19-25 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, we recommend that you disconnect the pump from your sap lines when the pump is not running and drain any excess sap from the pump. 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 the pump down and disconnect it 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 Quick 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, and you will see sap leaking from the diaphragm in and around the pump guard.

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 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, ensuring 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.

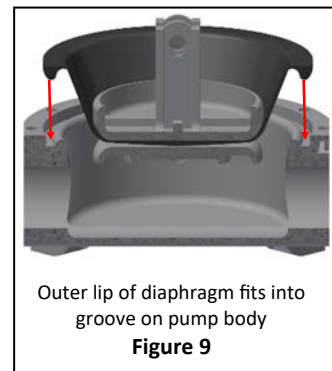
**Note:** Be sure to place the diaphragm on the plastic clevis so that the ridge running along the diaphragm's circumference is facing toward you. The other side of the diaphragm's outer edge is flat.

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

2. Secure the above with the diaphragm screw. Be sure the screw is tight. We recommend using blue Loctite on the screw to help ensure it does not come loose during pump operation.
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.



## MAINTENANCE - CHANGING PUMP VALVES

### Pump Valve Types

There are two valves in each Guzzler pump. One valve is located 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. When pressure is placed on the outside of the beak, it forces it to close; when pressure is placed on the other end of the valve, it forces the beak to open so that fluid may pass. (Figures 10A-10B) The duckbill valve on the GE-0504x series pumps is slightly larger than that on the GE-0404x pumps.

The other kind of valve available for your pump is an umbrella valve. The umbrella valve features a rubber valve 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.

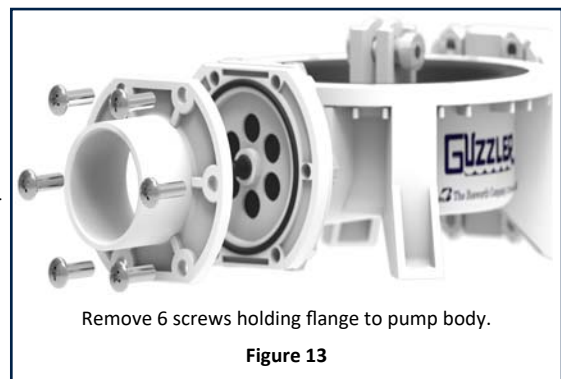
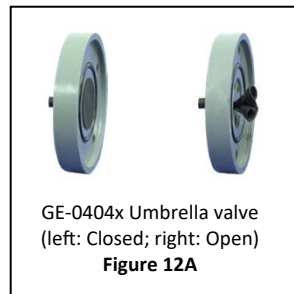
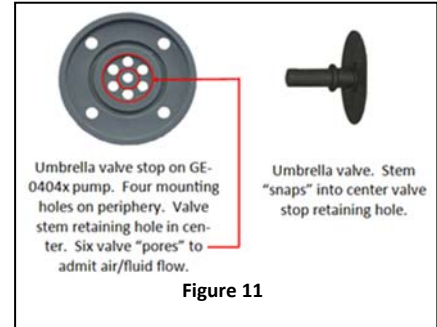
Either kind of valve can be fouled by material in the sap (e.g., wood shavings from taps, plastic shavings from tubing, etc.) that is too large to pass through the valve. When this happens, the pump will be unable to develop any vacuum. However, unlike the case of a diaphragm failure, valve malfunction will not result in any sap leaking from the pump. If you were to disconnect the pump from your tap lines and 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 re-move and replace the other valve.

### Changing the Valves

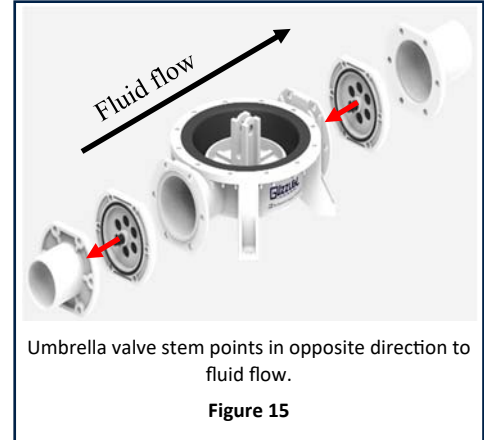
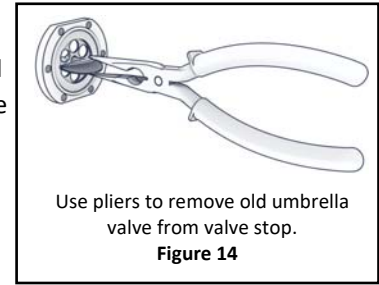
1. Follow steps 1-3 in **Removing a Diaphragm**.
2. On the GE-0504N pump, remove the 6 screws holding the inlet flange to the pump body (Figure 13). (Note: 4 screws are used on the GE-0404N pump). The umbrella valve is located between this flange and the pump body.
3. Inspect the valve for any tears. 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.



**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
<p><i>"I've got little or no vacuum on the gauge at my pump."</i></p>	<p>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.</p> <p>If the vacuum gauge doesn't go back up, then the pump is the problem. 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.</p> <p>If no sap is leaking from the pump diaphragm, then 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 the valves are at fault. 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.</p>
<p><i>"The pump was working fine and then stopped."</i></p>	<p>Inspect your power source to ensure that it is providing sufficient power. If the reset button is flashing, consult the <b>Pump Motor Protection Fault Table</b> for more specific information on the nature of the problem.</p> <p>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 and then press the "Reset" button to resume pump operation.</p> <p>The pump motor has 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. Use a vacuum/pressure relief valve available from suppliers like Grainger (www.grainger.com, Item # 5Z763).</p>



Troubleshooting, continued

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 motor develops a good deal of surface temperature when operating. 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 25 in Hg vacuum 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 <b>Pump Setup—Recirculation Line for Best Vacuum</b> ).
<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.

Pump Motor Protection Fault Table

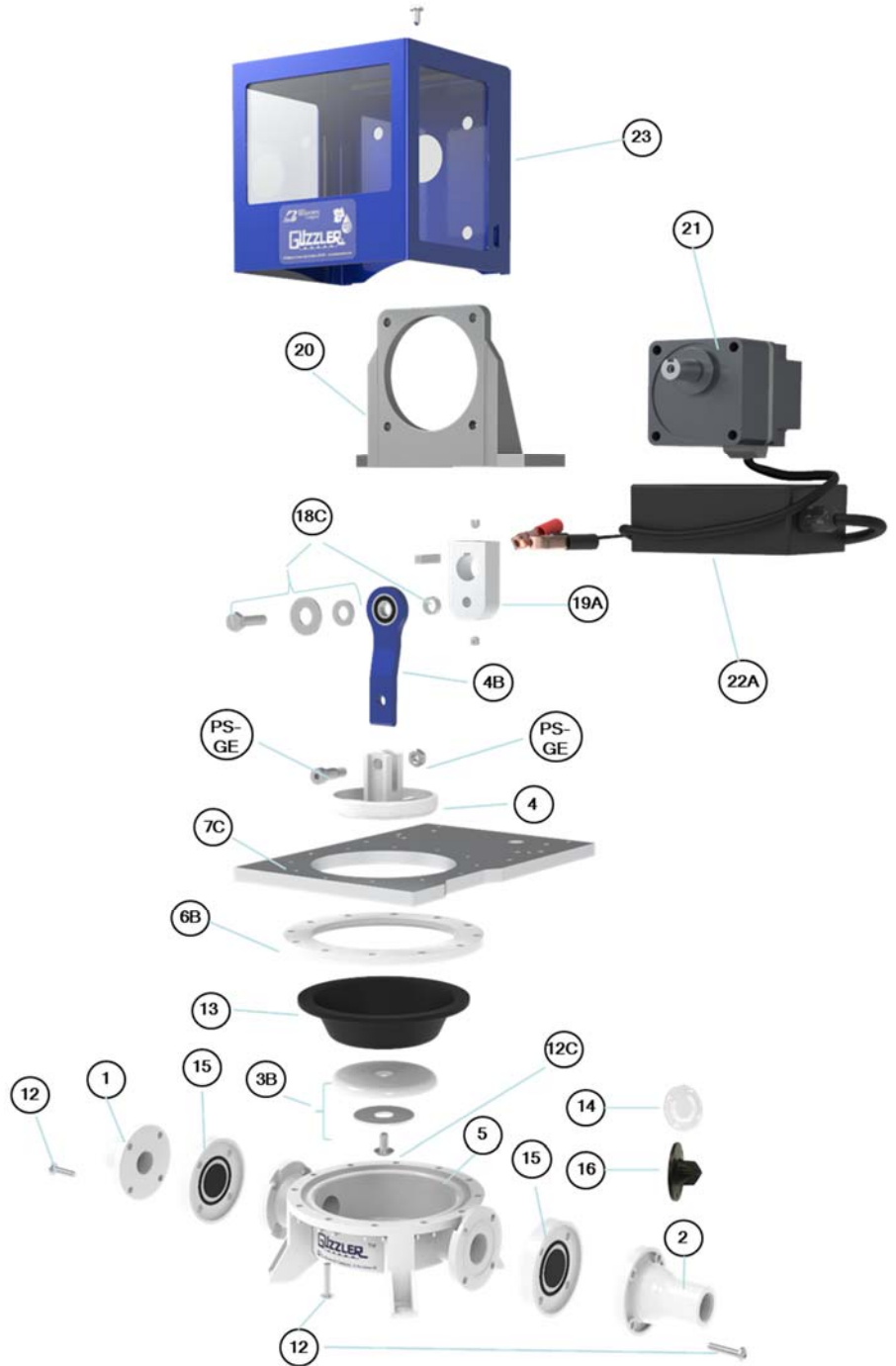
Protection Function	Number of Reset Button Flashes	Possible Causes
Overload protection	2	When a load in excess of the rated motor torque is applied to the motor for approximately 5 seconds or more
Motor sensor protection	3	When the sensor cable in the motor cable is disconnected
Over-voltage protection	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.)

**TECHNICAL SUPPORT**

For all technical inquiries, please refer to our website, [www.thebosworthco.com](http://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](mailto: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.

**PUMP EXPLODED VIEW — GUZZLER® GE-0404N**

Item #	Part Name
1	Inlet Flange
2	Outlet Flange
3B	Bottom Button & Stainless Steel Washer
4	Clevis
5	Body
6B	Intermediate Ring
7C	Motor Mounting Plate
12	Miscellaneous Hardware (10-24 Screws & Nuts)
12C	TH1/4-20x1/2 (1) Diaphragm Screw
13	Diaphragm
14	Flapper Valves
15	Umbrella Valves (Umbrella valves (2), Valve Stops (2), O-rings (4), Screws & Nuts)
16	Duckbill Valves
18C	Connecting Rod Bolt & Spacer
19A	Crank Arm (18mm with 1/4-20 Set Screws (2))
20	Motor Mounting Bracket
21	24 VDC Motor
22A	24 VDC Motor Controller
23	Pump Guard
PS-GE	Pin Set for GE pumps



**Note:**

GE-0404N is pictured.  
 GE-0404D has gray body, flanges and buttons.

Item #	Part Name
1	Inlet Flange
2	Outlet Flange
3B	Bottom Button & Stainless Steel Washer
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20	Motor Mounting Bracket
21	24 VDC Motor
22A	24 VDC Motor Controller
23	Pump Guard
PS-GE	Pin Set for GE pumps



**Note:**  
 GE-0504N is pictured  
 GE-0504D has gray body, flanges and buttons.



930 WATERMAN AVENUE  
EAST PROVIDENCE, RI 02914  
WWW.THEBOSWORTHCO.COM  
888-438-1110