LTP0024

WATER™ SOURCE

by AquaCal
Pool / Spa Heat Pump

Owner and Installation Manual

CONTENTS

INTRODUCTION

The Water•Source swimming pool and spa heat pump utilizes water as the heat source rather than air. The practical recovery of heat stored in lakes, canals, oceans, wells, cooling towers or other viable heat resources is a cost–effective method of conserving energy.

The Water•Source swimming pool / spa heat pump will provide many years of trouble–free service because of it's design:

- A non–corrosive casing protects components from corrosion.
- The aluminum chassis will not rust.
- The insulated evaporator prevents condensate from forming inside the unit.
- Acrylic paint resists aggressive salt air in coastal climates.
- A Scroll compressor is highly efficient and reliable with low sound levels.

The Water•Source uses a "refrigerant vapor compression cycle" to extract "free" heat from one location (the source water) and delivers it to another (the pool). You pay only for the electricity to accomplish the heat transfer.

The Water•Source uses two heat exchangers and makes two heat transfers. One captures heat from the source water and the other transfers heat (enhanced by the compressor) to the pool water.

Heat exchangers are a "tube within a tube". Water flows within an inner tube as the compressor circulates vaporized refrigerant within a surrounding tube, flowing "counter" to the pool water flow. Heat is conducted through the cupro–nickel inner tube designed to withstand fresh, salty, or chemically treated pool or spa water.

Amended 2/29/08

I. LOCATING THE UNIT

A. If the heat pump is installed outdoors:
- Mount on a "pre-cast" concrete near the pool filter and pump.
- The unit may be installed inside an equipment room since it does not require outside air.
- Make certain the unit is not set on a base that joins a building foundation. (sound abatement).
- If necessary, rubber isolation pads may be placed under each corner of the heat pump.

B. The one piece cover lifts up and off the chassis for access to piping and electrical components during installation or service.
- Allow adequate clearance above and around the unit to permit removal and access to the control panels on the front side of the chassis.
- The unit should be located at least 18" from any wall to permit connecting of rear piping and the electrical connections.

II. ELECTRICAL WIRING

A. Heat pumps are available in several line voltages:

208/230 volt – 60 Hz – 1 phase
models through 10 horsepower. using 1 or 2 compressors. (Common in North America).

208/230 volt – 60 Hz – 3 phase
models through 10 horsepower using 1 or 2 compressors. (Common in North America).

380 volt / 50 Hz – 3 phase
models through 10 horsepower using 1 or 2 compressors. (Common in Europe).

460 volt / 60 Hz – 3 phase
models from 5 to 10 horsepower using 1 or 2 compressors. (Common in North America).

B. See the cover or electrical panel name plate for minimum circuit ampacity and and maximum fuse size.

C. The Power Wiring box for connection to "supply power" is located on the side of the Control Panel at chassis front.

D. The Control Wiring box for connection of control wiring is located on the side the Control Panel at the chassis front.

E. The Grounding Lug (bonding lug) is located in an Electrical Panel and must be used to ground the unit as a safety precaution against electrical shock.

F. All wiring must be a copper conductor only and must comply to the National Electrical Codes including Articles 680 and 440; NFPA 70 latest edition; and all state and local codes.

IMPORTANT: To protect against mixed phasing, make sure all power wires are matched properly, i.e. Supply L1 to Contactor L1, L2 to L2, and L3 to L3.

TSB#: P-1032
Title: Bypass Check Valve for Ti-Equipped Heaters

Technical Service Bulletin

Affects Models: All Heat Pumps Equipped with Titanium Condenser

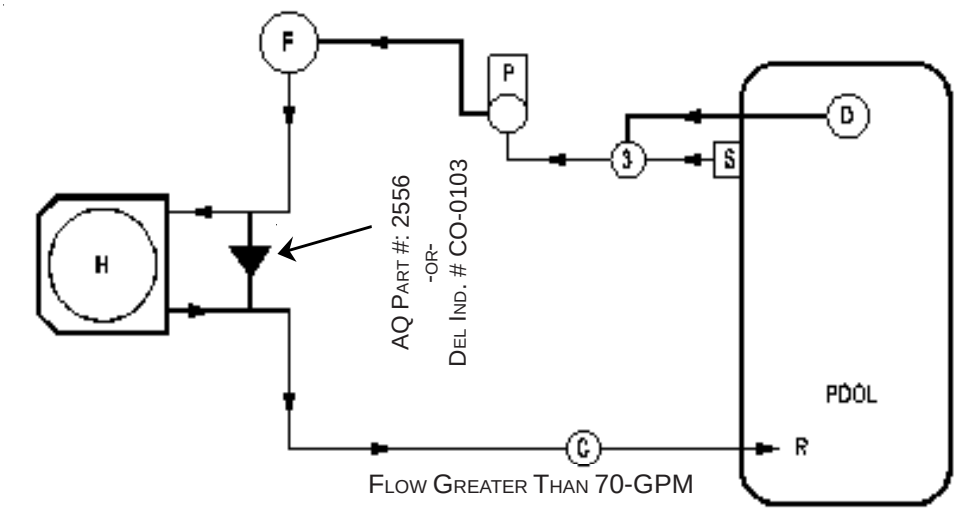
Purpose:

Should plumbing system design result in water flow exceeding 70-GPM, to avoid damage to condenser assembly, a bypass valve must be installed. While a system equipped with a 2-HP or greater circulation pump will nearly always require a bypass, well-plumbed systems, using less than a 2-HP pump, may also require a bypass. Whenever in doubt, and if as-built engineering data is unavailable, actual water flow should be verified by taking suction and discharge pump pressures, converting these pressures to foot-of-head, and plotting actual GPM on the installed pump's factory performance curve. Contact AquaCal factory Technical Support (800-786-7751) for further information concerning site verification of water flow GPM.

This TSB provides the specification, and prescribed placement location within the plumbing system (see drawing below), for the check valve required for bypassing excess water flow around AquaCal, titanium condenser-equipped heat pumps.

Procedure:

Install a 5-lb bypass spring check valve (AquaCal P. N.: 2556, or equal to Del Industries PN: CO-0103) across the "IN" and "OUT" water ports of the heat pump. Make certain the direction of the check valve flow will be from water inlet to water outlet. The check valve must be located within 3-feet of the heat pump, with no bends or reducers between the check valve and heater.



FLOW GREATER THAN 70-GPM

CAUTION !	Failure to heed the following may result in equipment damage.
Water flow exceeding 70-GPM may damage titanium condenser; such damage will NOT be covered under the equipment warranty. Install a bypass check valve (AquaCal P.N.: 2556, or equal to Del Industries P.N.: CO-0103) whenever water flow rate may exceed 70-GPM.	

Questions ?... Contact Technical Support at: 800-786-7751

III. POOL WATER PIPING

Piping for connection to the WATER•SOURCE heater should be in Schedule 40 PVC or a material acceptable to the local code authority. Metal heat sinks are not required.

A. The heat pump unit requires only a portion of the water normally circulated by the pool filter pump.

– Some pool water must "bypass" to the heat pump for heating, then return to the pool piping. To build an "automatic bypass", install:

1. Tee from the pool piping prior to the heat pump.
   PURPOSE: To direct water to the heat pump.

2. Tee to automatic bypass valve to stablize flow in all filter conditions.
   Use 7–13 pound spring check valve.
   If titanium condenser, see page 2.1.

3. Ball valve at heater inlet
   PURPOSE: Isolation and balancing at start–up. Throttle valve for tuning water flow.

4. Thermometer tee and well at the heater's "entry".
   PURPOSE: For visual monitoring of the "real" pool temperature at the water inlet.

5. Diversion valve between tees in the pool piping. (ball or butterfly valve).
   PURPOSE: To force water to the heater.
   NOTE: To balance a bypass system, a valve must be used between the two tees in the pool piping.
   CHECK FLOW REQUIREMENTS OF MODEL IN SPECIFICATION SHEET.

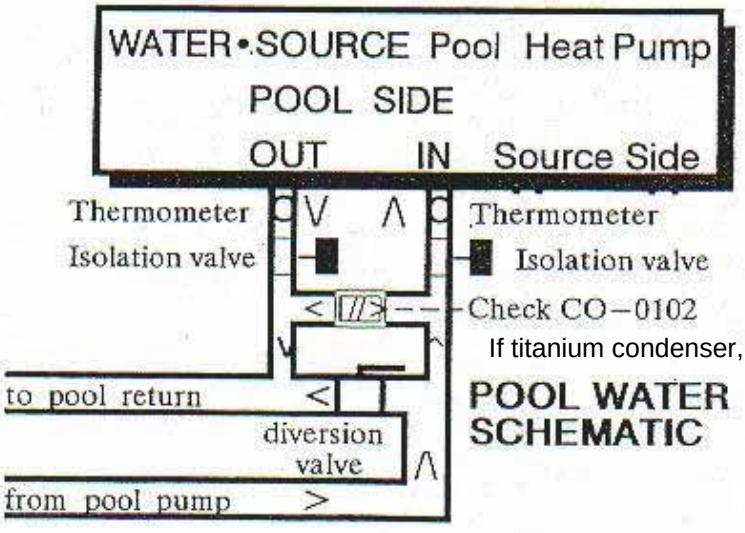
6. Thermometer tee and well at heater's "exit".
   PURPOSE: For a visual comparison to the heated water temperature – for fine tuning of ΔT by balancing valve position at final test.
   (See Startup & Balancing: Sec VII)

7. Tee from automatic bypass check valve.

8. Balancing valve at heater's exit.
   PURPOSE: To balance water flow thru the heater to fine tune at start–up. Also, for isolation requirements of codes.

9. Tee in the pool piping after a balancing valve connects the heater's water "out" to the pool return piping.
   PURPOSE: Heated pool water return.

POOL PIPING
(not to scale)



If titanium condenser, see page 2.1.

POOL WATER SCHEMATIC

IV. HEAT SOURCE WATER

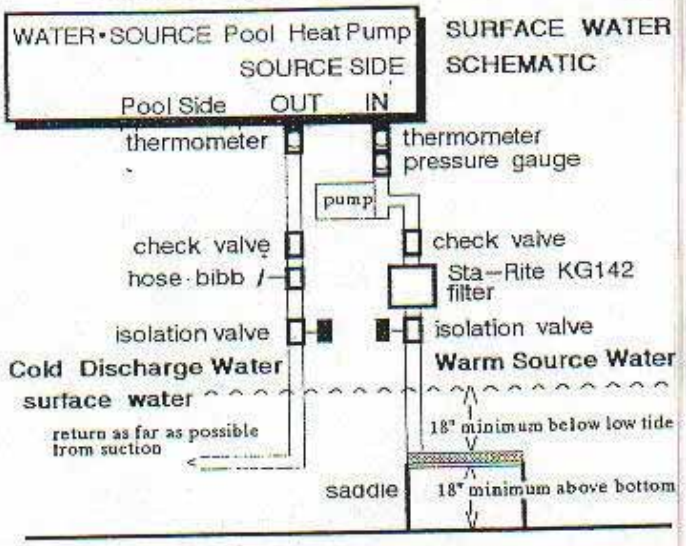
A. "Surface water" heat sources include bays, lakes, rivers, or oceans...fresh or salt water. A pump is required to bring the water to the heat pump.

1. The source water pump can be interlocked with the pump starter... or
2. Activated with a water solenoid valve and a pump pressure switch.

NOTE: If a pressure system is used with surface water, a pump suction screen that is cleanable (in addition to a main inlet strainer) is vital.

3. An inlet screen must be positioned high enough above the bottom to prevent pumping "mud" – and low enough to be safe from low tides and boat wakes.

NOTE – SEA WATER APPLICATIONS
Salt water applications should utilize copper heat source piping to prevent internal marine growth.

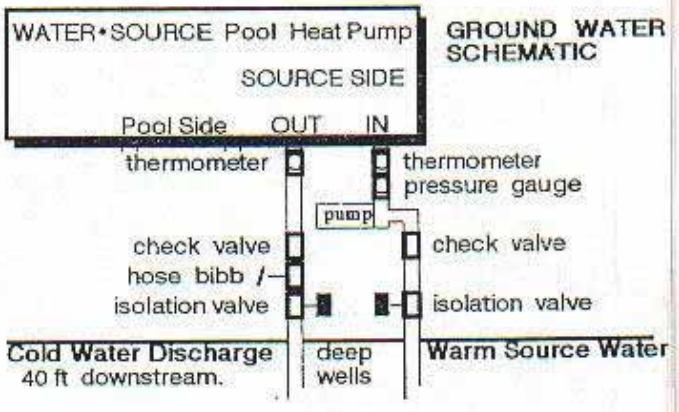


B. A well is a Ground Water heat source. Sizing a ground source water pump is critical. Efficient heater operation requires adequate water 24 hours a day during severe heating periods. Too little water means less heat efficiency and the potential of introducing "air" into the evaporator (oxide corrosion). Too large a pump uses more power than is needed.

B.1. "Multi–duty (for irrigation or heating) is discouraged. The water pump may be "over–sized" relative to the pool heat pump.

a. An existing well dedicated to another purpose can be used by installing another pump dedicated to pool use. – Simply "tee" into the well below the existing pump and pipe to the pool heat pump. NOTE: Each pump will need it's own check valve.

b. Check operation and water volume with both pumps running. An "interlock" relay may be required to "lockout the low priority pump when the higher priority pump comes on.



V. EQUIPMENT OPTIONS

A heat pump can be equipped with one or more available accessories or owners may require changes in the future.

A. POOL PUMP INTERLOCK RELAY

The heater should operate only with adequate water flow thru the heat exchanger. The unit control is "interlocked" electrically to the pool pump. See Sec. II.

As power energizes the pool pump (circuit breakers, switches, and timer contacts closed), power simultaneously applies to a pool pump interlock relay coil. The relay closes, completing the 24 volt circuit through the pool thermostat, high pressure switch, low pressure switch, and time delay relay contacts to energize a 24v compressor contactor.

NOTE: A 24 volt source water pump starter coil or solenoid valve is wired before the compressor time delay relay to permit source water flow thru the heat exchanger before the compressor starts.

B: PUMP STARTER or IRRIGATION BYPASS SWITCH

For "directly activated" source water pumps (see 4A1). The Pump Starter With an Irrigation Bypass is normally for fresh and salt water source applications as a service convenience in pump priming or coil clearing.

The Pump Starter consists of a rain-tight enclosure containing a 24 volt controlled relay (contactor) with an

B... over-ride toggle switch. The 24 volt pump starter relay coil is wired "in parallel" with a 24 volt compressor contactor and a toggle switch wired to "jump" the starter contacts. With the toggle switch in the "on" position, the source water pump runs continously.

CAUTION: If the discharge line ball valve is closed to force all the water through hose bibb, remember to open the ball valve before closing the hose bibb.

C. POOL / SPA KIT (Dual T-stat)

Available only for residential pool / spa combinations with a common filter and sharing a single heater.Two thermostats save re-adjustment for each spa use.

The Pool / Spa Kit (factory or field installed) is an added thermostat with a remote pool / spa toggle switch located customer convenience.

D. AUTOMATIC SPA ISOLATION WITH MOTORIZED VALVES

Motor actuated "isolating valves" can be used with Pool and Spa Controllers on residential pools with common filtration.

- One controller is for toggle switch initiated change-over...and
- the other is for a time clock initiated change-over.

NOTATION: For automatic control of a pool and spa with "separate filtration", use a "dual heat exchanger" model. The pool and spa water remain isolated. This will avoid spa drain-down during a valve actuation. Consult factory.

V. EQUIPMENT OPTIONS (cont)

E. HEATnCOOL

A factory installed "refrigerant reversing valve" permits cooling in the summer.

With air temperatures in the 60's or 70's, a comfortable water temperature for swimming or therapy ranges from 80°F to 85°F. However, with air temperatures in the 80's or 90's, swimming is truly refreshing in water temperatures below 85 degrees.

With the HEATnCOOL option, to change to cooling, select "cool" on the toggle switch and re-adjust the thermostat, if necessary. The selector switch is normally mounted on the chassis (under the cover) or in a remote location.

VI. CONTROL DEVICES

A. TIME DELAY RELAY

PURPOSE: Protects the compressor from low voltage (brown-outs) and power interruptions.

LOCATION: Inside the Control Panel.

The adjustable (delay on make) solid state time delay relay has an adjustable range of 6 seconds to 8 minutes and is factory pre-set at 3 minutes.

NOTE: The time Delay is wired to delay only the compressor - to permit source water flow thru the heat pump before the compressor starts.

B. LOCK-OUT (RESET) RELAY

PURPOSE: Prevents the compressor from short cycling.

LOCATION: Inside the Control Panel.

The lock-out relay is "normally closed" with it's contacts "in series" with high and low pressure switches and the coil wired to "shunt" all three switches.

If any pressure switch opens for any reason, control power stops bypassing the lock out relay coil, the coil energizes and the "normally closed" contacts open to lock-out the controls even after the pressures return to normal.

After the pressure switches close, the lock out relay can be reset by momentarily de-energizing the control power at the service disconnect switch. Sec. II.

CAUTION: Reset only once or twice - then locate the cause of the problem.

C. HIGH PRESSURE SWITCH

PURPOSE: To provide protection from low water flow rates, refrigerant over-charge, and excessive water temperatures.

LOCATION: Brazed into refrigerant discharge line.

Senses refrigerant discharge pressures and "opens" the contacts if the pressures become excessive.

D. LOW PRESSURE SWITCH

PURPOSE: To provide protection from low "source" water flow, low refrigerant charge and freezing.

LOCATION: Brazed into refrigerant suction line.

Senses refrigerant suction pressure and opens contacts if pressures are too low.

E. POOL / SPA THERMOSTAT

PURPOSE: Maintains water at the desired set-point.

LOCATION: Top of Electrical Control Panel (under cover).

The thermostat is adjustable over a wide temperature range with a fixed differential of 1°F.

F. THERMAL EXPANSION VALVE

PURPOSE: Meters refrigerant flow to the evaporator.

LOCATION: Brazed in the refrigerant line between the condenser and the evaporator with a sensing bulb fixed to the suction line.

The thermostatic expansion valve (TXV) provides efficient flow control of refrigerant over a wide range of conditions. The adjustable TXV is factory pre-set for 10°F superheat.

CAUTION: TXV adjustment must be performed by a qualified serviceman.

G. COPPER FILTER DRYER

PURPOSE: To capture and hold any particles harmful to the compressor or TXV and hold any unwanted moisture in it's dessicant.

LOCATION: Brazed into the refrigerant line between the receiver and TXV.

H. LIQUID LINE RECEIVER

PUROSE: To increase the resevoir of refrigerant available to the TXV for more efficient operation in a broader range of conditions.

LOCATION: Brazed into the refrigerant immediately after the condenser.

I. HARD START KIT

PURPOSE: To provide added starting torque for the compressor at start-up.

LOCATION: In Electrical Control Panel.

All models are euipped with thermal expansion valves and these "Hard Start" components: a potential relay and start capacitor. A thermostatic expansion valve does not stay open during the "off" cycle to allow suction and discharge pressures to equalize quickly. A compressor must restart under high pressure unless it has been "off" for a prolonged period of time.

On the initial compressor start, a high "inrush" of current causes an induced voltage (transformer action) higher than normal, to be applied to the start windings and the start relay coil wired in "parallel". The relay contacts close, placing the start capacitor across a run capacitor for an instant, until the compressor gains speed.

The induced voltage then drops, de-energizing the start capacitor from the circuit. This also prevents the dimming of lights and the nuisance tripping of the circuit breaker in power fluctuations.

VII. STARTUP & BALANCE

A. The heat pump was charged with the proper amount of refrigerant and run tested at the factory prior to shipping to the dealer. However, it is good practice to inspect the unit at startup.
   1. Refrigerant lines should not rub or touch other components.
   2. Look for oil spots that would indicate refrigerant loss.
   3. All piping clamps shoul be tight.
   4. Check for loose electrical terminal wires.
   5. The ground wire must be secure in the ground lug inside the heat pump's main control panel.
   6. Wiring is tight inside the building's service panel.

B. With power to the heat pump...
   1. Turn the water thermostat to it's lowest setting.
   2. Turn on the pool pump.
   3. After the pool water is flowing in a satisfactory manner:
      a. Close the diversion valve half way (45° angle).
      b. Note entry water temperature.
   4. Turn up the thermostat slowly to a "click" – that will eventually bring on the compressor. The thermostat should "click" at about the entering water temperature. A small variation is not unusual.
      a. The "source" water pump will cycle on first.
      b. After a three minute delay, the the heat pump will start.

C. With the heater running...check the source water pump operation:
   1. Adequate flow.
   2. Short cycling.

   Make rough adjustments at this time. It requires more running before final.

D. After 5 minutes, the water and refrigerant flows should be stabilized enough to make the final adjustments.
   1. Adjust the pool water diversion valve for a 9°F temperature differential between entering pool water and exiting pool water.

   NOTE: Closing valve – decreases "TD".
   Opening valve – increases "TD".

   2. Slowly close ball valve in heater return line until the "TD" reaches 10°F.

   3. Adjust Source water flow:
      a. Slowly close the ball valve in the source pump suction line, if used, to a 7°F TD between source "water in" and "water out".
      b. Slowly close the ball valve in the source return line from the evaporator until the "TD" reaches 8°F.

   NOTE: Temperature Differentials of surface source water will vary depending upon source water temperature.

E. Refrigerant System Check List

   With the water flows adjusted for proper temperature rise and drop thru the heat exchangers...check for these "proofs":
   – A cold refrigerant suction line should have moisture on it (outside the insulation) at the compressor.
   – A ring of moisture on the compressor fitting (3" to 4" diameter) depending the temperature and humidity.
   – The sight glass should be free of any bubbles indicating a proper charge.
   – A mositure indicator in the sight glass should show "dry", without moisture.

CAUTION: A HEAT PUMP IS A HIGHLY PRESSURIZED SYSTEM AND MUST BE SERVICED ONLY BY QUALIFIED TECHNICIANS.

IIX. HEATER RUN TIME

Your Water•Source pool heat pump has been sized and selected to your pool by a competent and knowledgable dealer. You should already be aware of it's limitations and capabilities.

The heater is designed to maintain pools about 20 to 25°F above the average air temperature. This allows for recovery from the effects of changing weather.

Pool temperatures are more stable than air and will follow average air temperatures by about 48 hours.

When a weather front (with new average air temperatures) is established and holds for more than 48 hours, the pool temperature will balance at 20° to 25°F above the new average air. This is true with cool or warm air changes...a pool temperature follows air temperatures up and down. The weather normally will change often enough for the heater to bridge" the gaps, but during extended cold spells, a pool may not be as warm as it is normally.

The pool heater is designed to restore a typical heat loss from the previous night and a little more to raise the pool temperature higher than yestersay.

A pool heater will run continuously on a cold pool during extreme weather conditions. However, once the desired pool temperature is attained, the unit will cycle for fewer hours.

Whether your heater was sized for use with a blanket or not, a blanket helps in heating a pool rapidly.

IX. SEASONAL SHUTDOWNS

A. SUMMER SHUTDOWN

If the heat pump will not be used to cool the pool in the summer...

1. Turn off power to the heater.
2. If the source pump is dedicated to the pool heater (not for irrigation), the power should be turned off.
3. If the source water is salty: remove the inlet pipe and screen from the water to prevent accelerated marine growth in and outside the pipe caused by stagnant water.

B. WINTER SHUTDOWN

In northern regions, winter shutdown is the same as for summer with one added requirement:

1. Protect the unit and pool piping from freeze damage.
   a. All outdoor piping should be installed to allow drainage, but pool equipment and piping can trap water. They must be drained and blown out with air pressure.
2. An unseasonable (sudden) freeze will not be severe enough to cause damage, but keep both pumps running to prevent any freeze damage.
3. Power failures in freezing weather necessitates immediate draining.

After seasonal shutdowns, repeat the Start–up and Balance Procedures. Sec VII.

TROUBLE SHOOTING GUIDE
WATER•SOURCE
by AquaCal

FAULT / PROBLEM CONDITION

PROBLEM CONDITION	POWER SUPPLY: Power failure	Tripped breaker / blown fuse	Faulty wiring	Loose connections	Low voltage	Single fault of 3ph.	Unbalanced 3 ph.	CONTROL CURCUITRY: Defective Contactor	Defective contactor coil	Compressor internal overload	Run capacitor	Lockout relay	Start capacitor	Ref. pressure controls	Potential relay	Defective transformer	Defective time delay	Defective thermostat	COMPRESSOR: Defective poolpump int. relay	Defective bearings	Locked Rotor (Motor)	Defective valves	Defective motor windings	REFRIGERANT: Low refrigerant charge	Over charged	POOL WATER COIL: Low water flow	Dirty water filter	Closed water valve	Hot entering water	SOURCE WATER COIL: TXV defective	TXV needs adjusting	Scaled water coil	Low water flow	TXV sensing bulb loose
UNIT NOT RUNNING																																	
Unit has power																																	
No power to unit																																	
Lockout relay tripped																																	
REFRIGERANT PRESSURES																																	
High discharge pressure																																	
Low discharge pressure																																	
Low superheat																																	
High superheat																																	
REFRIGERANT SWITCHES																																	
High press. tripped																																	
Low press. tripped																																	
LOCKOUT RELAY																																	
Lockout relay has tripped																																	
COMPRESSOR																																	
High compressor amp's																																	
Compressor hum's																																	
Noisy compressor																																	
Short cycles																																	
RUNNING NO HEAT																																	
Not heating																																	

WATER SOURCE™

LIMITED WARRANTY
POOL HEAT PUMPS
by AquaCal

Water • Source Pool Heat Pumps are warranted from the date of original purchase to be free of material and craftsmanship defects. The Warranty includes:

- Defective parts and service labor are warranted for one (1) year.
- The compressor only (not labor) is warranted for five (5) years.

This Warranty does not include repair damage due to:

- Neglect, abuse, improper operation, improper chemical levels, or freeze damage.
- Improper installation, incidental or consequential damages of a failure.
- Expendable materials, refrigerant and freight are excluded from the warranty.

This Warranty does not include non–warranty services, i.e.:

- Inspection, maintenance, or unnecessary service calls due to:
- Electrical services, external valve positions, auxillary support equipment, erroneous operational reports, improper operation or installation.

This Warranty is in lieu of all other warranties, expressed or implied.
AquaCal assumes no other liabilities.

FOR YOUR RECORDS

Model: _____ Serial No.: _____

Install Date: _____

For factory warranty service, call 813–823–5642

Installer: _____

address: _____

C/St/zip: _____

Phone : _____

Manufacturer:
AquaCal Inc.
2737 24th Street North
St. Petersburg, FL 33713