

Figure 10 - Heater Piping Arrangement

2. Thread the spring and retainer onto the sensor cable and secure sensor into the immersion well.
3. Route cable to heater control panel in a location where it will not be subject to damage. Secure with nylon cable ties.
4. Install the capillary tube/bulb sensor immersion well on the underside of the pool loop piping. The well should be installed just downstream of the heater outlet tee. **DO NOT INSTALL the bulb in the heater loop piping or upstream of the heater outlet tee.**
5. Route the capillary tube in a location where it will not be subject to damage. Secure with wire ties.

2.9 Automatic Chlorinators

A concentration of chlorine in the heater can be very destructive, therefore the following rules about the installation and operation of such devices must be followed:

1. The chlorinator should be installed so it introduces the gas or solution downstream from the heater.
2. The chlorinator should be wired so it cannot operate unless the filter pump is running.
3. The chlorinator should be provided with an anti-siphon device so that the draining of the piping

after the pump shuts off will not siphon chlorine solution into the heater.

4. When the operation of a chlorinator is such that it must be installed in the pump suction, or some other place where the chlorine solution flows through the heater, corrosion of the heater can occur. Excessive concentrations of chlorine caused by improper adjustment or failure of the chlorination equipment cause this corrosion. The resulting damage to the heat exchanger is not covered by heater warranty.

Section 3 Operation

3.1 Controls - General

(See Figures 11 and 12)

1. Electronic Ignition Controls:

- a. Intermittent Ignition:

Pilots are automatically lit when the operating control calls for heat (Systems #4, #9, and #11). The unit performs its own safety check and opens the main valves only after the pilot is proven to be lit. Whenever the pilot flame is interrupted, the main gas valve closes within 0.8 seconds.

- b. Electronically Supervised Standing Pilot System (System #16):

When pilot flame fails, the ignition control module responds in less than 0.8 seconds and provides 100% safety shutdown.

2. Operating Controls:

An electronic temperature control is provided on model AP heaters to control the pool water temperature. The temperature sensor (thermistor) is located in the pool loop piping (see Section 2.8).

3. Heater Power (On/Off/Auto) Switch:

This provides for constant or automatic pump operation.

4. High Limit Controls:

- a. The manual reset high limit switch is provided as standard equipment on all heaters. The temperature sensing bulb of the switch is always located in the heater outlet. Burners will automatically shut down whenever overheating of water occurs.

- b. The auto reset limit switch is provided as standard equipment on all heaters. The temperature sensing bulb of the switch is field installed and should be located in the pool loop piping. (See Section 2.8 for installation instructions.) Burners will automatically shut down whenever overheating of water occurs.

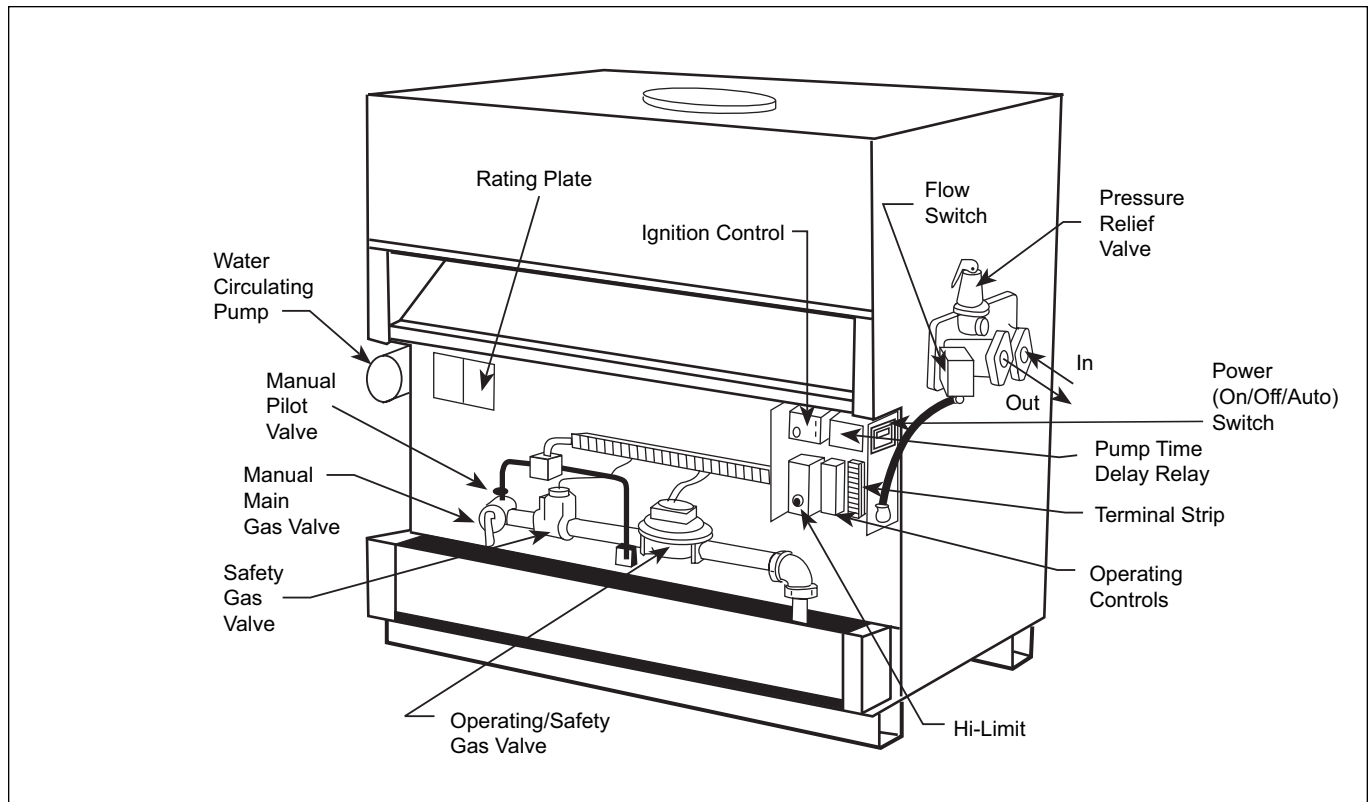


Figure 11 - Control Locations

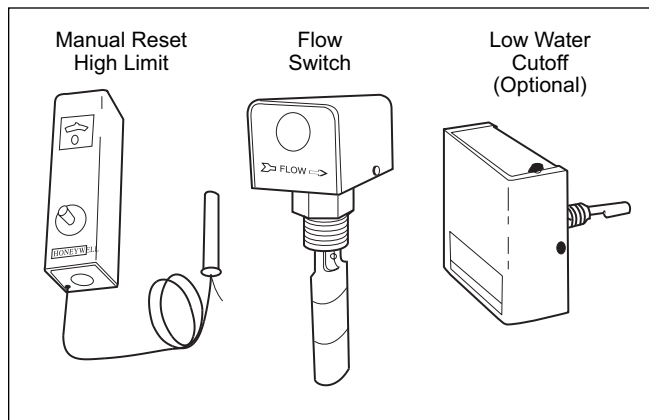


Figure 12 - Safety Components

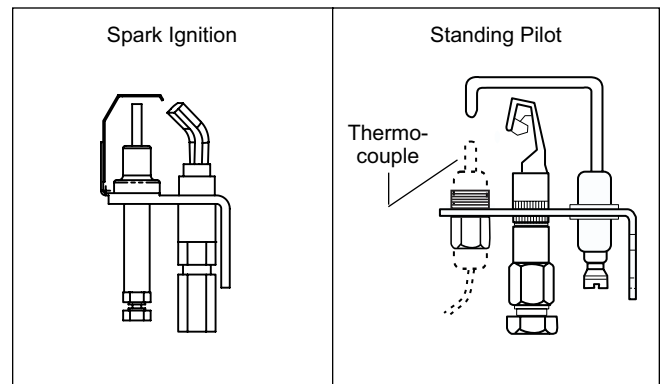


Figure 13 - Pilot Burners

5. **Flow Switch:**
Standard on all AP pool heating heaters. The switch is mounted in a tee fitting on the outlet header. This is a paddle type switch which is deflected by the water flow in the fitting. Any condition which interrupts or decreases the flow through the secondary loop will shut down the burners.
6. **Low Water Cut Off (optional):**
The low water cut off automatically shuts off heater whenever water level in the heat exchanger drops below probe level. It is located in the inlet header, and is a manually reset device.

3.2 Initial Start-Up

⚠ WARNING

Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the heater. The possible damage to a flooded appliance can be extensive and present numerous safety hazards. Any appliance that has been under water must be replaced.

Newly constructed pools may have low pH, and higher levels of calcium hardness or construction debris. Do not allow pool water to circulate through the pool heater until the water has been filtered to remove all debris,

and the chemical balance of the water has been adjusted to a stable pH of 7.2 to 7.8. After the pool water is filtered, and the pH is verified at 7.2 to 7.8, verify that the chlorine or bromine residual is no more than 2.0 to 4.0 ppm, the total alkalinity is 80 - 120 ppm and the calcium hardness is between 200 - 400 ppm. Corrosion and/or "liming" of the heat exchanger is possible when these levels are not maintained and the heater is fired.

1. Before placing the heater in operation, be certain that the heater is filled with water and that all air is purged from the system. Open all the valves in the secondary piping.
2. With the filter pump running, run the heater pump in manual "CONSTANT PUMP" for minimum of 10 minutes and listen for the flow switch to make as the pump is started. Loosen the pipe plug on the top of the pump scroll casting to bleed off any air. NOTE: If the system will be operated in a manner that causes air to be drawn into the heater and the secondary piping, an automatic float type air vent should be permanently installed on top of the pump scroll.
3. To check the heater firing, proceed as follows:
 - a. Turn off the power switch.
 - b. Turn off all manual gas valves and wait five minutes (Figure 14).
 - c. Set operating control to the lowest setting.
 - d. After placing the manual pilot gas valve in the open position and resetting all safety devices (high limit, low water cutoff, etc.), the pilot(s) can be lit following the procedure on the heater rating plate.
 - e. For standing pilot system, press on pilot relay lever (see Figure 15), light pilot and keep relay lever depressed for one minute then release. Once the pilot is lit, turn power switch to "AUTO PUMP."
 - f. Wait 5 minutes and turn up operating control until heater fires (for intermittent ignition system, the pilot will be ignited automatically). The main burners should ignite smoothly. Turn the operating control back to the lowest setting.

Note: Do not operate the heater until the following safety checks have been performed.

3.3 Safety Shutoff Component Checkout

1. Once the pilot(s) is lit and has been established for five minutes, the flame failure response time should be checked as follows:

Systems 4, 9, and 11 - (intermittent ignition). With this system pilots are automatically lit when the operating controls call for heat. If the pilot flame fails for any reason, the main valve is shut off within one second and the pilot spark ignition is initiated until the pilot flame has been reestablished. This sequence should be checked by turning off the manual pilot gas valve (see Figure 14), and, at the same time, monitoring the audible sparking at the pilot burner and signal interruption to the main valve.

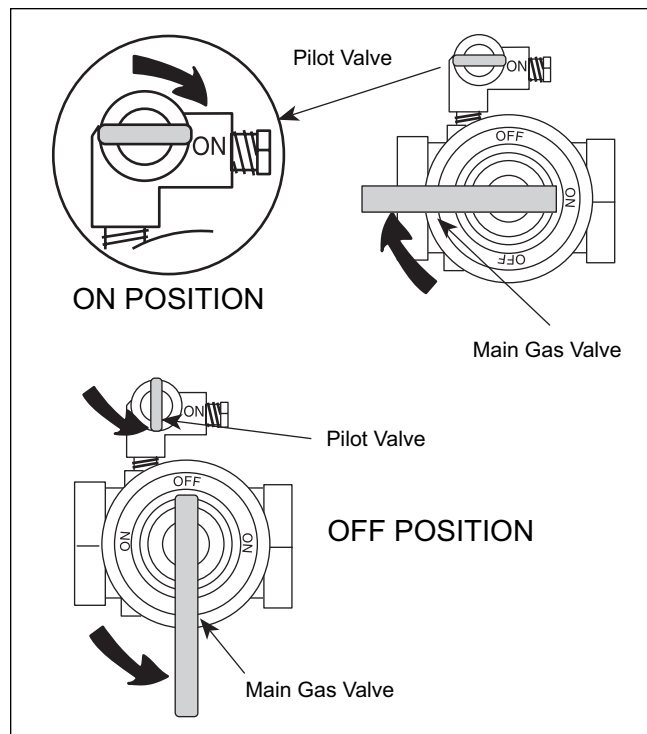


Figure 14 - Manual Gas Valves.

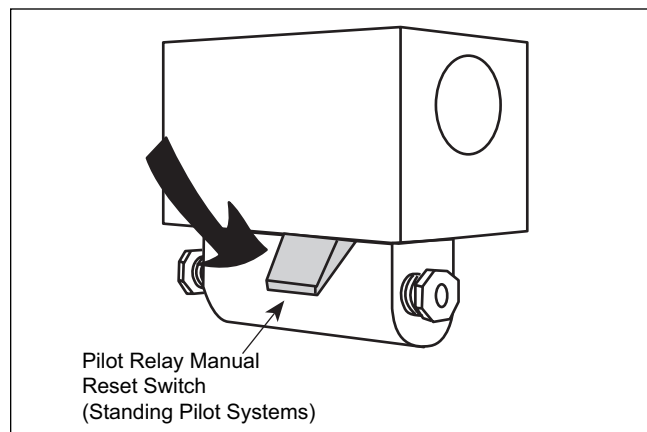


Figure 15 - Pilot Safety Relay.

⚠ Caution

Propane gas is heavier than air and sinks to the ground. Exercise extreme care in lighting the heater when so equipped.

System 16 - (electronically supervised standing pilot system). Extinguish the pilot flame by placing the manual pilot valve in the closed positions (see Figure 14), and at the same time, begin recording the time it takes for the output signal from the electronic ignition control to be interrupted. The signal interruption can be detected either with a test light or a voltmeter. The response time should never exceed one second.

2. **Manual Hi-Limit Checkout.** The manual high limit capillary bulb is installed at the heater outlet. (This is not the auto reset high limit installed in the pool return line). For spas see Section 3.9. The manual reset high limit is factory preset to 150°F (66°C). Confirm this set point on the unit and adjust if necessary. After running the heater in a firing mode for 10 minutes, slowly close the outlet valve “B” to raise the outlet temperature as indicated on the outlet thermometer. The high limit should trip within 2°F (1°C) or 3°F (2°C) of the 150°F (66°C) setpoint and shut off the burners. If this does not occur, adjust the set point on the unit to shut off the burners when the outlet thermometer reads 150°F (66°C). Open the outlet valve “B” and push the reset button. The main burners should reignite.
3. **Flow Switch:** See attached vendor literature.
4. **Low Water Cutoff (optional):** See attached vendor literature.

3.4 Inlet Temperature and Temperature Rise Adjustment

For proper operation the bypass and outlet valves must be adjusted to obtain the correct heater temperature rise and inlet water temperature. Use the following method to set the bypass assembly at start up:

1. With all bypass valves open, fire the heater for at least 10 minutes. The operating control should be set at least 5° to 10° F (2.8° to 6°C) above the pool temperature to ensure continued operation throughout this set up procedure.
2. Observe the thermometer on the inlet header. To prevent condensation and damage to the heater, the inlet water temperature has to be 110°F (43°C).

If the inlet temperature is LESS THAN 110°F (43°C): With the bypass valve “A” fully open, throttle (turn down) outlet valve “B” slightly. Observe the inlet thermometer for 5 minutes to see where the inlet temperature stabilizes. If it remains under 110°F (43°C), throttle outlet valve “B” a little more. Repeat as necessary. If the inlet temperature rises above 110°F (43°C), open outlet valve “B” slightly until the inlet temperature stabilizes as close to 110°F as possible (plus or minus 2°F (1°C)).

If the inlet temperature is MORE THAN 110°F (43°C): If outlet valve “B” has been throttled partially closed, open it slightly, wait 5 minutes, and, if the temperature is not down to 110°F (43°C) (plus or minus 2°F (1°C)) open it some more. If bypass valve “B” is fully open and you are still seeing inlet water temperatures in excess of 110°F (43°C), you can adjust bypass valve “A”. Throttle it (turn down) slightly towards closed, and wait until the inlet water temperature stabilizes again. Repeat as necessary.

When the inlet temperature is stabilized at 110°F (43°C), either lock the valve handles, remove them, or prominently mark them to prevent tampering or accidental changes to the valve positions.

If the pool water temperature needs to be raised more than 10° F (5°C) to reach a comfortable swimming temperature, inspect and re-adjust the valves twice a day to maintain the 110°F (43°C) inlet water temperature.

3. To prevent nuisance high limit tripping, set the adjustable pump time delay relay to 10 minutes for all models. This allows the heater pump to circulate water through the heat exchanger after the burners shut off, recovering all residual heat in the metal components.
4. The heater outlet temperature with the bypass adjusted as detailed above should be less than 142°F (61°C). The normal range will be 10 to 37°F (5° to 18°C) higher than the inlet temperature. If it exceeds 142°F (61°C), please contact the Service Department at 800-900-9276 for instructions. Outlet temperatures in excess of 142°F (61°C) may cause intermittent high limit tripping.

POOL OPERATING CONTROL ADJUSTMENT:

5. **Adjustable Differential Feature:** Remove the cover from the control box and verify that the white differential potentiometer is set at about 2°F (1°C). NOTE: a 2°F (1°C) differential means that, if the thermostat is set at 80°F (27°C), the heater will come on at 78°F (25°C) and go off when the pool reaches 80°F (27°C). The 2°F (1°C) value is a good starting point for most installations. This differential may be adjusted up or down to suit individual applications.
6. The operating control temperature setting can be adjusted incrementally to obtain the desired pool operating temperature.
7. An adjustable pump time delay relay is mounted in the control panel (see Figure 11). This relay keeps the pump running after the burners shut off. The delay should be set to 10 minutes.

3.5 Heater Shut Down

1. If heater is firing, turn operating control to lowest value, wait 10 minutes for pump to stop running, then turn power switch to off.
2. If heater is not firing, turn power switch to off.

3.6 Spring and Fall Operation Standby Service

Turn the thermostat down to approximately 70°F (21°C). This will prevent the pool and surrounding ground from becoming chilled and also permit the pool to be raised to swimming temperature in a shorter time.

Section 4 Maintenance

1. Inspect the pump seal every 6 months. Replace the pump if the seal shows signs of leakage or wear.
2. At start-up and every six (6) months thereafter, the pilot and main burner flame should be observed for proper performance (see Figure 16). See attached lighting and shut-down instructions for proper pilot flame pattern. If flame has the appearance of "sooting" tips, check for debris near orifices and call the Laars Service Department.
3. Inspect the venting system for obstruction, leakage and corrosion at least once each year.
4. Keep heater area clear and free from combustible material, gasoline and other flammable vapors and liquids (see Table 1 for minimum clearances).
5. Be certain all combustion air and ventilation openings in the room are unobstructed.
6. Check for fouling on the external surfaces of the heat exchanger every six months. (NOTE: after installation and first start-up, check the heat exchanger for fouling after the following periods of operation: 24 hours, 7 days, 30 days, 90 days and once every six months thereafter.)

Fouling on the external surfaces of the heat exchanger is caused by incomplete combustion and is a sign of combustion air and/or venting problems. As soon as any fouling is observed, the cause of the fouling should be corrected (see Section 5, Troubleshooting Guide). The heat exchanger can be checked with a flashlight by locating a mirror under the burners. An alternate method is to remove the venting and top panels as necessary to inspect the heat exchanger from above. Also check the vent system for defects at this time. (If cleaning is required, shut off all electrical and gas supply to the heater.)

7. To expose the heat exchanger:

Indoor Models: Remove the flue pipe, top of unit, rear upper jacket, flue collector rear panel and heat exchanger baffles.

Outdoor Models: Remove vent top assembly, rear upper jacket, flue collector rear panel and heat exchanger baffles.

8. To remove all burners:

It is usually more convenient to remove the burner tray assembly. Disconnect sensor wire, ignition cable (or thermocouple generator) and pilot gas line. Disconnect manifold inlet union(s). Remove the four (4) retaining screws. Grasp the manifold pipe and slide out the burner tray.

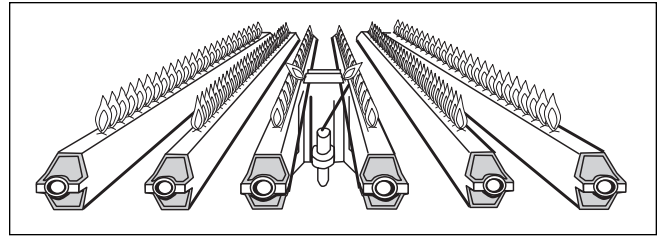


Figure 16 - Main Burner Flame Pattern

⚠ Caution

Black carbon or green soot on a dirty heat exchanger can, under certain conditions, be ignited by a random spark or open flame. To prevent this unlikely occurrence, dampen the soot deposits with wet brush or fine water spray before servicing or cleaning the heat exchanger.

9. Clean heat exchanger using a wire brush to remove soot and loose scale from the unit. Clean fallen debris from bottom of heater. Make sure burner ports are clear and pilot assembly is free of debris.
10. Reassemble in reverse order and be sure the heat exchanger baffles are replaced.
11. The gas and electric controls installed on the heater are engineered for both dependable operation and long life, but the proper functioning of these components is necessary for safe operation of the heater. It is strongly recommended that the basic items be checked by a competent serviceman every year and replaced when necessary. The basic controls are:
 - a. Water temperature controls.
 - b. Pilot safety system.
 - c. Automatic electric gas valve(s)
 - d. Flow switch.
12. Low water cutoffs should be inspected every six (6) months, when provided.

NOTE: The warranty does not cover any damage caused by lack of required maintenance or improper operating practices.

13. Pool Water Chemistry

Maintain the pool water chemistry in accordance with generally accepted principles in the swimming pool industry as stated by NSPI, the CDC or your local codes.

1. Symptom: heater is pounding, knocking or emitting steam from relief valve

Possible Cause	What to Do
A. Low or no water flow (most likely).	A. Is the heater wired into the filter pump circuit so that the heater cannot fire unless the pump is running? Check to see that all valves in system are open to be sure that water can circulate through the heater. Check pool filter, clean if clogged. Examine heater pump for clogged or frozen impeller. Check flow switch for proper operation and range setting.
B. Debris from system piping is blocking tubes.	B. Remove header covers. Examine all tubes and waterways. Clean out tubes. Use new gaskets when reassembling.
C. Scale has formed in tubes from high mineral content.	C. Clean tubes with tube cleaning kit. Determine hardness. Check water flow, and clean pool filter.

2. Symptom: heater will not fire

A. Heater not getting power.	A. Check to see that power switch is "ON." Use testing device to trace power to heater power source. Check fuse and secondary voltage in heater control.
B. Operating or safety control has opened circuit to electric gas valve.	B. Turn off power. Check continuity across terminals of each operating and safety control switch up to the electric gas valve. Replace defective control.
C. Pilot flame is out.	C. Relight pilot per instruction.
D. Manual reset device has tripped.	D. Reset pilot safety and all manual reset safety switches. Follow instructions for start-up.
E. No gas pressure to burners.	E. Trace gas line to service shutoff cock. If service cock is open, trace gas line to meter. If no pressure is present at meter, call for public utility service. If gas is present in heater inlet, check pressures in following sequence: (1) downstream from pressure regulator; (2) downstream from electric gas valve. Replace or adjust as necessary.
F. Electric gas valve operator is burned out or shorted.	F. Disconnect wiring harness at gas valve terminals. Check continuity of actuator coil. If open circuit or short is indicated, replace coil or operator.
G. Pump does not run.	G. Operate in manual. Check power to pump from relay. Check that pump/motor is free to rotate. Replace relay or motor as necessary.
H. Pump runs, but flow switch not closing.	H. Check continuity across flow switch. Inspect paddle for proper movement. Adjust flow range setting.
I. Field interlock open.	I. Jumper terminals and isolate problem in other equipment.

3. Symptom: pressure relief valve leaking intermittently or steadily

A. Faulty relief valve.	A. Replace with a new relief valve with proper setting (see rating plate).
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4. Symptom: soot in flueways or in tubes, or noxious fumes from bad combustion

A. Combustion air supply to heater room is inadequate.	A. Check air supply opening. Look for debris in screen or louver which covers combustion air opening, or for objects blocking the opening.
B. Stack or vent is blocked or restrictive.	B. Look for blocked stack and excessive number of elbows in stack or excessive length of horizontal runs.
C. Severe downdraft is causing spillage of flue products into room.	C. Check for (1) proper vent cap on stack; (2) adequate height of stack above roof; (3) equipment exhausting air from inside of building; and (4) proper installation of draft diverter.
D. Gas pressure to burners is excessive.	D. Check gas pressure with manometer, and adjust with heater firing at full rate.
E. Heater not fitted for the fuel supplied.	E. See nameplate for correct fuel.
F. Heater installed at high altitude without proper derating.	F. Installations at altitudes in excess of 2000 ft. above sea level are subject to jurisdiction of the local inspection authorities. Check orifice size, contact your dealer or factory for proper size.

5. Symptom: water dripping in firebox

A. Tube in heat exchanger has overheated and ruptured.	A. Tube failure is almost always caused by scale formation in the tube, or inadequate water flow through the heater.
B. Heater is condensing from low inlet temperature.	B. Check bypass valve adjustment.

The general recommendations include keeping the water chemistry stable within the following guidelines:

pH:	7.2 to 7.8
Free Available Chlorine:	2.0 - 4.0 ppm
Total Alkalinity:	80 - 120 ppm
Calcium Hardness:	200 - 400 ppm
Total Dissolved Solids:	< 1500 ppm

These values are important to maintaining the pool equipment in proper operating condition and preventing corrosion, liming or other problems. Proper pool water chemistry includes other values that must be maintained for swimmer safety. Refer to your local agency having jurisdiction, NSPI (National Spa and Pool Institute), the CDC (Centers for Disease Control), or the WHO (World Health Organization) for more information.

Section 5 Troubleshooting

For proper service and problem diagnosis of the heater and heater system, the following tools are required:

- a. Gas pressure test kit with range from zero to 14 W.C. Either a slack tube manometer or an accurate gas pressure gauge is acceptable with proper adapters to connect to the available fittings in the line and on the gas valve.
- b. Multi-meter with the following ranges:
 - 0 to 500 volts A.C.
 - 0 to 1000 ohms continuity
 - 0 to 50 millivolts
 - 0 to 20 microamps
- c. Tube cleaning kit consisting of reamer, stainless steel brush, speed handle and handle extensions.
- d. A pool thermometer with a proper range.
- e. A pressure gauge with proper range.

