



## 24 VDC *SAPPULLER* DOUBLE DIAPHRAGM PUMP

GUZZLER® G2-0504N



## OPERATOR'S MANUAL

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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](http://www.thebosworthco.com).

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

### Assembling Your Pump

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

To assemble your pump, simply attach each manifold to either side of the two pump bodies by slipping the manifold with rubber flex couplers over the flanges of the pump bodies. (Figure 2)

Secure the manifold to each pump flange with the included hose clamps to make a tight, leak-free connection.

Note that the inlet of each pump is the shorter of the two pump ports. (Figure 3).

You can connect the manifolds to your pump so that the manifold end port (inlet or outlet) faces in either direction along the axis defined by the blue pump tubular housing (Figure 4). Choose an orientation for your inlet and outlet manifolds that best suits the orientation of your incoming and outgoing sap lines. The pump assembly rests on the inlet manifold and the blue metal leg.

### 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 5) For normal operation, ensure that the smaller switch labelled "Remote" is set to "Off".

### 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.

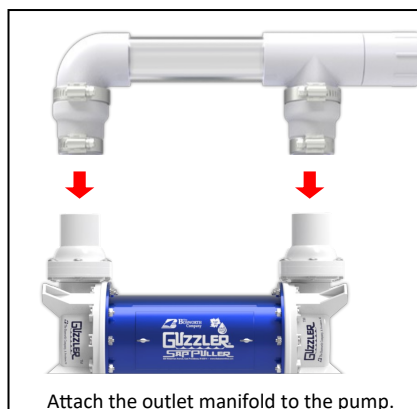
### Fault Status Indicator/Reset Button

The 24 volt Guzzlers feature an illuminated reset button on the side panel of the pump control box. (Figure 5) 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 serial number on side of motor

Figure 1



Attach the outlet manifold to the pump.

Figure 2



Outlet with bell-shape

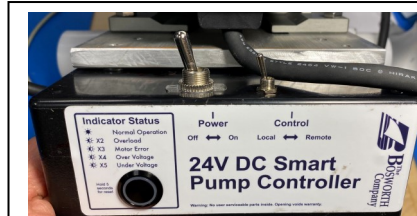
Inlet

Figure 3



G2 Manifolds are reversible.

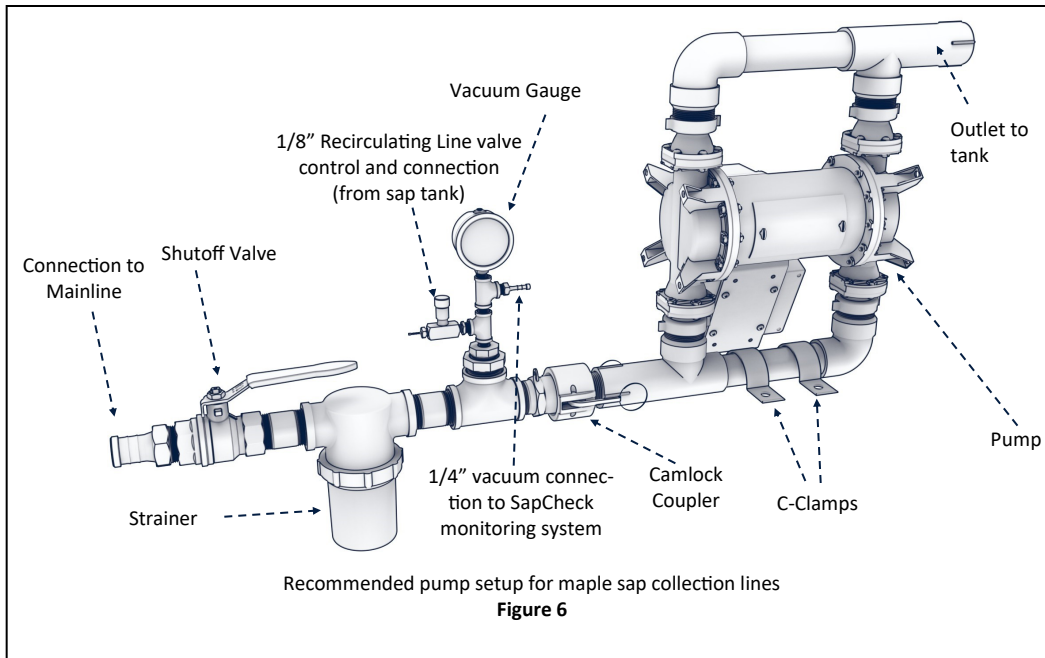
Figure 4



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

Figure 5

## PUMP SETUP



## PUMP SETUP

Figure 6 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 manifold to the mounting surface. 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. The pump motor is thermally protected and will shut off if overheated.

### Quick Connect Couplers between Guzzler and Mainline

We recommend the use of camlock 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. 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 more than 1-2 ft of 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 6). Regulate this backflow of sap by installing a small shutoff needle 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 7). 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 8)

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 7



Pump Control box showing manual and remote activation switches and fault status indicator  
Figure 8

## 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.

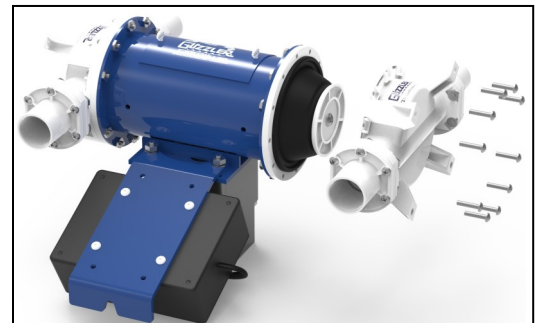
Tools Needed: Philips Head Screwdriver, Flat Head Screwdriver

Materials Needed: Blue Loctite 242

### Removing a Diaphragm

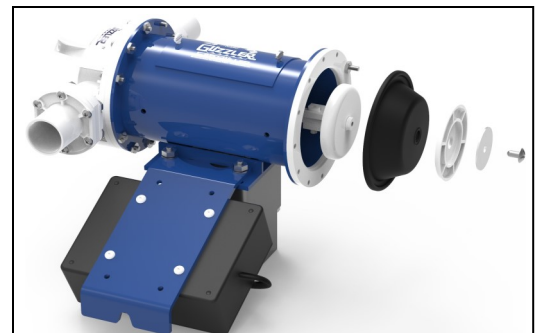
1. Disconnect the power.
2. Remove the pump/motor assembly by loosening the hose clamps on the flex couplers holding the manifolds to the pump flanges.
3. Pull the pump/motor assembly from the inlet and outlet manifolds.
4. Place the pump/motor assembly with the motor in a vertical position (Figure 9).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

*Note: If you plan to change the valves, do so now. Go to **Maintenance—Changing Pump Valves**, otherwise, go to **Installing a Diaphragm**.*



Remove pump body from housing.

**Figure 9**



Remove diaphragm.

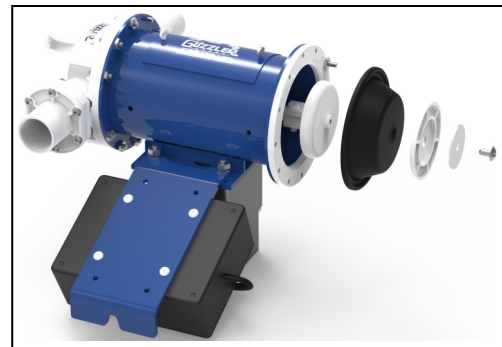
**Figure 10**

### 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 edge toward diaphragm) and stainless steel washer.

**Note:** Place the diaphragm on the clevis so that the “lip” running along the diaphragm’s circumference is facing toward you. (Figure 12)

2. Secure with 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 in the housing. The diaphragm’s outer lip should sit in the groove running around the circumference of the pump body (Figure 13).
4. With the pump body outlet port facing up, fasten the pump body to the housing using the 10 screws and nuts. Start all screws and nuts before tightening them down. When everything is aligned, tighten screws to a maximum of 30 in-lbs of torque. Tighten screws evenly in a crisscross pattern.
5. If necessary, repeat from step 5, **Removing a Diaphragm**, for the other pump body diaphragm.
6. Re-attach the pump/motor assembly, connecting the pump flanges to the manifolds, and tighten all hose clamps on the flex couplers.



Install the new diaphragm on the clevis.

**Figure 12**



Outer lip of diaphragm fits into groove on pump body.

**Figure 13**

## **MAINTENANCE - CHANGING PUMP VALVES**

### Pump Valves

Each pump body in the Guzzler G2 SapPuller pump features a pair of valves (total of 4 per pump assembly). A valve is fastened between the pump body and each of its inlet and outlet ports. (Figure 14)

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.

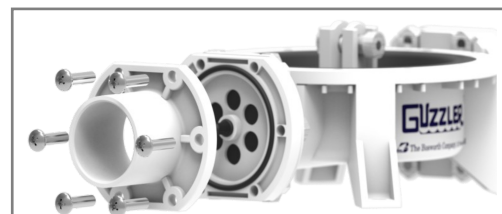
### Removing the Valves

1. Follow steps 1-5 in **Removing a Diaphragm** if not already done so.
2. Remove the 6 screws holding the inlet flange to the pump body. The umbrella valve is located between this flange and the pump body, inserted in a valve stop (Figure 15).



Location of inlet and outlet valves on pump body

**Figure 14**



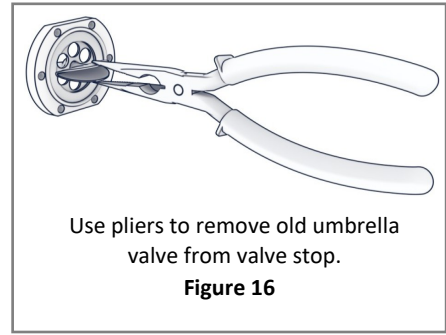
Remove 6 screws holding flange to pump body.

**Figure 15**

## MAINTENANCE - CHANGING PUMP VALVES / TROUBLESHOOTING

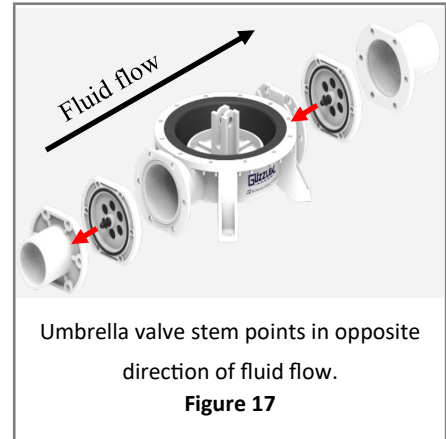
### Removing the Valves—continued

3. Remove the umbrella valve with a pair of pliers, pulling the flat of the valve until the stem is pulled through the valve stop center retaining hole (Figure 16).
4. 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 grooves of the valve stop.



### Installing the Valves

1. Insert the stem of the new umbrella valve (or the inspected and cleaned old valve) into the valve stop center retaining hole. Use pliers to grasp the stem of the valve on the other side and pull it completely through until it snaps into place.
2. Position the valve stop between the pump body and the pump inlet flange, taking care to orient it with the valve stem pointing in opposite direction of fluid flow and the valve flat toward the pump (Figure 17). Fasten the pump flange and the valve stop to the pump body using the flange screws.
3. Repeat from step 2, **Removing the Valves**, this time with the outlet side of the pump. When installing the umbrella valve on the pump outlet, be sure that the valve is oriented with the flat side of the rubber facing away from the pump body and toward the outlet flange.
4. Re-install the pump body to housing.



**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 (<a href="http://www.grainger.com">www.grainger.com</a>, Item # 52763).</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.

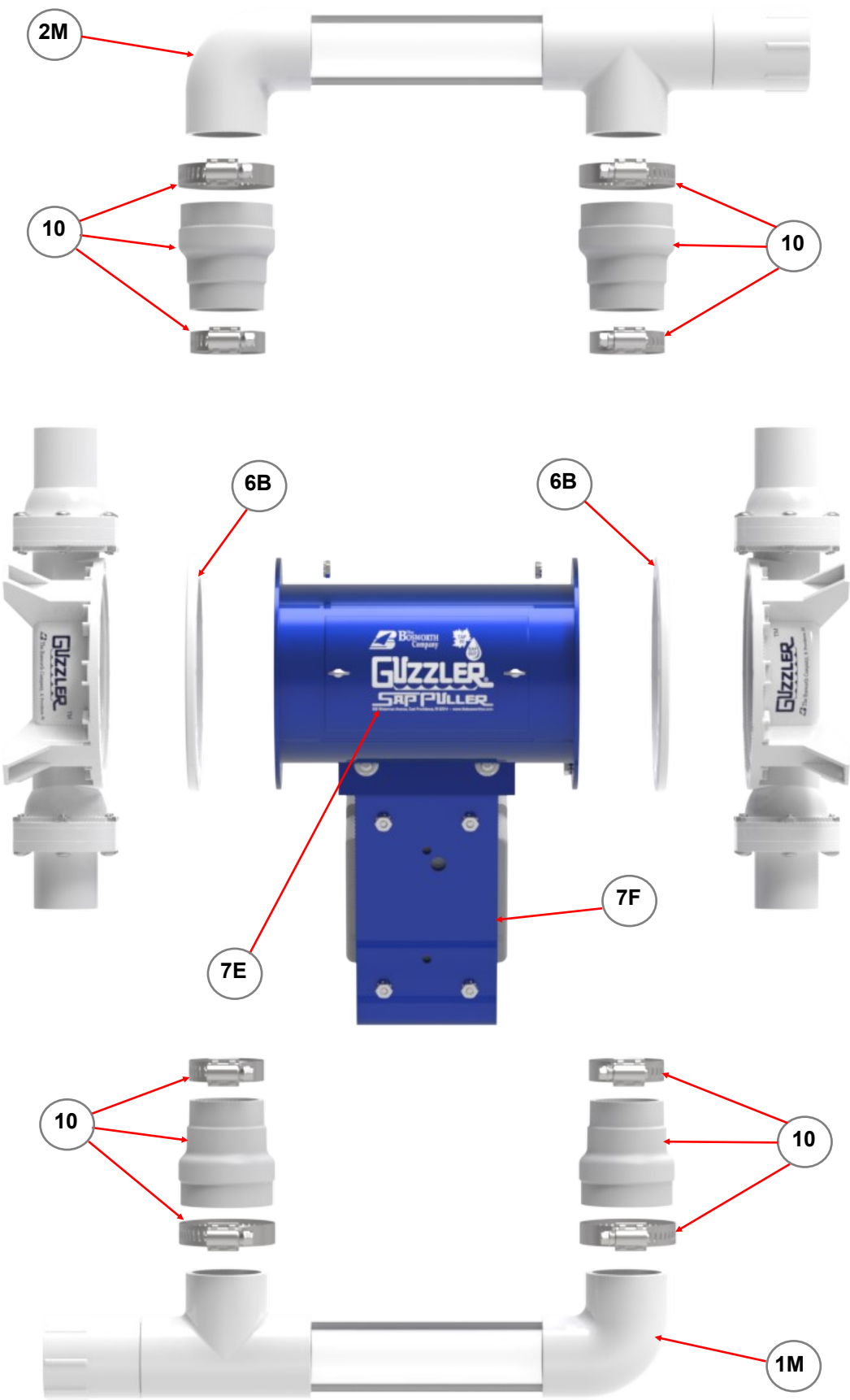
Pump Motor Protection Fault Table

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**

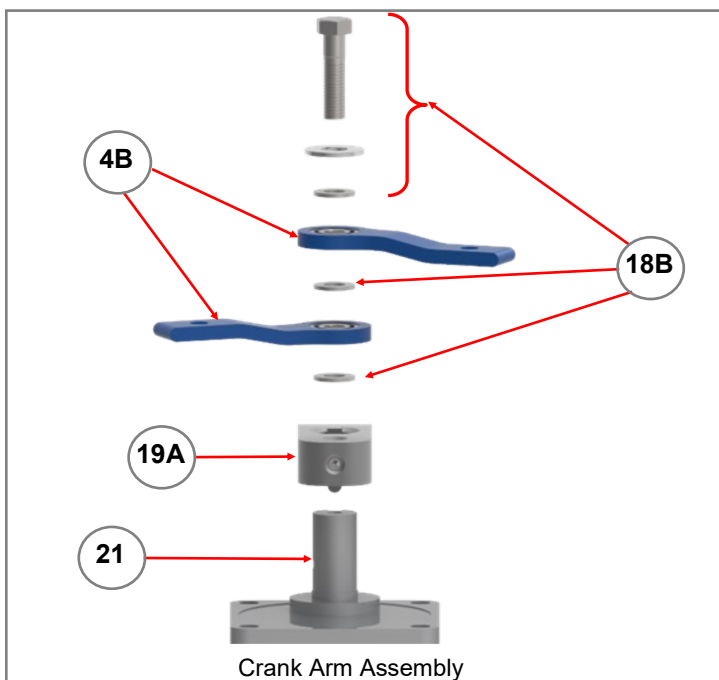
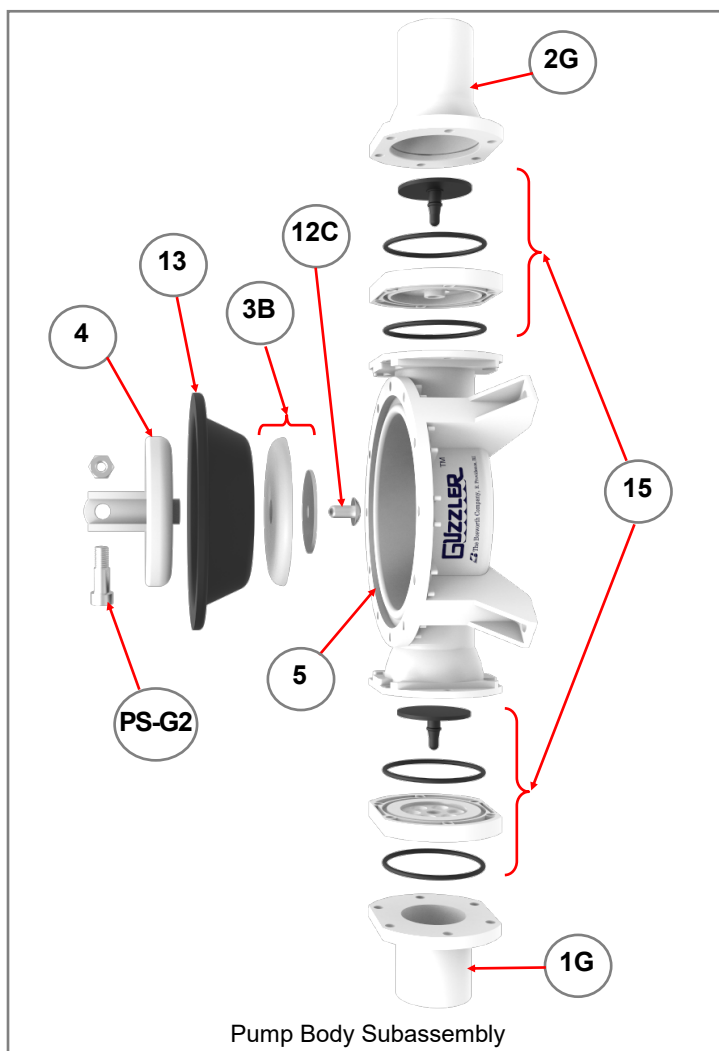
For all technical inquiries, please refer to our website, [www.thebosworthco.com](http://www.thebosworthco.com), Maple Sap Pumps Application, or contact The Bosworth Company. Be sure to have your pump serial number readily available if contacting Technical Support. You can email us at [info@thebosworthco.com](mailto:info@thebosworthco.com)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







Available Replacement Parts	
<b>1G</b>	Pump Inlet Flange: 1-1/2 in smooth
<b>1M</b>	Pump Inlet Manifold
<b>2G</b>	Pump Outlet Flange: 1-1/2 in smooth
<b>2M</b>	Pump Outlet Manifold
<b>3B</b>	Button & Stainless Steel Washer
<b>4</b>	Clevis
<b>4B</b>	Connecting Rod
<b>5</b>	Pump Body
<b>6B</b>	Intermediate Ring
<b>7E</b>	Housing Cover Plate
<b>7F</b>	Pump Support Leg
<b>10</b>	Flex Coupler & Hose Clamps
<b>12</b>	Misc. Hardware (10-24 Screws & Nuts) (10) (connects 1 pump body to housing)
<b>12C</b>	Diaphragm Screw
<b>13</b>	Diaphragm
<b>15</b>	Umbrella Valve Set: Umbrella valves (2), valve stops (2), O-rings (4), screws & nuts
<b>18B</b>	Connecting Rod Bolt w/washer
<b>PS-G2</b>	Connecting Rod-Clevis Shoulder Bolt & nut
<b>19A</b>	Crank Arm w set screws (2)
<b>21</b>	Gear Motor





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