

AquaCal AutoPilot Water Source

Operation and Installation Manual



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SECTION 1 - GENERAL INFORMATION

1.1 Contacting AquaCal AutoPilot

Web	www.AquaCal.com
Phone	(727) 823-5642 8-5 pm, Eastern M-F
Fax	(727) 821-7471


Please have your model and serial numbers available when contacting AquaCal AutoPilot for questions, service, or parts.

1.2 Safety


For personal safety, and to avoid damage to equipment, follow all safety instructions displayed on the equipment and within this manual. Repair and service of your heat pump must be performed by qualified service personnel. Should you suspect your equipment is not performing properly, refer to the section in this manual entitled: "Troubleshooting," to determine if a call for service is required. Warranties will be voided if the equipment has been improperly installed, maintained or serviced. Throughout this manual, safety signals have been placed where particular attention is required.


Safety Signals:

 **WARNING**" - signal relates to personal safety.

 **CAUTION**" - signal promotes avoiding damage to the equipment.

Follow all National Electric Codes (NEC) unless State or Local guidelines supersede. When installing and using your heat pump, basic safety precautions must always be followed, including the following:

-  **WARNING** - Failure to heed the following may result in injury or death.
- Repairs must be performed by a qualified technician. If service is deemed necessary, contact installing dealer or AquaCal AutoPilot Customer Support for a service center in your area.
 - Heat pump contains refrigerant under pressure. Repairs to the refrigerant circuit must not be attempted by untrained and/or unqualified individuals. Service must be performed only by qualified HVAC technicians. Recover refrigerant before opening system.
 - Improper water chemistry can present a serious health hazard. To avoid possible hazards, maintain pool / spa water per standards detailed later in this manual.

-  **CAUTION** - Failure to heed the following may result in equipment damage.
- Maintain proper water chemistry in order to avoid damage to pump, filter, pool shell, etc.
 - Do not use glue on the threaded portion of the equipment's unions. A glued-in-place union will prevent the equipment from being properly winterized.

SAVE THESE INSTRUCTIONS

SECTION 2 - OPERATION

2.1 Control Panel

The following information outlines the operation for a standard installation. Control Buttons will operate differently for custom installations; such as a heat pump connected to an external controller. Please see “External Controls / Equipment” on page 23 for more information.

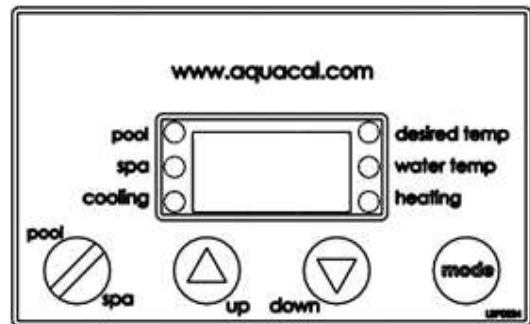


Figure 1

2.1.a Indicator Lights

“Pool”	Heat Pump is referencing the pool thermostat.
“Spa”	Heat Pump is referencing the spa thermostat.
“Cooling”	Indicates unit is cooling. Please note - the compressor must be operating before this light will illuminate.
“Desired Temp”	Indicates temperature set point is displayed. This is displayed when “UP” or “DOWN” is selected.
“Water Temp”	Indicates current water temperature is displayed.
“Heating”	Indicates unit is heating. Please note - the compressor must be operating before this light will illuminate.

Table 1

2.1.b Control Buttons (Inactive if unit under external control)

“Pool / Spa”	Select either the pool or the spa thermostat.
“Up”	Increase temperature set point.
“Down”	Decrease temperature set point.
“Mode”	Select heat pump operating mode.

Table 2

2.1.c LED Display

“XXX”	Heat Pump is on and displaying current water temperature.
“FLO”	No water flow is detected. Circulation pump is off or heat pump is not receiving correct water flow.
“OFF”	Heat pump has been turned off via the mode selector button or the temperature set point has been lowered below 45° F.
“888”	Control program is initializing. Displays only as power is applied to the heat pump. The program version number will be displayed.

Table 3

2.1.d User Level Programs

The heat pump features two levels of programming; User-level programming designed for the end user and Service-level programming designed for the product installer. This section describes User-level programming.

STEPS	EXPLANATION
Turning Heat Pump On	
Turn power on at external fuse box or breaker disconnect.	<ul style="list-style-type: none"> • Controller performs a lamp test. The display reads “888”. • Controller’s software version is briefly displayed. • Controller displays as described in section entitled “LED Display” on page 2.
Setting Operating Mode (“HEA”, “COO”, or “ACH”)	
Press “MODE” control button until “HEA” is selected.	Heat pump heats water to temperature set on thermostat.
Press “MODE” control button until “COO” is selected.	Heat pump cools water to temperature set on thermostat.
Press “MODE” button until “ACH” is selected.	Heat pump operates in either heating or cooling mode until reaching the temperature set on the thermostat. Once reached, the heat pump maintains the water temperature within three (3) degrees Fahrenheit of the temperature setting.
Turning Heat Pump Off	
Press “MODE” control button until “OFF” is selected.	<ul style="list-style-type: none"> • Heat pump functions, values, and programming become unavailable. The current water temperature is still displayed. • An alternate method of inactivating the heat pump is to lower the active thermostat below 45° F. This turns the thermostat off, leaving the heat pump itself available for programming.
Setting Thermostats	
Set heat pump to an active operating mode.	See “Setting Operating Mode (“HEA”, “COO”, or “ACH”)” in this chart for more information.
Press “POOL/SPA” control button to select thermostat.	The “Pool” or “Spa” indicator light specifies which thermostat is currently being used.
Press “Up” or “Down” control button to select desired temperature.	<ul style="list-style-type: none"> • The “Desired Temp” indicator light illuminates. • The thermostat’s temperature setting raises or lowers 1-degree per button key press. The thermostat can be adjusted from a minimum of 45° F to a maximum of 104° F. Please note - Setting the temperature below 45° F turns the thermostat off.
Wait 15 seconds to allow heat pump to exit programming mode.	<ul style="list-style-type: none"> • The “water temp” light turns on and the current water temperature is displayed. • If the desired water temperature is different than the current water temperature, the heating or cooling light will illuminate and the heat pump’s compressor will activate after a four minute time delay.
Selecting Celsius or Fahrenheit	
Press and hold “Up” and “Down” buttons simultaneously.	“CF1” (Celsius / Fahrenheit) code appears.
Press “Up” or “Down” button to select codes “0” or “1”.	Code “0” = Temperature displays in Celsius. Code “1” = Temperature displays in Fahrenheit.
Wait 15 seconds to allow heat pump to exit programming mode.	


STEPS	EXPLANATION
Enabling User Lock Option	
Press and hold "Up" and "Down" buttons simultaneously until "CF1" is displayed.	If "LOC" is briefly displayed, followed by a "0", the heat pump is already locked. A numerical password is required to proceed. See "Unlocking Heat Pump" on page 4 for more information.
Press "Pool/Spa" button until "ELC" is displayed.	Any prior password can be viewed from this program.
Press "Up" button once to view any existing numerical password.	
if desired, press "Up or "Down" button to change or add a numerical password	The password can be any number from "00" to "99". Without knowledge of the correct password, control adjustments will not be possible.
Press "Pool/Spa" Button to lock in the password.	
Press "Pool/Spa" button until "ULC" is displayed.	
Press "Up" button till "1" is displayed.	Code "0" = User Lock disabled. Code "1" = User Lock enabled.
Press "Pool/Spa" Button to save selection.	
Wait 15 seconds to allow heat pump to exit programming mode.	The heat pump lock-out feature is now enabled and the heat pump itself is locked. Any future changes will now require a numerical password.
Unlocking Heat Pump	
Press "Up" or "Down" Button.	If the heat pump is locked, "LOC" is briefly displayed followed by a "0", prompting the entry of the correct password.
Press "Up" button to enter the password.	
Press "Pool/Spa" Button.	If the correct password has been entered, the heat pump is unlocked. The current water temperature is displayed and control settings are available.
	<ul style="list-style-type: none"> • The heat pump locks after being left idle for 15 seconds or after changing a program option. • Before changing multiple program options it is recommended the lock-out option be disabled. The lock-out option can be enabled after all changes are completed
Disabling User Lock Option	
Press and hold "Up" and "Down" buttons simultaneously until "CF1" is displayed.	
Press "Pool/Spa" button until "ULC" is displayed	
Press "Down" button until "0" is displayed.	Code "0" = User Lock disabled. Code "1" = User Lock enabled.
Wait 15 seconds to allow heat pump to exit programming mode.	All programmable features are now available.


Table 4


SECTION 3 - MAINTENANCE

3.1 Cleaning Equipment

Clean and polish heat pump frequently to prevent damage to equipment. More frequent service is required for heat pumps located in sandy or coastal areas where sand and salt spray can become detrimental factors to equipment.

 **WARNING** - Failure to heed the following may result in injury or death. Possible electric shock hazard - Disconnect power to all electrical devices on pad when washing heat pump. Do not restore electrical power until equipment is completely dry.

 **CAUTION** - Failure to heed the following may result in equipment damage. Do not use a pressure cleaner to wash heat pump. Damage to heat pump components will result. If using a hose-end spray nozzle adjust spray pattern to low strength only.

 **CAUTION** - Failure to heed the following may result in equipment damage. Do not spray water directly into interior of heat pump; damage to components is likely.

Washing

- 1) Wash outside cabinet using a low-pressure water hose.
- 2) While the heat pump is still wet, use an approved cleaning agent and pump spray bottle to coat the exterior of the heat pump. Do not use chemicals on control panel.
- 3) Use a detergent-dampened cloth to wipe the heat pump's exterior cabinet.
- 4) Flush all exterior with fresh water using a low-pressure water hose.
- 5) Dry exterior cabinet using a soft cloth.

Polishing


- 1) Polish the heat pump's cabinet panels using an approved polishing agent and following the manufacturer's instructions. Do not use chemicals on control panel.
- 2) Rinse the heat pump panels with fresh water and wipe and buff panels using a dry soft cloth.
- 3) Allow heat pump interior and surrounding equipment to "air-dry" for several hours prior to restoring electrical power.


APPROVED CLEANING AGENTS
Fantastic
409
All Power Plain Detergent (3% solution)
Cascade
APPROVED POLISHING AGENTS
Simoniz Wax
Aero Wax
Glo-Coat
Aarmorall Protectant

Table 5

3.1.a Pool Chemistry

Check water chemistry regularly and maintain within recommended levels as shown in Table 6. Standards for commercial applications vary in different areas. Follow all local applicable codes.


 **CAUTION** - Failure to heed the following may result in equipment damage. Stop water flow when refinishing or acid washing pool. Failure to follow these instructions may damage equipment and voids heat pump warranty.

 **CAUTION** - Failure to heed the following may result in equipment damage. To avoid damage to equipment, monitor and maintain chemistry within recommended levels.

CHEMICAL	POOLS	SPAS
Chlorine	1.0 – 3.0 ppm	1.5 – 3.0 ppm
Bromine	2.0 – 4.0 ppm	3.0 – 5.0 ppm
pH	7.4 – 7.6 ppm	7.2 – 7.8 ppm
Total Alkalinity	80 – 140 ppm	80 – 120 ppm
Calcium Hardness	200 – 400 ppm	200 – 400 ppm
Total Dissolved Solids	1,000 – 2,000 ppm	1,500 ppm above start-up TDS in spas

Table 6

3.1.b Water Flow Rates

 **CAUTION** - Failure to heed the following may result in equipment damage. Water flow exceeding maximum flow rate may damage titanium heat exchanger; such damage will not be covered under the equipment warranty.

Maintain water flow rates as shown below. Please note, these specifications relate to the heat pump only. Code-specified whole system turnover rates must be satisfied. Contact AquaCal AutoPilot Technical Support for guidance regarding testing for water flow rates.

Source-Side Water Flow Rates

MODEL	HEAT EXCHANGER TYPE	FLOW RATES	
		MINIMUM	MAXIMUM
WS03	Titanium	20 GPM	70 GPM
	Cupro-Nickel	10 GPM	14 GPM
WS05	Titanium	20 GPM	70 GPM
	Cupro-Nickel	08 GPM	18 GPM
WS10	Titanium	30 GPM	70 GPM
	Cupro-Nickel	30 GPM	54 GPM
SP05	Titanium	20 GPM	70 GPM
	Cupro-Nickel		

Table 7

Pool-Side Water Flow Rates

MODEL	HEAT EXCHANGER TYPE	FLOW RATES		
		MINIMUM	MAXIMUM	RATED
WS03	Titanium	30 GPM	70 GPM	45 – 50 GPM
WS05	Titanium	30 GPM	70 GPM	45 – 50 GPM
WS10	Titanium	30 GPM	70 GPM	45 – 50 GPM
SP05	Titanium	30 GPM	70 GPM	45 – 50 GPM

Table 8

If water flow through the heat pump is reduced, internal safety devices will shut off the heat pump (i.e.: “HP”, “HP5”, “LP” or “LP5”). Maintain equipment as outlined below to prevent water flow issues:

- Operate water filtration devices per manufacturer's specifications. Dirty filters can cause reduced water flow to the heat pump. The higher the pressure on the filter gauge, the lower the flow rate.
- Keep baskets free of debris. Similar to a dirty filter, large volumes of debris in the pump and skimmer baskets can reduce water flow.
- Check for improper valve settings. A partially closed valve after the filter, or a full-open bypass around the heat pump, will cause insufficient water flow through heat pump.
- The maximum static (or operating pressure) is 50 pounds-per-square-inch (PSI). These specifications relate to the heat pump only. Code-specified whole system turnover rates must be satisfied.

3.1.c Adjusting Water Flow using ΔT (Delta-T)

The Δt is the difference in water temperatures going in and out of the heat pump. The equipment can be fine-tuned for maximum performance by balancing water flow rates to maintain an ideal ΔT . Please note the following adjustment procedure is to be completed with unit in “HEA” mode only; “ACH” and “COO” discharge temperatures are not shown.

- 1) Turn heat pump thermostat to its lowest setting while in “HEA” mode.
- 2) Turn off water pump.
- 3) Turn valves leading to heater to half-way open positions.
- 4) Turn valves leading away from heater to wide-open positions.
- 5) Turn on pool water pump.
- 6) Slowly turn up heat pump thermostat until heat pump turns on.
 - The source water pump will cycle on first.
 - After a four minute delay, the heat pump compressor will start.
- 7) With the heater running, confirm the source-side water pump is operating properly with adequate flow and no short cycling. If needed, clean filters leading to heat pump.
- 8) Wait for water and refrigerant flows to stabilize (approximately 5 minutes).
- 9) Adjust both source-side and pool-side valves leading away from heater to correct temperatures (measured with supplied temperature pressure probe). See Table 9 for correct temperatures. Temperature differences are based on source water temperatures of 72° (+ or – 3° F). For source temps outside this range contact AquaCal AutoPilot Customer Support.

Probe inserted into port when measuring water temperature to and from the heat pump



11) Mark valves at this position for future reference.

Water Temperature Range Chart

MODEL	HEAT EXCHANGER *	TEMPERATURE (HEA MODE ONLY)	
		SOURCE-SIDE	POOL-SIDE
WS03	Titanium	3° to 5° F	1.5° to 3° F
	Cupro-Nickel	6° to 9° F	
WS05	Titanium	3° to 5° F	2.5° to 6° F
	Cupro-Nickel	6° to 8° F	
WS10	Titanium	6° to 8° F	4° to 5° F
	Cupro-Nickel	6° to 8° F	
SP05	Titanium	3° to 5° F	2.5° to 6° F
	Cupro-Nickel		

* If you are unsure what heat exchanger type your heat pump uses, take front panels off the equipment and compare to figures starting on page 9. Please note that source-side and pool-side equipment may have different coil types.

Table 9

3.1.d Irrigation and Storm Run-Off

Irrigation water spray can damage heat pump components. Regardless of water quality, it is important that irrigation be directed away from the heat pump. Prevent rainwater runoff from pouring directly into the heat pump. The heat pump is designed to withstand normal rainfall, but solid streams of water from roof drip-lines may eventually damage heat pump components. If the heat pump resides beneath a roof edge, a rain leader (gutter) or rain shield is required.

3.2 Winterizing

There are two freeze conditions requiring heat pump attention. A light-freeze is when ambient air temperature falls below 32 degrees Fahrenheit for fewer than 8 hours. A hard-freeze is when ambient air temperature falls below 32 degrees Fahrenheit for 8 or more hours.



CAUTION - Failure to heed the following may result in equipment damage.

- Failure to properly winterize heat pump may result in serious equipment damage. Freeze damage is not covered under the heat pump warranty.
- While the plumbing connections are in the winterized condition (not fully tightened), it is imperative pool/spa water not be circulated through the heat pump. Loss of water through loose plumbing connections may result in damage to circulating pump, pool/spa structure, and/or other equipment.

Light-Freeze Conditions

Override time clocks and allow filtration system to run continuously during light-freeze conditions. Typically during light-freeze conditions, circulating (moving) water will not freeze.

Hard-Freeze Conditions

In areas where freezing conditions are prevalent and sustained, the heat pump **MUST** be winterized for hard freeze conditions. Please be aware that a water source unit will have multiple heat exchangers, one or more on the pool-side and one or more on the source-side. All exchangers must be properly winterized. Also note - different exchangers may require different methods of winterizing. In addition if using an external plate exchanger, you will need to follow the manufacturer's directions for winterizing that equipment as well.

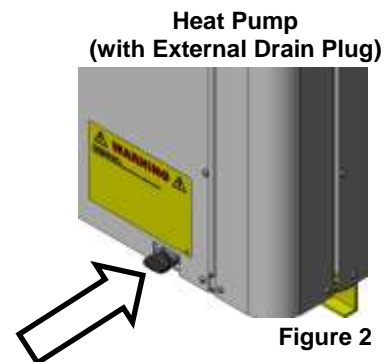
- 1) Disconnect all electrical power to heat pump; turn "OFF" water circulation pump.
- 2) Disconnect the plumbing to the heat pump at connection unions, (removal is counter-clockwise).
- 3) If heat pump does not have an external winterizing plug, remove front access panel. Compare

heat exchanger with Figures 4 through 7. Follow appropriate winterizing instructions for heat exchanger type.

- 4) When ready to use heat pump again, hand-tighten connection unions. Re-connect electrical power, and set operating mode on heat pump. Turn "ON" circulation pump.

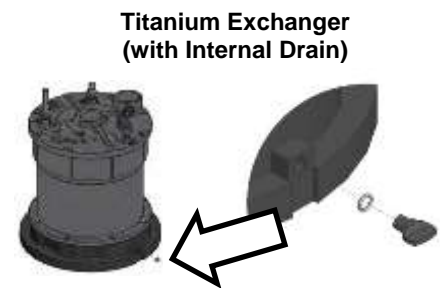
Heat Pump with External Drain Plug

- a) Remove external drain plug. (see Figure 2)
- b) A large volume of water will drain out of the exchanger at first. The remaining water will trickle out slowly. Allow sufficient time for all water to completely drain from exchanger.
- c) After heat pump is fully drained, re-connect external drain plug.
- d) Partially reconnect plumbing connection unions.



Titanium Exchanger with Internal Drain

- a) Remove internal drain plug. (see
- b) Figure 3)
- c) A large volume of water will drain out of the exchanger at first. The remaining water will trickle out slowly. Allow sufficient time for all water to completely drain from exchanger.
- d) After heat pump is fully drained, re-connect internal drain plug and re-install front access panel.
- e) Partially reconnect plumbing connection unions.



Titanium Exchanger with no Drain

- a) Re-install front access panel. Water will drain out of connection unions.
- b) A large volume of water will drain out of the exchanger at first. The remaining water will trickle out slowly. Allow sufficient time for all water to completely drain from exchanger.
- c) After heat pump is fully drained, re-install front access panel.
- d) Partially reconnect plumbing connection unions.

**Titanium Exchanger
(no drain plug)**



Cupronickel Exchanger

- a) Re-install front access panel.
- b) Place a garden hose into the pool side inlet of the heat pump; wrap a clean rag around the hose to form a temporary seal.
- c) Turn on the garden hose water supply.
- d) Allow water to run through the heat exchanger for 2-3 minutes; fresh water should be seen exiting the pool's out-port.
- e) Place a garden hose into the source-side inlet of the heat pump; wrap a clean rag around the hose to form a temporary seal.
- f) Turn on the garden hose water supply.
- g) Allow water to run through the heat exchanger for 2-3 minutes; fresh water should be seen exiting the out-port connection unions.
- h) After flushing is complete, shut off and remove the water supply.
- i) Place an air hose into the pool inlet of the heat pump; wrap a clean rag around the hose to form a temporary seal.
- j) Push all water from the water circuit using compressed air at approximately 50 psig. The residual water should be forced out of the pool out connection.
- k) Allow compressed air to blow into the heat pump inlet connection unions for at least 15-20 seconds after water stops coming out of the pool outlet.
- l) Repeat process on source side.
- m) Partially reconnect plumbing connection unions.

Cupronickel Exchanger
(no drain plug)

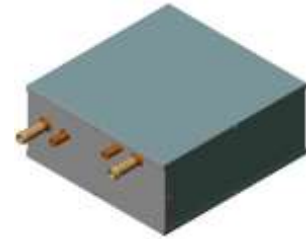


Figure 5

3.3 Planned Maintenance

An annual inspection and maintenance program is strongly recommended starting one (1) year after installation of heat pump. See Figure 6 for recommended inspection checklist. AquaCal AutoPilot can perform this service in limited areas. Contact Customer Support for more information.

⚠ WARNING - Failure to heed the following may result in injury or death. Annual inspection and service must be performed by a qualified pool and heat pump specialist in order to prevent physical injury or damage to equipment.

Planned Maintenance Checklist

<input checked="" type="checkbox"/>	Check Water Flow	<input checked="" type="checkbox"/>	Check Pool & Spa Water Chemistry
<input checked="" type="checkbox"/>	Clean Evaporator Coil	<input checked="" type="checkbox"/>	Check and Clean Condensate Drains
<input checked="" type="checkbox"/>	Check Relay Contacts	<input checked="" type="checkbox"/>	Check Compressor Amperage Draw
<input checked="" type="checkbox"/>	Check Capacitor Values	<input checked="" type="checkbox"/>	Check Water Pump Amperage Draw
<input checked="" type="checkbox"/>	Check Refrigerant Levels	<input checked="" type="checkbox"/>	Acid Wash Source Coil (As Applicable)
<input checked="" type="checkbox"/>	Clean Heat Pump Cabinet	<input checked="" type="checkbox"/>	Check Air Temperature Change Through Evaporator
<input checked="" type="checkbox"/>	Check Flow/Pressure Switch	<input checked="" type="checkbox"/>	Check Operating Controls and Temperature Sensors
<input checked="" type="checkbox"/>	Check Electrical Connections	<input checked="" type="checkbox"/>	Check Water Temperature Change Through Heat Exchanger
<input checked="" type="checkbox"/>	Check Proper Voltage To Unit		

Figure 6

SECTION 4 - INSTALLATION

⚠ WARNING - Failure to heed the following may result in injury or death. Installation of this equipment by anyone other than a qualified installer can result in a safety hazard. The information contained throughout the “Installation” section is intended for use by qualified heat pump installation technicians, familiar with the swimming pool/spa service industry safety standards and methods.

⚠ CAUTION - Failure to heed the following may result in equipment damage. Failure to properly protect equipment against corrosive environments or atmospheres will adversely affect the life of the equipment and will void equipment warranty.

4.1 Equipment Specifications

4.1.a Weights

MODEL	WEIGHT
WS03	320 Pounds
WS05	330 Pounds
SP05	330 Pounds
WS10	900 Pounds

Table 10

4.1.b Dimensions

WS03, WS05, SP05

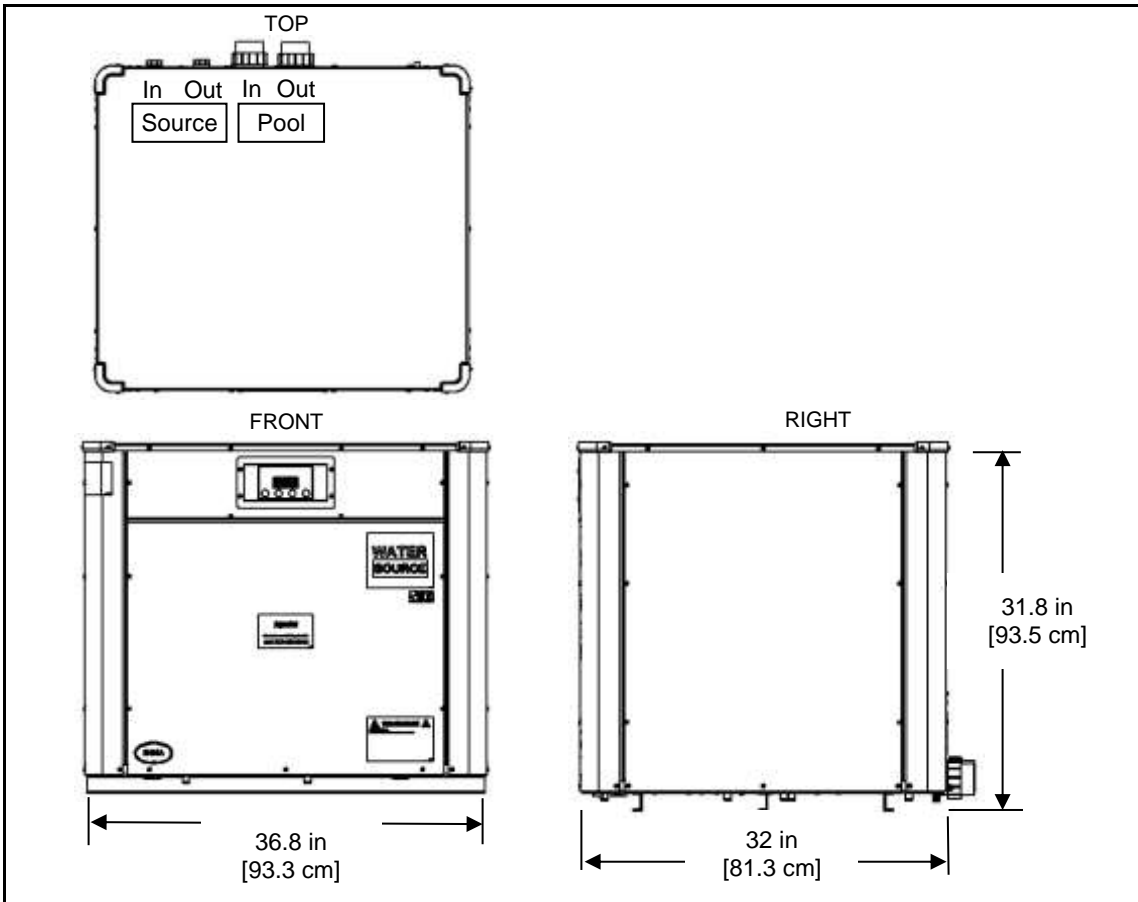


Figure 7

WS10

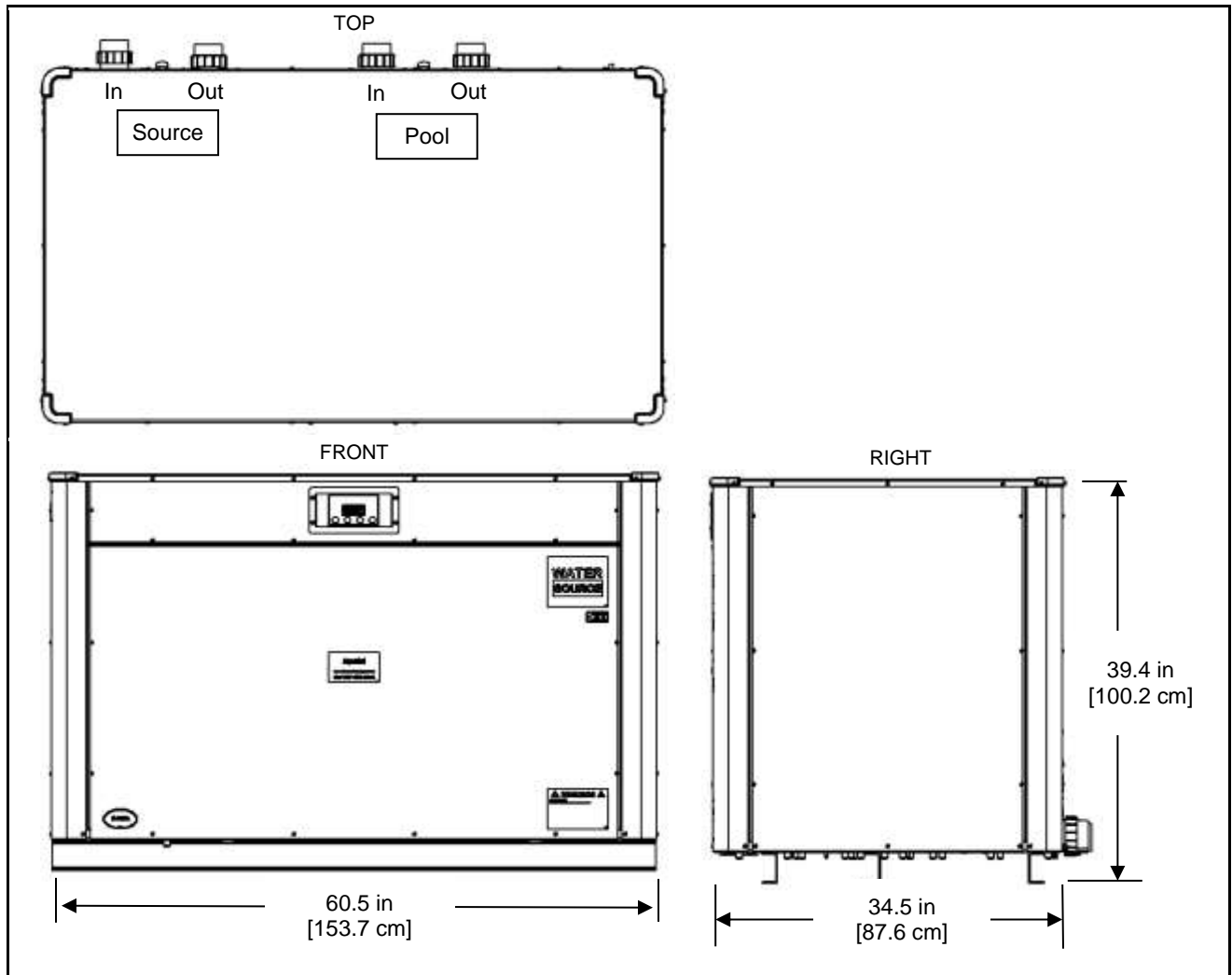


Figure 8

4.1.c Access Panels

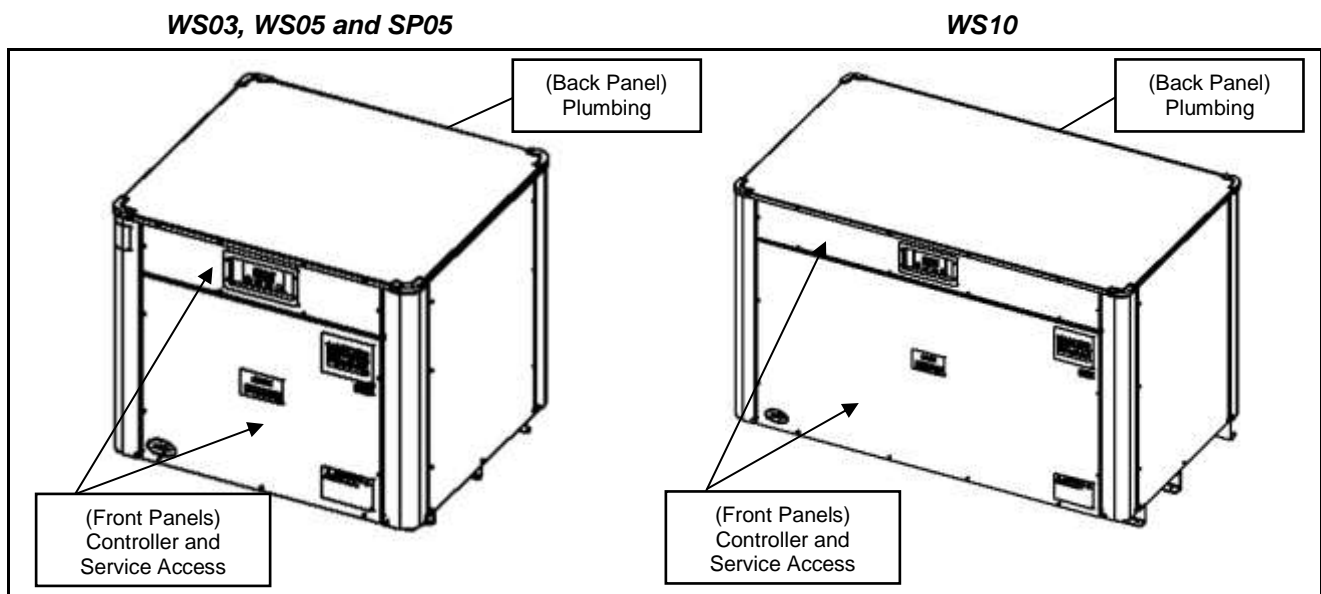


Figure 9

4.1.d Electrical Cutouts

WS03, WS05 and SP05

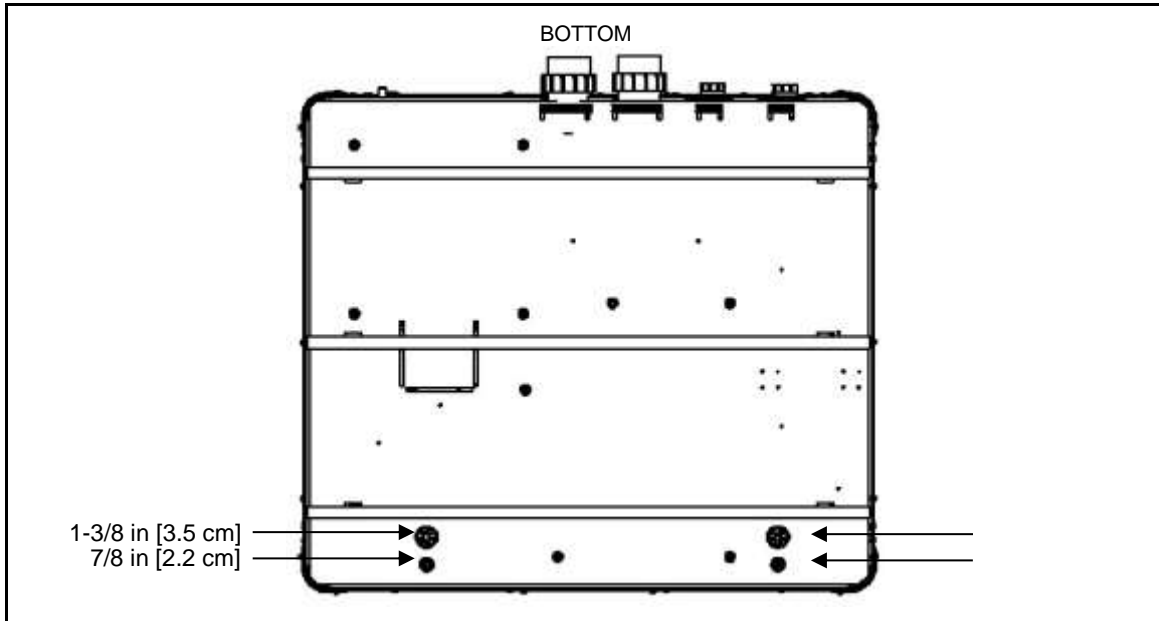


Figure 10

WS10

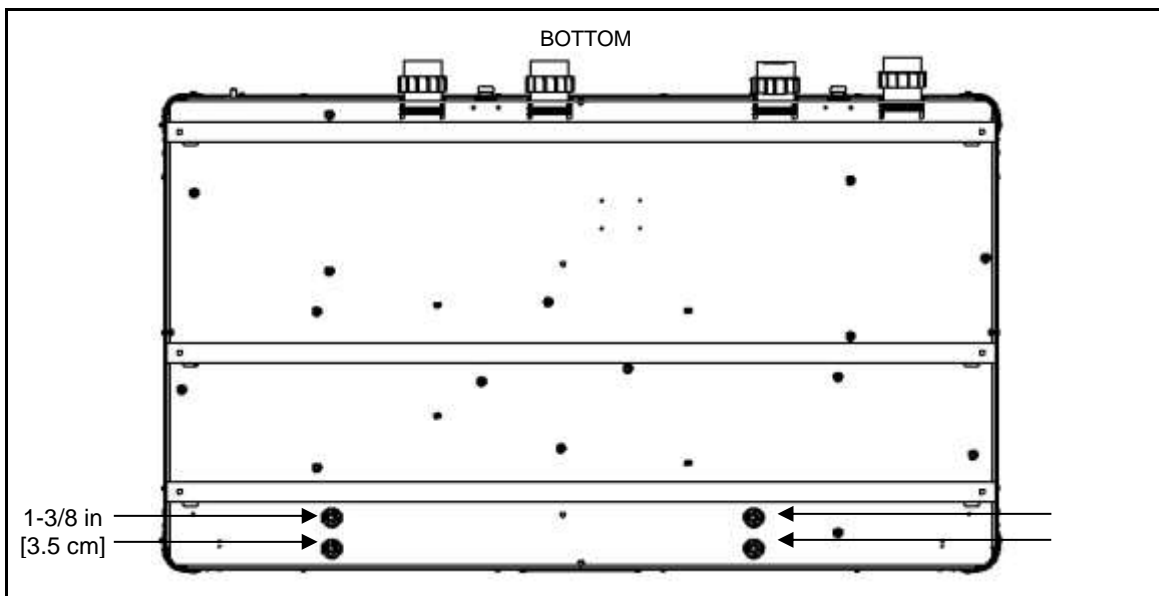


Figure 11

4.2 Placing Heat Pump

4.2.a Positioning Clearances

- Confirm adequate clearance is provided above and around heat pump to permit access panel removal during equipment maintenance and service. Do not place objects such as shrubs, bushes, lawn furniture, chemical containers, etc. immediately adjacent or on top of heat pump. These items can prevent access and may result in damage to the heat pump.
- The unit should be located at least 18 inches from any wall and at least 18 inches between units to permit rear plumbing and electrical connections.
- Follow all applicable local, state, and national requirements relative to spacing from other objects or equipment.

4.2.b Controlling Irrigation and Rainwater Runoff

Avoid placing heat pump in direct rainwater runoff from roofs. If the roof slope directs runoff into the heat pump, a gutter or rain shield is required on the roof edge above the heat pump. Avoid water spraying onto the heat pump by re-locating or adjusting irrigation.

4.2.c Planning for Condensation

Insulated evaporator and refrigeration components prevent significant volumes of condensation from forming inside the unit when operating.

4.2.d Mounting Pad Requirements

- Equipment pad is to be constructed of concrete, or other code-approved materials sufficient to support the weight of the heat pump.
- Pad is to be elevated to provide adequate drainage to base of heat pump.
- Pad is to be essentially level and extend in all directions (at least) 6" beyond the base of the heat pump. Under no circumstances should the heat pump be installed directly onto the earth.
- For purposes of sound abatement, equipment base is not to be joined to a building's foundation or placed directly on concrete floors inside building. For inside installations, vibration dampeners are recommended between equipment and concrete floor to avoid harmonic drone vibration during equipment operation.
- Do not place one water source heat pump directly on top of another. A structural metal rack is required when pumps are "stacked". See local code requirements for rack specifications. Water source heat pumps may be racked a maximum of two high.
- Equipment pad and racks must meet all requirements of authorities having code-related jurisdiction.

4.2.e Anchoring Heat Pump to Pad

Follow all relevant local, state, or national requirements regarding wind load anchoring. Contact AquaCal AutoPilot to obtain the correct anchoring kit information. Please have the heat pump model number ready when contacting AquaCal AutoPilot.

4.3 Plumbing



CAUTION - Failure to heed the following may result in equipment damage.
Water flow exceeding maximum flow rates may damage heat pump and will not be covered under equipment warranty.

Plumbing diagrams are provided in this section as a planning guide to the sequence of equipment, valves, fittings, etc. The basic plumbing configurations for typical installations are shown. If the installation does not closely follow any of the supplied plumbing diagrams, AquaCal AutoPilot Technical Support is available for installation advice and guidance.

- The heat pump must receive water flow within the specified minimum and maximum ranges and to maintain ideal water flow through the heat pump under worst-case conditions (i.e.: filter fouled to 10 PSI rise). See page 6 for more information.
- Install a bypass valve whenever water flow rate may exceed maximum rating. See "Water Flow Rates" on page 6 for specific maximum rates. Contact AquaCal AutoPilot Technical Support for guidance regarding testing for water flow rate.
- Temperature / pressure ports with PVC tees and a pocket test thermometer are also provided. This can be installed between the unions and the bypass valves. The preferred location of port is 6" from the heat pump union.
 - These ports are used for balancing temperature on the water supply and water return for maximum heat pump performance. See "Adjusting Water Flow using ΔT (Delta-T) on page 7 for more information on using these ports.

- Using an open (or raw) body of salt water as the heat pumps source water is not recommended.
 - Raw salt water promotes the growth of crustaceans, which can eventually clog a heat pump's heat exchanger. These types of applications are highly problematic and require additional maintenance.
 - If a raw salt water source is unavoidable, install an external plate heat exchanger to allow for this type of maintenance. Please note – Salt water wells do not require an external heat exchanger.

4.3.a Plumbing Diagrams

WATER SOURCE HEAT PUMP CONNECTIONS (WELL AND SURFACE WATER)

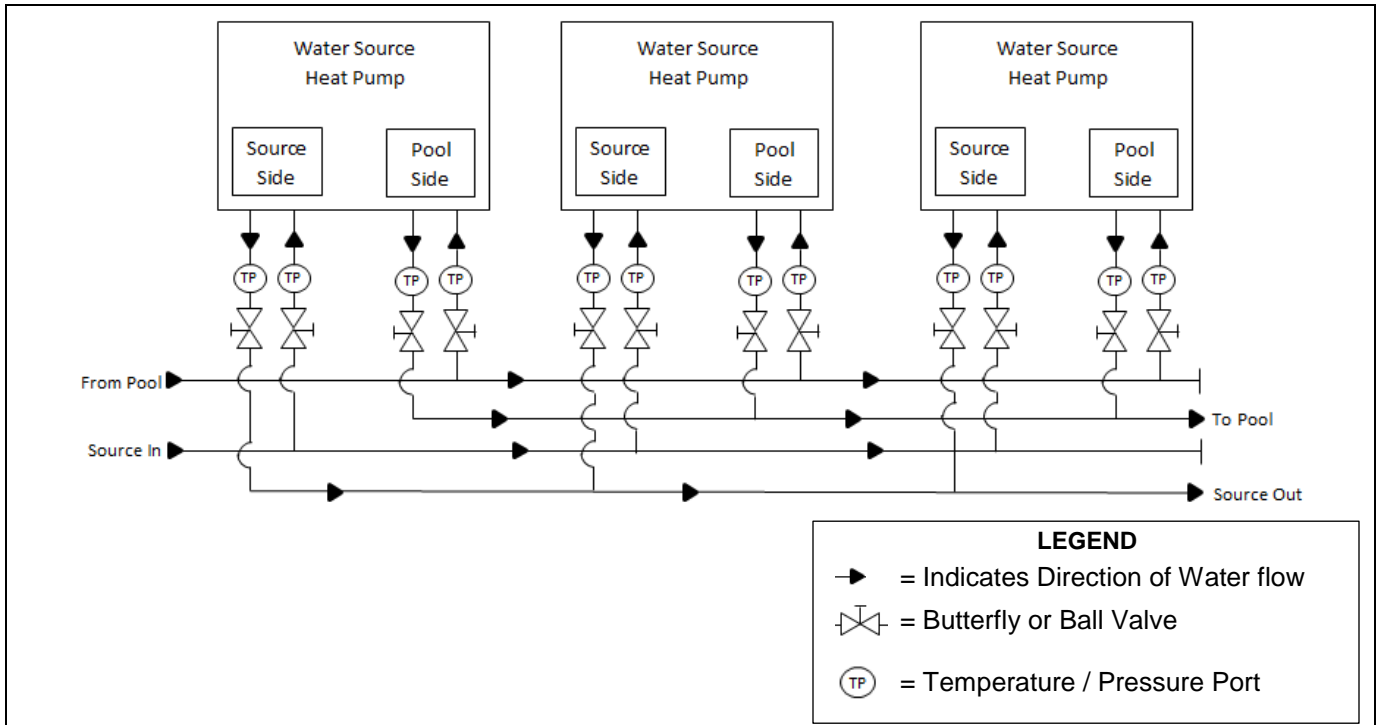


Figure 12

SOURCE WATER FROM WELL

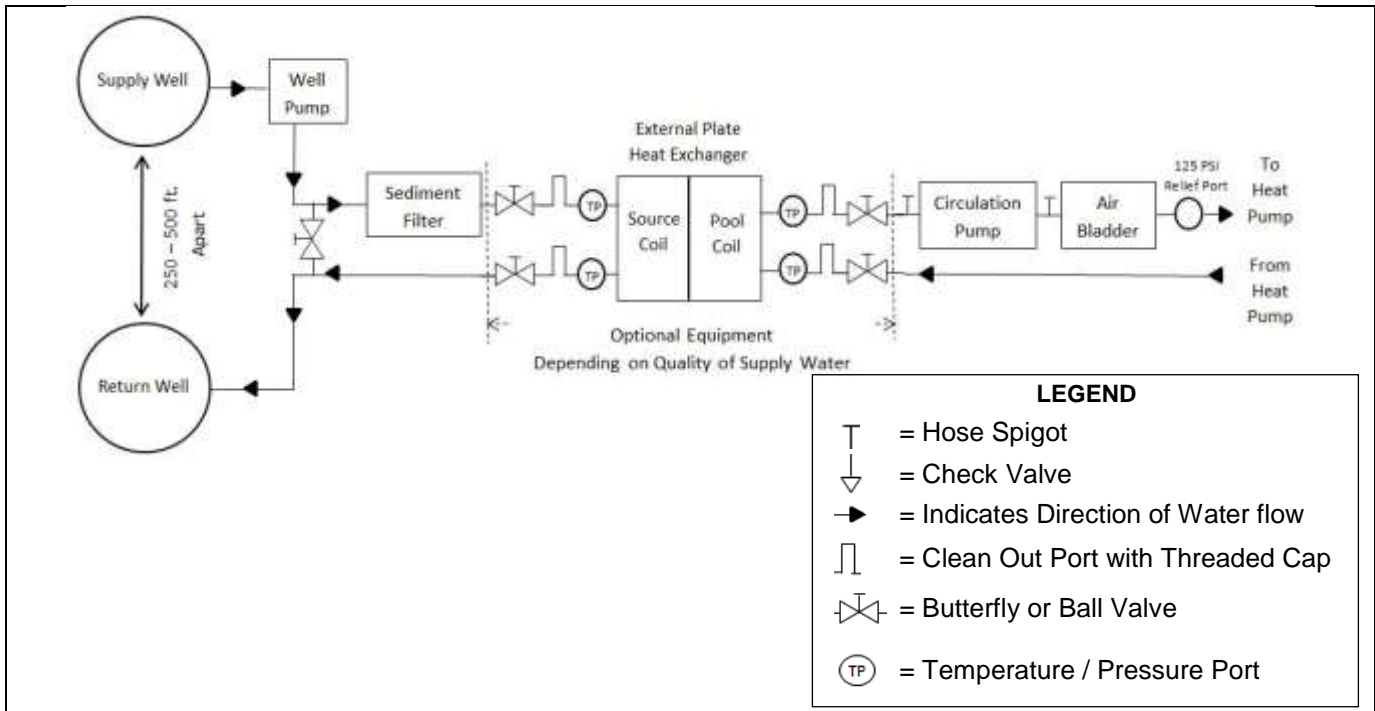


Figure 13

TYPICAL DEEP WELL CONSTRUCTION

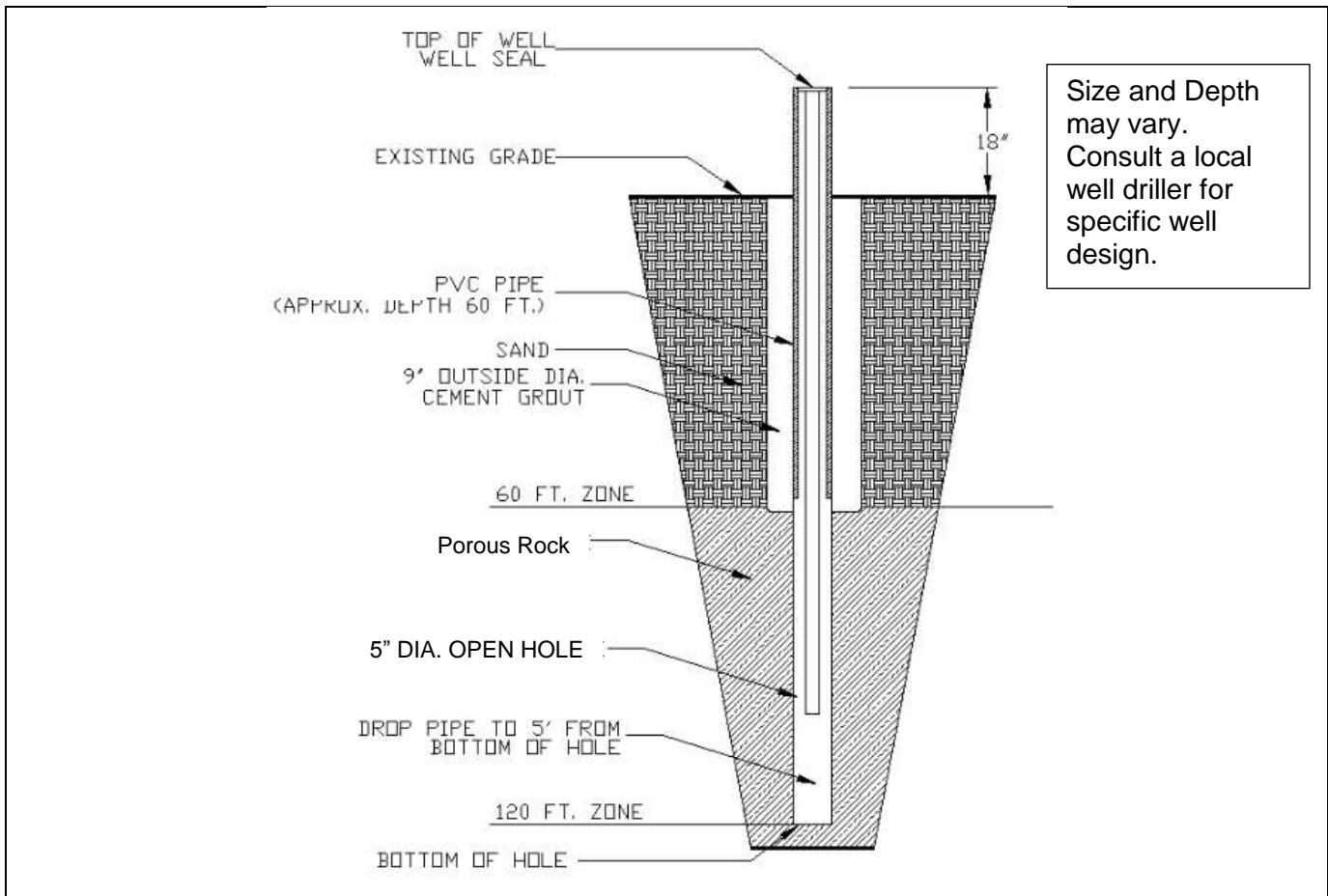


Figure 14

SOURCE WATER FROM SURFACE WATER

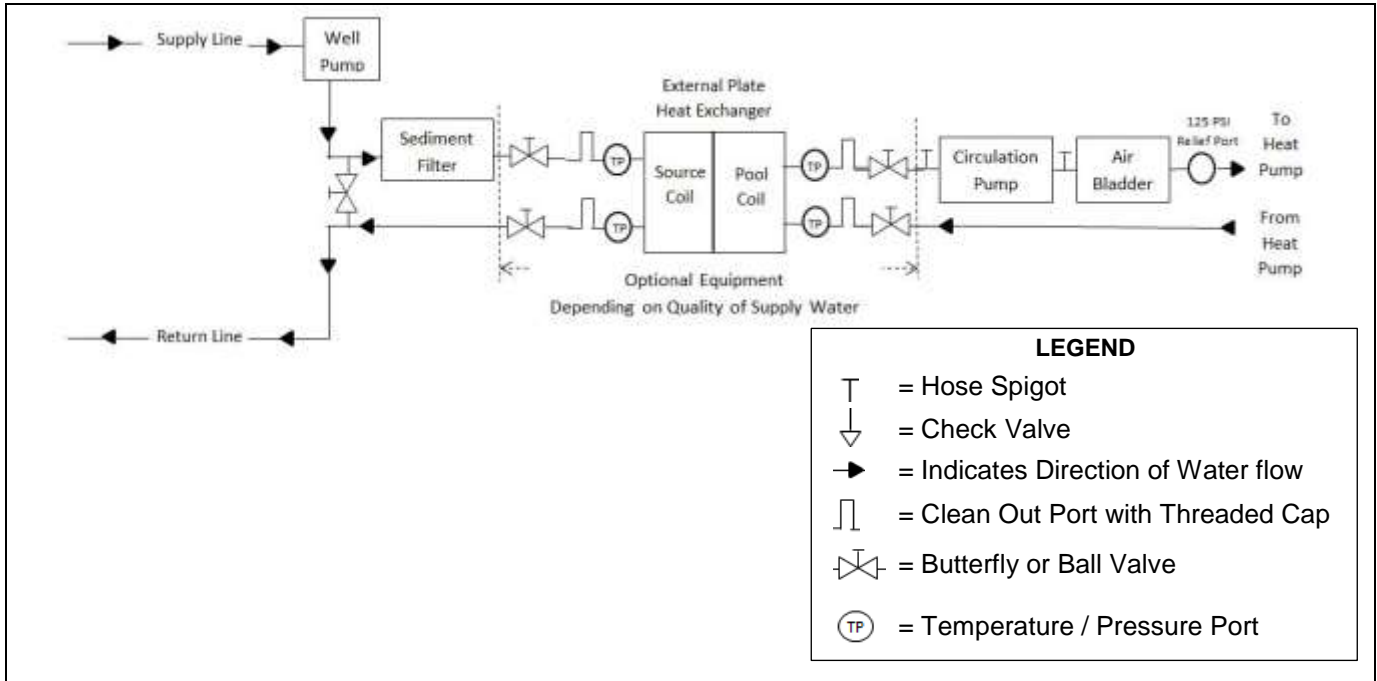


Figure 15

TYPICAL LAKE CONSTRUCTION

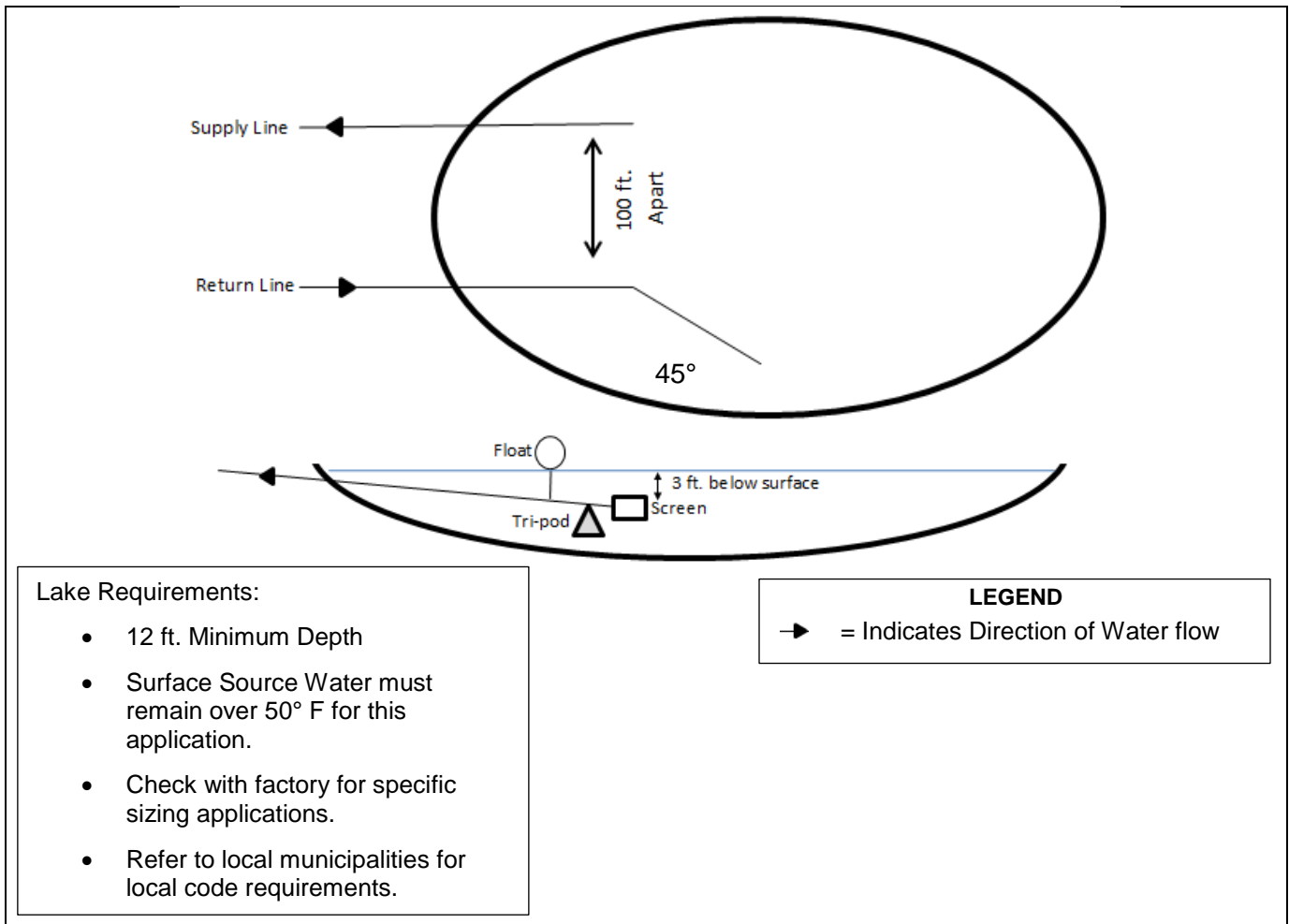


Figure 16

SOURCE WATER FROM POOL (SUNPOWER HEATING SPA)

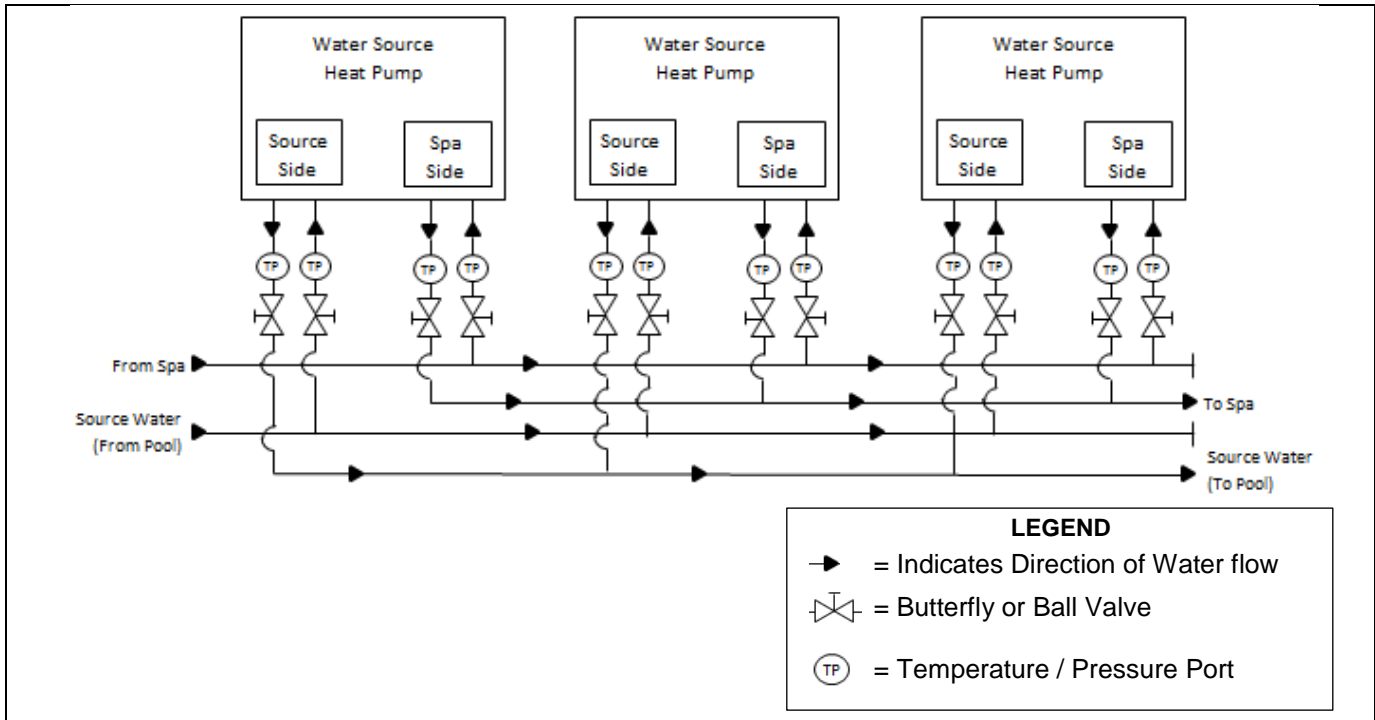


Figure 17

WATER SOURCE AND SUN POWER COMBO

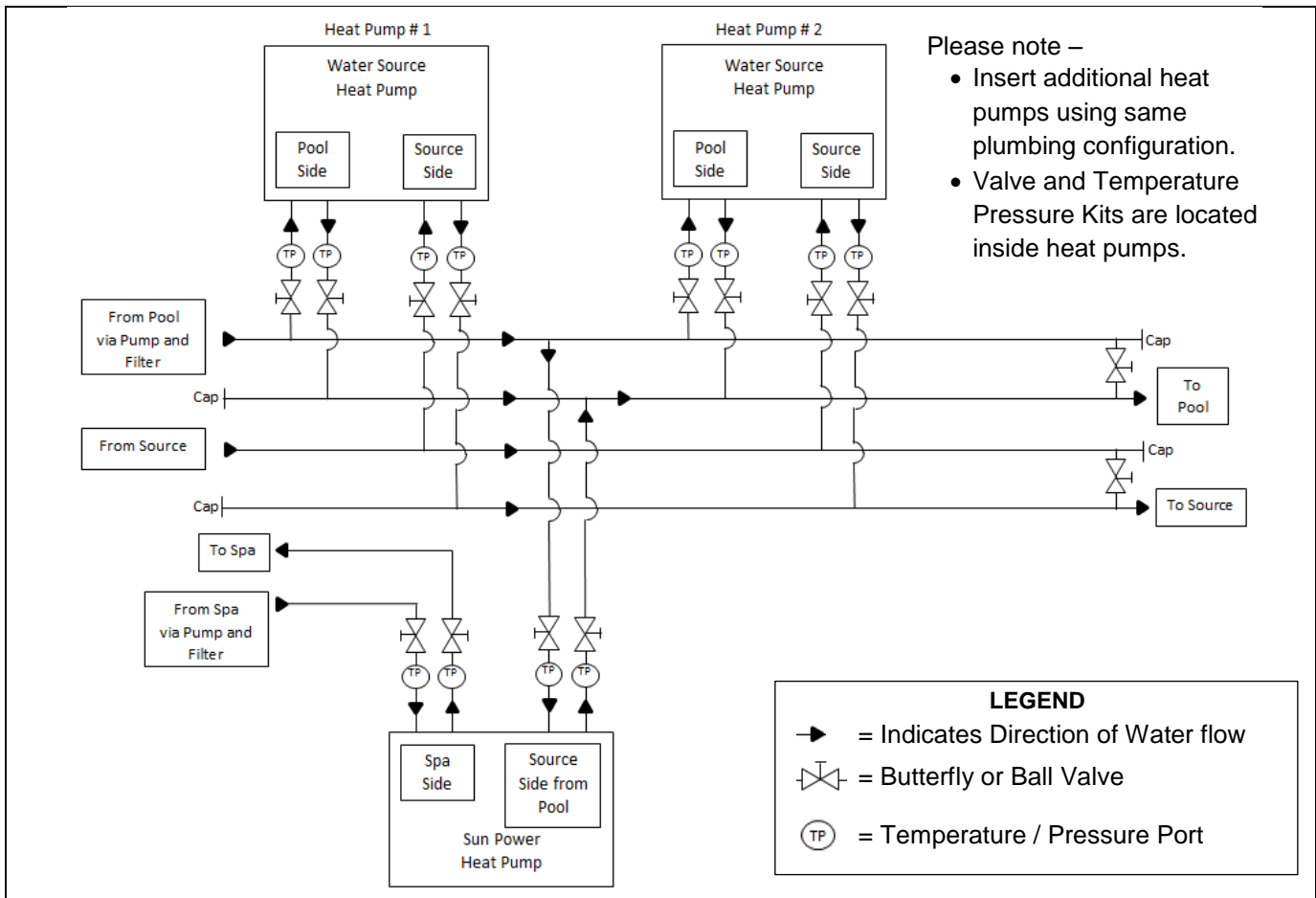


Figure 18

WATER SOURCE HEAT PUMP CONNECTIONS (TOWER)

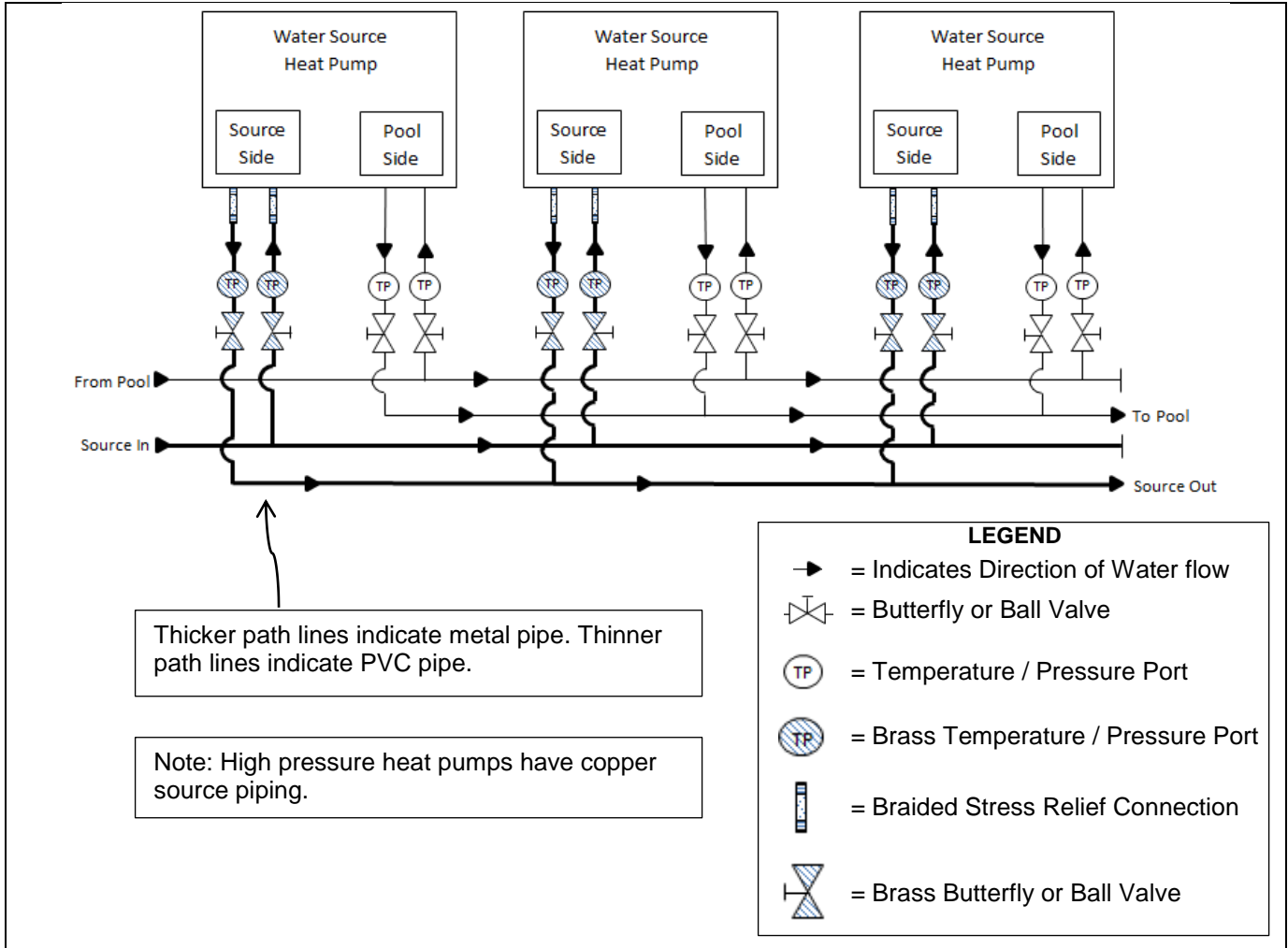


Figure 19

TYPICAL TOWER CONSTRUCTION

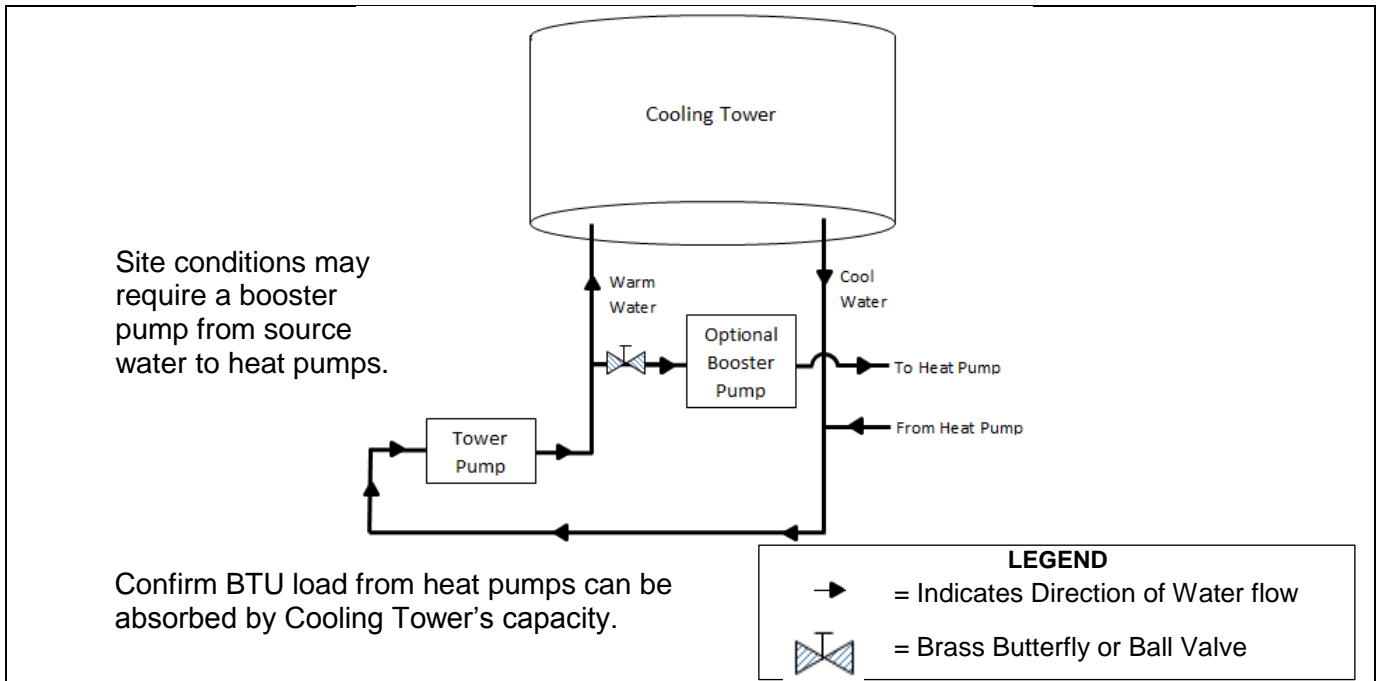


Figure 20

4.3.b In-Line Chlorine Feeders

Place in-line chlorinators as far downstream from the heat pump and as low in elevation as possible. If an erosion type feeder is used, always install a Hartford Loop to protect internal heat pump components.

4.3.c Water Connections to Heat Pump

Connection to site plumbing is made via PVC solvent cement to the female slip socket of the plumbing unions. Note - drawings are not drawn to scale.

WS03 and WS05 (Titanium Exchanger Only)

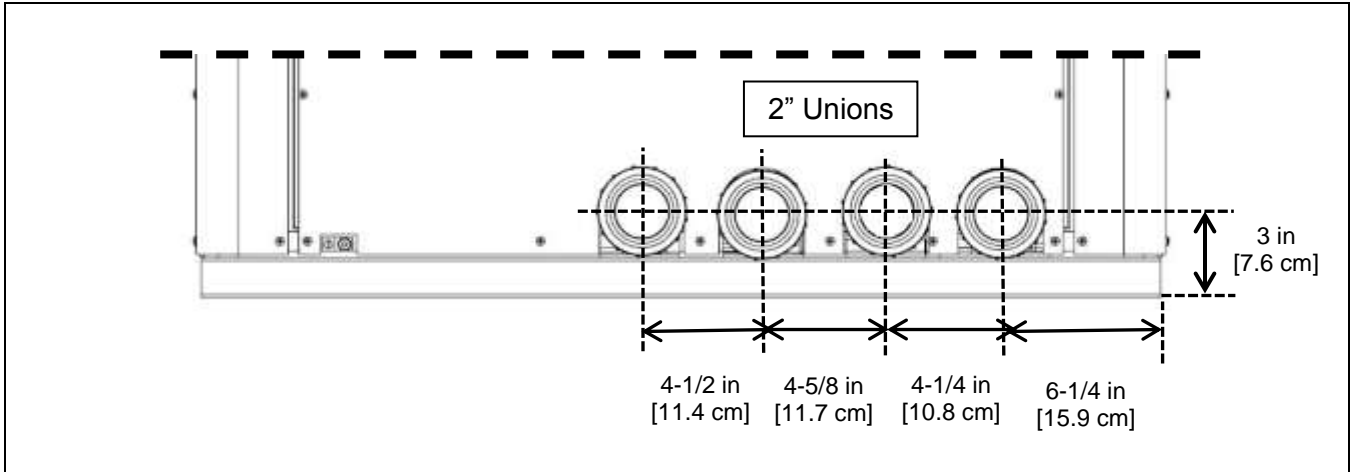


Figure 21

WS03 and WS05 (Titanium / Cupro-Nickel Combination Exchanger)

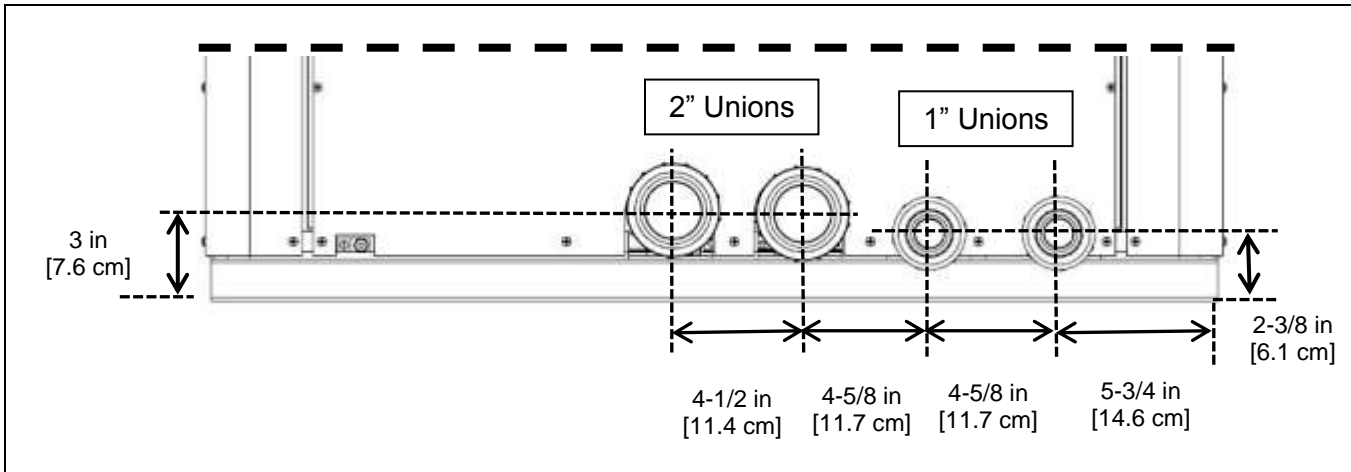


Figure 22

WS10 (Titanium or Cupro-Nickel Exchanger)

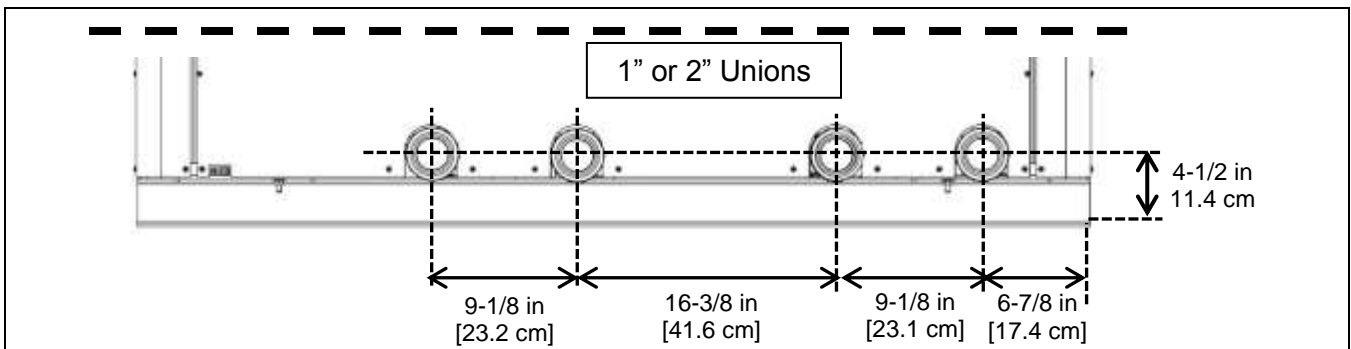


Figure 23

4.3.d Maintaining Ability to Winterize



CAUTION - Failure to heed the following may result in equipment damage.
Do not use glue on the threaded portion of the equipment's unions. A glued-in-place union will prevent the heat pump from being properly winterized.

The unions can be used to decouple the heat pump from the plumbing system during hard-freeze conditions. Do not defeat the function of the unions by using glue on the threaded portion of the unions. See section entitled "Winterizing" on page 8 for more information on winterizing heat pump.

4.3.e Water Flow (Pressure) Switch Adjustment

A water pressure switch adjustment may be required if heat pump operates without sufficient water flow. Confirm the following before attempting a water pressure switch adjustment:

- Water circulator pump is operating.
- Filter is clean.
- Water valves are set to flow water through the heat pump.
- "FLO" code is displayed (or displays intermittently).



WARNING - Failure to heed the following may result in injury or death.
Water Pressure Switch adjustment procedure to be performed by experienced service personnel only; procedure must not be attempted by individuals lacking adequate electrical and mechanical experience.



CAUTION - Failure to heed the following may result in equipment damage.
If, after water pressure switch adjustment, the heat pump continues to operate with water pump off, readjust water pressure switch to ensure heat pump will not run without water flow.

Adjusting Water Pressure Switch:

- Remove heat pump access plate (lower panel - below the control panel access plate)
- Locate water pressure switch. The switch will be found attached outside of the electrical enclosure, at lower edge; exact location will vary by heat pump model.
- Identify type of switch to adjust ("Len Gordon" or "TecMark"). To determine which brand pressure switch is installed compare water pressure switch in heat pump to Figure 24 and Figure 25. Follow the adjustment procedure for the appropriate switch.
- Should adjustment of water pressure switch prove unsuccessful, contact AquaCal AutoPilot Technical Support; site-specific factors may require the installation of an external flow switch.

“Len Gordon” Switch:

- 1) Locate black rectangular plastic tab, located on forward-facing side of the switch. See Figure 24. The black rectangle is a wheel lock tab.
- 2) Slide tab left to unlock the adjustment wheel.
- 3) With water pump operating and electrical power supplied to the heat pump, slowly rotate top of adjustment wheel to the left or right until “FLO” code (just) disappears.
- 4) Once adjustment has been completed, slide wheel locking tab fully back to right-hand locked position.
- 5) With electrical power remaining “ON” and heat pump operating, shut off power to circulating pump. If switch has been correctly adjusted, heat pump will shut off and “FLO” code will display when water pump stops.
- 6) Reinstall heat pump front cover.

Len Gordon Switch

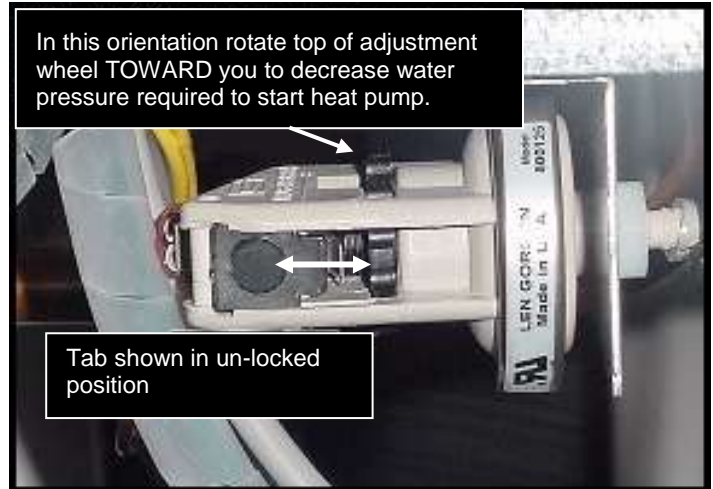


Figure 24

“TecMark” Switch:

- 1) TecMark switches do not have an adjustment wheel lock. See Figure 25.
- 2) With water pump operating and electrical power supplied to the heat pump, slowly rotate top of adjustment wheel to the left or right until “FLO” code (just) disappears.
- 3) With electrical power remaining “ON” to heat pump and heat pump operating, shut off power to circulating pump. If switch has been correctly adjusted, when water pump stops, heat pump will shut off and “FLO” code will display.
- 4) Reinstall heat pump front cover.

TecMark Switch



Figure 25

4.4 Wiring



WARNING - Failure to heed the following may result in injury or death. The information contained in this section is intended for use by qualified electrical installation technicians familiar with electrical service industry safety standards and methods.

4.4.a Standards

STANDARDS ¹	TITLE
Article 440	Standard for Safety for Electric Spas, Equipment Assemblies, and Associated Equipment.
Article 680	Standard for Safety for Swimming Pool Pumps, Filters and Chlorinators.
IEC 60335-1-2001	Household and similar electrical appliances - Safety - General requirements
IEC 60335-2-40 2006	Household and similar electrical appliances - Safety – Particular requirements for electrical heat pumps, air-conditioners and dehumidifiers.
NFPA 70	The electrical installation must conform to the current version of the NEC, and all applicable local and state codes.
UL1995	Heating and cooling equipment.

Table 11

4.4.b General Requirements

- Locate the equipment disconnect as close to the heat pump as possible. Always satisfy applicable codes and standards.
- AquaCal AutoPilot heat pumps are designed for copper conductors, only. Do not use aluminum wire.
- Never mount a power-disconnect directly to the heat pump.
- In sizing power wiring, be especially aware of up-sizing requirements necessary due to wiring distances. Always satisfy applicable codes and standards.
- Multiple heat pumps installed at the same site may benefit from automatic sequencing controllers to avoid excessive power drops at start-up. An “ASC” controller is available by calling AquaCal AutoPilot Customer Support. See “Available Accessories” on page 39 for more information.

4.4.c Grounding and Bonding

Follow local code requirements for properly grounding and bonding heat pump equipment.

4.4.d Surge Suppression

The use of approved commercial surge protectors is strongly recommended.

4.4.e Sizing the Electrical Service

There are two (2) identical data plates on the heat pump; one located on the outside right front corner and one behind the front access panel of electrical enclosure.

Refer to equipment data plate (Figure 26) for specific information required to size electrical service and over-current protection of heat pump. Sizing is based on data plate information, wire size, wiring devices, and over-current protection per applicable local codes and standards.

MINIMUM CIRCUIT AMPACITY MADE IN THE USA

ELEC. SERVICE: VOLTS PH Hz

MAXIMUM TIME DELAY FUSE OR HACR BREAKER

COMPRESSOR VOLTS R.L.A. L.R.A.

FAN MOTOR VOLTS H.P. F.L.A.

REFRIGERANT: Circuit 1 - Factory charged Only co/kg

REFRIGERANT: Circuit 2 - Factory charged Only co/kg

Tested to (high side) / (low side)

OUTDOOR USE

AQUA CAL, INC.
4 TEAM HORSE COMPANY
291 24th STREET NORTH
ST. PETERSBURG, FL 33716
FACTORY SERVICE
137-423-9640

MODEL NUMBER

IIIBAR CODEIII

SERIAL NUMBER

IIIBAR CODEIII

Figure 26

¹ Not all standards are applicable in all installations. Follow all local applicable codes.

4.4.f Verify Transformer Tap

Voltage settings must be confirmed and set correctly on the heat pump depending on the measured voltage found at the installation site. If an incorrect voltage is set on the heat pump, it may not start or it could possibly cause damage to heat pump components. The following procedure will allow the installer to set the heat pump's transformer for the appropriate site voltage.

WARNING - Failure to heed the following may result in injury or death. The information contained in this section is intended for use by qualified electrical installation technicians, familiar with electrical service industry safety standards and methods.

CAUTION - Failure to heed the following may result in equipment damage. Setting a voltage other than what is listed on the heat pump's data plate can damage equipment and is not covered under warranty.

Please note: If more than one voltage is shown on the equipment's data plate, the factory default setting is the higher listed voltage. As an example a "208/230" voltage will be set to "230" from the factory.

1. Attempt to turn heat pump on by adjusting thermostat to call for heat. If more than one heat pump is onsite, turn them all on. Final adjustments must be made with all heat pumps running.
2. Measure the running site voltage.
3. Confirm transformer tap used is set for the voltage shown on the data plate. If more than one voltage tap is shown, select the voltage nearest to the running site voltage.
4. If heat pump is using three-phase incoming voltage, see section entitled "Three Phase Monitor Adjustment" on page 24.

**Example of a Heat Pump Transformer
(Your transformer may vary)**

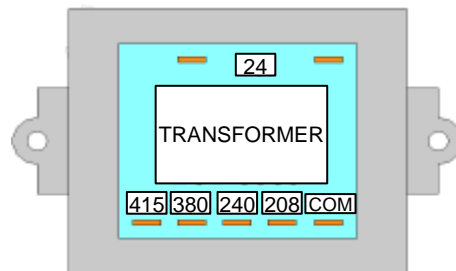


Figure 27

4.4.g Three Phase Monitor Adjustment

If heat pump uses three-phase voltage, settings must be confirmed on heat pump's phase rotation monitors. If an incorrect voltage is set on the heat pump, it may not start or could cause damage to heat pump components.

WARNING - Failure to heed the following may result in injury or death. The information contained in this section is intended for use by qualified electrical installation technicians, familiar with electrical service industry safety standards and methods.

CAUTION - Failure to heed the following may result in equipment damage. Setting a voltage other than what is listed on the heat pump's data plate can damage equipment and is not covered under warranty.

1. Attempt to turn heat pump on by adjusting thermostat to call for heat. If more than one heat pump is onsite, turn them all on. Final adjustments must be made with all heat pumps running.
2. Locate the phase rotation monitor in the electrical box of heat pump.
 - a) If a standard phase monitor is found (Figure 28), adjustment is not needed.

**Standard
Three Phase Monitor**



Figure 28

**Digital
Three Phase Voltage Monitor**



Figure 29

- b) If a digital phase rotation monitor is found (Figure 29), perform the following adjustments on the monitor.
 - a) Measure the running site voltage.
 - b) Scroll through setup options on monitor by pressing and releasing the “SETUP” button.
 - c) Set monitor options as shown in Table 12 and Table 13. *Press and hold the up or down arrow to cycle to correct setting. When option is selected, press “SETUP” to lock in choice.*
 - d) Select “READ” followed by “SETUP”. This will lock in the settings. After the heat pump’s time delay has elapsed the heat pump should turn on.

VOLTAGE

#	VOLTAGE AS SHOWN ON DATA PLATE	MEASURED RUNNING VOLTAGE	SET LINE VOLTAGE	SET PERCENT UNDER VOLT	SET PERCENT OVER VOLT
A & B	208 / 230	200 – 229	208	4%*	10%
		215 – 253	230	10%	10%
D & E	380	342 – 418	380	10%	10%
G	460	414 – 506	460	10%	10%
H	200 / 240	200 – 220	200	0%*	10%
		220 - 264	240	10%	10%

* When setting a unit line voltage for 208 and 200, the Percent under volt setting must be changed. At no time should operating voltage be under 200 volts. Damage to compressor may occur. This damage is not covered under warranty.

Table 12

ADDITIONAL DIGITAL MONITOR SETTINGS

OPTION	DEFAULT SETTING
Delay on Break	.1
Delay on Fault	15
Percent over volt	10%
Percent phase unbal	5%
Reset mode	On
CNTRL mode	On

Table 13

3. If heat pump(s) do not start, perform the following procedure:
 - A. Confirm heat pump’s transformer is set for correct voltage. See section entitled "Verify Transformer Tap" on page 24 for more information.
 - B. The heat pump may be out of phase with the supplied incoming voltage. Perform the following operation to switch phase on heat pump.
 - a. Switch legs “L1” and “L2” of incoming power to line side of contactor.
 - b. If heat pump does not turn on, switch legs “L2” and “L3”.
 - c. If heat pump still does not turn on, switch legs “L1” and “L3”.
 - C. Confirm heat pump is rated for measured site voltage.
 - D. Confirm the heat pump is not displaying an error code. If an error code is present, see Fault Code Definitions on page 36 for more information.

4.4.h External Controls / Equipment

The heat pump allows external equipment to control the heat pumps “ON” / “OFF” functionality. A direct connection for external controllers has been provided on the microprocessor board.

- 1) Connect the external controller to the terminal block of the microprocessor board using a minimum 18-gauge low voltage wire.
- 2) For a two-wire controller (which has a thermostat) – Connect to the “Y” and “Z” connections of the block labeled “X-Y-Z”. See Figure 27.
- 3) For a three-wire controller (which does not have a thermostat) – Connect to the block labeled “FS-2”.
- 4) Program the heat pump to accept an external controller’s signal. See section entitled “Configuring for External Controller” on page 29 for more information.

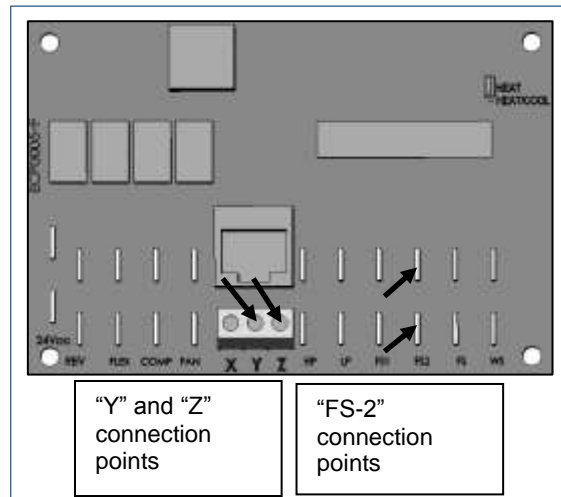


Figure 30

4.4.i External Controllers and Cooling Mode

The cooling function on heat pumps (if equipped) will be disabled when programmed to accept an external controller’s signal. When cooling function is needed the heat pump must be re-programmed to allow for local (not external) control. It is ok to leave external controller wires in place while unit is re-programmed.

4.4.j Positioning Mode Jumper

⚠ WARNING - Failure to heed the following may result in injury or death.
Risk of Electrical Shock- Ensure all electrical power to the heat pump has been disconnected prior to removing the heat pump front access panel. Leave electrical power disconnected throughout the following jumper repositioning procedure.

⚠ CAUTION - Failure to heed the following may result in equipment damage.
This is NOT an owner or operator procedure. Repairs must not be attempted by untrained and/or unqualified individuals.

Default Position

The position of a jumper on the heat pump's microprocessor is factory set for "Heat-Cool" on WS05, SP05 and WS10 water source units. The jumper is set for "Heat" only for the WS03 heat-only unit. Altering jumper settings will cause the heat pump to lose controller functionality and may cause equipment damage. If needed, the heat pump jumper can be verified and repositioned.

Verifying Position

1. Apply electrical power to heat pump.
2. Review the available modes by repeatedly pressing the "MODE" button:
 - Heat only models display "OFF" and "HEA".
 - Heat-Cool models display "OFF", "HEA", "COO", and "AHC".
3. If the modes do not display correctly the jumper is placed in the incorrect position.

Repositioning as Needed

1. Disconnect electrical power.
2. Remove heat pump's front access panel.
3. Unscrew control panel assembly and gain access to control board.
4. Remove and reposition jumper located at the upper right hand corner of control board. See Figure 31. Jumper must cover middle and lower pin as shown for "Heat and Cool".

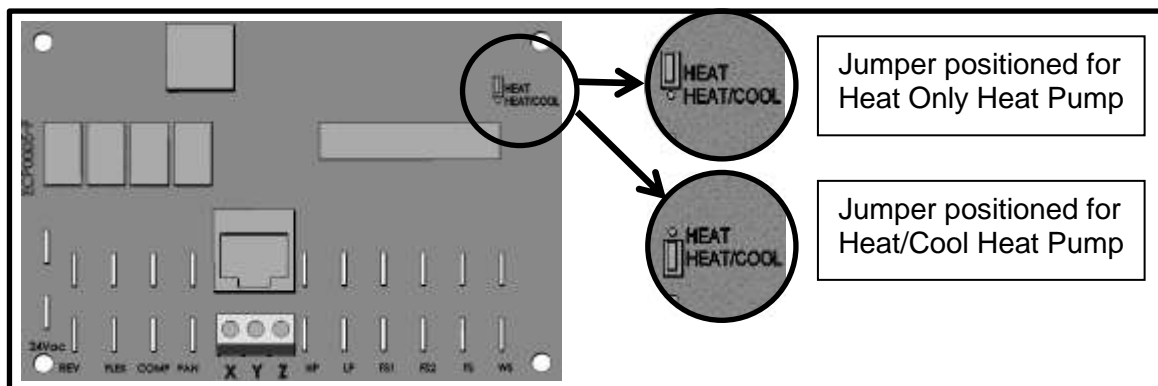



Figure 31

4.5 Programming

The heat pump allows for two levels of programming; User-level and Service-level programming. This section describes programming for site specific conditions in the Service-level programming.

The installer must insure the programming is compatible with any external controllers and confirm heat pump starts and operates per manufacturer's specifications. Unless instructed by AquaCal AutoPilot Technical Support Group, the installer should not adjust sensor calibration or dead-band values.

-  **CAUTION** - Failure to heed the following may result in equipment damage.
- Service Level Programming must only be attempted by authorized service centers. If adjustments are deemed necessary, contact installing dealer or AquaCal AutoPilot Customer Support. Un-authorized adjustments in the Service Menu (beyond the “LOC” menu) will void factory warranty.
 - The time delay should only be de-activated for diagnostic convenience, and must be re-activated prior to placing heat pump back in service. Failure to reset time delay could result in permanent damage to the heat pump compressor.
 - Using the back door entry to access a locked keypad will reset all settings to factory default including any installer entered configuration. See section entitled “Resetting Heat Pump (“Back Door” Entry)” on page 31 for more information. Re-programming all custom site condition settings will be required when using this reset.

4.5.a Program Displays

MESSAGE	DESCRIPTION
“CF1”	Select water temperature format; in either Celsius or Fahrenheit.
“ULC”	Enable heat pump lock-out feature.
“ELC”	Select password to lock heat pump access.
“LOC”	Access to site-dependent setup parameters. Factory code required. (Not intended for use by the owner)
“FS2”	Configure remote flow switch or automatic thermostat switch connected to heat pump.
“JAO”	Configure an external controller connected to the heat pump.
“dEL”	Deactivate time delay.
“tSC”	Calibrate water sensor.
“dSC”	Calibrate defrost sensor.
“dBS”	Adjust number of degrees water temperature must fall below set point before spa thermostat closes and calls for heat or cooling. (Dead-Band Spa)
“dBP”	Adjust number of degrees water temperature must fall below set point before pool thermostat closes and calls for heat or cooling. (Dead-Band Pool)

4.5.b Service Level Programs

STEPS	EXPLANATION
Entering Service Menu	
Press and hold “Up” and “Down” buttons simultaneously.	“CF1” code appears.
Press “Pool / Spa” button until “LOC” is displayed.	This is the entrance point for the Service Menu.
Use “Up” or “Down” button to enter factory access passcode.	The factory default code is “0”.
Press the “Pool / Spa” button once.	Service level programs are now available. If left idle for 15 seconds, program will time-out and exit programming mode.
Deactivating Time Delay	
The time delay should only be de-activated by qualified HVAC technicians for diagnostic convenience, and must be re-activated prior to placing heat pump back in service. Failure to reset time delay feature could result in permanent damage to heat pump compressor.	
Enter Service Menu	If needed, see “Entering Service Menu” in this chart.
Press the “Pool / Spa” button until “dEL” is displayed.	This is the entrance point for the Time Delay Menu.

STEPS	EXPLANATION
Press "Up" or "Down" button to select "0" or "1".	Select "0" to disable time delay. Select "1" to allow time delay to remain active.
Wait 15 seconds to allow heat pump to exit programming mode.	Configuration is complete.
Configuring for External Controller	
Enter Service Menu	If needed, see "Entering Service Menu" in this chart.
Press the "Pool / Spa" button until "JAO" is displayed.	This is the entrance point for the External Controller Interface.
Press the "Up" or "Down" button to select "0" or "1".	Select "0" for no external controller. Select "2" for two wire controller. Select "3" for three wire controller.
Wait 15 seconds to allow heat pump to exit programming mode.	Configuration is complete.
Configuring for Remote Flow Switch	
It is assumed that a remote flow switch has been connected to the heat pump for automatic thermostat switching.	See "Configuring for Remote Flow Switch" on page 39 for more information.
Enter Service Menu	If needed, see "Entering Service Menu" in this chart.
Press the "Pool / Spa" button until "FS2" is displayed.	This is the entrance point for the External Controller Interface.
Press the "Up" or "Down" button to select "0" or "1".	Select "0" for no switch. Select "1" to enable switch.
Wait 15 seconds to allow heat pump to exit programming mode.	Configuration is complete.
Calibrating Water Sensor	
If it is believed the displayed temperature does not match the actual temperature, follow the steps below to verify and adjust the controller as necessary. Be certain to use an accurate thermometer.	
Obtain an accurate water temperature reading.	<ul style="list-style-type: none"> • With circulating pump in operation and water moving through heat pump, place a reliable thermometer in water. Make sure to measure water away from returns and determine the temperature of the water entering the heat pump. • Once measured, compare the water temperature to heat pumps displayed water temperature. • If temperature is within 1° F, no calibration is necessary. • If temperature differs by 2° to 3° F, calibration is necessary. Proceed to next step.
Enter Service Menu	If needed, see "Entering Service Menu" in this chart.
Press the "Pool / Spa" button until "tSC" is displayed.	This is the entrance point for the water sensor calibration.
Press the "Up" or "Down" button to match the measured water temperature.	<ul style="list-style-type: none"> • The controller can be adjusted to +/- 10° F from the displayed temperature. • Offset calibrations greater than 3° F should be avoided. Such large offsets generally indicate problems with either the method of water temperature measurement, a water sensor not properly inserted into the well, or other equipment issues. Do NOT attempt to mask such issues through offset calibration.
Wait 15 seconds to allow heat pump to exit programming mode.	Calibration is complete.

STEPS	EXPLANATION
Calibrating Defrost Sensor	
Follow steps below to verify and adjust defrost operation.	
Press "MODE" Button until operating mode shows "OFF".	
Obtain an accurate temperature reading at suction line.	<ul style="list-style-type: none"> Remove the heat pump front panel to gain access to the defrost sensor location. Position a clamp-on, thermocouple-type temperature sensor onto the suction line; position the clamp immediately adjacent to the defrost sensor. Connect the clamp-on thermocouple to a multi-meter designed to accept the input of the clamp-on device.
Allow heat pump to remain OFF for a minimum of 10 minutes.	
Enter Service Menu	If needed, see "Entering Service Menu" in this chart.
Press "Pool / Spa" button until "dSC" is displayed.	This is the entrance point for the defrost sensor calibration.
Press "Up" or "Down" button once to display the current temperature value of the defrost sensor.	<p>Compare displayed defrost sensor temperature on controller against reading obtained by clamp-on device.</p> <ul style="list-style-type: none"> If the defrost temperatures is within 1° F, no calibration is necessary. If the temperatures differ by 2° to 3° F, calibration is necessary, proceed to next step.
Press "Up" or "Down" button to match temperature reading obtained by clamp-on device.	<ul style="list-style-type: none"> The controller can be adjusted to +/- 10° F from the displayed temperature. Please note - offset calibrations greater than 3° F should be avoided. Such large offsets generally indicate problems with the method of defrost temperature measurement, a defrost sensor not properly attached to the suction line, or other equipment issues. Do NOT attempt to mask such issues through offset calibration.
Wait 15 seconds to allow heat pump to exit programming mode.	Front panel can be re-attached. Calibration is complete.
Set system controls to desired mode of operation.	If needed, see "Setting Operating Mode" on page 3.
Adjusting Dead-Band Differential	
The dead-band differential determines the number of degrees the water temperature must rise or fall below the set point before calling for heating or cooling. The installer <u>should not</u> adjust sensor calibration or dead-band values unless instructed by an AquaCal AutoPilot Technician.	
Enter Service Menu	If needed, see "Entering Service Menu" in this chart.
Press "Pool / Spa" button until "dBS" is displayed for Spa or "dBP" is displayed for Pool.	This is the entrance point for the Dead-band Differential adjustment menu.
Press "Up" button once to display current setting.	
Press "Up" or "Down" button to adjust differential in 1-degree increments.	<p>The differential is adjustable in 1-degree increments from 1 to 5 degrees Fahrenheit.</p> <p>1 degree = .5 degree above or .5 degrees below water temperature. 2 degree = 1 degree above or 1 degree below water temperature. 3 degree = 1.5 degree above or 1.5 degrees below water temperature, etc.</p>
Wait 15 seconds to allow heat pump to exit programming mode.	Calibration is complete.

STEPS	EXPLANATION
Resetting Heat Pump ("Back Door" Entry)	
The factory "Back Door Entry" will reset the service lock code back to the factory setting "50".	
Simultaneously Press "Pool / Spa" button and "Up" button until display shows "888". Release buttons.	CAUTION - Using this option will RESET ALL SETTINGS TO THE FACTORY DEFAULTS. This includes external controller configuration and will require re-entry of any site condition settings. See "Microprocessor Default Parameters" for a complete list of factory default parameters on page 31.

Table 14

4.5.c Default Program Parameters

The following options have been pre-programmed into the microprocessor.

CODE	DESCRIPTION	DEFAULT VALUE	RANGE
"CFI"	Celsius / Fahrenheit Selection.	1	0 = Celsius / 1 = Fahrenheit
"CFO"	Call-Flex Options	0	This option is not used.
"dBP"	Pool Dead-Band Differential	1°	1° TO 5°
"dBS"	Spa Dead-Band Differential	1°	1° TO 5°
"dEL"	Time Delay	1	0 = "OFF" 1 = "ON"
"dSC"	Defrost Sensor Calibration	Factory Calibrated	Plus or minus 10° F
"ELC"	Enter Lock Code	50	00 - 99
"FS2"	Flow Switch / Auto T-Stat Switching Option	0	0 = "No Switch" 1 = "Enable Switch"
"JAO"	External Controller	0	0 = "No Controller" 2 = "Two Wire Controller" 3 = "Three Wire Controller"
"LOC"	Service Entry Point	50	00 - 99
"tSC"	Water Sensor Calibration	Factory Calibrated	Plus or minus 10° F
"ULC"	User Lock Code	0	0 = "User Lock Disabled" 1 = "User Lock Enabled"
	Operating Mode	"OFF"	Heat Only – "OFF", "HEA" Heat and Cool – "OFF", "HEA", "COO", and "ACH"
	Thermostat Settings (Pool and Spa)	"OFF"	

Table 15

4.6 Optional Installation

4.6.a Pool and Spa Combination Heating

The heat pump is equipped with two thermostats; one for pool and one for spa. The water is maintained at the selected thermostat set-point depending on the selected thermostat. Please note – when heating the spa, the water must be isolated from the pool by selecting the correct water isolation valve position.

Pool / spa installations can be automated with an "External Flow Switch". This option changes the selector thermostat each time the pool or spa isolation valve is positioned. See "Available Accessories" on page 39 for more information.

4.6.b Spa Setback Heating Option




When using a heat pump to heat a spa only (without a pool in the water circuit), the "POOL" thermostat can be used as a setback control. Set the "SPA" thermostat for the desired spa temperature. Select the "POOL" thermostat and set it at a point 10-15° F below the desired spa temperature. This allows the spa to be held at a heated temperature using the "POOL" thermostat, but somewhat lower than normal spa-use temperatures.

When ready to heat the spa, select the “SPA” thermostat to heat the spa to the desired temperature. This will result in reduced warm up periods over full cold starts. Switch back to the “POOL” thermostat when done using the spa.

To prevent excessive heat loss and increased run time, use a spa cover and turn off air blowers when heating spas.

SECTION 5 - TROUBLESHOOTING

5.1 Symptom / Resolution Charts

-  **WARNING** - Failure to heed the following may result in injury or death. Repairs must not be attempted by untrained unqualified individuals. If service is deemed necessary, contact installing dealer or AquaCal AutoPilot Customer Support.
-  **WARNING** - Failure to heed the following may result in injury or death. Heat pump contains refrigerant under high pressure. Repairs to refrigerant circuit must not be attempted by untrained or unqualified individuals. Service must be performed only by qualified HVAC technicians. Recover refrigerant before opening system.
-  **CAUTION** - Failure to heed the following may result in equipment damage. Service by un-authorized personnel will void factory warranty.

Please note – Troubleshooting charts are for Main Controller version 3.0.

SYMPTOM	RULE OUT	RESOLUTION
Control Panel Not Working		
	An external controller is being used	STEP 1: See section entitled “Configuring for External Controller” on page 29 for more information on heat pump controller functionality when using external controllers.
		STEP 2: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.
Heat Pump Not Running		
	No power to heat pump	STEP 1: Confirm heat pump display is illuminated. <ul style="list-style-type: none"> • If not, confirm the main breaker (located at the power supply panel) and the disconnect switch (located near the heat pump) are both turned ON. • If yes, proceed to next step.
	Incorrect mode setting	STEP 2: Confirm correct mode is selected. See “Setting Operating Mode” on page 3. If heat pump still does not turn on, proceed to next step.
	Thermostat set incorrectly	STEP 3: Confirm that thermostat is set above / below current water temperature depending on mode setting. See “Setting Thermostats” on page 3. If heat pump still does not turn on, proceed to next step.
	Error displayed	STEP 5: If an error code is displayed, see appropriate fault code in this section. If no fault code is displayed, proceed to next step.

SYMPTOM	RULE OUT	RESOLUTION
	External controller being used	<p>STEP 6:</p> <ul style="list-style-type: none"> If an external controller is being used, confirm heat pump is set to accept the controller's signal. See section entitled "External Controls / Equipment" on page 23 and "Configuring for External Controller" on page 29 for more information. If heat pump is set correctly to accept an external controller's signal, contact the installer of the external controller device or the device's manufacturer for further assistance.
		<p>STEP 7:</p> <p>Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.</p>
Heat Pump Running, Not Heating		
	Incorrect mode setting	<p>STEP 1:</p> <p>Confirm heat pump mode is set to either "HEA" OR "ACH". See "Setting Operating Mode" on page 3 for more information.</p>
	Not transferring heat into water	<p>STEP 2:</p> <p>Measure temperature of source-side discharge water coming out of heat pump. If discharge water is between 8° to 10° F cooler than incoming source water, the heat pump <u>is</u> moving heat from the source water.</p> <p>Also measure pool-side discharge water coming out of the heat pump. Refer to "Adjusting Water Flow using ΔT (Delta-T)" on page 7 for particular discharge temperatures. Please note - Temperatures shown when unit is in "HEA" mode only; "ACH" and "COO" discharge temperatures not shown.</p>
	Incorrect thermostat setting	<p>STEP 3:</p> <p>Confirm thermostat is set above the current water temperature. See "Setting Thermostats" on page 3 for more information.</p>
	External controller being used	<p>STEP 4:</p> <ul style="list-style-type: none"> If an external controller is being used, confirm heat pump is set to accept the controller's signal. See section entitled "External Controls / Equipment" on page 23 and "Configuring for External Controller" on page 29 for more information. If heat pump is set correctly to accept an external controller's signal, contact the installer of the external controller device or the device's manufacturer for further assistance.
	Error condition exists	<p>STEP 5:</p> <p>If an error code is displayed, see appropriate fault code in this section. If no fault code is displayed, proceed to next step.</p>
	Heating incorrect body of water	<p>STEP 6:</p> <p>Confirm valves are correctly positioned to heat correct body of water. If heating a spa that overflows into a pool, confirm the spa is isolated when being heated.</p>
	Insufficient run time	<p>STEP 7:</p> <p>Water source equipment will generally be set to run 24 hours a day in commercial applications. Confirm that water pump is not being set with low runtimes.</p>

SYMPTOM	RULE OUT	RESOLUTION
	Water not retaining heat	<p>STEP 8: If heating a spa, turn off water jets to allow for quicker heating times. For pools, turn off water effects, such as slides, waterfalls, or fountains to allow water to retain heat more efficiently. Use of a liquid pool blanket product, such as "Heatsavr™", can also compensate for excessive heat loss.</p>
		<p>STEP 9: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.</p>
Heat Pump Tripping Breaker		
	Weak breaker	<p>STEP 1: If breakers do not trip immediately, the issue is most likely a weak breaker. Have an electrician confirm breakers are in good condition and properly sized for heat pump.</p>
	Incorrect heat pump power sequence	<p>STEP 2: Multiple heat pumps installed at the same site require special automatic sequencing controllers to avoid excessive power drops at start-up. Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance on this type of equipment. See "Automatic Sequencing Controller" in "Available Accessories" on page 39 for more information.</p>
	Compressor Issues	<p>STEP 3:</p> <ul style="list-style-type: none"> If fault occurs when a compressor turns on, service will be required to determine compressor issue. PLEASE NOTE – Compressor failure is extremely rare. Compressor failure must be determined before replacement is considered. Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance on this type of repair.
Heat Pump Won't Shut Off		
	External controller being used improperly	<p>STEP 1:</p> <ul style="list-style-type: none"> If an external controller is being used, confirm heat pump is set to accept the controller's signal. See section entitled "External Controls / Equipment" on page 23 and "Configuring for External Controller" on page 29 for more information. Determine if external controller has its own thermostat. If yes, heat pump mode must be set to "OFF". If heat pump is set correctly to accept an external controller's signal to turn off, contact the installer of the external controller device or the device's manufacturer for further assistance.
	Incorrect mode setting	<p>STEP 2: Confirm the heat pump mode is set to "OFF". See "Setting Operating Mode" on page 3 for more information.</p>
		<p>STEP 3: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.</p>

SYMPTOM	RULE OUT	RESOLUTION
Heat Pump Running, Not Cooling		
	Incorrect mode setting	STEP 1: Confirm the heat pump mode is set to either "COO" OR "ACH". See "Setting Operating Mode" on page 3 for more information.
	Not transferring heat out of water	STEP 2: Measure temperature of source-side discharge water coming out of heat pump. If discharge water is warmer than incoming source water, the heat pump <u>is</u> moving heat into the source water.
	Incorrect thermostat setting	STEP 3: Confirm the thermostat is set below the current water temperature. See "Setting Thermostats" on page 3 for more information.
	External controller is being used improperly	STEP 4: <ul style="list-style-type: none"> • If an external controller is being used, confirm heat pump is set to accept the controller's signal. See section entitled "External Controls / Equipment" on page 23 and "Configuring for External Controller" on page 29 for more information. • If heat pump is set correctly to accept an external controller's signal, contact the installer of the external controller device or the device's manufacturer for further assistance.
	Error condition exists	STEP 5: If an error code is displayed, see appropriate fault code in this section. If no fault code is displayed, proceed to next step.
	Cooling incorrect body of water	STEP 6: Confirm valves are correctly positioned to cool the correct body of water.
	Insufficient run time	STEP 7: Water source equipment will generally be set to run 24 hours a day in commercial applications. Confirm that water pump is not being set with low runtimes.
		STEP 8: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.
Water Coming From Heat Pump		
	Determine if water is from a leak or condensation	STEP 1: If using chlorine or bromine as a pool / spa sanitizer, use a test strip in water at heat pump to determine if sanitizer is present. If sanitizer is present, a leak may exist.
		STEP 2: Turn off heat pump, leaving water pump on. After several hours, determine if water is still coming from heat pump. If water is still coming from heat pump, a leak may be present.
		STEP 3: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.

Table 16

5.2 Fault Code Definitions

FAULT CODE	RULE OUT	RESOLUTION
“dPO” Indicator		
Defrost sensor is open.	Cut or loose sensor wiring	Defrost sensor requires replacement.
“PO” Indicator		
Water temperature sensor is open.	Cut or loose sensor wiring	Water temperature sensor requires replacement.
“dPC” Indicator		
Defrost sensor is shorted.	Short circuit in the defrost sensor wiring or defective sensor	Defrost sensor requires replacement.
“PC” Indicator		
Water temperature sensor is shorted.	Short circuit in water sensor wiring or defective sensor	Water temperature sensor requires replacement.
“HP” Indicator		
Refrigerant system’s high-pressure switch is open.	Low water flow – (pool-side in heating mode) Or (source-side in cooling mode) Water pump off or insufficient flow	STEP 1: Confirm water pump on. If multispeed pump(s), run at high speed to determine if error persists. If error recurs, proceed to next step.
	Valves in incorrect position	STEP 2: Confirm water is not being diverted away from heat pump or insufficient water balance exists. See “Water Flow Rates” and “Adjusting Water Flow using ΔT (Delta-T)” on pages 6 and 7 for more. If error re-occurs, proceed to next step.
	Water Pressure Switch incorrectly calibrated	STEP 3: See section entitled “Water Flow (Pressure) Switch Adjustment” on page 21. If error re-occurs, proceed to next step.
	Defective high-pressure switch or wiring	STEP 4: A qualified HVAC technician should replace high-pressure switch. If error re-occurs, proceed to next step.
	High refrigerant charge.	STEP 5: A qualified HVAC technician should confirm coolant charge is correct for refrigerant circuit. See heat pump data plate for correct charge and verify charge. Please note – improperly charging the system can void manufacturer’s warranty.
		STEP 6: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.

“HP5” Indicator		
Heat Pump has locked out due to five HP (high-pressure) faults during one call for heating or cooling.		STEP 1: Reset heat pump by turning power off and back on to clear error. See resolution for “HP” Indicator. If problem persists, contact AquaCal AutoPilot Customer Support for further assistance.
“LP” Indicator		
Refrigerant system’s low-pressure switch is open.	Water pump off or insufficient speed	STEP 1: Confirm water pump on. Run at high speed to determine if error persists. If error recurs, proceed to next step.
	Valves in incorrect position	STEP 2: Confirm water is not being diverted away from heat pump or insufficient water balance exists. See “Operating Pressures and Water Flow Rates” on page 6 for more information on flow rates. If error recurs, proceed to next step.
	Water Pressure Switch incorrectly calibrated	STEP 3: See section entitled “Water Flow (Pressure) Switch Adjustment” on page 21.
	Defective low-pressure switch or wiring	STEP 4: Replace low-pressure switch. If error recurs, proceed to next step.
	Low refrigerant charge.	STEP 5: A qualified HVAC technician should confirm coolant charge is correct for refrigerant circuit. See heat pump data plate for correct charge and verify charge. Please note – improperly charging the system can void manufacturer’s warranty.
		STEP 5: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.
“LP5” Indicator		
Heat Pump has locked out due to five LP (low-pressure) faults during one call for heating or cooling.		STEP 1: Reset heat pump by turning power off and back on to clear error. See resolution for “LP” Indicator. If problem persists, contact AquaCal AutoPilot Customer Support for further assistance.
“OtA” Indicator		
Incoming water temperature exceeded 110° F and unit is locked (Over Temperature Alarm). Heat pump will not operate until incoming water temperature drops to 100° F or lower.	Improper usage of other heating equipment	STEP 1: Determine if another heat pump (gas heater, solar heater, etc.) is heating water being sent directly to heat pump. This situation will need to be corrected before continuing to use heat pump.
	Incorrect reading from water temperature sensor	STEP 2: Verify existing water temperature with an <u>accurate</u> external meter. If heat pump’s sensor is inaccurate, water temperature sensor requires replacement. If error recurs, proceed to next step.
		STEP 3: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.

“FLO” Indicator		
Low or no water flow detected.	Water pump off or insufficient speed	STEP 1: Confirm water pump on. Run at high speed to determine if error persists. If error recurs, proceed to next step.
	Valves in incorrect position	STEP 2: Confirm water is not being diverted away from heat pump or insufficient water balance exists. See “Operating Pressures and Water Flow Rates” on page 6 for more information on flow rates. If error recurs, proceed to next step.
	Water Pressure Switch incorrectly calibrated	STEP 3: See section entitled “Water Flow (Pressure) Switch Adjustment” on page 21.
		STEP 4: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.
“CSE” Indicator		
Control system error.	Defective control board	STEP 1: Disconnect then reconnect power to reset control. If error recurs, proceed to next step.
		STEP 2: Control board requires replacement. If error recurs, proceed to next step.
		STEP 3: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.
“CEr” Indicator		
Communication fault.	Loose or damaged cable	STEP 1: Check “Cat5” cable from control board to display assembly.
		STEP 2: Call heat pump installer or AquaCal AutoPilot Customer Support for further assistance.

Table 17

SECTION 6 - APPENDIX

6.1 Available Accessories

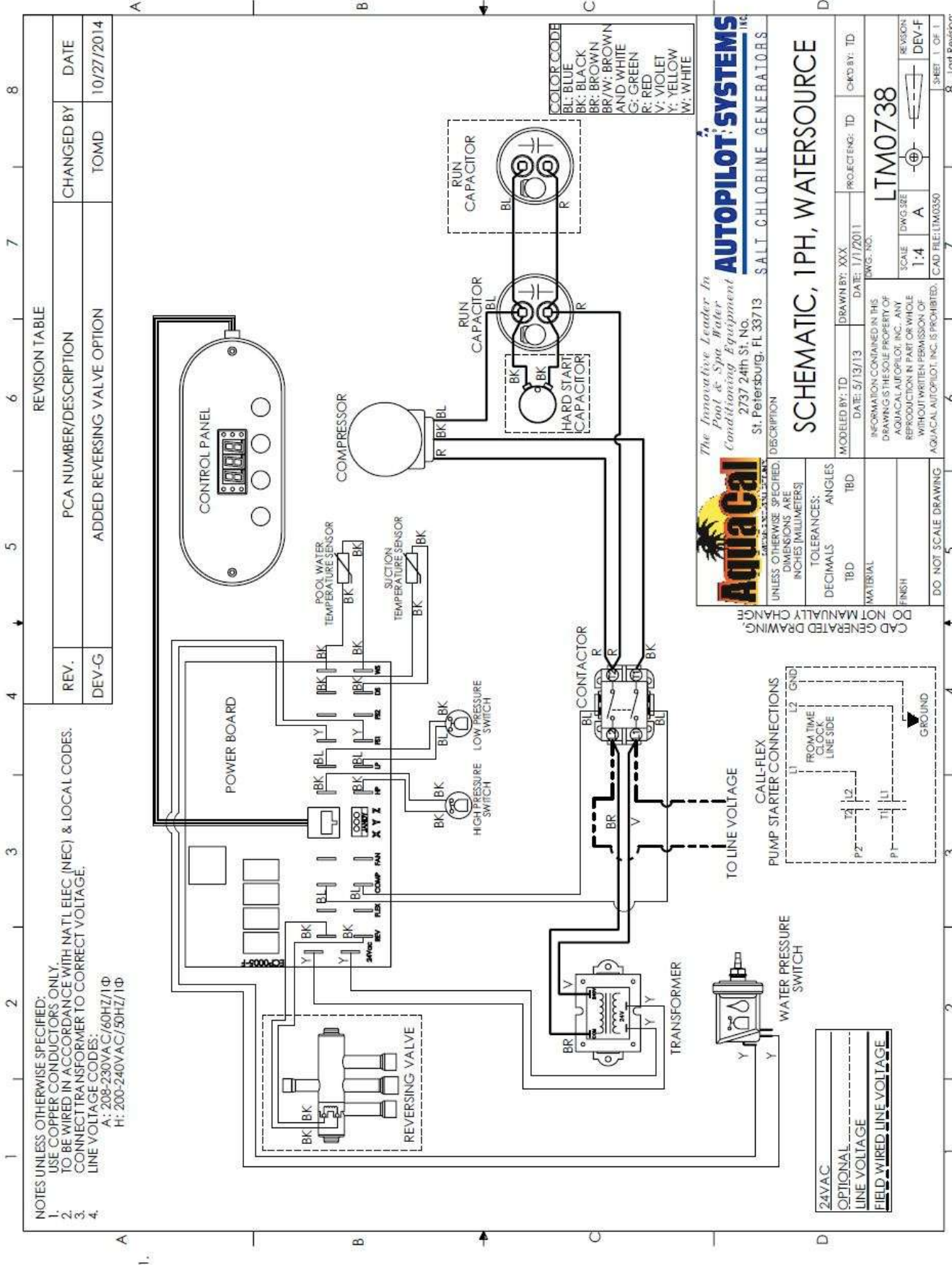
NAME	PART #	DESCRIPTION
EXTERNAL FLOW SWITCH KIT	0040S	<ul style="list-style-type: none"> Used for automatic pool / spa thermostat switching. Use when the pool / spa elevation is higher than the heat pump. Use when a two-speed circulation pump in low-speed mode does not provide enough water pressure to activate a heat pump's water pressure switch.
AUTOMATIC SEQUENCING CONTROLLER	Call Customer Support for correct configuration and part number.	An Automatic Sequencing Controller (ASC) prevents simultaneous startup of multiple heat pumps. Site voltage drop is minimized and utilities are not subjected to large in-rush demands of electrical current.
REMOTE CONTROLLER	STK0070	External microprocessor kit allows for full control of the heat pump from up to 100 feet from the equipment.

Table 18

6.2 Schematics

DOCUMENT #	MODEL	PHASE
LTM0738	WS03, WS05, SP05	Single Phase
LTM0739	WS03, WS05, SP05	Three Phase
LTM0196	WS10	Three Phase

Table 19



Autocal
 The Innovative Leader In Pool & Spa Water Conditioning Equipment
 2737 24th St. No. St. Petersburg, FL 33713 SALT CHLORINE GENERATORS

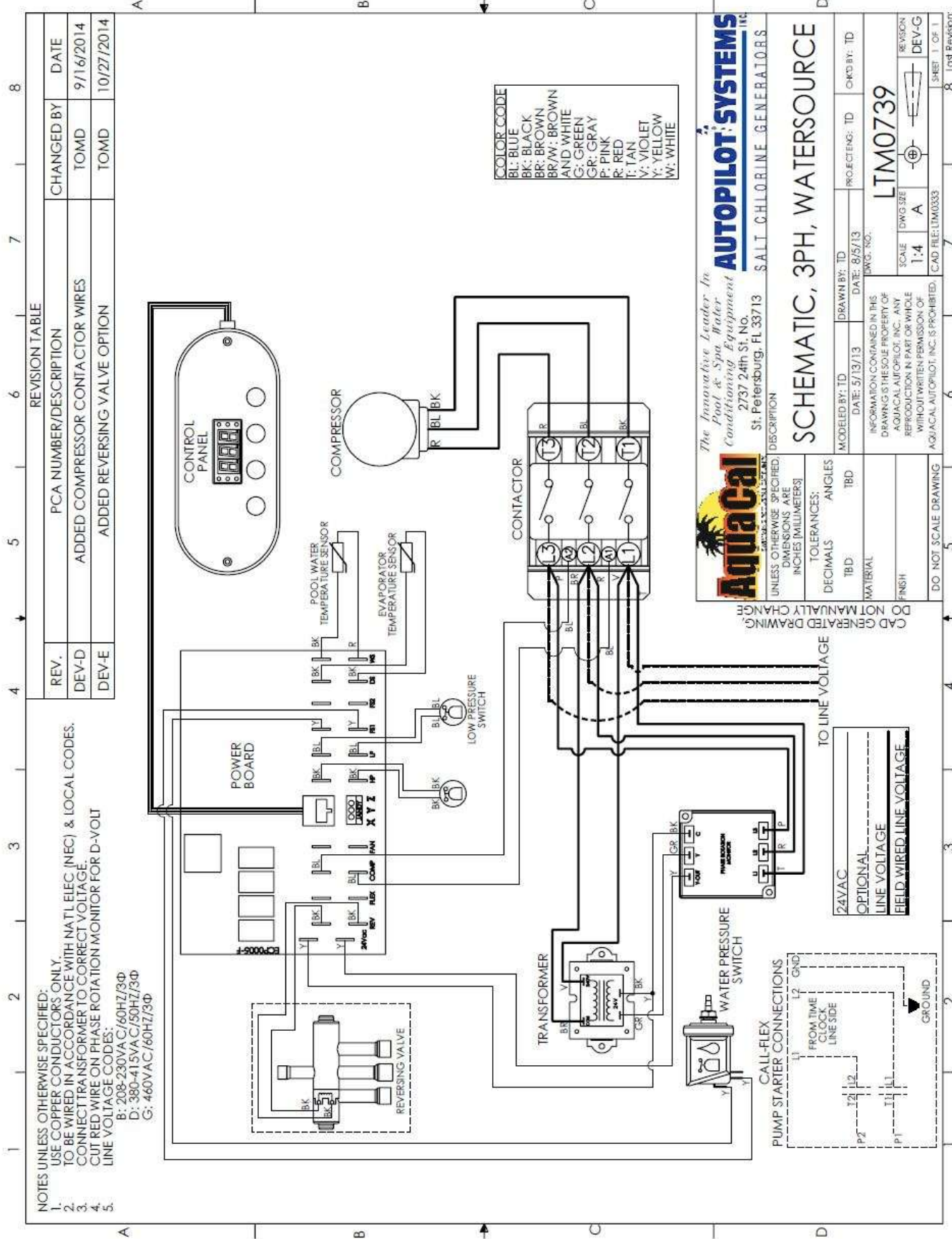
AUTOPILOT SYSTEMS INC

SCHEMATIC, 1PH, WATERSOURCE

MODELED BY: TD DRAWN BY: XXX DATE: 1/1/2011 PROJECT ENG: TD C-KD BY: TD
 DWG. NO. LTM0738
 SCALE DWG SEE 1:4 A DEV-F
 REVISION: DEV-F
 CAD FILE: LTM0350 SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE INCHES (MILLIMETERS)
 TOLERANCES: ANGLES
 DECIMALS: TBD TBD
 MATERIAL: TBD
 FINISH: TBD
 DO NOT SCALE DRAWING

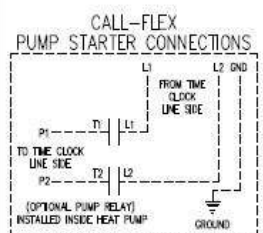
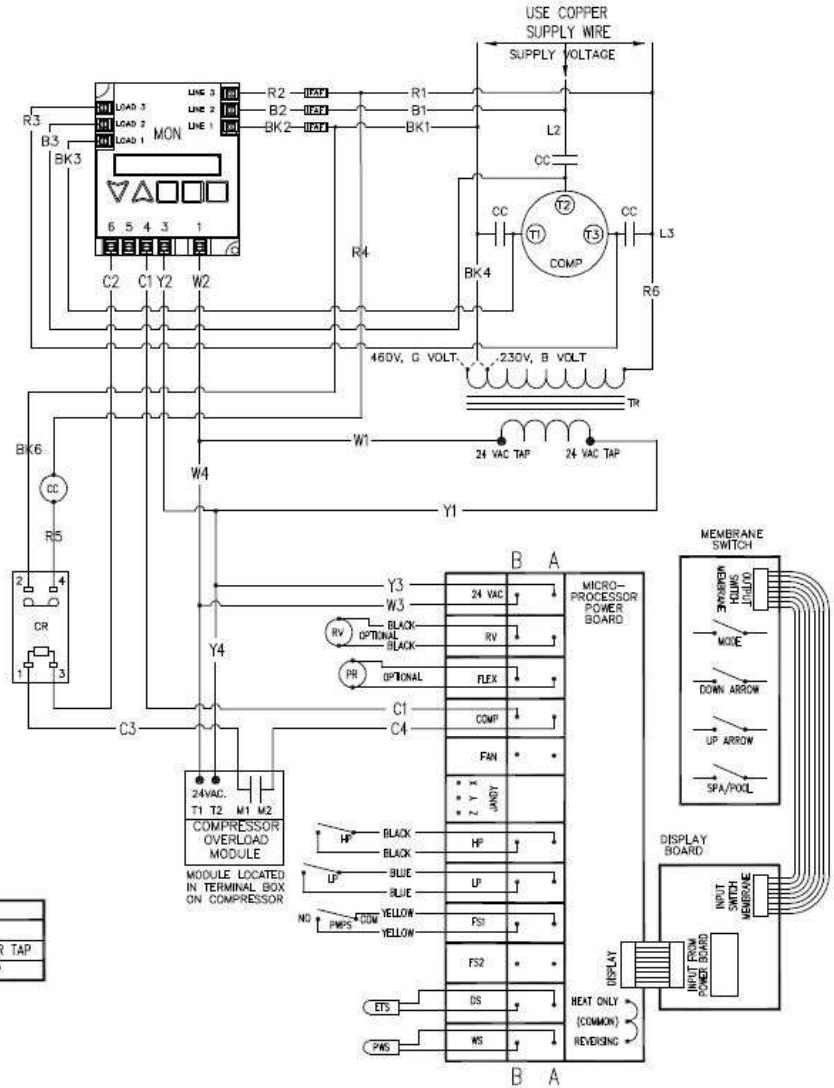
CAD GENERATED DRAWING
 DO NOT MANUALLY CHANGE



NOTES UNLESS OTHERWISE SPECIFIED
 1. USE COPPER CONDUCTORS ONLY.
 2. TO BE WIRED IN ACCORDANCE WITH NATIONAL ELECTRIC (NEC) & LOCAL CODES.
 3. EXTERNAL CONTROLLER HOOK UP:

- A. TWO-WIRE CONTROLLERS
 (JANDY RS 4,6,8, COMPOOL LX 3600)
 a. WIRES CONNECT TO Y & Z ON THE MICROPROCESSOR.
 b. WITH HEATER DISPLAYING WATER TEMPERATURE, PRESS THE UP & DOWN ARROW AT THE SAME TIME UNTIL CF1 APPEARS
 c. PUSH THE POOL/SPA KEY UNTIL LOC APPEARS PUSH THE UP ARROW UNTIL 50 APPEARS.
 d. PUSH THE POOL SPA KEY UNTIL JAO DISPLAYS; PUSH THE UP ARROW UNTIL 2 DISPLAYS.
 e. WHEN THE WATER TEMPERATURE DISPLAYS, TURN BOTH THERMOSTATS TO THE OFF POSITION
- B. THREE-WIRE CONTROLLERS (JANDY AQUASWITCH, COMPOOL) (USE ONLY COMMON AND THE SPA TERMINALS IN THE CONTROLLER)
 a. WIRES CONNECT TO FS2 ON THE MICROPROCESSOR.
 b. WHEN THE HEATER DISPLAYS WATER TEMPERATURE, HOLD THE UP AND DOWN ARROW AT THE SAME TIME UNTIL CF1 APPEARS
 c. PUSH THE POOL/SPA KEY UNTIL LOC APPEARS; PUSH THE UP ARROW UNTIL 50 DISPLAYS.
 d. PUSH THE POOL/SPA KEY UNTIL FS2 DISPLAYS; PUSH THE UP ARROW UNTIL 1 APPEARS.
 e. WHEN THE WATER TEMPERATURE DISPLAYS, SET BOTH THE THERMOSTATS.

REVISIONS				
REV.	PCA# / DESCRIPTION	DATE	CHG	ENG
REL-A	INITIAL RELEASE	12/17/09	SCF	DKS
REL-B	REMOVED PHASE ROTATION CONTROLLER INSTRUCTIONS	8/1/14	TD	TD



VOLTAGE CODES	
CODE	DESCRIPTION
B	200-230 VAC, 60 Hz, 3Ø-USE 240 VAC TRANSFORMER TAP
G	480 VAC, 60 Hz, 3Ø-USE 480 VAC TRANSFORMER TAP

LEGEND	
---	FACTORY WIRING
----	FIELD WIRING
CC	COMPRESSOR CONTACTOR
COMP	COMPRESSOR MOTOR
ETS	EVAPORATOR TEMPERATURE SENSOR
HP	HIGH PRESSURE SWITCH (REFRIGERANT)
LP	LOW PRESSURE SWITCH (REFRIGERANT)
MON	DIGITAL VOLTAGE MONITOR
PR	PUMP RELAY
PWPS	POOL WATER PRESSURE SWITCH
PWS	POOL WATER TEMPERATURE SENSOR
RV	REVERSING VALVE
TR	TRANSFORMER
WIRE COLORS	
B	BLUE
BK	BLACK
R	RED
W	WHITE
C	BLUE/WHITE TRACER

CAD GENERATED DRAWING. DO NOT MANUALLY CHANGE.

APPROVALS	DATE
DRAWN BY: S. FREDETTE	12/17/09
CHECKED BY: D. SMITH	12/18/09
APPROVED BY: SEB	12/18/09

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America's Leading Pool Heat Pump Manufacturer
 2737 24th St. No.
 St. Petersburg, FL 33713

SCHEM, W/S, DIGITAL MONITOR

SIZE	DWG. NO.	REV.
A	LTM0196	A
SCALE: N/A	CAD FILE: LTM0196	SHEET 1 OF 1

Last Revision: 06/22/05