

Standard Troubleshooting Approach



S.T.A. Manual
2002+ Jacuzzi Premium
Protech LED Model Hot Tubs



The following symbol is placed throughout this manual for your protection. Always use extreme caution whenever performing repairs to electrical control system components of any kind!



DANGER: Electrical Shock Hazard Exists!
High Voltage Present on Circuit Board. Use
Extreme Caution while Servicing Circuit Board.

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1.0 Standard Troubleshooting Approach (S.T.A.)

1.1 Why a Standard Troubleshooting Approach?

Service prices are basically set by local industry and geographic region. Stiff competition in the service industry has made it difficult to raise the price of a service contract; or charge more for time and materials than the competitive shop down the street. If your service business is to be profitable you must control the overall **cost of service**. The total cost of service is made up of many individual cost factors, but three in particular are more important than the rest combined:

1. Time of Repair - How long it takes to find and fix a problem.
2. Time Between Failures - How often you are called to repair any one particular hot tub? How many times are you called back to fix the same problem on the same hot tub?
3. Parts Usage - Except in rare circumstances, only one part fails. How many parts do you replace before you find the bad one?

The Jacuzzi Premium STA manual has been designed to help you control the overall cost of service by focusing on the three important aspects of your job outlined above. The STA will help you fix your customer's hot tub quickly, fix it well, and use fewer parts.

1.2 How to Use the STA

The STA was developed by the Jacuzzi Premium Technical Support Department and is designed to be the communications link between you and your customers. If you call for help on any symptom covered in this book, you will be told to do what the STA recommends, therefore, you will save time by calling technical support after you have done what the STA tells you to do.



1.3 Professional Customer Service

Doing your job in a way that keeps cost of service low and profit margin high also creates customer satisfaction. That's being a professional!

1.4 Before Leaving the Shop

Phone the customer(s), personally if possible, and ask what problem(s) should be corrected. This may not tell you what work must be done or what part(s) must be replaced, but it will tell you what you must fix after you arrive.



1.5 Fixing the Hot Tub

Use the STA to see how Jacuzzi Premium Technical Support Department would approach the customer's complaint. Try to fix the problem following the STA. Use your experience and other information to help you answer any "Whys" or "Hows." The STA is designed to keep unnecessary part replacement to a minimum. Least expensive, most likely, and easily changed parts are always swapped first. Some parts, like control panels and temperature sensors do not require complete installation to be temporarily swapped out for testing purposes. You should carry such spares as "Tools." Refer to suggested spare parts section, page 40.

1.6 Before Calling Technical Support

Make sure you have followed the STA and filled out a "Troubleshooting Data Collection Form" (see example on page 42). Have the STA manual and the Troubleshooting Data Worksheet near the telephone. Technical Support can help you best if these two things become the communications tools for the phone call.



1.7 Before Leaving the Customer

Even if you didn't have to fill out a Troubleshooting Data Collection Form, please do so. If this is a warranty repair, the information will be needed when your office fills out the "Returned Goods/Labor Tag." In any case, it will help you spot trouble before it happens. Pumps burn up if voltage at the hot tub is too low. Circuit breakers trip if heaters and motors draw too much current (Amps). Wires overheat and connections burn if wire size is too small or push-on connectors are loose. **Call backs cause cost of service to increase!**

1.8 Satisfying the Customer

Most customers do not care what work you have done or what parts you have replaced, but they always care whether or not their problem goes away. When you are done, show them that their problem is gone. If they ask how you did it, take a few minutes to explain. Show them the bad part(s) and explain or show why it is bad.



- **Develop** the habit of examining the hot tub's you service. Compliment customers on the things they are doing right. Tell them how their care and attention can stop trouble before it starts.
- **Mention** if you noticed any adverse conditions, especially in hot tub's under warranty or contract, that could lead to failure. Can the customer correct the problem? Would they like you to correct it? Can you recommend someone? Would they like an estimate?
- **Think** of yourself and the customer as a "team" trying to keep the product up and running as cost-effective and time-efficient as possible. That's good for the customer, and it is good for your business.

2.0 Electro Static Discharge (E.S.D.)

2.1 ESD - What is it? What does it do?

Static electricity is always being generated around us, even at those times of the year when we no longer get zapped after walking across a rug and touching something.

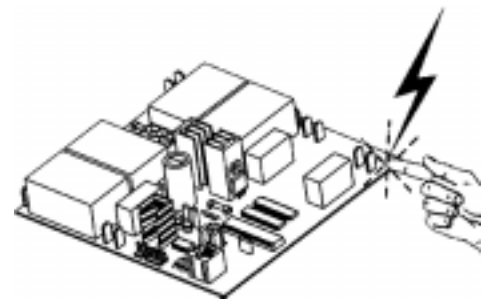


Like all state-of-the-art circuit boards, the hot tubs circuit board can be damaged by unnoticed static electricity. Damaged is the key word. Sometimes a board which has been subjected to ESD will fail immediately upon being put back into service. Usually a board will operate for a few days or months, then fail.

- **If the hot tub runs only a few days**, the customer thinks you provided poor service.
- **If the hot tub runs only a few months**, the customer thinks the circuit board is a low quality product.
- **The customer loses** use of the hot tub. **You lose money** because you must go back to make it right. Jacuzzi Premium loses its reputation for quality.

2.2 Avoiding ESD Damage

We can't prevent static charges from building up within our bodies as we go about our jobs, so we must do three things to protect circuit boards from getting zapped:



1. Never transport or ship circuit boards - **Good boards or bad boards** - except in static protective bags.
2. Never remove the board from the static protective bag unless you are ready to install it in the hot tub.
3. After removing the bad board from the hot tub, A) lay it on the ground, B) remove the replacement board from the static protective bag, C) lay the replacement board on the ground, D) place the bad board in the bag from which you removed the replacement board, E) return bad board(s) to Jacuzzi Premium in undamaged sealed static protective bags.

2.3 What About Wrist Straps and Special Mats?

The purpose of these devices is to keep the technician, the work surface, and the circuit board at the same electrical potential, and to drain into ground any static charges which might build up. Proper use of the wrist strap and special mat guarantees maximum protection against ESD damage.

2.4 Must Wrist Straps and Mats be Used When Replacing A Circuit Board?

No, if you keep the spare board in the protective bag during transport and you observe a few simple techniques during replacement.

The possibility of ESD damage to the circuit board during replacement will be minimal because of the hot tub's design and the way you normally work on it. Touching the grounding lug or heater will drain all built-up static charges from your body much like a wrist strap would. Laying the bad board on the ground will tend to keep it neutral. Touching a finger to the grounding lug or heater immediately before removing the good board from the bag will drain any charges built up by the rustling of your clothes. Laying the good board on the ground after removing it from the bag will tend to keep it neutral. Another quick touch of the grounding lug or heater before picking up the bad board will again drain built up charges. Slipping the bad board into the protective bag will allow it to be transported safely. Another quick touch of the grounding lug or heater before picking up the good board will again drain any charges built up by the rustling of your clothes. In the process of installing the replacement board, you and the board will be grounded to the load box, grounding lug, or heater, draining off charges you may build up during installation.

3.0 Main System Specifications

3.1 Protech LED Model Specifications

2002+ Models:

- Protech LED control system (control panel, circuit board, and load box)
- All components powered by 230-240 VAC. (Except J310 Model)
- A mazzei injector is required for aftermarket ozone use.
- All models include a 5.5kW tube heater. (J310 includes a 1 kW @ 120 VAC / 4 kW @ 240 VAC convertible tube heater.)
- All models include one circulation pump.
- J340 model includes two 2.5 hp pumps, J330 and J320 models include 1 2.5 hp pump and J310 includes 1 1.5hp pump.



2002 J340



2002 J330



2002 J320



2002 J310

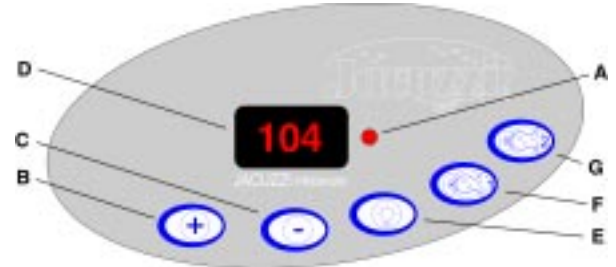
e = equipment access side

3.3 Main Control Panel Functions

2002 Protech LED Control Panel

Panel Functions:

- A. Heat Indicator: lit when heater is on.
- B. Warmer Button: increases water temperature setpoint.
- C. Cooler Button: decreases water temperature setpoint.
- D. LED Display: can display current water temperature (default display*), water temperature setpoint, selected filtration mode, and error messages.
- E. Light Button: turns underwater light on and off.
- F. Jets 1 Button: turns pump 1 on and off as follows:
 - Press once for low speed; a second time for high speed; a third time to turn off.
- G. Jets 2 Button: turns pump 2 on and off as follows:
 - Press once for high speed; a second time to turn off.



**Display shown for example purposes only, actual water temperature display will vary.*



Operation Details:

- Temperature Adjustment: 65 to 104 °F / 18 to 40 °C. Software default setting is 100 °F / 38 °C.
- Underwater Light Operation: light runs for 1 hour then shuts off for increased bulb life.
- Jets Buttons Operation: jets run for 20 minutes after activated then turn off automatically to conserve energy. Simply press JETS Button to continue operation for an additional 20 minutes.

4.0 Standard Control Panel Functions

4.1 Setting Filter Cycle Start Time





Two methods for setting the filter cycle start time are possible:

1. Turn power on to the hot tub **two minutes prior** to the desired filter cycle start time, or
2. Press and hold both WARMER  and COOLER  buttons **at the same time**, then press the JETS 1 button once to reset the control panel and start the power-up sequence. During the power-up sequence, the factory default filter cycle (F1) and temperature setpoint (100 °F / 38 °C) are automatically selected. To select another filter cycle at this time, see section 4.2 below. The selected filter cycle will start approximately two minutes after the power-up sequence ends.

Example: If you desire your first filter cycle to begin at 10:00 AM, perform either of the above steps 1 or 2 at 9:58 AM. Filter cycle start time may vary slightly from setpoint.

4.2 Programming Filter Cycles

Proper filtration is an important key to maintaining the clarity of your hot tubs water. The hot tubs filtration system is designed for unsurpassed effectiveness at removing debris and suspended particles from the water anytime the water is circulated by the pump.

To select a pre-programmed filter cycle or lockout mode, press and hold both control panel WARMER  and COOLER  keys **at the same time**, then release. Then press either WARMER  or COOLER  keys to select either filter mode F0 through L2 below:

Standard Filtration Modes F0 - F3

Heating in either of these modes (F0 - F3) is automatically controlled by water temperature. If the hot tub water drops 2 °F (1.2 °C) below the temperature setpoint, the low speed pump and heater turn on. Both remain on until the water temperature rises to the temperature setpoint, then turn off. Refer to options below:

- F0** No Filter Cycles
- F1** 4 hours of filtration a day - power-up default (2 hour cycle every 12 hours)
- F2** 6 hours of filtration a day (2 hour cycle every 8 hours)
- F3** 8 hours of filtration a day (2 hour cycle every 6 hours)

Economy Filtration Modes F4 - F6

In any economy mode (F4-F6), the control panel's digital timer circuit determines when each filter cycle takes place. The heater will only operate while a filter cycle is running. The heater will not operate when either JETS button is pressed to manually cancel an active filter cycle or to activate the main jet pump between filter cycles. Additional modes (L1-L2) are special modes designed for service/cleaning. Refer to options below:

- F4** 4 hours of filtration a day (2 hour cycle every 12 hours)
- F5** 6 hours of filtration a day (2 hour cycle every 8 hours)
- F6** 8 hours of filtration a day (2 hour cycle every 6 hours)
- L1** Lock Out (disables all hot tub functions to permit filter cleaning) - If hot tub is heating when the system is put into lockout mode, the heater will immediately turn off and the pump will cycle water for 30 seconds to cool heater element, then turn off.
- L2** Lock Mode (disables the jets and light buttons to prevent unauthorized use of the hot tub) - filter cycles and heater will continue to operate as programmed in this mode.

The temperature display flashes when this function is enabled. *Example: the “F3” filter cycle was enabled prior to choosing lock mode. The hot tub continues to perform filter cycle “F3” until lock mode is canceled, allowing another filter cycle to be selected.*

4.3 Aftermarket Ozonator Facts

An aftermarket ozonator can be installed on all 2002 models. A mazzei injector is required on all models. .





Ozone System Specifications

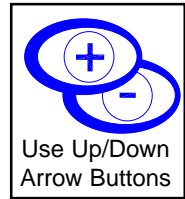
- Circulation pump runs 24 hrs
- Ozonator runs 24 hrs
- Ozonator shuts off when a JETS button is pressed. The Ozonator will resume operation approximately 5 minutes after jets are turned off intentionally or automatically. The ozonator also shuts if the hot tub goes into “summer logic.” See section 5.6 (page 8).

Refer to page 23 for troubleshooting details.

5.0 Additional Control Panel Functions

5.1 Setting Water Temperature

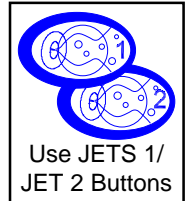
1. Press WARMER  or COOLER  button once and release while the current water temperature is displayed to view the current temperature setpoint, then
2. Press WARMER  or COOLER  button within 3 seconds to increase or decrease set temperature setpoint in 1 degree increments as desired. Water temperature can set to any value within 65 - 104 °F (18 - 40 °C).
3. After 3 seconds of keypad inactivity the LED display will return to actual water temperature and the new temperature setpoint will be maintained.



5.2 Selecting Jets Speed

- Press JETS 1 once for low speed; a second time for high speed; a third time to turn off.
- Press JETS 2 (on applicable models) once for high speed; a second time to turn off.

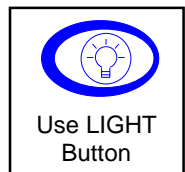
Note: Anytime a pump has been manually turned on by selecting either jet button, it will automatically turn off after approximately 20 minutes. If at this time you desire more jet operation, simply turn the jet pump back on.



5.3 Underwater Light Operation

Press LIGHT button once to turn on; a second time to turn off.

Note: Anytime the light has been manually turned on, it will automatically turn off after approximately 1 hour to maximize bulb life. If at this time you desire more light operation, simply turn the light back on.

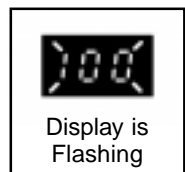


5.4 Lock/Unlock Control Panel

The control panel temperature display flashes when Lock Mode is active. Lock Mode disables the jets and underwater light to prevent unauthorized use of the hot tub. This mode is selected in the filter cycle selection menu. When selected, both filter cycles and heater will operate as programmed. See sections 4.1-4.2 (page 6).

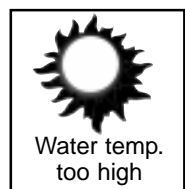
5.5 Lock Out Mode

The control panel temperature display flashes when Lock Out Mode is active. Lock Out Mode disables all hot tub functions to permit filter cleaning. If hot tub is heating when lockout mode is selected, the heater will immediately turn off and the pump will cycle water for 30 seconds to cool heater element, then turn off. See sections 4.1-4.2 (page 6).



5.6 Summer Logic

When water temperature in the hot tub rises to 2 °F (1 °C) above the temperature setpoint, the hot tub goes into “summer logic.” When this happens, the circulation pump automatically turns off to prevent additional heat from the pump that would eventually create an overheat condition. The circulation pump, main pump, and aftermarket ozone (when installed) will remain off until the water temperature cools to the set temperature, then reactivate as programmed. **This setting is not user-programmable.**



Note: summer logic does not take effect until the hot tub's water reaches 95 °F (35 °C) or higher.

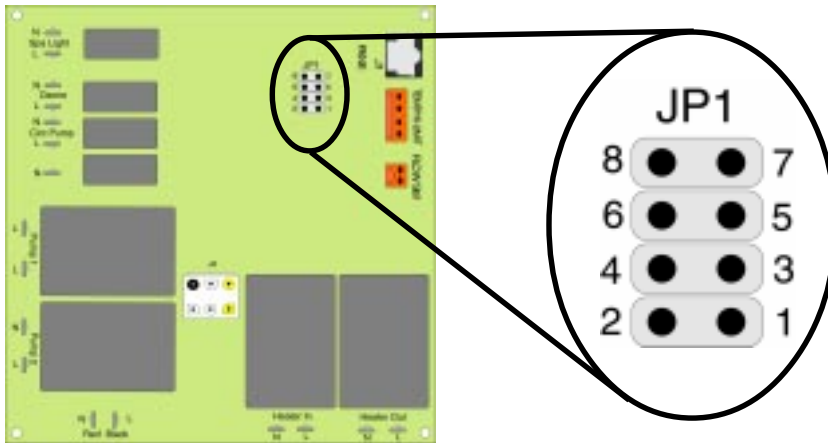
6.0 Understanding Circuit Board Pin Assignments

6.1 Circuit Board Jumpers

All Protech LED circuit boards can be configured for either 15/30A or 50A 240VAC operation. Refer to jumper pin table and circuit board diagram below for specific details:

2002 Protech LED Boards

Pins 1-2:	Jumper OFF	Enables 50A logic; allows heater to run with 1 pump in high speed.
Pins 1-2:	Jumper ON	Enables 15/30A logic; forces heater off when either pump is on high speed.
Pins 3-4:	Jumper OFF	Enables 1-speed pump logic.
Pins 3-4:	Jumper ON	Enables 2-speed pump logic.
Pins 5-6:	Jumper OFF	Not used at this time.
Pins 7-8:	Jumper OFF	Enables Fahrenheit (°F) temperature display
Pins 7-8:	Jumper ON	Enables Celsius (°C) temperature display



7.0 Troubleshooting Using The Control Panel

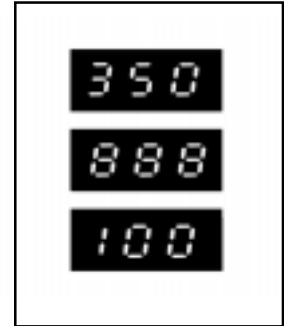
7.1 Control Panel Displays

Complete operating instructions for the control panel can be found in the owner's manual. The hot tubs self-diagnostic control system constantly monitors the hot tub for proper operation. When anything goes wrong, the control panel displays a message for the user which may result in a service call. Refer to section 7.3 below for a listing of error messages and probable causes.

7.2 Control Panel Default Display

The control panel displays the following information during initial start-up:

1. Control panel displays current software eeprom revision, then
2. Control panel displays "888" and all indicator LED's are lit, permitting visual inspection of all display segments and indicator lights for proper operation.
3. After the initial start-up sequence ends actual water temperature is displayed. If the water temperature at this time is less than the factory default temperature setting of 100 °F / 38 °C:
 - The circulation pump and heater will turn on and run until the water temperature rises to the the factory default temperature setting. Then the heater turns off and the circulation pump remains on for 24 hour operation.



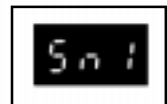
Approximately two minutes after initial start-up, the first filtration cycle begins to operate. The filtration cycle can be modified any time after the start-up sequence ends. You will be able to select a pre-programmed filter cycle and reset your temperature setpoint at this time (see page 6). Press either COOLER (+) or WARMER (-) button once at this time to display the current temperature setpoint. You can change the setpoint by pressing either COOLER (+) or WARMER (-) button within 3 seconds. Each button press increases or decreases the temperature setpoint by one degree. Three seconds after the setpoint is set, the display defaults back to actual water temperature.

7.3 Control Panel Status and Error Messages

SN1 Nonfunctional Hi-limit Sensor

Open or shorted hi-limit sensor. Heater is deactivated. Refer to test steps 1-2 below:

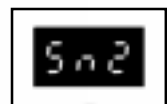
1. Turn off main breaker to hot tub. Refer to appendix page 37 for expected hi-limit sensor resistance/water temperature values.
2. Remove hi-limit sensor connector from circuit board test point 22. Refer to pages 33-34 for your circuit board configuration. Set ohmmeter to 100 k - 200 k range, then measure resistance across hi-limit sensor wires (see page 38). If sensor resistance tests ok, check sensor connections. If connections are ok, replace circuit board. If sensor resistance is incorrect, replace hi-limit sensor.



SN2 Nonfunctional Temperature Sensor

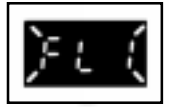
Open or shorted temperature sensor. Heater is deactivated. Refer to test steps 1-2 below:

1. Turn off main breaker to hot tub. Refer to appendix page 37 for expected hi-limit sensor resistance/water temperature values.
2. Remove temperature sensor connector from circuit board test point 22. Refer to pages 33-34 for your circuit board configuration. Set ohmmeter to 100 k - 200 k range, then measure resistance across temperature sensor wires (see page 38). If sensor resistance tests ok, check sensor connections. If connections are ok, replace circuit board. If resistance is open (infinite ohms) or shorted (0 ohms), replace temperature sensor.



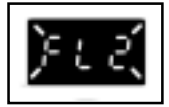
FL1 & FL2 Water Flow Problem

- **FL1:** flow switch not closed when pump is running. Heater is deactivated. Proper water flow is inhibited or flow switch may be obstructed, misaligned, or defective. Refer to troubleshooting steps 1-6 below.



1. Remove filter and allow air to bleed out of cartridge. Check filter for trapped air.
2. Check for proper water level.
3. Check for clogged filter cartridge.
4. If problem persists, refer to section 7.4 (page 12) for flow switch testing instructions.

- **FL2:** flow switch closed when pump is not running. Heater is deactivated and pump may or may not turn on. Flow switch is defective. Refer to section 7.4 (page 12) for switch testing instructions.



COL Cool Condition

If the water temperature drops 20 °F (11 °C) below the set temperature, the heater will activate to raise the water temperature within 15 °F (8 °C) of the set temperature. No corrective action is necessary.



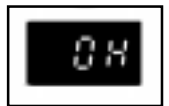
ICE Freeze Condition

A potential water freeze condition of 55 °F (13 °C) has been detected. No action is required. The heater will activate and raise water temperature to approximately 65 °F (18 °C), canceling the "ICE" error message. After the error message is canceled, the heater turn off.



OH High Temperature Condition

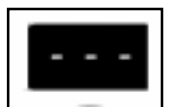
Water temperature is above acceptable limits. **DO NOT ENTER HOT TUB WATER!** Water temperature has reached 110 °F (43 °C) and the low speed pump has activated to circulate water through the heater to cool it down. Refer to test steps 1-4 below:



1. Verify actual water temperature with an accurate thermometer. If actual water temperature is less than 110 °F (43 °C), proceed to steps 2-4.
2. Turn off main breaker to hot tub. Refer to appendix page 37 for expected hi-limit/temperature sensor resistance/water temperature values.
3. Remove hi-limit sensor connector from circuit board points 22. Refer to pages 33-34 for your circuit board configuration. Set ohmmeter to 100-200 k range, then measure resistance across sensor wires (see page 38). If resistance tests ok, check wiring harness connections. If wiring harness connections test ok, replace the circuit board. If sensor resistance is incorrect, replace hi-limit sensor.
4. Set ohmmeter to 100-200 k range, then measure resistance across temperature sensor wires (see page 38). If resistance tests ok, replace circuit board. If temperature sensor resistance is incorrect, replace sensor.

--- Watchdog

Water temperature has reached 118 °F (48 °C). **DO NOT ENTER HOT TUB WATER!** The entire system is disabled. Refer to test steps 1-3 below:



1. Check hi-limit and temperature sensor resistance values. Both sensors should measure close in resistance to each other (e.g. one may be defective and way out of range). Refer to appendix page 37

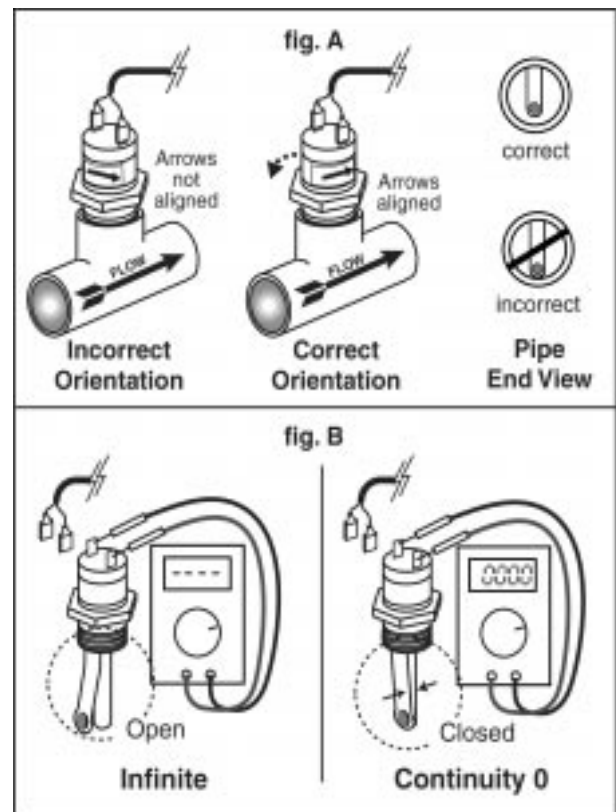
for expected hi-limit/temperature sensor resistance/water temperature values. If either sensor is faulty, replace it and recheck system. If problem persists, proceed to steps 2.

2. Plug in new control panel. If problem persists, proceed to step 3. If problem corrects, replace panel.
3. Check voltage at transformer secondary. See section A26, page 38 for transformer testing instructions. If voltage is bad, replace transformer. If voltage is good, perform step 4.
4. Check circuit board transformer connections. If connections are loose or oxidized, repair connections and retest system. If problem persists, replace circuit board.

7.4 Testing Flow Switch

Testing Flow Switch

- A. Verify flow switch directional arrow is pointing in the direction of flow towards the fitting outlet. If switch orientation is incorrect, loosen or tighten switch no more than 1/2 turn, being careful not to bottom switch in fitting. The switch's flow arrow must be parallel to tee fitting as shown (fig. A). Test system operation. If condition corrects, skip steps B-C.
- B. Remove switch from fitting making note of the number of turns (revolutions) it takes to do so. Visually inspect switch for debris interference or damage. If debris is present, remove debris, then install switch with the same number of turns as originally installed. Test system. If switch is damaged, replace switch and retest system. If condition corrects, skip step C.
- C. Test switch operation with an ohmmeter (set to 1000-2000 k range) for continuity across switch terminals. Measure resistance across switch terminals for infinite resistance with the magnet arm not touching the switch body (fig. B), and for continuity (0 ohms) with the magnet arm touching the switch body (fig. B). If flow switch tests ok, check switch wiring harness. If wiring harness tests ok, replace circuit board.

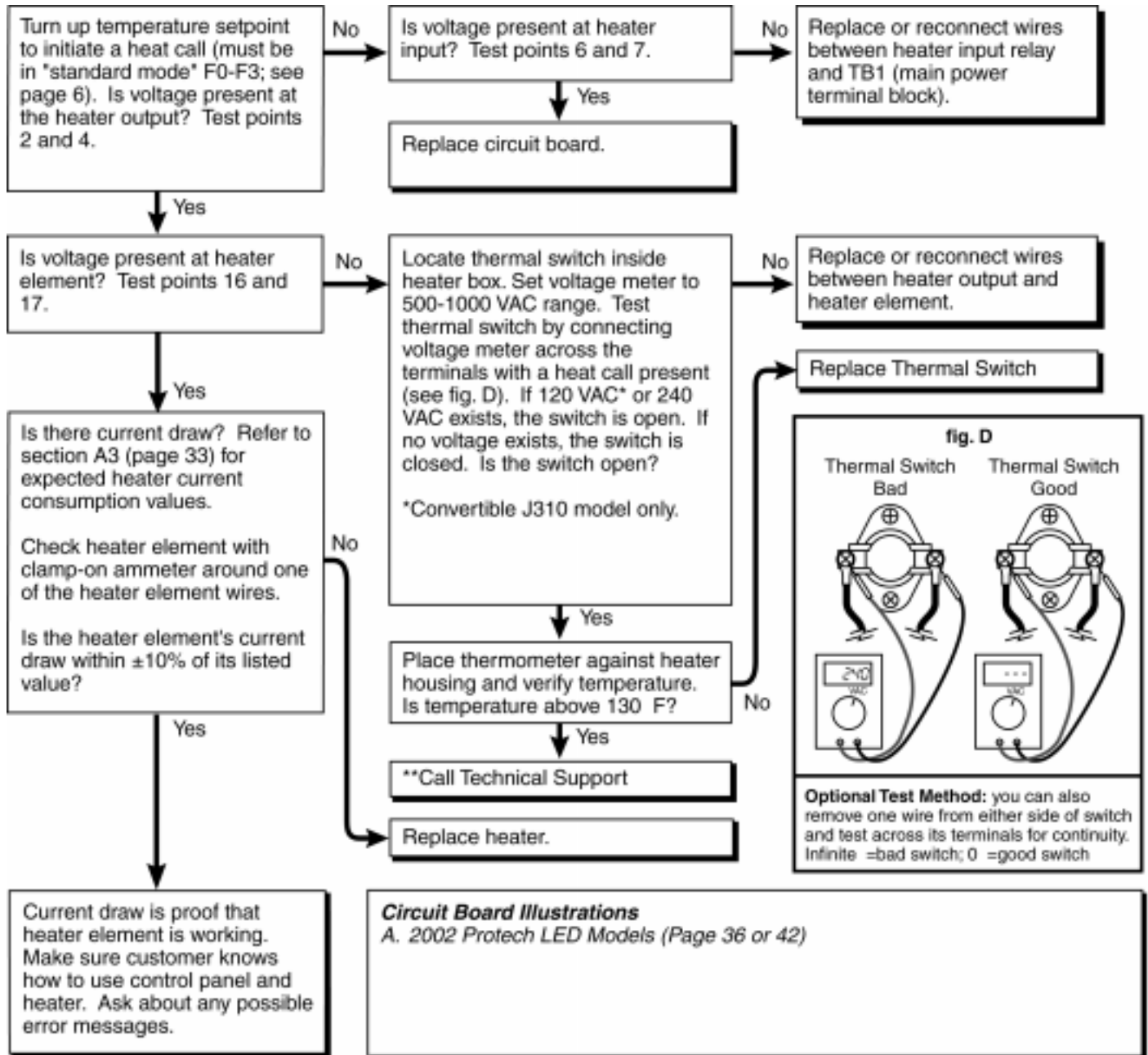



8.0 Troubleshooting without The Control Panel


- **Diagnostic Tools for Sections 8.1A-8.1D:** clamp-on ammeter, voltmeter, and ohmmeter
- **Suggested Spare Parts for Sections 8.1A-8.1D:** circuit board, control panel, temperature sensor, flow switch, heater assembly. Refer to page 40 for additional information.

8.1A No Heat or Not Enough Heat

- **Symptoms:** circulation pump (heating pump) is moving water, panel heat indicator is lit, **water is not getting hot.**
- **Configuration:** Protech LED system heaters will not operate with both pumps running in high speed, or with either pump in high speed if circuit board is configured for 30A operation. See section 6.1, page 9.

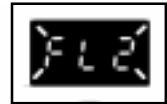


 **DANGER: Electrical Shock Hazard Exists!**
High Voltage Present on Circuit Board. Use Extreme Caution while Servicing Circuit Board.

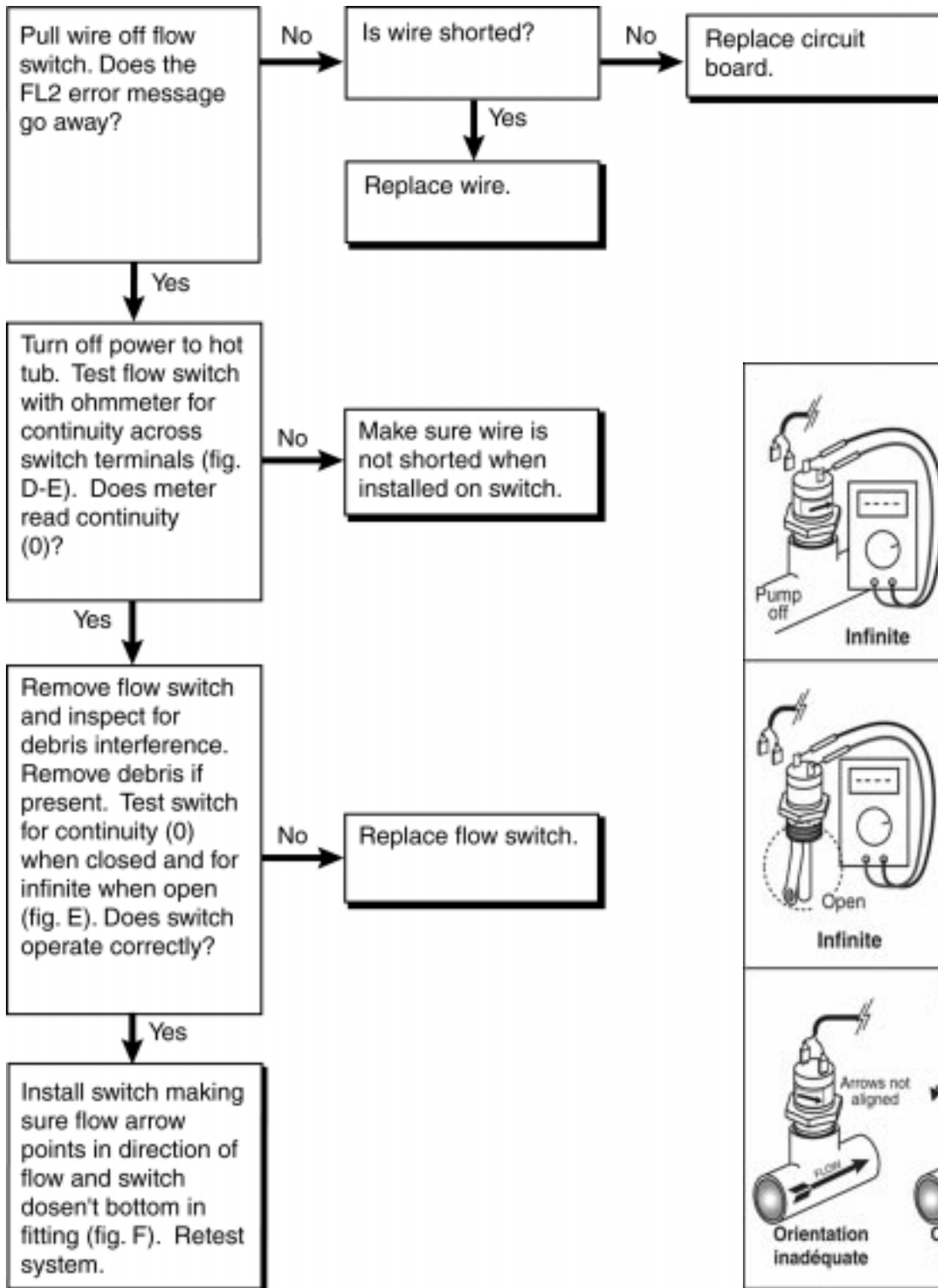
 ****WARNING: heater temperature may have exceeded 130 °F (54 °C). Inspect heater. Call technical support if visible damage is apparent.**

8.1B No Heat or Not Enough Heat

- **Symptoms:** circulation pump (heating pump) not turning, panel heat indicator not lit, panel is **flashing FL2**.



Standard Troubleshooting Approach

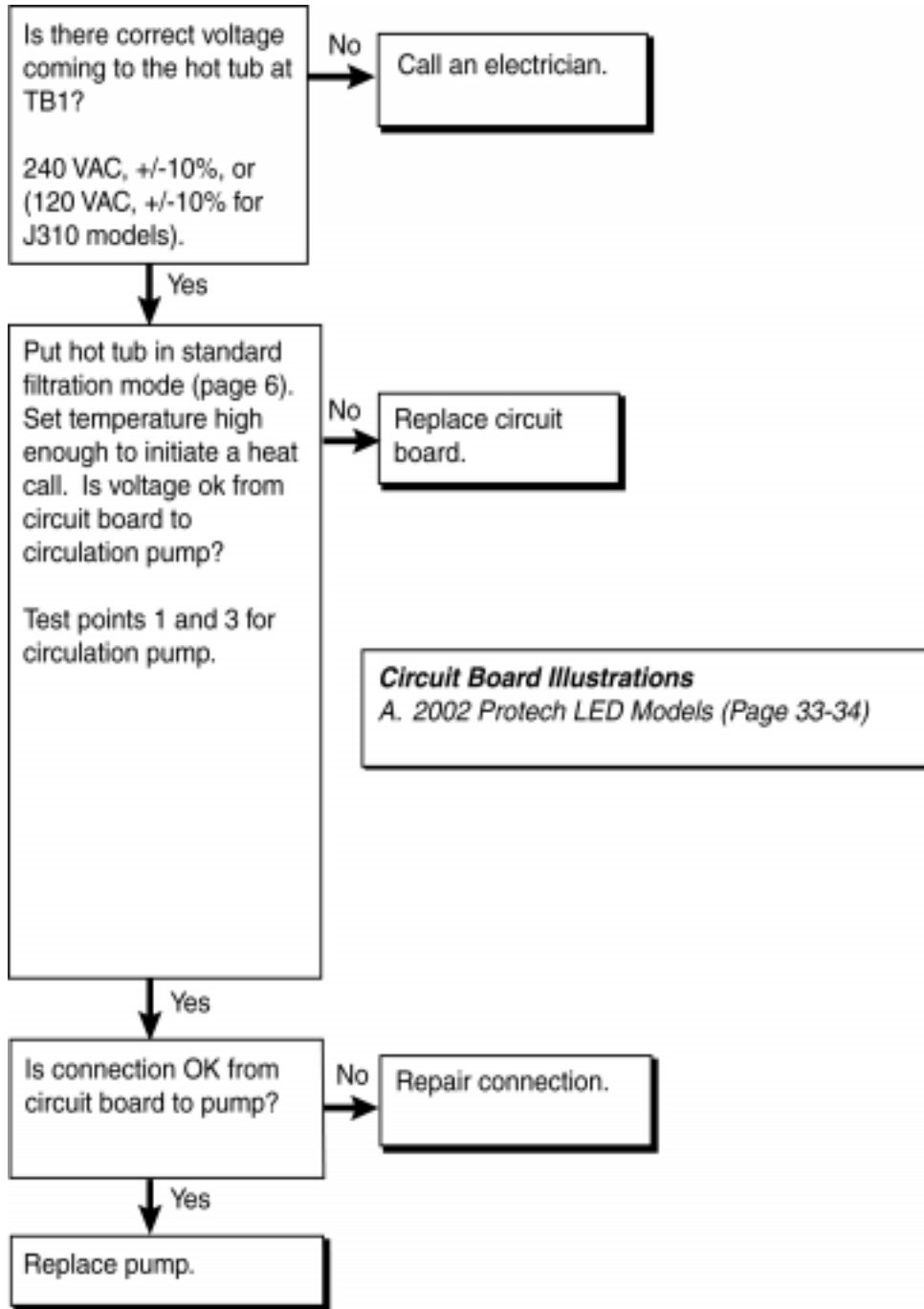


8.1C No Heat or Not Enough Heat

- **Symptoms:** circulation pump (heating pump) not turning, panel heat indicator not lit, panel is **flashing FL1**.



Standard Troubleshooting Approach



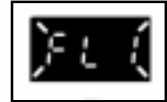
Note: Refer to voltage and current charts on appendix page 30 for expected voltage/current readings.



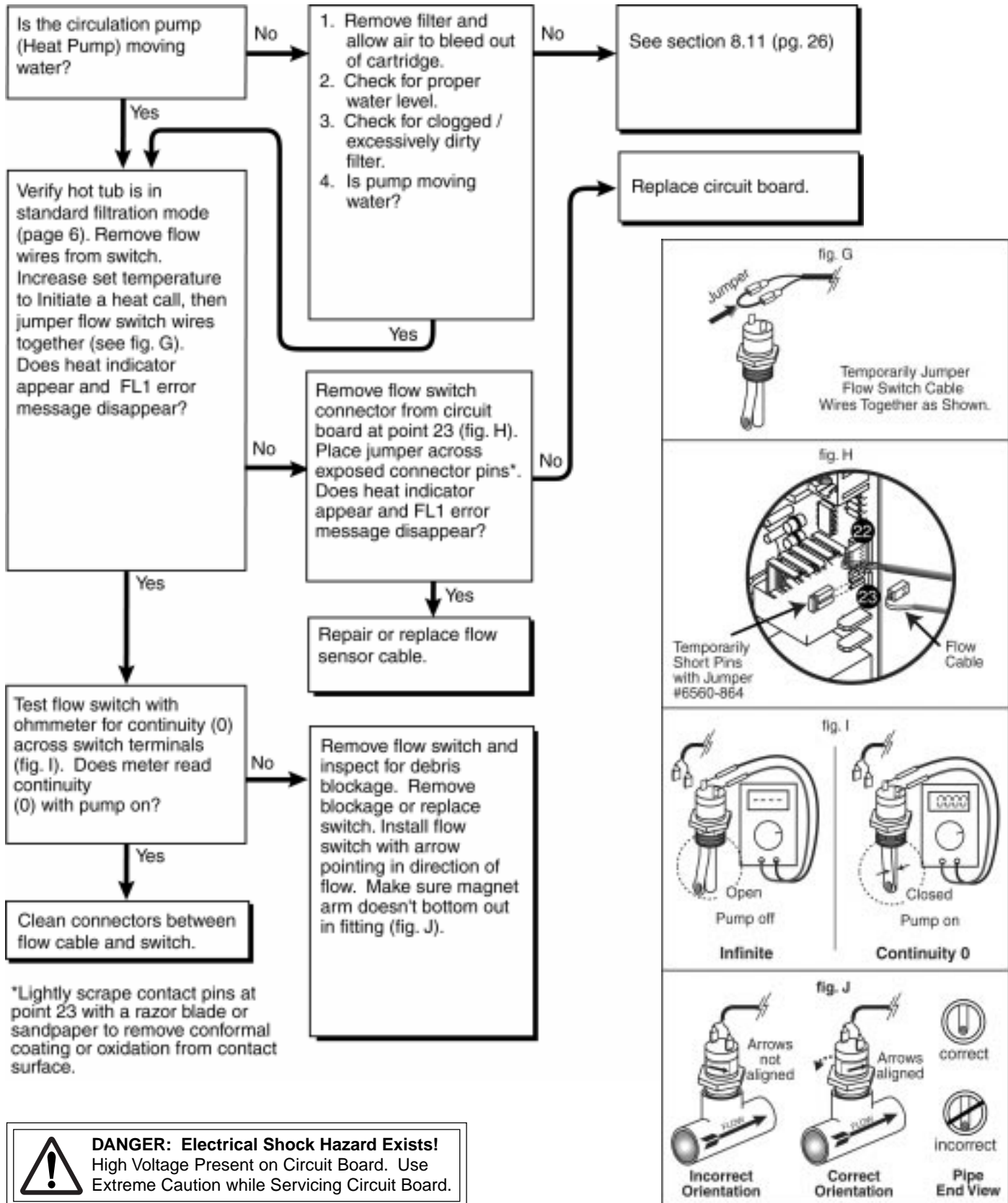
DANGER: Electrical Shock Hazard Exists!
High Voltage Present on Circuit Board. Use Extreme Caution while Servicing Circuit Board.

8.1D No Heat or Not Enough Heat

- **Symptoms:** circulation pump (heating pump) is turning, panel heat indicator not lit, panel is **flashing FL1**.



Standard Troubleshooting Approach



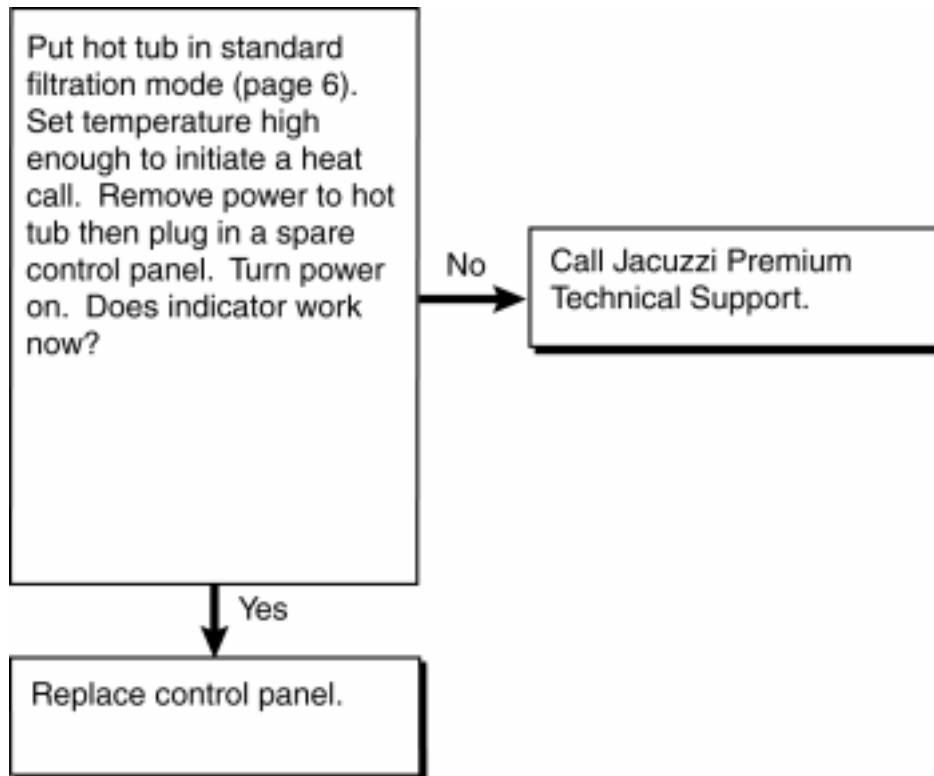
DANGER: Electrical Shock Hazard Exists!
High Voltage Present on Circuit Board. Use Extreme Caution while Servicing Circuit Board.

8.1E No Heat or Not Enough Heat

- **Symptoms:** circulation pump (heating pump) is turning, panel heat indicator not lit, panel is **NOT flashing FL1**.



Standard Troubleshooting Approach



8.2 Intermittent Heating

As with all intermittent problems, routine measurements and display panel error messages are not trustworthy. The following procedure will eliminate the most probable causes.

It is important to explain to the customer how difficult intermittent problems are to locate. You will be doing a series of things to eliminate the problem. Ask the customer to be patient and please cooperate by calling you back to inform you of the hot tubs status until the problem is corrected. It might be a good idea to review this STA with the customer. It may help he or she understand why it might take several callbacks to effect a repair.

Suspects: circuit board, temperature sensor, control panel, wiring connections, and partial water flow obstructions.

Diagnostic Tools

Voltmeter, Ohmmeter, Ammeter

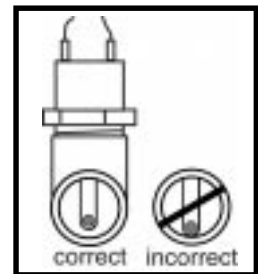
Suggested Spare Parts (Page 40)

Heater element, circuit board, temperature sensors, pressure switch, control panel

Standard Troubleshooting Approach

1. Check crimped wire connections to heater element. If burned, replace heater element wires. Verify heater element connections are good on circuit board. Check heater resistance, see current chart on page 37 for expected heater resistance values.
2. Check connections labeled “heater out” on circuit board (test points 2 & 4). Refer to pages 33-34 for the circuit board. If possible, clean and renew connections. If relay is physically burned at connections, replace circuit board.
3. Check flow switch switch for proper and consistent mechanical operation. Observe mechanical action of switch. **Refer to page 12 for flow switch testing procedure.**
4. Clean connections where panel plugs into board.
5. If all above items check out, ask the customer if the SN2 error has ever displayed. If the SN2 error message has displayed, replace temperature sensor.
6. Tell the customer what you have done, that you are not sure the problem has been fixed, and that you want to be called immediately if the problem returns. Explain what you will do if the problem returns. Check back with the customer in a few days if you haven't been contacted.
7. If the customer calls back, call Jacuzzi Premium Technical Support.

Note: All models use a “magnetic reed switch” type flow switch that can remain closed from debris interference. Removal of the flow switch for cleaning and inspection will correct most problems. Record the number of turns it takes to remove the switch from the fitting. After cleaning, use the same number of turns to reinstall the switch. DO NOT thread the switch farther than originally installed, or the paddle may stick on the bottom of the fitting.



8.3 Nothing Works

Things to remember: when a system fails, there is probably one, and only one problem. Verify power to the hot tub by observing the control panels LED display. The control panel will usually display something as long as there is power to the hot tub. Check for error messages. Displayed error messages usually indicate the problem.

Diagnostic Tools: Voltmeter

Suggested Spare Parts (Page 40): Fuses (see appendix page 31), control panel, circuit board

Nothing Works (Panel Indicators lit)

1. Plug in spare control panel. If it works, change panel.
2. Remove power from hot tub. Check connections on sensor harness and verify proper resistance of temperature and hi-limit sensors (see appendix page 37). Replace defective temperature or hi-limit sensor then test system.
3. Check transformer. See section A15, page 39.
4. Still no operation? Replace circuit board.

Nothing Works (Panel Dead)

1. Check for proper power to the hot tub (see appendix page 29). Check for 240 VAC (120 VAC for J310) at TB1 on the main terminal block. See pages 33-34 for the circuit board configuration. If voltage is not 120 VAC or 240 VAC $\pm 10\%$, consult an electrician.
2. Check for power at transformer secondary. **Refer to appendix page 39.** If power exists on transformer secondary, plug in spare control panel. Still nothing? Replace board.
3. If no power exists at transformer secondary, check for voltage at transformer primary. **Refer to appendix page 39.** If voltage exists on the primary but is missing on the secondary, replace transformer.
4. No power at the transformer primary indicates either an open 1.25 Amp fuse, 20/30 Amp fuse, or a loose or disconnected wire. If voltage exists on the primary but is missing on the secondary, replace transformer. See section A5 (page 31) for specific fuse details.

8.4 Hot Tub Doesn't Come On for Filter Cycle

Turn power to hot tub off and on to restart filter cycle program. Does filter cycle start approximately two minutes after applying power?

- **If yes:** the hot tub is functioning properly. Refer to sections 4.1-4.2 (page 6) for filter cycle setup details. Take time to explain filter cycle selection and operation to your customer. Make sure your customer understands filter cycles are selectable, not programmable.
- **If no:** Select appropriate filter cycle mode within two minutes after applying power. Refer to sections 4.1-4.2 (page 6). If filter cycle starts two minutes after setting, no corrective action is required. If filter cycle does not start two minutes after setting, replace circuit board.

8.5 House Breaker Trips

The hot tubs current draw will vary depending on how the circuit board is jumpered. Jumper options determine whether multiple functions can operate together.

If the house breaker trips, check the hot tubs current draw. If jumpers are properly set and current draw is within expected limits, the house breaker or wiring is defective and must be repaired/replaced. The hot tubs current draw at the breaker represents the sum of all enabled devices. **Refer to appendix page 30.**

If the hot tub's current draw is high, individual device current measurements must be made to determine which device is pulling excessive current. **Refer to appendix page 30.** Repair or replace the device which is drawing excessive current.

If the GFCI trips, try removing the heater, pump, ozonator (if installed), and circulation pump or pump 2 from the circuit board one at a time to find which device may be causing the GFCI to trip. For chronic GFCI tripping, call Jacuzzi Premium Technical Support.

North American 60 Hz Installations:

As of January 1, 1994 the National Electric Code (NEC) requires a Ground Fault Circuit Interrupter on all hot tub installations in the U.S. A GFCI must be wired correctly or it will trip. Make sure the electrician has wired the GFCI according to the diagram on pages 35-36.

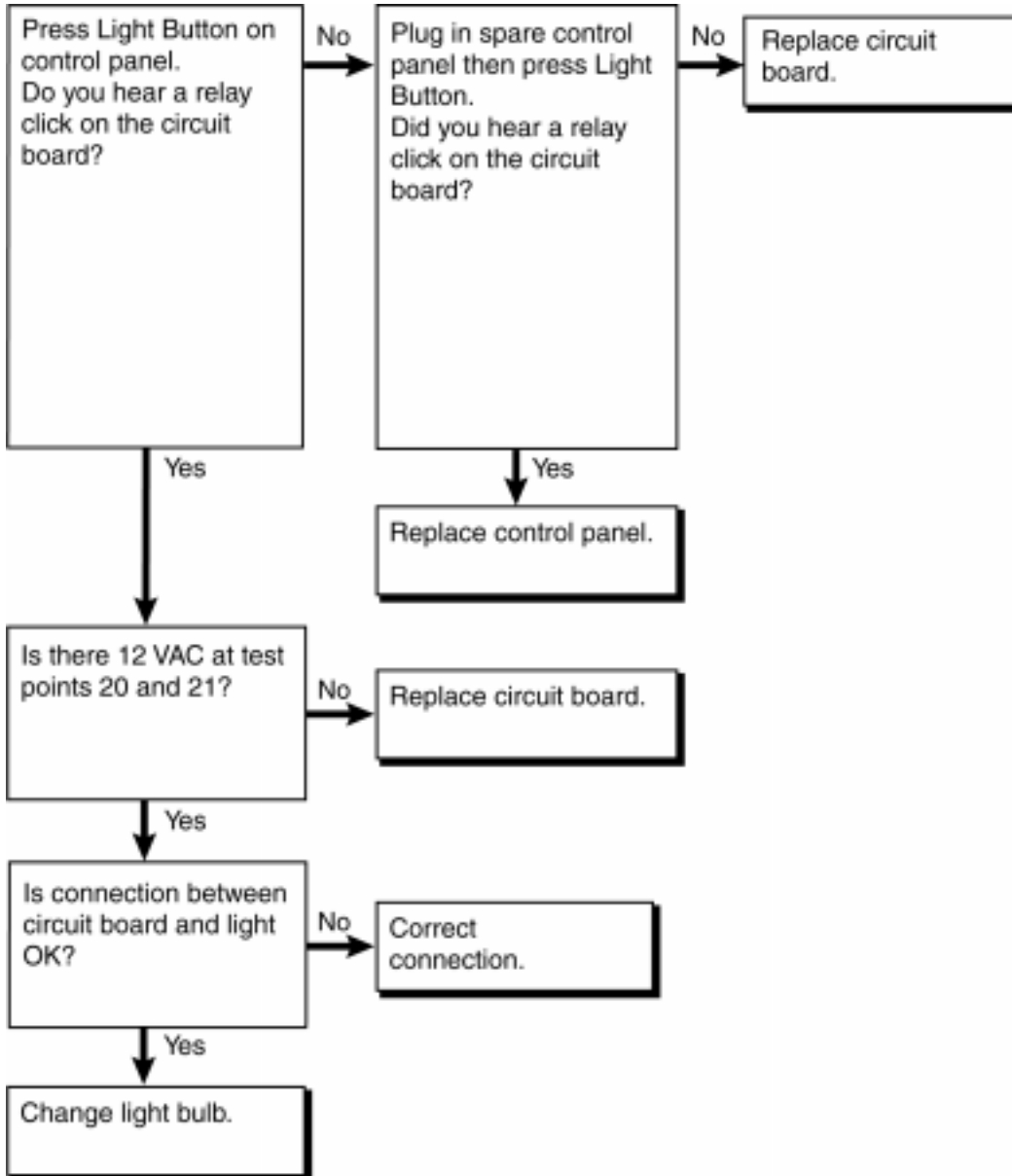
8.6 Hot Tub Light Will Not Come On

Diagnostic Tools: Voltmeter

Suggested Spare Parts (Page 40): Control panel, circuit board, light bulb, light harness



Standard Troubleshooting Approach



Circuit Board Illustrations

A. 2002 Protech LED Models (Page 33-34)



DANGER: Electrical Shock Hazard Exists!
High Voltage Present on Circuit Board. Use Extreme Caution while Servicing Circuit Board.

8.7 No Jets

This is a condition of constant zero water pressure. The first step in diagnosing the problem is to determine if the pump is actually turning. Once this determination is made, follow the appropriate portion of the STA.



Diagnostic Tools: Voltmeter

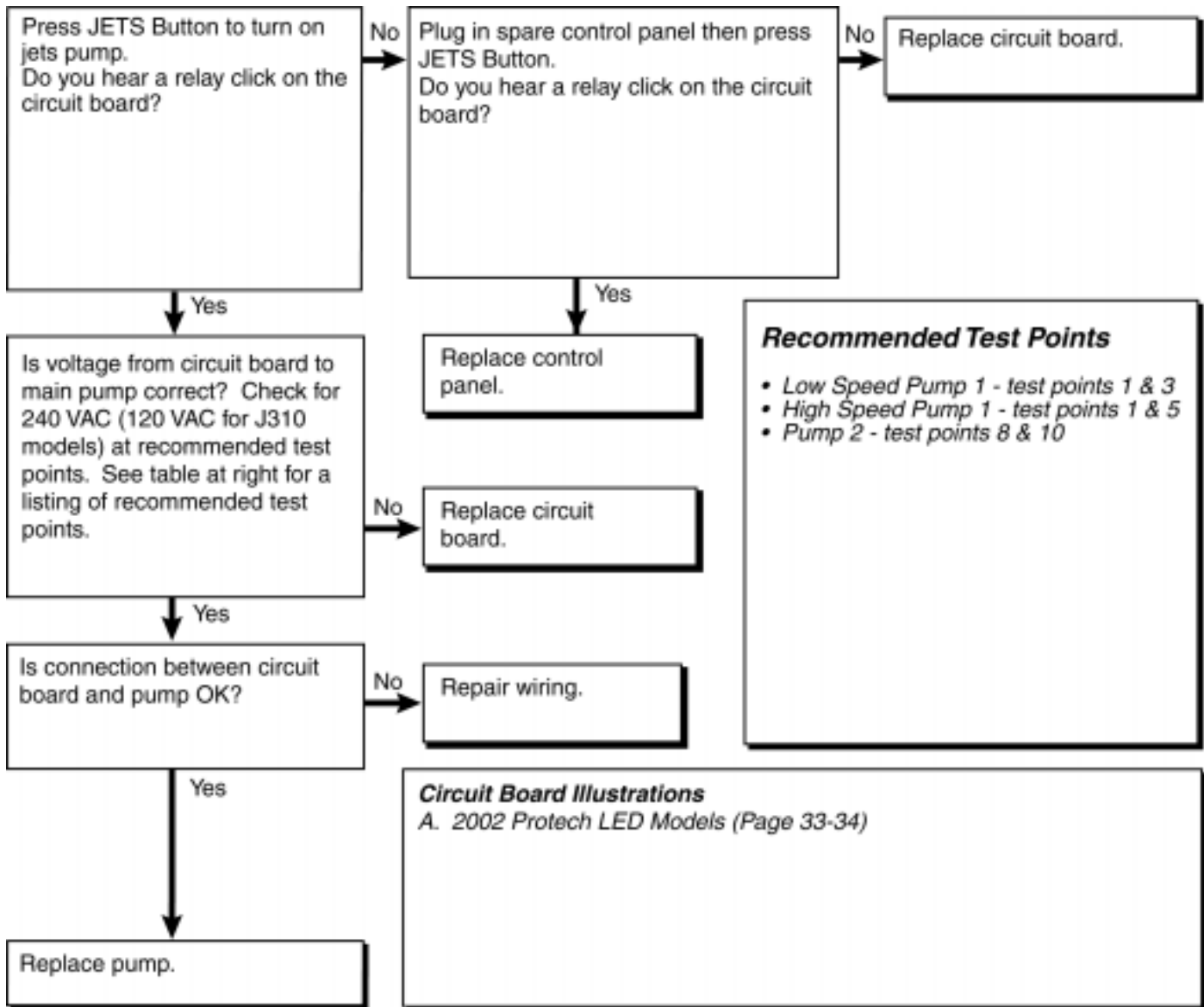
Suggested Spare Parts (Page 40): Control panel, circuit board, main pump

Pump Is Turning (Checking for A Flow Problem)

1. Make sure valves are open (if applicable).
2. Is the filter clogged?
3. Is there an obstruction in the plumbing line?
4. Check for air lock (clear air lock by opening union on pump discharge).

Pump Not Turning

Standard Troubleshooting Approach



DANGER: Electrical Shock Hazard Exists!
High Voltage Present on Circuit Board. Use Extreme Caution while Servicing Circuit Board.

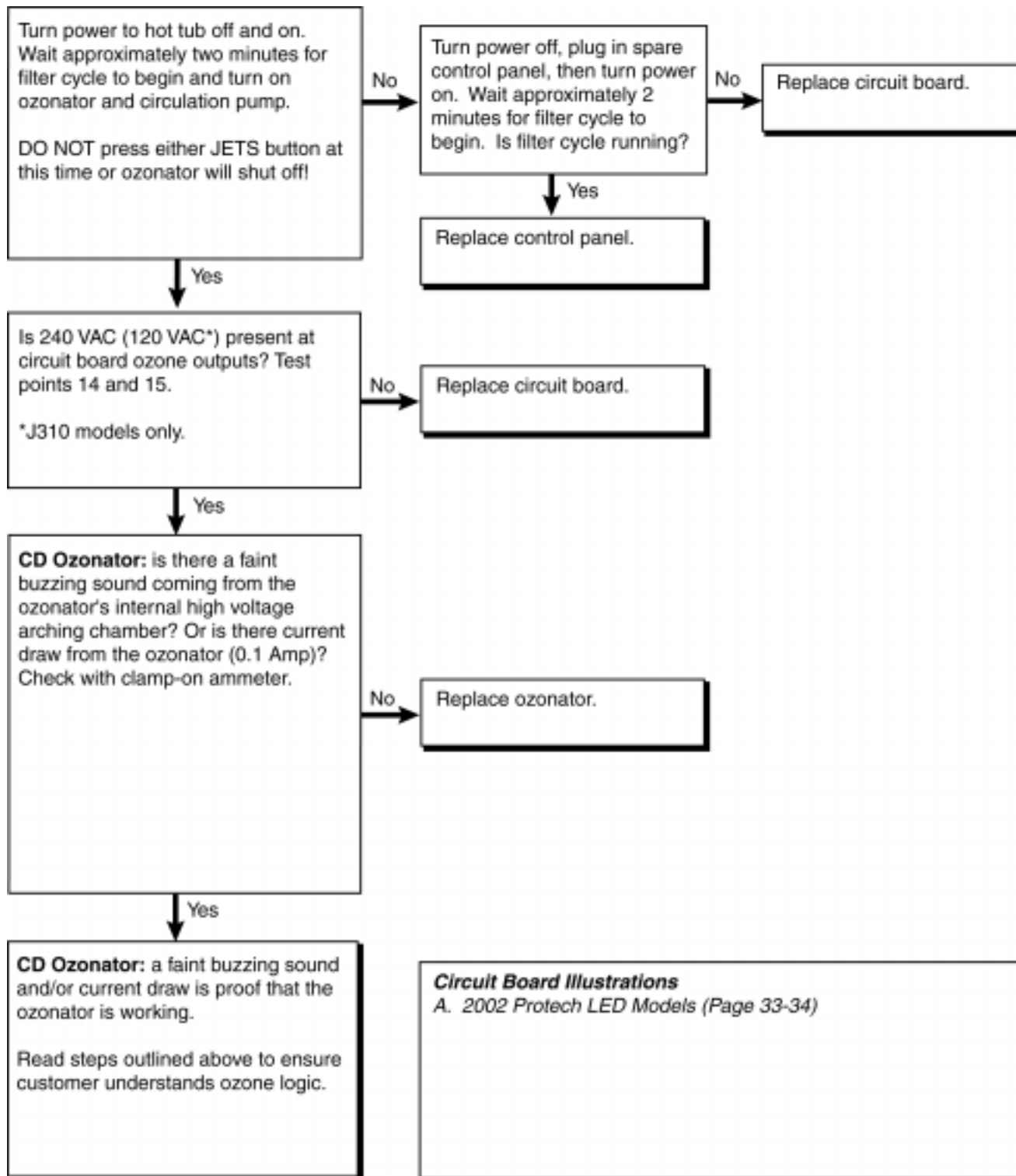
8.8 Ozonator Not Working

Diagnostic Tools: Clamp-on ammeter, voltmeter

Suggested Spare Parts (Page 40): Ozonator, circuit board, control panel



Standard Troubleshooting Approach



DANGER: Electrical Shock Hazard Exists!
High Voltage Present on Circuit Board. Use Extreme Caution while Servicing Circuit Board.

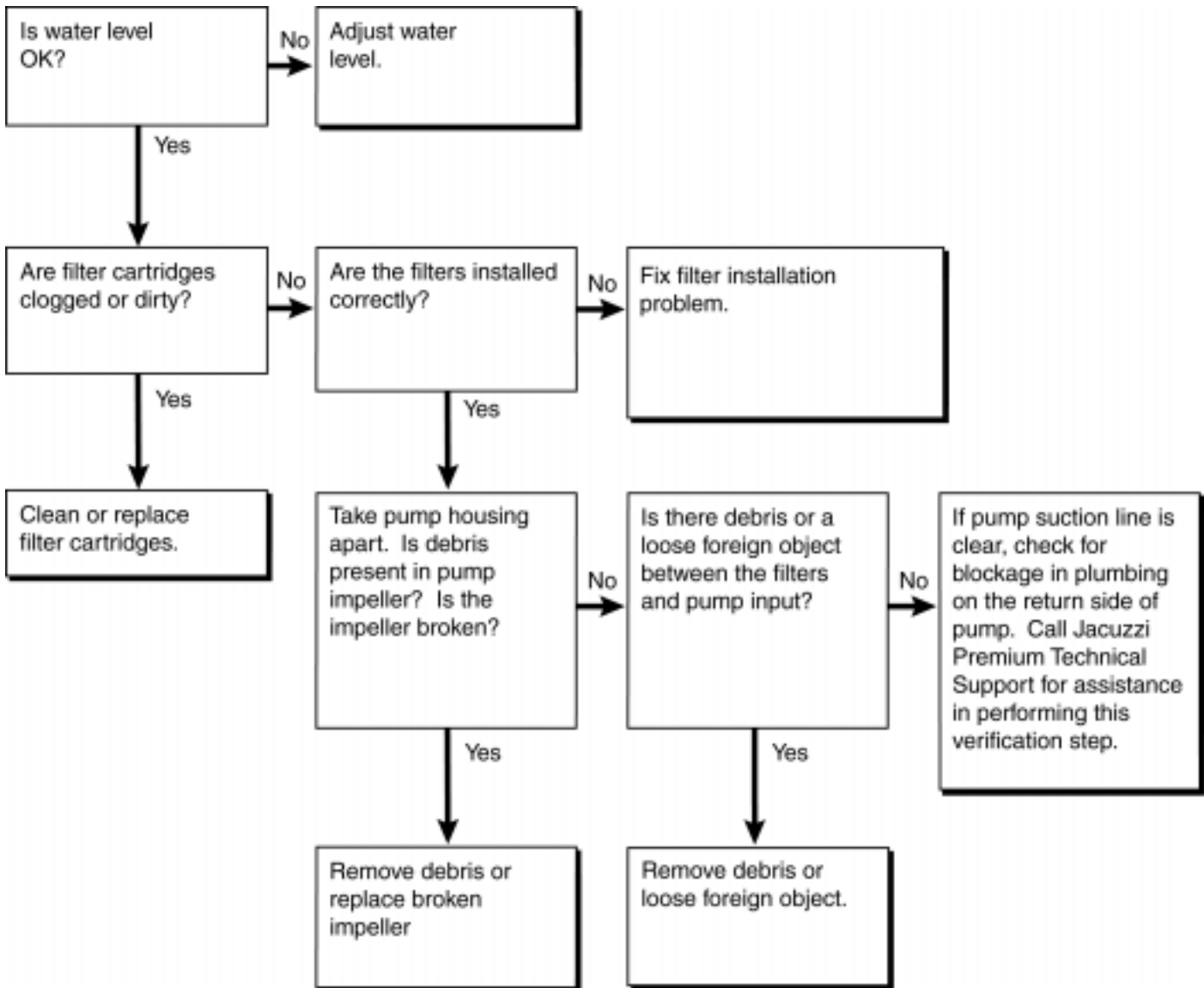
8.9 Weak or Surging Jets

Weak or surging jets are usually caused by an insufficient water supply to the pump or a clogged or broken pump impeller. The water level may simply be low, or there may be an obstruction in the water flow path to the pump or in the pump's impeller.



Suggested Spare Parts (Page 40): Filter, Pump

Standard Troubleshooting Approach



8.10 Pump Runs and Quits During Jet Mode

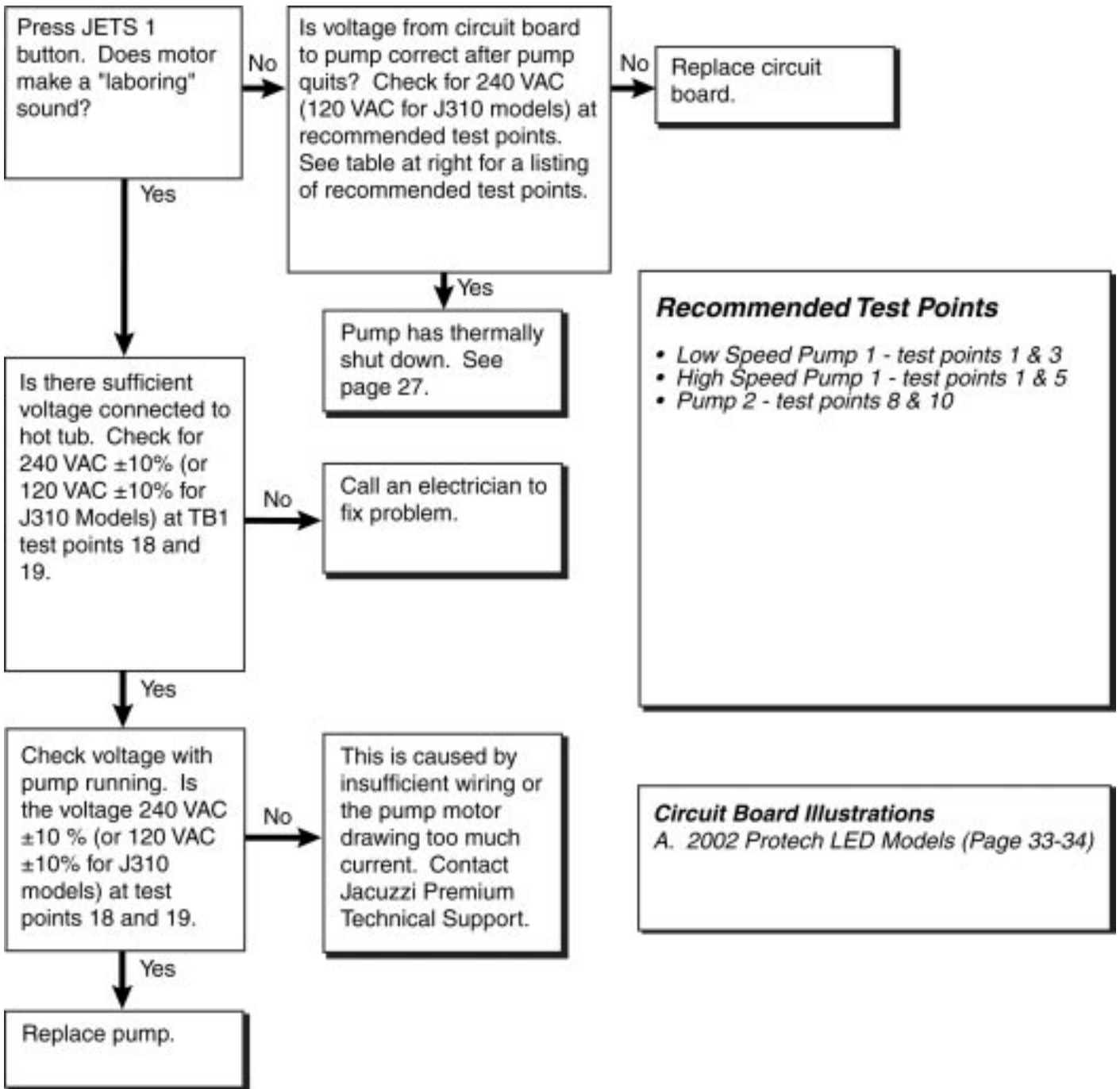
This is usually a problem of pump overheating. The pump motor incorporates a thermal cutout switch that triggers when the motor gets too hot. There is no reset for this condition. When the motor cools, the thermal switch resets automatically. In some cases, a faulty circuit can also cause this problem.



Diagnostic Tools: Clamp-on ammeter, voltmeter

Suggested Spare Parts (Page 40): Circuit board, pump

Standard Troubleshooting Approach



DANGER: Electrical Shock Hazard Exists!
High Voltage Present on Circuit Board. Use Extreme Caution while Servicing Circuit Board.

8.11 Circulation Pump Not Working

The circulation pump should be on 24 hours a day unless “summer logic” is activated. Verify “summer logic” is not activated before starting. Refer to section 5.6 (page 8) for details.



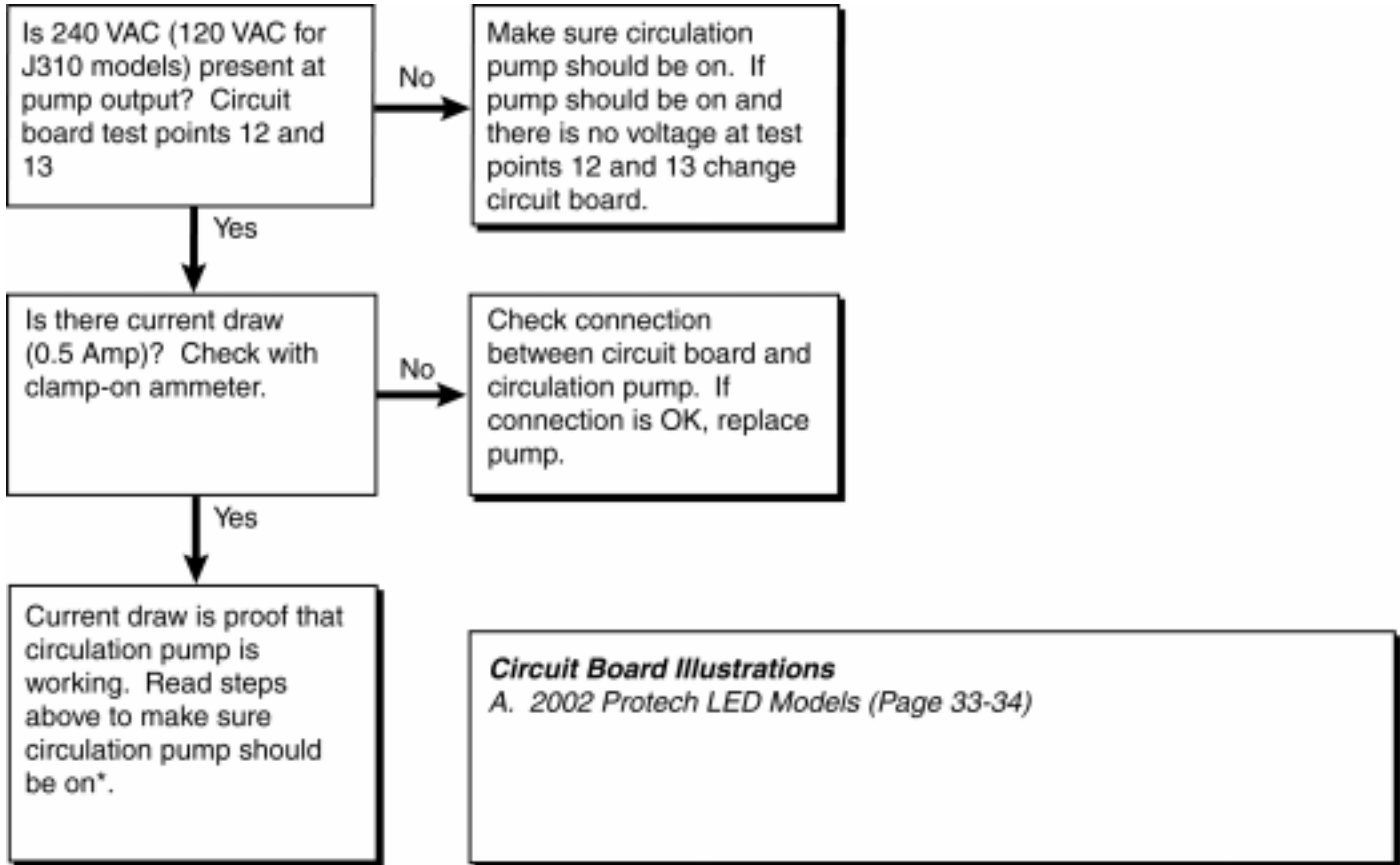
Diagnostic Tools

Clamp-on ammeter, voltmeter

Suggested Spare Parts (Page 40)

Circuit board, circulation pump

Standard Troubleshooting Approach



**Note: If circulation pump is running but there is no flow, check for an air lock, blockage in the plumbing, debris in the pump, or a broken pump impeller.*



DANGER: Electrical Shock Hazard Exists!
High Voltage Present on Circuit Board. Use Extreme Caution while Servicing Circuit Board.

8.12 Troubleshooting A Thermal Pump Cutout

1. Verify voltage to hot tub is 240 VAC $\pm 10\%$ (or 120 VAC $\pm 10\%$ for convertible models). An insufficient voltage supply can cause the motor to pull too much current and overheat. The situation must be corrected.
2. Check voltage to hot tub. Remember, the power company is required by law to provide correct voltage to the customer. They will come out and check suspected problems free of charge.
3. If voltage is OK, examine the environment in which the hot tub is installed. Hot sun, hot weather, and lack of breeze can cause heat buildup in the equipment bay in addition to the normal heat produced by the pump. This can raise the temperature high enough to cause the pumps thermal cutout to trip. There are two possible solutions to thermal pump cutout problems which are not due to low line voltage. One is to change the filter cycle period so that it does not coincide with the hottest time of day and peak power consumption hours. Another is to ventilate the equipment bay. Call Jacuzzi Premium Technical Support for advice on this matter.
4. If there seems to be no overheating problem yet the motor keeps cutting out, the motor's thermal switch may be bad. In this case the pump should be replaced.



8.13 Pump Hums and Will Not Start

If the pump impeller is not “frozen”, this condition usually indicates a bad start capacitor. This component is inside the pump motor housing.



Diagnostic Tools: Voltmeter

Suggested Spare Parts (Page 40): Pump, start capacitor, circuit board

Standard Troubleshooting Approach

Press JETS button. Check voltage at the following circuit board pump connections:

- All models: measure voltage across test points 1 and 3 for 240 VAC (or 120 VAC for J310 Models). Refer to pages 33-34 for your specific circuit board layout.

All Models

If there is no voltage present at the recommended test points, replace circuit board. If voltage is present, the pump needs to be repaired or replaced. Try replacing the pump's start capacitor. If the pump still doesn't work, replace pump.

If pump runs in low speed but hums in high speed, make sure circuit board is not sending voltage to both pump windings at the same time. **Disconnect pump wires from the circuit board before performing this test.** Test for voltage at test points 1 & 3. When voltage exists at test points 1 & 3 there should be no voltage at test points 1 & 5. Conversely, when voltage exists at test points 1 & 5, there should be no voltage at test points 1 & 3. If voltage is present across both sets of test points at the same time, replace circuit board. Refer to pages 33-34 for your specific circuit board layout.

APPENDIX

A1. Checking Voltage to Hot Tub

Correct supply voltage wiring to the hot tub is essential for safe/proper operation. The first step in troubleshooting a new installation should be to take voltage readings at the terminal block TB1. ***Do not trust wire colors. Electricians make mistakes and electrons are colorblind.*** A low line voltage or incorrectly wired hot tub will result in either of the following symptoms: A) Strange or intermittent symptoms, B) Displays with indications that simply cannot be correct

Many of the most perplexing problems in the past have been wiring errors and voltage drop problems. ***Human safety depends on proper hot tub grounding. It is essential that the voltage readings described below are as indicated. The ground connection must be heavy duty wiring.***

- All models (except J310 convertible models) are exclusively powered by 240 VAC. J310 models are convertible for either 120 VAC 3-wire or 120 VAC/240 VAC 4-wire operation. The 4-wire power configuration powers the heater with 240 VAC for increased performance while powering all other components with 120 VAC.

Verify Power Connections as Follows:



DANGER: Electrical Shock Hazard Exists!
High Voltage Present on Circuit Board. Use Extreme Caution while Servicing Circuit Board.

US/Canada J310 Model (120 VAC/60 Hz, fig. K)

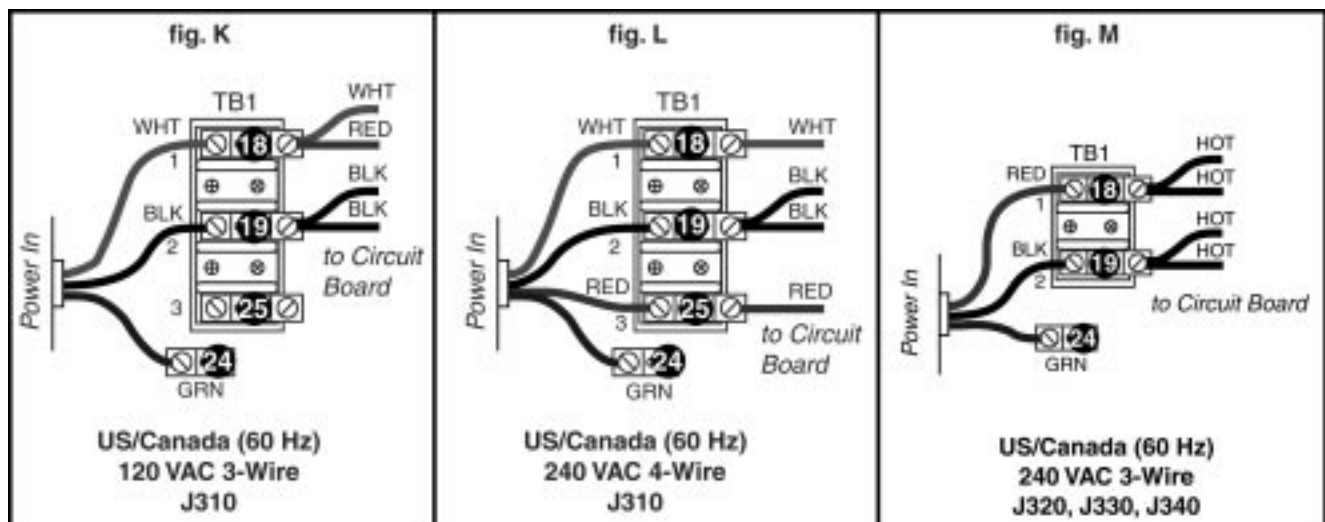
- Hot to Neutral: Measure across test points 18 and 19 with voltmeter for 120 VAC.
- Hot to Ground Test: Measure across test points 19 to 24 for 120 VAC.

US/Canada J310 Model (240 VAC/60 Hz, fig. L)

- Hot to Neutral: Measure across test points 18 and 19 for 120 VAC; then across test points 18 and 25 for 120 VAC.
- Hot to Ground Test: Measure across test points 19 to 24 for 120 VAC; then across test points 24 and 25 for 120 VAC.
- Hot to Hot Test: Measure across test points 19 and 25 for 240 VAC.

US/Canada LED Models (240 VAC/60 Hz, fig. M)

- Hot to Hot: Measure across test points 18 and 19 for 240 VAC.
- Hot to Ground: Measure across test points 18 and 24 for 120 VAC; then across 19 and 24 for 120 VAC.



A2. Checking Voltages to Devices

Device voltages are often measured at the circuit board to determine whether the board or device is bad. If the circuit board delivers voltage when device operation is called, the circuit board is probably good and the problem lies with the device or the wiring to the device. The following voltage chart shows operating voltages for all major hot tub components. Voltage is considered good if within $\pm 10\%$ of the listed value. Refer to appendix pages 33-34 for your specific circuit boards test point locations.

• 2002 Protech LED J310 Model (US/Canada 60 Hz)		
Device	Test Points	Voltage $\pm 10\%$
Pump (Low Speed)	1 and 3	120 VAC
Pump (High Speed)	1 and 5	120 VAC
Circulation pump	12 and 13	120 VAC
Water heater	2 and 4	120 VAC or 240 VAC*
Ozone generator	14 and 15	120 VAC
*Depends whether hot tub is connected to 120 VAC or 240 VAC supply		
• 2002 Protech LED J320, J330, J340 Models (US/Canada/Export 50 Hz/60 Hz)		
Device	Test Points	Voltage $\pm 10\%$
Pump 1 (Low Speed)	1 and 3	230 VAC - 240 VAC
Pump 1 (High Speed)	1 and 5	230 VAC - 240 VAC
Pump 2	8 and 10	230 VAC - 240 VAC
Water heater	2 and 4	230 VAC - 240 VAC
Ozone generator	14 and 15	230 VAC - 240 VAC

A3. Checking Current Consumption of Devices

This table lists current draw for most major hot tub components.

J310 Model (US/Canada 60 Hz)	
Device	Current Consumption $\pm 10\%$
Pump (48 FR) High	10.6A - 13.6A
Heater	16.6A (240 VAC) 8.3A (120 VAC) Approx. 14.5
Circulation Pump	0.5A
CD Ozone Generator	0.1A
J320, J330, J340 Models (US/Canada 60 Hz)	
Device	Current Consumption $\pm 10\%$
Pump 1 (48 FR) High/Low	7.0A - 9.5A / 2.5A - 3.2A
Pump 2 (48 FR) High	6.8A - 9.3A
Heater	23A (240 VAC) Approx. 10.5
Circulation Pump	0.5A
CD Ozone Generator	0.1A

A4. Testing Flow/Pressure Switch

When the “FL1 or FL2” message appears, it means the flow switch contacts have failed to close when the pump was turned on, or failed to open when the pump was turned off. This could be caused by an obstruction in the flow path or by a bad switch. The first thing to look for is an obvious obstruction, remembering (while not likely) that it is possible for a small object to work its way into the plumbing where it will not be obvious. After verifying no obvious blockage exists, the flow switch can be tested. Refer to page 12 for switch testing instructions.



A5. About Fuses

When current passes through a conductor the conductor heats up. If the conductor is a heavy piece of wire or a strip of metal, it will pass large currents and generate very little heat. If a wire is fine, or a strip of metal is thin, it will heat up at lower current levels. Fuses rely on this principle to protect circuits from massive current flows by simply melting if their current rating is exceeded. By selecting different alloys for the fuse element, fuses can be made to have their current rating exceeded for a short period of time. Such slow-blow fuses are excellent for protecting motor circuits where start-up currents (surge currents) are higher than running currents.

Fuse	Part	J310	J320, J330
	Number	Models	J340
Main Power, 20A	6660-106	X	
Main Power, 30A	6660-105		X
Transformer Primary, 1.5A	6760-120	X	X

Testing Fuses

A good fuse should read continuity (0 ohms); a blown fuse will read no continuity (infinite ohms).



CAUTION:

Make sure replacement fuses are exactly those listed above. Never test a fuse for continuity while installed in the fuse holder.

A6. The Watchdog (- - -)

Three horizontal dashes with no other control panel indicators illuminated is a result of the watchdog circuitry detecting a potential destructive condition within the hot tub.



There are many conditions that can cause a watchdog error message. Except for a runaway heat condition, most are caused by a faulty circuit board, bad hi-limit sensor, or temperature sensor. On rare occasions a control panel or a bad transformer will cause Watchdog. Confirm this by using a test panel and testing transformer connections on the circuit board, ***refer to appendix page 39.***

1. Turn power to hot tub off. Verify proper resistance of hi-limit and temperature sensor (see appendix page 37). Replace defective temperature or hi-limit sensor then retest system. If watchdog error goes away, skip steps 2-4.
2. If the heater is not overly hot to touch and the watchdog displays an immediate dashed line error, the circuit board is probably bad. Check transformer primary and secondary voltages (page 39) before changing the circuit board.
3. See if the temperature in the heater has reached 118 °F (48 °C). If the heater got too hot, check for flow restrictions and correct the problem.
4. If you cannot reproduce the watchdog error and the hi-limit and temperature sensors check out OK, tell the customer to call you if watchdog display reappears.

A7. Understanding Ozone

Oxygen is an element, and like other gaseous elements, normally exists as a pair of atoms bonded together to make a whole molecule. Chemists therefore use the symbol O_2 to speak of “oxygen molecules” rather than oxygen atoms.

In the presence of an electric discharge like lightning or a strong source of ultraviolet light, three molecules of O_2 can combine to form two molecules of O_3 known as ozone. While oxygen has no smell, ozone has a very pronounced smell in large concentrations. In small quantities, it causes the pleasant “fresh air” smell that laundry has when dried on a outdoor clothesline. Some clothing dryer manufacturers have installed an ultraviolet lamp inside their machines to give clothes that “fresh-as-all-outdoors” smell. Jacuzzi Premium offers a type of ozone system, the corona discharge (CD). The corona discharge (CD) use a highly efficient low current/high voltage arching chamber to generate ozone. The CD Ozone introduces ozone into the hot tub water through a “Mazzei” venturi fitting.

The technician must understand three things about ozone:

1. Ozone (O_3) breaks down quickly into plain oxygen (O_2).
2. Ozone kills germs.
3. Ozone is a strong oxidizer.

Because ozone breaks down quickly into oxygen (O_2), the hot tub would have to run 24 hours a day with the ozone generator operating to insure constant disinfecting. Even then a residual sanitizer must be used. There are two choices, chlorine or bromine. While chlorine is oxidized by ozone just as quickly as bromine, resulting bromine compounds are a much better disinfectant than resulting chlorine compounds. Hence ozone and bromine team up much better to do the overall job than ozone and chlorine.

A8. Understanding pH

Keeping hot tub water clean and clear involves a very complex set of chemical reactions. Most importantly, the hot tub must be sanitized. Bacteria, algae, and other single-cell life forms that may find their way into the hot tub must be killed. Three chemical elements, chlorine, bromine, and ozone are all good sanitizing agents. When any of these elements come into contact with bacteria or algae, these single-cell organisms die. Therefore, to keep the water germfree, we must simply keep a residual of the sanitizing agent in the water.

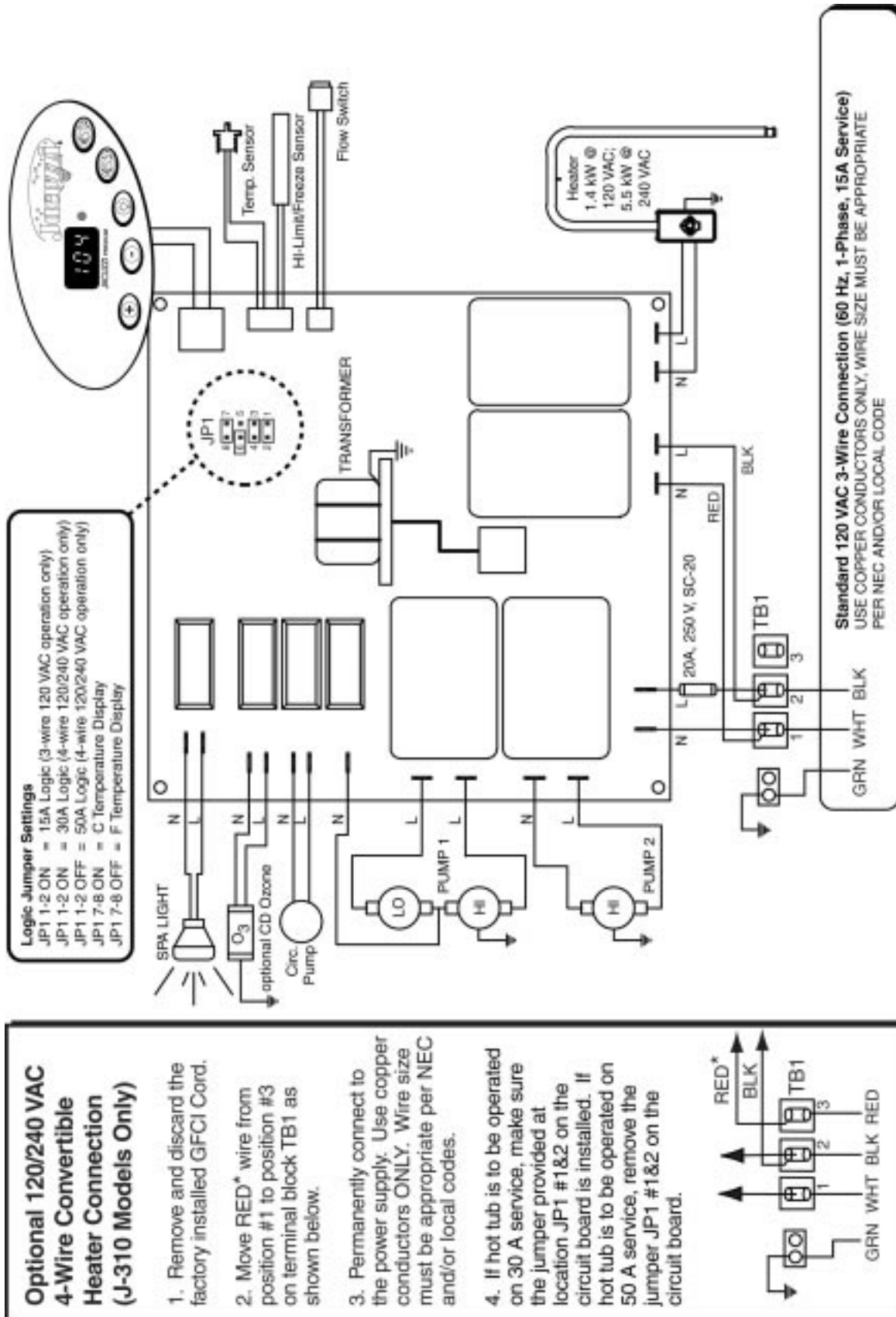
Making germs dead is only half the objective, however. The dead cells of the bacteria and algae we have killed, and the organic “stuff” (dandruff, perspiration, dead skin cells, etc.) that our bodies deposit in the hot tub, will make the water cloudy and uninviting as they decompose. These microscopic contaminants must be “burned out” or oxidized. These oxidation reactions occur simultaneously with reactions known as reduction reactions. The balance of these chemical reactions is quite critical and can occur properly only if pH levels are maintained from 7.2 to 7.8 pH. If the pH is out of range, the sanitizing agent itself will be oxidized or reduced and in effect be “used up” before it has a chance to do it’s job.

pH is critical for maximum disinfection, sanitizing, and cleaning results with the least amount of chemical addition. Make sure your customer understands the importance of regular water test intervals and the proper use of chemicals. Both are necessary to ensure maximum water quality and to maintain a healthy and fun hot tub environment.

A9. 2002 J310 Board (US/Canada 60 Hz)

USA/Canada 60 Hz Model

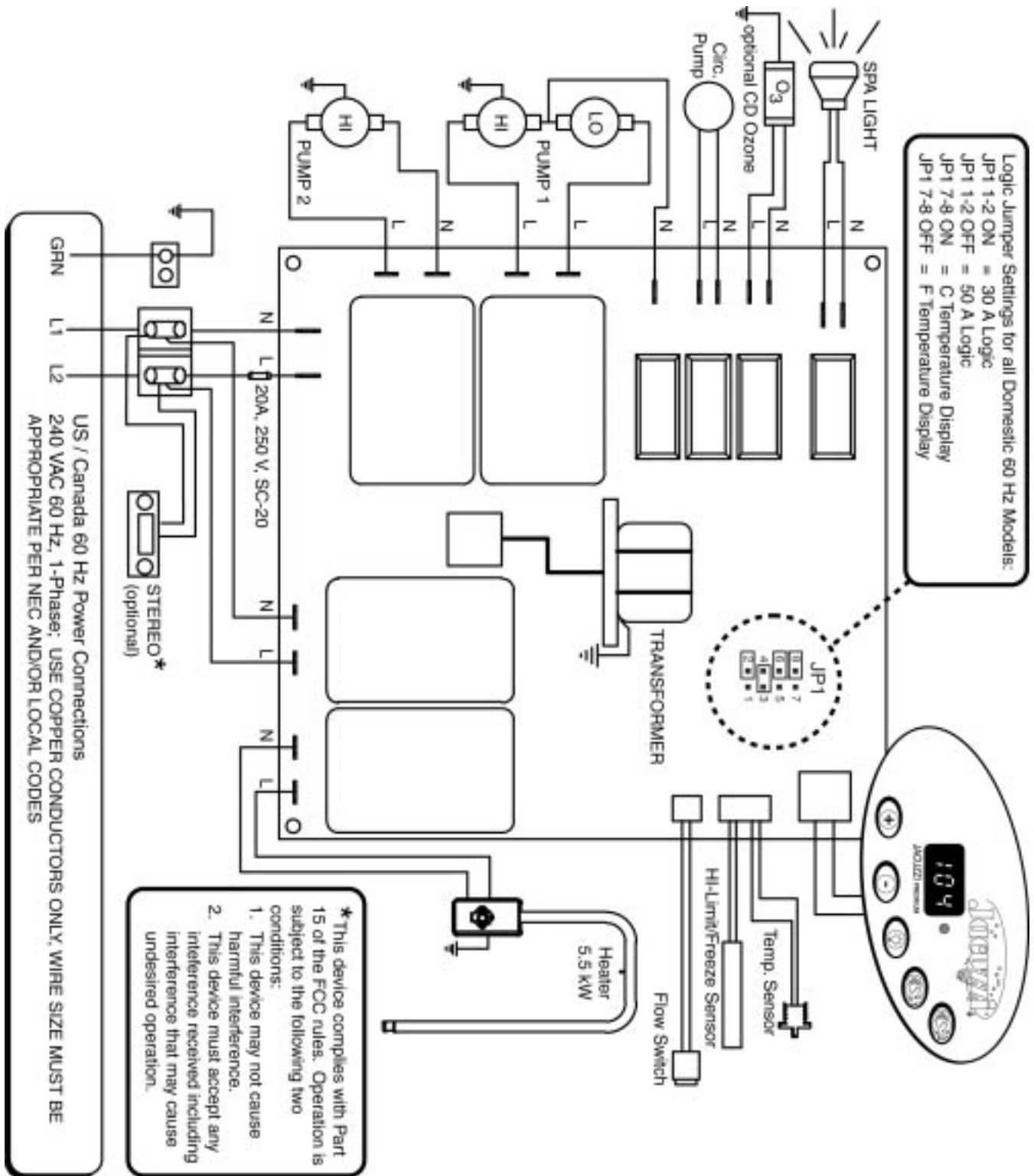
- Board Type: Protech LED, #6600-200



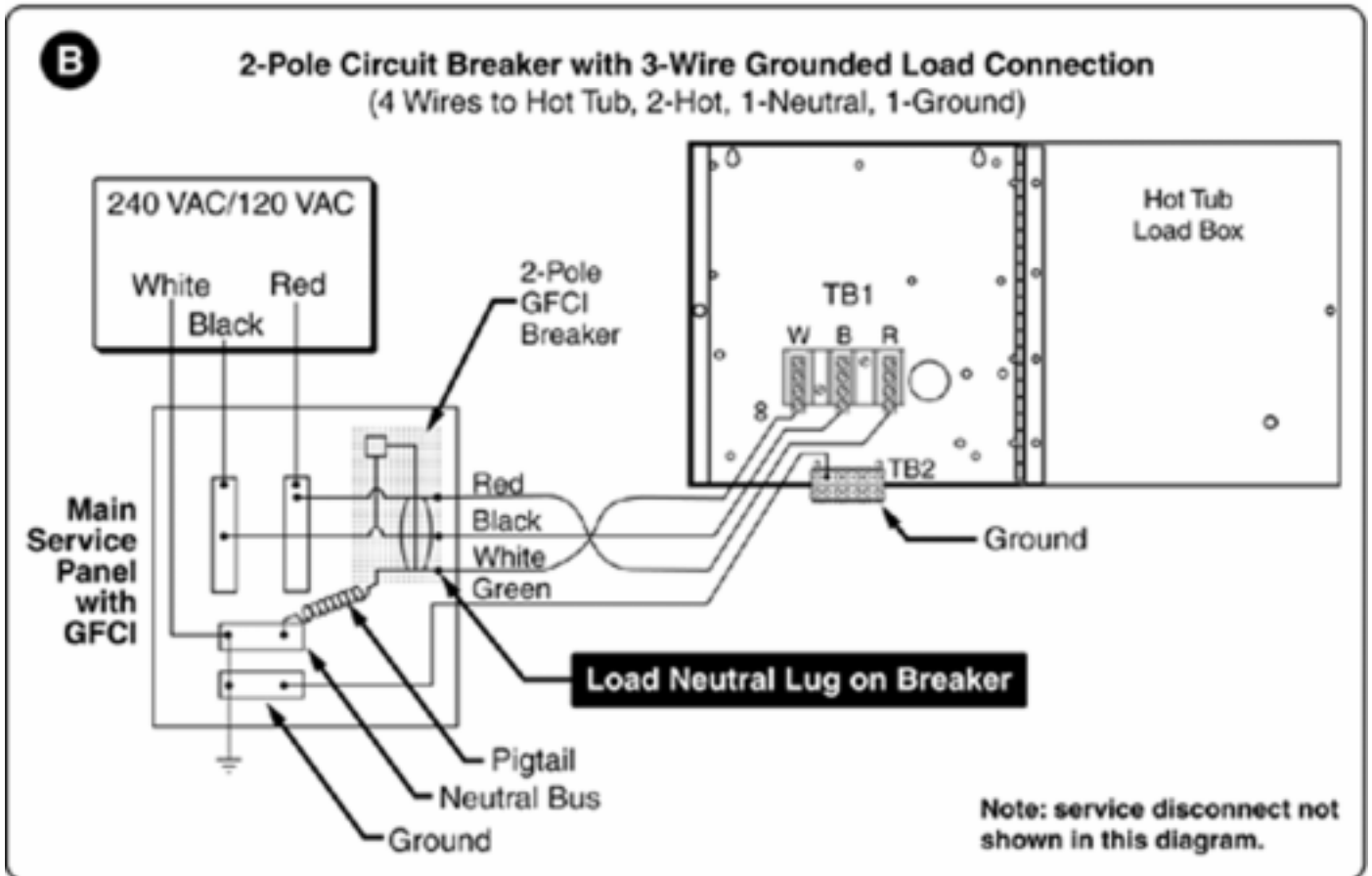
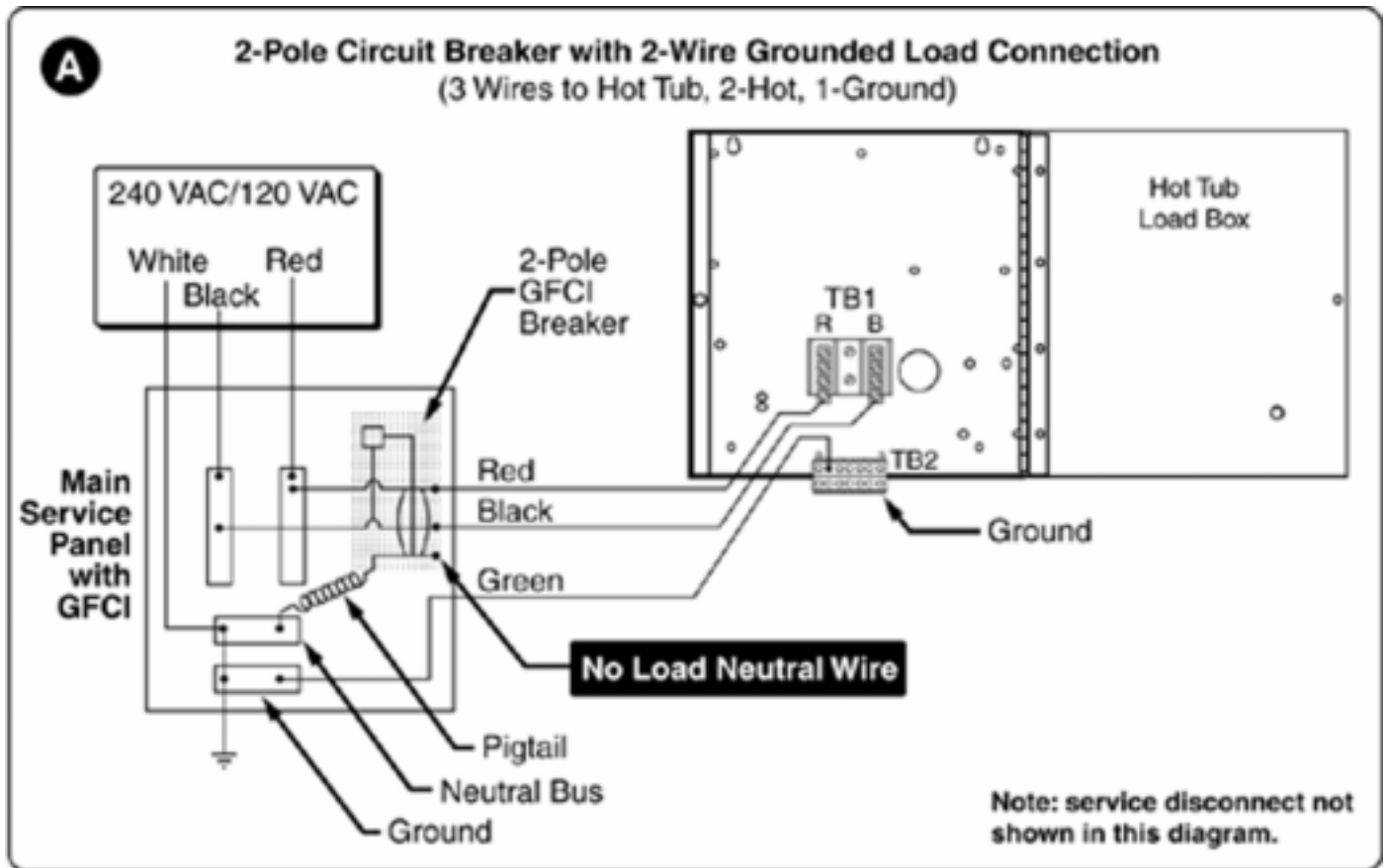
A10. 2002 Protech LED Board (US/Canada 60 Hz)

All USA/Canada 60 Hz Models

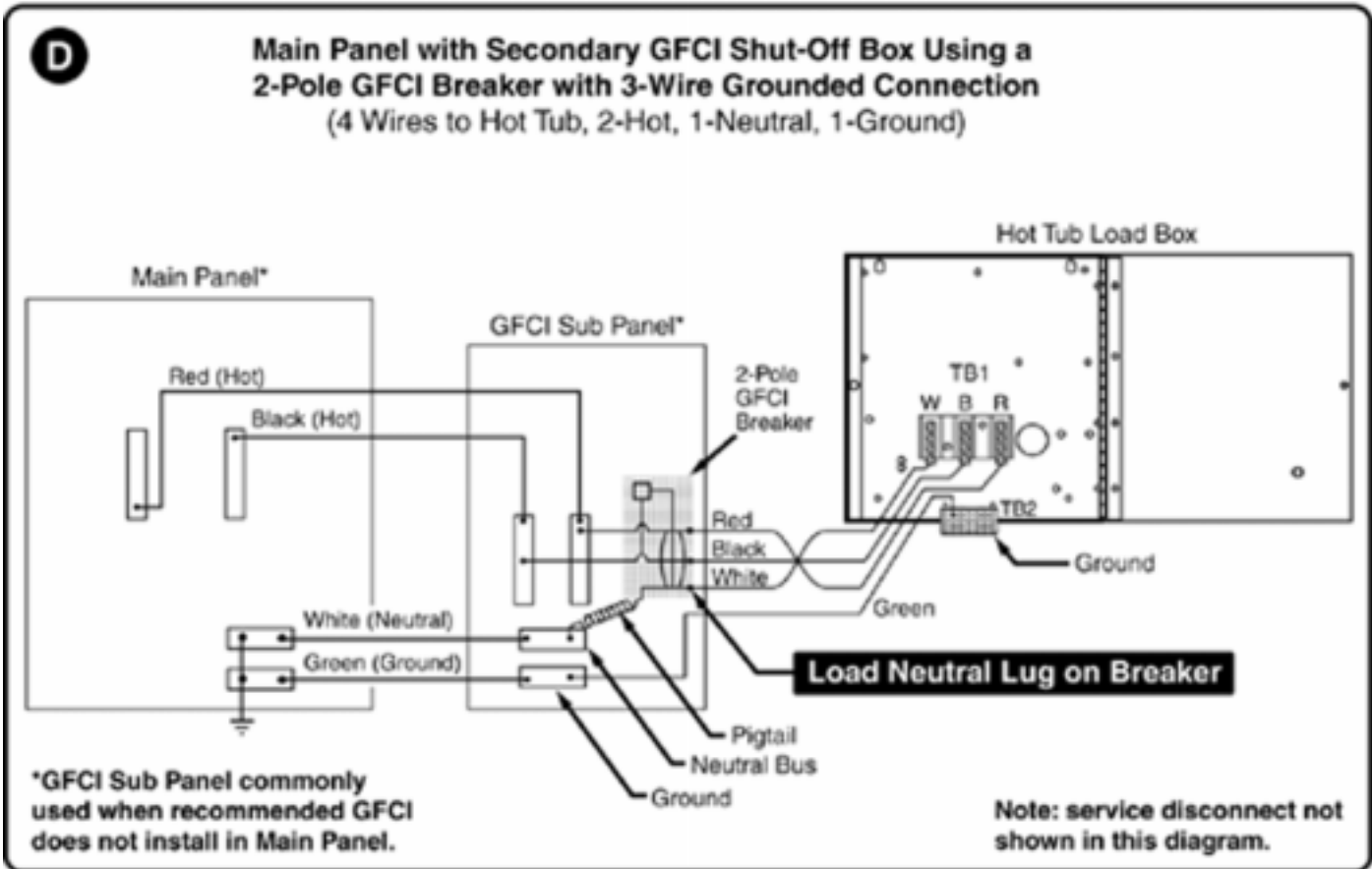
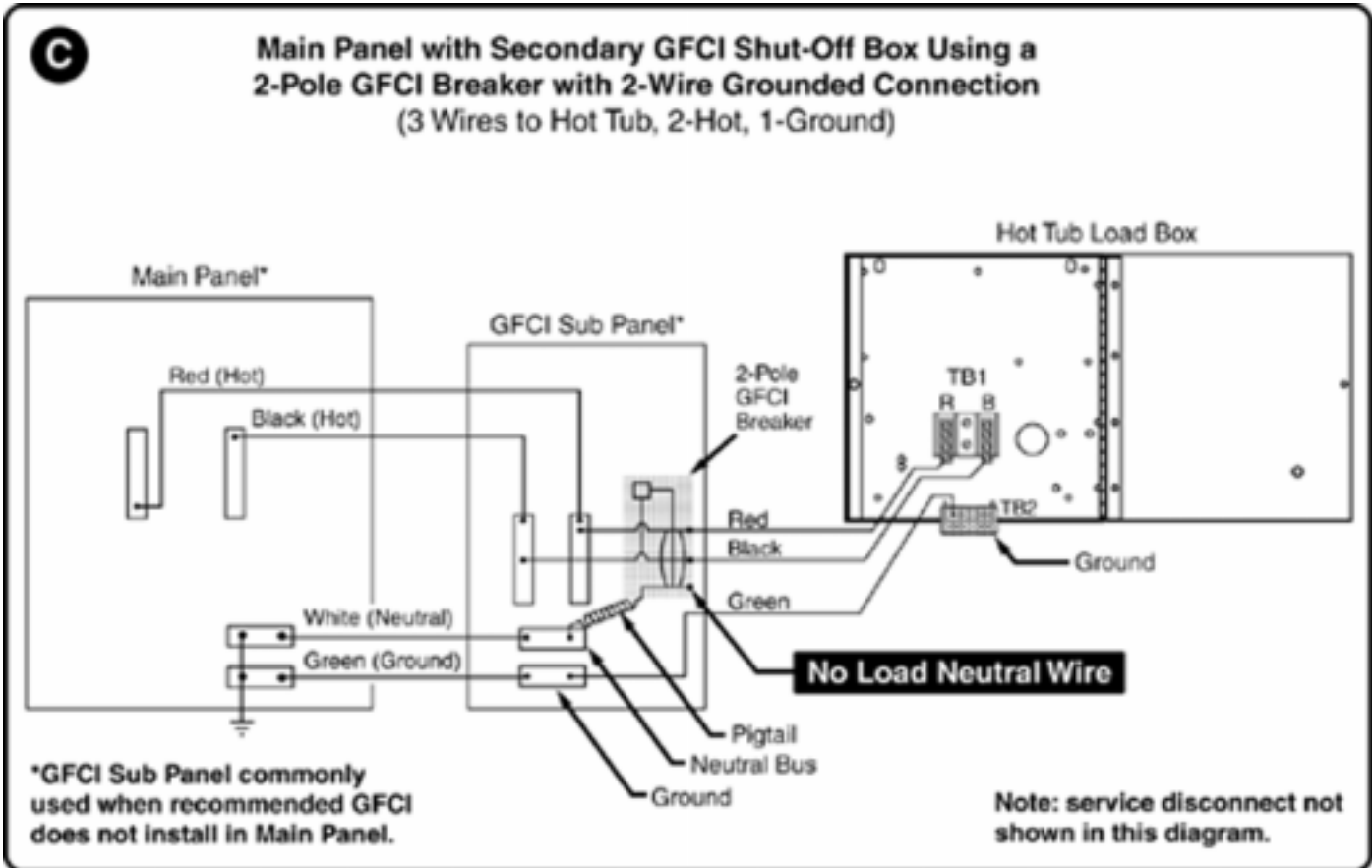
- Board Type: Protech LED, #6600-200



A21. Load Box Connection Diagrams A - D (US/Canada 60 Hz)



Load Box Diagrams (US/Canada 60 Hz)



A12. Temperature Sensor / Hi-Limit Sensor Resistance Chart

Fahrenheit (°F)	Celsius (°C)	Ohms (Ω)
59.0	15	48840
60.8	16	46680
62.6	17	44610
64.4	18	42630
66.2	19	40770
68.0	20	39000
69.8	21	37290
71.6	22	35700
73.4	23	34170
75.2	24	32700
77.0	25	30000
78.8	26	28740
80.6	27	27540
82.4	28	26400
84.2	29	25311
86.0	30	24270
87.8	31	23280
89.0	32	22329
91.4	33	21429
93.2	34	20571
95.0	35	19740
96.8	36	18960
98.6	37	18210
100.4	38	17490
102.2	39	16800
104.0	40	16149
105.8	41	15519
107.6	42	14919
109.4	43	14349
111.2	44	13800
113.0	45	13281

A13. Flow Switch Illustration

Flow Switch #6560-860

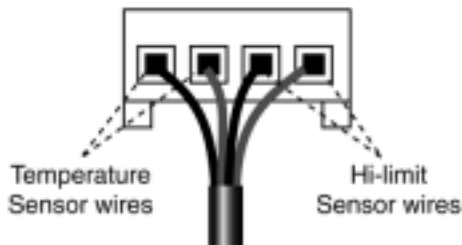
Compatibility: All 2002 Models

Connection: This flow switch style has spade connectors at top for easy cable removal for electronic troubleshooting.

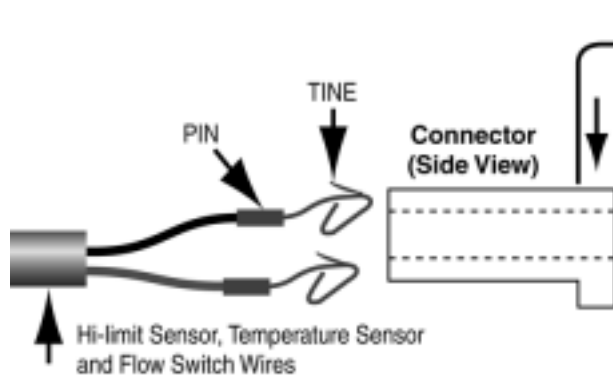


A14. Protech LED Sensor Harness Diagram

J2 Connector (Cable Side)
Shown while Plugged into Circuit Board



J3 Connector Flow Switch (Cable Side)
Shown while Plugged into Circuit Board



To remove a sensor/switch wire from the either J2 or J3 connectors, insert the end of a paper clip into the slot corresponding with the wire to be removed. This will depress the tine on the pin allowing the wire to be pulled from the harness.

IMPORTANT!!

When reinstalling the sensor/switch, make sure the tine on the pin is lifted so the sensor wire will lock into the connector body.

A16. Suggested Spare Parts

Circuit Board (All Models)

- 6600-088, Protech LED

Control Panels (All Models)

- 2600-301, Protech LED 1-Pump, for J310, J320, and J330
- 2600-302, Protech LED 2-Pump, for J340

Filter Cartridges

- 6540-476, 60 sq ft.

Flow Switch (All Models)

- 2560-040, Flow Switch with Tee Fitting

Fuses (All Models)

- 6660-106, main power fuse, 20 Amp
- 6660-105, main power fuse, 30 Amp
- 6760-120, transformer primary, 1.5 Amp

Heater Assemblies

- 6500-402, 5.5 kW, Stainless Steel Tube, J320, J330, J340
- 6500-059, 4kW@240VAC, 1kW@120VAC, J310

High Limit Disk (All Models)

- 6600-093, for all models.

Hi-Limit Sensor (All Models)

- 6600-140

Mazzei Kits (All Models)

- 6472-486, for all models.

Owner's Manual

- 6530-225, for 2002 Protech LED models.

Ozone (CD Type)

US/Canada 120 VAC/60 Hz Models

- 2472-650, for J310

US/Canada 240 VAC/60 Hz Models

- 6472-685, for J320, J330, J340
- 6472-685E, Export

Pumps

US/Canada 120 VAC/60 Hz Models:

- 6500-253, 2-Speed, 2.5 hp, 240C
- 6500-261, 2-Speed, 2.5 hp, 240V
- 6500-263, 1-Speed, 2.5 hp, 240V

Temperature Sensor (All Models)

- 6600-070, Short Housing with Curled Finger Connectors

Standard Underwater Light Bulb (All Models)

- 6560-246, Standard bulb

Circulation Pump (All Models)

- 6500-038, 120 VAC for J310
- 6500-035, 240 VAC for J320, J330, J340
- 6500-023, 230 VAC (Export)

Transformer

- 6560-274, 240VAC (Must use old plugs)
- 6660-039, 230VAC, Export

A30. Glossary of Terms

Circuit Board:	Printed circuit board assembly that distributes voltage to selected components.
Control Panel:	Component that allows user to access functions provided by the circuit board.
Ammeter:	Device which measures electrical current conducted through a wire or electrical device.
Eprom:	Chip on circuit board that stores hot tub software.
Flow Switch:	Switch that informs circuit board there is sufficient water movement to activate heater. This switch identifies water flow.
Hi-limit Sensor/Disk:	Sensor that monitors water temperature inside heater.
Jumper:	Device on circuit board that mechanically connects (bridges) two points together.
Ohmmeter:	Device that measures the resistance in ohms of a component or temperature sensitive device (e.g. temperature sensor, heater element etc).
Ozonator:	A device that produces ozone gas by passing air through Corona discharge (high voltage arc) method. Protech LED models introduce ozone 24 hours a day until a JETS button is pressed.
Pin Assignments:	Locations identified by numbers on circuit board.
Sensor Connector:	Plug in connector containing the temperature sensor and hi-limit sensor device connections.
Summer Logic:	Deactivates Circulation Pump and aftermarket ozone generator when hot tub water reaches 2 °F (1 °C) above the set temperature. Hot tub water must be 95 °F (35 °C) or higher for summer logic to activate.
Temperature Sensor:	Sensor that monitors hot tub water temperature.
Transformer:	Device that converts primary high voltage AC signal to a secondary low voltage AC signal.
Voltage Meter:	Device that measures AC or DC voltage potentials across components or from a specific test point to ground.

Troubleshooting Data Collection Form Protech LED Models

Customer Name _____

Address _____ Phone () _____

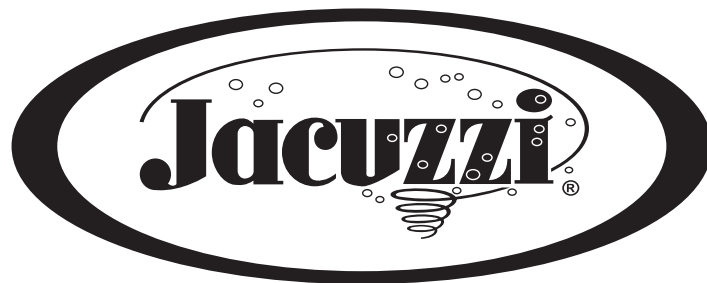
Before troubleshooting, collect the following:

1. Model # of Hot Tub _____
2. Serial Number _____
3. Operating Voltage _____ Input Voltage _____

Before calling Jacuzzi Premium, collect the following:

4. Low Speed Pump Amps _____
5. Pump with Heater Amps _____
6. High Speed Pump Amps _____ Pump #2 Amps _____
7. High Speed Pump + Heater Amps _____
8. Circuit Board Rev. _____ Eprom Rev. _____

Jacuzzi Premium Technical Support (909) 606-1416



P R E M I U M

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