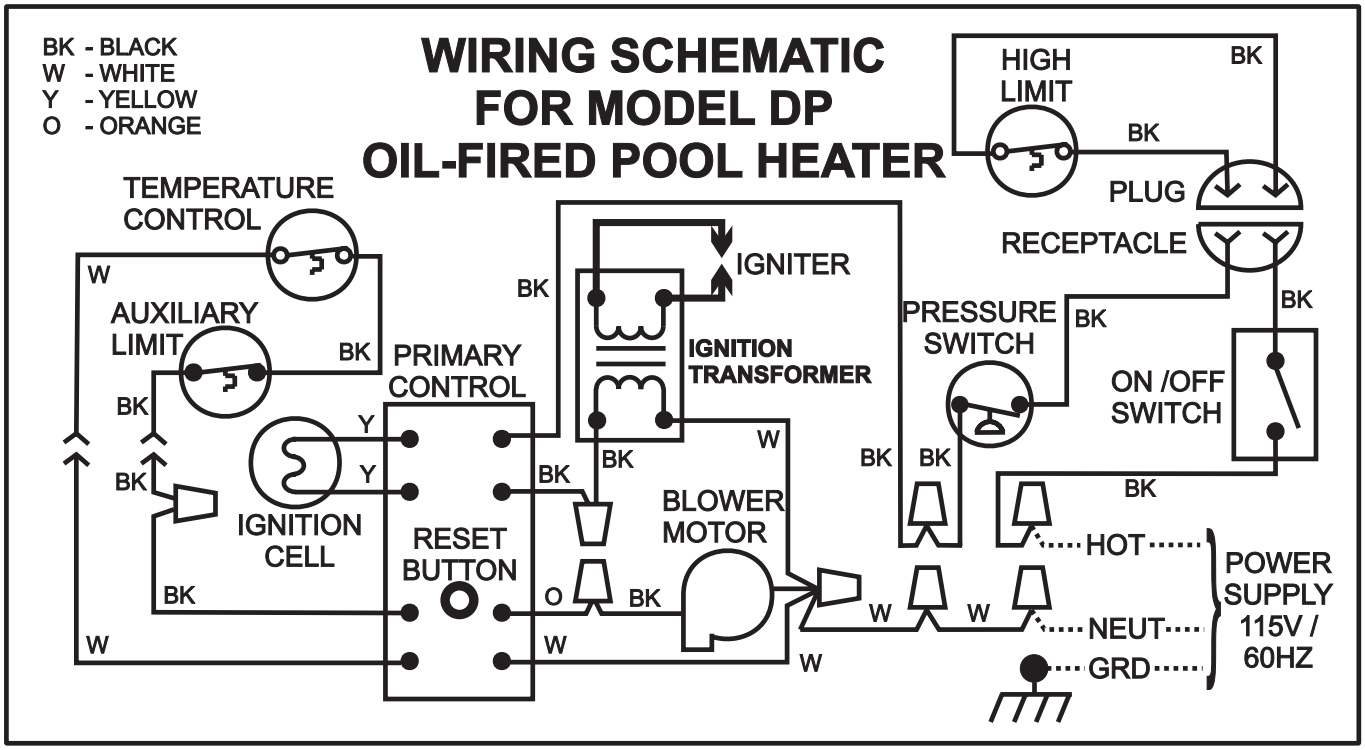

Figure 14. Wiring Diagram, 60 Hz Model.

SECTION 7.
Operating Instructions

7.1 Normal Operation

The XL-3 heater is capable of automatic operation based on a call for heat at preset temperatures. The heater has an internal safety system which allows operation in a variety of conditions and prevents operation when certain adverse conditions are encountered.

When the heater is powered, water is flowing through the heater, and the temperature of the water entering the heater is below the temperature control setting, an operating cycle is initiated by the automatic control. The ignition cell will energize, the burner motor will start and fuel will be forced through the nozzle into the firebox where it is ignited. Operation will continue until the temperature of the water entering the heater reaches the temperature control setting.

If ignition is unsuccessful, or if the flame fails during normal operation, the ignition control shuts off the motor. Subsequent cycles are initiated after the reset button on the ignition control is pushed.

When every part of the system is working properly, the heater will go through the following detailed sequence:

1. When the filter pump builds up enough pressure in the piping, the contacts in the heater pressure switch close.
2. The heater thermostat calls for heat completing the circuit between the two thermostat terminals on the primary control of the oil burner.
3. The primary safety control on the oil burner goes through a self-test sequence. One of the steps in the sequence is to check out the cadmium cell flame detector. If the cad cell senses light, the burner will not fire. If everything checks out, the burner motor and ignition transformer are powered. The ignition transformer operates during the entire burner operation.
4. If the cad cell does not sense a good flame within 30 seconds the primary control de-energizes the motor and ignition transformer. This turns off the heater. It can be manually restarted by pushing the reset button after waiting about one minute.
5. During the period when the filter pump is running, which is set by the time clock, the thermostat will turn the burner on and off as required to maintain the water temperature set on the thermostat.
6. If a time clock is used, the contacts in the Fireman switch open about 20 minutes before the pool filter cycle is completed. This shuts off the oil burner. The oil burner cannot be restarted during this period. The filter pump continues to run for another 20 minutes, transferring any heat stored in the firebox to the pool.

7.2 Start-up

⚠CAUTION

Vent pipes, and heater tops get hot! These surfaces can cause serious burns. Do not touch these surfaces while the heater is in operation.

⚠CAUTION

Do not use this heater if any part has been under water. Immediately call a qualified service technician to inspect the heater and replace any part of the control system and any fuel control which has been under water.

⚠CAUTION

Should overheating occur or the fuel supply fail to shut off, turn off the manual shut-off valve at the storage tank.

⚠CAUTION

Do not attempt repairs on the fuel controls or appliance. Tampering is dangerous and voids all warranties.

Be sure that there is water in the pool and that the surface level is above the skimmer or other inlet of the pool's filter system.

Confirm that pool water is flowing normally through the pool system and equipment. With any new pool or spa installation, operate the filter pump with the heater off long enough to completely clean the water. This will remove any installation residue from the water. Clean the filter at the end of this operation, before starting the heater.

⚠WARNING

Inspect the firebox after installation and after prolonged periods of non use. Do not try to light the burner if the firebox shows any signs of damage or deterioration. Call your service technician.

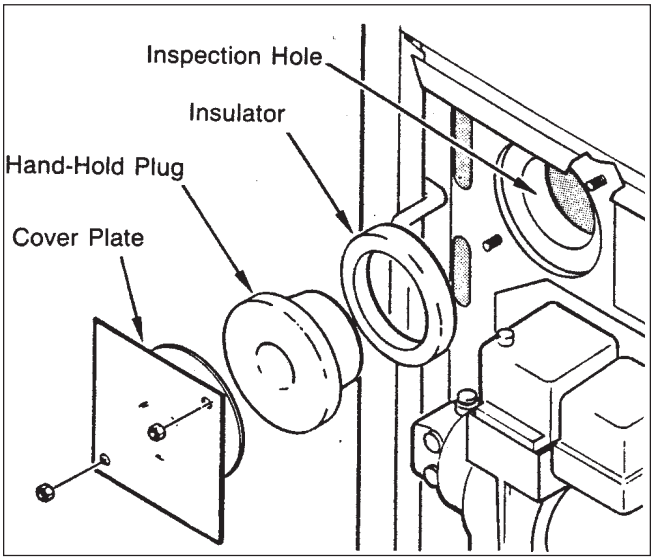

Figure 15. Inspection Hole Location.

Each heater is fully inspected and tested before it leaves the factory. However, rough handling may cause damage to the firebox during shipping. At initial start-up and at start-up after a prolonged period of non use, inspect the firebox for damage or deterioration. Remove the cover plate and plug from the inspection hole (see Figure 15). Use a mechanic's mirror to inspect the inside of the firebox. If the firebox shows cracks or deterioration, do not attempt to start the heater. Immediately call your service technician.

Start the heater in accordance with the Operating Instructions section of this manual, with particular attention to the lighting instructions and temperature control operation.

To start the heater, be sure the pump is running and move the lever of the ON/OFF switch to the on position (see Figure 16). The heater may not start on the first try. Air in the fuel line (see Section 7.4) or other start-up situations may cause it to cycle. To provide additional attempts, push the reset button on the ignition control.

When the heater starts, immediately feel the outlet header of the heater to confirm that there is adequate water flow. The header should not be hot. Normally, water temperature will rise only a few degrees as it passes through the heater, and a "hot" header or pipe indicates low water flow.

⚠WARNING

When the heater is fired for the first time, the combustion chamber refractory binder material is driven out by the heat of the flame. White smoke and/or sharp odors may be emitted from the vent during this period. Do not inhale combustion product fumes at any time, and especially when these fumes are being emitted. This "burn-in" period may last an hour or more.

Figure 16. Heater's ON/OFF switch in OFF position.

Figure 17. Heater's Temperature control.

When raising the temperature of a cold pool, program the time clock to turn the pump off 23 hours after the start time (i.e. If the start time is 2:00 PM, then set the stop time at 1:00 PM.). This lets the filter system and heater operate continuously until the water reaches the temperature setting on the temperature control. When that happens, the heater will automatically shut off, but the filter pump will continue running.

7.3 Temperature Control

The XL-3 heater has an ON/OFF switch located on the right side of the heater (see Figure 16). This switch must be in the ON position for the heater to operate.

There is a temperature control located just above the inlet/outlet header (see Figure 17). The temperature control has a thermostat that will sense the temperature of the water entering the heater and will automatically turn the heater off when the water has reached the temperature set by the control knob. The control is not calibrated to show actual temperature settings. The water in the pool must be monitored with an accurate pool thermometer. When the water in the pool reaches the desired temperature, slowly turn the knob on the temperature control counterclockwise until the burner shuts off.

Important: The temperature controls cannot be calibrated in the field. If the control is faulty, shut down the heater, turn off the fuel supply and have a qualified service technician replace the control.

7.4 Lighting the Heater

Before starting the oil burner, check the wiring to make sure there are no loose connections. Check all fuel line connections for tightness. Open the fuel shutoff valves at the heater and the tank.

⚠Caution

Do not try to light the burner if excessive oil has accumulated in the firebox, or when the heater is full of vapors.

ONLY A QUALIFIED SERVICE TECHNICIAN MUST START THE OIL BURNER FOR THE FIRST TIME AND AFTER A PROLONGED PERIOD OF NON USE.

Check the operation of the burner. Make sure of the proper air adjustment. The air shutter is factory set for 12% $C0_2$, but verify this after installation. When starting the heater, follow these steps:

1. Start the filter pump. Let it run for about five minutes to free any trapped air.
2. Set the thermostat well above the pool water temperature.
3. Turn the heater switch to the ON position. If the burner motor does not start immediately, reset the manual overload switches on the motor and primary control. If the motor runs but the burner fails to light, it may be necessary to bleed air from the fuel line.
4. When the heater is attached to a two-pipe system, the fuel pump will automatically vent air out of the fuel lines. If there is a lot of air, the primary control may shut the burner down before all the air has been purged. If this happens, wait 2 minutes, then press the reset button on the primary control. Repeat this procedure until all the air has been vented and the unit fires properly (see NOTE below). If a one-pipe system is used, it must be thoroughly purged of air using the vent plug on the oil pump. See the instructions included in the bag attached to the oil pump for more details.
5. On initial start-up and at the start-up after a prolonged period of non use such as the beginning of a new pool season also do the following.

   Check the initial air adjustment (see Fig. 18). Normally, the bulk air band (A) and the end air shutter (B) should be partially open. It is factory set for both indoor and outdoor installations, but check it again after completing the installation by measuring the $C0_2$, It should be 12% $C0_2$ with zero smoke. Set a barometric draft control to give .02" to .03" W.C. draft below the draft control when the heater is installed indoors.

IMPORTANT: If there is no ignition after three reset attempts, stop. Check for accumulated oil in the firebox. Remove all unburned oil with dry rags before continuing the restart procedure. If there is no oil accumulated, try three more resets. If there is still no ignition, have a qualified oil service technician bleed the fuel line and check for ignition problems.

When the heater does fire, oil which is in the firebox will cause considerable smoke as it burns off.

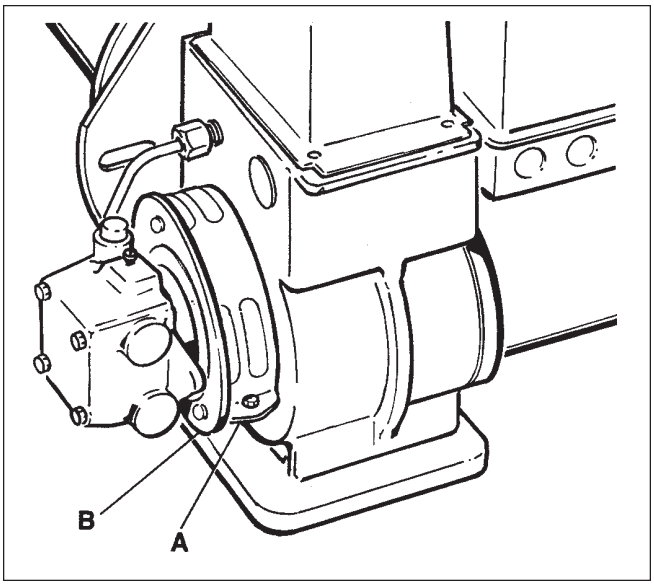

Figure 18. Initial Air Adjustment.

6. Set the thermostat to the desired temperature. Until the pool water reaches a temperature of approximately 70°F (21°C), there may be condensate on the heat exchanger. This will stop after the water reaches the right temperature.

If the heater is installed in an enclosed area, keep all doors and windows open during the first two hours of operation. After a long shutdown, there may be some smoke-like emissions from the heater when it is first fired. This condition will only last a few minutes.

7.5. Setting the Time Clock

The most economical and trouble-free way of operating a pool heater and filter system is to include a time clock in the system for automatic cycling.

Adjust the stops on the time clock to provide a single filter cycle every 24 hours.

The ON cycle should be at least 12 hours to allow the filter system to properly clean the pool. Set the ON cycle at least 4 to 6 hours before the pool is to be used. During cold spells, the heater may have to be on longer to maintain the proper pool temperature.

Remove all stops on the time clock during these periods.

IMPORTANT: Run the heater continuously during the initial warm-up period by removing all time clock stops. If the pool temperature is going to be maintained on standby temperature, operate the filter pump until the water temperature reaches 70°F (21°C). If the pool is going to be used for swimming, bring the water up to swimming temperature before replacing the time clock stops.

When the water reaches the temperature level on the thermostat, the heater will turn off automatically, but the filter pump will continue to run for about 20 minutes.

7.6 Adjusting the Water Pressure Switch

⚠ CAUTION

The water pressure switch should be adjusted to turn the heater off when the pump is off. Setting the switch to close at too low of a flow can damage the appliance. Adjust the switch to turn the heater off, not on.

The pressure switch is preset at the factory for activation at 2 psi (14 kPa). However, it is adjustable in the range of 0.5 psi to 15 psi. Adjust the pressure switch **only** if any part of the filter system piping or water level of the pool is 3 feet (0.91 m) or more above or below the top of the heater jacket.

Do not adjust the pressure switch if the heater is installed more than 15 feet (4.57 m) below or 6 feet (1.83 m) above the pool surface. Consult your local Jandy representative for recommendations.

On some installations, the piping from the heater to the pool is very short. The back pressure could be too low to trigger the pressure switch. If this happens, it may be necessary to install a directional fitting or elbows where the return line enters the pool. This will increase back pressure enough for the heater to operate properly.

Make sure the pool filter is clean before making any pressure switch adjustment: A dirty filter will restrict the water flow and the pressure switch cannot be adjusted properly.

To adjust the pressure switch, proceed as follows:

1. Set the heater control to the "OFF" position.

2. Start the filter pump and confirm by means of an meter that the pressure switch closes. If the switch fails to close call your Jandy representative or the Jandy Pool Products, Inc. Technical Service Department at 707.776.8200 extension 260.

3. Turn the thermostat to the maximum setting and set the heater control to the 'ON' position. The heater should start.

4. Turn the thumb wheel on the pressure switch very slowly clockwise until the heater goes off.

5. Slowly turn the pressure switch thumb wheel **counterclockwise** one-quarter turn. The heater should come back on.

6. Check the adjustment by turning the filter pump OFF. The heater's burner should shut off immediately. If it does not, restart the filter pump and repeat Steps 5 and 6. Check the adjustment again.

7. Return the pool temperature control to the desired temperature.

It may be necessary to repeat these steps to get a proper setting. The switch must be set so that the heater will not fire unless the pump is running. If a proper setting cannot be reached, contact the factory service department.

7.7 Temperature Rise

The XL-3 pool and spa heater has an internal bypass which accommodates a wide range of water flow. The bypass assures constant heat exchanger flow even though flow through the filter system will vary depending on how dirty the filter is.

For most installations, an external bypass valve is not needed in the heater water piping. This is due to the large size of the heater's internal bypass valve. If the pump flow rate is known to significantly exceed 60 gpm (3.8 l/s), an external bypass will be needed to assure proper heater operation.

Water flow should be confirmed upon start-up of the heater and in most servicing situations. If the flow is not normal, corrections must be made to the pool system. Flow is evaluated by determining the water temperature rise through the heat exchanger.

Before checking the temperature rise, make sure that the pool filter is clean. If necessary, clean all components of the filter system. Temperature rise is measured in the outlet of the far-right tubes when facing the inlet/outlet water heater. To measure the temperature rise, turn off the filter pump and remove the 1/4" brass plug to the right of, and just below the level of the outlet water pipe. This is mounted flush with the heater jacket (see Figure 19). With the plug removed, install the special thread adapter and "Pete's" plug fitting and insert a pocket thermometer. A temperature rise measurement kit is available through your Jandy distributor. See section 10 of this manual for the correct kit number.

Use the following procedure to adjust the external bypass valve to assure proper water flow through the heat exchanger.

1. Clean the filter.
2. Install a thermometer in the 1/4" NPT threaded opening in the front header casting as shown in Figure 19.
3 Close the manual bypass valve.
4. Set the heater's control to the "OFF" position.
5. Start the filter pump.

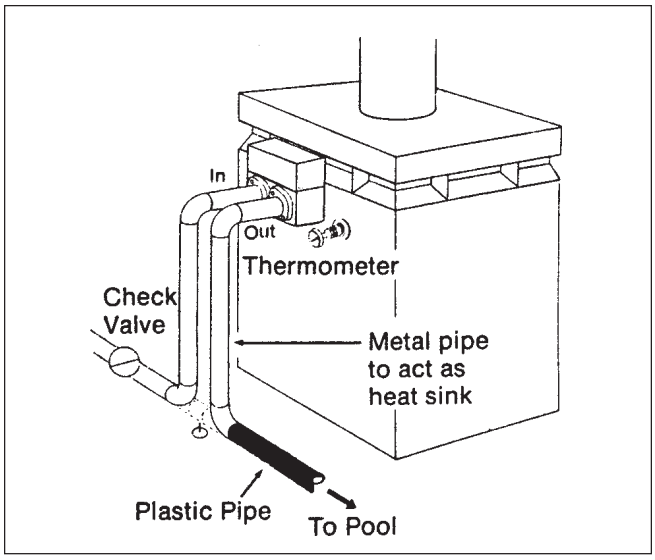

Figure 19. Thermometer Placement.

6. After three minutes, note and record the thermometer reading. This is the pool water temperature.
7. Start the heater by setting the control to the "ON" position and set the thermostat high enough to call for heat. Allow the heater to operate for five minutes or more. Note and record the thermometer reading. Subtract pool water temperature from this reading. This difference is the temperature rise. If your measured temperature rise is within the range of 16° to 20°F (8.9° to 11.1°C), skip step 8.
8. Gradually open the manual bypass valve until the temperature rise falls within the range of 16° to 20°F (8.9° to 11.1°C)
9. After obtaining the correct temperature rise, scribe a line on the bypass shaft and case to mark the correct adjustment position. Wire or remove the valve handle to prevent tampering.

If temperature rise is too high, there is inadequate flow, possibly requiring a change to the piping system or a larger pump. Before proceeding with any changes, verify proper heater operation. A problem with the heater's internal bypass assembly will effect measured temperature rise.

SECTION 8. Maintenance

8.1 Water Chemistry

The mineral content of swimming pool water increases daily due to natural evaporation and the addition of sanitizing chemicals. If the mineral concentration in the pool gets too high, the excess minerals will deposit on the walls of the pool, in the filter system, and in the heater tubes.

The proper chemical balance in spa water is more critical than in a swimming pool heater operation. Due to the spa's size, high water temperature and heavy usage, chemical values in a spa can vary greatly. This chemical imbalance can result in unsanitary water conditions, and affect the life of the heater.

Proper chemical balances are necessary for sanitary bathing conditions as well as ensuring your heater's long life. Kits are available from your local pool supply dealer for making the various test for mineral content. One of these kits will detect copper in the system. The is usually a warning that corrosion is taking place, possibly due to a low pH value combined with other chemistry problems. The condition can be corrected by changing the spa water and closely monitoring the pH factor and chemical properties of the water. Be sure to keep your chemical levels within the values indicated in Table 4. **Jandy Pool Products, Inc. does not warrant heat exchangers damaged by corrosive chemical levels or excess dissolved solids in pool or spa water.**

For spas, it is also necessary to perform water changes in addition to chemical treatment. It is recommended to change the spa water every 60 days for light usage and every 30 days if usage is heavy.

Table 4. Chemical Concentration Levels

Test	Recommended Level
Free Chlorine or	1.0 to 3.0 ppm
Bromine	2.0 to 4.0 ppm
pH	7.2 to 7.6
Total Alkalinity (TA)	80 to 120 ppm
Calcium Hardness (CH)	200 to 400 ppm
Langelier Saturation Index (SI)	-0.5 to +0.5
Cyanuric Acid	30 to 150 ppm
Total Dissolved Solids (TDS)	Less than 2000 ppm
Copper	0 ppm

8.2 Seasonal Care

⚠CAUTION
Do not operate this heater outdoors at temperatures below 32 degrees Fahrenheit (°F) (0 degrees Celsius [°C]).

8.2.1 Spring and Fall Operation

During periods when the pool is only going to be used occasionally, set the control temperatures to the lowest setting possible. See Section 7.3. This prevents the pool water from becoming chilled, and minimizes the time required to raise the pool water back up to the desired temperature.

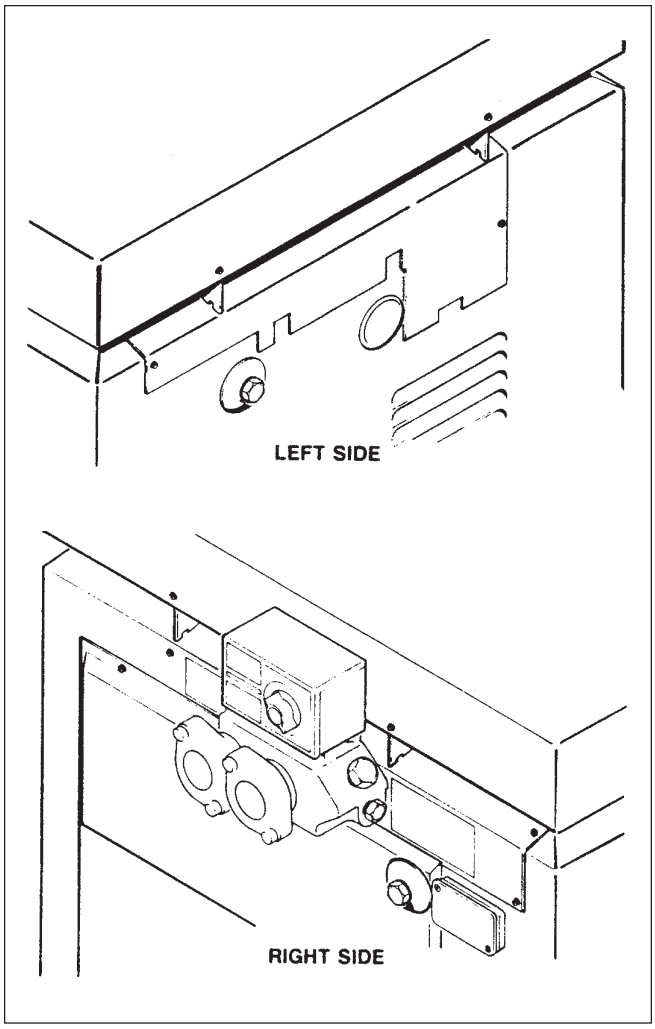

Figure 20. Heater Drains.

If the heater is not going to be used for a long period of time, shut it down completely by turning off the main switch on the right side of the heater.

8.2.2 Winterizing

The heater could be seriously damaged by freezing temperatures if it is not properly drained. Evidence of improper winterizing will void the warranty

In areas where freezing temperatures occur in winter and the pool or spa will not be used, have your service technician perform the following steps:

1. Turn off the main fuel supply to the heater, using the shut off valve in the supply line at the storage tank.
2. Remove heater door.
3. Turn off the heater at the main switch on the right side of the heater. If the heater is on it's own circuit breaker, it is a good idea to switch the breaker off.

4. Remove both drain plugs from the heater. One is located on the right side of the inlet/outlet header (see Figure 20), The other is located on the left side of the heater in the return header. Completely drain the heater before the first frost.

5. After all water has drained from the heater, check for mineral buildup in the openings.

6. Use compressed air to blow out any standing water remaining in the heat exchanger.

7. Grease the threads on both drain plugs and ports and place the drain plugs in a safe place for the winter. Do not reinstall the drain plugs until the heater is to be started again.

8. Remove the siphon loop cover from the right side of the heater.

9. Remove the compression nut attaching the siphon loop tube to the pressure switch near the front of the heater.

10. Allow the siphon loop to drain.

NOTE: The XL-3 heater is not designed for continuous use to combat freezing temperatures. Keep the temperature at a minimum 70°F (21°C) or shut the heater down completely.

Operating the heater for long periods at or near freezing water temperature can seriously damage the heater, and may create a dangerous condition by fouling the external heat exchanger passages, causing incomplete combustion. Even with water flowing through the system, ice may build up in the pipes, restricting the flow of the water to the heater and damaging the heat exchanger.

8.2.3 Spring Start-up

To restart the heater in the spring, have a qualified professional technician reassemble the heater as follows:

1. Fill the siphon loop with approximately 5cc of SAE 50, non-detergent oil. Attach the copper tubing to the pressure switch.

2. Install the drain plugs in the ports on both headers.

3. Make sure that power is supplied to the pump. Turn on the filter pump and circulate water through the heater for 5 minutes. Check for leaks while circulating.

4. Turn on the main fuel supply to the heater at the shut off valve near the storage tank.

5. If a circuit breaker was switched off during the winter, be sure that the breaker is back on.

6. Turn on the heater following the start-up instructions in this manual (see Section 7.2).

8.3 Inspection and Service

Jandy Pool Products, Inc. designs and constructs the XL-3 heater to provide long performance life when installed and operated properly under normal conditions. Periodic inspections, especially at spring start-up, are important to keep your heater running safely and efficiently through the years.

⚠ WARNING

Improper installation or maintenance can cause nausea or asphyxiation from carbon monoxide in flue gases which could result in severe injury, or death.

8.3.1 Owner Inspection and Maintenance

Jandy Pool Products, Inc. recommends that you inspect the heater on a continual basis and especially after abnormal weather conditions. The following basic guidelines are suggested for your inspection:

1. Keep the top and surrounding area of the heater clear of all debris.

2. Keep the area around and beneath the heater clean and free of all combustible materials such as paper, leaves, etc.

3. Do not store or use gasoline or other flammable vapors, liquids or chemicals in the vicinity of this or any other appliance.

4. Do not use this heater if any part has been under water. Immediately call a qualified service technician to inspect the heater and replace any part of the control system, firebox and any fuel control which has been under water.

5. If the heater is equipped with a pressure relief valve, check for corrosion in and around the valve. Twice a year, with the filter pump on, lift the release lever on the top of the valve to make sure that water runs freely through it. If corrosion is found, replace the pressure relief valve. When replacing the valve, be sure that the pump is off. Install the valve so that the discharge is directed away from any area that may be damaged by water.

6. Be sure all combustion air and ventilation openings are not blocked. Check for spider webs and other debris in the air band, end air shutter and in the exhaust outlet– especially after a long period of nonuse.

7. Visually inspect the firebox for damage and deterioration.

NOTE: Keep this manual in a safe place for future reference by you and your professional technician when inspecting and servicing the heater.

8.3.2 Professional Inspection and Maintenance

Inspections performed at least once a year by a qualified technician are required to maintain your heater's safe and efficient operation. The following basic safety checks must be performed.

1. Check for loose or broken wires and terminal connections.
2. Make sure that the pressure switch operates properly by shutting the filter pump off and on a few times. The burner should go off immediately after the pump stops. An ignition sequence should start shortly after the pump is turned back on.
3. Inspect the electrical controls, specifically the following:
   a. High limit controls.
   b. Water pressure switch.
   c. Fuel burner operation.
   d. Temperature control.
   e. Control circuit fuse.
   f. Ignition control.
   g. Cad cell.
4. Inspect the venting system for blockage, leakage, and corrosion.
5. Replace the in-line oil filter cartridge once a year.
6. Check for spider webs or other obstructions in the air shutters and bands – especially at Spring start-up. Clean with wire brush if necessary.
7. Conduct a normal operating cycle and observe that the sequence proceeds as intended.
8. If the heater is equipped with a pressure relief valve, clean any accumulated corrosion and make sure that water runs freely.
9. Inspect the inside of the firebox and burner for deterioration and indication of improper operation.
10. Perform a temperature rise test in accordance with Section 7.7 of this manual.
11. Regularly inspect electrical controls for deterioration. Repair and replace as necessary.
12. Clean the heat exchanger using the following schedule:

    After installation and first start-up, check the heat exchanger for black carbon soot buildup after the following periods of operation: 24 hours, 7 days, 30 days, 90 days and once every 6 months thereafter, preferably at the end of the swimming season.

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

⚠Caution
Be careful to avoid damaging the firebox material when cleaning the heat exchanger or inspecting the heater. Keep water out of the firebox. Be sure to replace the gasket, inspection plug and retainer when the cleaning or inspection is complete.

Clean the heat exchanger as follows:

a. Remove the heater top assembly and flue collector.
b. Remove the inspection hole cover (see Fig. 15).
c. Remove the “V’ baffles (the retaining wire does not have to be replaced)
d. Use an ordinary kitchen brush to brush across the top of the heat exchanger between the tube fins.
e. Use a bottle brush to brush down between the tube fins toward the firebox.

The ash can be softened for easier removal by lightly dampening with a wet brush. Do not let water get in the firebox. **DO NOT** use a water hose to clean the heat exchanger while it is still installed in the heater. Water will damage the firebox material.

f. Reach through the inspection hole and brush across the bottom of the tube fins using the kitchen brush.
g. Carefully remove all dirt and soot from the firebox by inserting a vacuum cleaner nozzle through the inspection hole.
h. Replace the flue collector and top assembly.

For more thorough cleaning, remove the heat exchanger completely and wash it with a garden hose.

13. Replace the oil nozzle once each season (see the oil burner manual).
14. Oil the burner motor every three months. Use non- detergent #40 motor oil at both oil holes.

SECTION 9. Troubleshooting

9.1 Home Owner Heater Troubleshooting

Problems which may come up with the pool heater operation or performance will require a trained, professional technician. There are a few preliminary symptoms the pool owner should check before calling a technician:

9.1.1 Oil Burner Does Not Fire

1. Is the pool temperature control set high enough to call for heat?
2. Is the pool heater switch ON? Are all circuit fuses and remote switches ON?
3. Is the pool filter clean?
4. Is there enough fuel in the tank? Is the fuel valve turned ON?

If the answer to all of these questions is yes, try the manual overload reset switches on the burner motor and primary control. If burner does not fire, turn the heater switch OFF then ON, and try the reset switches again. If the burner still refuses to fire, call the service technician.

9.1.2 Heater Does Not Maintain the Desired Water Temperature

1. Is the temperature control set high enough?
2. Is the filter cycle setting on the time clock long enough to permit the heater to raise the temperature?
3. Is the heater the right size for the pool?

If these conditions are satisfactory, the heat exchanger could be fouled, or the heater controls may not be functioning properly. Call a service technician.

9.1.3 Burner Operates, But There is Smoke or Pulsating Combustion

This is usually caused by improper combustion adjustment, fouled heat exchanger or a fuel supply problem. Call a service technician.

9.1.4 Pool Water Overheating

Turn the heater switch OFF and call a service technician.

9.2 Professional Troubleshooting Guide

9.2.1 Introduction

A qualified oil burner technician must service this equipment. Frequently, this service is available through the fuel oil supplier.

⚠WARNING
Some of these procedures involve exposing the line voltage circuit. There is considerable danger of electric shock.

The XL-3 is an oil-fired pool heater designed to burn No. 2 fuel oil or No. 2 diesel fuel. Do not use other fuels. The burner assembly comes standard with a two-stage pump. This allows the heater to be installed a relatively long distance from the fuel tank.

9.2.2 Initial Checks

1 . Is the oil burner connected to a one- or two-pipe system? All units are factory set for one-pipe systems. To convert a unit to a two-pipe system, a bypass plug must be installed in the fuel pump. The plug is supplied with the oil burner. There is a decal located on the fuel pump showing where the bypass plug goes.

   If a fuel unit is set up for a two-pipe system, but is actually connected to a one-pipe system, the pressure in the fuel pump builds up to over 300 psi when the burner turns on. This will cause the motor to bind and stop running or ruin the pump seals, or both.

2. An oil filter must be installed on the inlet line. A very small amount of dirt in the oil can plug the nozzle. A properly sized oil filter is shipped with the heater (see Figure 8).
3. Is there oil in the storage tank?
4. Are all of the shut-off valves on the oil lines open?
5. Are the fuel lines adequately sized according to the Table 3 on page 10?
6. Are there any leaks in the fuel line? A very small leak can cause the fuel pump to suck air into the system, resulting in failure to operate or a pulsating, noisy fire.
7. Is the unit properly grounded electrically? This is extremely important. Use of PVC piping in the pool filter system prevents grounding through the piping.

8. If a time clock is installed, is there power to the timer? Is the timer motor working? There is usually a visual motor check opening on the timer mechanism. Is the switch located below the timer dial "ON"?
9. Are there any loose wires or terminals?
10. Is the pool filter clean, and is the pump operating properly?

9.2.3 Troubleshooting

NOTE: These troubleshooting procedures require connections to electrical terminals and jumper wires to check operation. To avoid electrical shock, turn off electric power before servicing line voltage controls. Never leave a jumper wire in place to fix a heater. This would bypass safety and operating controls. See Figure 21 for burner parts identification.

9.2.3.1 Burner will not start (motor and transformer do not come on)

1. Is there power to the heater? Have you checked the reset buttons on the motor and primary control?
2. Place a jumper wire across the two terminals on the cad cell. If the burner starts, the problem is in the heater control circuit. This circuit consists of the pressure switch, high limit control, safety switch, thermostat, time clock switch (if one is installed) or the wire harness. Check the wire harness for any loose wires or worn insulation. Then jumper each control until the problem is located.
3. Press the reset button on the primary control. If the unit does not start, go to step 5. If the unit starts, turn off the power and check the following items that can lock out the primary control:

    a. Dirty or defective cad cell.
    b. Defective primary control.
    c. Oil level in tank too low or water in the tank.
    d. Poor combustion caused by:
        Fouled nozzle
        Fuel line air leaks
        Improper nozzle pressure (pressure should be 100 psi)
        Improper air setting (see Section 9.2.3.4)

4. Press the reset button on the motor. If the unit does not start, go to step 5. If the unit starts, shut off power and check the blower wheel and flexible coupling between the motor and the fuel pump. Make sure the blower wheel and fuel unit are not binding. Make sure the return fuel line is not restricted.

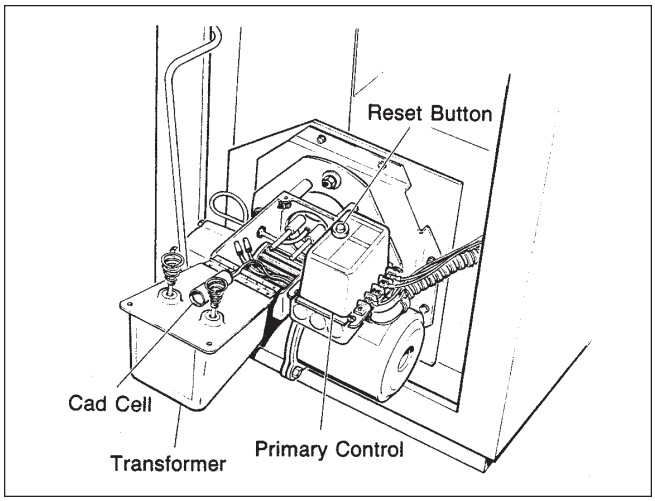

Figure 21. Cad Cell and Primary Control.

5. Remove one cad cell wire from the primary control. If the burner starts, replace the cad cell.
6. Turn off electric power to the heater. Short out the high limit switch, in the high voltage circuit. If the burner starts when power is restored, the switch is faulty.
7. Turn off electric power and inspect the wiring below the primary control and the ignition transformer. Make sure there are no loose connections.
8. If the wiring is okay, and the blower wheel rotates freely, replace the primary control.

9.2.3.2 Burner Tries to Start, but the Primary Control Shuts Off (either motor or transformer or both come on)

1. Is the burner motor turning? If yes, go to next step.
2. Press the reset buttons on the motor and primary control. If the motor does not start, but transformer is providing spark at the electrodes, go to step 3.
3. Lift the ignition transformer and make sure the motor rotates freely. If it does not rotate freely, replace the motor. If the motor is internally binding, replace the motor.
4. Open the inspection port and use a mirror to check combustion. If there is no ignition before the primary control shuts the burner down, go to step 6. If the burner does ignite with a good flame, go to step 5. If the burner tries to ignite, but the flame is intermittent, go to step 8.
5. Check the cad cell and primary control.

6. Lift up the ignition transformer and put tape over the front of the cad cell (the burner will not start unless the cad cell senses no light). Disconnect the black lead going to the motor. Press the primary control reset button. Use an insulated screwdriver to touch the metal blade to one spring contact on the transformer, and about 3/8" away from the other spring contact. If there is good spark between the blade and the spring, go to the next step. If there is no spark, replace the transformer.
7. Remove the electrode-nozzle assembly and inspect the high voltage sections for fouling, cracked insulators or burnt electrodes. Replace any defective parts.
8. If the flame is poor quality or intermittent, use a pressure gauge to check the nozzle pressure. If the pressure is below 100 psi, but steady, reset it to 100 psi and go to step 9. If the pressure is not steady, use the attached Sundstrand Field Service bulletin to check out the fuel unit. An unsteady pressure reading could be a sign of a dirty oil filter.
9. Replace the burner nozzle with the nozzle called out on the heater rating plate and go to step 10. Replace nozzles once a year as part of the annual cleaning and inspection service.
10. Check the $C0_2$ Of the flue gases. The reading should be between 11.5 to 12.5%. If the reading is different, go to Section 9.2.3.4.

9.2.3.3 Oil Burner Will Not Shut Off

Remove one of the thermostat leads from the primary control. If the oil burner shuts off, the problem is in the heater control circuit. The circuit includes the pressure switch, high limit safety switch, thermostat and wire harness. Check for worn insulation on the wire harness, which could cause a short. Check operation of the thermostat and pressure switch.

9.2.3.4 Setting the Correct Fuel-Air Mixture

Measure the $C0_2$. If it measures less than 11.5%, decrease the air supply. If it measures higher than 12.5%, increase the air supply.

When the fuel-air setting is correct, there will be zero smoke. If there are still traces of smoke after adjusting the fuel-air mixture, slowly increase the air supply until the smoke disappears.

Use the proper instruments to measure both the smoke and $C0_2$.

1. **Too Much Air** (low $C0_2$)

   Too much air decreases the efficiency of the heater, and causes overheating of the jacket by pressurizing the firebox. Too much air can also cause poor ignition and a pulsating flame. If the $C0_2$ reading is below 11.5%, reduce the air adjustment openings on the burner.

2. **Not Enough Air** (high $C0_2$)

   Not enough air is much easier to detect. The flame is dark yellow and the heater will smoke. Generally, the $C0_2$ reading will be above 12 % when not enough air is provided.

   Lacking proper instruments, a temporary fuel-air adjustment can be made. Close the end shutter and then slowly close the air bank until the heater starts to smoke. Slowly open the end shutter until the smoke completely disappears. The fuel-air mixture will be close to the correct setting.

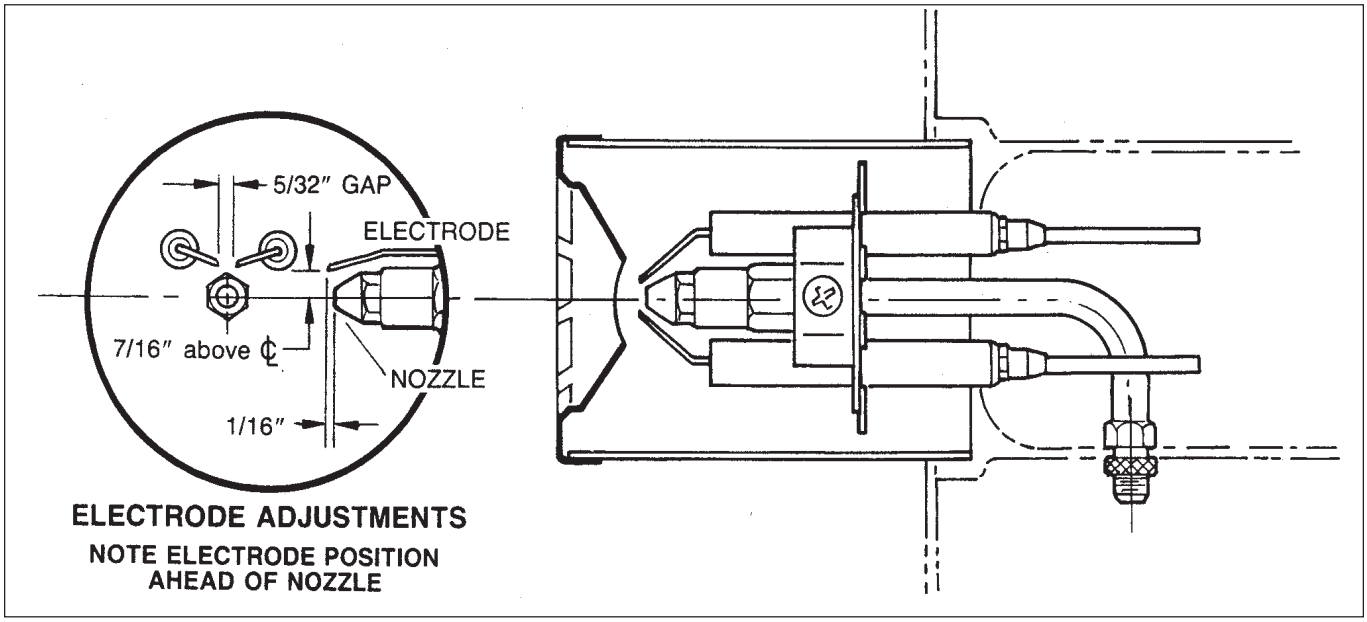

Figure 22. Electrode Adjustment.

9.2.3.5. Control & Cad Cell Troubleshooting Guide

Symptom	Possible Cause
Burner runs all the time	Defective primary control
No combustion	No power to the primary. Limit switch turned off. Defective limit switch. Bad wire connection. Bad burner motor. No power from fuse box. Defective primary
Ohmmeter pointer above 2	Partly plugged nozzle. Cad cell dirty. Cad cell misaligned. Defective cell.
Ohmmeter pointer below 3	Not enough combustion air. Cad cell sees too much light. Adjust alignment.
Primary won't lock out	Defective primary
Ohmmeter pointer below 50	Stray light in burner housing. Defective cad cell.
Burner won't start	Open circuit in thermostat wiring. Dirty thermostat contacts. Defective thermostat.
Burner runs with thermostats contacts open	Short circuit in thermostat wiring