

# Troubleshooting



## IMPORTANT NOTICE

These instructions are primarily intended for the use of qualified personnel specifically trained and experienced in the installation of this type of heating equipment and related system components. Installation and service personnel may be required by some states to be licensed. Persons not qualified shall not attempt to install this equipment nor attempt repairs according to these instructions.

## MECHANICAL (FOR QUALIFIED SERVICE PERSONNEL ONLY)

<u>PROBLEM</u>	<u>CAUSE</u>	<u>SOLUTION</u>
Harmonics, or whining noise.	U.G. inoperative.....	Check movement by putting in hot water (110°F or higher). If no movement, replace.
	* Debris or restriction in system.....	Locate the restriction and remove. Flush system and clean.
	* Debris in gas line.....	Remove debris or blow out gas line.
	Low flow.....	Scale forming in heat exchanger-clean heat exchanger and check pool pH and total alkalinity.
Heater going on and off continuously.	Dirty filter.....	Backwash filter.
	Low water level in pool.....	Raise water level.
	External bypass setting out of adjustment.....	Adjust bypass
	* Pressure switch out of adjustment.....	Adjust pressure switch
Liming or scale forming on heat exchanger.	Pool water.....	See Water Chemistry page 2.
Sooting	High flow rates.....	Reduce by adding manual bypass valve and adjust by putting thermometer in header (1/4" NPT) drain opening. Set bypass so thermometer reads between 105° and 110°F.
	U.G. Inoperative.....	Check movement by putting in hot water (110° or higher). If no movement, replace.
	* Air starvation.....	Refer to installation instructions.
	* Improper venting.....	Follow recommended installation instructions.
	* Insects or debris clogging burner intake ports.....	Clean burners.
Pilot outage.	Low gas pressure.....	Adjust gas pressure.
	Restricted pilot.....	Clean pilot.
	Weak pilot generator.....	Replace pilot.
Yellow lazy flame	Low gas pressure.....	Adjust gas pressure.
	* Insects or debris clogging burner intake ports.....	Clean burners.
Outer jacket very hot (paint blistered)	* Broken refractory caused by shipping damage or improper combustion.....	Replace refractory panels.
Takes long time to heat pool or spa.	Excessive sooting of heat exchanger.....	Determine cause of sooting & correct.
	Calculate temperature in °/hr.....	Heat rise (°/hr.) = Heater output ÷ (Pool gallonage x 8.33) or refer to heater sizing chart. This does not take into account heat loss due to weather.
	Filter not running long enough.....	Reset time clock.
	Dirty filter.....	Clean filter.
	Gas line or meter undersized.....	Refer to installation instructions.

(\*Usually occurs on initial start-up)

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Liming	Bypassing too much water.....	Inspect bypass for movement, if no movement, replace.
	U. G. not functioning.....	Replace if no movement when heated.
Leaking at well. Leaking at heat exchanger.	Overacid.....	Replace well and maintain water chemistry properly.
Gasket brittle and leaking (overheated).	Overacid.....	Replace heat exchanger and maintain chemistry properly.
	Heater running after pump shuts off.....	See pressure switch adjustment.
	Refractory damage.....	Replace refractory.
	Sooted heater.....	Determine cause of sooting and correct.

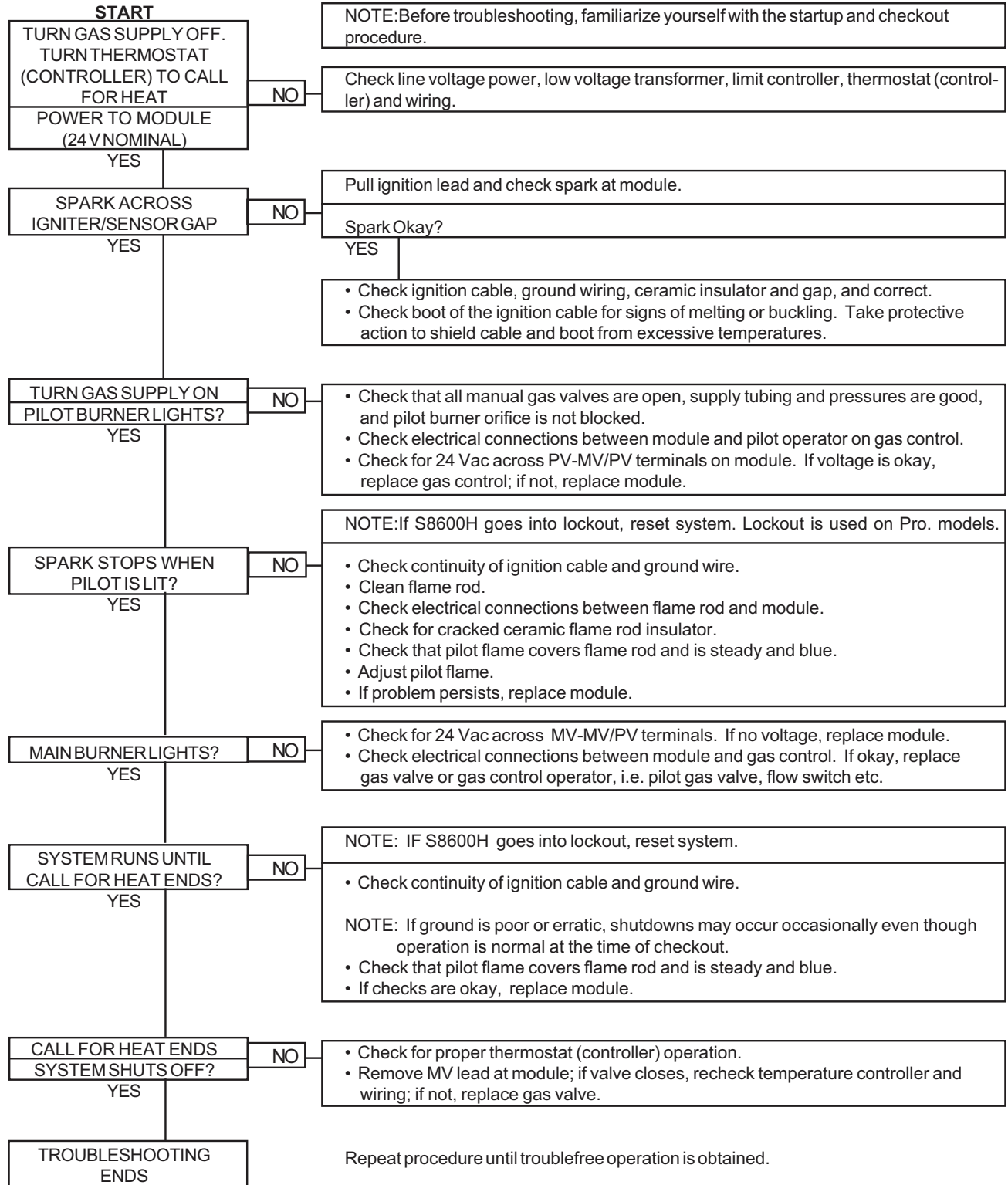
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**ELECTRICAL**

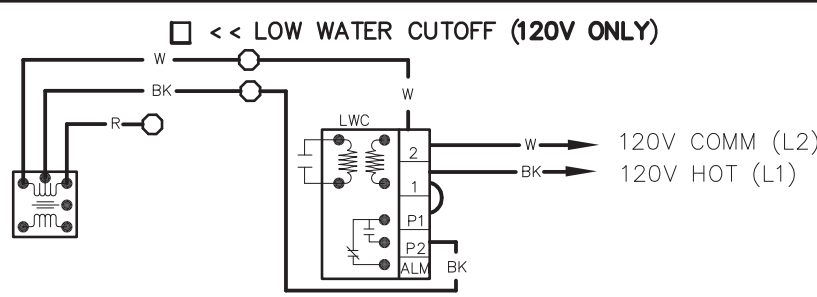
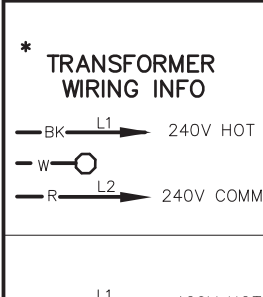
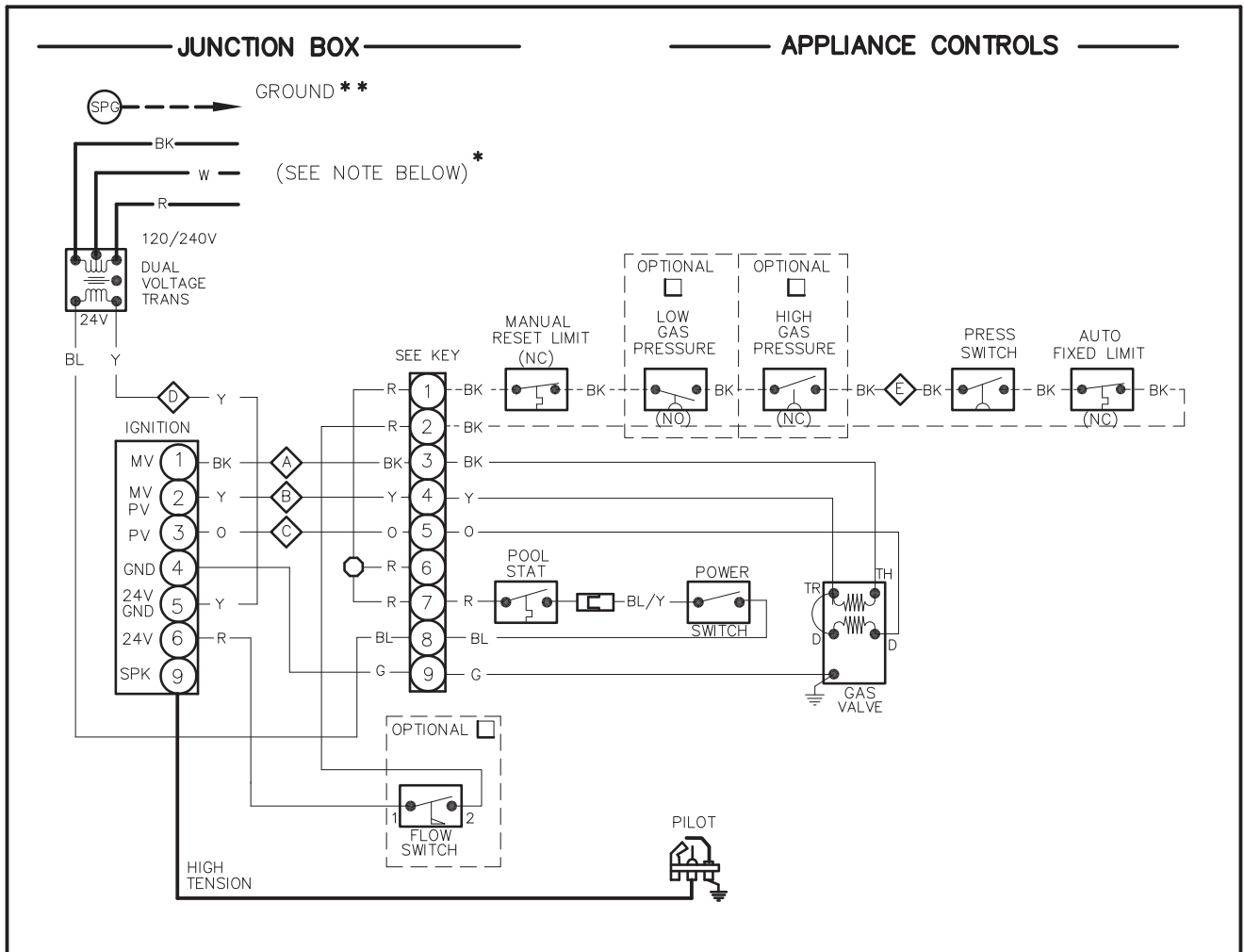
**WARNING: HIGH VOLTAGE.** For qualified technicians **ONLY**.

**NOTE:** Some heaters may be equipped with an ignition module that shuts off pilot gas if the pilot fails to light. To reset, interrupt power to the heater.

**Intermittent Pilot System  
TROUBLESHOOTING HONEYWELL S8600**



# Wiring Diagram—Models 514-724



NOTES:  
 ALSO USED ON MODEL 824 PROPANE.

\*\* USE GROUND CONNECTION PROVIDED. FAILURE TO PROVIDE PROPER GROUND MAY RESULT IN LOCK-OUT. ALL GROUND  $\perp$  TERMINATE AT  $\text{SPG}$ .

$\Delta$  —  $\Delta$  CONNECTIONS FOR OPTIONAL E-4 ALARM PANEL.

CHECK CONTROLS PROVIDED (WIRED AS SHOWN)  
 REPLACE WIRING WITH 105°C WIRE ONLY

APPROVED BY:

CHECKED BY:

ORIG E.O. **1908**  
**04/16/84**

CHG E.O. **4000**  
**03/20/07**

*Raupak*

**WIRING DIAGRAM IID**  
**FIRING MODE — ON/OFF**

INPUTS: 512,000 THRU 726,000 BTUH

SIZE: **514-724** TYPE: **P**

**KEY**

— 24V 105°C  
 - - - 24V 150°C  
 — 120V 105°C  
 - - - 120V 150°C

$\text{SPG}$  GROUND  
 $\bigcirc$  WIRE NUT  
 BK — BLACK  
 BL — BLUE  
 BR — BROWN  
 G — GREEN  
 O — ORANGE  
 R — RED  
 V — VIOLET  
 W — WHITE  
 Y — YELLOW

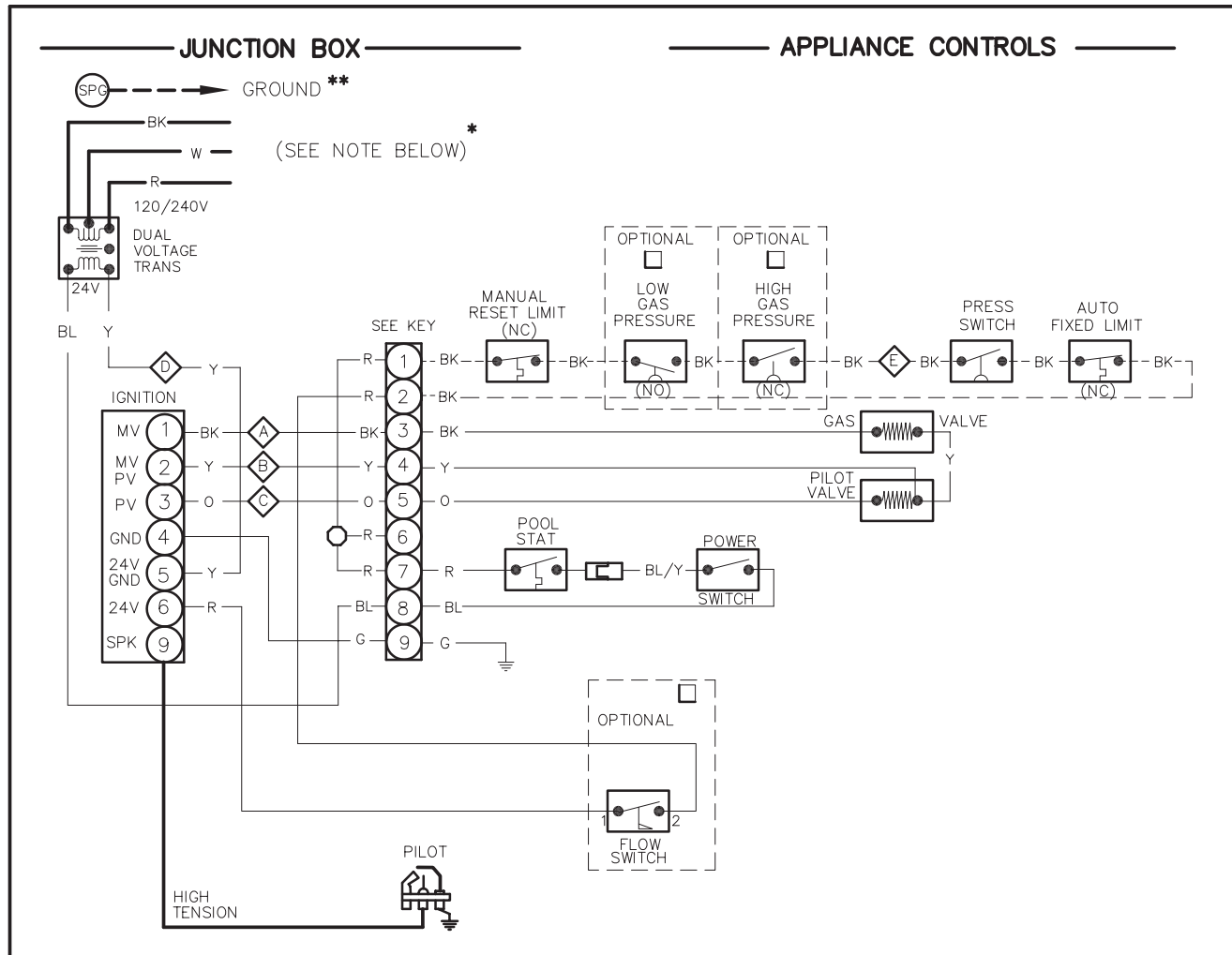
PLUG (ACTUAL)

3	2	1
6	5	4
9	8	7

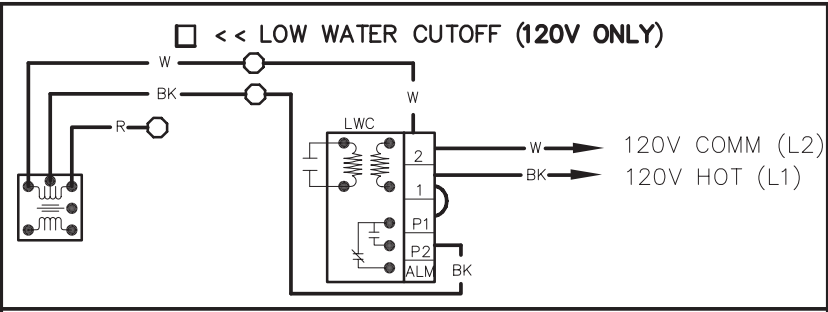
FRONT VIEW

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# Wiring Diagram—Model 824



<p><b>* TRANSFORMER WIRING INFO</b></p> <p>—BK— L1 → 240V HOT          —W— W → 240V COMM          —R— L2 → 240V COMM</p> <p>—BK— L1 → 120V HOT          —W— W → 120V COMM          —R— L2 → 120V COMM</p>
APPROVED BY:
CHECKED BY:
ORIG E.O. <b>1908</b>
<b>04/16/84</b>
CHG E.O. <b>3528</b>
<b>12/16/03</b>
<b>Raypak</b>



**NOTES:**

**\*\*** USE GROUND CONNECTION PROVIDED. FAILURE TO PROVIDE PROPER GROUND MAY RESULT IN LOCK-OUT. ALL GROUND  $\perp$  TERMINATE AT  $\text{SPK}$ .

$\text{A}$  —  $\text{E}$  CONNECTIONS FOR OPTIONAL E-4 ALARM PANEL.

CHECK CONTROLS PROVIDED (WIRED AS SHOWN)  
 REPLACE WIRING WITH 105°C WIRE ONLY

<b>WIRING DIAGRAM IID</b>	
<b>FIRING MODE — ON/OFF</b>	
INPUTS:	825,000 BTUH
SIZE:	<b>824</b>
TYPE:	<b>P</b>

**KEY**

— 24V  
 — 120V  
 - - - 150°C

$\text{SPK}$  GROUND  
 ○ WIRE NUT

BK — BLACK  
 BL — BLUE  
 BR — BROWN  
 G — GREEN  
 O — ORANGE  
 R — RED  
 V — VIOLET  
 W — WHITE  
 Y — YELLOW

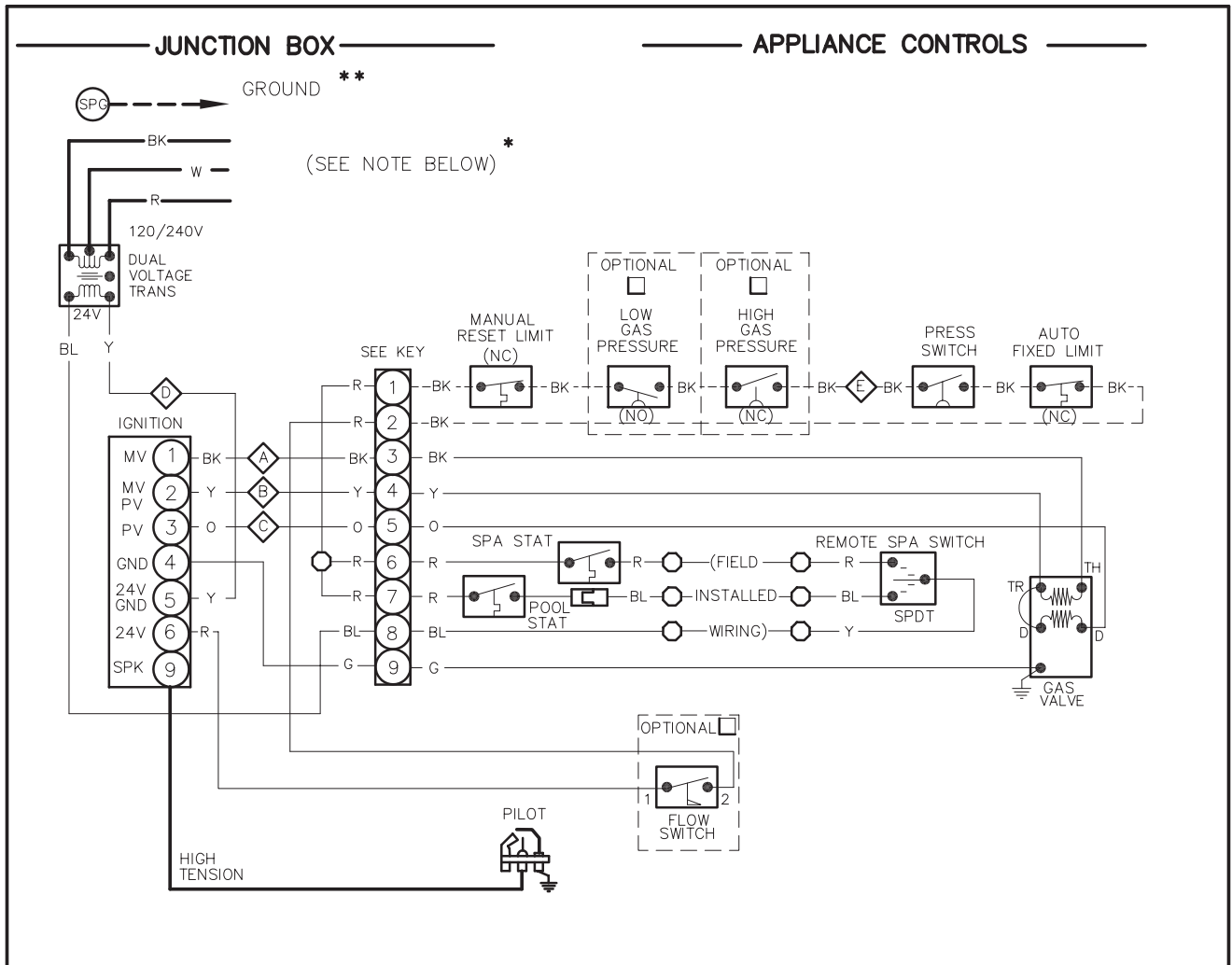
PLUG (ACTUAL)

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6	5	4
9	8	7

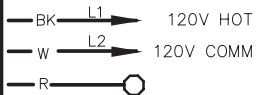
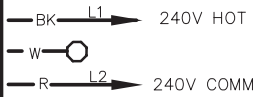
FRONT VIEW

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# Wiring Diagram—Models 514-724—Spa



### \* TRANSFORMER WIRING INFO

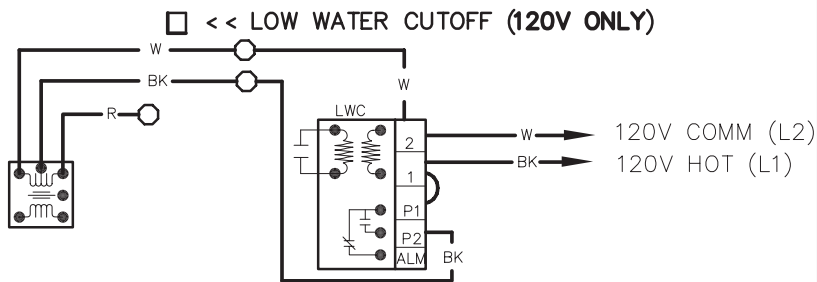


APPROVED BY:

CHECKED BY:

ORIG E.O. **2096**  
**01/03/86**

CHG E.O. **3528**  
**12/16/03**



### NOTES:

\*\* USE GROUND CONNECTION PROVIDED. FAILURE TO PROVIDE PROPER GROUND MAY RESULT IN LOCK-OUT. ALL GROUND  $\perp$  TERMINATE AT  $\oplus$ .

$\triangle$  -  $\diamond$  CONNECTIONS FOR OPTIONAL E-4 ALARM PANEL.

CHECK CONTROLS PROVIDED (WIRED AS SHOWN)  
REPLACE WIRING WITH 105°C WIRE ONLY

## WIRING DIAGRAM IID REMOTE SPA FIRING MODE - ON/OFF

INPUTS: 512,000 THRU 726,000 BTUH

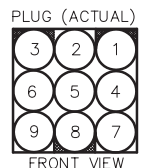
SIZE: **514-724**

TYPE: **P**

### KEY

— 24V  
— 120V  
- - - 150°C

- $\oplus$  GROUND
- $\circ$  WIRE NUT
- BK - BLACK
- BL - BLUE
- BR - BROWN
- G - GREEN
- O - ORANGE
- R - RED
- V - VIOLET
- W - WHITE
- Y - YELLOW

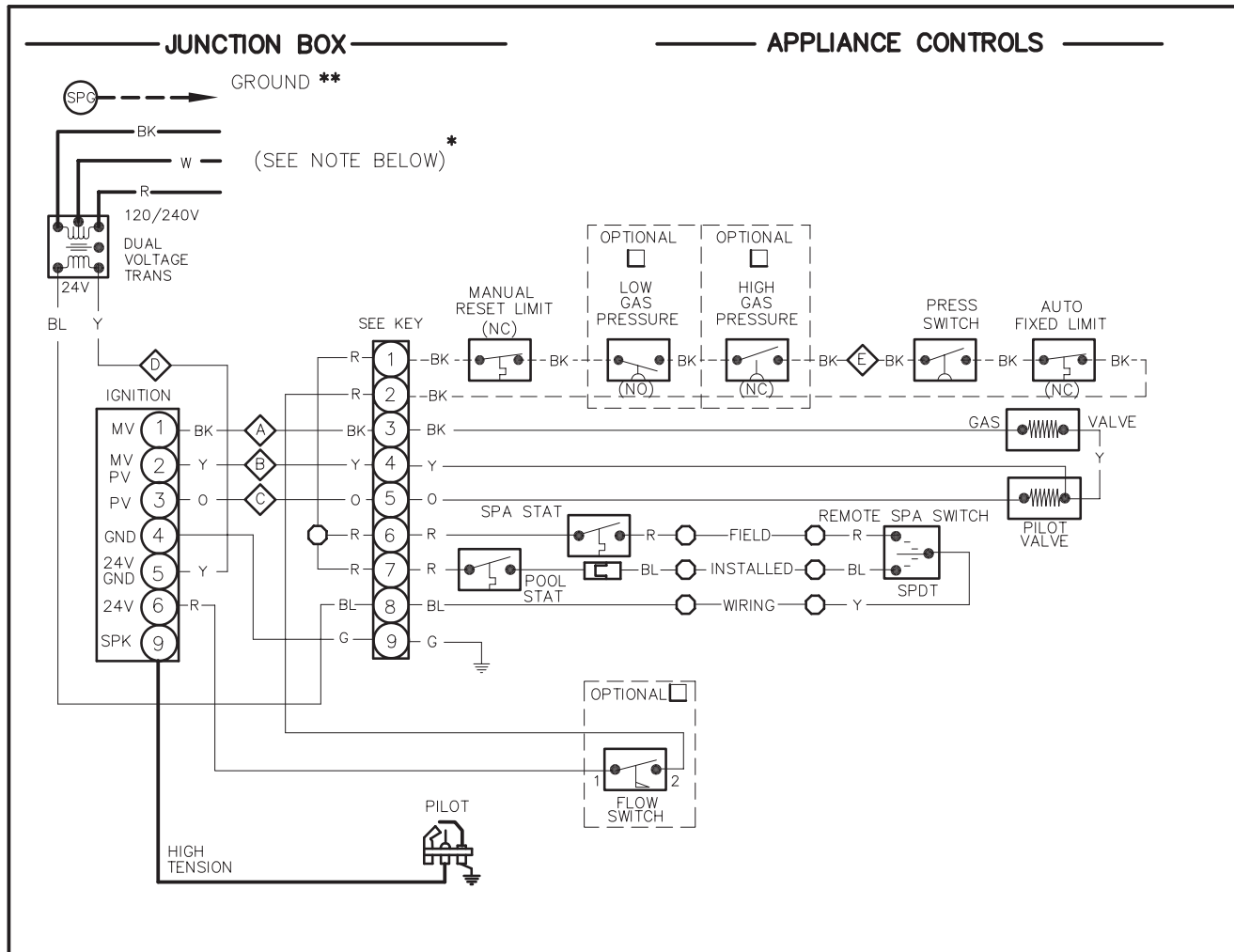


FRONT VIEW

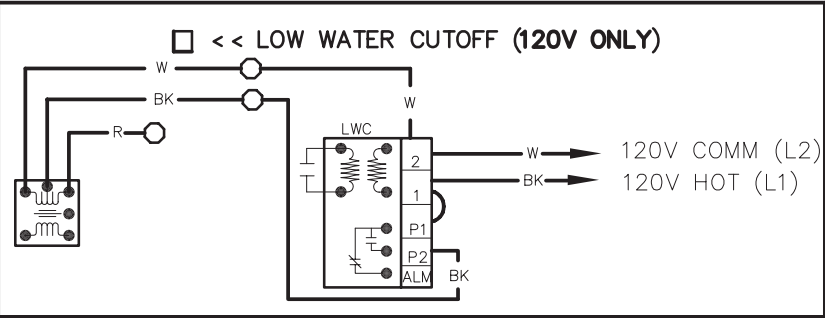
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# Wiring Diagram—Model 824—Spa



<p><b>* TRANSFORMER WIRING INFO</b></p> <p>—BK— L1 → 240V HOT          —W— L2 → 240V COMM          —R— L2</p>	
<p>—BK— L1 → 120V HOT          —W— L2 → 120V COMM          —R—</p>	
APPROVED BY:	
CHECKED BY:	
ORIG E.O. <b>2096</b>	
<b>01/03/86</b>	
CHG E.O. <b>3528</b>	
<b>12/17/03</b>	
<i>Raypak</i>	



**NOTES:**

\*\* USE GROUND CONNECTION PROVIDED. FAILURE TO PROVIDE PROPER GROUND MAY RESULT IN LOCK-OUT. ALL GROUND  $\perp$  TERMINATE AT  $\text{SPG}$ .

$\diamond$  —  $\diamond$  CONNECTIONS FOR OPTIONAL E-4 ALARM PANEL.

CHECK CONTROLS PROVIDED (WIRED AS SHOWN)

REPLACE WIRING WITH 105°C WIRE ONLY

<b>WIRING DIAGRAM IID REMOTE SPA FIRING MODE — ON/OFF</b>	
INPUTS:	825,000 BTUH
SIZE:	<b>824</b>
TYPE:	<b>P</b>

**KEY**

— 24V  
 — 120V  
 - - - 150°C

$\text{SPG}$  GROUND  
 ○ WIRE NUT

BK — BLACK  
 BL — BLUE  
 BR — BROWN  
 G — GREEN  
 O — ORANGE  
 R — RED  
 V — VIOLET  
 W — WHITE  
 Y — YELLOW

PLUG (ACTUAL)

3	2	1
6	5	4
9	8	7

FRONT VIEW

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# Servicing

## General Location of Controls

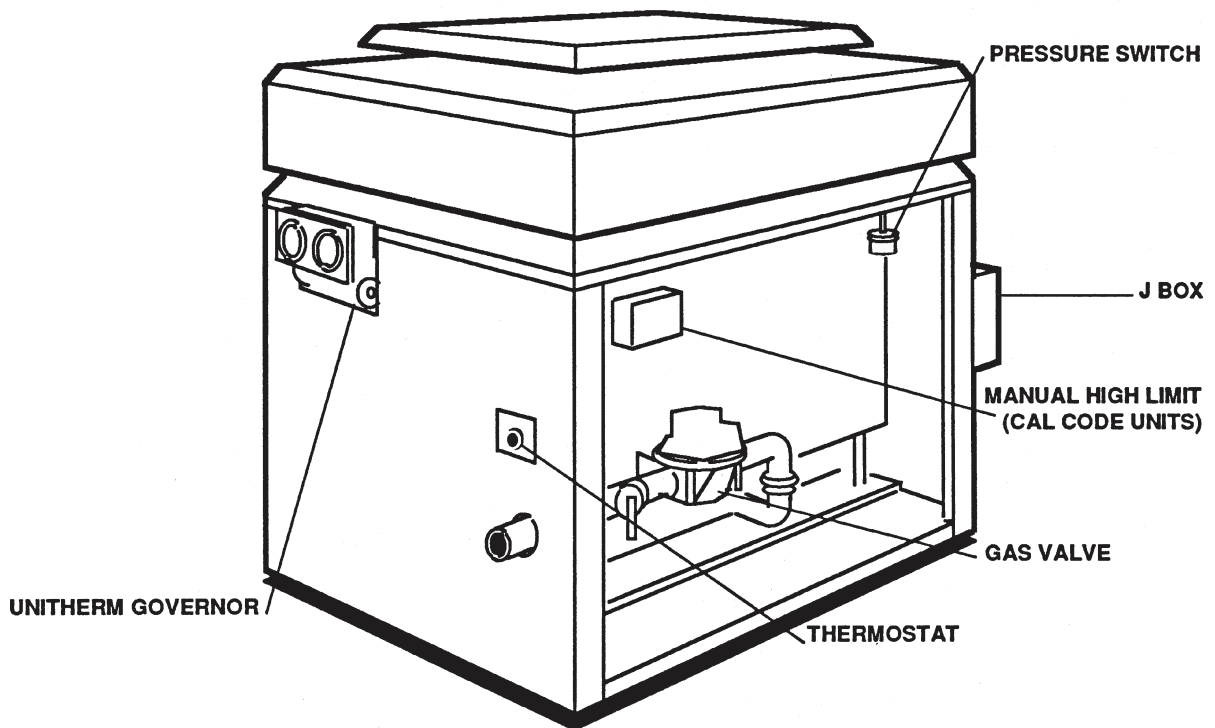


Fig. 19: General Location of Controls

## Controls/Adjustments/Replacements

### Thermostat

The heater is built with a single mechanical thermostat, located in the front panel above the door. The thermostat may be set for any desired pool or spa temperature

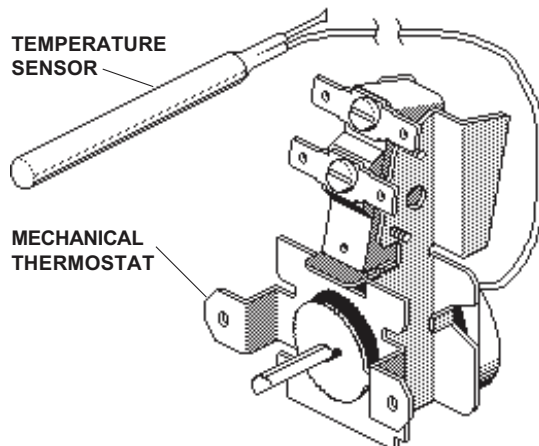


Fig. 20: Thermostat

TYPICAL COMFORTABLE SPA TEMPERATURE RANGE

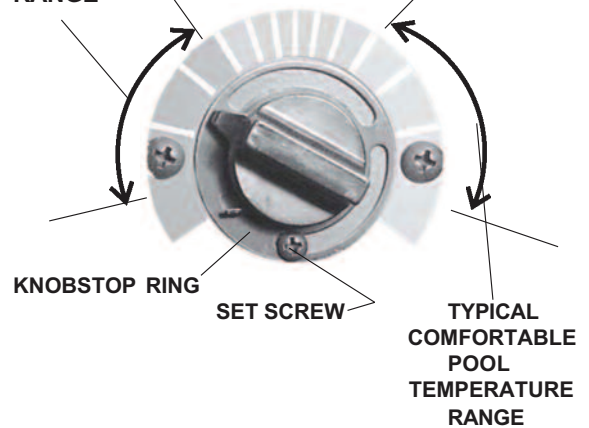


Fig. 21: Knobstop

### Knobstop Adjustment

If desired, a higher setting of the thermostat can be obtained by adjusting the knobstop ring on the dial plate. Loosen the set screw, adjust the knobstop for the higher desired temperature setting and retighten the set screw.



## Pressure Switch

The pressure switch, or heater actuator, ensures that the heater operates only when the filter pump is in operation. It is factory set at 1.75 PSI for deck level installations. When the heater is located below the level of the spa or pool it may be necessary to reset the pressure switch to compensate for the no-flow static head. If it is necessary to reset the pressure switch, we recommend the following procedure.

### Pressure Switch Adjustment

1. Make sure the pool filter is clean before adjusting the switch.
2. Set the heater control to the OFF mode.
3. Turn the filter pump on and confirm that the pressure switch is closed (use a multimeter to check). If the pressure switch fails to close, either the switch setting is too high or the filter pump is not supplying enough pressure.
4. Turn the heater ON.
5. Manually turn the pressure adjustment knob clockwise until the heater shuts off. (A flat screw driver may be necessary if knob is too tight).
6. Slowly turn the adjustment knob counter-clockwise until the heater calls for heat again.
7. Turn an additional 1/2 turn counter-clockwise.
8. While the heater is running, check the adjustment by turning the pump off and on several times. The burners should shut off immediately when the pump is turned off. If it does not, repeat the above steps until proper operation is observed.

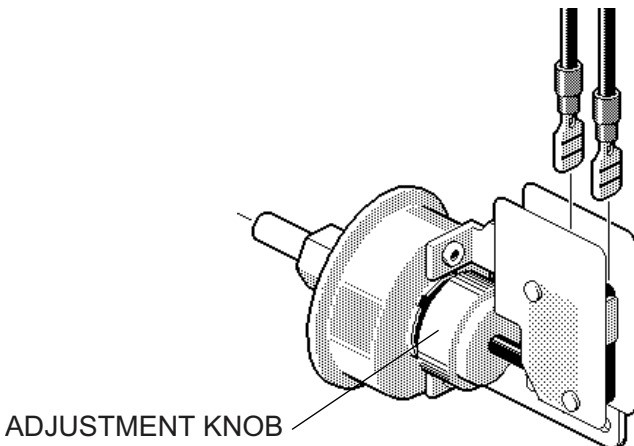


Fig. 22: Pressure Switch Adjustment Range

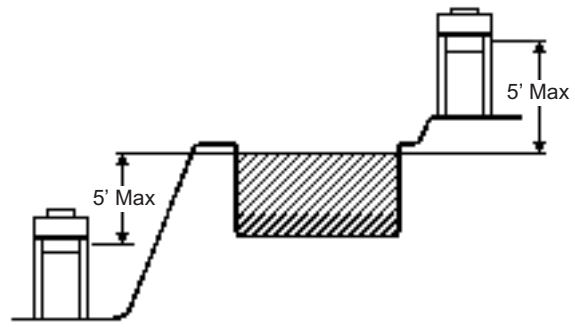


Fig. 23: Heat Exchanger Height Above/Below Pool

**NOTE:** If heater is installed outside of the limits shown in Fig. 23, a flow switch must be used in place of the pressure switch when mounted and wired adjacent to the heater.

### Two Speed Pumps

In some cases, the flow on the low speed is insufficient to operate the heater. This is apparent when the pressure switch cannot be further adjusted or if the heater makes banging noises. In these cases, the pump must be run at high speed when heating the water.

**CAUTION:** Do not operate the heater without a functioning and properly adjusted pressure switch.

### High Limits

The heater is equipped with two automatic high limits. Set to operate at 135°F and 140°F.

**NOTE:** An erratic high limit is often characteristic of an internal heat exchanger problem, i.e. scale build-up, U.G. operation. Refer to troubleshooting sections.



Fig. 24: High Limit

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### High Limit Removal

1. Shut off main electrical power switch to heater.
2. Remove inspection panels.
3. Drain heater.
4. Remove defective high limit and replace with a new high limit.
5. Reverse above procedure to re-install.

### Pilot Safety

The heater employs a pilot safety which closes the main gas valve within 8/10ths of a second whenever the pilot flame is interrupted. Pilot flame is automatically lit when the device is powered. Unit performs its own safety check and opens the main valve only after the pilot is proven to be lit.

### Burner Drawer Removal

1. Shut off main electrical power switch to heater.
2. Shut off gas upstream of heater.
3. Remove front door.
4. Disconnect gas line from gas valve.
5. Remove (2) screws that mount burner tray to unit, and (2) screws that secure gas valve to jacket.
6. Disconnect wires that terminate at gas valve.
7. Slide out burner tray.
8. Reverse above procedure to reinstall.

### Gas Valve Removal

1. Shut off gas supply to the heater. Remove gas piping to gas valve inlet.
2. Disconnect wires, pilot tubing and bleed line, if required.
3. Turn vertical gas pipe from manifold slightly and unscrew gas valve.
4. Reverse above procedure to re-install.

### Main Burner and Orifice Removal

1. Remove burner drawer. See burner drawer removal procedure.
2. Remove screws and burner hold down bracket.

**NOTE:** If the heat exchanger is sooted badly, the burner hold down bracket and spacer can become distorted from direct flame impingement and this usually necessitates replacement of these parts.

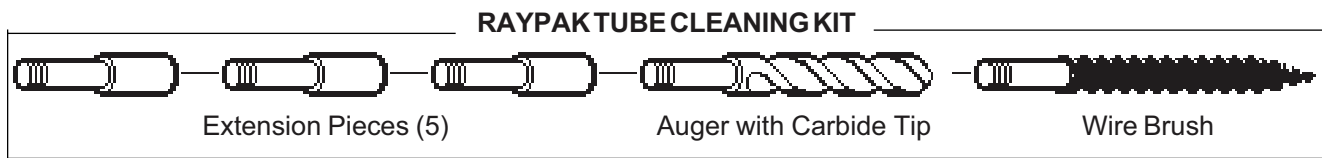
3. Lift burners from slotted spacers and slide from orifices. Clean with a non-sparking wire brush.
4. Orifices usually do not need to be replaced. To clean, run either copper wire or wood toothpick through orifice. Do not enlarge hole. To remove orifice, use a socket wrench and remove from manifold. DO NOT over tighten when reinstalling.

### Pilot Removal and Cleaning

1. Remove burner drawer. (See burner drawer removal procedure).
2. Disconnect pilot tubing, disconnect wires from gas valve.
3. Disconnect pilot bracket from burner shield.
4. Remove pilot from bracket.
5. Remove pilot orifice and air opening, and clean with wire or small brush. CAUTION! DO NOT enlarge hole in pilot orifice.
6. Reverse above procedure to re-install.

### Heat Exchanger Removal

1. Shut water, gas and electricity off, close valves and relieve pressure, remove relief valve. Remove side inspections panels.
2. Remove top holding screws.
3. Remove draft diverter, lift and remove top and flue collector. Remove inspection panels.
4. Loosen bolts and disconnect flange nuts on inlet-outlet header, loosen union(s) at gas pipe and slide heater away from piping until stud clear the header.



**Fig. 34: Tube Cleaning Kit**

5. Remove heat exchanger corner brackets.
6. Remove combustion chamber clips at the four corners of the heat exchanger.
7. Lift heat exchanger straight up using caution not to damage refractory.
8. Reverse above procedure to reinstall.

### **Tube Cleaning Procedure**

Establish a regular inspection schedule frequency, depending on local water condition and severity of service. Do not let the tubes clog up solidly. Clean out deposits over 1/16" in thickness.

The heater may be cleaned from the right side, without breaking pipe connections. It is preferable, however, to remove both headers for better visibility through the tubes and to be sure the ground-up lime dust does not get into the system.

Note that you do not remove the top panel or the heat exchanger, generally. After reaming, mount the wire brush in place of the auger and clean out debris remaining in the tubes.

Another method is to remove the heat exchanger, ream tubes and immerse heat exchanger in non-inhibited de-scale solvent for severe scale build up.

### **Tube Replacement Procedure**

On Raypak units, tube replacement may be effected without rolling as a temporary means or repair, providing there are two or more tubes rolled in to act as stays on the left and right side. The "O" rings should provide a seal up to 120 PSI working pressure.

Use 3/8" heavy duty reversible drill motor or larger to power the tube roller. If a reversible drill is not available, after rolling the tube in, remove the drill motor and wrench out the roller. A tube roller is available from the factory.

Shut gas and power off to the unit, close the system off and drain the heater. Remove the draft diverter. Remove the access panel and jacket top. Lift flue collector off. Remove "V" baffles over tube(s) to be replaced. If no pipe unions have been provided, use the header as a union, remove the flange nuts off the inlet/outlet header, break gas connection and slide heater away from piping to allow room to work. Pull wedge clips out of control wells and remove sensing bulbs. Remove flange nuts of the return header and remove header. Lift heat exchanger straight up and out.

Heat exchanger header o-rings must be replaced with new ones. The tube may be cut out with a hacksaw or hammer and chisel adjacent to both tube sheets, leaving studs in the tube sheets. Then proceed to collapse studs in the tube sheets with a chisel or screwdriver. Use caution not to cut into the tube sheet. Replacement tubes will have the fins stripped off longer on one end. The long end is inserted into the opening of the tube sheet first; then the short end is fitted through the opposite tube sheet. If the tube ends become dented or bent, straighten at least (4) inches back from the tube and by means of a tapered punch.

Insert tube roller into tube opening up to stop against tube, then push center rod in until roller is tight. Be careful to keep replacement tube squared up 1/8" outside each tube sheet. A loose tube will sometimes pull toward the roller. Attach drill motor to tube roller, holding it straight and level. Proceed to expand tube until the tool begins to grab. At this point, 1/2" to 1" should be expose on the tool shank. Reverse drill motor or wrench out by hand. Care should be exercised to avoid applying excessive torque during rolling operation and to avoid thinning out any part of the tube wall excessively over .015". Use same procedure at the opposite end of the tube.

Apply line pressure test, and re-roll, if necessary, before reassembly of the heater.

## De-sooting Procedure

**CAUTION:** Soot is combustible. exercise extreme care.

Soot will clog areas between fins and cause eventual tube failure. Any sign of soot at the base of the burners or around the outer jacket indicates a need for cleaning.

1. Remove top and flue collector from cabinet.
2. Remove "V" baffles from heat exchanger.
3. Remove burner drawer. (See burner tray removal).
4. Take garden hose and wash heat exchanger, making sure soot is removed from between fins. (Avoid excessive water against refractory).
5. Reassemble-When heater is fired, some steam will form from wet refractory. This is normal.

**NOTE:** In extreme cases it may be necessary to remove the heat exchanger completely for cleaning. The simplest method is steam cleaning at the local car wash. DO NOT WIRE BRUSH.

## Combustion Chamber Removal

To remove combustion chamber, you must first have removed the heat exchanger. Unbolt metal combination chamber retainer from top and remove combustion chamber panels individually.



Fig. 35: Refractory Panels—Top View

## Control Immersion Well Replacement

Remove top, sensing bulb and clip. Collapse well tube at the open end with a chisel, push through into header and remove the header. Insert a new well and roll into place. If a roller is not available, solder or braze.

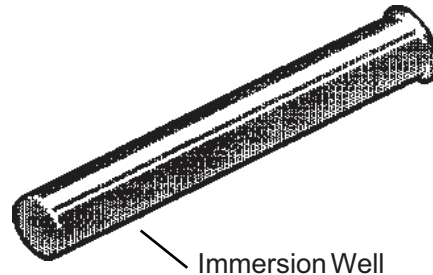


Fig. 36: Immersion Well

## Unitherm Governor (U.G.) Replacement

1. Shut water, gas and electricity off, close valves and relieve pressure.
2. Drain heat exchanger.
3. Loosen and remove (2) bolts that secure U.G. Assembly to header.
4. Remove U.G. Assembly with gasket.
5. Reverse above procedure to re-install.

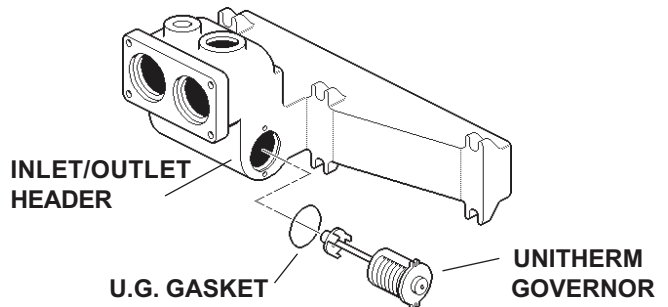


Fig. 37: Location of U.G.

To test the operation of the Unitherm Governor, place in hot water (over 100°F) and watch for movement against spring. If there is not movement, replace unit.