



The Mechanics and Repair of
Jacuzzi® Whirlpool Bath
Hot Tub Spas

For the Following ELECTRONIC Spas Made 1995-2001

Dealer Premium Model Line (sold through dealers):

Alexa, Laser, Lexus, Solaris, Cirrus, Pinnacle, Triton, and Quantum

Z Builder Series Line (sold through big box stores):

Z-100, 110, 112, 120, 130, 135, 140, 145, 150, 235, 240, 255
(does not include Z101)

Published by Clear Creek Spas

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Disclaimer

Every effort has been made to make this manual understandable and applicable. If you have doubts or little experience with electrical appliances, it's best to leave electrical work to licensed electricians. Care and proper electrical procedures must be adhered to whenever working with electricity and especially is true with spas since you are dealing with electrical current that can harm or kill you or those near or in the spa.

As a Rule of Thumb: ALWAYS TURN THE SPA'S MAIN POWER OFF UNLESS REQUIRED TO PERFORM A TEST. WHEN YOU DO HAVE POWER ON BE CAREFUL AND USE PROPER ELECTRICAL PROTECTION AND PROCEDURES.

Although this booklet should be able to guide you through most repairs and even diagnosing the problem, www.clearcreekspas.com offers an "Ask the Expert" free of charge and you can write me and be more specific for your spa and your particular problem.

Every effort has been made to be accurate and complete but note we cannot guarantee specific accuracy.

Throughout this manual reference to part numbers are Jacuzzi Premium Spa numbers. If the part number prefix is "CC" the part is our own number and available on our website.

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Introduction

I started servicing Jacuzzi Whirlpool Bath spas in 1995. I first started by working for a friend who was an Authorized Service Center for Jacuzzi Whirlpool Bath. Shortly after that I purchased the spa repair business from him and became the owner.

From that date to 2001 we were the authorized Service Center for Jacuzzi Whirlpool Products in the Denver and Eastern Colorado area. During that time we were rated in the top 10 service companies in the United States for customer service. We were the only Service Company to receive that award every time it was offered during those years. When Jacuzzi, Inc reorganized their company in 2001, they moved their spa production to their Sundance plant. We continue to and are still servicing Jacuzzi Hot Tubs as a service center.

It just happened that when I started working and servicing spas for Jacuzzi Whirlpool Bath was also the time the industry was switching to electronic controlled spas. Therefore I experienced the changes that have occurred during this time and continue to work in the field, I have experienced a wide spectrum of problems and their solution. I would like to say I have seen it all but that always proves untrue.

I have tried to make this manual simple but comprehensive; quite a challenge. To do so I try first to explain what and how the part works. Then how to replace or repair the part. I have also come up with the CLICK method of identifying problems.

In the Troubleshooting Section I have found 99% of the problems with a spa are routine if you follow a systemic approach. Sometimes I make this approach too obvious but for the sake of the weekend warrior, I made it so.

If you have questions not specifically addressed in this manual, I have an email address specifically created for you. It's the first email I check, usually every business day. Just email me at: manualhelp@clearcreekspas.com. I will be willing to help all I can.

Overview

GENERAL

Basically, spa operation is simple. The pump draws the water from the spa, through the pump and pushes it through the heater and back into the spa. Now add more jets, more pumps, an air blower, and maybe a stereo. That's today's popular spa.

America's lust for more jets has driven the need for more pumps to drive the jets. To help keep the spa clean with less chemicals, manufacturer's have added a 24 hour circulation pump and Ozonator. For some older premium models, you also have added an air bubbling up from the bottom of the spa.

Many end users have opted for the simpler "Z" or builder series of spas Jacuzzi Whirlpool produced for about six years. These spas were produced with volume sales through big box stores in mind. Doing so made spas available to many who could not afford to buy the dealer line of spas.

This manual focuses on both the Dealer line of Jacuzzi Whirlpool spas and the "Z" series.

SPA SHELL

Jacuzzi's spa finish skin is acrylic. A sheet of acrylic is heated and dropped into a mold and vacuumed to form the shell. Then it's flipped over and sprayed with a fiberglass solution that gives it strength. Holes are drilled into the spa and jets installed. Then the plumbing is finished and insulation is now sprayed. Finally the equipment is installed. The construction of the spa is mostly performed with the spa upside down. Finally the spa is flipped upright and final tests including water testing is done.

The spa frame is made a wide variety of ways over the years but basically on either a wood bracing, solid plywood base, or fiberglass base. Often the spa shell has part of the frame molded into the actual spa shell or glued to it to create strength.

Paneling

The paneling of spas has changed over the years. Initially redwood or cedar was the common siding. Jacuzzi built spas with slats glued to a plastic sheet and screwed to the spa frame. An attempt to economize cost panels were built of various woods and stained but this has been discontinued. Most common now are synthetic plastic panels or slats. These are becoming popular even though they can be as costly as redwood or cedar. But they are able to withstand the elements with little care.

Chapter ONE Pump & Motors

Overview:

There can be confusion; What's a pump? What's a motor? Are they the same?

The "**pump**" is considered by many to be the complete pump/motor and by others only the end where the water passes through. The "wetend" is the more common word for the end that moves the water.

Jacuzzi's pump or wetend is patented by Jacuzzi and only sold by them. The motor is made by others.

Jacuzzi Whirlpool first used their WHITE pump in common production. It's a one piece pump that bolts to the motor body by 4 bolts on the pumps gray mounting plate. If the pump fails, you must replace the complete white pump. They are NOT interchangeable with the next generation pump.

The "J" PUMP is BLACK and made of the main body or bracket that mounts on the motor by the 4 bolts that hold the motor together.

Then the impellor which attaches to the motor shaft. When the impellor rotates its what moves the water. Between the impellor and the bracket is the seal. The seal is a two part component with $\frac{1}{2}$ in the bracket and $\frac{1}{2}$ on the impellor shaft. When these two mate they compress and seal the pump from leaking. Then an "eyeseal" is on the front of the impellor. A large oring seals the front of the pump (volute) when the bolts tighten them together.

Simply explained, when the impellor turns it compresses the water and the compressed water escapes out of the top of the pump.

Commonly, the "**motor**" is ONLY the motor, Jacuzzi used either AO Smith or Emerson motors although earlier they used other brands. Most motors are either 110vac or 220vac although some can be either. If either, you can "field wire" the motor to match the application you are installing. But typically, it's a set voltage.

The key for motors is matching the horsepower (hp) of the motor to the pump.

You can have a motor oversized for a pump hp and be OK. It's like having an oversized motor for your car. But you can not have a pump too large for the motor. If you do, the motor will have an early failure. It's like driving a large car with an undersized motor. Best bet is to match.

Jacuzzi used 3 motors on their 1995-2001 spa production. For 110vac spas, 2 speed single motor. On their 2 pump systems they commonly used two 220v single speed pumps. In 1999 they introduced the Pinnacle Model which has a small circulation pump and two non-Jacuzzi pumps. They did this configuration on other models in 2000/1.

In the early 90's Jacuzzi designed their own proprietary pump. They called it the "J-pump" (explained previously) and soon followed with the "K-Pump". The "J-Pump" has a low snout for the incoming suction fitting and a top center discharge. It's used in the low and 2 speed pumps. The "K-Pump" is a mid-center suction connection with a top center discharge. It's only used in the 3hp pump.

The "J" and "K" pump are a volume pump at low pressure. What this means is that they are designed to move a large volume of water but not at high pressure. It's easy to compare the Jacuzzi pump as a wide flowing river versus a narrow fast moving river. By design you can sit again a number of jets for a length of time and not feel irritation. On pumps built by others the pressure out of the jets are often strong enough to become uncomfortable. In later products Jacuzzi Whirlpool added high pressured pumps.

Just a note about ratings: It seems Jacuzzi engineers have a hard time rating their pumps, especially the low and 2 speed. It's easy to understand because they initially rated the low speed pump as a ¼ hp pump and the 2 speed 1 ½ hp. But it must have become apparent that they underated the pumps because they upgraded the rating to 1hp and 2hp. Since then, the rating has change to just the low pump and their 2 speed pump. The 3hp pump has remained at their rating.

Lastly, in the industry the motor is motor only, pump is the wetend, and when they are together, they are called pump complete.

PUMP/MOTOR

The motor takes electrical current and turns the shaft clockwise. Although

individual parts may be available, usually bad motors are replaced not repair.

REPLACING Pump/Motor:

SINGLE PUMP SPAS:

110vac, 2 Speed Pump;(part #2500-255 standard duty pump/motor complete;
#CC-F570HD heavy duty pump/motor complete; Pump Only: #CC-2jp)

If your spa has only one pump, You have a 110v, 2 speed pump that serves as both low and high speeds.

Removal:

Turn main power off. Drain the spa. Most Jacuzzi models do not have valves to close to avoid draining the spa. Once the spa is drained, disconnect the 2 couplings attached to the pump (wet end). Normally you can hand loosen but occasionally you will need to use a large wrench to loosen. You can also use a oil filter wrench to loosen. (see Chapter XX for specific spa suggestions)

Next: The motor itself is attached by four nuts at the feet. There is likely a copper bonding wire attached to the motor. Remove. Unplug the pump cord from the control box.

Remove pump/motor assembly.

Disassemble Pump (wetend).

A. Remove 4 bolts holding the front face of the pump (volute) to the pump housing.

B. You will see the eye-seal on the nose of the impellor and the impellor. You will want to disconnect the impellor from the motor shaft. The motor shaft screws into the impellor. The intended method to separate is this: on the opposite end of the pump/motor assembly, in the middle, is the motor shaft end. It has a slot. Take a large slotted screwdriver and while holding the impellor stationary with one hand, turn the motor shaft with the other. If this doesn't work, reverse focus and turn the impellor with your hand while holding the motor shaft stationary. In worst case situations, you can grab the motor shaft between the pump and motor with a pair of vice grips and hand turn the impellor loose. If that doesn't work, you will have to use a wrench on the impellor to separate. This will likely damage the impellor and will need to be replaced.

C. Once the impellor is separated you need to disconnect the pump

bracket or body from the motor. It is held by 4 long bolts that run through the motor and bolt to the pump. Disconnect each bolt but DO NOT pull the bolts out. They also hold the motor together and removal will likely cause the motor to disassemble.

D. If you are replacing the pump (wetend), reverse. If the motor shaft is corroded, you need to remove the rust. The least abrasive method is best. Start with steel wool, then try a wire brush or even sandpaper. You need to have a clean motor shaft so the impellor can tighten cleanly against the seal and make the seal work. If the motor shaft is highly corroded, the new impellor will not tighten against the seal and the pump will leak.

E. If you are replacing the motor, you have to move the motor cord from the old to new. The motor is only a 110-130vac motor so you don't have any internal wiring to change for the new motor. The sequence of wiring is the same for either an Emerson or an AOSmith/Magnatek motor. The top wire connection is the white (neutral) wire; the middle is the red (high) wire. The bottom is the black (low) wire.

Extra Help:

If you strip the bolts that hold the pump face (volute) to the J-light pump housing (bracket), you can easily buy a long bolt and nut locally and insert that through the hole and tighten. You must tighten all four bolts to snug. If not, the pump will eventually leak.

On a few models, access to the pump/motor is difficult. Because the pump/motor is behind the piping and control box, I have found often it's best to remove the piping and in a few cases, the control box itself to get to the pump.

"Z" Models made from late 1996- early 1998 often have only a limited access panel of about 3 feet. The rest of the spa panel is one piece on each side. Because each side's panel is built as one piece and screwed into various points for strength, the only way to remove is to lift the spa up to get to screws that were placed in upward angles. It's quite a project. You should consider building a new side panel and cutting a hole through the existing panel. The amount of effort to remove the side is more than the time and effort paid to build a new side panel. This is only applicable to those few production models that only have a small access panel in front of the equipment.

SINGLE SPEED, 2 or MORE PUMP SPAS:

All 3 Styles of 1 Speed Pump 220-240vac Pump/Motors (2500-250 is the single low speed pump/motor complete. 2500-251 is the K-Pump 3hp pump/motor complete. 6540-xxx is the 2.5hp, high pressure pump/motor complete.)

All spas that operate on ONLY 220-240vac current are 2 pump systems. Some also have a circulation pump.

TWO Pump Systems:

The #1 pump will be the standard Jacuzzi 1JP-pump. The secondary or HIGH pump will be either a second 1JP-pump or depending on the model, a K-Pump.

TWO Pump Spas with Circulation Pump:

If you have a circulation pump, you have TWO High Pressure pumps to drive the jets. The circulation pump handles the heating and filtering.

Compare the #2 pump with the #1 Pump. If they have an identical face, they are both 1JPumps. If the #2 pump has the front suction fitting in the middle of the face rather than a snout, you have a 3hp K-Pump. If your #1 or #2 pump have the top discharge on the side of the pump rather than the center, you have a high pressure pump.

Removal:

Turn off main power. Drain the spa. Most Jacuzzi models do not have valves to close to avoid draining the spa but check yours.

Once the spa is drained, disconnect the 2 couplings attached to the pump (wet end). Normally you can hand loosen but occasionally you will need to use a large wrench to loosen. You can also use a oil filter wrench to remove.

The motor itself is attached by four nuts at the feet; remove. There likely is a copper bonding wire attached to the back of the motor. Remove. Unplug the pump cord from the control box.

Remove pump/motor assembly.

Preface: Although pumps can have different fittings, they basically are the same. So the following is basically applicable for all pump/motors.

Disassemble Pump (wetend).

A. Remove 4 bolts holding the front of the pump (volute) to the pump housing.

B. You will see the eyesel on the nose of the impellor and the impellor. You will want to disconnect the impellor from the motor shaft. The motor shaft screws into the impellor. The designed method to disconnect is this: on the opposite end of the pump/motor assembly, in the middle, is the motor shaft. It has a slot. Take a large slotted screwdriver and while holding the impellor stationary with one hand, turn the motor shaft with the other. If this doesn't work, reverse; turn the impellor with your hand while holding the motor shaft stationary. In worst case situations, you can grab the motor shaft between the pump and motor with a pair of vice grips and hand turn the impellor loose. If that doesn't work, you will have to use a wrench on the impellor to separate. This will likely damage the impellor and it will need to be replaced.

C. Once the impellor is separated you need to disconnect the pump bracket or body from the motor. It is held by 4 long bolts that run through the motor and bolt to the pump. Disconnect each bolt but DO NOT pull the bolts out. They also hold the motor together and removal will likely cause the motor to disassemble.

D. If you are replacing the pump (wetend), reverse. If the motor shaft is corroded, you need to remove the rust. The least abrasive method is best. Start with steel wool, then try a wire brush or even sandpaper. You need to have a clean motor shaft so the impellor can tighten cleanly against the seal and make the seal work. If the motor shaft is highly corroded, the new impellor will not tighten against the seal and the pump will leak.

E. If you are replacing the motor, you have to move the motor cord from the old to new. The motor is 220-240vac. If it's the 1JP or High Pressure pump there is likely only one configuration for wiring. On the K-pump the motor can be

wired either 110-130vac or 220-240vac. So observe the label on the motor to wire correctly. The sequence of wiring is the same for either an Emerson or an AOSmith/Magnatek motor. White will be neutral and black hot.

Extra Help:

If you strip the bolts that hold the pump face (volute) to the pump housing (bracket), you can easily buy a long bolt and nut locally and insert that through the hole and tighten. You must tighten all four bolts to snug. If not, the pump will eventually leak.

On some models the pump/motor is either behind another pump or even behind the control box. There is no simple way to remove if you can do have access on the side of the spa. In these cases, removing the pump/motor in front or in worst case, the control box is easier.

See Specific Model suggestions found in later Chapters.

Circulation Pump:

On early Pinnacle you have either a smaller 110-130vac circulating pump or a larger 220-240vac circulation pump. Replacement is easy for both. Usually you will drain the spa. There isn't a shut off valve to replace the circ pump with water still in the spa so you will have to drain it.

For the smaller pump, it's a 110-115vac Might Mite. Jacuzzi switched over to a larger 220vac Aquaflo circulation pump for a short period. During this time many Pinnacles were retrofitted with the Aquaflo pump. You may have to visually see which brand pump you have. Also remember to check voltage.

Final productions used a black circulation pump that's located right in front when you open the wood access.

Some supply houses sell the smaller replacement pump parts and motors. Because of the constant service demands on this pump, it usually is wise to replace the pump/motor complete. With the smaller circ pump, the replacement

pump/motor will come with a cord. It easy to splice the wires together. On the larger circ pump, you will remove the cord connection from the back of the motor and install into the new.

Chapter TWO HEATER

Function:

The heater is a simple device. Electricity is applied to the heater element. Because the element is made to resist the current but not completely, the heater's resistance causes the element to glow. The result is heat.

Overview:

The heater does just what's name says, heats the water. Generally on Jacuzzi designed spas you will not notice noticeably warm water coming out of the jets because of the design of the jets. On Jacuzzi Whirlpool design, the water passes through the heater and then a manifold disperses the water to many jets and thus spreading out the amount of heater water. On a few designs including the current Jacuzzi Premium spas it's common to have the water pass through the heater and then into the spa using only a couple jets. In doing so you can feel the heater water entering the spa. As to the better design, it's a personal preference.

The two basic flow methods start the same way; the water is pulled from the lower part of the spa (called suction fittings) and one or two assemblies with filters designed to pull water from the top of the spa. The theory is this will draw water from upper and lower and therefore keep a thorough water movement.

From these two points the water is pulled through the circulation pump or #1 pump, depending on the design of your spa. Jacuzzi mostly used the #1 pump method of their spas but later Platinum spas did have a circulation pump.

Then the water passes through the heater. You have 2 types of heaters for a Jacuzzi Whirlpool. The most common is the horizontal heater attached to the bottom or bottom backside of the control box. Jacuzzi Whirlpool at the end of their spa production did begin to use a vertical heater with a circulation pump. This heater is attached to the left side of the control box.

From the heater the water flows to a manifold that dispenses the heated water throughout the spa.

The heater itself is simply an element that heats. Electrical current enters it and slows down. This slowing down causes the element to heat. As water flows by the heated element the temperature is transferred from the element to the water. It's typical to heat 1-6 degrees per hour. The spas that operate on 110-130vac typically heat 1-2 degrees per hour. Spas that operate on 220-240vac heat 5-6 degrees per hour.

The various generations of Heater Assemblies:

First, there are several generations of heater designs that Jacuzzi used. The first generation was a horizontal heater with a pressure switch that screws into the backside and the high limit clips against the heater. It was the most popular designed used throughout their production.

The next production used a similar horizontal heater that also had the pressure switch screwed into the top middle and the OH Sensor inserted into the heater assembly.

On the Pinnacle Model the heater used is a similar model to the first production model but longer.

On the Z112 models they used a short horizontal heater on the top of the control box.

On many of the last Platinum models they began using the vertical heater to the left of the control box and a small circulation pump in front of the control box.

When the electronic spas were first introduced, I attempted to remove the heater assembly with the control box remaining attached. The heater is held in place by two "L" straps. Each strap is held to the control box by a bolt. One end of the strap is attached to the back of the control box and the other underneath. I would remove the back bolts and then attempt to loosen the lower bolt. These weren't or rarely were easily accessible and I would end up with a lot of frustration and bloody knuckles. I would even try leaving the lower bolts tight and bend the straps and remove the heater assembly but this would distort the straps so when you bend them back they would not align with the holes.

Then I thought outside the box and now always do it this way: remove the control box.

On models built from 1995-2001 Platinum, 1995-1996 ECHO, 1998-2001 SELECT:

Turn off main power. Drain spa.

Remove cover on control box. You will see the heater's post coming through the wall of the control box. There are two. Note on the posts there is a nut holding the wire going to the in place. To remove the nut and since the post is rather thin, the manufacturer builds into the post a second nut below the wire. In doing this, you can loosen and tighten the nut without putting pressure on the post. The manufacturer recommends you place a wrench above and below to loosen and tighten the nut. I have found that if care is taken, you only need to loosen/tighten the nut itself but if you are concerned, by all means use both nuts. I have found that if you insert your finger to stabilize the post when loosening/tightening the nuts you can provide enough torque without bending the posts. But care must be used. Save the nuts because you normally must reuse them.

Disconnect heater assembly from plumbing. ID the heater strap holding the heater in place. Reach around to the back of the strap where the strap attaches to the back of the control box. Remove the 2 bolts holding the strap in place. This will also release the control box from the mounting bracket holding the box to the spa.

Now note that the box is being held by 2 nuts on the upper corners of the mounting bracket. Remove those nuts and the whole control box will be free standing.

The only thing keeping you from pulling the control box up and toward you is the incoming electrical. Depending on how your electrician wired your spa determines how easy this will be. If he included slack on the line, you should be able to pull the box up and toward you enough for your purpose. On rare occasions the electrician wired the system with no slack. If this is true with your's you have several choices: first, call an electrician to disconnect the wiring while you replace the heater,. Or you can remove the heater assembly as mentioned above and keep the control box in place. Or if you are confident you understand and can

deal with electrical wiring, disconnect the incoming wires that attach to the terminal at the control box, remove the cord from the box, and pull the box up and out then reverse when installing. The key part if you decide to do yourself is the note which wire goes where. The key is you have a NEUTRAL which should be either a white wire or a wire with white tape on it. Then you have two HOTS which are either red and black wires or sometimes just black. Then you have a GROUND wire. The terminal identifies the neutral, hots, and ground lines. Failure to connect the wires back as previously wired can damage the board. Fortunately the wires tend to stay in the right configuration. Also remember to insert the wires completely into the terminal block and tighten the screw.

Now lift the control box out enough that you can comfortably reach down and loosen the 2 other bolts holding the heater in place. Remove bolts or loosen to end.

Now the only thing holding the assembly in place are the OH sensor and the two wires connected to the pressure switch.

To remove the OH sensor, simply pull out of the clip holding it to the heater. I have found times that the clip was TOO tight and had to bend the clip apart taking care not to damage the sensor. But normally the sensor pulls straight out.

Simply pull the 2 wires off the pressure switch. When you reattach, there is no proper sequence

Now simply remove the heater assembly and install the new.

Reverse.

On Models built 1997-1999 with a DIAL Temperature Control on Topside.

Again, I learn to think outside the box. It seems almost impossible to remove the heater assembly with the control box in place. It's not but my way is easier and quicker.

Turn off main power and drain spa. Disconnect heater from spa plumbing.

Open the metal cover on the control box. You will see 2 copper straps running

from the board terminal to the heater posts. Unscrew the two screws holding the straps to the board terminal. Unbolt the two nuts holding the copper straps to the heater posts. When you reattach the new heater you will tighten to snug.

You will see that your control box stands on two legs. On most electrical installation the electrician left enough play on the incoming power to remove the control box enough to do the following. If your incoming power is tight and there is no extra cord, see the above for help.

Remove the 2 bolts on each side that hold the box to the legs. Do NOT remove the nut/bolts that hold the legs to the floor of the spa.

Now the control box will be free to pull up and toward you. When you do you will see the OH sensor attached to the heater on a clip. Pull the sensor out. You will also see 2 wires attached to the pressure switch. Unplug.

Remove the 2 bolts on the upper strap holding the heater assembly. I usually only loosen the lower 2 bolts to the end of their thread. This will allow you to remove the heater assembly.

Reverse to install. Tighten nuts/screws to snug. If the alignment of the heater has slightly change so the straps don't align with the holes, you can slightly bend the copper straps to adjust for the change.

On Z models with a digital topside 1998-2001

Turn off power and drain spa. Disconnect heater from plumbing.

Open the metal cover on control box. You will see the heater on the bottom of the box. Unplug the 2 wires connected to the pressure switch. On the right topside of the heater you will see the OH sensor. Follow that line up to where it connects to the board on the upper right corner. The plug is a clip with a release. Unfortunately, the release clip is on the top of the plug so sometimes you can reach and press down to release. Other times you take a small screwdriver to reach and press down. The plug will simply pull out. If a little confused, look at the new assembly and you will see the clip mentioned.

Remove the 2 copper straps. First unbolt where then attach to the board. Second remove nuts connecting the board to the heater posts. Note that the heater posts have a nut on top and a nut built in to the bottom below the copper contact. This is so you can put less pressure on the post when loosening or tightening. You place a wrench on both top and bottom and loosen/tighten. If you cant reach the lower nut, just take care when loosening/tightening so you don't bend the heater posts.

Remove old heater. Reverse above to install new heater.

On Vertical Heater:

For spas with a vertical heater on the left side of the control box, replacement is easy.

You must replace the complete heater.

Turn off power. You probably will have to drain the spa. Disconnect the two hoses connected to the heater input/output. The 2 leads from the board to the heater need to be removed. Simply remove the nuts (save for reuse) and disconnect the leads.

Finally, the heater is held to the control box by 2-3 nuts. Remove. The heater will disengage from the control box and replace.

Chapter THREE Control System

WE label the "Control System" the box which the electronic control is located and on some models, the heater.

BOARDS:

Overview:

Circuit boards came into common use in the mid 90's. They are a major improvement in many ways over the older mechanical spas. They are more accurate in keeping the proper temperature. They typically will filter automatically or on some models, are programmable to when and what length of time they will filter. They also have settings for when you are away so the spa will keep the water clean yet not stay hot.

How It Works:

Basically the board is computer board and are commonly called a board. They test various components including pressure/flow switches, temp and OH sensors, topside, motors, and heaters. Some will notify you when its time to replace the filter. They are design both to make operation of the spa easier, keep the water cleaner, and filter the water on a regular basis.

The Steps the Board Takes to Come On:

Circuit boards typically go through the same routine. When you turn on power the spa does a self test to make sure internally everything is operating properly. On some models there is a countdown, some have a heater light that stays on during the self test, some a flickering topside. During this time on a few models, the circulation pump will turn on.

When the board is going through it test it will look to confirm the board's integrity is fine. It will look at the temp and OH sensor to confirm they are within tolerance and close to equal. It will also look at the flow/pressure switch to confirm that the switch is open. Then it will turn on either the circulation pump, the #1 pump, or the

low speed on the #1 pump.

When it turns the pump on it will look again at the flow/pressure switch to confirm the switch is now closed since water movement should be sufficient to register. If the switch is closed, the board will turn the heater on.

After a period of time it will turn the ozonator on if the board is designed for ozone use. Many boards will turn the ozonator off if any function of the topside is activated. This is to avoid any chance of ozone gas being extensively breathed in.

Newer editions also include a "blowout" mode. Periodically the board will turn all the pumps and the air blower on to move water throughout the complete water system. This assures clean, sanitized water is refreshed.

If you don't have a spa with a circulation pump the spa should periodically go into a filter cycle. On standard models by default they filter twice a day for 2 hours or a total of 4 hours. These cycles usually default when you first power up the spa. Then it filters 2 hours at that point and 12 hours later. On some models you can set a jumper on the board to increase the cycle 5 hours each time. The problem that this can create is the spa can overheat during the summer because of extended filtering when it would normally be off. On Premium models you can adjust the filter time and duration from the topside control.

Jacuzzi Model Generation:

In 1995 Jacuzzi began their switchover to board with the F106/7 and the F108/9 control systems by Balboa Instruments.

The F106/7 system has "Platinum" written on the topside. It's their premier system. From the topside you can operate all the components, program the time and duration of the 2 cleaning cycles, and set the time. It's uses LCD icons with light backup to be seen at night.

The F108/9 is similar to the Platinum but with less options. It occupies the same box but you don't have the control on the topside. They only used it for a couple years.

When Jacuzzi introduced the "Z" series sold through home improvement stores

they used the F108/9 control system on their entry level spas. Then they went to a simpler system, the H136 or H276. These topsides used a dial temperature control and only one button to change the modes of the spa.

During this time, on their dealer line of spas, they added the "Select" series. It included a digital topside but was simpler than the Platinum.

Finally Jacuzzi offered the R576 series which give the unit a small digital topside control with 2 buttons; one for the temperature setting and the other for the jets and mood light.

REPLACEMENT:

WARNING: As a routine, always touch a metal surface before touching a board. A static charge from your hand can damage the board.

All of the control boxes have a diagram of the wiring of the board on the cover of the control box. They are helpful but it's better to replace the board systematically.

F106/7 and F108/9.

These boards are fairly easy to replace if you are careful. First turn off main power at the main breaker panel.

- a. Remove control box cover.
- b. Remove the screws holding the lower finger boards to the lower terminal.
- c. On the wires connecting to the board on the left, it's easy to mix up the wires. So note which wires go to which connection. It would make sense to label the wires. Unplug the transformer wire to the board.
- d. Unplug the pressure switch and both sensor wire connections to the board. Disconnect topside phone type plug.
- e. The board is now held to the control box by 4 nylon posts and sometimes one screw. IF there is a screw, remove and save. To release the board from the nylon post: there is a clip on the post. Press the clip toward the middle of the post and pull the board toward you. Do this for all posts and the board will release. To install, reverse.

H136/276 and H756???

- a. Turn off main power.
- b. Remove control box cover
- c. Unplug transformer cord from board.
- d. Unplug sensors and pressure switch cords to board.
- e. Disconnect topside phone type plug.
- f. Remove the screws holding to the fingers of the board. Save screws.
- g. There is a screw holding the board; remove and save for reuse.
- h. Now the only thing holding the board to the control box are the nylon posts. Press the center clip toward the middle of the nylon posts and the board will release.
- i. At this point I swing the old board out and install the new. Then unplug the wires off the old and place on the new board.

Reverse to install.

F574/6

- a. Turn of main power.
- b. Remove control box cover.
- c. Unbolt the 2 bolts holding the copper straps to the board. Save for reuse.
- d. Unplug phone type cord from board.
- e. Label incoming power line to which terminal they are attached to and loosen.
- f. Unplug 2 black sensor and 1 pressure switch connectors from the board.
- g. There are 2 screws holding the board to the control box. One on the lower right; the other on the upper left. Remove and store for reuse.
- h. There are 3 nylon posts holding the board to the control box. Press the center clip toward the middle of the nylon posts and the boards will release.
- i. Carefully slide the board up and out. It might seem the pressure switch is making the board unmovable but with care, you can pull it out.
- j. At this point I swing the old board out and install the new. Then unplug the wires off the old and place on the new board.

Reverse to install.

Z112

Unplug the phone type jack from the topside. Unplug the sensors. Note which of the incoming power cord terminals attach to the board. Loosen the screws that hold the incoming cord.

The hardest thing about the replacing the board is its in a small space. It has 1-2 screws holding the board to the box and 2 nylon posts. Remove the screw(s) and compress the nylon posts and the board will release from the box.

Swing the board out and to the left. Install the new board. Move the wires one at a time.

Chap Four: AIR BLOWER:

Some higher end spas have an air blower system besides the water flowed plumbing. It is separate then from the normal forced water jets. The blower is turned on and the air is forced into the spa as bubbles. Between the air blower and the method of air disbursement is a looping system to stop water from flowing back to the air blower. Typically either two loops of flex hose or 2 rigid pipe loops and a check valve will stop any water from reaching the blower.

When building the spa one of two common methods are used: either one or more channels are built into the bottom of the spa. Then holes are drilled along these channels. When the air blower is turned on it pushes air into the channels. The other common method is installing a separate piping system with small nozzles along the bottom of the seating area and applying air into those nozzles.

Electronic spas have an automatic blowout at least a couple of times a day. The spa will turn on several times a day and run for a couple minutes. This will fill the channels with air. When the blower turns off the cleaner sanitized water will flow back into the channels and help keep them clean.

Jacuzzi: Only the Dealer Line of Jacuzzi electronic spas had an air blower. This would include Lexus Plus, Quantum Plus, Pinnacle, and Triton to name a few. Their Select, LC, and Z series did not have air blowers.

Removal:

The blower is either 110v or 220v depending on the model. You must match voltage.

To remove is easy. There usually is one screw holding the blower to the plumbing. There might also be a hose strap tighten around the area. IF so, loosen.

Once both screw and strap are removed, loosen, the blower lifts out. Replacement blowers might have a cord to splice in to the older cord or include a cord you simply plug into the control box.

Chap FIVE: Pressure/Flow Switches

PRESSURE SWITCH

How It Works: The lower chamber of the switch is physically attached to the water flow of the plumbing system. The pressure internal to the plumbing is also manifested in this chamber. This chamber expands to push a post toward a microswitch. When the chamber is not pressurized (pump off) the post pulls back and the microswitch opens. When the pump is turned on the post pushes out and closes the microswitch. The distance between the post and microswitch can be adjusted on most switches. Typically turning the adjustment wheel clockwise moves the post closer to the chamber and further from the microswitch. Turning the wheel counterclockwise gives the opposite result.

What it Does: The purpose of the pressure switch is to notify the board whether enough water is moving past the heater element. If sufficient pressure closes the microswitch, the board turns the heater on. Otherwise it does not. Due to the low pressure of Jacuzzi pumps 2 speed pumps should use a 1lb pressure switch. 2 pump, single speed pumps should use a 2 lb pressure switch. Overtime the microswitch can fail, the post is less responsive, or doesn't withdraw fast enough. Any of these failures will cause the board to fail.

REPLACEMENT:

F106/7, F108/9, H136/276

Replacement of the pressure switch is easy. The pressure switch screws into the heater assembly. Looking at the control box and heater (the steel tube), on the left backside is where the pressure switch is.

You can change with water in the spa. You must work fast. First, put Teflon tape or plumber's putty on the threads of the new switch.

Turn off main power. Unplug the 2 wires from the old switch. Take an open end 1/2" wrench. Note on the top of the threads a 1/2" socket is available for your 1/2" wrench. Loosen. Switch old with new. Tighten to snug. There is no direction to end at. Plug the wires into the switch.

R574/6

Turn off power. Open metal cover on control box. You will see the pressure switch on the top center of the heater (steel tube).

Manufacturer's Recommended Procedure:

Disconnect the 2 copper straps from the board and the heater posts. Take care in removing the heater posts for the post will bend and break.

Loosen the 2 screws on each "C" bracket that hold the heater in place. Finally loosen the 2 heater coupling on both ends of the heater.

Twist heater toward you. You can change with water in the spa if you protect the board from getting water on it. You must work fast. First, put Teflon tape or plumber's putty on the threads of the new switch.
Replace.

My Method: It's usually faster and safer for the board to do it my way. I remove the board except for the wires connected directly to the board. I swing the board out and to the left and protect the board. Now any water that comes out of the pressure switch hole will not affect the board.

FLOW SWITCH:

The flow switch performs the same function as the pressure switch.

How It Works: The flow switch is a simple device. It is installed typically after the #1 pump discharge. It's a reed switch and a magnet. The switch is inside the center post of the flow switch. The magnet is on the metal armature.

What It Does: When water flows pass the armature it moves toward the center post and closes the reed switch. This tells the board that there is enough water flow. When water stops flowing, the armature moves back and the switch opens. Flow switches either work or do not. The key to installing is making sure the right direction of water flow matches the design of the flow switch. Flow switch usually

have arrows pointing the direction of the flow but if not, it's easy to understand. The armature will be toward the water flow so when the flow comes, it moves to the post.

Jacuzzi. Most of Jacuzzi's spas use pressure switches. It wasn't until about 2000 did Jacuzzi introduce the flow switch on it's electronic spas specifically late editions of the Pinnacle, the Triton, and some Quantum Plus spas. All of the others used pressure switches.

REPLACEMENT:

Note the direction of the flow of water. The new switch must follow the same flow. Remove the clips and hoses and switch with new.

Chapter SIX: SENSORS

TEMP/OH SENSORS:

HOW IT WORKS: Sensors work by reacting to temperature at the bulb. As the temperature raises or lowers, the resistance inside the sensor bulb changes. The board reads the resistance of the temperature and knows what the temperature of the spa is. That is how it determines spa temp. Some spas have their temperature sensor inserted into the actual spa. Others in a housing inserted into the spa. Jacuzzi's most common design is the sensor inserts into the side of the filter box.

The second sensor is the Over Heat sensor. If that sensor raises above a certain threshold, usually 112-115 degrees, it shuts the spa down. It is clipped against the heater.

Typical Resistance Values for Sensors and the water temperature.

Temperature	Resistance
59	55.0
65	40.0
77	30.0
84	25.5
94	20.2
99	18.1
101	17.2
104	16.2
106	15.4
108	14.7
110	14.1
115	12.7
121	11.1

WHAT IT DOES:

Typically, when you power up the sensor the board looks at both Over Heat Sensor and the Temperature Sensor and compares them. It should see no significant difference and the range should be within normal range. If it see outside the tolerances, depending on which system you have, it will notify you of the problem and fail to turn the spa on. If the temperatures are close, it continues it's self test.

To Replace:

The Temperature sensor inserts into the filter box. Simply pull down and the seal will break and the sensor will come out. If you have water in the spa, it will pour out. You usually can switch with the new sensor fast enough to minimize water.

The Over Heat sensor clips on the heater. Again, simply pull out.

Connection to the board:

The most common connection of the sensors to the board is a joint plug where both the temperature and high limit sensor pair together. To release the wires from the plug do this: Unfold a paper clip. Note on the plug the ends of the wires inside the plug are rectangular windows. By pressing down on the wire rectangular ends and pulling the wire, the end will release from the plug and slide out exposing the ends.

If you have black ends to your cord there is a simple clip to press to release. The biggest problem is the clip is hard to see and sometime to reach. If you look on the top of the clip you will see the lever to press down to release. I use a small screwdriver to press down and pull out..

Chap Seven: Topside Control

There are several types of topside controls used on the Jacuzzi electronic spa. One style uses a combination of jet button and temperature dial. More common are topsides with digital readouts and various buttons.

HOW THEY WORK:

Topsides with a dial temp control simply work by resistance. Turning the dial up or down changes the resistance that the board reads and either turns the heater on or off.

The buttons on electronic topsides operate with piezo switches. They are simply a crystal that when press creates a small voltage that travels down the wire to the board. The board sees this impulse from the topside and responds. On some models it's a step process; each time you press on the switch the board responds going to the next step. On other models its simply an on/off response. (Example: Press the air blower button on the topside and it turns the air blower on. Press again and it goes off)

Topsides with a digital readout will have either a Liquid Quartz or Light Emitting readout. They operate the same. The Liquid Quartz displays a quartz style readout. The light emitting has light legs. Typically the higher end systems use the Liquid Quartz.

The Platinum Series topsides are a liquid quartz readout with a light backlight. It's the only topside Jacuzzi used with a liquid quartz. The remainder use a light emitting diode or LED. Some have more function buttons than others. Jacuzzi also used a topside with a Dial temperature control and a single jet button on many of their Z series spas.

Chapter Eight OZONATORS:

What is an Ozonator? Ozone gas is O³ which is a gas that can serve as a sanitizer. Because it serves as a sanitizer, you can use less bromine or chlorine. You must use a chemical sanitizers with an ozonator to make them work effectively. So the reason a person uses an Ozonator is to lower the need to use a large amount of chemicals to keep the water clean.

How does it work? The two popular methods for producing ozone gas with an ozonator is with a bulb coated with a coating that will produce the gas when lit or with a capacitor discharge that makes an arc and the arc creates ozone gas. The capacitor discharge method is becoming the most common method used. Because of their ability to make a large amount of gas (measured in milliliters). With this method a large amount of gas injected into the water will lower to amount of sanitizer you will need.

Whether the bulb or CD method is used, the actual method of injecting ozone gas is the same. First, you plug the ozonator into the control box. Although older spas require a "hot wired" method, your spa's control system should have a socket designed for an ozonator to plug in. Once the ozonator is plugged in, depending on the configuration of the spa, the board will turn the ozonator on.

When the ozonator comes on it produces ozone gas. Now you need a method of getting that gas into the water. This is how it's done: in line with the circulation pump or the low speed #1 pump, a mazzai or molex or like is installed. What it does is as the water is reduced through the device it creates suction. There is also a 3rd barb which is the air line hose from the ozonator. So as the water passes by the mazzai or like suction pulls the ozonated gas into the water. From there the mixture is blown into the spa. Some ports where the water comes out are dedicated for the ozonator; other are a mixture of heated water and ozone gas. As the ozonated bubbles rise to the surface of the spa they sanitize the water.

Jacuzzi began using the Hercules brand ozonator with their electronics spas. This was a 110v ozonator with a bulb type ozone source. They then switched to Prozone brand although different in design was basically the same. Since this production of spas the CD designed ozonators became available.

Chapter Nine: SPA MOOD LIGHTS:

Most spas have some type of mood light system. The simpler method is with a light bulb and lens. The board applies 12vdc to the bulb. You usually have the option to put a colored lens over the clear lens or leave the clear lens.

Manufacturers have now added the ability to add color not by a lens but with assemblies that produce a variety of colors through red, blue, and green bulbs. Some systems allow you to choose the color, some follow a certain rotation, and others allow you to start and stop at certain colors. Many systems that came with a standard clear light are upgradeable to these color light assemblies by simply unplugging the clear 120vdc bulb and plugging in the color assembly.

Jacuzzi used a single lens/light on most of their spas. A few Platinum models they used 2 lights. On the Platinum topside control they also have a 2 level light intensity level. The others only have an on/off ability.

Chapter Ten: Plumbing

Spas started with copper piping and soon went to rigid PVC plastic piping. By the mid 90's flex PVC piping became popular. Both have a "Schedule 40" rating so they can be used for drinking water.

In the late 90's soft plastic piping was introduced and has become popular. It's common to see current spas using all 3 types of piping.

Jacuzzi used all 3 types of piping.

The key to gluing is care. First, you need clean both inside and outside of couplings and pipes that will come into contact. Then prime. Primer/cleaner remove dirt and soften the plastic. Again, do both side of the pipe where they will come together.

Finally, add a good layer of glue. I prefer "medium" body glue which is a fast setting glue. Glue and insert together and hold about 30 seconds.

The glue sets within minutes but you should wait 24 hours to fully cure. If you add water and apply pressure too early there is a good chance you will have a leak. If it leaks, usually you have to cut the parts apart and start over again.

Chapter Eleven: SPA JETS:

There are several methods jets are installed. One way is ½ of the jet body is placed on the plumbing side of the spa. Then the opposite half is screwed into the half with either a gasket or silicon sealer from the water side. Then the jet assembly snaps into the 2 halves.

The second method is the jet assembly inserts through the spa wall and tightened by a nut on the plumbing side. Either silicone or a gasket is used to seal the housing.

Jacuzzi: In the mid 90's Jacuzzi spas used their own patented jets. The older have the AMH jet with is a medium size jet with directional nozzle but you can adjust the flow. This jet is commonly used in the footwell area. Because you can't adjust the flow the water from the pump has an output incase other jets nozzles are closed. Next popular are the HTA jet which is a large jet. It has adjustable flow and direction. Jacuzzi used these are their upper end spas.

In the mid 90's they started using their HTC jets which they continue to use on their jetted baths even to this date. It was a popular jet. Finally they began to use the BMH jet which is also a popular jet. On a few models you will find the HTA, HTC, and BMH jet. Many have the HTC and BMH jets. On the Z series they used mostly the BMH jets.

Chapter Twelve: STEREO:

Spas with stereos use car stereos. The spa has a transformer that changes the voltage from AC to DC and lowers the voltage to 12 volts. Jacuzzi used major brand car radios to add music and outdoor speakers.

Some stereos pick up noise when on AM but not FM. I have found the common problem is the step down transformer is the cause. If you purchase a quality transformer with "clean" current this can remove the noise.

SECTION TWO: TROUBLESHOOTING:

Warning:

I need to repeat the warning given at the beginning of this manual. If you don't have a working knowledge of electricity and can safely work with electricity, then you should have a licensed electrician or properly trained service repairman handle electrical problems. We try to make this information safe but we can't cover all possibilities. Just make it a routine to turn off main power when doing any service. There are only a handful of times you might have to do tests that require power to be on. Special care must be given in those situations. Also, although some troubleshooting is reasoning on the problem and observing what is happening, at times the definitive test will require use of a volt/ohm meter. Again, if you are knowledgeable of their use it makes it easier to isolate the problem. But if you are not comfortable using a meter, it's best to consider experience help.

TROUBLESHOOTING SECTIONS:

- I. Trips GFCI or GFI.
- II. Doesn't Heat
- III. Motor hums
- IV. Pump Leaks
- V. Diagnosing by CLICKS
- VI. Error Codes on the Topside:

I. Trips GFCI

First, check the equipment and electrical connections for any water. Water dripping onto equipment will cause the gfci to trip.

1. Most common cause is the heater. If the gfci pops instantly its almost always the heater. To isolate, do the following:

Turn off power. Remove the cover on the control box. You will see either 2 straps running from the heater posts to the board or 2 wires that do so. If you have 2 copper straps, you need to remove both. Remove the 2 nuts or screws holding the copper straps to the board or terminal block. Remove the 2 straps from the heater posts. The heater posts will have a nut on the top holding the copper/wire to the posts. Underneath the copper/wire is another nut built into the heater posts. This allows you to place an open end wrench on both top and below to loosen and remove the nut. Do so. You will then have a totally disconnected heater from the loop.

Turn ON power. If the spa comes on and operates fine without tripping the gfci as it did previously, you have identified the heater as the cause. That is common because the heater's element can crack or corrode enough for the voltage to leak and the gfci to see the leak to ground and trip.

NOTE: On spas operated on 110-130vac cord, the heater will cause the gfci to pop after the low speed pump comes and then the heater is turned on causing the gfci to trip.

2. If the spa still trips the spa, try disconnecting the ozonator and leaving disconnected to test to see if that is the problem.

3. If the two steps above don't isolate the problem, then the low pump could cause the problem. Usually the motor will be hot to the touch. But either way, sporadic gfci failure is most likely the pump/motor.

4. In rare cases the gfci tripping is caused by the board. It's the least likely failure.

II. Doesn't Heat

If the heater light is solid and the spa is not heating, it's likely the heater. Remember, spas plugged by a cord into an outlet only gain 1-2 degrees per hour. Spas hardwired to 220-240vac will gain 5-6 degrees per hour. Typically you might not be able to feel a different temperature of water coming out of the heater nozzle. Even touching the heater element doesn't always "feel" different.

The tech's method to test the integrity of the heater element is with an ohm meter. Set the meter to OHMS. Place each probe on the heater posts WHEN THE POWER TO THE SPA IS OFF. You should get 11-15ohms resistance. If not, you have a failed element. If the ohms is correct, he next checks:

The power to the spa. A perfect heater without proper current won't heat. PLEASE NOTE: that to check current you need a good meter and know how to use it safely. If you do not, seek help from someone who does or have a licensed electrician do this test.

When the heater light is ON, the heater should be receiving either 110-130vac or 220-260vac, depending on your spa and incoming power service.

To check, remove the metal cover on the control box. Turn on spa and let the motor come on and the heat light to come on solid. Set the voltmeter to above 300vac. With the heater light on solid, place the probes on the heater's 2 heater post. You should have either voltage range. If you do not and the heater light is solid, then the board has failed and you will have to replace.

If you have the proper ohms resistance on the first test AND the proper voltage at the heater AND you gave the spa enough time to heat, several things could be the problem.

First, it's not uncommon for the above test to pass and still be misleading. The test proves true and then minutes or an hour later the heater stop heating and the heater light go out. So you have to eliminate that possibility. First, remove the filter(s) and leave out for a day. Does the spa still not heat? IF not, check to confirm the heater light is still solid, if you catch the heater light out or flashing or a error code is displayed, that will lead you one direction. But, if the heater light is solid all the time, you have voltage, and the resistance on the heater was correct

even with the power off, then it's likely the board. What can happen is the heater relay although closed and apply voltage to the heater, it's not allowing enough current to reach the heater element. To determine if that is the problem, you need to test the amperage draw when the heater is on.

What the spa tech will do is use his meter set to AMPS and test one hot wire to the spa. He will note the amperage draw when the pump comes on. Then when the board turns on the heater and the heater light is solid he will notice the meter show a large demand again. If so, the heater should be heating. Yours would not. But if you don't have a meter to check the amps or do not know how to, if you have come to this point and can't check the amps, then you should expect the board to be the cause of the heater failure.

IF the heater light does NOT come on or is flashing, that means there is a failure. See the "CODES" failure section.

Why do Heaters Fail?

Heaters tend to fail one of two ways. They no longer pass current through the element and therefore no longer heat.

The most common cause of this failure is water quality. Over time water quality can cause the element to "leak" current and cause the GFCI to shut down the spa. The manufacturers of elements insist that if the water is kept to "optimum" levels that the element should last forever. Their claim is that the only thing that will harm an element is the on/off of the electrical current to the heater and poor water quality that damages the element itself.

Their claim is paralleled to a light bulb. If you leave a light on and do not turn it off, it will last a long time. It's the initial startup that causes the bulb to fail (that's why this flash when you turn them on). The element on the heater is supposed to have the same problem. Since they will literally be turned on/off throughout the day over the years, they fail. That along with the water quality determines the longevity of the heater.

Therefore you can extend the life of your spa by making sure the top and sides of the spa are insulated well (to lower heat lost) and keep the water chemistry

balanced and not using too much or too little chemicals.

III. Motor Hums

Why does the motor hum? Because it doesn't know the words.... Sorry, just had to say that.

Humming motors is typical of a failed motor. Can internal parts be replaced? If a tech was trying to save the motor he might start with a new discharge capacitor. But other parts also can be near failure including bearings. Because of the possibilities, most techs will opt to replace the motor rather than having it rebuilt.

A major reason is economics; both for the tech and the homeowner. If the customer pays the cost of removing, rebuilding, and installing the motor and then a couple months later it fails, who is to blame? The homeowner will place the fault on the tech's shoulders. So in an effort by the tech to save the customer money turns out to create friction between tech and homeowner. Whereas replacing the motor with new makes the failure a remote possibility.

IV. Pump Leaks

Pumps can leak for several reasons. The most likely is the seal on the pump. The seal is a 2 section construction. Basically the seal has 1/2 of the seal that's a ceramic ring with a rubber boot to seal in a seat on the main body or bracket of the seal. The other 1/2 slides onto the impellor shaft and contains a rubber seal and has a steel spring to compress both 1/2's to seal. There are 3 rubber parts of the seal that can leak.

Next possibility is the rubber o-ring that seals the 2 halves of the pump together. If you have leak from there make sure the bolts or screws that hold the halves together are tight or not stripped. The 1/2's of the pump must be tight together.

Rarely but possible are the o-ring seals of the pump union seals. These are the seals where the plumbing connects to the pump. This is call a union and has a o-ring. Usually you can hand tighten the union and stop the drips.

Finally, in rare exceptions the pump body has a crack.

For me, I have found that replacing the whole pump makes sense. Often you replace the part you think is leaking, fill the spa and turn it on and find it still leaking. Therefore, it makes sense for time and effort to replace the pump. It's the only option I give my customers.

V. Diagnosing by CLICKS

I have found over the years that many failures can be determined by the CLICKS the board makes. The CLICKS are relays closing on the board. Since all of the boards used by Jacuzzi Whirlpool Bath spas were made by Balboa Instruments, the CLICKS follow the same sequence.

What each CLICK means:

CLICK #1

When power is first applied to the spa, the board will produce an audible CLICK. If it does you have power to the board.

The board does a self test. This test includes checking the sensors. It looks to see the temperature and overheat sensor are within tolerance and close to identical. It also checks the pressure switch to confirm it's open. If everything is fine.

CLICK #2

The #1 pump comes on. If the spa sees the water moving, then...

CLICK #3

The heater light comes on and the spa starts heating.

CLICK #4

The spa turns on the ozonator if so equipped.

OK, lets diagnose using the CLICKS:

NO CLICK #1

You power up the spa and you do NOT get a click.

Cause of Failure: First thing to check is incoming power. You MUST use a meter to confirm proper voltage. Using a volt pen that lights up when power is present won't work. You must confirm you have 110-130vac if you have a single pump system and 220-260vac if you have 2 or more pumps.

If you have proper voltage, double check the fuses inside the control box. You do this with power OFF and the meter set to ohms.

Finally, with proper power to the spa and the all fuses are OK, the only possible reason for failure is either the transformer or the board. Most of the spas have a separate transformer. In very, very rare occasions the failure is the transformer. I 12 years of working on these electronic spas, I can't remember one spa's failure attributed to the transformer. It COULD be the problem but likely not. So that leaves the failure the board. This unfortunately isn't rare. Often caused by line wire surges and brownouts. It can also be caused by lighting. Although the board failure is not common, it can fail. You need to replace.

#1 CLICK and then nothing.

The spa does #1 CLICK it goes into the self test. If you don't get to the #2 CLICK, it could be one of several reasons. First and least likely is also a board failure. Likely the failure is one of the sensors. See the ERROR codes section. But let me mention the failures that can occur here in case the ERROR doesn't display either in Digital readout or on some ECHO spas, the heater light flashes.

The spa board at this point is looking at the sensors. One sensor it looks at is the pressure or flow switch. The board is expecting to see an OPEN pressure or flow switch. OPEN tells the board it will see a CLOSED sensor when the pump is turned on. If the board doesn't see this sensor OPEN, it will not go further.

The board also checks the temperature and overheat sensor. It compares the temperatures and also if they are within tolerance. IF so, they pass. Then the board considers the pressure/flow switch. The board must find either in the OPEN condition. If the topside goes to solid FL or FLO or the heater light starts flashing, it indicates the switch has failed.

It's easy to check if the pressure switch has caused the failure. Unplug one or both wires of the pressure/flow switch from the board. IF the pressure/flow switch has failed and you unplug it, the pump will come on. If it does not, then it's not the pressure switch

When pressure/flow switch, temperature sensor, and the overheat sensor pass testing, the spa goes to

#1 and #2 CLICK and then Nothing.

You get the SECOND CLICK then nothing: The 2nd Click turns on the #1 or LOW speed pump (see Pinnacle models section for exceptions.)

If the pump comes ON and you see water movement you know the pump is OK. If you hear the CLICK and the pump doesn't come on, one of two problems exists. First, the #1 pump/motor is bad. Second it's the pressure switch has failed or needs adjusting. Final indication is a board failure; rare but happens.

So, to check first and last, check the voltage to the #1 pump. To do this you need your voltmeter set above the voltage of your spa. If you are running the spa on 110-130vac, check for that voltage. If 220-260vac, check for that.

On 2 pump, 220vac systems, the #1 and #2 pump are labeled. On most spas you can just ID the 2 slots the pump wires use for the white and black lines and check the voltage for 220-260vac.

On one model, since the plugs connect to the control box from the bottom, you must change how you reach the wires to check. Because it's impossible to reach the wires, you need to open the cover on the control box, ID the wires you want to check and check the voltage that way. Be very careful to place the probes on the correct wires and not to short anything.

If you have a single, 2 speed pump, the LOW speed is the white and black wires. Do as explained above to check the voltage.

If you have voltage, the motor has failed and you will need to replace it. One final double check can be done on 2 pump systems. You can unplug the #1 pump and move the #2 pump to the #1 spot and turn on main power. If the pump now DOES come on, you have shown the real #1 pump has failed.

#1 and #2 CLICK and Pumps Come ON but no HEAT.

First step to isolate the problem is the pressure switch. To check, turn off power. Identify the heater and the pressure switch screwed into the heater. It has 2 wires coming out of the switch.

Take a short piece of wire and strip the ends of the wire. Disconnect the 2 wires and place the wires in an accessible locale. Turn on power. Once the pump automatically comes on, place the short piece of wire into both ends of the pressure switch wire. This is going to tell the board there is water movement and it can turn the pump on.

If you here a CLICK, the heater light or Icon should be ON. If so, you have focused the problem as the pressure switch.

Now you might think, "I'll just leave this short in and bypass the switch altogether. I probably don't even need it." Good thought; won't work. What the board will do is catch your short. When the water reaches temp and turns the #1 pump off, it immediately looks at the switch to make sure it's now open (your wire has made it constantly closed). If it's not open, it will go into failure mode and either give you a solid FL or FLO or the heater light will flash (depending on model of spa). The spa will not start until it resets and you usually have to manually power up the spa.

Real Solution:

a. You can try to adjust the pressure switch. This will work sometime. FIRST, turn off main spa power. On most brands of pressure switches you can adjust them. Again, usually you can turn the adjustment wheel. Some models have a metal clip or piece of tape holding the wheel in place. Others use a gate you slide up and then you can adjust. Usually once the adjustment wheel is free you turn the wheel one full turn clockwise. That may solve the problem. If you turn it too far, the result will be the pump will come on but the heater will not. So try turning only one turn.

b. Otherwise, replace the pressure switch to gain dependability.

IF shorting out the pressure switch does NOT solve the problem, the failure is the board itself. Double check that the pressure switch cord to make sure it's plugged securely into the board and the cord isn't cut. IF not, your short is telling the board water movement is happening and it's ignoring the signal. This rarely happens but when it does, you have to replace the board.

The CLICKS are not over:

After the pump and heater come on and don't touch any topside control, you will hear another CLICK. That is the ozonator being turned on.

Summary:

- a. Power up spa.
- b. If no CLICK:
Cause: Incorrect or no power OR bad board.
- c. Get 1st Click but not Second:
Cause: Board, sensor, or pressure switch failure.
- d. Get 1st and 2nd Click but not 3rd.
Cause: Pump failure, pressure switch failure, or board failure.
- e. Get 1st, 2nd, and 3rd but No Heater Light
Cause: Pressure switch or board failure.

VI. Error Codes on the topside:

DIGITAL TOPSIDE ERROR CODES.

Solid FLO or FL

This means a failure of the pressure switch. To confirm that is the cause of the failure, turn the main power off. ID whether you have a pressure switch or flow switch. Then identify where it's at. Flow switches are connected to the piping hose. Pressure switches are screwed into the heater assembly. Flow the cord from either the flow switch or pressure switch to where it plugs into the board. Unplug. Turn on main power. If the spa still goes to Solid FLO or FL, then the board has failed. If the pump now comes on automatically when you turn main power on, you have isolated the problem to be at the flow/pressure switch. If you have a flow switch, you will need to replace. If you have a pressure switch, you may try to adjust the pressure switch. If your pressure switch has a dial adjustment on the pressure switch, you can try turning the wheel one full turn clockwise. Otherwise, replace the pressure switch.

Flashing FLO or FL with temperature and possibly COOL or FC. This means the board has turned on the #1 or circulation pump and does not see water flow. If you can see water moving, first try removing the filters to see if this helps. If not and sufficient water is moving, usually it's best to replace the pressure switch. It's always necessary to replace flow switch. You might be able to adjust a pressure switch by turning the adjustment wheel one full turn counterclockwise.

SN. Means a sensor failure. It will be either the temperature or overheat sensor. The method to tell which is by using a good digital voltmeter. Set the meter to OHMS. On sensor cords the access to check the resistance can be difficult. A common way to overcome the minimal access is with a paper clip extensions for the meter probes. You take a paper clip and unfold and break into two. Now use the paper clip to connect the sensor to the meter probes.

Sn1. OH Sensor has failed. Replaced.

Sn3. Water Temperature Sensor has failed. Replaced.

OH. Overheat protection enacted. Caused by the heater actually getting hot, a failed OH Sensor, or the board. Option is to replace.

Pd. Power failure. Unit is on battery backup if available.

COOL. Water temperature is below 20 degrees from what the topside is set for. This is normal when spa water is changed with cold water. Otherwise is warning that spa is not at temperature set point.

ICE. Freeze Protect. Spa is going into panic mode and will turn all pumps on periodically to avoid freezing.

ECON: If available, spa is in Economy Mode. Unit will go up to 20 degrees below the temperature set. It is NOT a more economical setting. It is usually set when you are on vacation and will not be using the spa.

STAN: Standard mode. All functions work.

Spa Topsides with a DIAL Temperature Control

The heater light will flash to indicate what the failure is. I have found these codes only slightly trustworthy but they are suppose to mean the following:

Brief flashing red heater light

Meaning: Board sees a failure in water pressure. This failure can be:

The pressure switch itself, or

The pump has failed, or

The PC board has failed not seeing the pressure switch properly.

Even flashing:

Meaning: Board sees an overheat situation. If the water hasn't overheated, then this failure can be:

PC Board turned on heater without water flow which requires replacing the
PC board, or

Not enough water is moving over the element which is a flow problem, many
times due to dirty filters, or

Failed sensor

Flashing More On then Off:

Meaning: PC Board sees a sensor failure. Isolate which sensor and replace. Also
may occur if PC Board has failed.

SECTION THREE: Review of Specific Models

AERO PLUS and SELECT

ALEXA and DELFINO

CIRRUS

LEXUS PLUS, LC, and SELECT

LASER PLUS and SELECT

PALIO

PINNACLE

QUANTUM/PLUS

SANTINA

SOLARIS

TIRAGE

TRITON

Z-100

Z-110

Z-112

Z-120

Z-130

Z-135

Z-140

Z-145

Z-150

Z-235

Z-240

Z-255

Aero Plus/Aero Select

Dimensions: 84x76x30
 Capacity: 225 g
 Empty Weight: 675 lbs
 Water Weight: 3299 lbs
 Voltage: 230v
 Pumps: One 2hp Pump on Earlier Production; Two 1hp pumps on Select
 Accessory: Air Blower on Earlier Production; None on Select Series
 Heater: 5.5kw

	
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570HD
Heater	2600-050
Board	2600-019
Topside	S-51057
Air Blower	2560-150
	
Pump (wetend only)	CC-1jp
Motor Only	2500-200
Pump/Motor Complete	2500-250
Heater	2600-050
Board	2600-016
Topside	2500-151

Alexa/Delfino



Dimensions: 72x60x30
Capacity: 158 g
Empty Weight: 349 lbs
Water Weight: 1965 lbs
Voltage: 110vac
Pumps: ONE 2hp Pump
Accessory: None
Heater: 1.5kw

Part	Part #
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570HD
Heater	2600-050
Board	2600-015
Topside	2500-152

Cirrus



Dimensions: 84x84x36
Capacity: 375g
Shipping Weight: 884 lbs
Water Weight: 4659 lbs
Voltage: 220vac
Pumps: TWO 1hp Pumps
Accessory: Air Blower
Heater: 5.5kw

Part	Part #
Pump (Wetend Only)	CC-1jp*
Motor Only	2500-200*
Pump/Motor Complete	2500-250*
Heater	2600-050
Board	2600-017
Topside	2500-150
Air Blower	2560-150

***Some Models 3hp #2 Pump. On those, it uses a CC-3jp wetend, 2500-203 motor, or 2500-251 pump/motor complete**

Lexus Plus/Select/LC

Laser Plus/Select

Dimensions: 84x84x36
Capacity: 375g
Empty Weight: 595 lbs
Water Weight: 771 lbs
Voltage: 220vac
Pumps: Two Pump/motor (either 2 X 1hp OR 1 1hp and 1 3hp)
Accessory: Air Blower Optional
Heater: 5.5kw



Part	Part #
Pump (Wetend Only)	CC-1jp*
Motor Only	2500-200*
Pump/Motor Complete	2500-250*
Heater	2600-050
Board	2600-017
Topside	2500-150
Air Blower	2560-150

Lexus Continues next page:

Lexus/Laser Continued



Part	Part #
Pump (Wetend Only)	CC-1jp*
Motor Only	2500-200*
Pump/Motor Complete	2500-250*
Heater	2600-050
Board	2600-016
Topside	2500-151



Part	Part #
Pump (Wetend Only)	CC-1jp*
Motor Only	2500-200*
Pump/Motor Complete	2500-250*
Heater	2600-050
Board	2600-019
Topside	S-51057

*Some Models 3hp #2 Pump. On those, it uses a CC-3jp wetend, 2500-203 motor, or 2500-251 pump/motor complete

Palio

Dimensions: 72x66x30
Capacity: 190 g
Empty Weight: 409 lbs
Water Weight: 2558 lbs
Voltage: 115vac
Pumps: One 2hp 2 Speed Pump
Heater: 1.5/11kw

Part	Part #
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570HD
Heater	2600-050
Board	2600-015
Topside	2500-152

Pinnacle



Dimensions: 96x96x42
Capacity: 550 g
Empty Weight: 950 lbs
Water Weight: 6732 lbs
Voltage: 230vac
Pumps: One Circulation Pump, 2 High Pressure Single Speed Pumps
Accessory: Air Blower, Optional AM/FM Radio
Heater: 5.5kw Low Flow

Part	Part #
Circ Pump	If Small Pump, 110v Tiny Might If Large Pump, 2500-259
High Volume 1 Speed #1 or #2	6500-763
Heater	2000-300
Board-4 Wire	2600-018
Board-3 Wire	2600-011
Topside	2500-150
Air Blower	2560-150

Quantum Plus



Dimensions: 94x87x37
Capacity: 400 g
Empty Weight: 748 lbs
Water Weight: 4980 lbs
Voltage: 220vac
Pumps: Either One 1hp and One 3hp Pump/Motor or One "Circulation Pump and 2 High Pressure Single Speed Pump
Accessory: Air Blower
Heater: 5.5kw Low Flow

Part	Part #
Pump (Wetend Only)	CC-1jp and CC-3jp
Motor Only	2500-200 and 2500-203
Pump/Motor Complete	2500-250 and 2500-251
Small Circulation Pump (if your spa has one)	6500-035
High Pressure, 1 Speed Pumps (only on spas with small circ pump)	6500-763
Heater	2600-050
Board- K286-w/o circ pump	2600-017
Board- R327-with small circ pump	2600-011
Topside	2500-150
Air Blower	2560-150

Santina Select



Dimensions: 84x84x36
Capacity: 375g
Empty Weight: 562 lbs
Water Weight: 4771 lbs
Voltage: 230vac
Pumps: Two Single Speed 1hp (some models replaced one 1hp with a 3hp pump)
Heater: 5.5kw

Part	Part #
Pump (Wetend Only)	CC-1jp
Motor Only	2500-200
Pump/Motor Complete	2500-250
Heater	2600-050
Board	2600-016
Topside	2500-151

SOLARIS



Dimensions: 78x72x32
Capacity: 249 g
Water Weight: 4281 lbs
Voltage: 230vac
Pumps: 2 x 1hp
Heater: 5.5kw

Part	Part #
Pump (Wetend Only)	CC-1jp
Motor Only	2500-200
Pump/Motor Complete	2500-250
Heater	2600-050
Board	2600-016
Topside	2500-151

TIRAGE PLUS



Dimensions: 94x87x37
Capacity: 375 g
Empty Weight: 749 lbs
Water Weight: 4874 lbs
Voltage: 230vac
Pumps: 2 1hp Pumps or 1 1hp and 1 3hp Pumps or 1 Circulation and 2 High Pressure Pumps
Accessory: Air Blower
Heater: 5.5kw

Part	Part #
Pump (Wetend Only)	CC-1jp and CC-3jp
Motor Only	2500-200 and 2500-203
Pump/Motor Complete	2500-250 and 2500-251
Heater	2600-050
Board (4 Wire Incoming)	2600-017
Board (3 Wire Incoming)	2600-011
Topside	2500-150
Air Blower	2560-150



Triton

Dimensions: 91x91x38
Capacity: 390 g
Empty Weight: 880 lbs
Water Weight: 5335 lbs
Voltage: 230vac
Pumps: 1 Circulation Pump; 2 Single Speed Pumps
Accessory: Air Blower; Optional AM/FM Radio
Heater: 5.5kw

Part	Part #
Circulation Pump	6500-035
Pump/Motor Complete	6500-763
Heater	6500-301
Board R-327	2600-018
Topside	2500-150
Air Blower	2560-151
Ozonator	CC-ECS-RPAM-240


Z-100


Dimensions: 64x70x28
Capacity: 170 g
Empty Weight: 350 lbs
Water Weight: 2365 lbs
Voltage: 110/220vac
Pumps: One 2 Speed 110v Pump
Accessory: None
Heater: 1.5/5.5kw

Part	Part #
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570HD
Heater	2600-050
Board	2600-015
Topside	2500-152

Z-110

Dimensions: 72x66x30 OR 75x69x30
 Capacity: 220 g
 Empty Weight: 327 lbs
 Water Weight: 3641 lbs
 Voltage: 110/220vac
 Heater: 1.5/5.5kw

	
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570HD
Heater	2600-050
Board	2600-015
Topside	2500-152

	
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570HD
Heater	2000-688
Board	2600-005
Topside	2500-152

Z-115

Dimensions: 81x81x30
Capacity: 207 g
Empty Weight: 353 lbs
Water Weight: 3129 lbs
Voltage: 110/220 vac
Pumps: One 110vac 2hp Pump
Accessory: None
Heater: 1.5/5.5kw

Part	Part #
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570HD
Heater	2600-050
Board	2600-015
Topside	2500-152

Z120



Dimensions: 78x78x30
81x81x31
Capacity: 300 g
Empty Weight: 430 lbs
Water Weight: 3641 lbs
Voltage: 110/220vac
Pumps: One 110vac 2hp Pump
Accessory: None

Part	Part #
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570HD
Heater	2600-050
Board	2600-015
Topside	2500-152

Z130



Dimensions: 90x76x32
Capacity: 325 g
Empty Weight: 587 lbs
Voltage: 230vac
Pumps: TWO 1hp Pumps
Accessory: None
Heater: 5.5kw

Part	Part #
Pump (Wetend Only)	CC-1p
Motor Only	2500-200
Pump/Motor Complete	2500-250
Heater	2600-050
Board	2600-019
Topside	S-51057

Z-135/145

Dimensions: 81x81x30
 Capacity: 248 g
 Empty Weight: 349 lbs
 Water Weight: 3317 lbs
 Voltage: 110/220vac
 Pumps: One 110vac 2hp Pump
 Heater: 1.5/5.5kw

	
Part	Part #
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570HD
Heater	2600-050
Board	2600-015
Topside	2500-152
	
Pump (Wetend Only)	CC-2jp
Motor Only	2500-204 or CC-C180-HD
Pump/Motor Complete	2500-255 or CC-F570-HD
Heater	2000-688
Board	2600-005
Topside	2500-154

Z-140/240

Dimensions: 84x84x36
 87x87x37
 Capacity: 400 g
 Empty Weight: 635 lbs
 Water Weight: 4578 lbs
 Voltage: 220vac
 Pumps: Two 1hp Pumps
 Heater: 5.5kw

	
Part	Part #
Pump (Wetend Only)	CC-1p
Motor Only	2500-200
Pump/Motor Complete	2500-250
Heater	2600-050
Board	2600-601
Topside	2500-152
	
Pump (Wetend Only)	CC-1p
Motor Only	2500-200
Pump/Motor Complete	2500-250
Heater	2000-684
Board	2600-005
Topside	2500-154


Z-150/235

Dimensions: 90x78x32
 92x82x32
 Capacity: 290g
 Empty Weight: 410 lbs
 Water Weight: 3728 lbs
 Voltage: 230vac
 Pumps: Two 1hp Pumps
 Heater: 5.5kw

	
Pump (Wetend Only)	CC-1p
Motor Only	2500-200
Pump/Motor Complete	2500-250
Heater	2600-050
Board	2600-601
Topside	2500-152
	
Pump (Wetend Only)	CC-1p
Motor Only	2500-200
Pump/Motor Complete	2500-250
Heater	2000-684
Board	2600-005
Topside	2500-154

Z-255

Dimensions: 87x87x36
Capacity: 302g
Empty Weight: 619 lbs
Water Weight: 3878 lbs
Voltage: 220vac
Pumps: Two: 1hp and 3hp
Accessory: None
Heater: 5.5kw

	
Pump (Wetend Only)	CC-1h + CC-3hp
Motor Only	2500-200 or 2500-203
Pump/Motor Complete	2500-250 or 2500-251
Heater	2000-684
Board	2600-005
Topside	2500-154

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