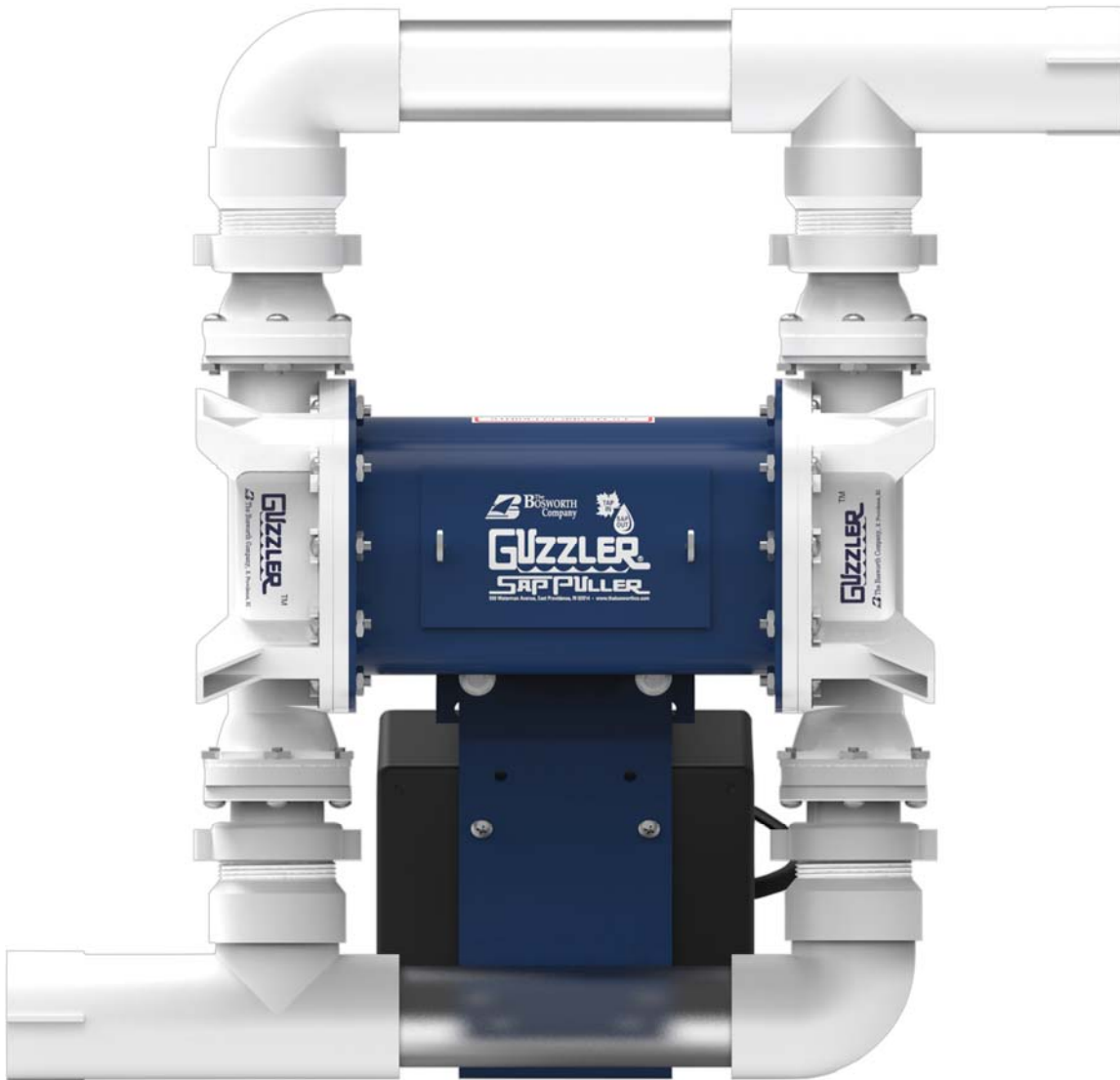




24 VDC *SAPPULLER* DOUBLE DIAPHRAGM PUMP

GUZZLER® G2-0504N



OPERATOR'S MANUAL

WWW.THEBOSWORTHCO.COM

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IMPORTANT SAFETY INFORMATION

NEVER OPERATE YOUR GUZZLER PUMP WITHOUT THE PUMP HOUSING COVER PLATE 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.

Your Guzzler G2-0504N 24 vdc diaphragm pump ships with two spare diaphragms. Additional diaphragms can be purchased through your maple equipment dealer or directly online from The Bosworth Company at www.thebosworthco.com.

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



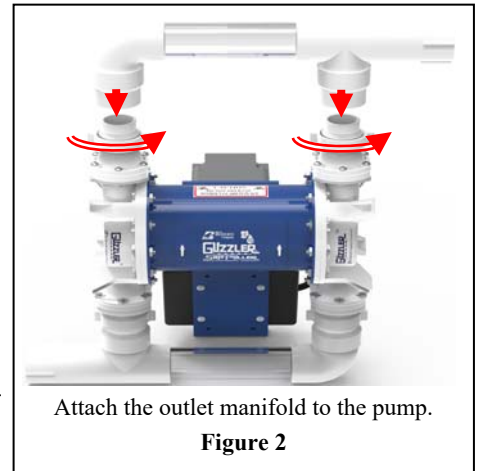
Pump serial number on side of motor
Figure 1

Assembling Your Pump

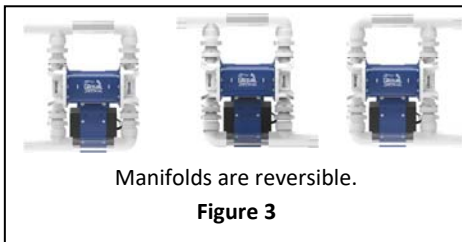
Your Guzzler G2-0504N pump ships with the outlet manifold disconnected from and packed separately in the box with the pump.

To assemble your pump, simply attach the outlet manifold to the twin pump bodies by slipping the manifold elbow and "T" fittings over the outlet flanges of the pump bodies. (Figure 2)

Secure the manifold to each pump flange by tightening the Coupler Nut (Item #10 on page 9) on the pump flange onto the threaded ends of the manifold. The nut forces the nylon sleeve against the manifold to make a secure, leak-free connection.



Attach the outlet manifold to the pump.
Figure 2



Manifolds are reversible.
Figure 3

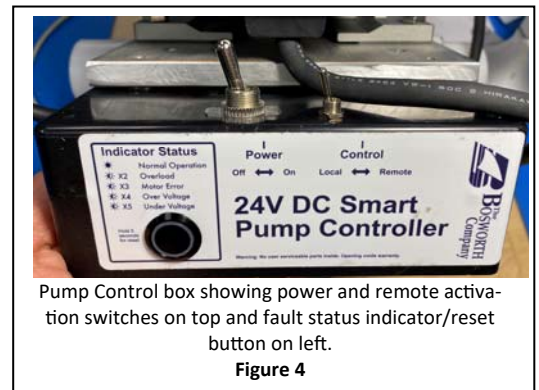
Note that you can connect the outlet manifold to your pump so that the outlet end of the manifold is on the same side as the end of the inlet manifold, or the opposite side. (Figure 3) Similarly, the inlet manifold can be

connected to your pump with the inlet end facing in either of these two possible directions. Choose an orientation for your inlet and outlet manifolds that best suits the orientation of your incoming and outgoing sap lines.

Power Requirements

The G2-0504N pump requires 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. (Figure 4) For normal operation, ensure that the smaller switch labelled "Remote" is set to "Off".



Pump Control box showing power and remote activation switches on top and fault status indicator/reset button on left.
Figure 4

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. **Be sure to connect the positive (red wire) lead from the motor to the positive terminal on the battery/power supply; the negative (black wire) motor lead, to the negative terminal.** The pump will not operate if the power leads are connected incorrectly.

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 Guzzlers feature an illuminated reset button on the side panel of the pump control box. (Figure 4) 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. Refer to the Pump Motor Protection Fault Table to determine the problem cause. Once the problem has been corrected, simply press and hold this reset button for 3 seconds to restart the pump.

PUMP SETUP

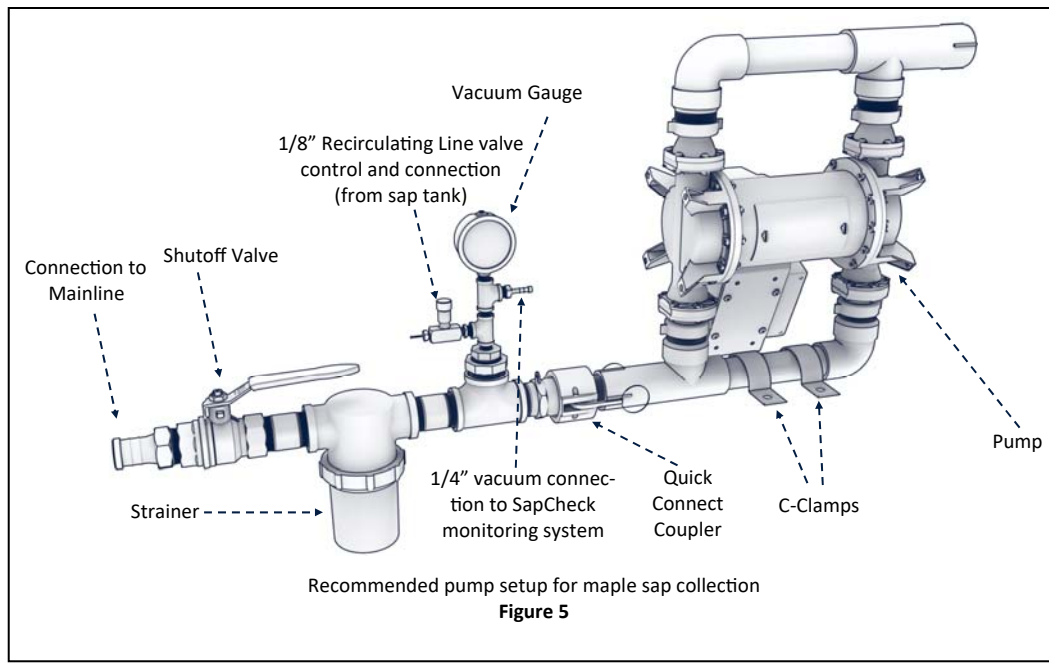


Figure 5 shows a recommended installation setup for the Guzzler G2-0504N pump when used for vacuum production on a maple sap collection line. The topics below refer to that figure in more detail.

Protect the Pump from the Elements

However you deploy your pump, ensure it is protected from the elements and securely mounted. Use the two C-clamps provided with your pump to secure the inlet flange to the mounting surface. (Figure 5) The support leg of the pump has a mounting hole that accommodates a 1/4 in (6.4 mm) diameter bolt or screw.

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 5). This will allow you to isolate the pump from your sap lines for troubleshooting 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"-1/4") recirculation line from your collection tank back to the inlet of the Guzzler (Figure 5). 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.*

Remote Operation

The 24-volt Guzzlers are equipped with a remote activation option. The pump can be either manually turned on/off 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 6). 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 7)

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



Remote Control Interface on side of Controller Box
Figure 6



Pump Control box showing manual and remote activation switches and fault status indicator
Figure 7

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.

Isolate the Pump to Find Cause of Vacuum Loss

If you experience a loss of vacuum in your system – as registered in 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.

*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.

TIPS FOR BEST OPERATION / MAINTENANCE - CHANGING A DIAPHRAGM

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 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

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

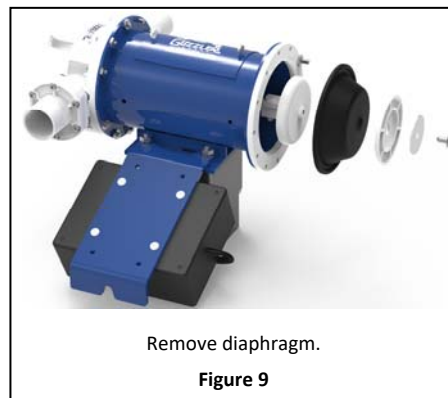
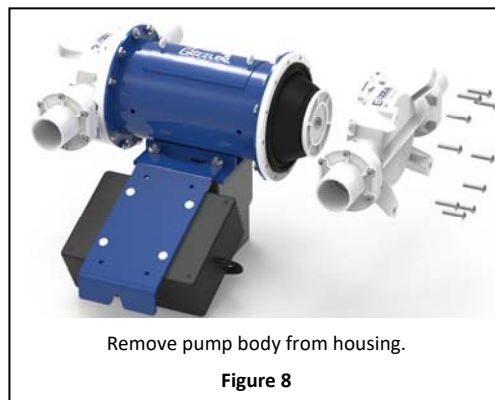
Materials Needed: Blue Loctite 242

Removing a Diaphragm

1. Disconnect the power.
2. Place the pump assembly with the motor in a vertical position.
3. Remove the manifolds by loosening the hose clamps holding the manifold to the pump flanges.
4. Remove the 10 screws holding the pump body to the housing. (Figure 8)
5. Remove the pump body to expose the diaphragm screw attaching the plastic "button" (a plastic support plate) to the diaphragm.
6. Pull the diaphragm out to its maximum travel. Remove the slotted head screw, washer, button and diaphragm from the plastic clevis. (Figure 9)

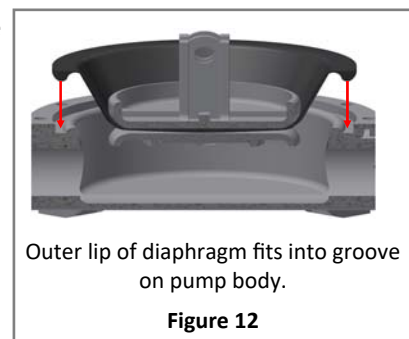
Note: If you plan to change the valves, do so now. Otherwise, go to Installing a Diaphragm.

7. Using a narrow flat-tipped screw driver, push on the stem (center) of the umbrella valve. Continue pushing the valve from the pump. (Figure 10)
8. Push the new umbrella valve (stem end first) toward the flat side of the valve stop. Ensure the valve is seated in the center hole of the valve stop. Using needle-nose pliers, pull on the valve stem from the other side until it snaps securely into place.
9. Repeat steps 7 and 8 to change the other umbrella valve.



Installing a Diaphragm

1. Place the new diaphragm onto the clevis and secure it with the button (rounded edge side toward diaphragm), washer & screw. Note: Be sure to place the diaphragm on the clevis so that the ridge running along the diaphragm's circumference is facing toward you. (Figure 11) (The other side of the diaphragm's outer edge is flat.) 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.
2. Place the pump body up against the diaphragm and align it with the holes in the housing. Be sure that the diaphragm's outer lip sits in the groove running around the circumference of the pump body. (Figure 12) (Note: Ensure the pump body is installed in the correct orientation, with the outlet facing up.)
3. Fasten the pump body to the housing 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.
4. If necessary, repeat steps 4-12 for the other pump body.
5. Replace the manifolds and tighten all hose clamps.



MAINTENANCE - CHANGING PUMP VALVES

Pump Valves

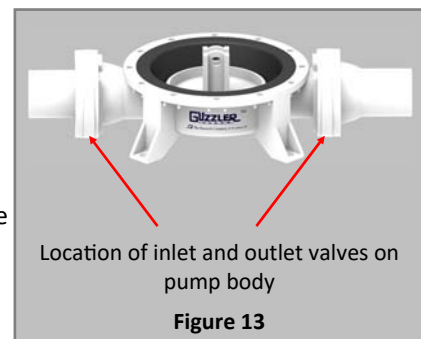
Each pump body in the Guzzler G2 SapPuller pump features a pair of valves (a total of 4 for the pump). A valve is fastened between the pump body and each of its inlet and outlet ports. (Figure 13)

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.

Removing the Valve

1. Disconnect the power.
2. Place the pump assembly with the motor in a vertical position.
3. Remove the inlet manifold by loosening the hose clamps holding the manifold to the pump flanges.
4. Remove the 6 screws holding the inlet flange to the pump body. (Figure 14) The umbrella valve is located between this flange and the pump body.

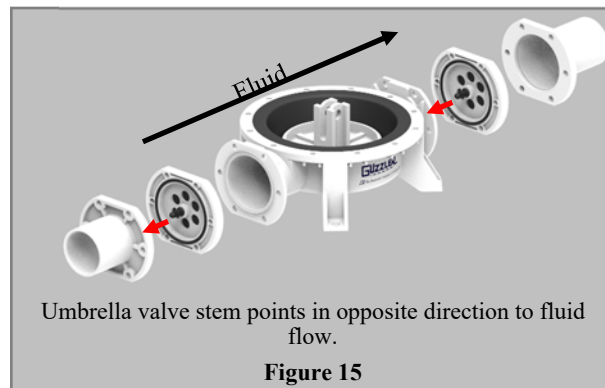
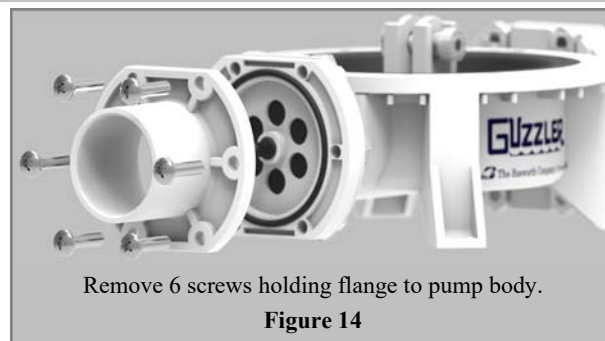


Note the orientation of the umbrella valve. The valve stem points opposite to the direction of fluid flow. (Figure 15)

MAINTENANCE - CHANGING PUMP VALVES

Installing the Valve

5. Inspect the rubber umbrella 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.
6. 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. 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.
7. Position the new umbrella valve (or the inspected and cleaned old valve) between the pump body and the pump inlet flange, taking care that the flat side of the valve is facing toward the pump body and the O-rings are in place. (Figure 15) Fasten the pump flange and the valve stop to the pump body using the 6 flange screws.
8. Re-install the inlet manifold.
9. Repeat *Removing the Valve*, from step 3, this time with the outlet side of the pump. However, when installing the umbrella valve **on the pump outlet, be sure that the flat side of the valve faces away from the pump body and toward the outlet flange.**



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>"The pump was working fine and then stopped."</i>	<p>Inspect your power source to ensure that it is providing sufficient power. If the reset button is flashing, it may be that your power source is not providing sufficient power. Consult the table on pg. 8 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>
<i>"I'm only getting 19-20 in Hg vacuum at the pump. How can I get more?"</i>	<p>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 recirculating line from your sap tank back into the inlet of the pump will help keep the pump valves wet and maximize pump vacuum. (See pg 3.)</p>

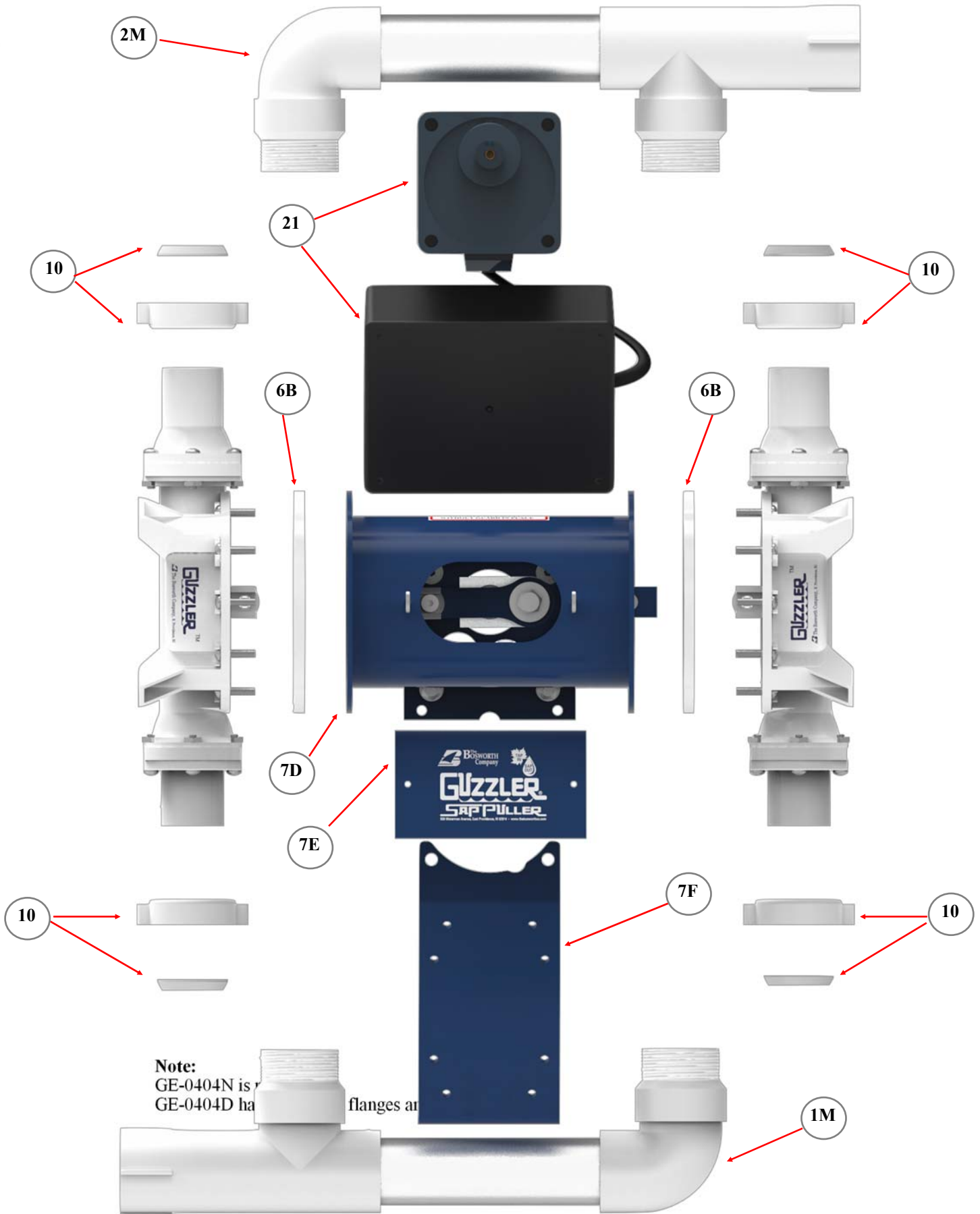
PROBLEM	WHAT TO DO
<i>"My motor is very hot. Is something wrong?"</i>	A properly operating motor can be uncomfortably hot to the touch. Even with adequate ventilation, the motors develop a good deal of surface temperature when operating. This alone does not indicate anything is wrong.
<i>"I've got little or no vacuum on the gauge at my pump."</i>	<p>If you've installed a shut-off valve in front of the gauge, 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 each 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 diaphragms, then disconnect the pump from your sap lines. Remove the pump manifolds (top and bottom) and, with the pump turned on, place your hand over the inlet/outlet of each 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>
<i>"My pump is frozen. Should I start it up?"</i>	Do not start a pump if you suspect there is ice in any of the pump bodies. Starting a pump when there is ice in the pump bodies could tear the pump diaphragm and/or damage the pump body. Allow the pump to thaw before restarting.
<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.)

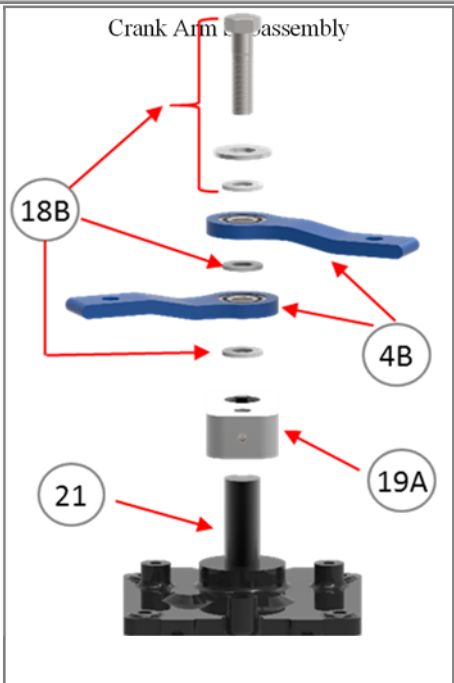
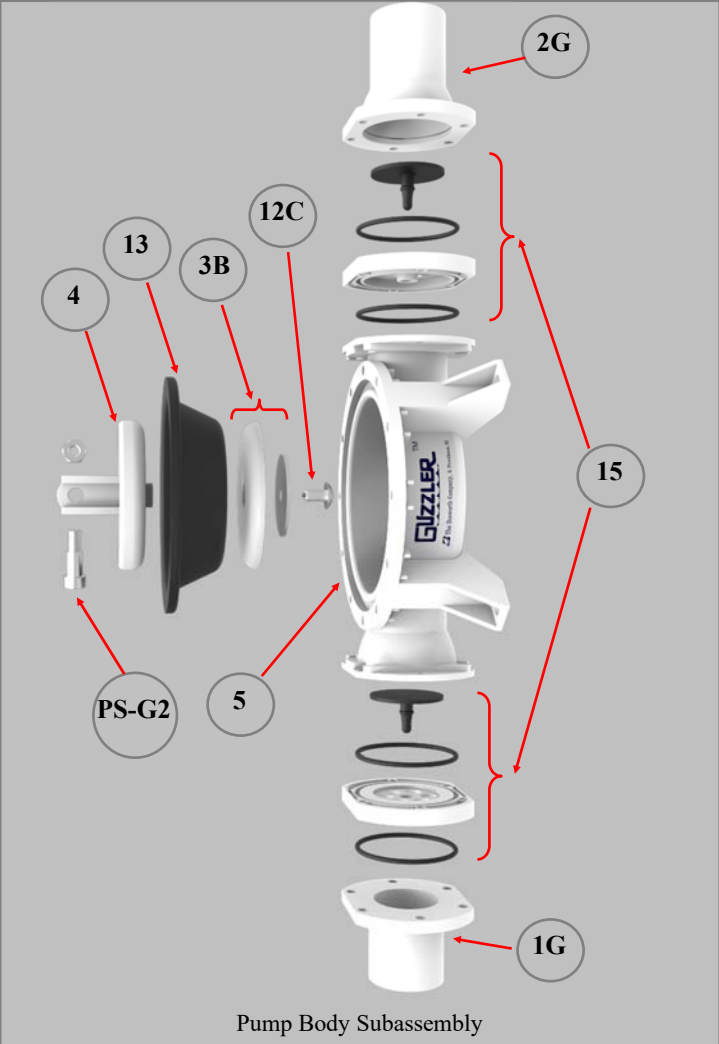
TECHNICAL SUPPORT

For all technical inquiries, please refer to our website, www.thebosworthco.com, 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.



GUZZLER G2-0504N PUMP - EXPLODED VIEW

1G	Pump Inlet Flange: 1-1/2 in smooth
1M	Pump Inlet Manifold
2G	Pump Outlet Flange: 1-1/2 in smooth
2M	Pump Outlet Manifold
3B	Button & Stainless Steel Washer
4	Clevis
4B	Connecting Rod
5	Pump Body
6B	Intermediate Ring
7D	Pump Housing
7E	Housing Cover Plate
7F	Pump Support Leg
10	Coupler Nut (4) & Nylon Sleeve (4)
12	Misc. Hardware (10-24 Screws & Nuts) (10) (connects 1 pump body to housing)
12C	Diaphragm Screw
13	Diaphragm—FDA Buna-N
15	Umbrella Valve Set: Umbrella valves (2), valve stops (2), O-rings (4), screws & nuts
18B	Connecting Rod Bolt w/washers
PS-G2	Connecting Rod-Clevis Shoulder Bolt & nut
19A	Crank Arm w set screws (2) & key
21	24 VDC GearMotor & Controller





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