



on. Decrease the pressure setting another 2 psi to complete the switch setting.

2. Test the setting by closing the manual gas valve and turning off the filter pump. Turn the thermostat to the high setting and slowly open the manual gas valve. The boiler should not try to fire when the filter pump is off.

If the boiler is installed more than three feet above the pool level, install an eyeball fitting on the end of the return line to the pool to create adequate back pressure that the boiler to operate the pressure flow safety switch. Never reduce the factory setting of the pressure switch. For special installation problems, consult the factory.

## SECTION 3. Operation

### 3A. Initial Start-Up

#### 3A-1. Initial Filter Cycle on a New Pool

On a newly constructed pool, be sure to run the filter pump long enough to completely "turn-over" the pool water before turning on the boiler. This will insure that any dirt and residue from the construction will be removed. The filter may clog rapidly during this period, causing the boiler to severely cycle if it is on.

#### 3A-2. Starting Instructions

1. Check the following installation details before proceeding:
  - a. Has the required air supply been provided?
  - b. Is the boiler properly vented?
2. Be sure the filter is clean.
3. Start the filter pump.
 

Before placing the boiler in operation, the automatic safety shutoff devices must be checked. Once the unit is connected to the gas piping and after all of the requirements in Section 2 have been met, follow this procedure:

  - a. Before beginning the tests, make sure the main manual gas valve, and any other firing valves are in the OFF position.
  - b. Make sure the power switch on the boiler is in the "ON" position. After placing the

manual pilot valves in the open position, and resetting all safety devices (high limit, pressure switch, Low-Water-Cutoff, etc.), pilots can be lit following the procedure located on the boiler rating plate.

- c. Once the pilots are lit and have been established for five minutes, the flame failure response time should be checked as follows:

**System 16:** (Electronically supervised standing pilot system standard on propane gas). Extinguish the pilot flame by placing the manual pilot valve in the closed position, and, at the same time, begin recording the time it takes for the output signal from the electronic ignition control to be interrupted. Refer to the electrical drawing supplied with the boiler for wiring details. The signal interruption can be detected either with a test light or a voltmeter. Because the ignition controls are in series, the control just upstream of the gas valves should be tested first. Under no circumstances should the response time exceed 5 seconds.

**System 18:** (Intermittent ignition supplied only for natural gas). With this system, pilots are automatically lit when the thermostat calls for heat. The pilots are permitted a trial period for ignition, then the system is locked out if it fails to light. To retry ignition, power to the boiler must be momentarily interrupted. After the pilot is initially lit, the trial for ignition time should be checked by turning off pilot gas, and, at the same time, monitoring the time it takes for the audible sparking at the pilot burner to stop. Under no circumstances should the trial for ignition exceed 15 seconds because electronic ignition controls are in series. The control just upstream of the gas valves should be tested first (refer to the electrical drawing supplied with the unit).

Once the trial for ignition period has been checked, the controls should be reset and the flame failure response time checked by following the procedure given for system 16.

4. With the pilots lit, initial activation of the main burners can be achieved by slowly opening the main manual valve. The result should be a smooth lighting of the main burners.

### 3A-3. Hi-Limit Checkout

After running the boiler for a long enough period to bring the water temperature within the range of the hi-limit, slowly back off the high limit setting until the unit shuts off. The main burners should re-ignite when the hi-limit is turned back up to its original setting.

The high limit should now be reset and the boiler run until it shuts off automatically on high limit.

Now that all tests of the safety shutoff devices have been completed, refer to Section 3B for the proper settings of temperature controls.

**NOTE:** Should any of the controls fail to function properly, consult the factory or your gas company representative.

### 3B. To Start Up System (See Section 3A for Initial Start Up)

#### Start up boiler:

1. Be certain system pump is running.
2. Lighting instructions are provided on the rating plate and in the User's Manual and are as follows:
  - a. Turn off main electrical switch.
  - b. Turn off all manual gas valves and wait five minutes.
  - c. Set aquastat or thermostat to lowest setting.
  - d. Turn manual pilot valve to "ON." For standing pilot system, press on pilot relay knob, light pilot and keep relay knob depressed for one minute then release. Once the pilot is lit, the power will be supplied to the gas valve(s) upon activation of the aquastat.
  - e. Slowly turn manual gas valve to "ON."
  - f. Reset all safety switches (manual reset high limit, low water cutoff, etc.).
  - g. Turn on main electric switch.
  - h. Set temperature controller (aquastat) to desired temperature. Pilot will light automatically (intermittent ignition pilot system) and ignite main burners whenever the aquastat calls for heat.
  - i. Adjust the pool aquastat as follows:

When the pool water has reached the desired temperature, as measured with an accurate thermometer, decrease the aquastat setting with a small screwdriver until the boiler shuts off. The pool boiler will maintain the existing pool water temperature automatically.

### 3C. To Turn Off Boiler

1. Turn off main electrical switch.
2. Close all manual gas valves.

### 3D. Spring and Fall Operation

When the pool is not going to be used for a long period of time, turn the aquastat down to approximately 70° F. This will prevent the pool and surrounding ground from becoming chilled, save on fuel costs, and also permit the pool water temperature to be raised back to swimming temperature in a shorter period of time.

The pool water temperature should not be maintained below 70° F. Colder water will cause condensation to form on the heat exchanger when the boiler does fire. Prolonged operation at a lower temperature will cause the boiler to foul externally. See "Improper Use of Boiler."

### 3E. Winter Operation

To shut down the boiler for longer periods, turn both the manual gas valve and pilot gas valve to OFF. Where the danger of freezing does not exist, the normal filter cycle should be continued all year long to circulate water through the system even when the boiler is turned off or shut down completely.

#### 3E-1. Draining Boiler Before Freezing

If the boiler is located where it will be exposed to freezing temperatures, it should be drained before the first frost. Drain the boiler by removing the drain plug on the bottom of the front header casting. Leave the plug out until time to use the boiler again. The boiler must be level for proper drainage. If compressed air is used to blow out the lines, it is still necessary to follow the same procedure. Keeping the pool heated by continuously running the boiler may not be adequate protection due to the possibility of a pump or power failure.

#### 3E-2. Improper Use of the Boiler

The Laars AP pool boiler is not designed for continuous use as an anti freezing device for pools.

Operating the boiler at water temperatures below 70° F will cause the heat exchanger fins to be partially blocked with condensation, resulting in incomplete combustion. Prolonged operation under these conditions will result in sooting of the heat exchanger which can seriously damage the boiler and cause a fire hazard.

### **3F. Time Clock Operation**

During the initial warm-up period, the boiler must run continuously. Therefore, remove all time clock stops until the pool water reaches a temperature of at least 70° F.

When resetting the time clocks, be sure to allow the filter pump and boiler enough time to maintain the pool water at the desired temperature.

### **3G. Spa (Hot Tub) Safety Rules**

Therapeutic pools, or “spa” pools, are usually piped and controlled so that very warm or hot water, often with air injection, is forced at high velocity into a confined area of a swimming pool or into a small, separate pool. Both the energy of the water and the heat furnish certain hydrotherapeutic benefits. These pools are excellent for relaxation, body-conditioning, and for arthritic and rheumatic problems, but can be hazardous. The Consumer Product Safety Commission has recommended the following “Safety Rules for Hot Tubs.”

1. Spa or hot tub water temperature should never exceed 104° F (40° C). A temperature of 100° F (38° C) is considered safe for a healthy adult. Special caution is suggested for young children.
2. Drinking of alcoholic beverages before or during spa or hot tub use can cause drowsiness which could lead to unconsciousness and subsequently result in drowning.
3. Pregnant women beware! Soaking in water above 102° F (39° C) can cause fetal damage during the first three months of pregnancy (resulting in the birth of a brain-damaged or deformed child). Pregnant women should stick to the 100° F (38° C) maximum rule.
4. Before entering the spa or hot tub, users should check the water temperature with an accurate thermometer; spa or hot tub thermostats may err in regulating water temperatures by as much as 4° F (2.2° C).
5. Persons with medical history of heart disease, circulatory problems, diabetes or blood pressure problems, diabetes or blood pressure problems should obtain their physician’s advice before using spas or hot tubs.
6. Persons taking medications which induce drowsiness, such as tranquilizers, antihistamines or anticoagulants, should not use spas or hot tubs.

### **3H. Periodic Service**

Inspect the heat exchanger tubes of the Model AP pool boiler on a regular basis. In most areas and under most operating conditions, the AP pool boiler will operate for years without accumulating any scale in the tubes. However, in some pools the mineral content of the water is such that completely scale-free operation is impossible. For this reason, the AP boiler was designed so that all of the internal wet surfaces can be easily inspected and, if necessary, cleaned. Simple cleaning tools are available from your dealer or the factory.

In order to establish a proper inspection schedule, the tubes should be inspected after the first sixty days of operation, and again after 120 days. From the appearance of the tubes, it will be possible to determine the best regular inspection schedule.

When pool equipment is located outdoors, a certain amount of dust and moisture can infiltrate the mechanical parts of the controls. After many years, this could cause deterioration. A regular service schedule will insure longer life and safe operation of the equipment.

### **3I. Pool Water Chemistry**

Due to natural evaporation, which only removes the water and leaves the minerals, the mineral content of pool water increases daily. Also, the regular addition of algaecidal and sanitizing chemicals substantially adds to the mineral content of the pool. If the mineral content of the pool is allowed to get too high, the minerals will precipitate out of the water and deposit on the walls of the pool, the filter, and the heat exchanger tubes. For this reason, it is important that the pool be completely drained regularly (at least every two years) to reduce the chance of expensive repairs to the pool, filter system and boiler.

It is also important to maintain the pH level of the pool water between 7.3 and 7.7 which can add years to the life of the pool finish, filter system and boiler.

Most algaecidal and sanitizing chemicals contain sodium hypochlorite, while others contain calcium hypochlorite. Sodium is not a scaling chemical, but calcium definitely is. So when chemicals are used which contain calcium, it is even more critical that the pH level of the pool water be maintained properly, and that the pool water be completely changed when the dissolved solids indicate an excessive mineral content.

## SECTION 4. Maintenance

- At start-up and every six (6) months thereafter, the pilot and main burner flame should be observed for proper performance (see Figures 9 and 10; see attached lighting and shutdown instructions for proper pilot flame pattern). If flame has the appearance of “sooting” tips, check for debris near orifices. Call service technician.

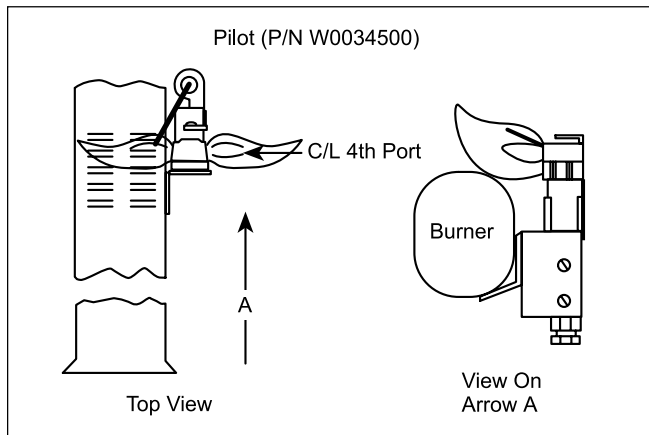


Figure 9. Pilot Location.

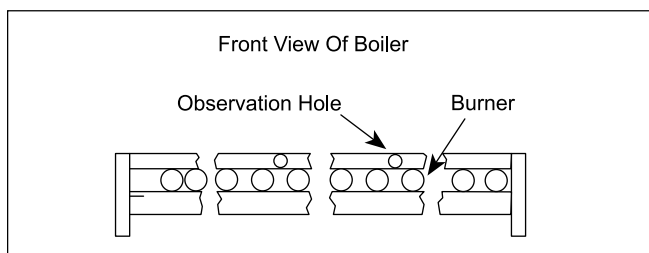


Figure 10. Periodic Flame Observation.

- Inspect the venting system for obstruction, leakage, and corrosion at least once a year.
- Keep boiler area clear and free from combustible material, gasoline and other flammable liquids and vapors. Boiler surfaces are hot and could ignite combustible materials.
- Be certain all combustion air and ventilation openings are unobstructed.
- 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). 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 panel as necessary to inspect from above. Also, check the vent system for defects at the same time.

- If cleaning is required, shut off all electrical and gas supply to the boiler.
- To expose the heat exchanger:
  - Remove top panel covers located at the base of the front and rear flue collector panels. Remove all but the top screws on each side of the front and rear flue collector panels. The panels can be swung outward and propped up to reveal the heat exchanger. Remove all heat exchanger baffles.
  - Remove all burners:

### **⚠ 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 a wet brush or fine water spray before servicing or cleaning the heat exchanger.

With a wire brush, remove soot and loose scale from the heat exchanger. Do not use water or compressed air for cleaning. Clean fallen debris from the bottom of the boiler. Check that burner ports are clear and pilot assembly is free of debris.

- Reassemble in reverse order:
    - Be sure to replace the heat exchanger baffles.
- The gas and electric controls installed on the boilers are designed for both dependable operation and long life. But the safety of this equipment depends completely on their proper functioning. It is strongly recommended that the basic items be checked by a competent service technician every year, and replaced when necessary. The basic controls are:
    - Water temperature controls.
    - Pilot safety system.
    - Automatic electric gas valve(s).
    - Water pressure switch.
    - Flow sensing safety device (when used).
  - Low water cutoffs should be inspected every six (6) months, including flushing or float types.
 

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

## Troubleshooting and Analysis of Service Problems

1. For proper service and problem diagnosis of the boiler and system, the following tools are required:
  - a. Gas pressure test kit with range from zero to 14" W.C. Either a slack tub manometer or an accurate gas pressure gauge is acceptable with proper adaptors which will connect to the available fittings in the line and on the gas valve.
  - b. Electric meter(s) with the following ranges:  
 0 to 500 volts A.C.  
 0 to 1000 ohms continuity.
  - c. Millivolt meter with the following ranges:  
 0 to 50 millivolts. 0 to 500 millivolts.  
 0 to 1000 millivolts.
  - d. Tube cleaning kit consisting of reamer, stainless steel brush, speed handle and handle extensions.
  - e. Accurate thermometer and pressure gauge.
2. In addition, the boiler should be equipped with a thermometer with proper ranges.

<b>Boiler Will Not Fire</b>	
<b>Possible Cause</b>	<b>What To Do</b>
Electric Power is off.	Check to see that main power switch is ON. Use testing device to trace power to boiler junction box.
Operating or safety control has opened circuit to electric gas valve.	Turn off power. Use continuity tester to check continuity across terminals of each operating and safety control switch up to the electric gas valve. Replace defective control.
Pilot flame is out.	Relight pilot per instructions.
Manual reset device has tripped.	Follow instructions for start-up. Reset pilot safety and all manual reset safety switches.
No gas pressure to burners.	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.
Electric gas valve operator is burned out or shortened.	Disconnect wiring harness at gas valve terminals. Check continuity to actuator coil. If open circuit or short is indicated, replace coil or operator.

<b>Boiler is Pounding, Knocking, or Emitting Steam from Relief Valves</b>	
<b>Possible Cause</b>	<b>What To Do</b>
Lower or no water flow.	This condition is usually caused by lack of adequate water flow through heater. check the following: 1. Is the heater wired into the pump circuit so that the heater cannot fire unless the pump is running? 2. Check to see that all valves in system are open to be sure that water can circulate through the heater and the system. 3. Examine pump for clogged impeller. 4. Check water filter.
Debris from system is blocking tubes.	Remove header covers. Examine all tubes and waterways. Use new gaskets when reassembling. Clean out tubes.
Scale has formed in tubes.	This is always caused by heavy mineral content of the water or clogged filter. Check the water chemistry. Replace the filter and clean all the internal wet surfaces.

<b>Soot in Flueways or in Tubes, or Noxious Fumes Indicative of Bad Combustion</b>	
<b>Possible Cause</b>	<b>What To Do</b>
Combustion air supply to equipment room is inadequate.	Check air supply opening. Look for debris in screen or louvre which covers combustion air opening, or for material blocking the opening.
Stack or vent is blocked or restrictive.	Look for blocked stack and excessive number of elbows in stack or excessive length of horizontal runs.
Severe down draft is causing spillage of flue products into room.	Check for (1) proper vent cap on stack; (2) adequate height of stack above roof; (3) equipment exhausting air from inside of building.
Gas pressure to burners is excessive.	Check gas pressure with manometer, and adjust with heater firing at full rate.
Heater not fitted for the fuel being supplied.	See nameplate for correct fuel.
Heater installed at high altitude without proper derating.	Installations at altitudes in excess of 2000 ft. above sea level are subject to jurisdiction of the local inspection authorities. Check with the factory.

<b>Water Dripping in Firebox</b>	
<b>Possible Cause</b>	<b>What To Do</b>
Tube in heat exchanger has overheated and ruptured.	A tube failure is almost always caused by: (a) Scale formation in the tube, or: (b) inadequate water flow through the boiler. Replace heat exchanger tube(s) and check for proper flow.