

Section 5 / Maintenance

5/1. GENERAL PRECAUTIONS

This section contains instructions for use by a qualified serviceman in making tests and repairs to your XE Electronic. Step by step procedures are included for trouble shooting the electrical control system, and it is strongly advised that these and other procedures be reviewed before undertaking actual repair.

Remember that most complaints about the heater are not related to the heater at all, but to other things that affect its operation. Most often these are things like improper heater installation, inoperative pump, clogged filters and strainers, closed valves in the circulating system, inadequate gas supply, improperly adjusted time clocks. A quick-reference Trouble Shooting Chart is included at the back of this manual. See Fig. 28.

5/2. REGULATED GAS PRESSURE

It is desirable to check the main line gas pressure and the regulated gas pressure in the heater manifold to make sure both are adequate to operate the heater. (See paragraph 3/4). A slack-tube manometer is a convenient way to check this, and a kit is available from factory. Instructions for operating the manometer are included with the test kit, but the proper connection is shown in Figure 14.

5/3. ELECTRICAL TROUBLE SHOOTING

Trouble shooting and repairing the Type ES heater should only be done by a qualified serviceman. Prior to calling the serviceman, the homeowner should check the following:

1. The system pump must be operating and the filter must be clean in order for the pressure/flow switch in the heater to allow heater operation.
2. The heater circuit breaker and/or switch serving the heater must be ON and the heater control toggle switch must be positioned HI or LO and the corresponding temperature control knob set high enough to call for heat.
3. All external manual gas valves must be open and the heater gas valve knob must be ON.

IMPORTANT NOTICE: Disconnect power to heater or pull RED wire from transformer secondary before removing or replacing any component or wire connections.

If power is not disconnected, "jumpering" the gas valve or accidental grounding of wire harness or component terminals to heater frame or jacket can cause ignition control fuse to blow. Such accidental grounding may also damage the temperature control board and make it inoperative or unreliable.

TESTING MAIN LINE GAS PRESSURE

1. Attach slack tube manometer to heater jacket.
2. Open both valves on manometer.
3. Shut off gas to heater by using shut-off cock ahead of heater controls.
4. Remove 1/8" NPT test plug in upstream shut-off valve as illustrated.
5. Screw in 1/4" NPT fitting from manometer kit. Attach manometer hose to fitting and to one of the manometer valves.
6. Open all gas valves, light pilot and bring on main gas burners.
7. Mainline gas pressure will register on the manometer. With burners on, readings should be as follows: 5" to 10" WC

TESTING MANIFOLD REGULATED GAS PRESSURE

1. Attach slack tube manometer to heater jacket.
2. Open both valves on manometer.
3. Shut off manual main gas valve.
4. Remove 1/8" NPT plug on valve outlet face and screw in 1/4" fitting from manometer kit. Connect manometer hose to fitting and to one of the manometer valves.
5. Wait five minutes. Relight pilot as instructed on rating plate and bring on main burners.
6. Manometer should register as follows: 4" WC —
7. To adjust gas pressure: Remove regulator cap screw on top of valve marked "Reg. Adj.". Turn screw adjustment clockwise to increase or counter-clockwise to decrease gas pressure.

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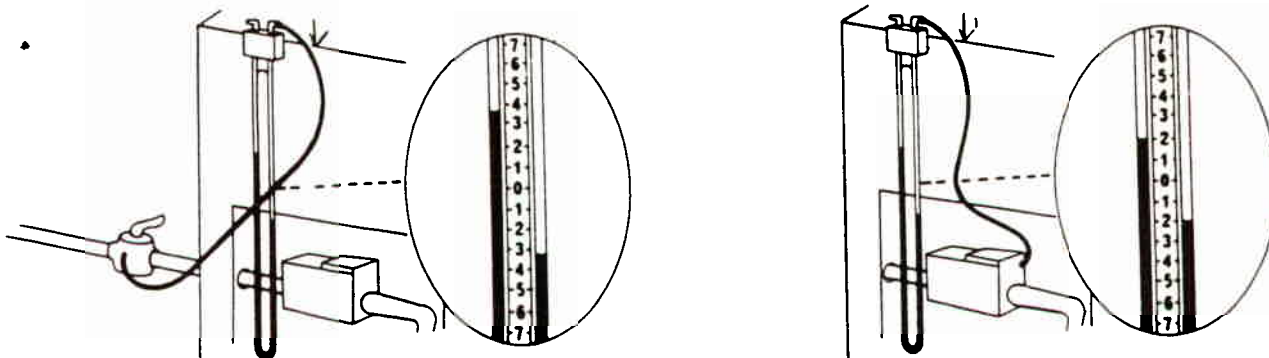


FIG. 14

CONTROL SYSTEM TROUBLE SHOOTING SEQUENCE

Heater Does Not Come On.

If Heater Will Not Shut Off See Step 5.

Step 1.

Experience shows that most complaints about properly installed heaters not coming on have nothing to do with the heater itself. Usually something has happened to reduce water flow through the heater. The protective switches in the heater then operate to protect it.

Any of the following could keep the heater OFF. Check them first.

1. Be sure heater is properly installed. See Section 3.
2. Be sure filter is clean. Build-up of residue on the filter can lower the pressure through the heater and shut it off.
3. Make sure pump is not airlocked, clogged or inoperative.
4. Check main drain and skimmer valves to be sure they are open.

5. Make sure gas valve is ON and gas pressure is available.
6. Make a careful visual inspection of all electrical connections and wiring. Finding a loose connection or a charred wire can save a lot of time.
7. Verify that the electrical circuit serving the heater is on.
8. Check to see that the heater toggle switch is set to one of the operating positions ("HI" or "LO").
9. Verify that the selected temperature control knob is set to call for heat (See 4/4).

If the pump and filter system is properly circulating water and all the above items have been checked, the trouble is in the heater control systems. Go to Step 2.

NOTE: Keep the filter system running.

FIG. 15

Step 2.

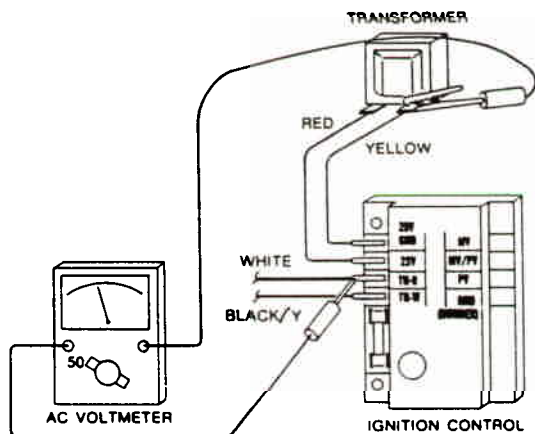
Testing performance of 24V transformer, pressure switch and the limit switches. An AC Voltmeter with a 50-volt range is required.

TRANSFORMER

1. Clip one lead of the voltmeter to the *yellow wire* terminal of the transformer.
2. Touch the free lead of the voltmeter to the *TH-R* terminal of the Ignition Control.

Meter should verify that the transformer is providing 20-28 volts. If there is no voltage indication, replace the transformer.

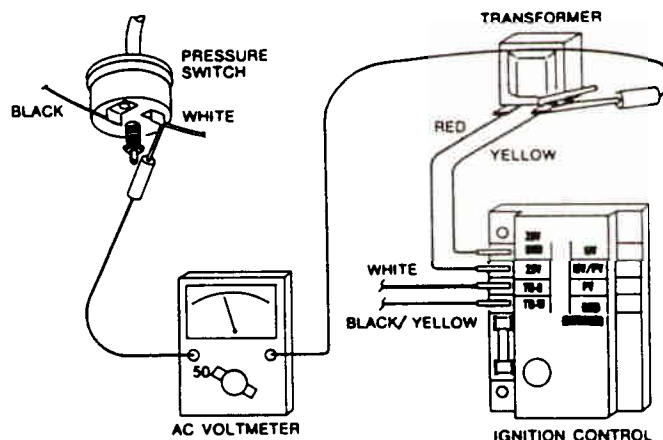
If voltage is low, the electrical circuit to the heater may be at less than 103V/207V, possibly from pump load, air conditioners or other wiring problems. Assistance of an electrician or utility company may be required.



WIRE HARNESS/LIMIT SWITCHES

To check the white wire harness, which contains the limit switches, touch free lead of the voltmeter to the *white wire* terminal of the pressure switch. If meter indicates voltage, the white wire harness and limit switches are OK.

If no voltage is indicated, check for defective or loose terminals, broken or charred wires. Also check wiring to field-installed fireman's switch if one is used.



If wiring and terminals are in good condition, the limit switches are keeping the heater off. See Para. 5/7.

PRESSURE SWITCH

Check the pressure switch by touching the free lead of the voltmeter to the *black wire* terminal on the pressure switch. If voltage is indicated, the pressure switch is operating properly. If there is no voltage, the pressure switch must be replaced.

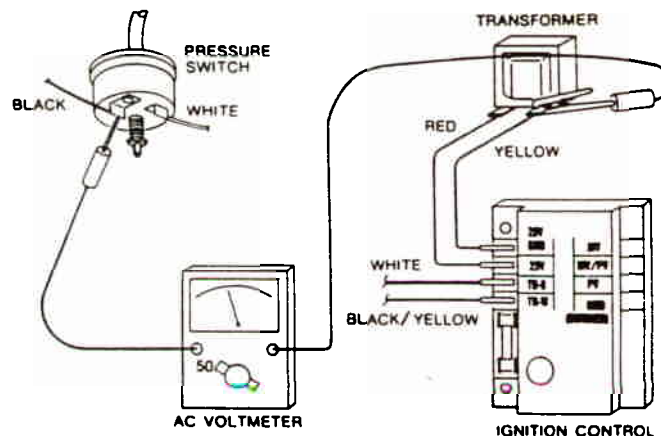


FIG. 16

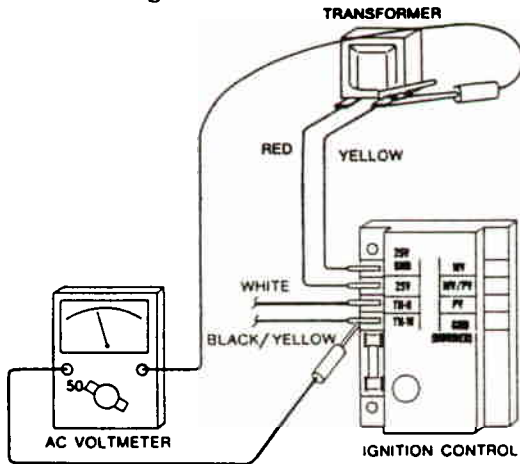
Step 3.

If the checks in Step 2 show that the safety controls are not keeping the heater off, the problem may be in the Electronic Temperature Control.

The Temperature Control is a solid-state device using an electronic water temperature sensing bulb called a thermistor. The thermistor sensor and the temperature control will be checked in this step.

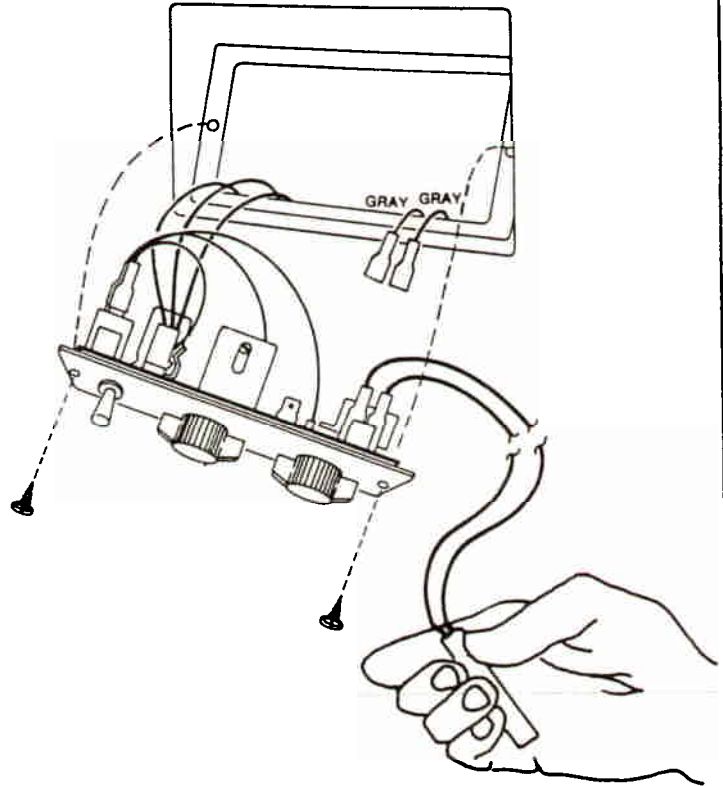
Confirm that the toggle switch is positioned either Hi or Lo and the corresponding temperature control knob is set at a higher temperature than the pool water.

With one lead of the voltmeter still clamped to the Yellow Wire terminal of the transformer, touch the free lead to the TH-W terminal of the Ignition Control.



If the control is obviously damaged, replace it. If not, correct any loose wire connections and check the thermistor sensor. The thermistor sensor is easily checked by disconnecting the gray wires at the corner of the circuit board and temporarily connecting a new sensor.

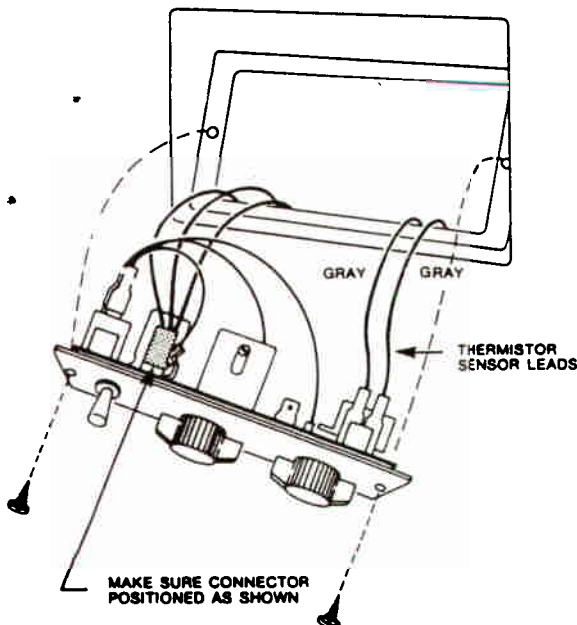
Reinstall the control but hold the "new" sensor in your hand. Turn on power to the heater. The heater should operate with the control knob set near the center of the dial (approximate body temperature).



If voltage is indicated, the temperature control is operating properly. Proceed to Step 4.

If no voltage is shown, shut off power to the heater and remove the temperature control unit from the heater.

Hold the control a few inches from the heater and inspect for obvious damage and loose wires. Verify that the three-wire connector is not reversed and that the gray thermistor wires are securely connected at their terminals on the printed circuit board.



If the heater operates, the thermistor sensor in the heater should be replaced. If the heater does not operate, replace the electronic temperature control unit.

Replacement temperature control units are provided as a quick-change assembly, complete with logo plate and knobs. When reinstalling the temperature control, be sure the gasket is in place. Do not overtighten the mounting screws—this will distort the mounting plate and may permit water leakage.

Alternate procedure for checking the thermistor sensor: A fixed resistor (6000-9000 Ohms) can be substituted for the thermistor sensor. When the resistor is connected to the board, the heater will operate at the mid-range of the dial unless the electronic temperature control is defective.

IMPORTANT NOTICE: Disconnect power to heater or pull RED wire from transformer secondary before removing or replacing any component or wire connections.

If power is not disconnected, "jumpering" the gas valve or accidental grounding of wire harness or component terminals to heater frame or jacket can cause ignition control fuse to blow. Such accidental grounding may also damage the temperature control board and make it inoperative or unreliable.

FIG. 17

Step 4.

IGNITION CONTROL

Presence of voltage between the *Yellow Wire Terminal* and the *TH-W* terminal of the ignition control indicates that the

safety controls, temperature control or wire harness are *not* keeping the heater OFF (Step 3).

This step will determine whether the Ignition Control is functioning properly.

SEQUENCE OF OPERATION XE POOL HEATERS WITH HONEYWELL S86B INTERMITTENT IGNITION CONTROL

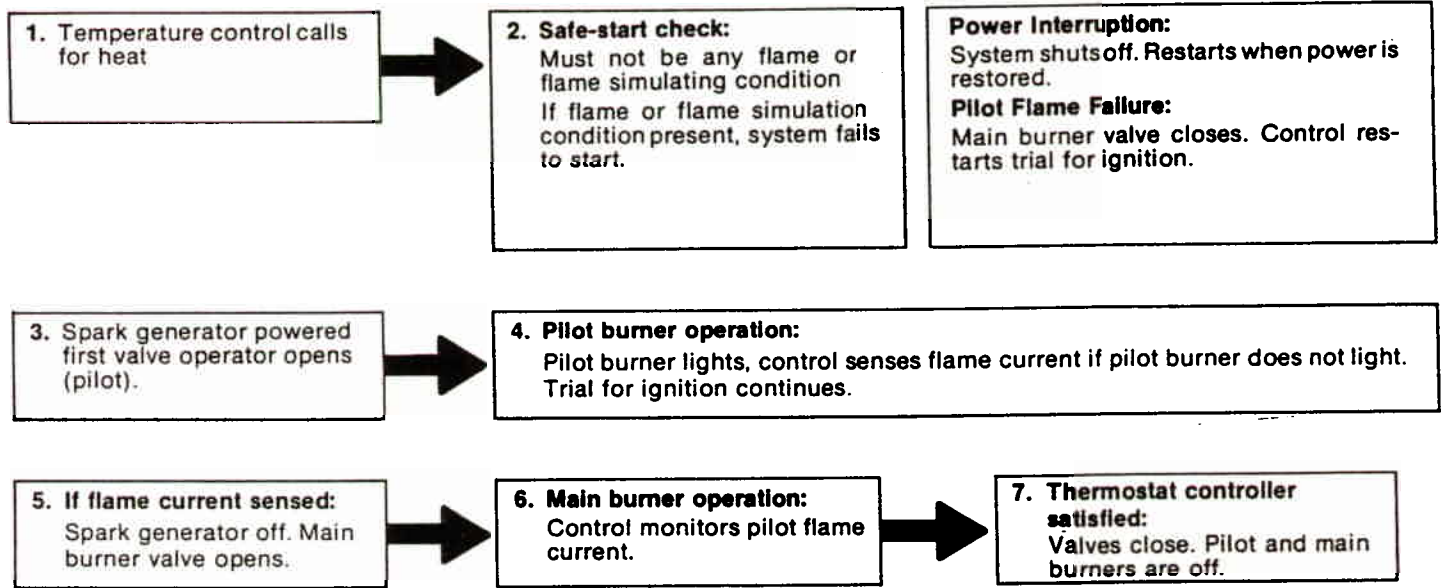
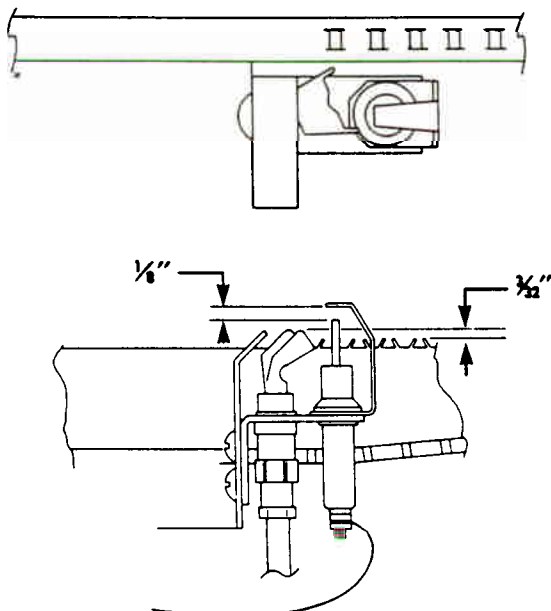


FIG. 18

Before beginning the electrical diagnosis, make a visual check of the Ignition Control components.

1. **Pilot Burner.** Make sure it is properly positioned next to main burner as shown and free of soot or dirt.



2. **Igniter-Sensor Electrode.** Check for proper spark gap. Electrode must be clean, terminal connection tight and the stainless steel lead wire at least $\frac{1}{8}$ " from the heater chassis or any other metal.
3. **High Voltage Ignition Lead.** Connections must be tight and silicone rubber boots in place. Bare metal parts at the base of the manifold bracket must be at least $\frac{1}{8}$ " from other metal objects.
4. **Electrical Connections.** Be sure that all wire connections at the Ignition control and the gas valve are tight. Confirm that all wiring is as shown in Fig. 12.
5. **Fuse.** A three-ampere fuse is located next to the *TH-W* terminal of the Ignition Control. *Accidental grounding of the wire harness or "jumping" the gas valve will cause this fuse to blow. Such accidental grounding may also damage the temperature control board and make it inoperative or unreliable.*

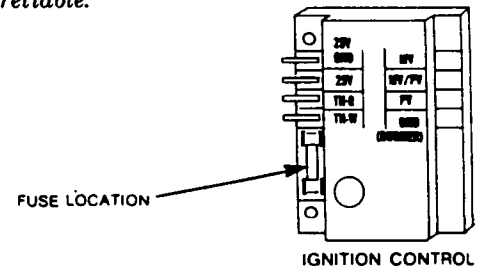


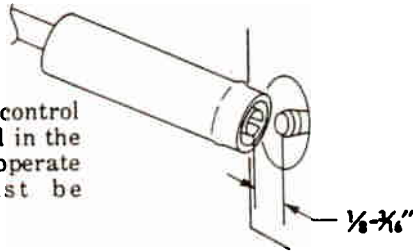
FIG. 18A

Step 4 continued...

With toggle switch at Hi or Lo and the corresponding control knob set high enough to call for heat, a spark should immediately appear at the pilot burner electrode.

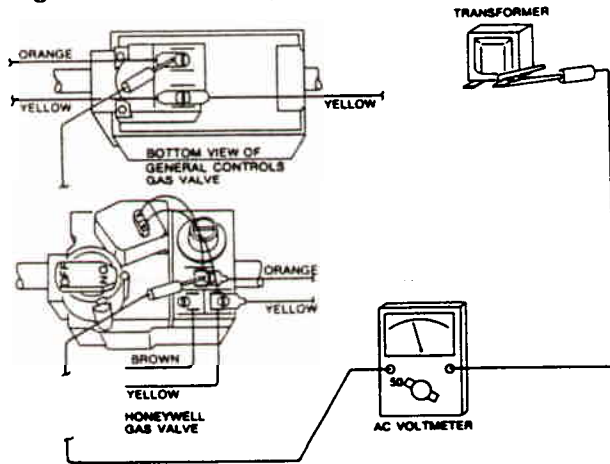
If there is no spark, pull the ignition wire from the Ignition Control and hold the bare terminal $\frac{1}{8}$ "- $\frac{3}{16}$ " from the ignition stud. If no spark jumps this gap, the fuse may be blown or the ignition control is defective and must be replaced.

NOTE: The ignition control must not be repaired in the field. If it does not operate properly, it must be replaced.



If spark is attained at the stud, check the high voltage lead, ceramic insulators and terminals, etc.

If sparking occurs at the pilot burner, but there is no pilot ignition after two or three minutes, check for voltage between the yellow wire terminal of the transformer and the pilot gas valve terminal (Orange Wire) on the gas valve.



If no voltage is shown, the Ignition Control is defective and must be replaced.

If voltage is between 20-28V, but there is no pilot gas flow, replace the gas valve.

PILOT BURNER LIT — NO MAIN BURNER IGNITION

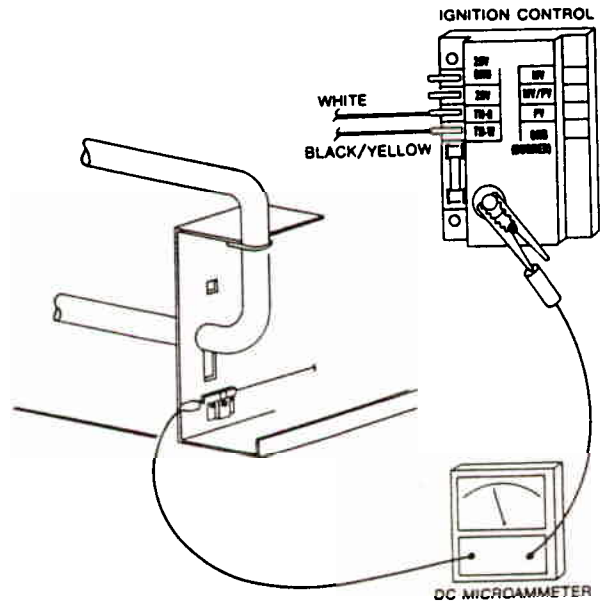
When pilot burner is lit, the sparking should stop and the main burners should come on.

If sparking continues and the main burners do not fire, the ignition cable or connections may be bad, wet or the pilot flame is unsatisfactory.

If wires and connections appear OK, measure the flame sensing current by connecting a DC MICROAMMETER as shown below..

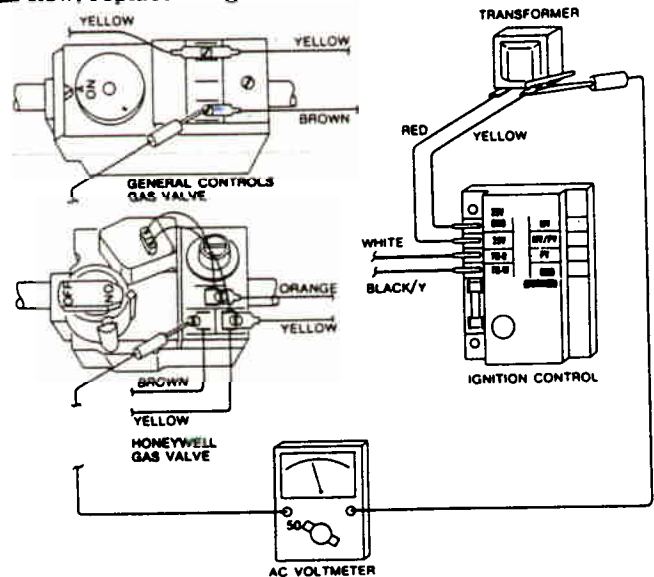
Note: Meter leads must be separated from each other and clear of the heater chassis for most of their length.

With pilot burner lit, the meter should indicate a flame sensing current of *one microampere or more* with or without the main burners operating. The Ignition Control will not allow main burner operation if flame sensing current is below 0.6 microamperes. Inadequate flame current is caused by unsatisfactory pilot flame, electrode configuration or poor cable and connections.



If pilot flame and sensing components are OK, the main burners should come on shortly after pilot ignition. If there is no main burner ignition, check for voltage between the yellow wire terminal on the transformer and the brown wire terminal on the main gas valve.

If voltage is between 20-28V but there is no main burner gas flow, replace the gas valve.



ON-OFF MAIN BURNER CYCLING:

If a safety control or the temperature controller is not causing the problem, cycling is generally due to erratic pilot burner flame. Adverse draft conditions, pilot or chassis components out of position or inadequate gas pressure can be the cause.

When gas lines are undersize, the pilot flame will appear to be satisfactory before the main burners come on but shrink when the main burners fire. Trouble shooting procedures are illustrated in Fig. 18C.

FIG. 18B

Step 4 continued on next page...

Step 4 continued...

TROUBLE SHOOTING PROCEDURE FOR HONEYWELL S86 IGNITION CONTROL SYSTEM

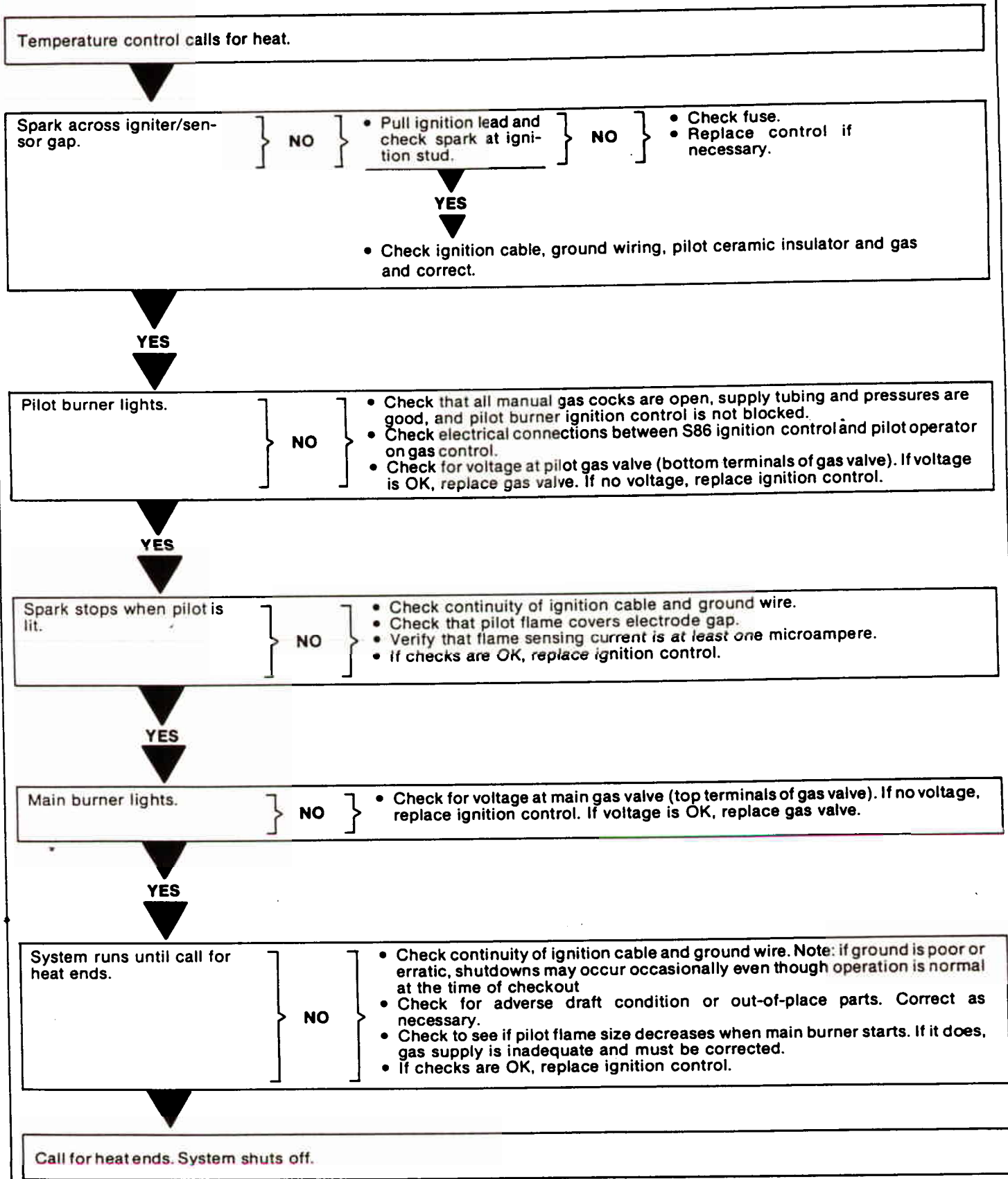


FIG. 18C

CONTROL SYSTEM TROUBLE SHOOTING SEQUENCE

Heater stays on — The controls will not shut it off ...

Step 5.

This step will determine whether the controls or the gas valve is keeping the heater on. Keep filter pump running while conducting these tests.

If heater stays on with brown wire disconnected at gas valve, (See illustration below) the gas valve is at fault.

Debris may have collected under gas valve seat. Replace gas valve. Disassembly of valve will invalidate manufacturer's warranty. See Para. 5/4 and Fig. 20 for replacement procedure.

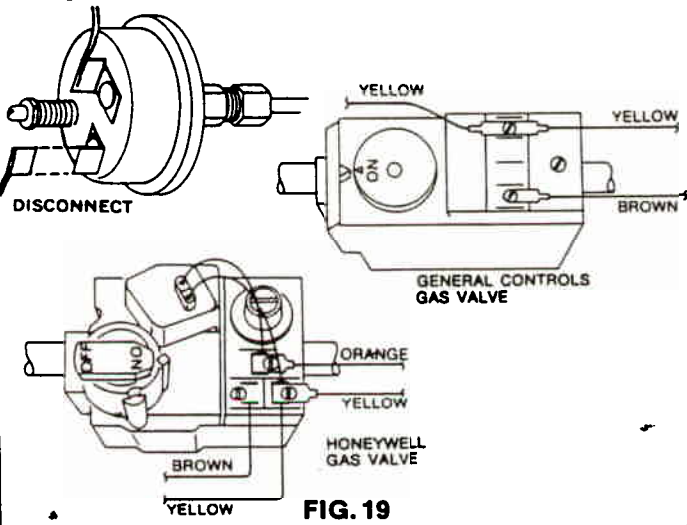
If gas valve is OK, disconnect one of the lead wires to the pressure switch, as shown. If heater goes off, turn off filter and reconnect pressure switch. If heater comes on the problem is in the switch assembly.

Check as follows:

1. Switch may be out of adjustment. See Para. 3/7 for proper adjustment procedure.
2. Syphon loop may be clogged. Disassemble switch assembly and blow out until clear. See Para. 5/5.
3. Pressure switch may be defective. See Para. 5/5 for testing and replacement procedure.

If heater still stays on with the pressure switch disconnected, (See illustration below) wiring may be at fault.

4. Make visual inspection. Jiggle wires to detect loose connection. Disconnect one of the lead wires of the wire harness at the gas valve. If heater goes off, wiring is at fault. Repair or replace Wire Harness.



5/4. GAS VALVE REPLACEMENT

WARNING: Never attempt to repair the gas valve. When defective operation has been determined, replace it. Attempts to repair it can void the warranty and possibly lead to dangerous results.

Procedure for testing the operating gas valve is found in Figs. 18C & 19. To remove and replace gas valve, follow steps in Fig. 20.

REMOVING GAS VALVE

1. Turn off main line gas cock.
2. Disconnect main gas line.
3. Disconnect pilot tubing and all wiring from gas valve. Disconnect ignition lead.
4. Detach burner tray assembly from heater inner panel and slide out.
5. Unscrew gas valve from manifold pipe.
6. Replace and reassemble.

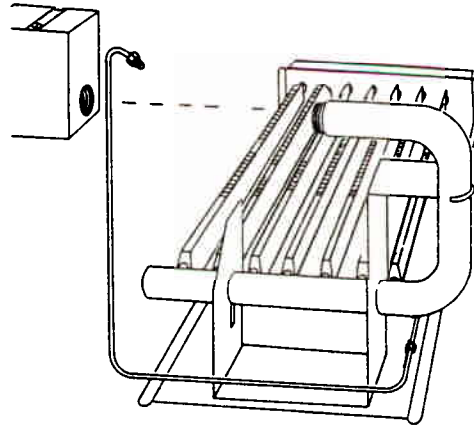
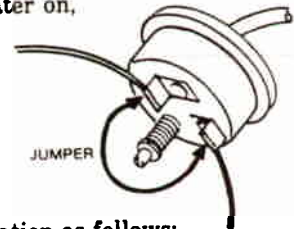


FIG. 20

5/5. TESTING PRESSURE SWITCH

1. Turn thermostat to maximum warm position.
2. With filter pump running, if connecting a jumper across pressure switch brings the heater on, the contact points in the switch are open.



This does not mean the switch is defective — check switch operation as follows:

Back wash filter before attempting to calibrate pressure switch. Verify correct flow by inserting hand in front of pool return line closest to equipment. If filter is clean you should feel a fast water flow on palm of hand.

Connect a voltmeter between the yellow wire terminal of the transformer and the black wire terminal of the pressure switch.

Start and stop the filter pump. The meter should jump cleanly to full voltage when pump is turned on.

If the meter needle does not register, rises or falls slowly or hesitates going up or down, a defective pressure switch or clogged connector tube should be suspected

- a. To clean connector tube, remove tube from heater and switch
- b. Blow out until clear
- c. Fill switch and tubing with heavy non-detergent oil, SAE 50 preferred, using a pump-type oil can. The connector must be completely filled with oil.
- d. Reinstall connector tube to heater and pressure switch. Tube must be *air tight*.
- e. Reconnect wire terminals, start filter pump and retest pressure switch.

If cleaning pressure switch tube does not correct the erratic meter readings, replace the switch.

REMOVAL AND REPLACEMENT OF PRESSURE SWITCH

1. Disconnect wires from pressure switch.
2. Disconnect pressure switch from pigtail tube fitting.
3. Reverse procedure and replace, being sure pigtail and switch are filled with oil.

REMOVE AND REPLACEMENT OF CONNECTOR TUBE

1. Remove top assembly.
2. Remove gap closure.
3. Remove copper tubing from header and remove switch from tubing.
4. Reverse procedure to replace, being sure pigtail and switch are filled with oil.

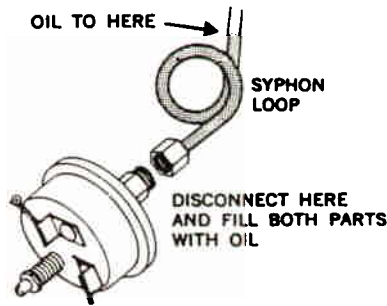


FIG. 21

5/6. TESTING TEMPERATURE CONTROL

The control dials do not have temperature markings other than the nine reference marks which cover an approximate range from 70°F to 105°F. Use an accurate pool thermometer to determine dial settings which give you the most comfortable swimming temperature and use the Safe-T-Lok to mark this setting.

The XE Electronic Temperature Control can not be calibrated in the field, and if found to be defective, must be replaced.

IMPORTANT NOTICE: Disconnect power to heater or pull RED wire from transformer secondary before removing or replacing any component or wire connections.

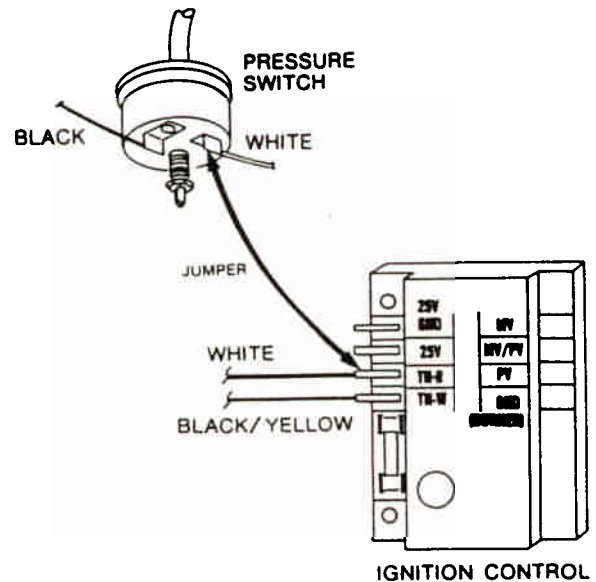
If power is not disconnected, "jumpering" the gas valve or accidental grounding of wire harness or component terminals to heater frame or jacket can cause ignition control fuse to blow. Such accidental grounding may also damage the temperature control board and make it inoperative or unreliable.

5/7. HIGH LIMIT SWITCHES

NOTE: The high limit safety switches are pre-set at the factory and no field adjustment should be attempted. Before replacing either of the high limit switches make sure they are not holding the heater off because of overheating in the water tubes due to other causes. The limit switches may be performing their proper function. Follow steps in Fig. 22.

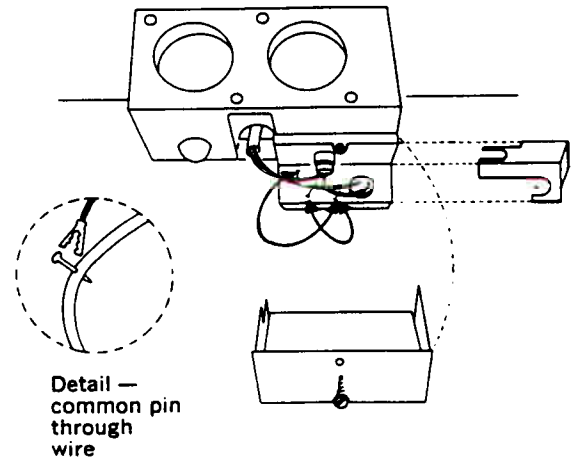
TESTING AND REPLACEMENT OF HIGH LIMIT SWITCHES

1. Install thermometer as shown in Fig. 10.
2. Install a jumper between white wire terminal of the pressure switch and the TH-R terminal on the ignition control to eliminate both switches from the circuit.



3. Let heater run 5-10 minutes, temperature should be approximately 30° higher than the pool water temperature. If this temperature is excessive, check the Automatic FLOW Control Valve (paragraph 5/11). If the temperature is normal:

- a) Jumper each high limit switch in turn to determine which one is holding the heater off.



- b) Replace defective switch. Be sure that 135°F. limit is replaced in upper well and 150°F. limit in lower well.

NOTE: The high limit switches can be jumpered individually without removing them from the header.

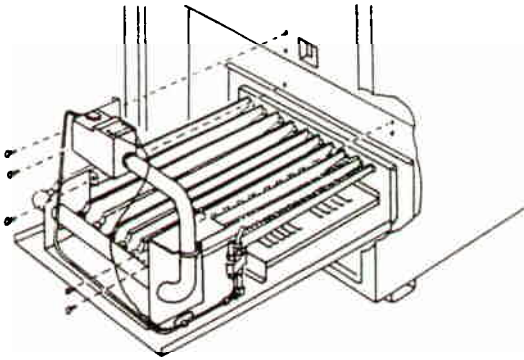
REMOVE ALL JUMPERS WHEN TESTING IS COMPLETE.

FIG. 22

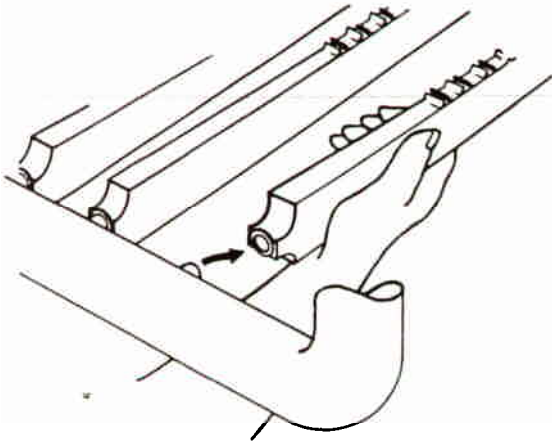
5/8. REMOVAL OF THE GAS BURNERS

REPLACEMENT OF GAS BURNER

1. Turn off main line gas cock.
2. Turn off gas valve.
3. Disconnect service union in gas line and unscrew gas pipe from gas valve.
4. Disconnect all wires to the gas valve.
5. Remove two screws holding gas valve bracket to inner panel and three screws holding manifold bracket to inner panel. Slide burner tray out of heater.



6. Grasp burner firmly and push away from manifold. (A screwdriver can be used to pry the burner retainer clip free of the orifice groove.) Push burner inward until clear of orifice. Now drop burner down and slide from burner tray.



7. To replace, insert burner into rear rail slot, line up with proper orifice and snap into position.
8. Reinstall burner tray and reconnect gas piping. Check for gas leaks.
9. Re-connect wires & ignition lead.

NOTE: To remove burner with pilot attached:

1. Remove burner tray from heater, per above.
2. Disconnect pilot gas tube from gas valve.
3. Detach pilot burner from bracket on main burner by removing screw into pilot bracket.
4. Grasp main burner firmly, push toward rear of tray until clear of orifice, drop down and remove.
5. Reinstall pilot burner and reconnect pilot gas tube after replacing main burner. Check for gas leaks.

FIG. 23

5/9. PERIODIC INSPECTION OF HEAT EXCHANGER WATER PASSAGES

Scale accumulation can be detected by a quick periodic inspection of heat exchanger tubes and should be made from time to time on the tube having the highest temperature. This tube is also the last pass through the heat exchanger. It is easily viewed by removing the drain valve and bushing shown in Figure 24. The complete heat exchanger inspection is accomplished by removing it from the heater as shown in Figure 25.

The tubes should be inspected after 60 days of operation, and then again after 120 days of operation. From the appearance of the tubes, it will then be possible to set up a regular inspection schedule.

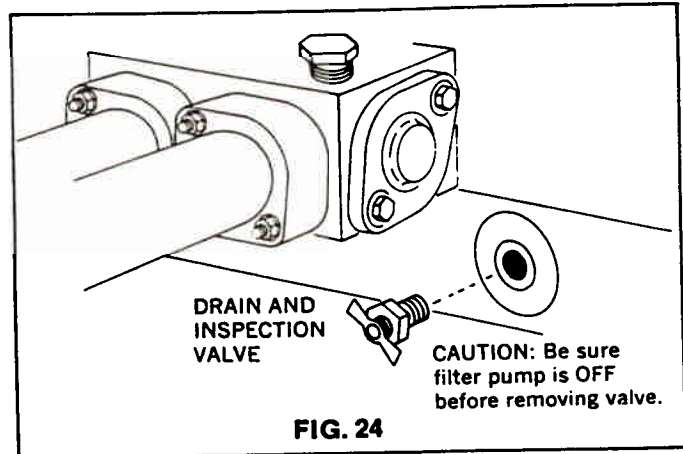


FIG. 24

5/10. TESTING AND CLEANING THE HEAT EXCHANGER

CAUTION: Black carbon 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.

1. Light accumulation of soot or corrosion on the outside of the tubes can be readily removed with a wire brush if the tube heat baffles are removed. If soot or corrosion is heavy, remove the heat exchanger to allow thorough cleaning and to prevent any removed material from falling into the burners or blocking the burner ports.
2. There are two (2) ways to clean the inside of the tubes:

Acid cleaning:

After removing the water header castings, bolts, gaskets, and Tube Heat Baffles, the exchanger can be immersed in a properly inhibited muriatic acid solution (3 part water to 1 part acid solution). The inhibited muriatic acid solution, however, will remove some copper, but at a slow rate. When tubes are clean, flush the assembly with soda-ash solution. Dry and paint steel plates with a good quality rust inhibiting paint.

Reaming:

The tubes may be reamed out as shown in Fig. 26. For easy reaming, dry the heat exchanger first. Also, withdraw the reamer frequently to remove lime powder and prevent the drill bit from binding in the tube.

NOTE: Use *only* the correct size carbide tipped reamers which are available from the factory.

3. Install new gaskets. DO NOT use the old gaskets.
4. Tighten bolts progressively, starting with two center bolts, keeping header straight on the tube plate. Maximum torque is 20 foot pounds. DO NOT over-tighten.
5. Pressure test heat exchanger for leaks with city water pressure before re-installing. See Figure 26.

6. When re-installing the heat exchanger, carefully hold refractory insulation blocks apart and lower the heat exchanger into place. Be sure that the sheet metal covers which protect the insulation blocks are carefully replaced.
7. If a header bolt is stripped it may be driven out of header plate and replaced. See parts list, Page 25.

REMOVAL OF HEAT EXCHANGER

1. Remove top assembly by unscrewing four screws — two front and two back.
2. Remove screws and lift out gap closures (2 & 3). Lift off thermistor sensor insulation and cover (1).
3. Remove drain valve (large hex.) located under water connections (4).
4. Remove all grommets (2 each side) — (5 & 6).
5. In order, lift out the lower flue collector (7) and the front and rear insulation block covers (8).
6. Disconnect siphon loop fitting at heat exchanger (9).
7. Remove thermistor sensor from header by loosening cap screw and sliding retainer bracket off of bulb flange. Pull bulb away from heat exchanger and carefully drape over front of heater.
8. Disconnect water piping and lift out heat exchanger.

IMPORTANT — While heat exchanger is removed from the heater inspect the firewall refractory insulation blocks to check for wear, cracks and breakage. Replace where necessary.

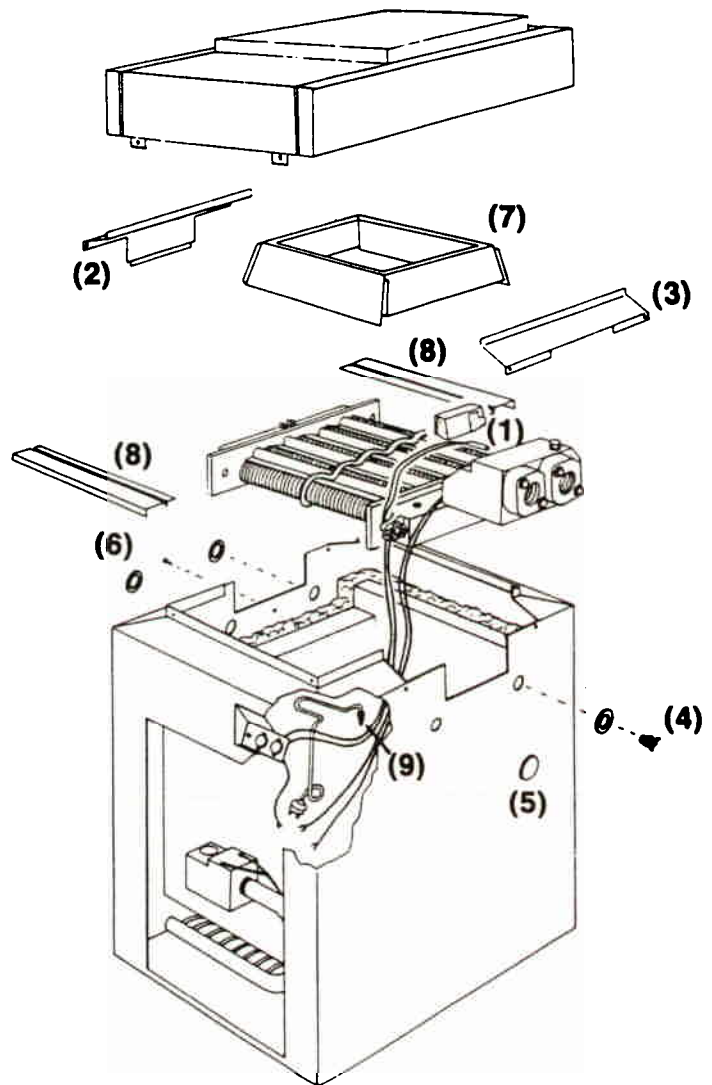


FIG. 25

CLEANING AND TESTING OF HEAT EXCHANGER

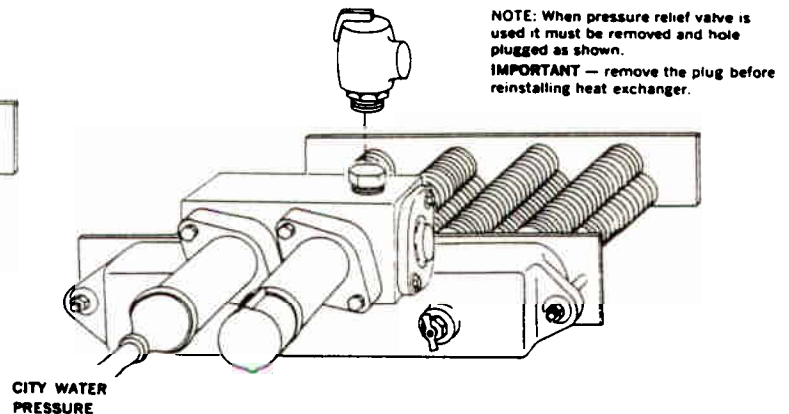
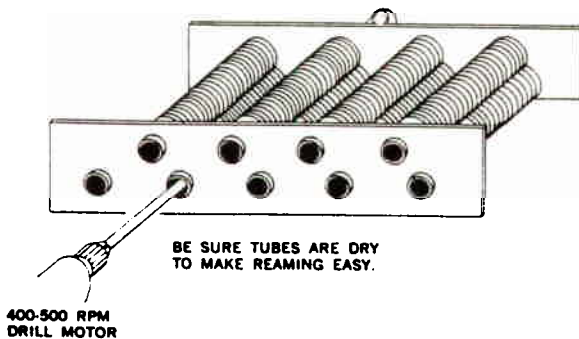


FIG. 26

5/11. AUTOMATIC FLOW CONTROL VALVE

The automatic flow control valve maintains the correct flow of water through the heater over widely varying conditions of filter flow.

It is an extremely simple device, having only one moving part, and it ordinarily requires no service. The parts are made of polycarbonate, naval brass and stainless steel and will resist normal pool water for many years. Extremely high acid or chlorine concentration may, however, damage valve parts. Extreme hard water may leave deposits on valve parts which may make the valve sluggish or inoperative. Such a condition might overheat the water in the heater, but not heat enough water to raise the pool temperature as desired. If heater tube water is overheated because of a sticky valve, the high-limit switch will open to cycle the heater. If the automatic flow valve *stays* closed, too much

water flows through the heater, causing condensation on tubes. Either situation can result in inadequate heating.

The function of the automatic flow control valve may be tested by removing the drain valve and bushing below the water connection casting and inserting a thermometer (see Fig. 10.)

When the pool filter is delivering normal flow to the heater, the thermometer should read approximately 30°F ABOVE pool temperature.

To determine if valve is stuck in open position, shut off filter pump and remove flow control cap. Make visual inspection of disc. If not properly seated in flush position, disassemble the valve and overhaul. Figure 27 shows the procedure for removal and cleaning of the valve. If parts are pitted due to corrosion by excessive acid or chlorine in the pool water, they should be replaced. A parts list is shown on page 25.

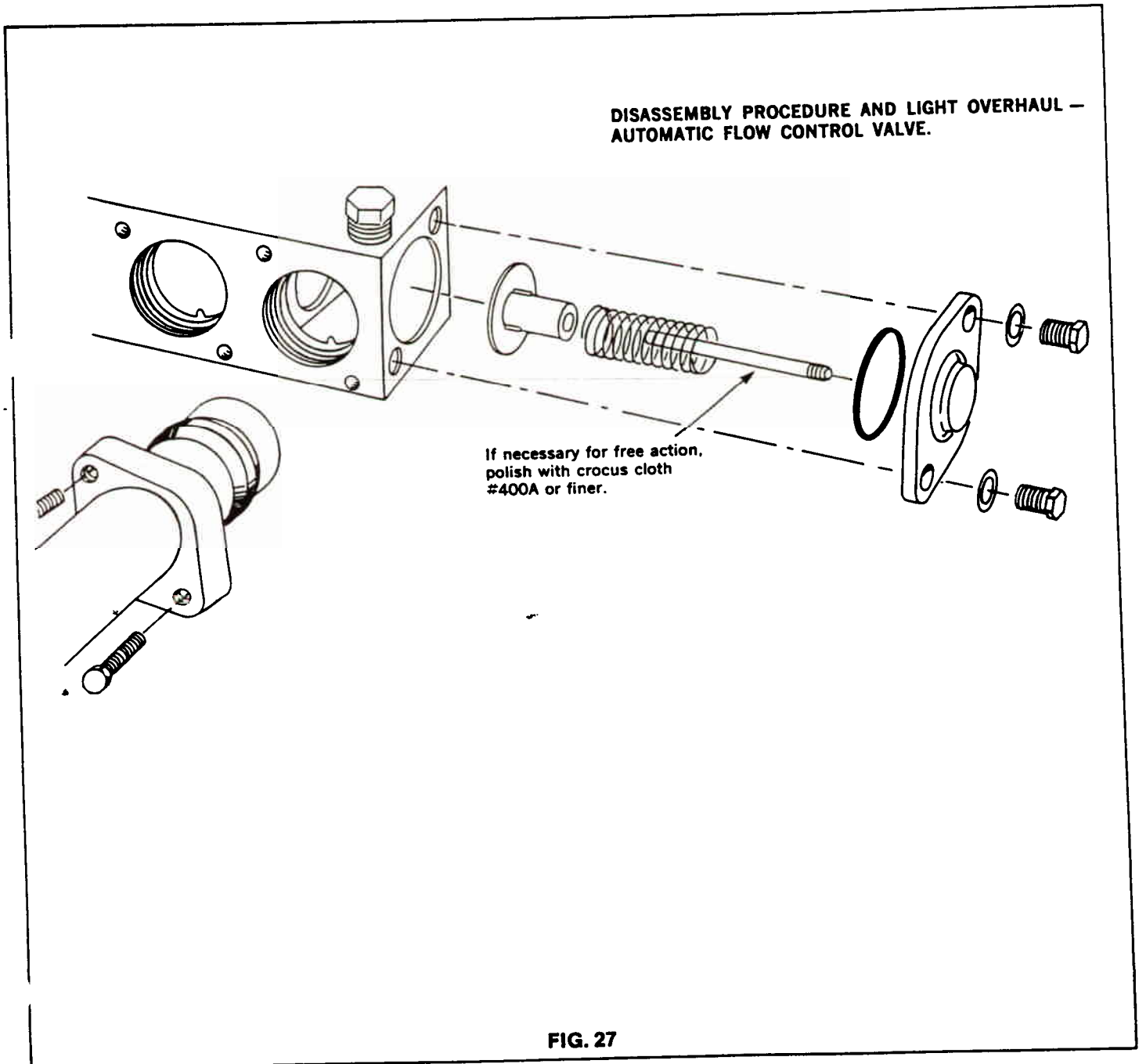


FIG. 27

Section 6 / Appendix

TROUBLE SHOOTING CHART

Use this chart for quick reference to maintenance and service procedures.

HEATER WILL NOT COME ON

See Pages 13, 14, 15, 16, 17.

HEATER WILL NOT SHUT OFF — See Fig. 19.

What to look for	Why did this happen	What to do
1. Pressure switch is clogged.	Possible debris in gas line.	1. See Par. 5/5.
2. Short in wire harness.		2. Check wiring (see Fig. 12).
3. Defective gas valve.		3. Replace gas valve. See Par. 5/4.

SOOT HAS FORMED IN THE COMBUSTION CHAMBER AND/OR FLAMES ARE COMING OUT OF THE SIDES OF THE HEATER

What to look for	Why did this happen	What to do
1. Too much water flowing through heater.	Water flow valve out of adjustment causing heat exchanger fins to plug.	1. Clean heat exchanger. See Par. 5/10. Adjust water flow. See Par. 5/11.
2. Lack of adequate air supply.	Possible restriction by small animal, lint or dirt.	2. Provide adeq. air supply to heater. See Par. 3/2, 3/3.
3. Improper venting.		3. Provide proper venting of heater. See Par. 3/3.
4. Burner air inlet throat.		4. Clean burners.
5. Gas burning at orifice (flashback).	Improper gas supply.	5. Check name plate for correct gas. See Par. 3/4.
6. Time Clock out of adjustment.	If the clock prevents heater from bringing cold pool temp. up in one continuous operation, condensate damage may result.	6. Adjust time clock properly. See Par. 4/3. Clean heat exchanger. See Par. 5/10.
7. Collapsed firebox.	Pressure too high.	7. Replace firebox. See Fig. 29 for access procedure.
8. Gas regulator out of adjustment.		8. See Fig. 14 for testing procedure.
9. Automatic flow control valve may be stuck shut.	Mineral deposits on valve parts. Corrosion of valve parts.	9. Check for excessive hardness, acidity or chlorine. Par. 4/7. Clean heat exchanger. See Par. 5/10. Repair valve. See Par. 5/11.

HEATER WILL NOT BRING POOL UP TO DESIRED TEMPERATURE

What to look for	Why did this happen	What to do
1. Filter not operating long enough to permit heater to heat pool.	Time clock incorrectly set.	1. Re-set time clock See Par. 4/3.
2. Filter clogging up rapidly, thus reducing flow and pressure and shutting off heater.	Filter is not being cleaned often enough.	2. Clean filter more frequently.
3. Thermostat out of adjustment or defective.	Damage in handling. Out of calibration.	3. Test thermostat — replace if needed. See Fig. 17.
4. Pressure switch inoperative.		4. Test Pressure Switch. Replace if necessary. See Fig. 16.
5. Gas line too small.		5. Check gas pipe size chart. See Par. 3/4.
6. Heater too small.		6. Check pool sizing chart. Install larger heater if nec. See Fig. 1.

SCALE HAS FORMED IN ONE OR MORE TUBES IN THE HEATER

What to look for	Why did this happen	What to do
1. Unnecessary manual by-pass valve installed.	Water supply is hard. pH is too high. Calcium-hypochlorite is being used for chlorination. Concentration of scale forming minerals in pool due to evaporation.	1. Close by-pass valve and remove handle. See Par. 3/5.
2. Manual by-pass valve out of adjustment.		2. Adjust by-pass valve properly. See Par. 3/5.
3. Excessive hardness in pool water. Total alkalinity of pool water should be kept in the 80 to 100 ppm range.		3. Empty pool and refill. If supply water causes rapid scale deposit, consult a local water treatment company. Inspect and clean boiler tubes regularly.
4. Heater improperly installed.		4. See Sec. 3.
5. Automatic flow control valve may be stuck open.	Mineral deposits on valve parts. Corrosion of valve parts.	5. Check water for excessive hardness, acidity or chlorine. Also check if chlorine is being fed through heater. Repair valve. See Par. 5/11.
6. Heater staying "on" when filter flow diminishes as a result of debris.	Defective pressure switch or high limit switch.	6. Replace pressure switch or high limit switch. See Par. 5/5, and Fig. 21.
7. Chlorinator is connected upstream of heater.		7. Install Chlorinator downstream of heater. See Par. 3/8.