5/1. GENERAL PRECAUTIONS

This section contains instructions for use by a qualified serviceman in making tests and repairs to your XE. Step by step procedures are included for trouble shooting the electrical millivolt-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. 30.

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

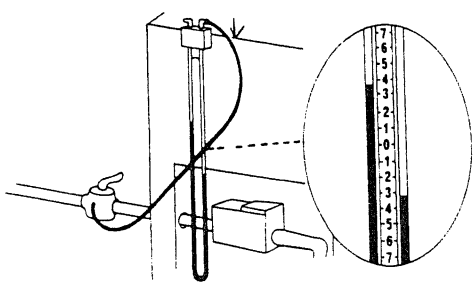
The XE pool heater may have either a General Controls gas valve or a Honeywell gas valve. The electrical troubleshooting procedures in the following pages are illustrated with the General Controls valve. The procedure is the same with the Honeywell valve if it is understood that the two center terminals in the General Controls valve (with Jumper) are replaced by a single terminal on the Honeywell valve. See Fig. 18 for wiring hookup on each valve.

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 ⅛" NPT test plug in upstream shut-off valve as illustrated.
5. Screw in ⅛" 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 — Natural Gas
   11" to 14" WC — LP Gas

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 ⅛" NPT Plug on valve outlet face and screw in ⅛" 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 — Natural Gas
   9" WC — LP Gas
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.



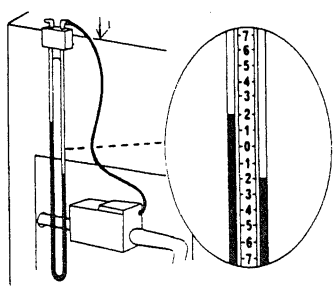


FIG. 14

ELECTRICAL SYSTEM TROUBLE SHOOTING SEQUENCE
Heater Does Not Come On.
If Heater Will Not Shut Off See Step 4.

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 2.
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. Be sure thermostat control is set at mid-range or higher. Move the control knob back and forth 6 or 7 times to free the contacts. Often this is all that is required to fix or clean thermostat contacts. Be sure that the toggle switch is in the ON position.

If Heater Still Does Not Operate, Remove Control Compartment Door And —

6. Make sure pilot is ON and adjusted properly. See Para. 4/2.
7. Make sure gas valve is ON and gas pressure is available.
8. 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.

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. The check-out procedures in Steps 1, 2, and 3 depend on the heater coming on to tell you when the trouble has been located.

CAUTION: If filter is off, DO NOT let burners come on for more than five seconds during service procedure. Shut off operating gas valve until you know what the trouble is.

WIRING SCHEMATIC

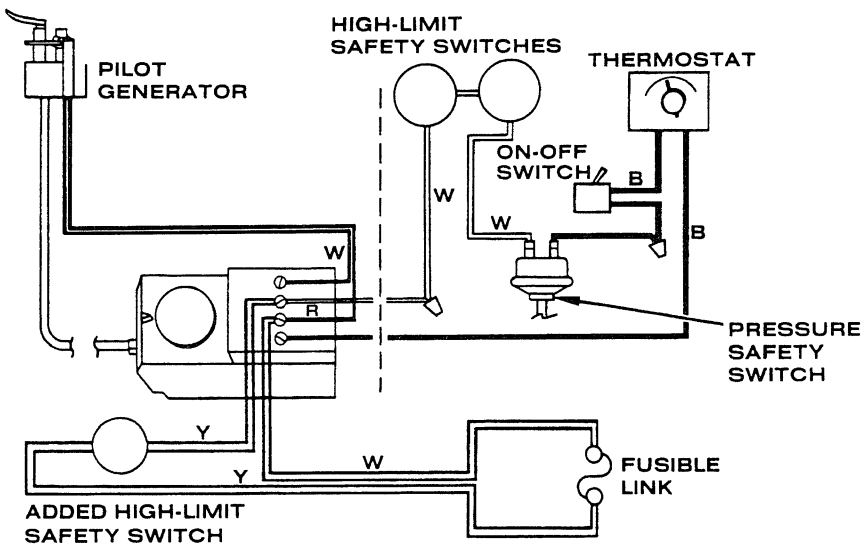


FIG. 15

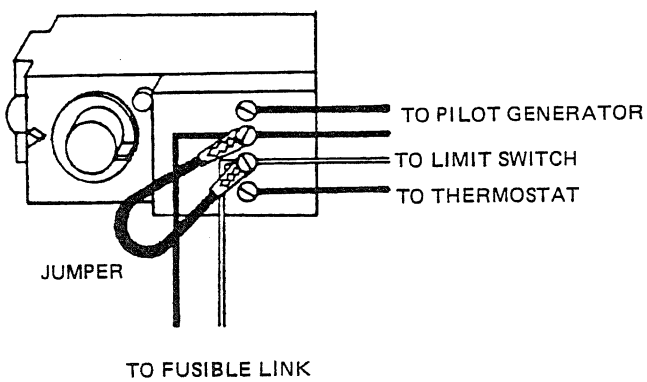
Step 2.

This step will isolate the trouble in the protective Fusible Link. (Part Number E-994)

Place jumper or any short circuit as shown.

If heater comes on with the jumper in place and shuts off when it is removed, the trouble is in the Protective Fusible Link. See Paragraph 5/6.

If heater does not come on, GO TO STEP 3.



ELECTRICAL SYSTEM TROUBLE SHOOTING SEQUENCE
Heater Does Not Come On.
If Heater Will Not Shut Off See Step 4.

Step 3.

This step will isolate the trouble area:
The protective controls or thermostat,

or

The gas valve, pilot generator or grounded wire harness.

Place jumper or any short circuit as shown below.
If heater comes on with jumper in place and shuts off when it is removed, the trouble is in the protective controls or thermostat. Go to Step 4.

If the heater does not come on, the trouble is either a grounded wire harness, the gas valve or the pilot generator.

To test for grounded wire harness, disconnect harness wires and replace jumper. If heater comes on, harness is grounded. Inspect for pinched or pierced insulation, a terminal touching a metal ground, loose strands of wire grounded, broken or burned wires, etc.

If heater does not come on, the trouble is in the pilot generator or gas valve.

To test pilot generator:

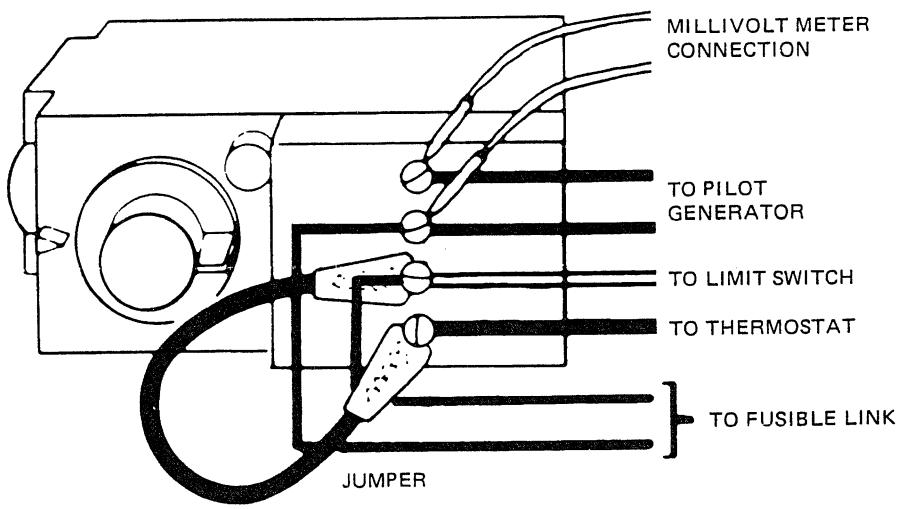
With jumper in place, connect leads from millivolt meter to gas valve as shown below. Reverse leads if needle deflects in opposite direction.

If meter reads more than 200 millivolts and the gas valve doesn't open, the gas valve is defective and should be replaced.

If meter reads less than 200 millivolts, disconnect pilot generator leads from valve and connect them directly to the millivolt meter. To prevent pilot from going out during this test the gas valve knob must be held down. If meter does not read over 500 millivolts, the pilot generator is out of position at the pilot burner (reposition and retest), or the pilot generator is weak and should be replaced. See paragraph 5/4. The generator must be properly enveloped in the pilot flame to generate its full potential.

If heater still does not come on after replacement of pilot generator cartridge, the problem is in the gas valve. Replace valve. See paragraph 5/7.

WARNING: Never leave a jumper on a heater control to keep the heater operating.



Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 18A.

FIG. 16

Step 4.

If the heater comes on when the jumper is installed as in Fig. 16 and shuts off when the jumper is removed, the problem is in one or more of the protective switches or their wiring.*

In this step, jumpers will be used to remove each of the protective switches from the circuit, one at a time, to determine which one is keeping the heater off.

** Check for terminals loose on wire end, loose terminal screws, cut or broken wires.*

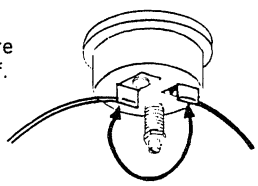
IMPORTANT: If water flow through the heater is stopped after the heater has been on for more than three (3) minutes, the residual heat in the firebox will heat the standing water in the tubes and travel to the pool thermostat and the high-limit switches. This may prevent the heater from coming ON for several minutes after starting water flow through the heater. Cool the heater by turning the Operating Gas Valve to OFF and let the pool water circulate through the heater for ten (10) minutes before proceeding with these tests.

NOTE: Keep filter pump running and turn the gas valve ON so that heater will come on when the troublesome switch is jumpered.

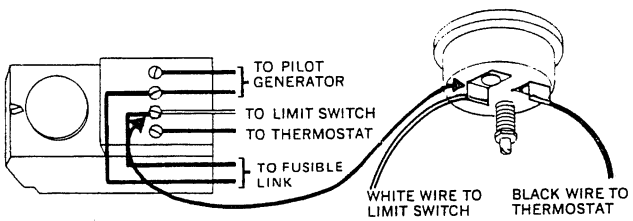
Remove control compartment door. Rotate thermostat shaft clockwise to the stop.

To find out which switch is keeping the heater off, add jumpers one at a time.

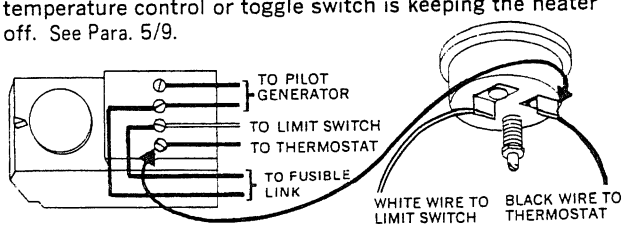
1. First put a jumper wire here. If heater comes on, the Pressure Switch is keeping the heater off. See paragraph 5/8.



2. Connect jumper to the **white** wire terminal on pressure switch and the **white** wire of wiring harness that is connected to gas valve terminal block. If the heater comes on the High Limit Switches are keeping heater off. See Para. 5/10.

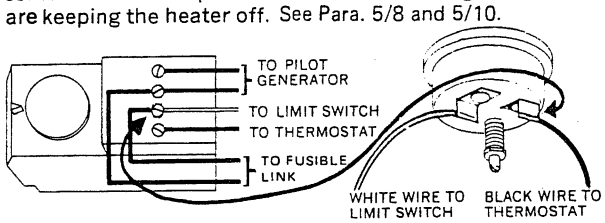


3. Connect jumper to the **black** wire terminal on pressure switch and the **black** wire of wiring harness that is connected to gas valve terminal block. If the heater comes on, the temperature control or toggle switch is keeping the heater off. See Para. 5/9.

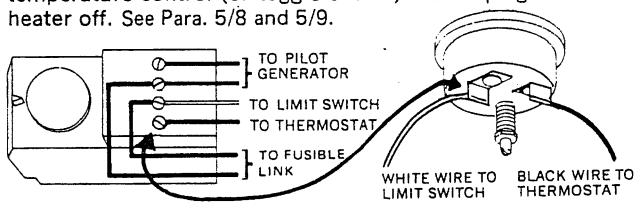


Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 18A.

4. Connect jumper to the **black** wire terminal on pressure switch and **white** wire on gas valve terminal block. If heater comes on **both** the pressure switch and the high limit switch are keeping the heater off. See Para. 5/8 and 5/10.



5. Connect jumper to the **white** wire terminal on pressure switch and the **black** wire on gas valve terminal block. If heater comes on **both** the pressure switch and the temperature control (or toggle switch) are keeping the heater off. See Para. 5/8 and 5/9.



Testing for Voltage Loss in Safety Circuit

This test determines whether or not there is excessive voltage drop (resistance) in any contact or control.

High resistance in the safety circuit can cause intermittent operation and is a warning of future problems. This test must be done with filter pump and burners ON.

6. Attach the millivolt meter as shown below. Using the low range scale on the millivolt meter, the reading should be 20 mv or less. This is the total voltage drop through the safety controls and wire harness.

7. If the voltage drop is over 20 mv locate source of voltage drop by jumpering out the pressure switch, thermostat, and the high limits in turn, using the millivolt meter to jumper the controls instead of a jumper wire. See 1 thru 5. When all the voltage drops obtained in this manner are added up, the total should be the same as the mv reading obtained in 6.

8. If there is more than 10 mv drop across the **pressure switch,** make sure the 2 terminals are tight. If this doesn't eliminate the voltage drop, remove the adjustment screw (with spring) and rub the tip of the screw on a paper towel to remove any contamination. Replace screw and tighten until the heater comes on. Then turn the screw back and forth ½ turn about a dozen times to make sure the contacts are clean. Readjust the pressure switch by the procedure in Figure 11.

9. If there is more than a 10 mv drop in the **thermostat,** check and clean the spade terminals and retighten the terminal screws on the thermostat. If this does not eliminate the high voltage drop, replace the thermostat.

10. If there is more than 10 mv drop across the toggle switch, flip toggle several times. If this does not eliminate the excessive drop, replace the switch.

11. If there is more than a 10 mv drop in the **high limit switches** check each switch independently as shown in Fig. 24. Make sure the quick connect terminals are attached tightly to the wire and the limit switch. If more than a 5 mv drop appears to originate from inside a limit switch, replace it.

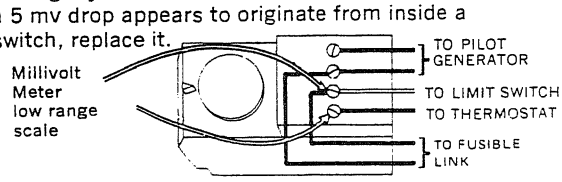


FIG. 17

ELECTRICAL 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.

First, 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, causing delayed on-off action. Check as follows:

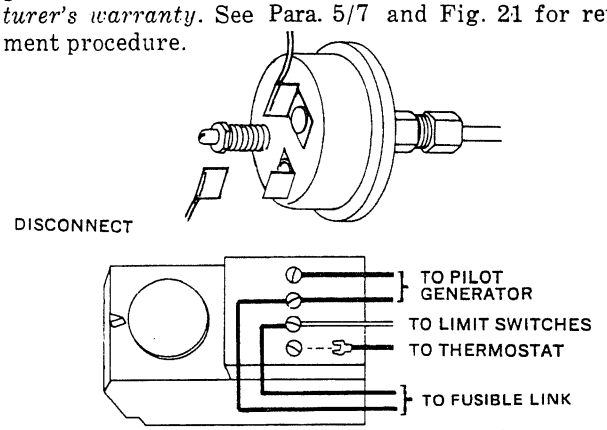
1. *Switch may be out of adjustment.* See Para. 3/7 for proper adjustment procedure.
2. *Syphon loop may be clogged.* Disassemble switch assembly and blow out until clear. See Para. 5/8.
3. *Pressure switch may be defective.* See Para. 5/8 for testing and replacement procedure.

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

4. *Shorts in wire insulation.* 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.

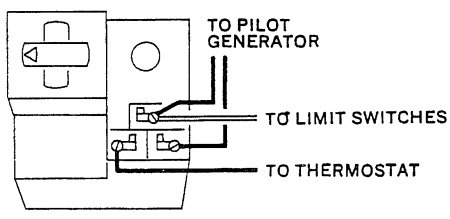
If heater still stays on with wiring disconnected at gas valve, (See illustration below) the gas valve is at fault.

5. *Debris may have collected under gas valve seat.* Replace gas valve. *Disassembly of valve will invalidate manufacturer's warranty.* See Para. 5/7 and Fig. 21 for replacement procedure.



GENERAL CONTROLS GAS VALVE

FIG. 18



HONEYWELL GAS VALVE

Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve.

FIG. 18A

5/4. PILOT GENERATOR REPLACEMENT

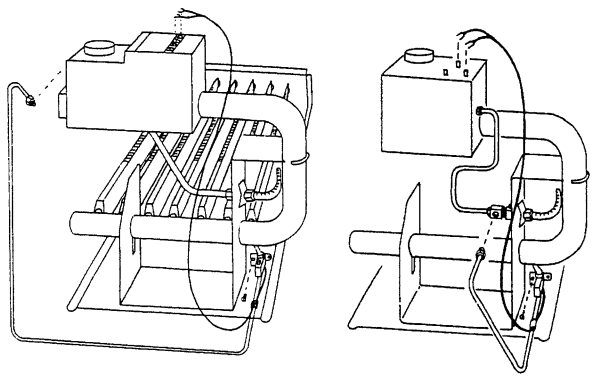
The procedure for testing the pilot generator is found in Figure 16. To remove the pilot and generator assembly, follow the steps in Fig. 19.

PILOT GENERATOR UNIT REPLACEMENT

1. Disconnect pilot generator wires from gas valve and remove retainer bands.
2. Grasp shielded wire at base of pilot generator and pull down while deflecting spring clip.
3. To replace reverse procedure.

PILOT BURNER ASSEMBLY REPLACEMENT

1. Disconnect pilot generator wires from gas valve.
2. Disconnect pilot gas tube at pilot burner.
3. Disconnect pilot burner from its bracket by removing screw into pilot bracket.
4. Also, pilot burner attached to main burner can be removed by following procedure in Par. 5/10.



GENERAL CONTROLS GAS VALVE

HONEYWELL GAS VALVE

FIG. 19

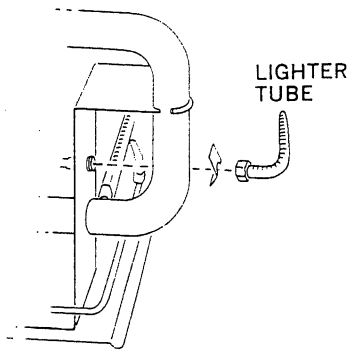
5/5. VISOFLAME PILOT LIGHTER

Visoflame pilot lighting is used to facilitate the lighting of the pilot and to make it easy to determine if the pilot is burning properly.

General Controls gas valve: With gas valve knob set on pilot position, pressing down on the knob sends gas through the lighter tube, escaping through the perforations for sure easy lighting of the pilot flame. To check for a lighted pilot, press gas valve down and flame will return along the perforations and be readily detectable, indicating the pilot is burning.

Honeywell gas valve: With gas valve knob set on pilot position, press red Visoflame button next to perforated lighter tube. To check for a lighted pilot, press Visoflame button and flame will return along the perforations and be readily detectable, indicating the pilot is burning.

See paragraph 4/1 for pilot lighting details.



VISOFLAME REMOVAL

1. Remove compression cap and cleat which holds perforated tube.
2. Pull assembly from heater.
3. Reverse procedure to replace.

NOTE: It is important that perforated tube be adjusted so that torch flame from end properly lights pilot burner. Secure in proper position by tightening the tube retaining nut.

FIG. 20

5/6. TESTING FUSIBLE LINK

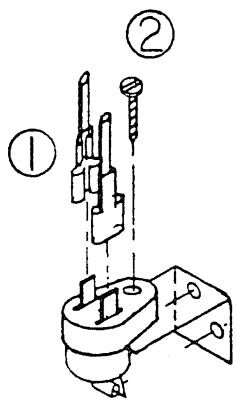
1. Turn thermostat to maximum warm position.
2. With filter pump running, if connecting a jumper across the fusible link (center terminal of the General Controls Gas Valve), the heater comes on, the fuse may be "open." However, first check for broken or loose terminals and/or wires.

Replacement of the Fusible Link

Note: The opening of this protective fuse may be an indication of an unsafe installation location or condition which may result in an adverse "roll-out" condition in your heater. Correct any unsafe condition before replacing Fusible Link assembly.

The Fusible Link is located along the inner panel, back below the gas valve. Replace "open" fuse with Teledyne Laars part E-994.

1. Disconnect wires from Fusible Link Assembly 1
2. Remove mounting screw 2
3. To replace, reverse procedure.



FUSIBLE LINK ASSY.

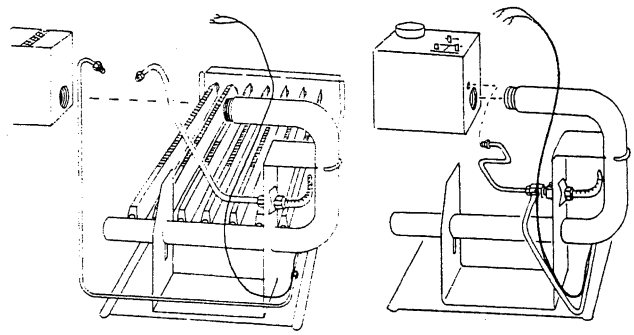
5/7. GAS VALVE REPLACEMENT

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 paragraph 5/3, Step 2. To remove and replace gas valve, follow steps in Fig. 21 Step 3.

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.
4. Detach burner shelf assembly and control assembly from heater inner panel and slide out.
5. Unscrew gas valve from manifold pipe.
6. Replace and reassemble.



GENERAL CONTROLS GAS VALVE HONEYWELL GAS VALVE

FIG. 21

5/8. TESTING PRESSURE SWITCH

1. Turn thermostat to maximum warm position.

2. With filter pump running, if connecting a jumper across the pressure switch (Fig. 17) 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.

Remove jumper (General Controls valve) or disconnect white wire (Honeywell), and connect millivolt meter to pilot generator terminals at the gas valve. See Figs. 22 and 18A.

Start and stop the filter pump. The meter should register 200 millivolts or more when the pump and heater come on under normal conditions and should jump cleanly to 500 millivolts or more when the pump is shut off.

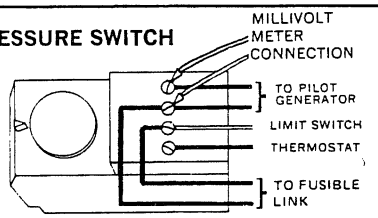
If the millivolt meter needle does not register, rises or falls slowly or hesitates going up or down, a defective pressure switch or clogged connector tube should be suspected.

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 millivolt meter readings, replace the switch.

TESTING PRESSURE SWITCH



Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 18A.

REMOVAL AND REPLACEMENT OF PRESSURE SWITCH

1. Disconnect wires from pressure switch.
2. Disconnect pressure switch from pigtail tube fitting.
3. Reverse procedure to 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.

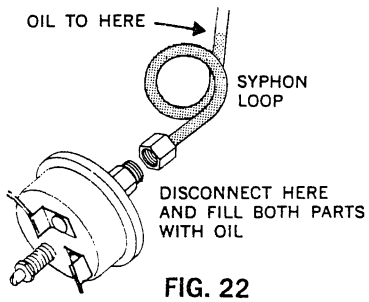


FIG. 22

5/9. TESTING TEMPERATURE CONTROL

The control dial does not have temperature markings other than the eight reference marks which cover an approximate range from 70°F to 107°F. Use an accurate pool thermometer to determine the dial setting which gives you the most comfortable swimming temperature and use the Safe-T-Lok to mark this setting.

The Mark V control can not be calibrated in the field, and if found to be defective, must be replaced or returned to the factory for checking and recalibration.

The condition of the control can be checked with a millivolt meter.

Make sure pump is on and has been circulating water through the heater for at least fifteen (15) minutes.

Rotate knob *counter-clockwise* to the stop to shut heater OFF. Connect millivolt meter to pilot generator terminals on the Operating Gas Valve. Meter should read between 500-750 millivolts.

Rotate knob *clock-wise* slowly, while watching the millivolt meter, until the thermostat turns "ON." This will be indicated by the millivolt needle moving to between 200-250 millivolts. The millivolt meter should move cleanly without hesitation. Now turn the thermostat knob slowly *counter-clockwise* until millivolt meter needle moves back without hesitation to between 500-750 millivolts. The thermostat knob should not have to be rotated more than one dial mark to obtain this. If knob has to be moved more than two marks, or the millivolt meter needle hesitates on the way up or down, the thermostat should be replaced. See Fig. 23.

REMOVAL AND REPLACEMENT OF TEMPERATURE CONTROL AND ON/OFF SWITCH

1. Remove two screws holding control plate in place.
2. Pull out control assembly for easy access.
3. Loosen set screw and remove knob.
4. Remove two screws holding thermostat in the spring clip.

ON/OFF SWITCH

a) Disconnect black switch wire at terminal block of thermostat.
b) Remove wire nut on other black switch wire.
c) Loosen hex. nut behind control mounting plate and remove knurled flat nut on front of dial face.
d) Replace and reconnect.

THERMOSTAT

a) Disconnect both black wires at terminal block.
b) Remove thermostat bulb from header.
c) Replace and reconnect.

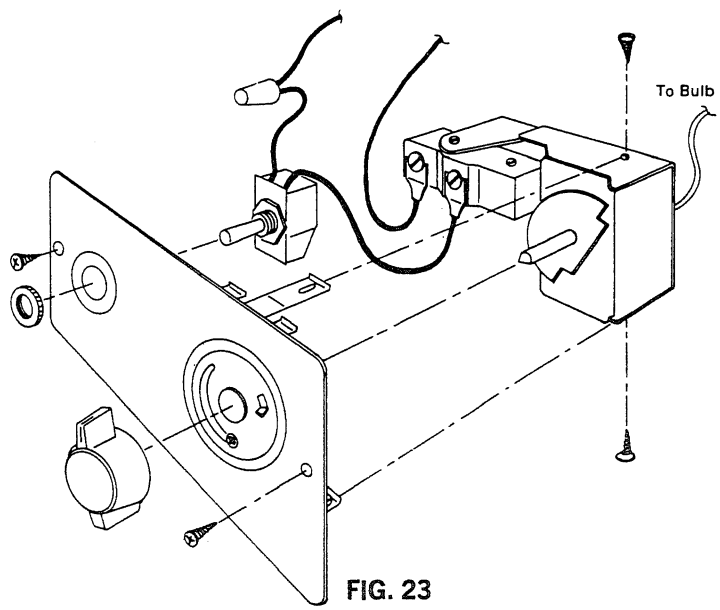


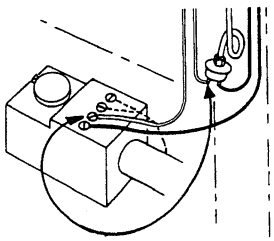
FIG. 23

5/10. HIGH LIMIT SWITCHES

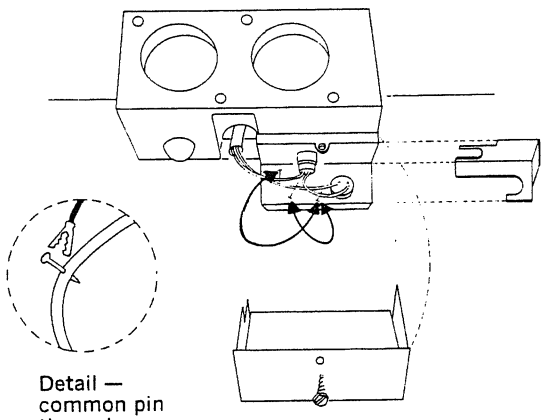
NOTE: The high limit safety switches are pre-set at the factory and no field adjustment should be attempted. Before replacing either of the high limit switches make sure they are not holding the heater off because of overheating in the heater tubes due to other causes. The limit switches may be performing their proper function. Follow steps in Fig. 24.

TESTING AND REPLACEMENT OF HIGH LIMIT SWITCHES

1. Install thermometer as shown in Fig. 10.
2. Install a jumper between the white wire terminal of the pressure switch and the gas valve 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 5/13). If temperature is normal:
   a) Jumper each high limit switch in turn to determine which one is holding the heater off.



Detail — common pin through wire

   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.

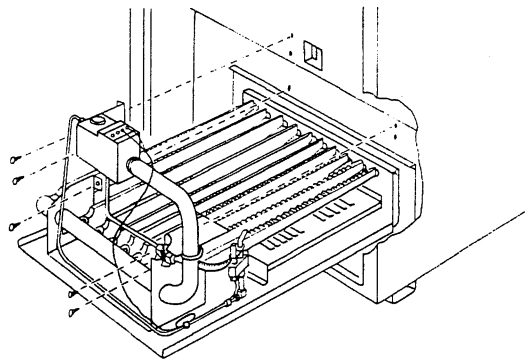
Note: The two jumpered center terminals on the General Control gas valve (illustrated) are replaced by a single terminal on the Honeywell gas valve. See Fig. 18A.

FIG. 24

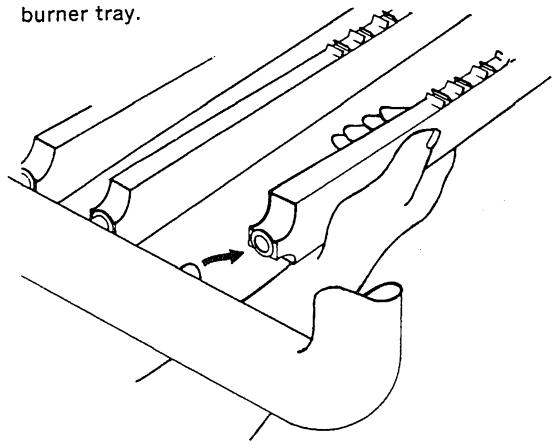
5/11. REMOVAL OF THE GAS BURNERS

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. 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.



5. 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.



6. To replace, insert burner into rear rail slot, line up with proper orifice and snap into position.
7. Reinstall burner tray and reconnect gas piping. Check for gas leaks.

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. 25

5/12. 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 26. The complete heat exchanger inspection is accomplished by removing it from the heater as shown in Figure 27.

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.

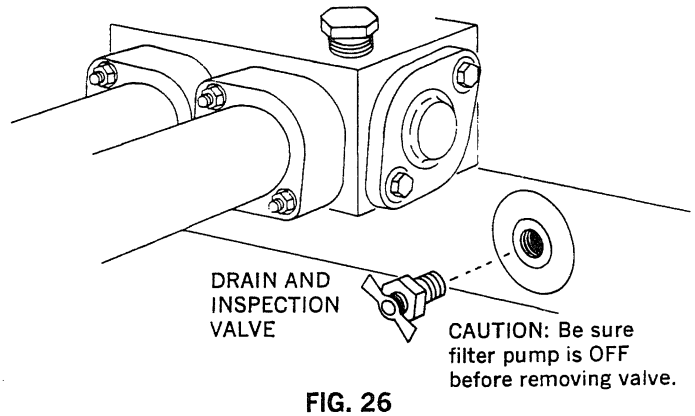


FIG. 26

REMOVAL OF HEAT EXCHANGER

1. Remove top assembly (1) by unscrewing four screws — two front and two back.
2. Remove screws and lift out gap closures (2 & 3).
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. Disconnect white wires at pressure switch and at gas valve. Pull wires through and coil them on top of heat exchanger.
8. Remove temperature sensing bulb 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.
9. 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.

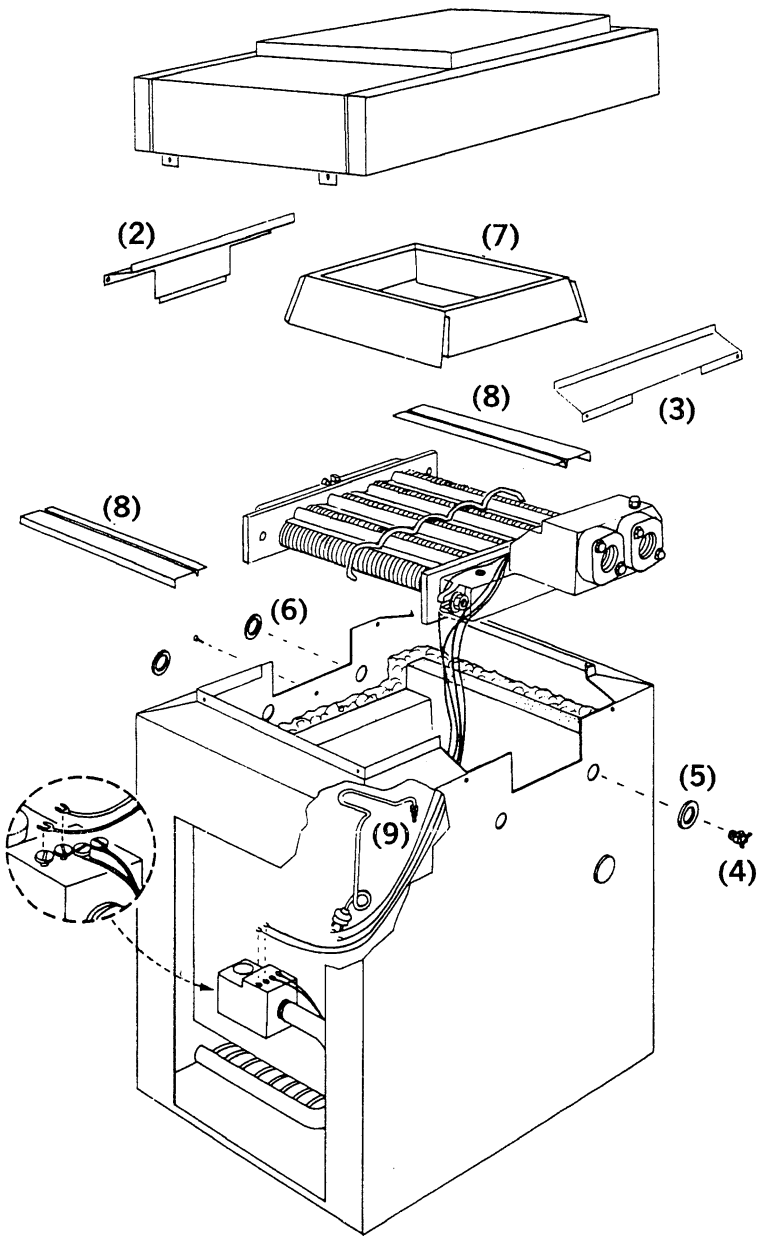


FIG. 27

5/13. 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. 28. 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 28.
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.

CLEANING AND TESTING OF HEAT EXCHANGER

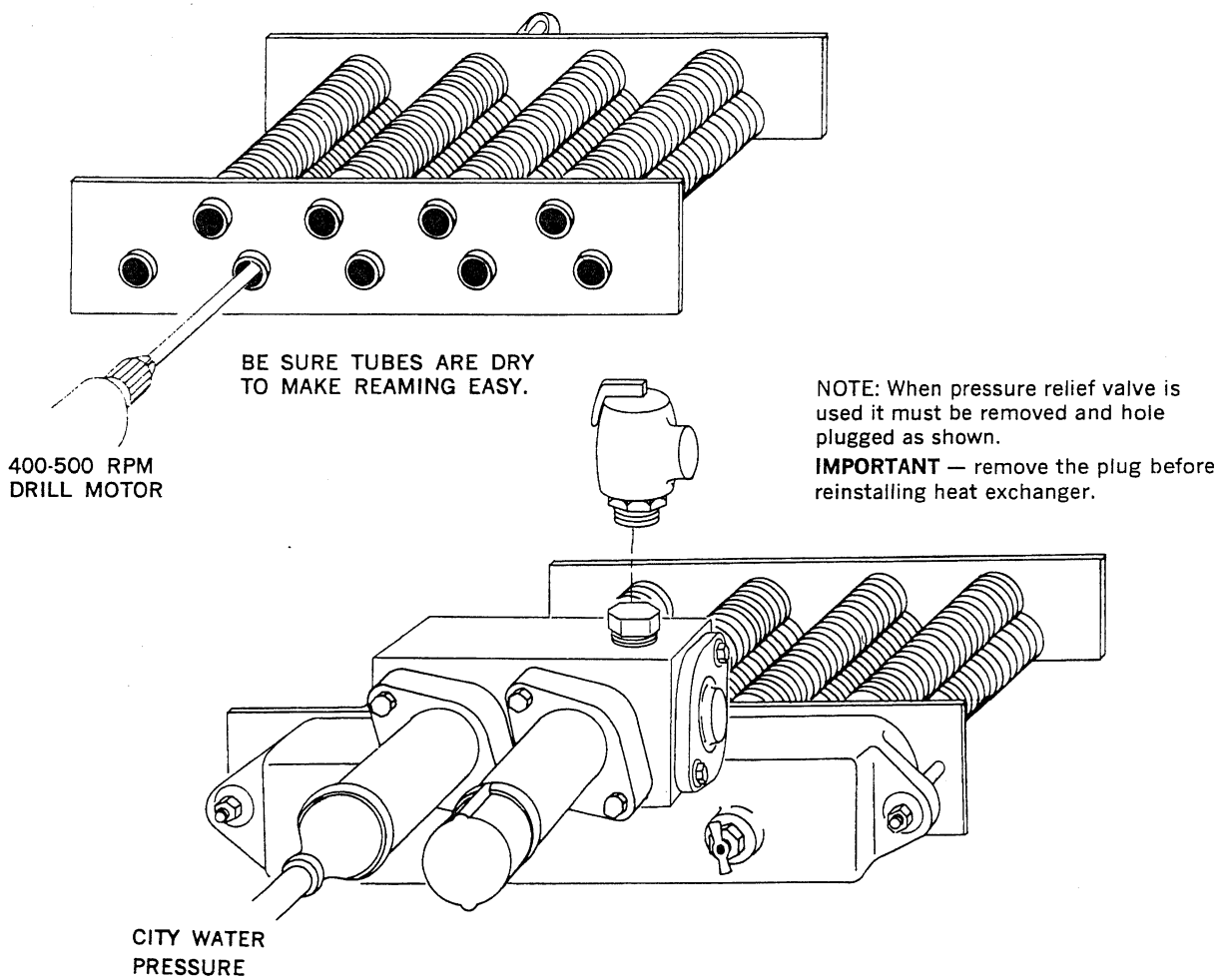


FIG. 28

5/14. 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 29 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.

DISASSEMBLY PROCEDURE AND LIGHT OVERHAUL — AUTOMATIC FLOW CONTROL VALVE.

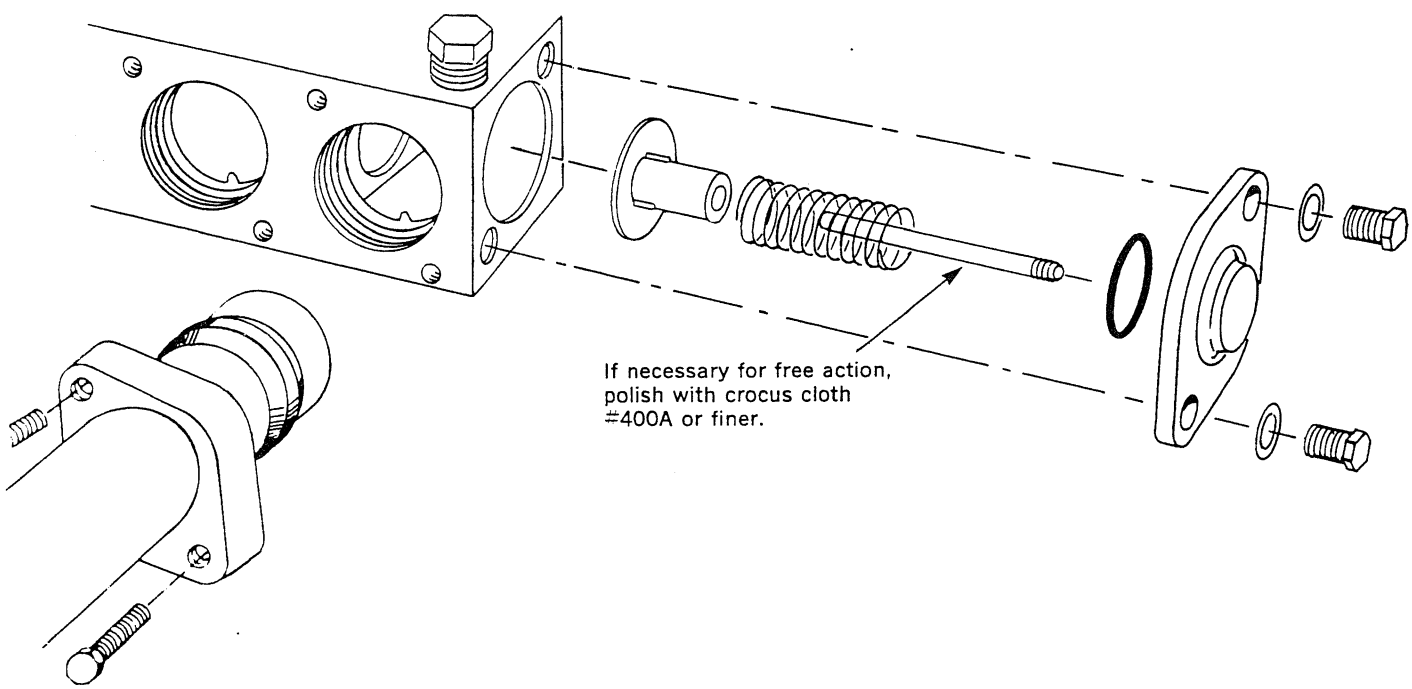


FIG. 29

TROUBLE SHOOTING CHART

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

HEATER WILL NOT COME ON

See Figs. 15, 16, & 17.

HEATER WILL NOT SHUT OFF — See Fig. 18.

What to look for	Why did this happen	What to do
1. Pressure switch is clogged.		1. See Par. 5/8.
2. Short in wire harness.		2. Check wiring (see Fig. 16).
3. Defective gas valve.	Possible debris in gas line.	3. Replace gas valve. See Par. 5/7.

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. 5/13. Adjust water flow. See Par. 5/14.
2. Lack of adequate air supply.		2. Provide adeq. air supply to heater. See Par. 3/3.
3. Improper venting.		3. Provide proper venting of heater. See Par. 3/3.
4. Burner air inlet throat.	Possible restriction by small animal, lint or dirt.	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. 4/2. Clean heat exchanger. See Par. 5/13.
7. Collapsed firebox.		7. Replace firebox. See Fig. 27 for access procedure.
8. Gas regulator out of adjustment.	Pressure too high.	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. 4/6. Clean heat exchanger. See Par. 5/13. Repair valve See Par. 5/14.

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. 4/2.
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 Par 5/9.
4. Pressure switch inoperative.		4. Test Pressure Switch. Replace if necessary. See Par. 5/8.
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.		1. Close by-pass valve and remove handle. See Par. 3/6.
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.	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.	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. 3/8, 5/14.
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. 5/8 and 5/10.
7. Chlorinator is connected upstream of heater.		7. Install Chlorinator downstream of heater. See Par. 3/8.