

# INSTALLATION AND OPERATION MANUAL

# E3T

*Electric 3-Series Titanium*



## Electric Heater MODELS

**ELS 0005, ELS 0011,  
ELS 0018, and ELS 0027**



**Intertek**  
4000856

Tested to UL Standard 1261

**FOR YOUR SAFETY:** Do not store or use gasoline or other flammable vapors and liquids or other combustible materials in the vicinity of this or any other appliance. To do so may result in an explosion or fire.

**NOTE:** The instructions in this manual are for the use of qualified individuals specially trained and experienced in the installation and maintenance of this type of equipment and related system components. Installation and service personnel are required by some states to be licensed. Persons not qualified shall not attempt to install, service, or maintain this equipment.

This manual should be maintained in legible condition and kept adjacent to the electric heater or in a safe place for future use.

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## 1. WARNINGS

### Pay Attention to these Terms

<b>DANGER</b>	Indicates the presence of immediate hazards which will cause severe personal injury, death or substantial property damage if ignored.
<b>WARNING</b>	Indicates the presence of hazards or unsafe practices which could cause severe personal injury, death or substantial property damage if ignored.
<b>CAUTION</b>	Indicates the presence of hazards or unsafe practices which could cause minor personal injury or product or property damage if ignored.
<b>NOTE</b>	Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.

**WARNING:** Do not use this heater if any part has been under water. Immediately call a qualified service technician to inspect and replace the heater.

**EFFICIENCY TESTING NOTICE:** For purposes of verifying or testing efficiency ratings, the test procedure in Title 10 APPENDIX P to Subpart B of Part 430 (Uniform Test Method for Measuring the Energy Consumption of Pool Heaters).

**WARNING:** To minimize the possibility of improper operation, serious personal injury, fire, or damage to the heater:

- Always keep the area around the heater free of combustible materials, gasoline, and other flammable liquids and vapors.
- Heater should never be covered or have any blockage to the flow of fresh air to the heater.

**WARNING:** Risk of electrical shock. More than one disconnect switch may be required to de-energize the equipment before servicing.

**Revision 4 reflects the following changes:**

Update WARNING to read "to inspect and replace the heater." on page 2.

Added "IMPORTANT SAFETY INSTRUCTIONS" and "SAVE THESE INSTRUCTIONS" on page 3.

Updated section 11 to read "Hold the knob for two (2) seconds..." on page 7. Updated digital control decals on page 7.

Remove the two sentences on top of Table G and updated the table heading-titles on page 9.

## 2. WATER CHEMISTRY

**CAUTION: Corrosive water voids all warranties**

For your health and the protection of your pool equipment, it is essential that your water be chemically balanced. The levels shown in **Table A** must be used as a guide for balanced water.

### Pool/Spa Water Chemistry

Occasional chemical shock dosing of the pool or spa should not damage the heat exchanger providing the water is balanced. Automatic chemical dosing devices and salt chlorinators are usually more efficient in heated water. If not controlled, they can lead to high chemical levels which can damage the heat exchanger. Further advice should be obtained from your pool or spa builder, accredited pool shop, or chemical supplier for the correct levels for your water.

### Automatic Chlorinators and Chemical Feeders

All chemicals must be introduced downstream of the heater and completely diluted into the water before being circulated through the heater. Chlorinators must feed downstream of the heat exchanger and have an anti-siphoning device or check valve to prevent chemical back-up into the heat exchanger when the pool filtration pump is shut off.

**CAUTION: High chemical concentrations from feeders that are out of adjustment will cause rapid corrosion of the heat exchanger. Such damage is not covered under the warranty.**

**CAUTION: Failure of a heat exchanger due to lime scale build-up on the heating surface, low pH, or other chemical imbalance is not covered under the warranty.**

## 3. SAFETY INFORMATION

Pool water temperatures typically range from 78°F (26°C) to 82°F (28°C). The American Red Cross recommends a

Water Chemistry	Allowable Levels
Water Temperature	68-104°F (20-40°C)
pH	7.6-7.8
Total Alkalinity (ppm)	80-120
Calcium Hardness (ppm)	200-400
Salt (ppm)	4500 Maximum
Free Chlorine (ppm)*	2-3
Total Dissolved Solids (ppm)	3000 Maximum**

\*Free Chlorine **MUST NOT EXCEED 5 ppm!**

\*\*In saltwater chlorinated pools, the total TDS can be as high as 6000 ppm.

**Table A. Spa and Pool Water Chemistry**

temperature of 78°F (26°C) for competitive swimming. However, this may be too cool for young children and the elderly, who may require a temperature of 80°F (27°C) or higher.

## 4. OVERVIEW

Congratulations on the purchase of the most advanced spa/pool electrical heater in the market. To get the best performance and savings from your new heater, it is important to install the heater in accordance with our instructions and the electrical, plumbing codes applicable to your area. If you have any questions, please contact your Authorized Dealer, or visit our website at [www.raypak.com](http://www.raypak.com).

## IMPORTANT SAFETY INSTRUCTIONS

### READ AND FOLLOW ALL INSTRUCTIONS GIVEN IN THIS MANUAL.

The water in a spa or pool should never exceed 104°F (40°C). A water temperature in excess of 104°F (40°C) is considered unsafe for all persons. Lower water temperatures are recommended for extended use (exceeding 10-15 minutes) and for young children.

Excessive water temperatures have a high potential for causing fetal damage during the early months of pregnancy. Pregnant or possibly pregnant women should limit spa or pool water temperatures to 100°F (38°C).

Before entering a spa or pool, the user should measure the water temperature at several locations using an accurate thermometer since the tolerance of water temperature - regulating devices may vary as much as +/- 5°F (3°C)

Alcohol, drugs or medication should not be used before or during spa or pool use since their use may lead to unconsciousness with the possibility of drowning.

Persons suffering from obesity or with a medical history of heart disease, low or high blood pressure, circulatory system problems, or diabetes should consult a physician before using a spa or pool.

Persons using medication should consult a physician before using a spa or pool since some medication may induce drowsiness while other medication may affect heart rate, blood pressure and circulation.

Prolonged immersion in hot water may induce hyperthermia. Hyperthermia occurs when the internal temperature of the body reaches a level several degrees above normal body temperature of 98.6°F (37°C).

The symptoms include dizziness, fainting, drowsiness, lethargy and an increase in the internal temperature of the body. The effects of hyperthermia include: Unawareness of impending hazard, failure to perceive heat, failure to recognize the need to exit spa or pool, physical inability to exit spa or pool, fetal damage in pregnant women and unconsciousness resulting in a danger of drowning.

**SAVE THESE INSTRUCTIONS**

## 5. BEFORE INSTALLATION

Please read these instructions thoroughly and completely before installation and before use. Failure to do so could cause property damage or serious personal injury or death and void your warranty.

By installing this product, you acknowledge the terms of the manufacturer's warranty and your Authorized Dealer's return policies. The heaters that have been installed cannot be returned. If you have any questions regarding the warranty or product return policies, please consult your Authorized Dealer prior to installation.

Open the box and carefully unpack the heater. Inspect all components.

- Electrical Heater
- Installation and Operation Manual

## 6. INSTALLATION

The heaters are designed for indoor and outdoor use.

- The heater must be mounted on a vertical position over a ground level base or a wall.
- Secure the heater to the base with screws (not provided).

**CAUTION: Combustible materials should be kept at least 24" (610 mm) away from the heater.**

Recommended Clearances:

**TOP: 18" (457 mm)**

**SIDES: 6" (152 mm) away from your heater and the outlet hot water pipe.**

## 7. WATER CONNECTION

Please follow all plumbing instructions carefully. This product must be installed by a licensed and qualified plumber in accordance with all applicable national, state, provincial, and local plumbing codes.

**IMPORTANT: When preparing the connections going to heater, make sure you do not use glue or putty. Any glue or putty going into the heater will damage the flow sensor permanently. Prior to the final connections to the heater, flush all the lines to clear any debris.**

**NOTE: When using two-speed pumps, do not install a gate valve on the inlet. No shut-off valves are to be installed in the piping between the spa heater outlet and the spa. If using an in-line chlorinator, a check valve must be used. Any chlorinator valves that can cause return line blockage will VOID the warranty.**

- The heater must be installed after installation of the filter.

- **Models ELS 0005 and 0011** are supplied with 1-1/2" NPT inlet and outlet plumbing connections.
- **Models ELS 0018 and 0027** are supplied with 2" NPT inlet and outlet plumbing connections.
- All heater models are rated operation ONLY on 240V single-phase, 60Hz power.
- Heaters are flow activated.
- No Hartford loop is required.

After tightening both fittings at the water heater, start the pump to allow water to run through the spa/pool heater for at least 5-10 minutes. This process purges all the air from the water lines and must be performed prior to turning on the power at the heater.

**CAUTION: Failure to follow this step can cause permanent damage to the heating elements.**

When any maintenance is performed on the spa/pool that may introduce air into the plumbing pipes, it is important to turn the power off to the heater and purge the air out of the lines before allowing the heater to power up.

### Dry-Firing of Elements

Dry-firing of elements is caused by water voids when power is on. All air must be purged from the system before any heat start-up. It is important to purge all air after cleaning or changing a cartridge filter. The filter casing acts as an air reservoir during this procedure, the circulation system must be on for at least two (2) minutes before you turn power on to this heater.

The heater must have an adequate flow of water for proper operation. Adequate water flow removes the heat produced by the heater and transfers the heat to the spa/pool and prevents overheating. Low water flow usually results from dirty filter or improperly adjusted manual bypass. The heater is designed to run at a minimum flow rate of 15 gpm (57 lpm) and maximum of 60 gpm (227 lpm). A manual bypass valve is needed when the flow rate exceeds 60 gpm (227 lpm). The heater will not energize elements if the water flow is under 15 gpm (57 lpm). Once 15 gpm (57 lpm) has been established, the heating elements will energize 1 minute after flow is configured. This is to make sure the tank is completely filled with water and any air in the tank has had time to escape.

**CAUTION: The heater's supporting base must be high enough to keep completely free of standing water at all times.**

**RAIN WATER RUN OFFS.** The heater is designed to operate outdoors and can be exposed to rain. However, rain water run-off falling directly onto the heater from a roof can cause damage and/or shorten the life of your heater. This may also void your warranty. Install rain gutters or rain diverters on your roof if the heater is installed in a position where contact with rain run-off may occur.

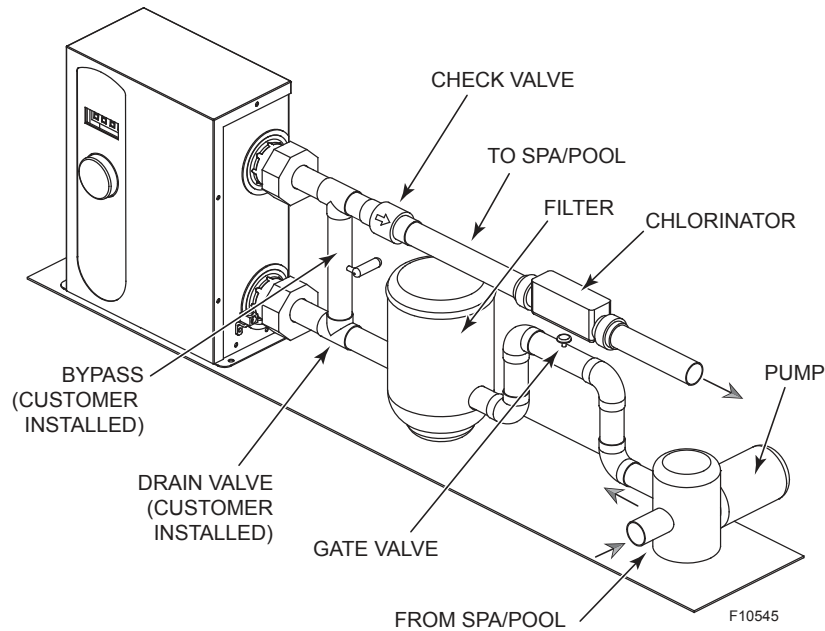


Figure 1. Spa/Pool Installation Diagram

## 8. FREEZE PROTECTION

If the heater is installed in a location subject to freezing conditions, it is important to protect the water circuit from freezing, just as should be done for the pump and filter.

### System Drain-Down

1. Make sure the heater is disconnected or turned off.
2. With the pool pump OFF, loosen the PVC unions supplied with the heater on both inlet and outlet pipes.
3. This should allow all of the water inside the heater to drain out and prevent freeze damage to the heater.

## 9. ELECTRICAL CONNECTIONS

**WARNING:** Please read these instructions thoroughly and completely before installation and before use. Failure to do so could cause property damage or serious personal injury, or death and void your warranty.

**WARNING:** Risk of electrical shock. More than one disconnect switch may be required to de-energize the equipment before servicing.

This product must be installed by a licensed and qualified electrician in accordance with Article 680 of the National Electrical Code, NFPA 70 and with the requirements of the authority having jurisdiction and all applicable national, state, provincial, and local electrical codes.

As with all electrical appliances, under no circumstances should you attempt to install, repair or disassemble this heater without first shutting off all power to the heater directly at the fuse or breaker box.

**WARNING:** Serious bodily injury or death could occur if you ignore shutting off all power to the heater at the fuse or breaker box.

All wiring (wire gauge) and circuit protection (breakers) must comply with the U.S. National Electrical Code (NEC) in the U.S.A., or the Canadian Electrical Code (CEC) in Canada. Failure to do so could result in property damage and/or personal injury, and void your warranty.

**NOTE:** The Canadian Electrical Code generally requires that all supply wires and corresponding circuit protection (breakers) used for hot water heating applications be sized to a minimum of 125% of the maximum current rating of the heater (see model specifications below for details).

Before installing this product, ensure that the home has sufficient electrical power available to handle the maximum amperage load of the applicable model. **All heaters have one (1) minute time delay on start.** The heater will not energize the elements until 15 gpm (57 lpm) is established. A separate ground conductor for each incoming circuit is required.

**CAUTION:** Make sure that the electrical connections are correct and all wire connections are tight and secure. Make sure that the correct breaker size and wire gauge has been used. Make sure that the heater has been connected to a ground in accordance with applicable codes.

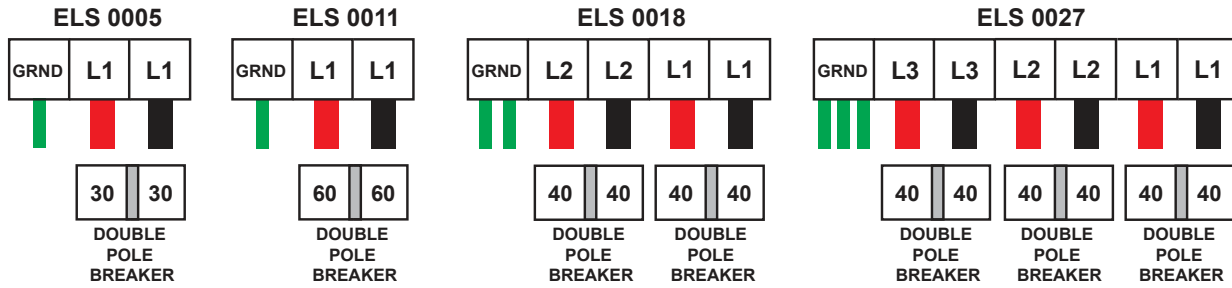


Figure 2. Wire Connection to Circuit Breakers

Properties	Models			
	ELS 0005	ELS 0011	ELS 0018	ELS 0027
Elements	1	2	2	3
Voltage	240 V	240 V	240 V	240 V
Frequency (HZ)	60	60	60	60
Power (kW)	5.5	11	18	27
Each Element Supply (kW)	5.5	5.5 (Qty 2)	9 (Qty 2)	9 (Qty 3)
Required Breaker (min/max amps)	30/30	60/60	40/50 (Qty 2)	40/50 (Qty 3)
Electrical Service (amps)	100	150	150	200

Table B. Electrical Specification

Properties	Models			
	ELS 0005	ELS 0011	ELS 0018	ELS 0027
Wire Gauge	#10	#6	#8	#8
Wire Set	1	1	2	3
Breaker Amperage	30	60	40/50	40/50
Breaker Type	Double Pole	Double Pole	Double Pole	Double Pole
Breaker Quantity	1	1	2	3

Table C. Circuit Breaker Specification

## 10. OPERATION

Once the heater is installed, it can be used year round. The user MUST make sure the pump is not disengaged to allow it to run until the desired temperature setting is reached.

The heater will function only when there is sufficient flow through it [15 gpm (57 lpm) minimum]. On the digital control panel, press and hold the knob for five (5) seconds to check the flow rate in the unit.

Models ELS 0005 and 0011 display the inlet temperatures on the GPM screen by turning the knob to the right. The outlet temperature is displayed by turning the knob to the left.

Models ELS 0018 and 0027 have the outlet and inlet temperatures displayed at all times.

The unit also has a one (1) minute built-in TIME DELAY to protect it from air in the lines and to avoid burning out the elements as a result of it. When the unit senses sufficient water flow it will automatically activate.

# 11. CONTROL

Turn the control knob to set your desired temperature. When the set temperature is reached the heater will go to idle and the elements will not draw power.

**NOTE: If the controls and display are active, they still draw some power.**

## Digital Control Temperature Setting

The heater comes with a digital temperature control located in the front panel that can be set from 40°-104°F (4°C-40°C) in one (1) degree increments by a simple turn of the knob.

The heater is turned OFF by pushing the control knob once. Hold the knob for two (2) seconds to switch from Fahrenheit to Centigrade.

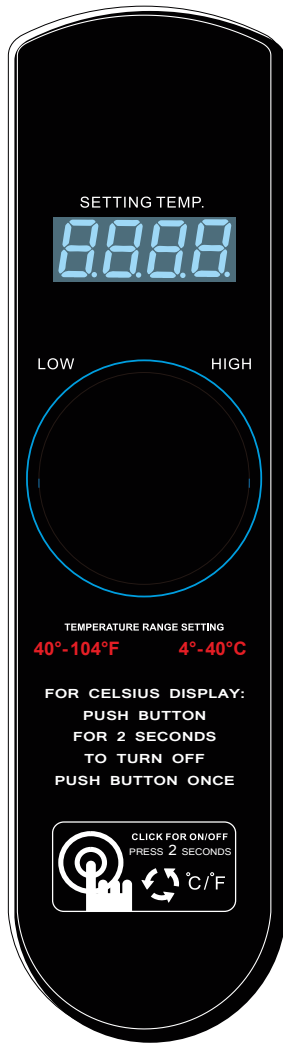


Figure 3. Digital Control for Models ELS 0005 and 0011

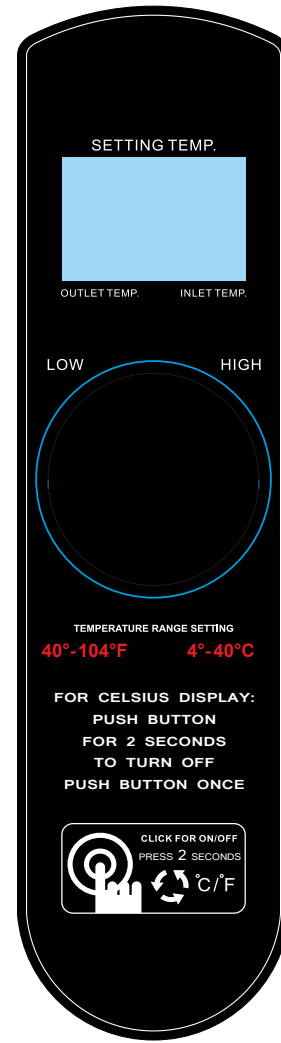


Figure 4. Digital Control for Models ELS 0018 and 0027

Code	Description	Action
E1	Inlet sensor has a short.	Buttons do not function, no heat. Need to replace sensor.
E2	Outlet sensor has a short.	Buttons do not function, no heat. Need to replace sensor.
E3 (ELS 27 only)	Chamber #1 sensor short.	The heater will continue to operate, continues to heat.
E4 (ELS 27 only)	Chamber #2 sensor short.	The heater will continue to operate, continues to heat.
E5	Remote wiring is in use. The master external controller is not CFH.	The heater will not heat until the master control has a CFH.

Table D. Fault Codes

## 12. REMOTE OPERATION

The heaters are equipped to work with external remote controls. The unit can be connected to either a toggle switch or the switch contacts of a third party remote. The remote works by either making or breaking the circuit created by the remote wiring.

Typically, a remote does not supply power to the heater, it only provides a switching function to turn on/off the heater. If your remote is supplying its own voltage to the heater, it will not work with this heater and may damage the digital circuit board.

### Remote Control Wiring

Important installation notes for remote or external wiring configuration.

- Remote wiring must be run in a separate conduit.
- Remote wiring must not be run parallel to high voltage lines.
- For runs of under 30 ft. (9 m), remote wiring should have stranded conductors with a minimum of 22 AWG, 600V, cable twisting 1.5" to 2.5" (38 mm to 64 mm) lay and jacketed.
- For runs over 30 ft. (9 m), the conductors should be a minimum of 20 AWG, 600V, cable twisting 1.5" to 2.5" (38 mm to 64 mm) lay that is shielded and jacketed.
- Maximum cable length is 200 ft. (61 m).

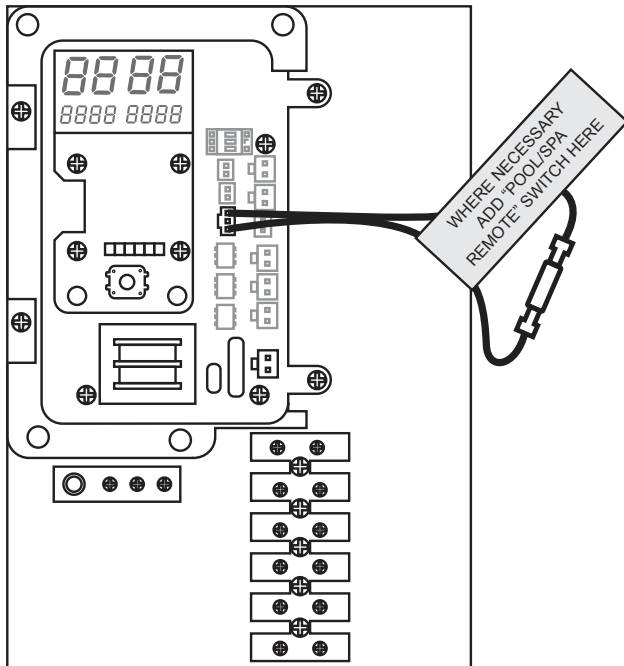


Figure 5. Supplied Wires for the Remote Interface Harness

### Remote Control (On-Off)

1. Turn on power to the heater.
2. For a remote control **without its own sensor**, set the desired set point, for example 102°F (39°C).
3. For a remote control **with its own sensor**, set the temperature to the highest setting available on the control on the heater. The actual set point will be controlled by the remote control.
4. Turn off and remove power from the heater.
5. On the "Remote Interface Harness", the supplied two wires provide power out to either a toggle switch or the switch contacts of a third party remote. See Figure 5.

**NOTE: Code E5 is displayed on the heater digital display when remote wiring is in use and the master external controller is not calling for heat (CFH). The heater will not heat until the master control is CFH.**

GPM (lpm)	Pressure Drop in PSI	Pressure Drop in ft. of Head
15 (57)	1.6	3.6
20 (76)	2.4	5.6
25 (95)	3.6	8.2
30 (114)	5.2	11.9
35 (132)	7.5	17.3
40 (151)	8.8	20.3
45 (170)	19.2	44.4
50 (189)	22.6	52.2
60 (227)	23.2	53.7

Table E. Pressure Drop for Models ELS 0005 and 0011

GPM (lpm)	Pressure Drop in PSI	Pressure drop in ft. of Head
15 (57)	2.1	4.8
20 (76)	2.8	6.6
25 (95)	3.4	8
30 (114)	5.6	12.8
35 (132)	7.2	16.5
40 (151)	8.9	20.5
45 (170)	14.1	32.7
50 (189)	17.4	40.3
60 (227)	21.4	49.5

Table F. Pressure Drop for Models ELS 0018 and 0027



150K Inlet/Outlet Sensor, All Models	
Temp °F/°C	Resistance Ω
32 (0)	491399.3
41 (5)	384009.2
50 (10)	303720
59 (15)	242375.9
68 (20)	191172
77 (25)	150000
86 (30)	122049
95 (35)	97403.8
104 (40)	77394
113 (45)	61780.2
122 (50)	49539.7

10K Sensor for Model 0027 Element 3 Only	
Temp °F/°C	Resistance Ω
32 (0)	31537
41 (5)	24783
50 (10)	19587
59 (15)	15568
68 (20)	12443
77 (25)	10000
86 (30)	8080
95 (35)	6563
104 (40)	5359
113 (45)	4398
122 (50)	3628

**Table G. Sensor Resistance**

Models ELS 0005 and 0011	
Heater Features	Standard Values
Element resistance (check with at least one wire lead disconnected from each element).	9.97 to 11.6 Ω
Delay in energizing elements (heater starts heating 1 minute after powering up and sufficient flow is recorded).	1 minute ± 30 secs.
Turn on flow rate.	15 gpm ± 2 gpm (57 lpm ± 8 lpm)
Individual element current at max temp and max flow.	20.5 to 29.06 A
ECO trip point.	140°F (60°C)
To change temperature setting from Fahrenheit to Celsius.	Press and hold the knob for 3 secs.
To display GPM.	Press and hold the knob for 5 secs.
To display inlet and outlet water temperatures.	On the display GPM screen, turning knob to the left shows inlet water temperature and turning it to the left shows outlet water temperature.

Models ELS 0018 and 0027	
Heater Features	Standard Values
Element resistance (check with at least one wire lead disconnected from each element).	6.10 to 7.11 Ω
Delay in energizing elements (heater starts heating 1 minute after powering up and sufficient flow is recorded).	1 minute ± 30 secs.
Turn on flow rate.	15 gpm ± 2 gpm (57 lpm ± 8 lpm)
Individual element current at max temp and max flow.	31.7 to 40.2 A
ECO trip point.	140°F (60°C)
To change temperature setting from Fahrenheit to Celsius.	Press and hold the knob for 3 secs.
To display GPM.	Press and hold the knob for 5 secs.
Inlet and outlet water temperatures.	The inlet and outlet temperatures are displayed at all times.

**Table H. E3T Electric Heater Features**

## 13. TROUBLESHOOTING

Problem	Cause	Solution
Nothing happens when the thermostat is turned on.	Low flow.....	1. Check filter, skimmer basket, pump. 2. If a 2-speed pump is used, turn to high speed. 3. Press and hold the knob for 5 seconds. Make sure the flow rate displayed on screen is at least 15 gpm (57 lpm).
	High limit.....	Push the reset button.
	Thermostat not calling for heat.....	Turn thermostat to higher temperature.
It takes a long time to heat the spa.	Low input voltage.....	Call the electric company.
	Undersized heater.....	Calculate temperature in heat rise °/hr.= Heater input (kw) x 410 divided by spa gallonage (This does not take into account heat loss due to weather).
	Heat loss from poor weather conditions (cold, high winds).....	Use an spa cover.
	Defective heating element.....	Call an electrician.
Spa does not reach temperature.	Low flow.....	Check filter, skimmer basket, pump.
Heating element continuously burning out.	High input voltage.....	Call the electric company.
	Poor water chemistry.....	See " <b>WATER CHEMISTRY</b> " on page 3.
	Heating element split open.....	Over-acid condition. Watch pH, add acid slowly.
Fuses blow or circuit breaker opens.	Shorted heating elements.....	Replace element.
	Undersized wire.....	Replace field wiring.

# 14. WIRING DIAGRAMS

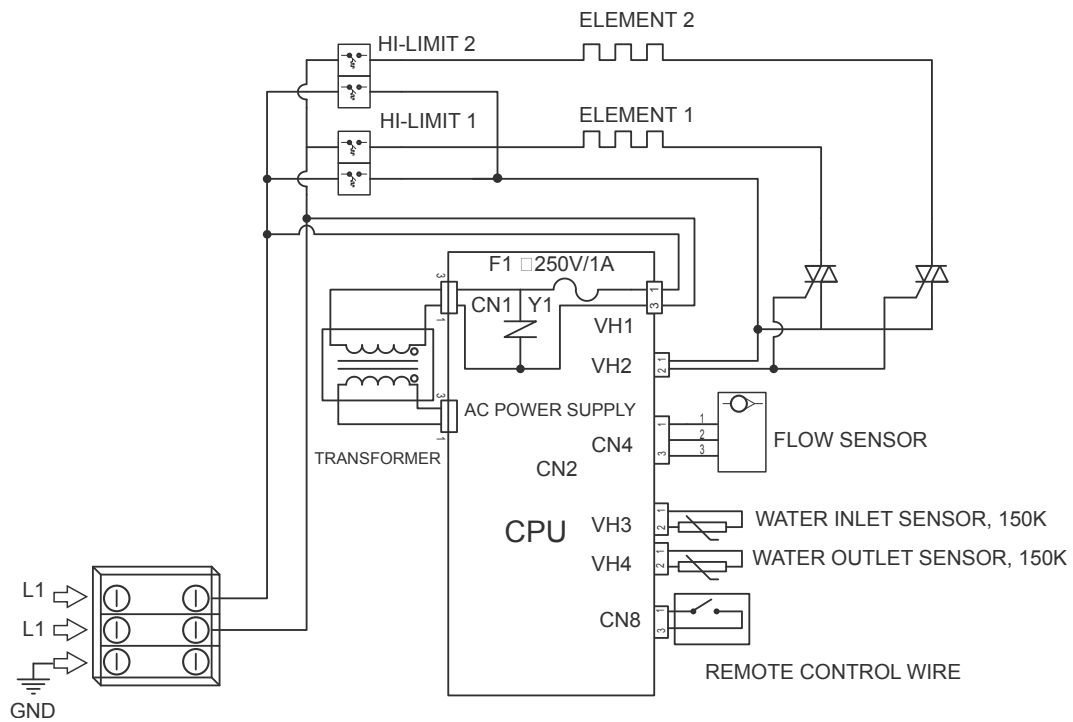


Figure 6. Wiring Diagram for Models ELS 0005 and 0011

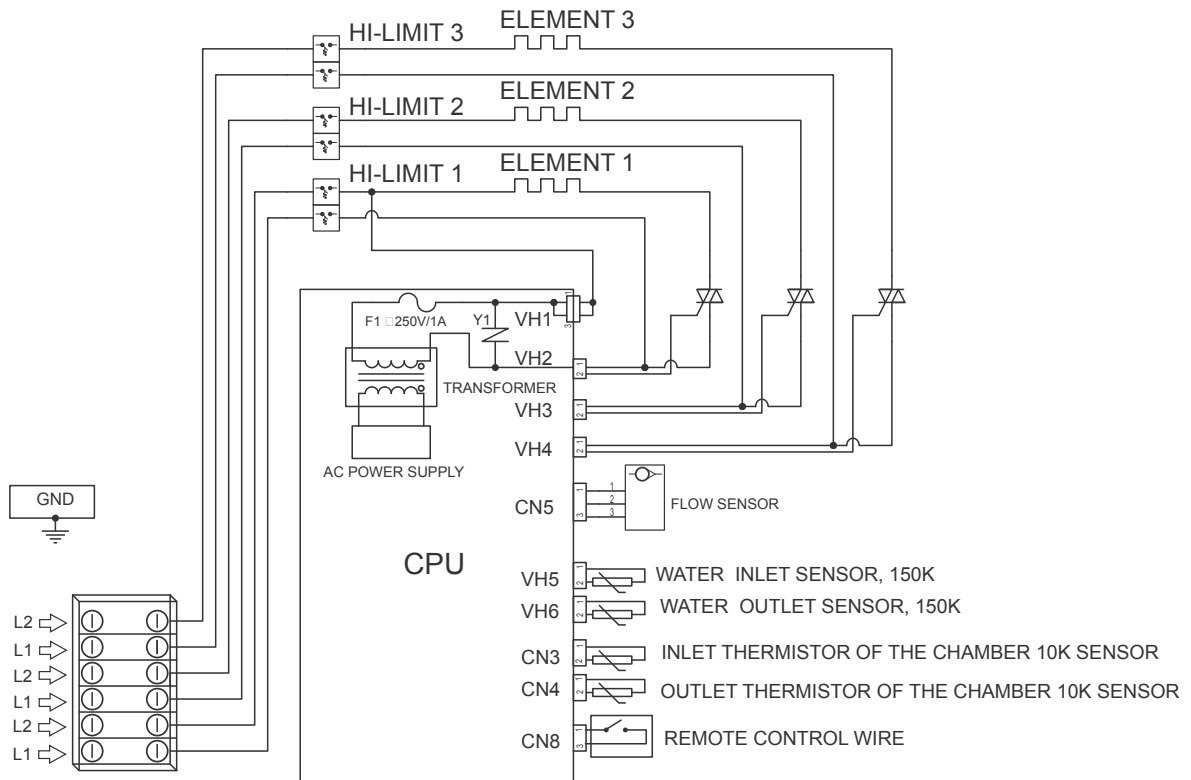


Figure 7. Wiring Diagram for Models ELS 0018 and 0027



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