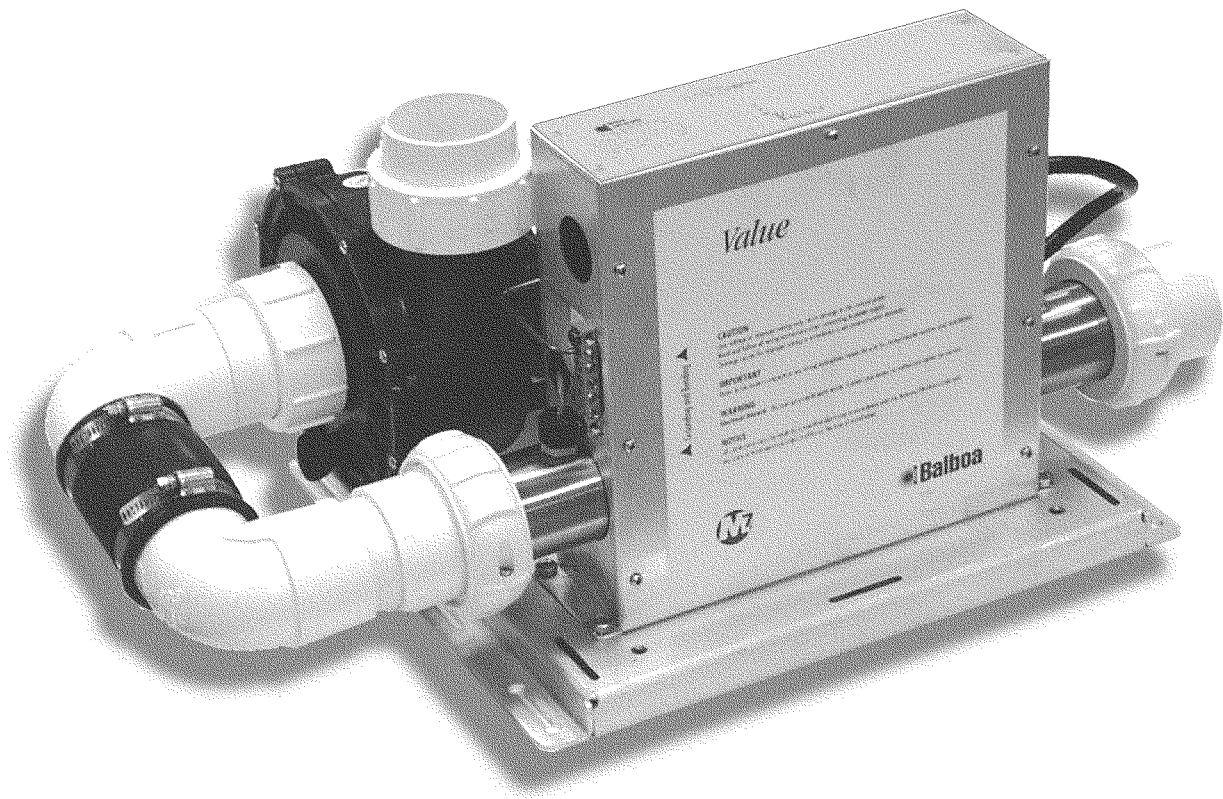
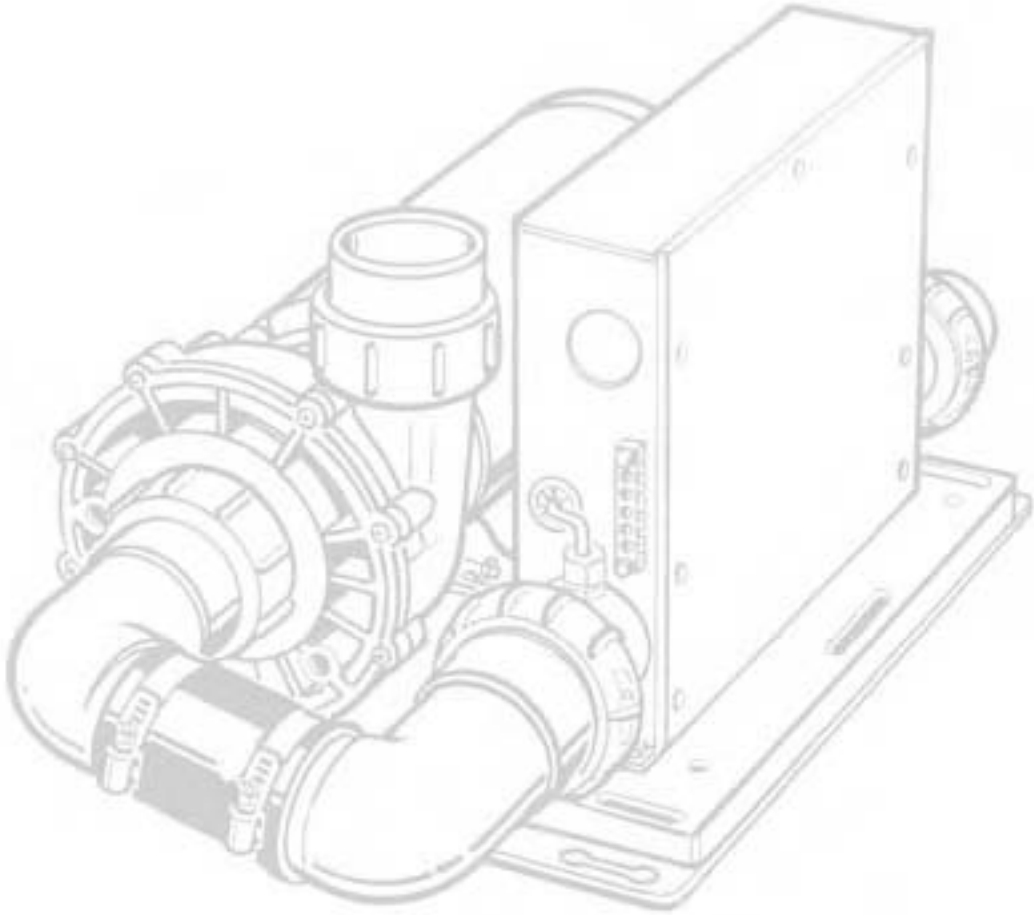


**Installation**

# *Instructions*

## **SUV Series Power Systems**





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## Warranty

Products manufactured by Balboa Instruments, Inc. are warranted to be free from defects in materials and workmanship for a period of two years from date of manufacture. Specifically excluded are misuse, abuse, and damage from improper installation. Repaired, used, and reconditioned boards are also excluded from the two-year warranty. Labor reimbursement is specifically excluded from this warranty.

### Circuit Boards

New circuit boards:	2 years from date of manufacture
Repaired circuit boards:	90 days
Used and reconditioned circuit boards:	90 days

### Control Panels

New control panels:	2 years from date of manufacture
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### Return Policy

A 25% restocking fee will apply to any product returned within 30 days. No refunds after 30 days. No refunds on any used product. No reimbursement for return shipments.

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## Technical Support

Phone: **1-800-645-3201**

Fax: **1-714-435-6862**

[www.balboa-instruments.com](http://www.balboa-instruments.com)

# Important Electrical Safety Instructions

*When installing and using these Power Systems, basic safety precautions should always be followed, including those listed below:*

## Read And Follow All Instructions

1. A bonding wire connector is provided on this Power System to accommodate the connection of a minimum No. 8 AWG ( $\approx 8.4\text{mm}$ ) solid copper conductor between this unit and any metal equipment, metal enclosure of electrical equipment, metal water pipe, or conduit within 5' (1.5 m) of the unit.
2. **DANGER - Risk of Electric Shock.** Do not permit any electric appliance, such as a light, telephone, radio, or television within 5' (1.5 m) of a spa.
3. **WARNING -** This Power System is not intended for outdoor use unless protected by the surrounding structure of a portable spa.
4. The electrical supply circuit connected to this Power System must be equipped with a suitably rated disconnect device - a circuit breaker, switch or other device capable of opening all ungrounded conductors in the supply circuit. This disconnect must be installed at least 5' (1.5 m) from the spa, but be within sight of and readily accessible to a spa user.
5. A suitably rated Ground Fault Circuit Interrupter (GFCI) must be installed in the electrical supply circuit connected to this Power System. This GFCI may also provide the disconnect function referenced in item 4 if it meets the within-sight and accessibility criteria.
6. All GFCI's require periodic testing to assure their safety features are functioning properly. Follow the GFCI manufacturer's instructions to perform the test. In the event that the GFCI fails any test or does not operate as described in the manufacturer's instructions, immediately turn all electricity to the Power System OFF and discontinue use of the spa until a qualified technician has corrected the problem.



**SAVE THESE INSTRUCTIONS • SAVE THESE INSTRUCTIONS • SAVE THESE INSTRUCTIONS**

# Important Water Safety Instructions

When installing and using these Power Systems, basic safety precautions should always be followed, including those listed below:

## Read And Follow All Instructions

1. **WARNING** - Risk of Accidental Drowning. Extreme caution must be exercised to prevent unauthorized access by children. To avoid accidents, ensure that children cannot use the spa or hot tub to which this Power System is connected unless they are closely supervised at all times.
2. **DANGER** - To reduce the risk of drowning from hair or body entrapment, assure that the suction fittings in the spa to which the Power System is connected are approved for the application and are marked with a flow rate that equals or exceeds the flow rate information provided with the Power System.
3. **DANGER** - To reduce the risk of injury, do not remove the suction fitting covers. Never operate the spa if the suction fitting covers are broken or missing. Never replace a suction fitting with one rated less than the flow rate marked on the original suction fitting.
4. **WARNING** - To reduce the risk of injury:
  - a) The water in a spa to which the Power System is connected should never exceed 104°F (40°C). Water temperatures between 100°F (38°C) and 104°F (40°C) are considered safe for a healthy adult. Lower water temperatures are recommended for young children and when spa use exceeds 10 minutes.
  - b) Since excessive water temperatures have a high potential for causing fetal damage during the early months of pregnancy, pregnant or possibly pregnant women should limit spa water temperatures to 100°F (38°C).
  - c) Before entering a spa, the user should measure the water temperature with an accurate thermometer since the tolerance of water temperature-regulating devices vary.
  - d) Prolonged immersion in water hotter than 104°F (40°C) may cause hyperthermia. Hyperthermia occurs when the internal temperature of the body reaches a level several degrees above the normal body temperature of 98.6°F (37°C). The symptoms of hyperthermia include dizziness, fainting, drowsiness, lethargy, and an increase in the internal temperature of the body. The effects of hyperthermia include: (1) unawareness of impending hazard, (2) failure to perceive heat, (3) failure to recognize the need to exit the spa, (4) physical inability to exit the spa, (5) fetal damage in pregnant women, and (6) unconsciousness resulting in a danger of drowning. **WARNING** - The use of alcohol, drugs, or medication can greatly increase the risk of fatal hyperthermia.
  - e) Leave the spa immediately if nausea, dizziness or headaches occur. Immediately cool the body by taking a cool shower or by applying cold towels or ice packs. If the symptoms persist, seek medical attention.
  - f) The use of alcohol, drugs, or medication before or during spa use may lead to unconsciousness with the possibility of drowning.
  - g) Obese persons and persons with a history of heart disease, low or high blood pressure, circulatory system problems, or diabetes should consult a physician before using a spa.
  - h) Persons using medication should consult a physician before using a spa since some medication may induce drowsiness or may affect heart rate, blood pressure, and circulation.
5. Occasional users of the spa should be made aware of these Important Safety Instructions.

**SAVE THESE INSTRUCTIONS • SAVE THESE INSTRUCTIONS • SAVE THESE INSTRUCTIONS**

# Introduction

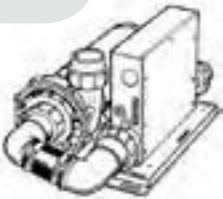
The Balboa SUV Power Systems are designed for installation into a portable spa assembly. These state-of-the-art units will provide years of trouble free operation by combining the latest technology with the finest components available.

Please take a few minutes to read the Installation Instructions in order to become familiar with the elements of a properly installed power system.

## System Configurations

### Basic System Components

Basic SUV Power System



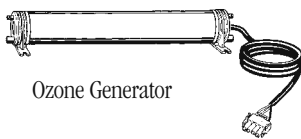
Installation Manual & Operations Card



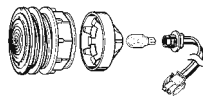
Top-Side Control Panel

### Optional System Components

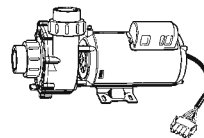
Ozone Generator



Spa Light

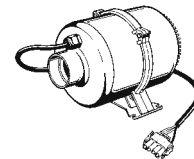


2nd Single-Speed Pump



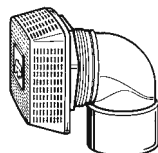
OR

Air Blower

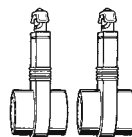


### Recommended Installation Accessories

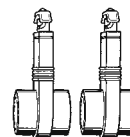
Rated Suction Fittings



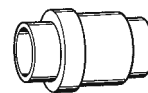
Pump 1 Shut-Off Valves



Pump 2 Shut-Off Valves



Air Blower Check Valve



Ground-Fault Circuit Interrupter/Circuit Breaker (GFCI)

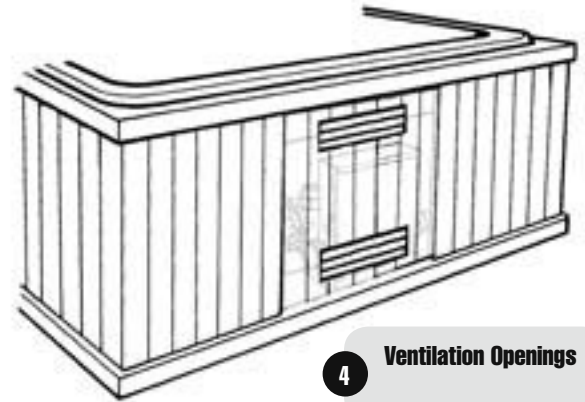


# Installation Considerations

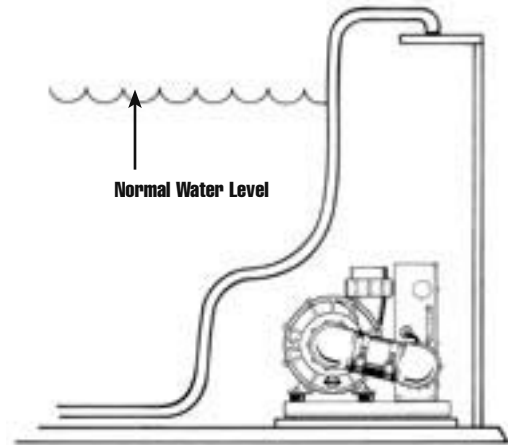
The Balboa SUV Power Systems were designed exclusively for installation into the equipment compartment of a portable spa. The skirting of the portable spa, with suitable equipment compartment doors securely fastened, serves as a barrier to prevent a spa user from coming in contact with any part of the Power System. Additionally, the skirting provides weather protection for the Power System.

The following requirements apply to all installations. Specific information pertaining to plumbing, electrical and installation of accessory items is provided in other sections of this manual dedicated to those subjects.

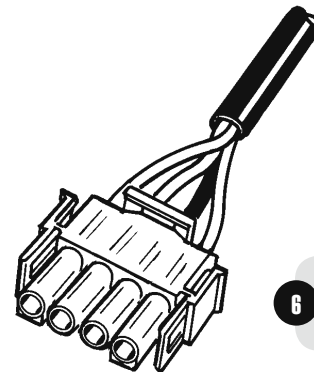
1. The Power System must be installed on a firm, level surface provided by the cabinet of the spa.
2. The area in which the Power System is mounted must have adequate drainage to prevent flooding of the equipment under all circumstances. A minimum of 4" measured from the spa supporting surface (concrete slab or deck) to the lowest electrical part of the power system (the pump motor) or to any of the power system accessories must be provided.
3. If the spa in which the Power System is to be installed is indoors, precautions must be taken to assure that floors, walls, carpeting and nearby furnishings are protected. Water splash during normal spa use, as well as the possibility of water drip and flooding that might occur due to a defect in the spa's plumbing, must be considered.
4. The equipment compartment in which the Power System is installed must have adequate ventilation. A minimum of 64 square inches of ventilation openings should be provided with all Power System configurations. (Mandatory on all 2 pump configurations). Ideally, this is accomplished by having two 32 square inch openings located as shown. **The ventilation openings must be rain proof.** This configuration will assure proper cooling of the Power System.
5. The pump(s) provided with the Power System are not self-priming and must be installed below the normal water level of the spa regardless of the equipment compartment configuration. The discharge or pressure portion of the circulation plumbing should slope upwards to the spa. This will help prevent air from being trapped in the pump and will aid the process of priming the pump each time the spa is drained and refilled.
6. All devices such as the pumps, air blowers, ozone generators, and lights that are controlled by the Power System are connected to the unit via electrical receptacles mounted on the printed circuit board of the Power System. The plugs that mate with these receptacles



4 Ventilation Openings



5 Pump Installed Below Water Level

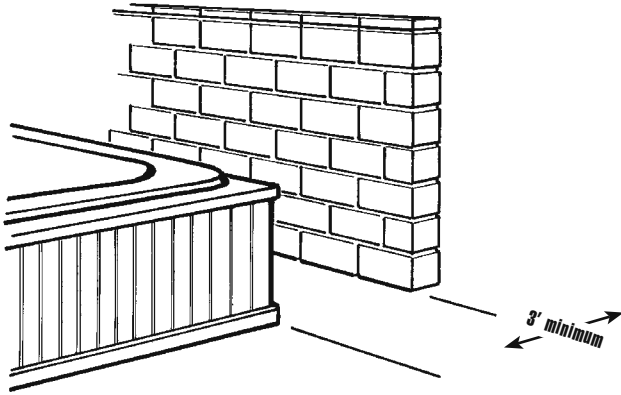


6 AMP "Mate-N-Lok" Series Plug (4 Pin shown)

*continued on next page*

# Installation Considerations

## Parameters for equipment side of spa **7**



are commonly referred to by their manufacturer's designation - AMP "Mate-N-Lok" plugs. Additional information is included on pages 10 through 13. If existing components are to be connected to these Power Systems, their electrical plugs must be of this style.

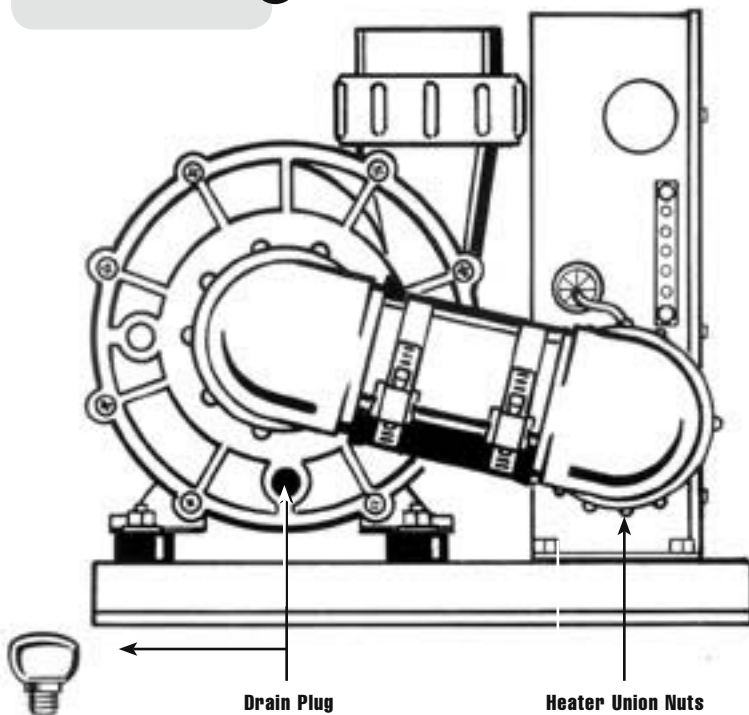
7. The portable spa should be installed with a minimum of 3' (1 meter) of free, unobstructed space between the opening of the equipment compartment and any wall, fence or other permanent structure.  
This will allow for ease of installation of the Power System into the equipment compartment, and provide the necessary access space for regular maintenance and service activities in the future.
8. It is mandatory that an insulated spa cover be used on the portable spa to which the Power System is connected. There are several benefits:
  - a. The spa water will be cleaner, free from air-borne particles and require far less sanitizing chemicals.
  - b. The Power System will be able to maintain the desired temperature of the spa water with significant savings in electricity.
  - c. The cover will provide a barrier to prevent access to small children and to all intruders if the cover has a locking feature.
9. If the Power System is installed in a spa that is subjected to freezing temperatures, consideration must be given to protecting the Power System, and the portable spa and its plumbing, from freeze damage. The temperature of the water in the spa may be maintained at a point above freezing throughout the freezing period, or the spa may be drained and taken out of service.

The steps to drain the spa vary with the spa manufacturers, and may entail the use of an auxiliary sump pump, the use of a siphon hose, or possibly by attachment of a drain hose to a fitting within the spa plumbing.

Regardless of the method used to drain the spa, steps must be taken to drain the Power System as well. A threaded drain plug is provided in the front of the Power System's primary and secondary pumps for this purpose.

After the spa has been drained, drain the pump by removing the drain plug in the pump. Drain the heater by loosening the heater union nuts enough to allow water in the heater to drain.

## Draining the Spa **9**



**NOTE:** The Power System will use the sensors within the heater to protect against freezing. If conditions exist in the spa circulation system that are not represented by the sensors in the heater, an optional air temperature sensing auxiliary freeze sensor is available. This sensor can be remotely mounted to protect isolated pumps or piping. Call Balboa for details.



# Power System Installation

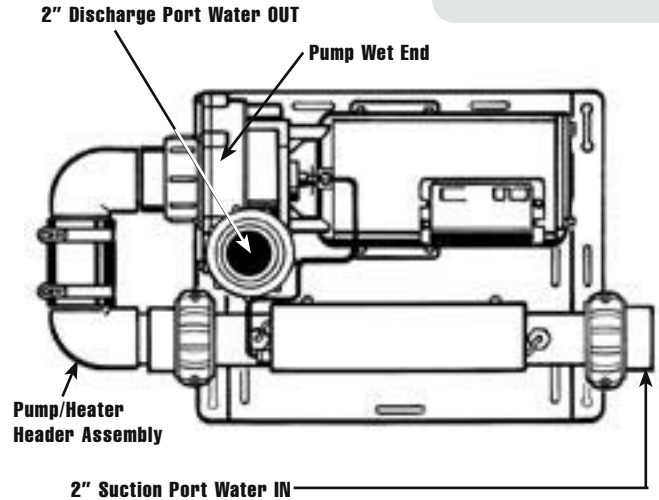
The Balboa SUV Power Systems may be plumbed with the pump facing either to the left or to the right. This versatility can significantly simplify the installation of these Power Systems, particularly into spas with existing plumbing systems.

The “Pump - Right” and “Pump - Left” designations refer to the direction that the wet end of the pump is facing, as shown on the diagram at the right.

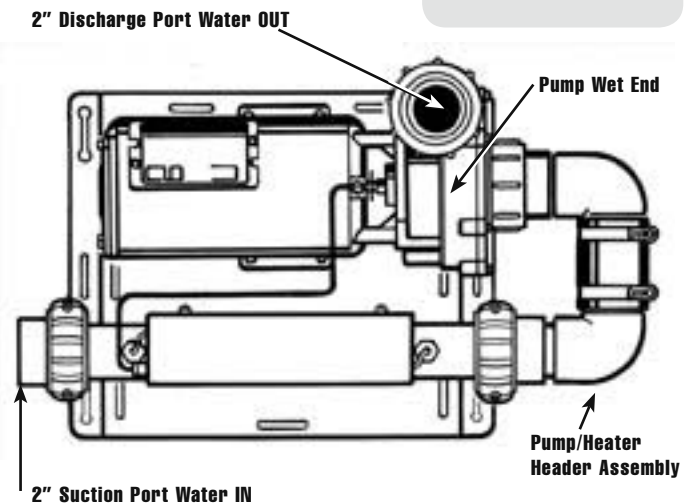
All SUV Power Systems are shipped from the factory in the Pump - Left configuration. Instructions for converting the Power System to a Pump - Right configuration are given below.

1. Loosen the union nuts at each end of the pump/heater header assembly until the header assembly can be removed completely. Set the header assembly aside.
2. Loosen the union nut on the right side of the heater and remove the heater union tailpiece. Set the tailpiece aside.
3. Loosen the screw in the bonding lug on top of the motor and remove the bonding wire from the lug. (The other end of the bonding wire should remain attached to the bonding lug on the control system enclosure.)
4. Loosen and remove the four pump mounting nuts from the motor base. (A  $\frac{7}{16}$ " socket wrench may be used.) Set the nuts aside.
5. Lift the pump/motor straight up and off of the mounting studs. Turn the pump/motor end-for-end and place it down onto the mounting studs.
6. Thread the four nuts onto the mounting studs. Do not tighten the nuts at this time.
7. Reassemble the header assembly to the pump and heater in the following sequence:
  - a. Attach the header assembly to the heater union nut at the right side of the heater. Do not tighten the union nut at this time.
  - b. Move the pump as necessary to make the header assembly align with the pump suction port. Thread the pump union nut onto the pump suction port. Move the pump as necessary to allow the union nut to turn easily. Be careful not to cross-thread the union nut onto the pump port.

**Pump - LEFT Configuration**

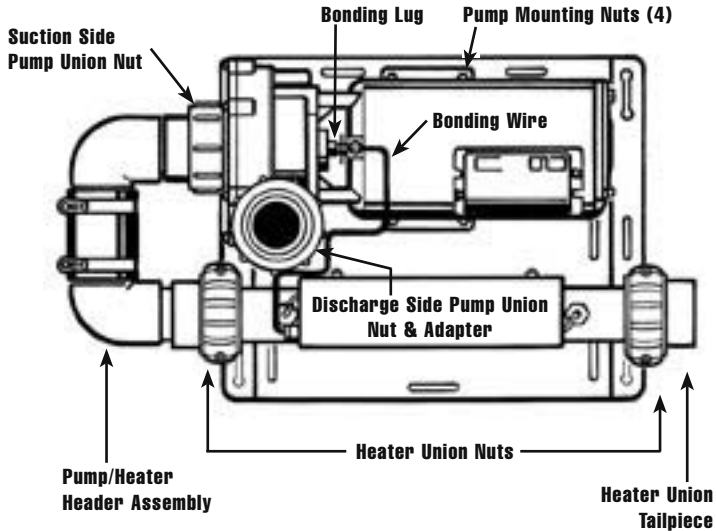


**Pump - RIGHT Configuration**



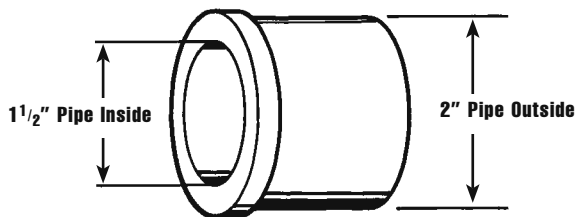
# Power System Installation

## Pump Parts



## Plumbing Connections

10



- c. Alternately tighten both the pump union nut and the heater union nut until they are tight.
  - d. While holding the pump in place, tighten the four pump/motor mounting nuts.
  - e. Reattach the bonding wire into the bonding lug on top of the motor and tighten the screw firmly. Check the other end of the bonding wire to assure it has not become loose. Tighten as necessary.
8. The Power System is now ready to be plumbed into the plumbing system of the spa.
  9. To assure adequate performance, the spa plumbing must be 1½" minimum. The use of 2" is highly recommended. Either schedule 40 or flexible PVC pipe is acceptable.
  10. All of the plumbing connections in the SUV Power Systems are standard 2" pipe size. If the spa plumbing is 1½", reducer bushings, as shown, are available to allow the connection of the 1½" pipe into the 2" fittings.
  11. To prevent solvent cement from dripping into the pump and causing permanent damage, the union tailpieces and adapters should be removed from the pump, bonded to the plumbing, then reconnected to the pump after the joints are thoroughly dry.
  12. A good grade of fresh PVC-to-PVC primer and solvent cement should be used for all water plumbing connections.
  13. It is recommended that shut-off valves be installed in the suction and discharge lines, as shown on page 9.

# Power System Installation

**14.** There may be three separate plumbing systems in the spa. Inspect the various pipes to determine the correct function of each pipe, as follows:

- a. Suction Side Plumbing - this plumbing will go to the spa's skimmer, main drain in the floor or suction fittings mounted in the spa's walls. This plumbing connects to the suction port (open end of heater) on the Power System.
- b. Discharge Side Plumbing - this plumbing will go to the spa's hydrotherapy jet fittings and massage fittings. This plumbing connects to the discharge port on top of the pump in the Power System.
- c. Air Blower Plumbing - this plumbing will go to an air channel under the floor of the spa or to an air distribution manifold. This plumbing connects only to an air blower. Information on installing an air blower is on Page 11.

**15.** To assure the safest operation of the spa, the suction fittings connected to the suction port of the Power System must be listed or approved for the purpose. Additionally, the fittings must be marked with a flow rating no less than specified on the **Maximum Flow Rate Label** affixed to the top of the Power System.

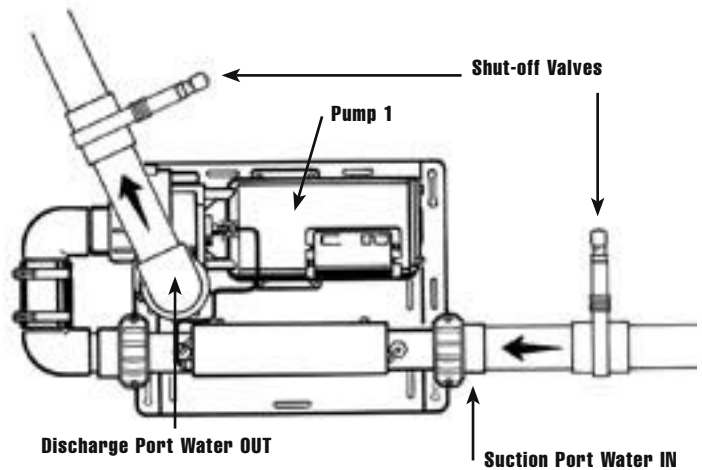
**16.** If suction fittings rated less than the specified ratings are used, or if pumps other than those specified by Balboa are used, the complete spa assembly must be flow tested to determine the suitability of the suction fittings.

**17.** Suction fittings in existing spas must be replaced with appropriately rated suction fittings if existing fittings are rated less than the specified ratings and the complete spa assembly is not flow tested to determine the suitability of the existing fittings.

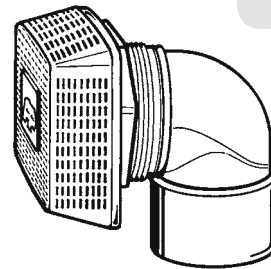
**18.** Each pump must be provided with a minimum of two suction fittings, or a pump can be provided with a suction fitting and a skimmer. Pump 1 is generally connected to a suction fitting and a skimmer, while Pump 2 is generally connected to two suction fittings.

**19.** After plumbing is complete, secure the Power System to the spa cabinet with appropriate screws. Remember to provide 4" of clearance between the spa supporting surface (concrete slab or deck) and the lowest electrical part of the Power System (the pump motor).

## 14 Pump-with Shut-off Valves



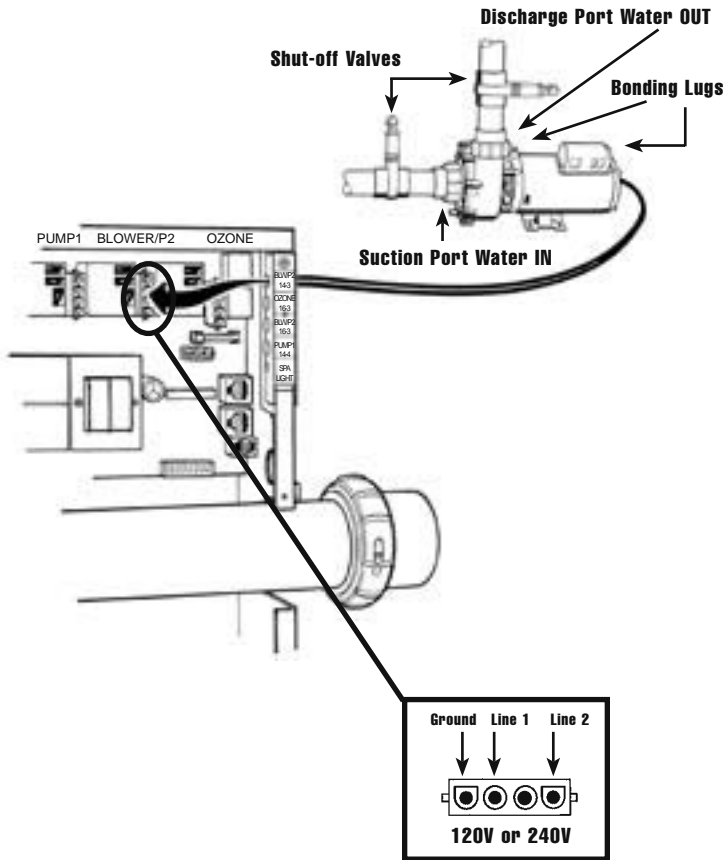
## 18 Typical Suction Fitting



**NOTE:** This is a typical Suction Fitting. Two Fittings or One Fitting and One Skimmer are required for each pump

# 2nd Pump Installation

## 2nd Pump



**NOTE:** You may connect a single-speed Pump 2 or a blower to the output labeled Pump2/Blower. You cannot connect both.

**NOTE:** The amperage requirements of the 2nd pump must be added to the amperage requirements of all other electrical components in order to complete the electrical installation. See page 26, Electrical Connections (3), for details.

An optional single-speed hydrotherapy jets booster pump—commonly referred to as “Pump 2,” is available for connection to the Balboa SUV Power System. Pump 2 connects to the output receptacle located on the printed circuit board of the power system labeled Pump2/Blower. You may connect a single-speed Pump 2 or a blower to this output if amperage ratings as determined by the power supply are not exceeded. You cannot connect both a second pump and a blower. The Power System will provide 120V or 240V electrical power and control circuitry for the 2nd pump.

An existing 2nd pump may be connected to the Power System if equipped with the correct electrical cord and connecting plug and amperage ratings as determined by the power supply are not exceeded. The following installation instructions apply to any 2nd pump that might be used.

1. To assure the safest operation of the spa, the suction fittings connected to the suction port of the 2nd pump must be listed or approved for the purpose. Additionally, the fittings must be marked with a flow rating no less than that specified on the **Maximum Flow Rate Label** (see page 9).
2. If suction fittings rated less than the specified ratings are used, or if pumps other than those specified by Balboa are used, the complete spa assembly must be flow tested to determine the suitability of the suction fittings.
3. Suction fittings in existing spas must be replaced with appropriately rated fittings if existing fittings are rated less than the specified ratings and the complete spa assembly is not flow tested to determine the suitability of the existing fittings.
4. Each pump must be provided with a minimum of two suction fittings or a pump can be provided with a suction fitting and a skimmer. Pump 1 is generally connected to a suction fitting and a skimmer while pump 2 is generally connected to two suction fittings.
5. Please refer to Page 8, items 9-14, for information on making the plumbing connections to the 2nd pump.
6. Secure the pump with appropriate screws. Remember to provide 4" of clearance between the spa supporting surface (concrete slab or deck) and the pump motor.
7. Electrical connection to the 2nd pump is accomplished by inserting the attachment plug at the end of the 2nd pump cord into the receptacle labeled “Pump2/Blower” located on the printed circuit board of the power system. Check the electric data label on the pump to determine whether the pump requires a 120V or a 240V connection, and then verify that the power system is configured to supply the correct voltage. Push the plug firmly into the receptacle until the locks on each side of the plug snap into place.
8. A bonding wire must be connected from the bonding lug on the pump to the bonding wire terminal block on the side of the Power System enclosure. Solid copper wire (no smaller than #8 AWG) is required for this bonding connection (#6 AWG in Canada).

# Air Blower Installation

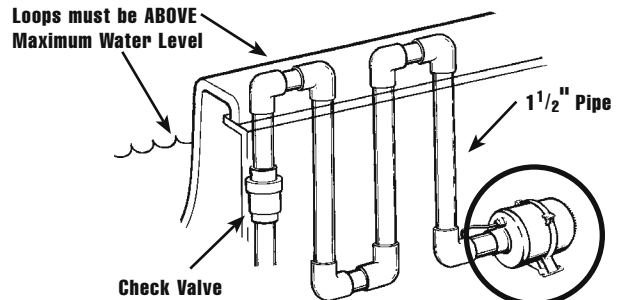
An optional air blower is available for connection to the Balboa SUV Series Power Systems. An existing air blower, if equipped with the correct electrical cord and connecting plug, may also be used. The blower connects to the output receptacle located on the printed circuit board of the power system labeled Pump2/Blower. You may connect a single-speed Pump 2 or a blower to this output if amperage ratings as determined by the power supply are not exceeded. You cannot connect both. The Power System will provide either 120V or 240V electrical power and control circuitry for the air blower.

An existing blower with an amperage rating not exceeding 7 amps may be connected to the power system if equipped with the correct cord and connecting plug.

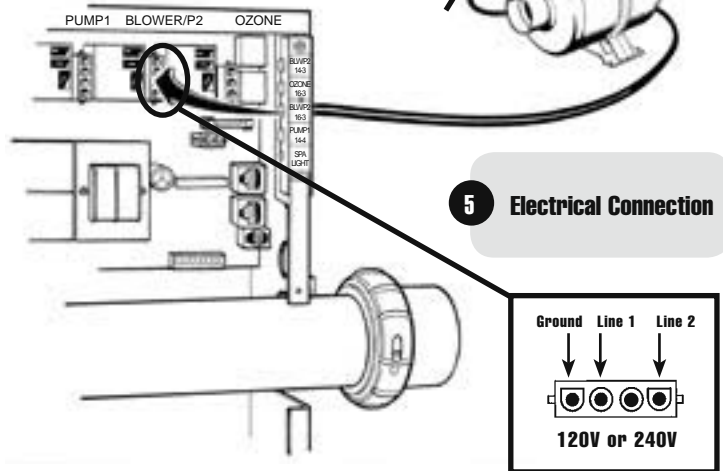
The following installation instructions apply to any air blower that might be used:

1. The air blower may be mounted either vertically or horizontally and must be positioned in such a manner as to ENSURE THAT WATER CANNOT ENTER THE AIR BLOWER MOTOR. This can be accomplished by installing a double air loop that incorporates a check valve, as shown at right.
2. The air blower must be connected ONLY to a spa's air distribution piping which is connected to air holes in the floor or seats of the spa. Connection of the air blower to any air piping associated with the spa hydrotherapy jets will create a hazard by providing a path for high-pressure water to be forced back into the air blower. This will result in damage to the air blower and possibly create an electrical shock hazard.
3. The air blower must be securely mounted to a structural member of the spa to prevent movement during operation.
4. Do NOT use any form of solvent cement or glue when connecting the spa piping to the air blower. Instead, install screws supplied with the blower to mechanically fasten the blower to the piping.
5. Electrical connections to the air blower are accomplished by inserting the attachment plug at the end of the air blower cord into the receptacle labeled Pump2/Blower located on the printed circuit board of the power system. Check the electric data label on the air blower to determine whether the air blower requires a 120V or a 240V connection, and then verify that the power system is configured to supply the correct voltage. Push the plug firmly into the receptacle until the locks on each side of the plug snap into place.
6. If the air blower is equipped with a bonding lug, a bonding wire must be connected from that bonding lug to the bonding wire terminal block on the side of the control system enclosure. Solid copper wire (no smaller than #8 AWG) is required for this bonding connection (#6 AWG in Canada).

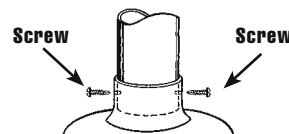
## 1 Double Air Loop



## 5 Electrical Connection



## 4 Plumbing Connection to the Air Blower

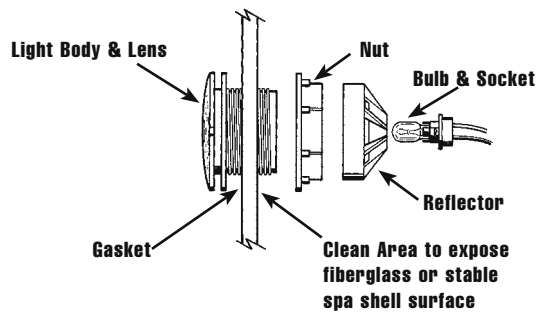


**NOTE:** The amperage requirements of the air blower must be added to the amperage requirements of all other electrical components in order to complete the electrical installation. See page 26, Electrical Connections (3), for details.

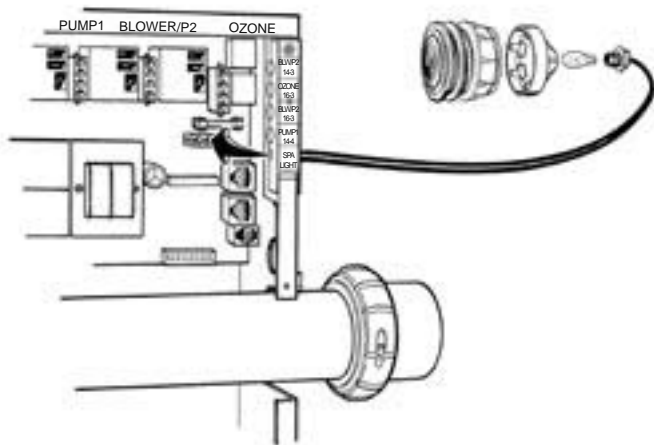
# Spa Light Installation

**NOTE:** If there is an existing light in the spa, an attempt should be made to mate the new reflector and/or bulb and socket parts from the spa light kit to the existing light's body. This will eliminate the need for removing the existing light body from the spa wall. Skip to instruction #7 if an existing light body is to be used.

## Light Assembly



## Electrical Connection



**NOTE:** If a light is not to be installed, a figure of 0.1 amp may be deducted from the total amperage requirement of the Power System. See page 26, Electrical Connections (3), for details.

An optional 12V spa light is available for connection to the Balboa SUV Series Power Systems. An existing 12V spa light, if equipped with the correct electrical cord and connecting plug, may also be used. The Power System will provide electrical power and control circuitry for the spa light.

1. Select the mounting location for the spa light in a flat area of the spa wall. Many spas have a flat area molded into the spa wall for this purpose.
2. Inspect the outside of the spa wall at the selected point to assure that there is no plumbing, wiring, or other obstructions that would interfere with the installation of the light body.
3. Using a suitable 2 1/2" (65 mm) diameter hole-saw, cut the hole in the spa wall. Cut from the inside of the spa wall toward the outside to prevent splintering of the spa wall's inner surface.
4. On the outside of the wall, remove any insulating material or other coating from around the hole for a distance of 1/2" (13 mm).
5. Place the gasket onto the light body, then insert into the hole. Alternately, discard the gasket and seal the light body to the spa wall with an appropriate silicone sealant for use with polycarbonate and ABS plastics.
6. Install the nut onto the light body and tighten clockwise. Do not over tighten the nut; doing so might break the light body.
7. Push the reflector onto the end of the light body and twist clockwise until it snaps into place.
8. Push the bulb and socket assembly into the hole on the rear of the reflector and twist clockwise. The assembly will snap into place in the reflector.
9. Insert the attachment plug at the end of the light wires into the receptacle labeled "Light" located on the printed circuit board of the power system. Push the plug firmly into the receptacle until the locks on each side of the plug snap into place.
10. When filling the spa, it is recommended that the water level be stopped just above the level of the spa light until a thorough inspection determines that there are no leaks around the light. If silicone sealant is used to seal the light to the spa wall, be sure to allow adequate time for the sealant to cure before filling the spa.
11. Replacing the spa light bulb:  
With access to the back of the spa, turn off all electric power to the spa. Twist the bulb and socket assembly counter-clockwise and pull the assembly out of the reflector. Do not pull on the wires. Pull the bulb straight out of the socket and replace with a standard automobile type #912 bulb.

# Ozone Generator Installation

All of the SUV Series Power Systems provide control circuitry and electrical receptacles for connection of an ozone generator. The power system can be configured to provide 120V or 240V for the ozone generator as may be required.

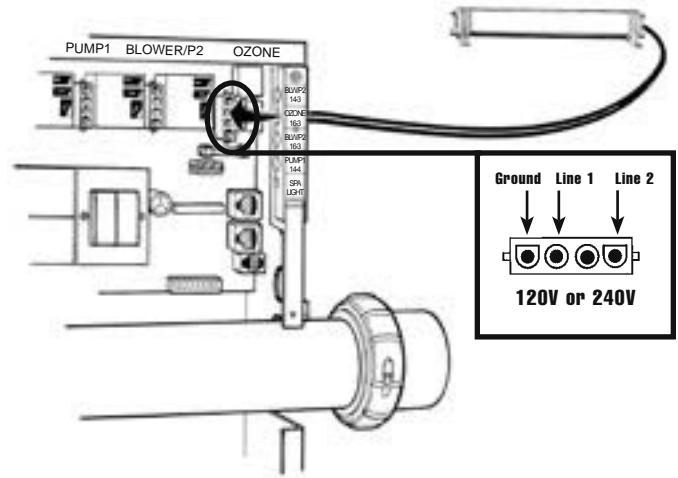
An existing ozone generator may be connected providing that the ozone generator is equipped with the correct cord and connecting plug. The plug is connected to the receptacle labeled “Ozone” located on the printed circuit board of the power system. The wiring connections to the plug must align with the receptacle diagram shown on the right.

Follow the installation instructions from the manufacturer of the ozone generator pertaining to the mounting of the unit, installation of venturis or injectors, and the connection of all required piping, tubing and check valves.

The following instructions apply to the connection of all ozone generators to the Power System:

1. Electrical connections to the ozone generator are completed by attaching the plug at the end of the ozone generator cord into the proper receptacle. Check the electric data label on the ozone generator to determine whether the ozone generator requires a 120V or 240V connection, and then verify that the power system is configured to supply the correct voltage. Push the plug firmly into the receptacle until the locks on each side of the plug snap into place.
2. If the ozone generator is equipped with a bonding lug, a bonding wire must be connected from that bonding lug to the bonding wire terminal block on the side of the Power System enclosure. Solid copper wire (no smaller than #8 AWG) is required for this bonding connection (#6 AWG in Canada).

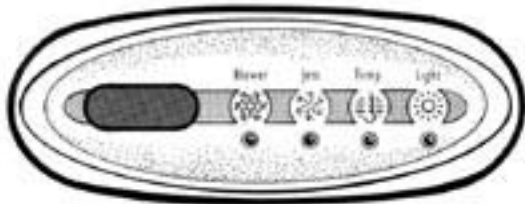
## 1 Electrical Connection



**NOTE:** The amperage requirements of the ozone generator must be added to the amperage requirements of all other electrical components in order to complete the electrical installation. See page 26, Electrical Connections (3), for details.

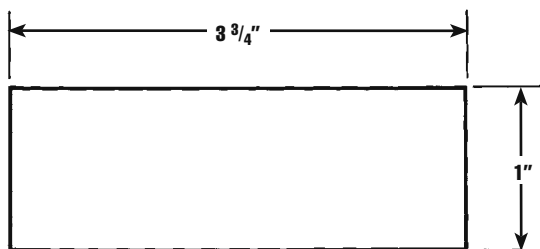
# Top-side Panel Installation

## Top-side panel



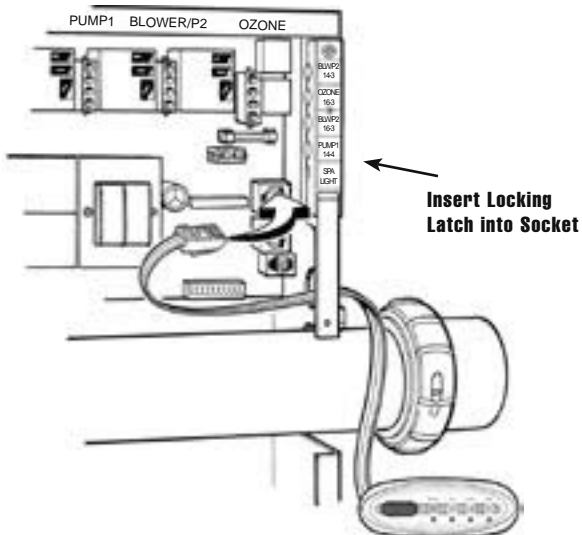
## Mounting Hole for Top-side Panel

1



## Connecting Cord Plug

7



A top-side panel, similar to the one shown at left, is furnished with each Balboa SUV Power System. The top-side panel is specifically designed to withstand the harsh spa environment and is intended to be mounted in a location on, or close to the spa, in order to provide the spa user with the greatest convenience when controlling the spa equipment. When selecting a mounting location for the top-side panel, several factors should be considered:

- Select a location that is easily accessible. The user should be able to reach the panel without stretching or getting into an awkward position.
- The mounting location should allow the user to see all of the visual indicators and display features of the top-side panel without strain.
- The panel's connecting cable must reach the Power System without stretching or being forced against any sharp corners. A "dry run" is highly recommended. Hold the top-side panel at the desired mounting location and route the connecting cable toward the Power System to determine that the 10' cable is long enough to allow it to be connected inside of the unit.
- The mounting area must be above the maximum water level of the spa and in an area with good drainage to prevent the accumulation of any water. The top-side panel must not be submerged.
- If the top-side panel must be mounted underneath a spa cover, select a mounting location that will prevent the cover from resting directly upon the panel, but will allow the cover to seal when closed.

Complete the installation of the top-side panel as follows:

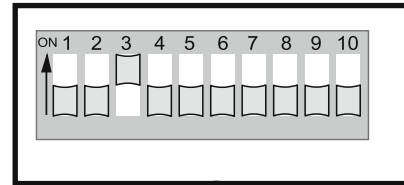
1. Cut a mounting hole with the dimensions shown on the right. Try to insert the top-side panel into the hole. Make sure the hole is the proper size before proceeding.
2. Remove all dust and particles from the mounting surface around the hole. A clean smooth surface that is dry and oil free is required for the adhesive on the back of the panel to attain a good bond.
3. Remove the paper backing from the adhesive on the rear of the panel. All of the adhesive should be exposed.
4. Route the connecting cable through the opening and place the top-side panel into the opening. Align the panel and press firmly onto the mounting surface.
5. Remove the front cover from the Power System control enclosure and route the connecting cable through the hole on the right side of the enclosure as shown at the right.
6. Route the connecting cable upward along the left side of the control enclosure to the top-center of the unit.
7. Plug the connecting cable into the socket labeled J-1.



# Printed Circuit Board Dip Switch Settings

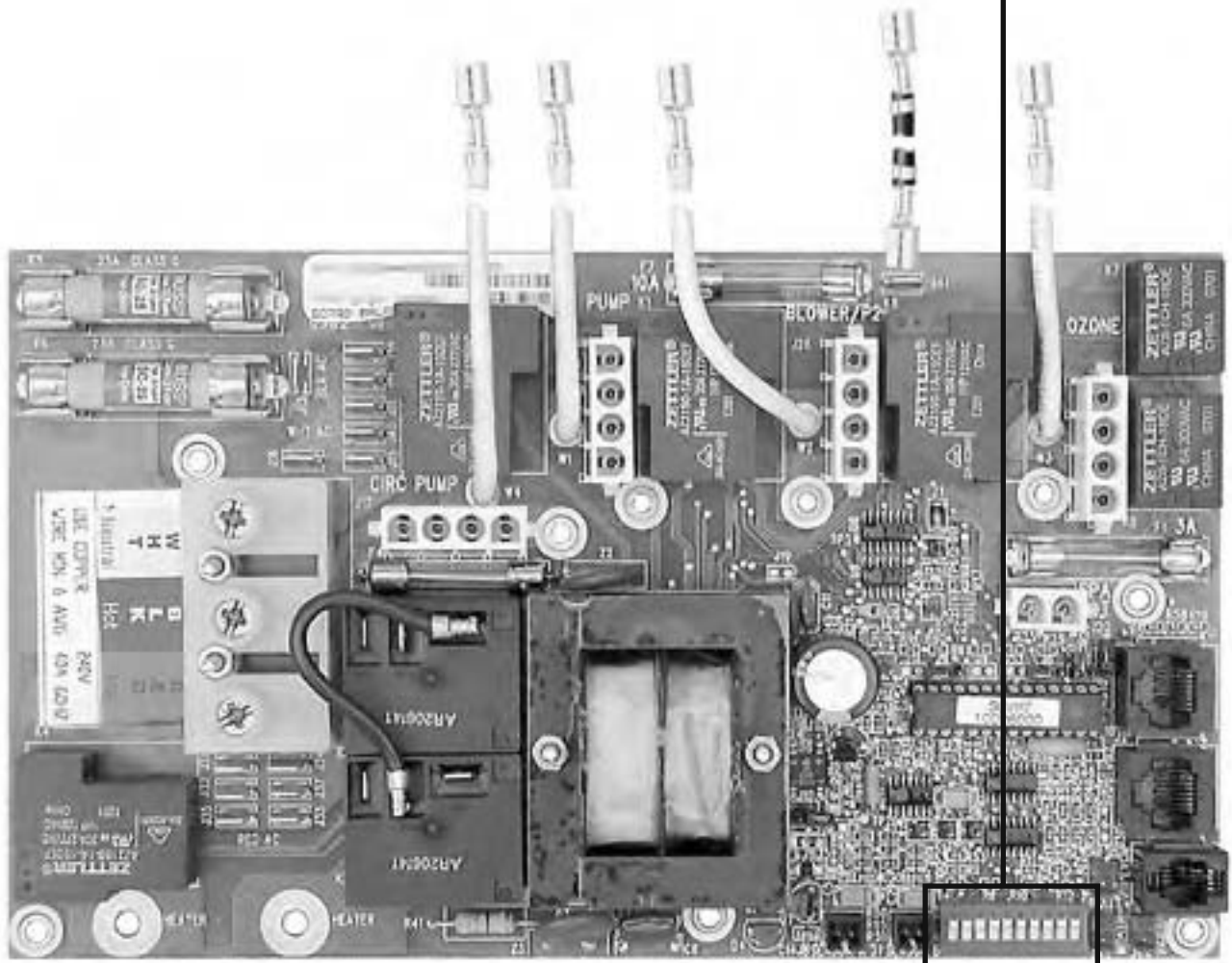
The printed circuit boards of the SUV Series Power Systems utilize dip switches that control the operation of the Power System depending upon the desired configuration of the system. These dip switches are located on the lower right corner of the power system printed circuit board and are positioned at the time of manufacture as follows:

S1	Test Mode	Off
S2	N/A	Off
S3	Panel Option	On (mini panel)
S4	N/A	Off
S5	N/A	Off
S6	50/60Hz	Off (60Hz)
S7	N/A	Off
S8	Deg C/F °	Off (F °)
S9	N/A	Off
S10	30/50 Amp	Off (50 Amp)



If the final application of the power system does not match the above switch settings, change as necessary.

NOTE: All switches labeled N/A should be in the “Off” position.



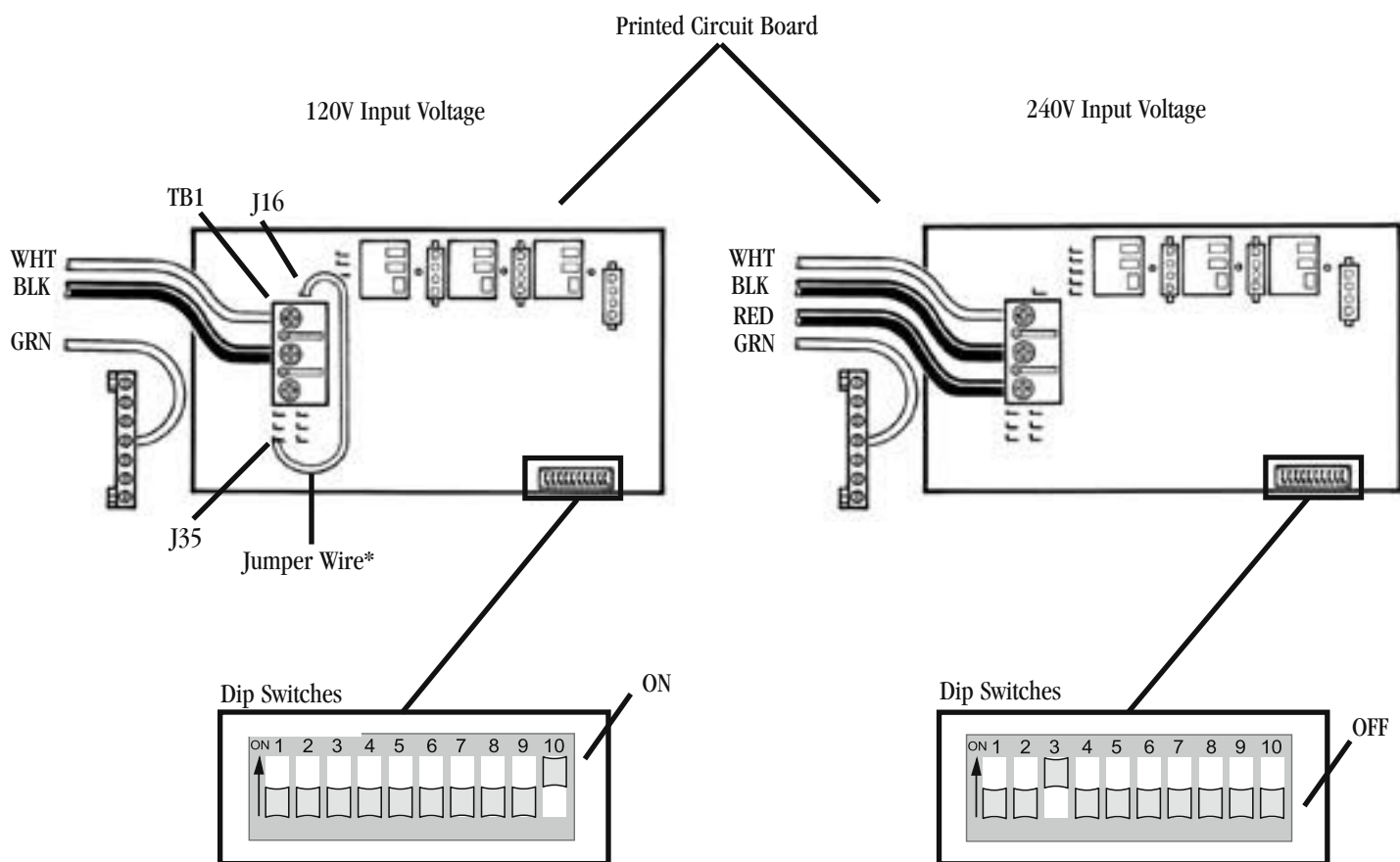
# Configuring the SUV Power System

## Input Voltage

This Power System is supplied to utilize a 240V power supply (2 hot wires, a neutral wire, and a ground wire). If conversion to 120V is required, a jumper wire supplied with the system must be installed between J16 and J35. Also, dip switch #10 must be set to the “On” position. A 120V power supply (1 hot wire, 1 neutral wire, and a ground wire) can then be hard wired to the power input terminal block labeled TB1. Attach the black wire to the terminal marked “Black,” the white wire to the terminal marked “White,” and

the green wire to the terminal marked “Ground.” See conversion instructions on the wire schematic attached to the back of the power system enclosure cover.

When configured to operate at 120V, the heater is rated at 1.5kW and will heat only during Pump 1 low operation. When configured to operate at 240V, the heater is rated at 5.5kW and will heat whenever heat is required.



\*Jumper wire attached to rear of power system enclosure.

NOTE: When the power system has been converted to run on 120V power supply, all the outputs must also be converted to 120V. See output voltage configuration on page 20.

# Configuring the SUV Power System

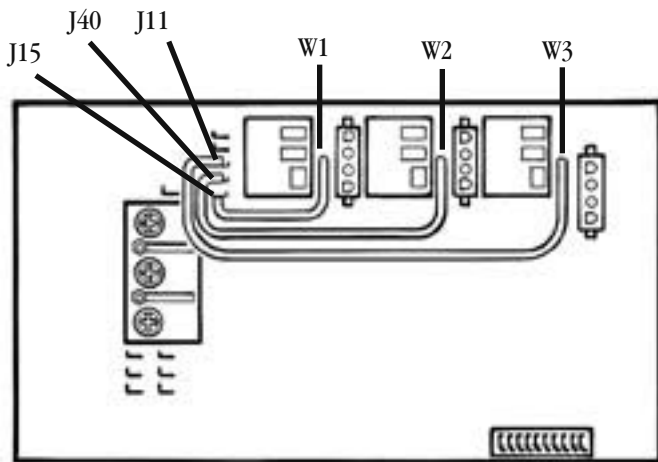
## Output Voltage

The SUV Power System is typically configured at the factory to supply 120V to all output receptacles. If some of the components connected to the outputs require 240V, the power supplied to these outputs must be converted. This is done by disconnecting the appropriate wire W1, W2, or W3, from the terminals labeled J15, J40 or J114 respectively, and reconnecting them to the terminals labeled

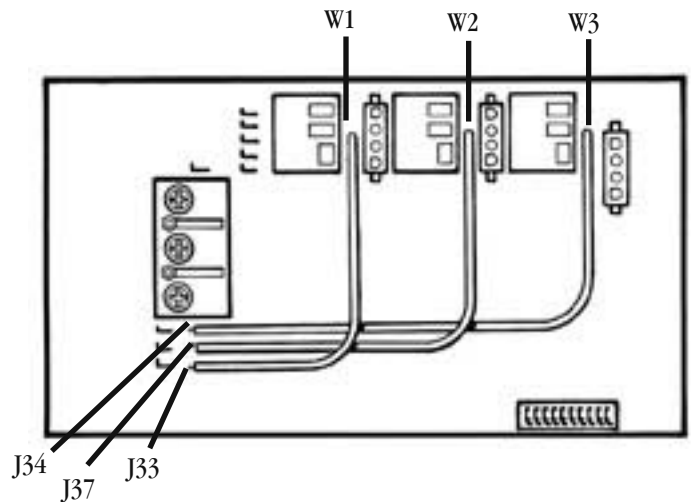
J33, J37 or J3 respectively. Note that W1, W2 and W3 supplies voltage to a 2-speed Pump 1, a 1-speed Pump 2, or a blower, and an ozone generator respectively.

If the power system has been converted to run on a 120V power supply, all the outputs must also be converted to 120V.

120V Output Voltage



240V Output Voltage

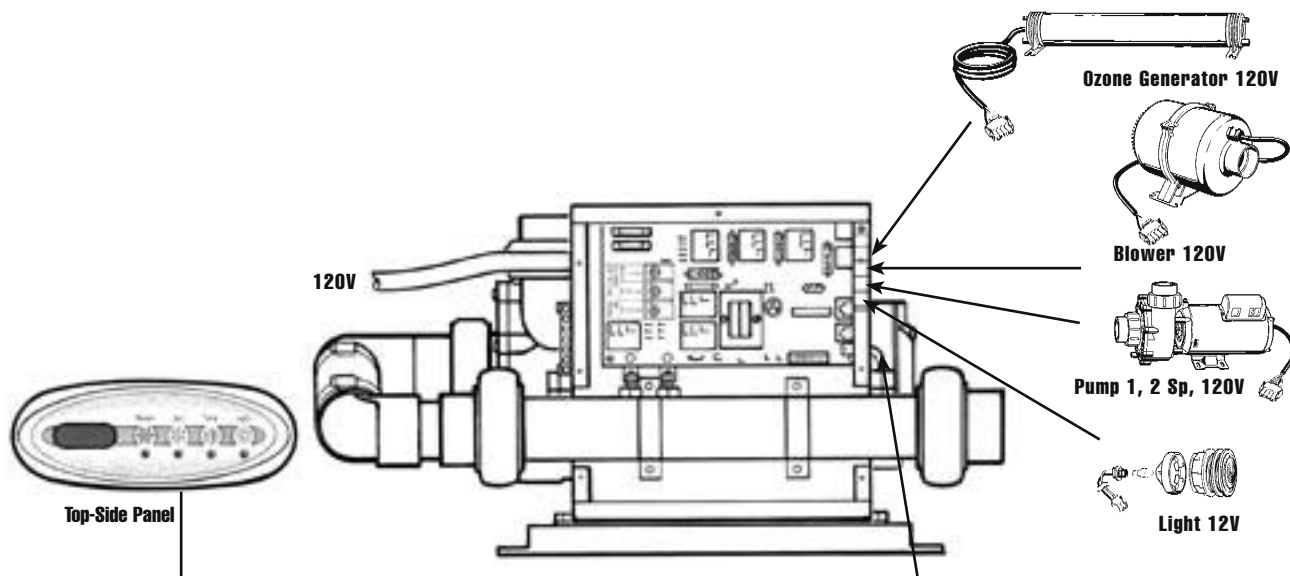


When configuring the output voltages on the SUV Power System, remember to also consider the amperage of each component. Be sure that the total amperage draw does not exceed the capability of the circuit supply and power to the system.

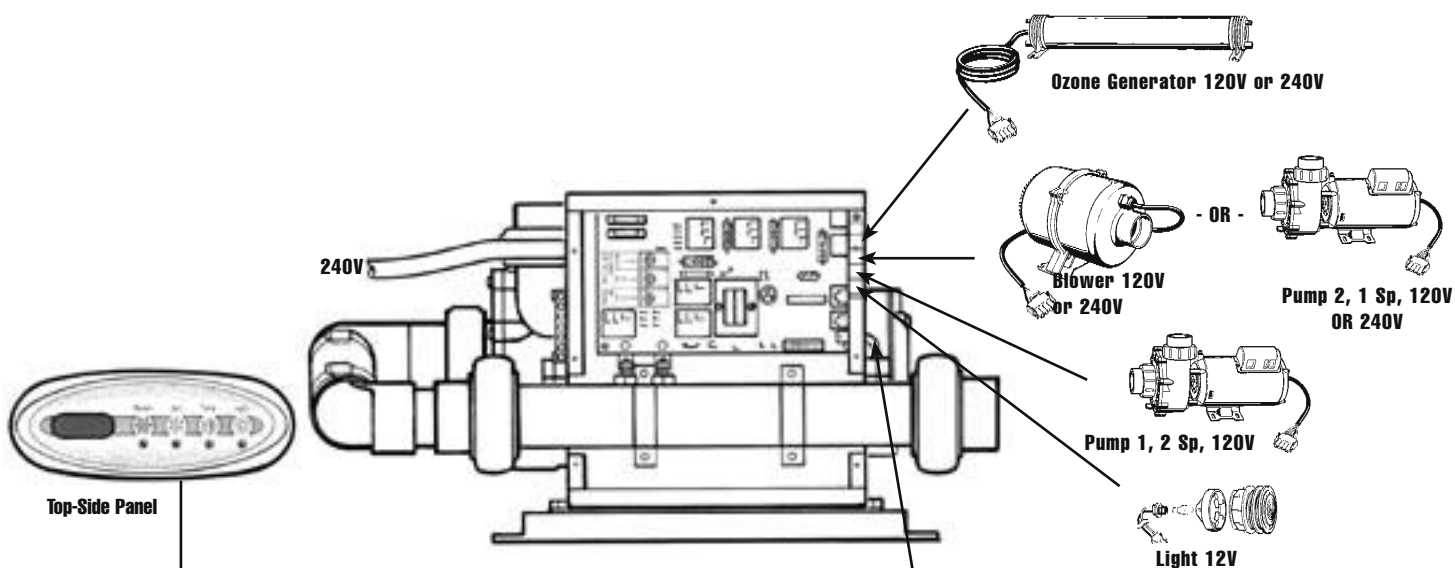
# Configuring the SUV Power System

## Component Configurations

If the SUV Power System is connected to a 20 Amp, 120V power supply, the system can support the following components.



If the SUV Power System is connected to a 50 Amp, 240V power supply, the system can support the following components.



## Using the Blower/Pump2 Output

If the SUV Power System is connected to a 50 Amp, 240V power supply, this output can supply power to a thermally protected blower or a single-speed 2nd Pump at 120V or 240V provided the amperage does not exceed 10 Amps.

If the power system is connected to a 20 Amp, 120V power supply, this output can supply power to a thermally protected blower only. The blower must be rated for 120V and the amperage must not exceed 7 Amps.

Blowers that are connected to this output must be internally thermally protected. If the blower is not thermally protected, call Balboa Direct for detailed instructions.

# Electrical Connections (1)

All of the electrical wiring methods and materials used to complete the electrical installation of the SUV Series Power Systems must be in accordance with the National Electrical Code or the Canadian Electric Code, as well as any local electrical codes in effect at the time of installation.

The selection of electrical materials required to accomplish this installation and the installation of the Power System must be accomplished by, or be under the direct supervision of, a qualified electrician.

These Power Systems are classified as “continuous duty appliances” and are intended primarily for installation at a single family dwelling. The installation recommendations and instructions contained in this manual are directed solely toward these issues. Different or additional electrical requirements may exist if these products are installed other than as instructed.

## GFCI Requirements

A Ground-Fault Circuit Interrupter (GFCI) is required to be installed in the electrical supply circuit connected to these products. GFCI's are ultra-sensitive switching devices, providing the ultimate in safety. The most common style of GFCI also provides high-current protection as a circuit breaker.

One of the two configurations of GFCI's, as depicted on the left, will be required for your installation, depending upon the options selected.

Page 22 and 23, Electrical Connections (2) and (3), provide guidance for selecting the correct GFCI.

## Electrical Disconnect

A disconnect must be installed where readily accessible and within sight of the spa, but at least 5' (1.5 meters) from the inside wall of the spa.

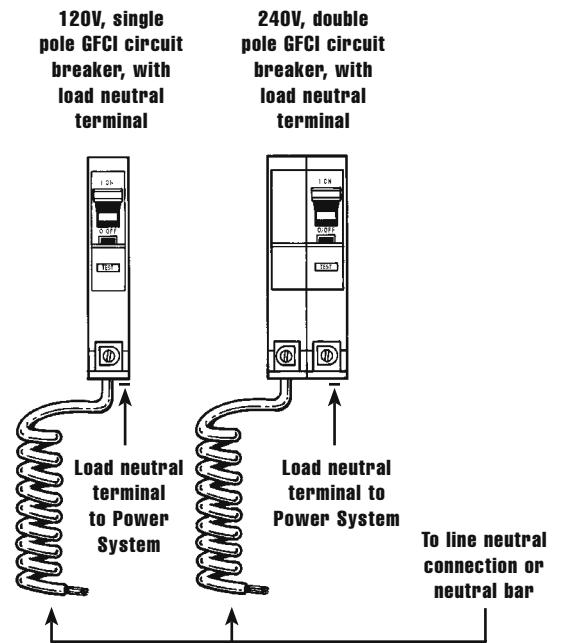
The disconnect must open all ungrounded conductors of the electrical supply connected to the spa.

If the main panel meets the sight-line and distance criteria, a GFCI circuit breaker installed in that panel may be used as the disconnect, as shown in option (A) to the left.

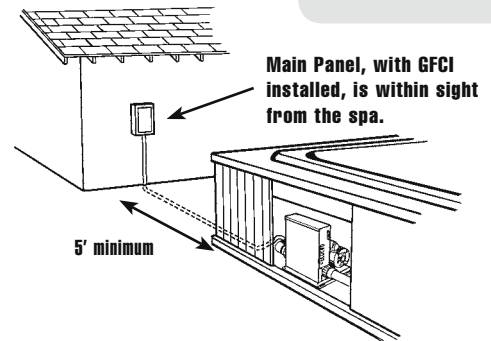
If a new sub-panel must be installed to meet the sight-line requirements, as shown in option (B) two possible arrangements exist:

1. The GFCI circuit breaker may be installed in the main panel, and a suitable switch, circuit breaker or other disconnecting device installed in the sub-panel. (OR)
2. The GFCI circuit breaker may be installed in the sub-panel, and a suitably rated circuit breaker (non-GFCI) installed in the main panel.

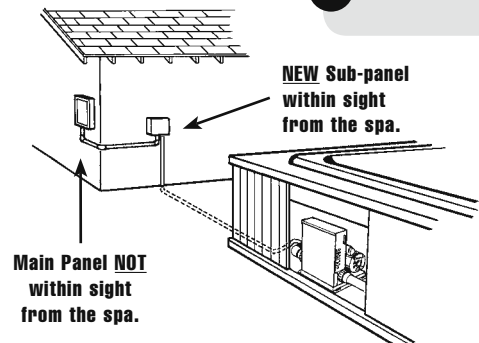
## Circuit Breaker



## Option A



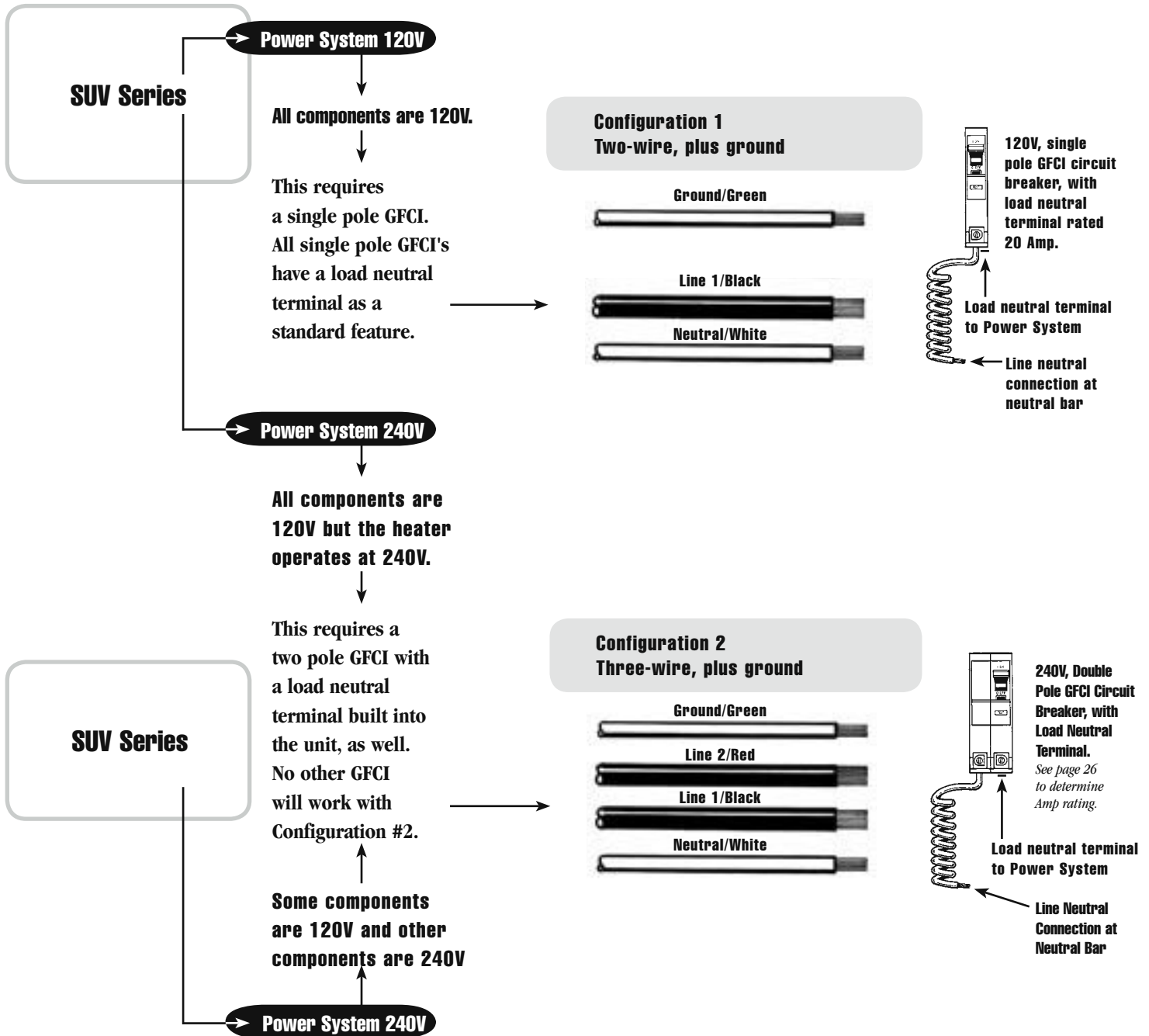
## Option B



# Electrical Connections (2)

Starting below, select the correct voltage for your Power System and follow the arrows across the page to the right. The path corresponds to the desired operating voltage of the Power System, and the voltage of any added components such as an air blower, ozone generator, or a 2nd pump.

The arrows will direct you to the correct wiring configuration and a description of the correct Ground-Fault Circuit Interrupter (GFCI) type circuit breaker to be installed.



**NOTE:** All of the GFCI's shown here have a Line Neutral connecting wire attached. (The white coil or pigtail in the lower left of each Circuit Breaker drawing.)

# Electrical Connections (3)

The next step in making the correct electrical connections to the SUV Series Power System is to determine the total electrical requirements of the complete package, including any added options such as an air blower, ozone generator, or a 2nd pump.

**For the SUV System operating at 120V, the maximum total amp draw is controlled by the Power System and is limited to 16 amps +10%.** It does this by preventing combinations of electrical loads that would exceed 16 amps from being energized at the same time. For example, when the high pump and blower are running, the heater does not run. Or, if the low pump, heater, and the ozone generator are running and the blower is activated; the heater

automatically turns off. This allows the SUV operating at 120V, to use a GFCI circuit breaker rated for 20 amps. For this reason, if you add a blower, it must be rated 120V and not exceed 7 amps. If you add an ozone generator, it must be rated at 120V and not exceed 2 amps. For SUV Series Power Systems operating at 240V, locate the amp numbers on the electrical data label on each component and insert the appropriate numbers into the corresponding spaces in the form below. Use the Total number at the bottom of the form to determine the correct wire and GFCI circuit breaker size in the chart at the bottom of the page.

		SUV 120V <small>(must use 20 AMP GFCI breaker)</small>		SUV 240V
<b>Basic Power System Amperage</b>		Pump Hi <b>10.5</b>	Pump Lo & Heater <b>14.6</b>	<b>33.5</b>
Air Blower	120V 240V	<b>7 max</b>		
Ozone Generator	120V 240V	<b>2 max</b>		
2nd Pump	120V 240V			
<b>Total</b>		<b>17.5</b>	<b>16.6</b>	
		<b>17.5 max</b>		
<i>If a spa light is not connected, subtract 0.1 amps</i>				
<b>Total</b> ampere rating of Power System from the form above	<b>Supply wire size**</b> <i>Use Copper ONLY, with 90° C insulation</i>	<b>Ampere rating of GFCI Circuit-breaker</b>		
0 A to 16 A*	#12 AWG	20		
16 A to 20 A*	#10 AWG	25		
20 A to 24 A*	#10 AWG	30		
24 A to 28 A*	#8 AWG	35		
28 A to 32 A*	#8 AWG	40		
32 A to 36 A*	#6 AWG	45		
36 A to 40 A*	#6 AWG	50		
40 A to 48 A*	#4 AWG	60		
<i>*These amperages may be exceeded by no more than 10%</i>	<i>**These wire sizes assume a total wire length not exceeding 100' (30 m). For longer distances, increase wire size accordingly.</i>			

# Electrical Connections (4)

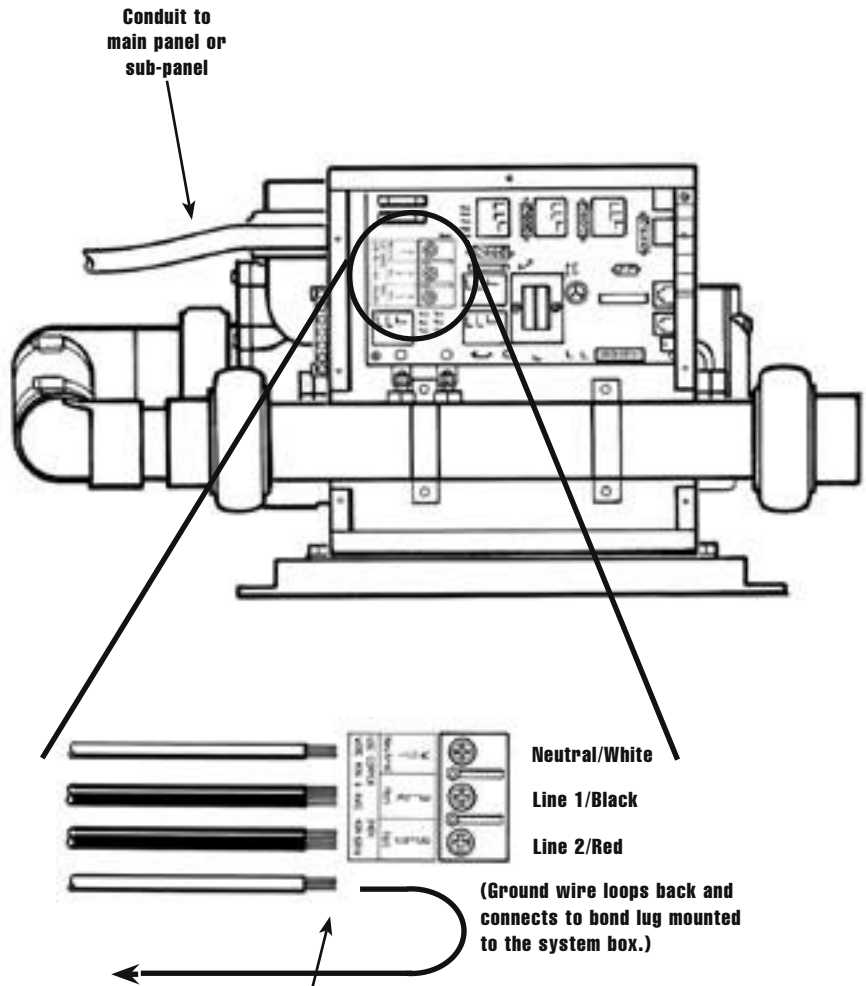
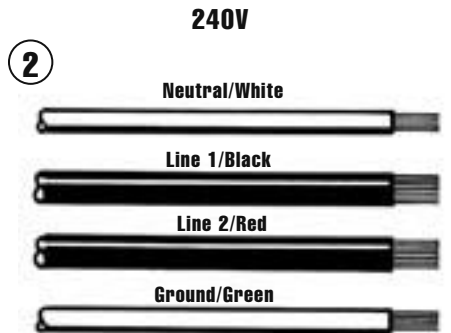
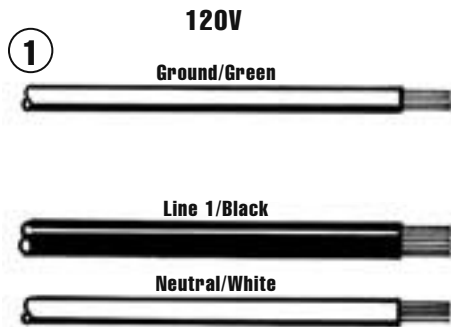
The electrical installation of the SUV Power System can now be completed using the electrical materials and components selected on pages 21, 22 & 23.

1. Install the proper sized conduit into the entrance hole on the left side of the Power System. Generally a transition from rigid conduit to flex conduit is appropriate as the conduit enters the spa cabinet.

2. Pull the required conductors into the Power System. Cut the conductors to provide for convenient routing and connection to the terminal block.
3. Connect the conductors to the terminal block as described below.

**NOTE: Do NOT apply voltage until you have reviewed the power-up procedures on page 25.**

## Configurations from page 18



**NOTE on Wire Color Coding:**

Neutral conductors MUST be white or natural gray.

Ground conductors MUST be green or green/w yellow stripe.

Line and Load conductors may be any color other than white, neutral gray, green or green/w yellow stripe.

Customarily, black is used for line 1 and red for line 2.

Strip  $\frac{3}{8}$  inch (10mm) of insulation from conductors. Insert fully into terminal block, making sure that all strands are captured and tighten each screw firmly.



# Section Title

Before applying voltage to the Power System, it is very important that you understand the sequence of events that occur when power is applied so that the pumps can be primed efficiently and damage to the Power System can be prevented.

**Please review the following procedures and power-up events before applying voltage to the Power System:**

1. Check the voltage at the main power panel to be sure that you have the correct voltage for the Power System being used. Also, be sure that the voltage is within + or - 10% of the mean voltage. For 120V it should be between 108V and 132V. For 240V it should be between 216V and 264V.
2. Test and reset the GFCI. If it does not operate properly, do not apply voltage to the Power System until the problem has been corrected.
3. Fill the spa to its correct operating level. Be sure to open all valves in the plumbing system before filling to allow as much air as possible to escape from the plumbing and the Power System during the filling process.
4. Vent air from the pump(s). Do this by loosening the union nuts on the discharge of all pumps. Allow a small amount of water and air to escape from the pump(s) and related plumbing. Retighten the union nuts.
5. After turning the power on at the main power panel, the top-side panel displays will go through specific sequences. During these sequences you will need to prime the pump(s) as described in the following:

- Display #1 will appear at power-up and will countdown as follows:



- Display #2 will appear after the count down as shown above.



**NOTE:** Display #2 is indicating that the Power System is in a pump priming mode. This mode will automatically last for 4-5 minutes or you can manually exit the priming mode after the pump(s) have primed. (Manually exiting the priming mode is described later in this text). Regardless of whether the priming mode is automatically terminated or you manually exit the priming mode, the system will automatically return to the normal heating and filtering mode at the end of the priming mode. During

# Power-Up and Pump Priming

the priming mode, the heater is disabled to allow the priming process to be completed without the possibility of energizing the heater under low flow or no flow conditions. Nothing comes on automatically, but the pump(s) can be energized by pushing the “Jet” buttons.

- **Pump Priming.** As soon as “Pr” is indicated on the top-side panel, push the “Jet” button once to start Pump 1 in low speed and then again to switch to high speed. Also, push the “Blower” button, if you have a 2nd pump, to turn it on. The pumps will now be running in the high speed mode to facilitate priming. If the pumps have not primed after 2 minutes, and water is not flowing from the jets in the spa, **DO NOT allow the pumps to continue to run.** Turn the power off at the main power panel and repeat the process of venting the air from the pump(s). (See step 4 on this page). After venting air from the pump(s) a second time, turn the power back on at the main power panel. This will initiate a new pump priming mode. Sometimes momentarily turning the pump off and on will help it to prime. Do not do this more than 5 times.

**Important:** A pump should not be allowed to run without priming for more than 2 minutes. Under **NO** circumstances should a pump be allowed to run without priming beyond the end of the 4-5 minute priming mode. Doing so may cause damage to the pump and cause the system to energize the heater and go into an overheat condition.

- After pump priming, push the “Jet” button (and the “Blower” button if you have a 2nd pump). This will turn off the pump(s).
- Next, manually exit the priming mode by pushing the “Temp” button. Note that if you do not manually exit the priming mode as described above, the priming mode will be automatically terminated after 4-5 minutes. Be sure that the pump(s) have been primed by this time.
- After you have manually exited the priming mode or the system has automatically exited the priming mode, the top-side panel will momentarily display the set temperature and then display #3 will appear.



Note that display #3 is not showing the temperature yet. This is because the system requires approximately 1 minute of water flowing through the heater to determine the water temperature.

- After 1 minute of water flowing through the heater the temperature will be displayed as shown in display #4.



*continued on next page*

# Power-Up and Pump Priming

Push the “Temp” button to adjust the temperature to the desired setting. If the water temperature in the spa is less than the set temperature, the heat indicator light will turn on signifying that the heater has been energized.

- The Power System will automatically heat the spa and maintain it at the set temperature and all user buttons will be functional. If a higher temperature is desired, simply push the “Temp” button until the desired temperature is displayed. (The maximum temperature setting is 104°F). For details on the operation of the Power System, see the Power System Operation Guide.
- 6. After the Power System has been powered-up and the pumps have been primed, make a final voltage check at the Power System terminal block.
- **For the SUV System operating on 120V.**  
**Condition 1**
  1. Activate the high speed of the pump.
  2. Activate the blower.
  3. Activate the light.
  4. Check the voltage.

## **Condition 2**

1. Activate the low speed of the pump.
2. Adjust the temperature to turn on the heater.
3. Activate the light.
4. Check the voltage.

The voltage should be 120V + or - 10%.

- **For the SUV System operating on 240V.**

1. Activate the high speed of pumps 1.
2. Activate the blower or Pump 2.
3. Adjust the temperature to turn on the heater.
4. Activate the light.
5. Check the voltage.

The voltage should be 240V + or - 10% between line 1 and line 2 and 120V + or - 10% between either line and neutral.

**NOTE:** If the voltage is not within tolerance while the Power System is operating as described above, turn off the power at the main power panel and correct the problem before continuing to operate the Power System.

# SUV Electrical Schematic



02/20/02

## SUV SYSTEM WIRING DIAGRAM

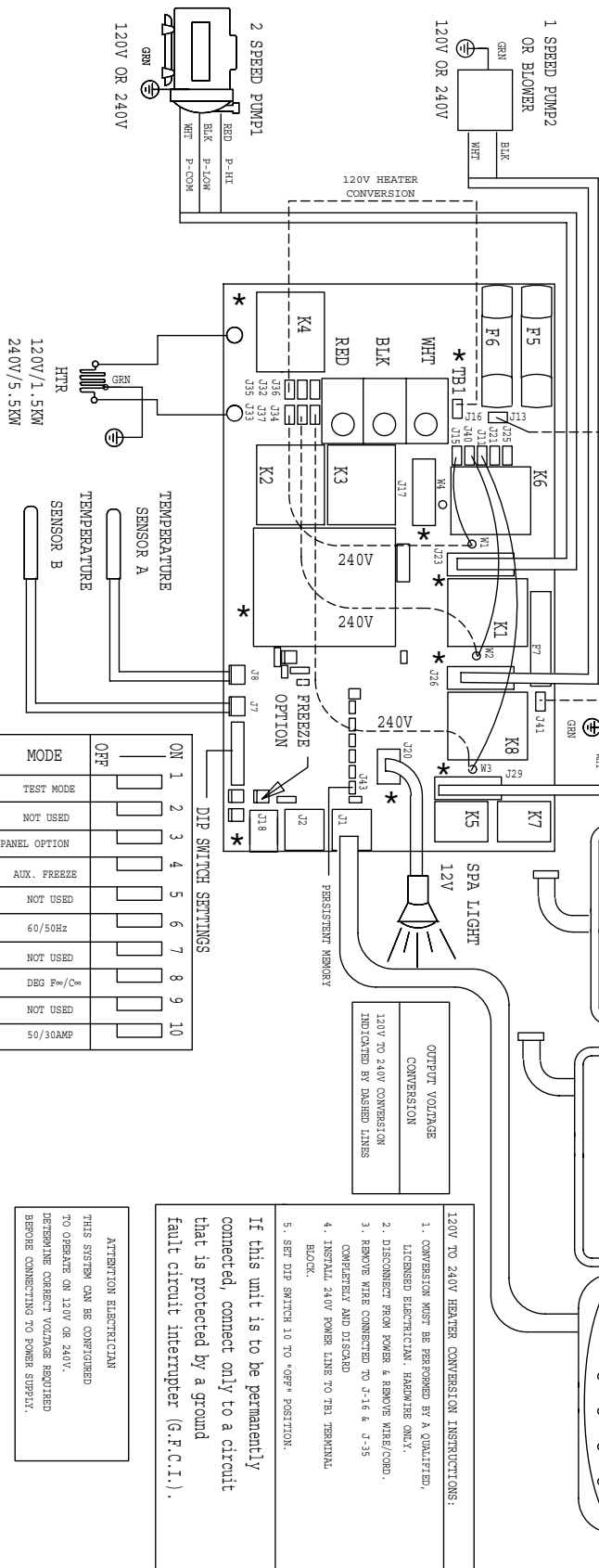
- BLOWER TO PUMP2 CONVERSION INSTRUCTIONS**
1. REMOVE 10A FUSE FROM F7 COMPLETELY.
  2. INSTALL BLK WIRE FROM J13 TO J41

**OZONE GENERATOR**  
120V OR 240V

DIGITAL DUPLEX (OPTIONAL)

DIGITAL DUPLEX (OPTIONAL)

MINI PANEL



**OUTPUT VOLTAGE CONVERSION**  
120V TO 240V CONVERSION INDICATED BY DASHED LINES

- 120V TO 240V HEATER CONVERSION INSTRUCTIONS:**
1. CONVERSION MUST BE PERFORMED BY A QUALIFIED, LICENSED ELECTRICIAN. HARMINE ONLY.
  2. DISCONNECT FROM POWER & REMOVE WIRE/CORD.
  3. REMOVE WIRE CONNECTED TO J-16 & J-35 COMPLETELY AND DISCARD
  4. INSTALL 240V POWER LINE TO T81 TERMINAL BLK/C.
  5. SET DIP SWITCH 10 TO "OFF" POSITION.

If this unit is to be permanently connected, connect only to a circuit that is protected by a ground fault circuit interrupter (G.F.C.I.).

**ATTENTION ELECTRICIAN**  
THIS SYSTEM CAN BE CONFIGURED TO OPERATE ON 120V OR 240V. DETERMINE CORRECT VOLTAGE REQUIRED BEFORE CONNECTING TO POWER SUPPLY.

**DIP SWITCH SETTINGS**

ON	1	2	3	4	5	6	7	8	9	10
OFF	TEST MODE	NOT USED	PANEL OPTION	AUX. FREEZE	NOT USED	60/50Hz	NOT USED	DEG F <sup>o</sup> /C <sup>o</sup>	NOT USED	50/30AMP
OFF	MODE	NOT USED	D. DUP	MUST BE "OFF"	60Hz	F <sup>o</sup>	NOT USED	C <sup>o</sup>	NOT USED	50A
ON	TEST MODE	NOT USED	MINI	MUST BE "OFF"	50Hz	C <sup>o</sup>	NOT USED	50/30AMP	NOT USED	30A

ALL UNUSED SWITCHES SHOULD BE OFF

**NOTE: THIS CIRCUIT BOARD HAS NINE MOUNTING HOLES (INDICATED BY \*)**



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