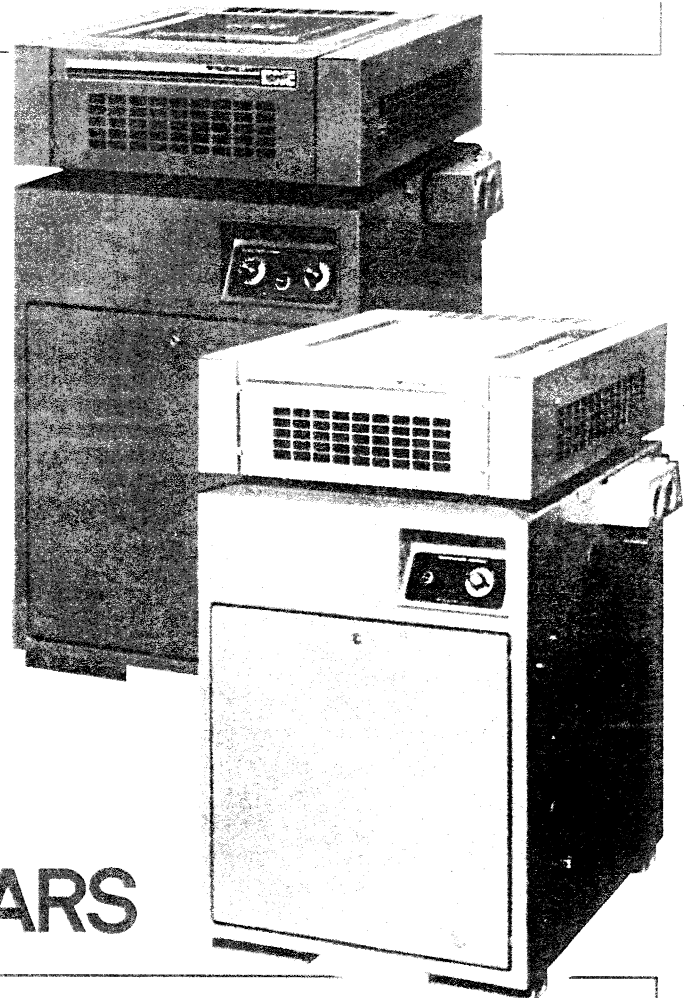


**FOR YOUR SAFETY** - This product must be installed and serviced by a professional service technician, qualified in pool heater installation. Improper installation and/or operation could cause serious injury or death. Improper installation and/or operation will void the warranty.

# Installation, Operation and Service Manual Series One Model EPC, EPS Pool and Spa Heater



**TELEDYNE LAARS**

**WARNING:** If these instructions are not followed exactly, a fire or explosion may result, causing property damage, personal injury or death.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance

## WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier

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## SECTION 1. General Information

### 1A. Introduction

This manual provides installation and operation information for the Teledyne Laars Series One Model EPC and EPS swimming pool/spa heaters. It is strongly recommended that the installer read SECTION 3. INSTALLATION INSTRUCTIONS, and check local and state codes before installing the heater. Experience has shown that most service calls are a result of improper installation. The unit is designed for the heating of swimming pools and spas, and should not be used as a heating boiler, general service water heater, or for use with salt water pools. Consult your dealer for other Teledyne Laars products for those applications.

Series One heaters are design-certified by the American Gas Association as complying with the latest edition of the Standard for Gas-Fired Pool heaters, ANSI Z21.56.

### 1B. Description

The EPC/EPS model pool heaters are compact, high performance appliances which get their electrical power from an external 120V or 240V source. They are available with either a single thermostat (EPC models) or dual thermostat Electro-Temp control system (EPS models) for pool/spa combinations or pre-heat convenience. All Series One EPC/EPS heaters meet the California, New York, Hawaii and Oregon state energy requirements for intermittent ignition gas appliances.

### 1C. Warranty

The Series One is sold with a limited factory warranty. Details are specified on the back cover of this manual, and a copy of the Warranty and Warranty Registration Card are included in the plastic bag. Fill out and return the Warranty Registration Card. The heater serial number can be found on the rating plate located on the inside panel behind the front access door. Damage caused by improper installation or assembly, or to the Heat Exchanger by corrosive water, is NOT covered by this Warranty. See Section 4F regarding maintenance of proper pool water chemistry.

## SECTION 2. Assembly Instructions

### 2A. Reversible Water Connections

The Series One Pool/Spa heater can be installed with the water connections on either side. The unit is shipped with the connections on the right side, but it could be necessary, or advantageous, to switch the connections to the other side for ease of installation or to improve access for heater service and mainte-

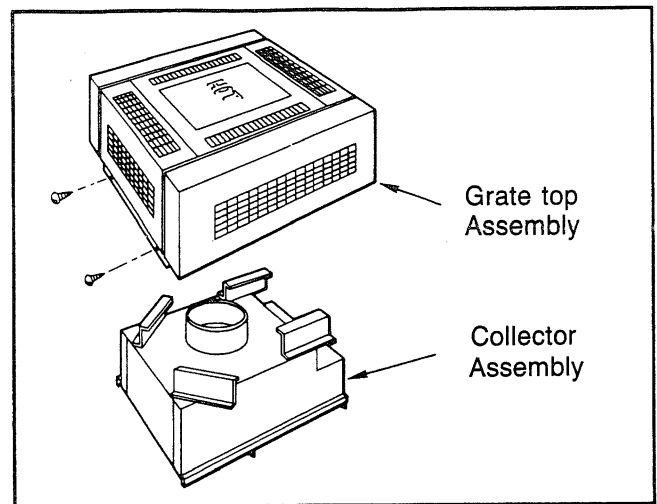


Figure 1. Top Assembly

nance. To make this change, it is necessary to rotate the heat exchanger assembly 180 degrees. This procedure should be done prior to installation by a trained service technician. Follow these step-by-step instructions and accompanying illustrations.

1. If there is already a vent cap/stack or drafthood installed on the heater, remove it.
2. Open the front cover.
3. Remove the hex-head screws shown in Figure 1 and lift the grate top assembly straight up.
4. The collector assembly can now be removed by lifting it out of the chassis.

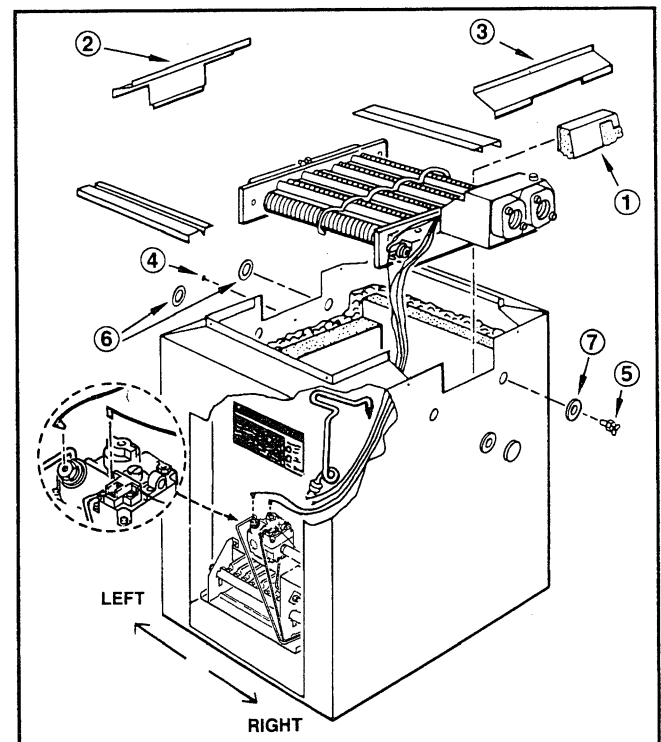


Figure 2. Heat Exchanger Reversal

5. Remove the 5 screws securing the gap closures (2 & 3) and put them aside.
6. Remove the grommet (6) from the left side of the heater.
7. Remove the two drain valves and drain valve grommets.
8. Gently pry off the large cap located on the right side.
9. Remove the insulation retainer bracket. Set the fiberglass insulation under the bracket aside.
10. Remove the temperature sensor from the back of the header by loosening the cap screw and sliding the retainer bracket off the bulb flange. Retain the fiberglass insulation under the retainer bracket. Remove the sensor from the header and rotate it out of the way.
11. Disconnect the pressure switch copper tubing from the top of the header by loosening the upper hex nut. Swing the copper tubing out of the way.
12. Remove the front and rear insulation blocks.
13. Disconnect the white wire from the pressure switch, and separate the two white wires at the wire nut. Pull the wires out of the front compartment, and coil them on top of the heat exchanger.
14. Lift out the heat exchanger assembly, rotate it 180 degrees, and re-seat the unit in the heater with the water connections on the left side.
15. Reconnect the pressure switch copper tubing on the back of the header, and locate the switch in the original position, carefully straightening the copper tubing as necessary.
16. Re-install the temperature sensor and sensor retainer bracket, in the header, securing it with the cap screw. Route the sensor wiring carefully along the inside of the heater jacket.
17. Cover the back of the header with insulation, and replace the insulation retainer.
18. Reroute the white wires alongside the heat exchanger and back down to the original location. It is very important that these wires be kept away from all heat producing surfaces. Connect one white wire to the pressure switch and twist the other white wire together with the white wire coming from the fusible link and secure the two with the wire nut.
19. Replace the front and rear insulation block covers.
20. Replace the gap closures and tighten the screws securely (the gap closures will go back on the opposite side they were removed from).
21. Replace the drain valves, grommets and the cap.
22. Replace the collector assembly inside the enclosure.
23. Carefully slip a hand inside to make sure there are no gaps between the heat exchanger and the flue collector.
24. Make sure the wiring is not pinched against sharp edges, or resting on the collector assembly.
25. Replace the top assembly and secure it with the hex-head screws.

## SECTION 3. Installation Instructions

### 3A. General

All gas-fired products require correct installation to assure safe operation. The requirements for pool heaters include:

1. Site Location (clearances).
2. Combustion air and ventilation air.
3. Venting (products of combustion)
4. Properly sized gas pipe.
5. Adequate water flow.
6. Regular maintenance.

The National Fuel Gas Code offers general criteria for combustion air, ventilation air, and venting. These criteria must be followed to ensure a safe, efficient installation.

The location selected for the heater must permit satisfactory air entrance for proper venting, and allow space for maintenance access. Recommended clearances are specified in Section 3B and 3C.

Correct gas pipe sizing is also required for safe operation at the proper manifold pressure. The National Fuel Gas Code also offers general criteria for gas piping.

If the above installation requirements are not followed, the fuel used in these appliances could produce and expose you to substances that are known to cause cancer and reproductive harm.

The National Fuel Gas Code is available from:

AGA  
American Gas Assn.  
(Administrative)  
1515 Wilson Blvd.  
Arlington, VA 22209

NFPA  
National Fire Protection  
Battymarch Park  
Quincy, MA 02269

The heater should be located in an area where leakage of the tank or connections will not result in damage to the area adjacent to the appliance or to the structure. Where such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the heater. The pan must not restrict air flow.

### 3B. Outdoor Installation

#### 3B-1 Heater Clearances

The heater must be located in an open, unroofed area away from walls and windows, and the following clearances must be maintained:

Blank Side and Rear of heater	6" Minimum clearance
Piping side	12" Minimum clearance
Front of heater	18" Minimum clearance for service access and air circulation
Floor	Non-combustible*

\*If the heater is to be installed on a combustible surface, a special base can be ordered from Teledyne Laars (Part No. 105217-01 through -05).

**IMPORTANT:** Install the heater on a floor of non-combustible construction with no combustible materials against the underside, or on fire-resistant slabs or arches having no combustible materials against the underside.

The heater can be installed on a combustible floor if a non-combustible base, available from Teledyne Laars, is used. Heaters must not be installed on carpeting.

As an alternative to the Teledyne Laars non-combustible base, the National Fuel Code allows a heater to be placed on other than a non-combustible surface when such an installation complies with the American Insurance Code. This code specifies the surface under the heater be protected with hollow masonry no less than 4" thick. The masonry must be covered with sheet metal at least 24 ga. in thickness, and must be laid with ends unsealed, and joints matched in such a way as to provide free circulation of air side to side through the masonry. See figures at the bottom of page 4.

Do not install the heater in a location where leaves or other combustible materials can accumulate around the base.

Do not place the heater in close proximity to sprinklers; the water could damage the controls and/or the electronics.

If the heater is to be installed under an overhang, there must be a minimum clearance of 3 feet above the top of the heater. The area under the overhang must be open on three sides, so that combustion gases cannot be diverted into living areas through doors, windows or gravity inlets. There must be rain gutters to protect the heater from direct water drainage. There must be a minimum of 4 feet horizontally and vertically between the heater and any door, window or gravity inlet to a building (see Figure 4).

**IMPORTANT:** When selecting the heater location, keep in mind that high winds can roll over or deflect off adjacent buildings and walls causing pilot outage. Placing the heater at least 3 feet from any vertical surface could prevent such adverse wind conditions from affecting the performance of the heater. The addition of a vent cap may be necessary to solve the problem.

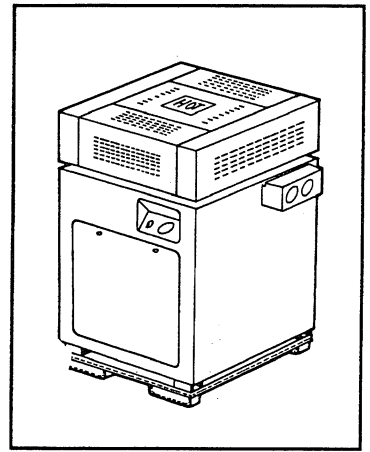


Figure 3. Non-combustible Base

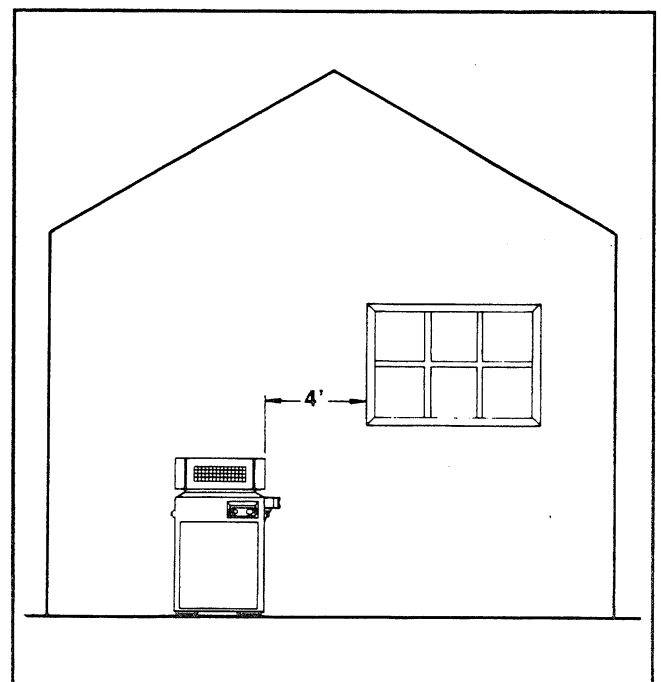


Figure 4. Outdoor Location Diagram

### 3C. Indoor Installation

The Series One heater is design-certified for indoor installation when equipped with a draft hood. Check the rating plate for the correct Teledyne Laars draft hood part numbers. Install the draft hood without change.

Connect the draft hood to a vent pipe which stops at least two feet above the highest point of the roof or other object that is within ten feet of the vent. Install a listed cap which allows a full equivalent opening for flue products.

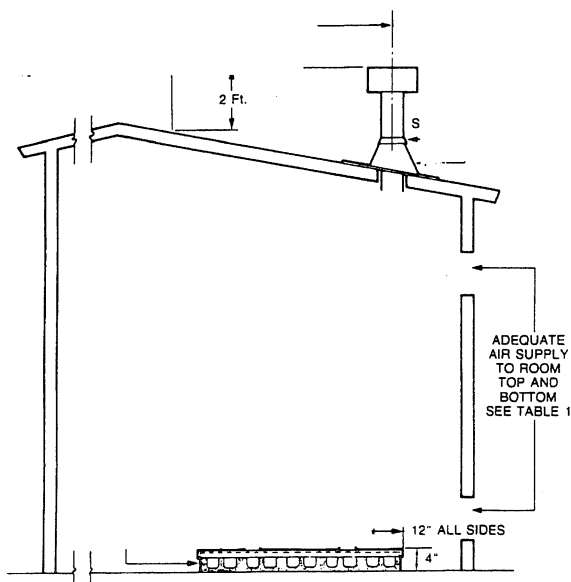
#### 3C.1 Heater Clearance

Top of Heater	44" minimum clearance
Blank side and Piping side	6" minimum clearance 12" minimum clearance
Front of heater	18" minimum clearance for service access and air circulation. In Canada, this clearance must be 36". (Closet installation not permissible)
Floor	Non-combustible*

\* If you are installing the heater on a combustible surface, order a special base from Teledyne Laars (Part No. 15217-01 through -05).

#### 3C-1. Combustion and Ventilation Air Supply

In all indoor installations, there must be uninterrupted openings to outside air for combustion and ventilation. Table 1 shows the net free opening areas required at both ceiling and floor for the different heater sizes. Teledyne Laars does not recommend indoor installations that depend on infiltration air for combustion.



- NOTE:
1. The draft hood must sit directly on top of the heater as shown and must not be altered in any manner.
  2. An Underwriters Laboratories listed vent cap is required to eliminate down draft and allow the heater to function properly.
  3. Use approved roof fitting.

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

The Installation, Operation and Maintenance manual must be followed exactly. Additional copies of this manual are available from the factory: 6000 Condor Dr., Moorpark, CA 93021.

If the heater is installed in a residential garage, it must be located 18" above the garage floor. See the National Fuel Gas Code for more information and exceptions to this rule.

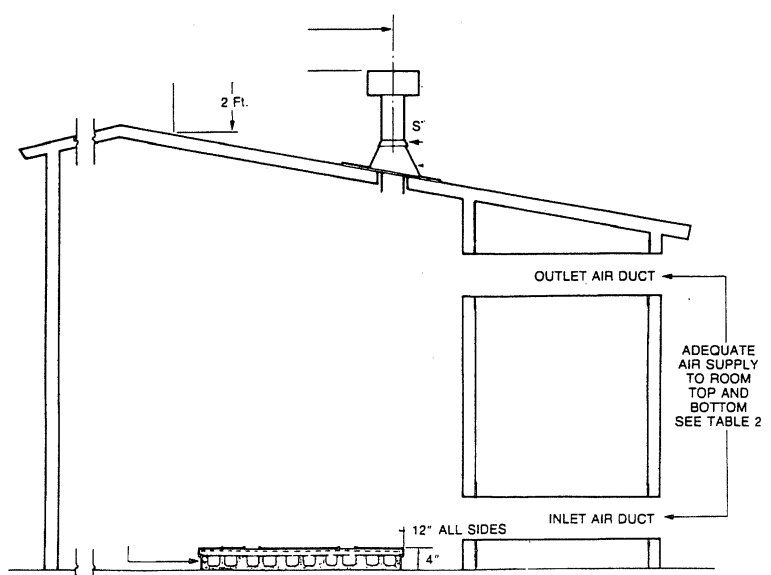
#### 3C.2 Special Precautions for LP Gas Heaters

Liquefied petroleum gas is heavier than air. Therefore, do not install pool heaters using LP gas in pits or other locations where gas might collect. Locate the heaters a safe distance from LP gas storage and filling equipment. Consult local codes and fire protection authorities about specific installation restrictions.

**WARNING:** The conversion of this appliance from one gas to another must be done by a qualified technician. The change is made by replacing the existing burner tray assembly with a new burner tray ordered and supplied by Teledyne Laars. Changing burner and pilot orifices is prohibited. The installer must add and sign a gas conversion tag when the conversion is made

Model	Directly from Outside	Ducted from Outside
125	32	63
175	44	88
250	63	125
325	82	163
400	100	200

Table 1. Required Openings in Sq. Inches



- NOTE:
1. The draft hood must sit directly on top of the heater as shown and must not be altered in any manner.
  2. An Underwriters Laboratories listed vent cap is required to eliminate down draft and allow the heater to function properly.
  3. Use approved roof fitting.

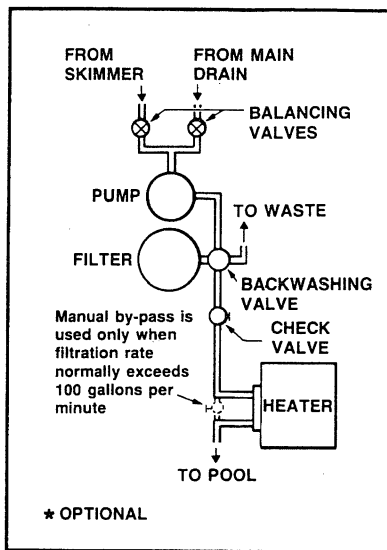


Figure 5. Typical Pool Piping Diagram

### 3D. Water Piping

Plastic materials may be used in pipes, fittings, grids and other elements of the filter system if acceptable by the authorities having jurisdiction. A metal "heat sink" pipe should be used between the filter and the heater as shown in Figure 8.

Do not install PVC plastic piping directly to the heater inlet/outlet header. PVC pipe does not have the high temperature capabilities required to assure safe and reliable operation of the heater. CPVC high temperature plastic piping, Schedule 40, can be connected directly to the heater inlet/outlet header when allowed by local codes.

A check valve should be installed if there is any chance of "back-syphoning" when the pump stops. Do not install any other valve or variable restriction in the piping between the heater outlet and the pool, unless it is necessary to increase back pressure, or is being used as a diverter valve.

The heater is equipped with 2" universal header couplings. The flange couplings, flange gaskets and plastic sleeves allow the following connections:

- Threaded 2" pipe
- Unthreaded 1-1/2" pipe
- 1-1/2" or 2" copper pipe.

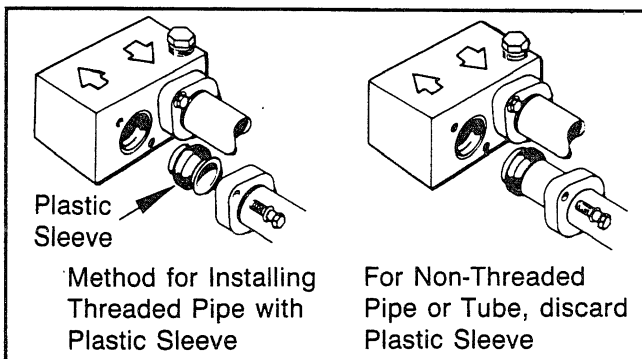


Figure 7. Piping Installation

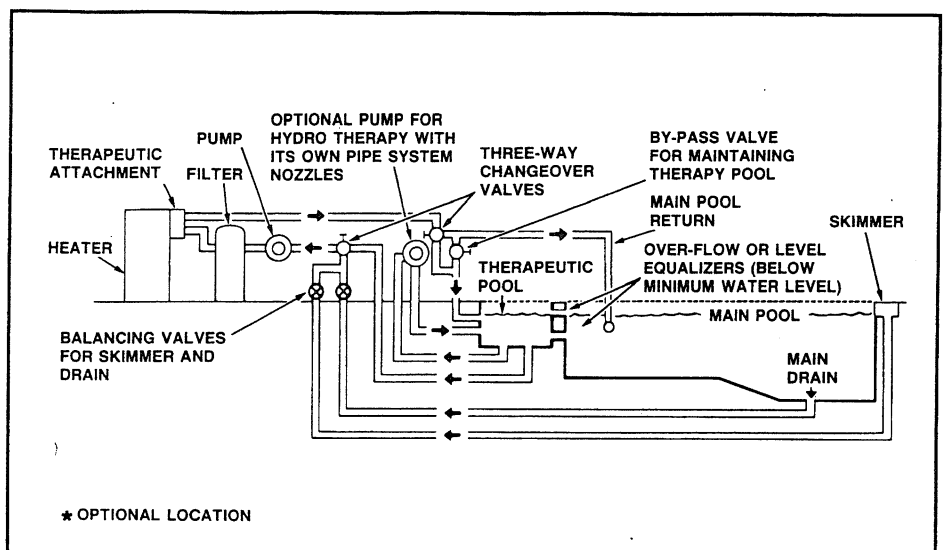


Figure 6. Piping Diagram for Pool/Spa Combination

**NOTE:** A 2" x 1-1/2" threaded adapter is required to connect 1-1/2" threaded pipe to the heater. See Figure 14 for connection details.

Figures 5 and 6 illustrate typical water piping for a pool, spa or pool/spa combination. Minimum water flow requirements are shown in Table 2. For 2-speed pumps, exercise caution when heating at low speed. The heater is equipped with an internal automatic bypass valve that will maintain proper flow through the heater at flow rates up to 125 gallons per minute. Flow rates higher than that require a manual bypass.

Figure 8 shows a manual by-pass valve installed between the heater inlet and outlet. This valve is required if the system filter-flow rate exceeds 125 gallons per minute. To set the bypass valve, follow this procedure:

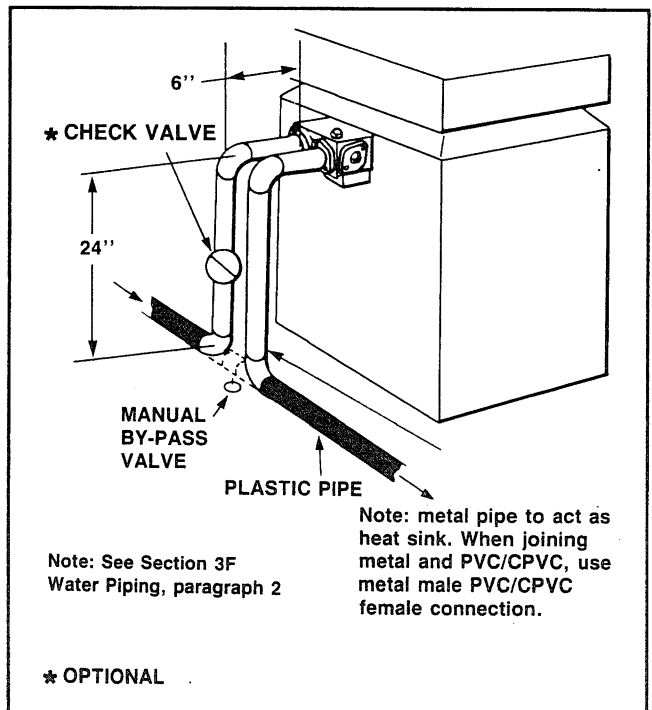


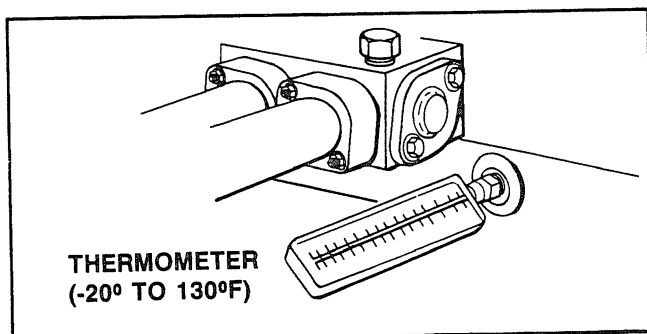
Figure 8. Use of Plastic Pipe ( Where Permitted)



- a. Clean the pool filter.
- b. With the filter pump off, remove the drain valve located on the right side of the header, and install a 1/4" Pete's plug and thermometer (see Figure 9).
- c. Close the manual by-pass valve.
- d. Turn off the heater by moving the toggle switch to the "OFF" position.
- e. Start the filter pump.
- f. After 3 minutes, note and record the thermometer reading (this represents pool water temperature).
- g. Turn the heater back on.
- h. Slowly open the manual by-pass valve, counting the rotations, until the temperature rise shown in Table 2 is obtained (the temperature rise is the difference between the first reading and this one).
- i. Be sure the thermometer reading remains constant for at least 3 minutes.
- j. Scribe a line on the by-pass valve to record the position in case it is necessary to repeat the procedure. Remove the handle from the valve.

SIZE	TEMPERATURE RISE, F		MIN. FLOW (GPM)
	MIN.	MAX.	
125	27	36	20
175	33	42	20
250	33	42	25
325	28	38	30
400	30	39	30

**Table 2. Temperature Rise & Minimum Flow Rates**



**Figure 9. Temperature Check**

### 3E. Gas Supply and Piping

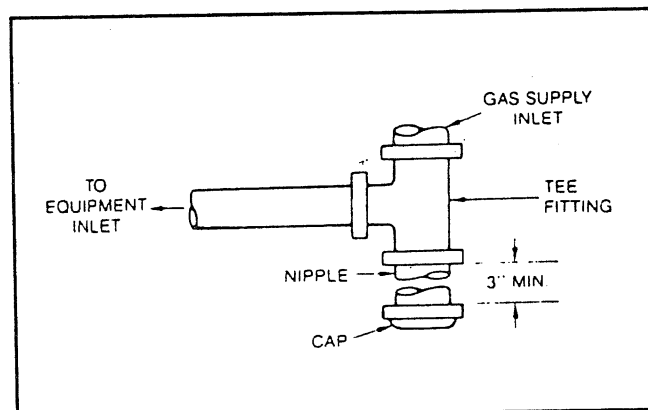
Heaters are shipped from the factory to operate on natural gas only at a maximum altitude of 2000 feet. If a modification is made for higher altitude operation, an appropriate sticker or tag is attached to the heater manifold. Converting the heater from natural to propane is not allowed.

Teledyne Laars recommends the gas supply pipe sizes in Table 3. Check local codes for compliance before installing the heater.

SIZE	DISTANCE FROM METER		
	0-50'	51-100	101-200'
125	3/4"	1"	1"
175	1"	1"	1-1/4"
250	1"	1-1/4"	1-1/4"
325	1-1/4"	1-1/4"	1-1/2"
400	1-1/4"	1-1/2"	1-1/2"

**Table 3. Recommended Gas Supply Pipe Sizes**

Provide a union on the gas supply line outside the heater jacket, including a drip leg and a manual shutoff valve. Do not use a restrictive gas cock.



**Figure 10. T-Fitting and Sediment Trap**

The maximum inlet gas pressure must not exceed the value specified by the manufacturer, and the minimum value listed is for the purpose of input adjustment.

Before operating the heater, test all gas connections for leaks with a soap solution. Do not use an open flame. Disconnect the heater and its individual shutoff valve from the gas supply piping during pressure testing if the test pressure is higher than 1/2 psig (3.7 kPa). If the test pressure is equal to or less than 1/2 psig (3.7 kPa), close the manual shutoff valve on the heater during the piping pressure test.

Check the heater and its gas connection for gas leaks before placing it in operation.

Table 4 shows the gas supply pressure:





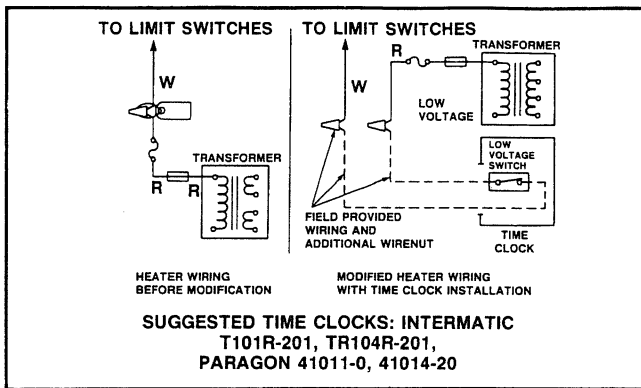


Figure 13. Typical Time Clock Wiring Diagram

To include a time clock auxiliary switch in the heater wiring, follow these steps (see Figure 13):

1. Remove the front access door.
2. Remove the factory installed wire nut, tagged "Connect Wires from Firemans Switch Here", and separate the two white wires.
3. Connect the wires from the time clock auxiliary switch to the two white wires using wire nuts. The wire should be 14 ga. copper, with insulation at least 3/64" thick, with a temperature rating of 105°C or greater.

### 3G. Pressure Relief Valve

A pressure relief valve is not furnished with the heater. It may be required by local plumbing codes.

To install a pressure relief valve, replace the 3/4" brass plug on top of the header with the valve (see Figure 14). The pressure relief setting of the valve should be at or below the lowest working pressure of any component in the filter system.

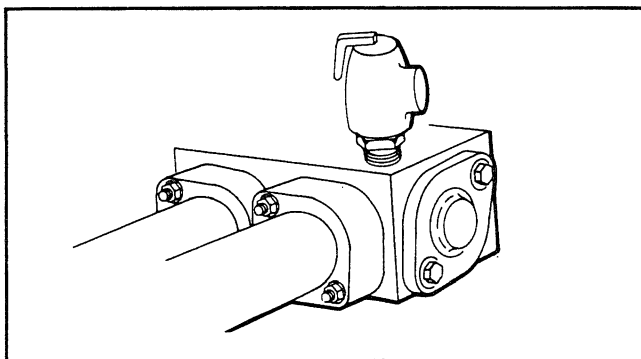


Figure 14. Pressure Relief Valve

## SECTION 4. Operating Instructions

**WARNING:** Vent pipes, drafthoods and grate tops get hot! These surfaces have the potential to cause serious burns, so do not touch these surfaces while the heater is in operation. The addition of a vent cap/stack will reduce the temperature on the grate top.

### 4A. Lighting and Shutdown

Full lighting and shutdown instructions can also be found attached to the back of the control compartment door.

Turn off all electrical power to the heater at the main junction box. Turn the gas valve to its lowest setting, and the toggle or rotary switch to OFF. **WAIT FIVE MINUTES BEFORE TRYING TO LIGHT THE HEATER.**

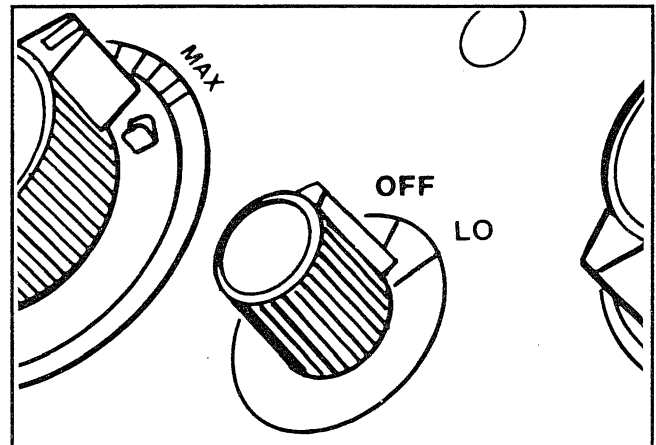


Figure 15. ON-OFF Switch, EPS

**WARNING:** For your safety when starting the heater, keep your head and face well away from the lower firebox opening to prevent any risk of personal injury.

#### 4A-1. Lighting the Heater

The EPC and EPS heaters do not require manual pilot lighting. This is done automatically by the ignition control when the thermostat calls for heat.

1. Remove the control compartment door to get to the gas valve.
2. Turn the gas valve control knob counterclockwise to ON.
3. Replace the control compartment door.
4. Turn on electrical power to the heater.
5. Turn on the filter pump.
6. Set the thermostat to the desired setting, and turn the toggle or rotary switch ON.

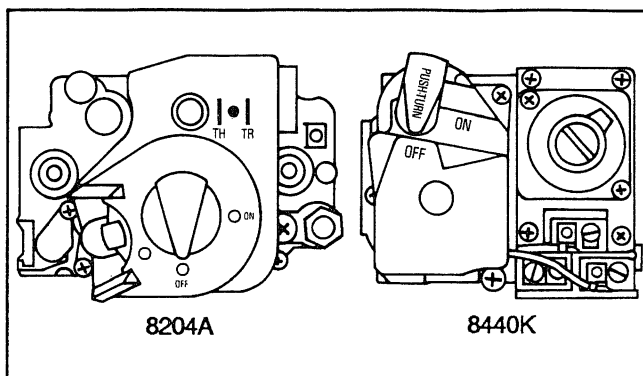


Figure 16. Gas Valves in OFF Position

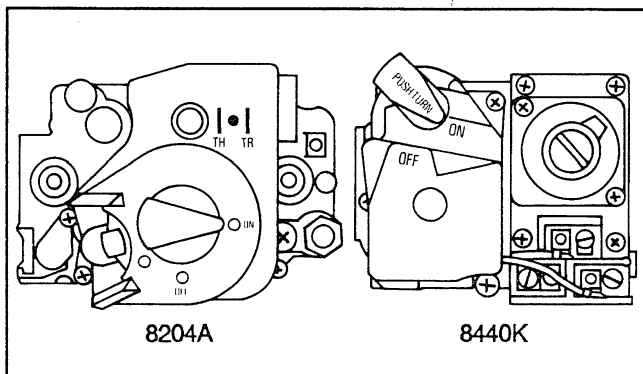


Figure 17. Gas Valves in ON Position

**NOTE:** Should overheating occur or gas supply fail to shut off, refer to Section 4A-2 for complete shut down instructions.

#### 4A-2. Shutdown

For a complete shutdown, turn the switch on the control panel to OFF, turn off all electrical power to the heater at the main junction box, and set the thermostat to its lowest setting. Open the control compartment door and turn the gas valve knob clockwise to OFF.

#### 4B. Start-Up Procedure

With any new pool or spa installation, it is strongly recommended that the filter pump be operated with the heater off long enough to completely clean the water. This will clear any residue in the water left there as a result of the installation. It's a good idea to clean the filter at the end of this operation before starting the heater.

When raising the temperature of water in a cold pool, all time clock settings should be removed so the filter system and heater will operate continuously until the desired water temperature on the thermostat is reached. When that happens, the heater will shut off automatically, but the filter system will continue to operate.

**CAUTION:** Keep all objects off the top of the heater. Blocking air flow could damage the heater and invalidate the warranty.

1. Start the filter pump.
2. Position the switch on the control panel to ON.
3. Set the thermostat to the fourth mark on the dial. The heater should come on. Until the pool water reaches a temperature of approximately 70°F, it is common for there to be a substantial amount of water condensate dripping from the heat exchanger into the firebox.
4. Re-set the time clock so there will be a single filter cycle every 24 hours according to the recommendations of the filter manufacturer.

The outlet piping carries a large volume of water from the heater to the pool; but only a small portion of that water actually goes through the heater. The rest of the water is by-passed in the header. That's why the outlet water piping will not feel hot to the touch.

#### 4C. Temperature Controls

The temperature controls (single on the EPC and dual on the EPS model heaters) are calibrated at the factory, and cover a range from 70°F to 104°F. Always use an accurate pool thermometer to verify the actual pool water temperature. Once the correct position for the control knob is determined, use the TEMP-LOK to keep it from going any higher by positioning the tab next to the knob then tighten the screw.

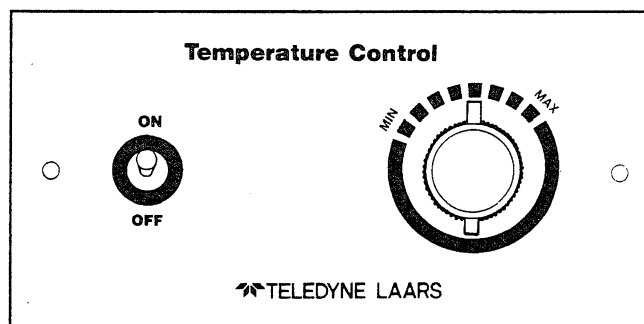


Figure 18. EPC Control Panel

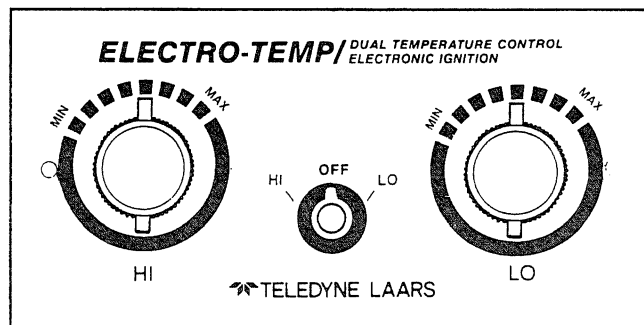


Figure 19. EPS Control Panel

The EPC control panel includes an ON/OFF toggle switch which enables the user to shut off the heater without removing the front access door.

The EPS heater has dual temperature controls which allows two different temperature settings selected by the rotary switch in the middle of the panel. This feature gives the user the option of setting one control for normal use and the other for standby, or one could be set for a pool and the other for a spa.

**IMPORTANT:** The temperature controls cannot be calibrated in the field. If the control is faulty, shut down the heater and replace the control according to the instructions in Section 5. DO NOT use the toggle or rotary switch to shut down the heater. The heater can only be shut down completely by removing the access door and turning the main gas valve OFF.

#### 4D. Cold Weather Operation

During periods of the year when the heater is only going to be used once in a while, it is best to turn the temperature control counterclockwise to the MIN setting. This will prevent freeze damage, yet still permit bringing the pool water back up to the desired temperature in the least amount of time.

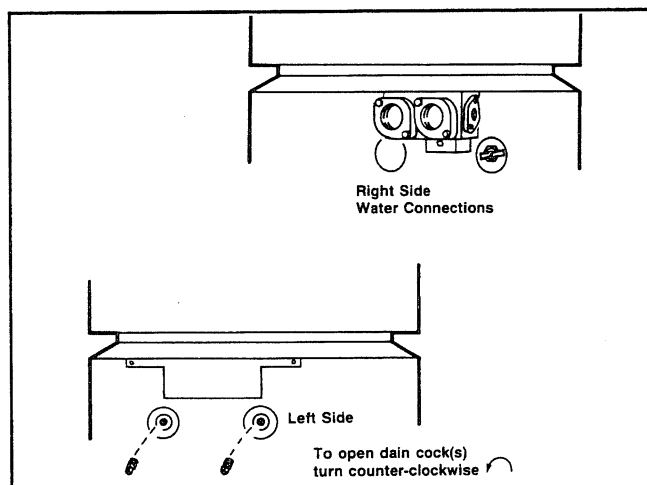


Figure 20. Heater Drain Plugs

If the pool is not going to be heated for a long period of time, shut the heater off (see Section 4A-2). In areas subject to occasional short cold snaps, the filter pump should be run continuously during the cold period. In areas where freezing temperatures occur, the heater should be completely drained before the first frost.

To drain the heater, shut off the gas supply to the heater, and open the front access door and shut off the heater gas valve. Remove all of the drain valves and plugs (see Figure 20). Coat the threads on the drain plug and valve openings with some type of grease for winter protection.

It is also necessary to disconnect the copper tubing from the pressure switch which is located

inside the front access door. Place a few drops of oil in the pressure switch connection before re-attaching it to the copper tube in the springtime.

#### 4E. Water Chemistry

Due to natural evaporation and the addition of sanitizing chemicals, the mineral content of swimming pool water increases daily. If the mineral content is allowed to get too high, the excess minerals will deposit on the walls of the pool, the filter system, and in the heater tubes. Take the precaution of maintaining the proper pH factor of the pool water (7.4 and 7.6), chlorine level (3 to 5 ppm) and total alkalinity (100 to 120 ppm).

The control of proper chemical balance in spa water is more critical than in a swimming pool for satisfactory heater operation and safe, sanitary conditions.

A spa is more like a large bathtub than a small swimming pool, because usage density in a spa is much greater than that for a swimming pool. For example, five persons using a 500-gallon spa is equivalent to 250 people using a typical 25,000-residential swimming pool. Because of the spa size, the higher water temperature, and the heavy usage, chemical values in a spa can differ greatly. These differences can result in unsanitary water conditions, and affect the life of the heater. If the water chemistry is not maintained properly, it can cause serious damage to the heat exchanger which will void the warranty on the heater.

Maintaining sanitary water conditions in a spa can only be accomplished by regular water changes and the proper addition of sanitizing chemicals. There are kits available from your local pool supply dealer for making the various tests for mineral content. One of the kits will detect copper in the system. This is usually a warning that corrosion is taking place caused by a low pH value in combination with other chemistry problems. The condition can be corrected by changing the spa water and closely monitoring the pH factor and mineral content of the water.

Teledyne Laars recommends regular changing of spa water every sixty days for light usage and every thirty days for heavy usage. Be sure to re-stabilize the water chemistry after every water change.

#### 4F. Therapeutic Spa Safety Rules

The following safety rules, recommended by the U.S. Consumer Product Safety Commission, should be observed when using the spa:

1. Spa or hot tub water temperature should never exceed 104°F. 100°F is considered safe for a healthy adult. Special caution is recommended for young children.

2. The drinking of alcoholic beverages before or during spa or hot tub use can cause drowsiness which could lead to unconsciousness and subsequently result in drowning.
3. Pregnant women beware! Soaking in water above 102°F can cause fetal damage during the first three months of pregnancy (which could result in the birth of a brain-damaged or deformed child). If pregnant women are going to use a spa or hot tub, they should make sure the water temperature is below 100°F maximum.
4. The water temperature should always be checked with an accurate thermometer before entering a spa or hot tub. Thermostats may vary by as much as 4°F.
5. Persons with a medical history of heart disease, circulatory problems, diabetes, or blood pressure problems should consult their physician before using a hot tub or spa.
6. Persons taking any medication which induces drowsiness, such as tranquilizers, antihistamines, or anticoagulants should not use spas or hot tubs.
7. Prolonged immersion in hot water can induce hyperthermia.

Hyperthermia occurs when the internal body temperature reaches a level several degrees above the normal body temperature of 98.6°F. Symptoms include dizziness, fainting, drowsiness, lethargy, and an increase in the internal body temperature.

The effects of hyperthermia include:

1. Unawareness of impending hazard
2. Failure to perceive heat
3. Failure to recognize need to leave spa
4. Physical inability to leave spa
5. Fetal damage in pregnant women
6. Unconsciousness resulting in a danger of drowning

#### 4G. Periodic Inspection

The Teledyne Laars Series One heaters are designed and constructed to provide long performance life when installed and operated properly under normal conditions. Regular inspections by trained service personnel are recommended to keep the heater operating efficiently throughout the year. The following suggestions will help extend the life of the heater:

1. Keep the top of the heater clear of all debris, and make sure there is no accumulation of flammable materials, leaves, paper, etc. beneath the heater.

2. Inspect the internal surfaces of the heat exchanger tubes annually, and remove any accumulation of scale.
3. The external surfaces of the heat exchanger tubes can be inspected for soot accumulation by placing a mirror between and under the burners when the heater is firing. If soot has accumulated on the tubes, it must be removed and the cause of the sooting corrected.
4. Check for spider webs and other debris in the pilot and main burner orifices - especially at spring start-up.
5. Make a periodic visual check of the main burner flame pattern. It should resemble that shown in Figure 27.

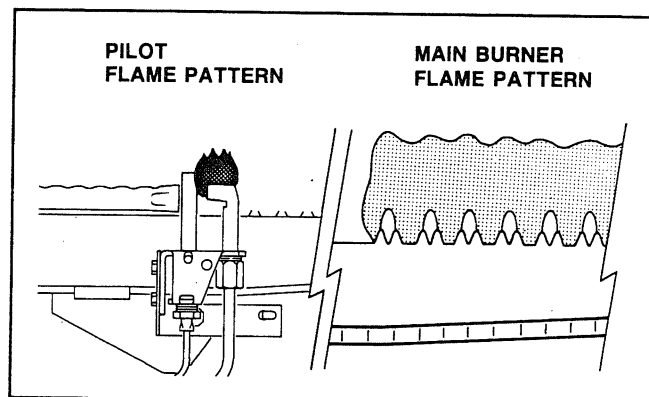


Figure 21. Main Burner and Pilot Flame Patterns

6. Inspect the gas and electronic controls annually to assure safe and dependable operation. Specifically, check the following:
  - a. High temperature limit switch.
  - b. Water Pressure Switch.
  - c. Automatic gas valve.
  - d. Temperature Control.

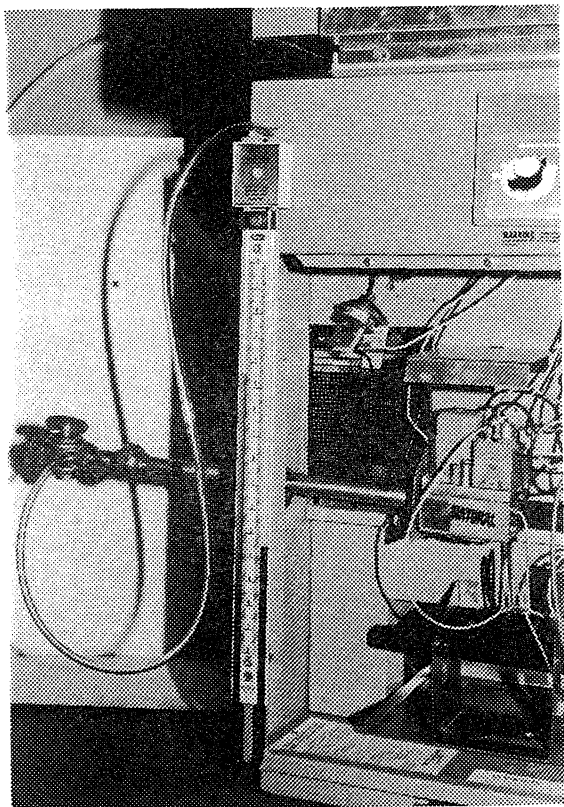
Moisture and dust can infiltrate these controls, causing deterioration over a period of years. A regular inspection schedule, with repair and replacement as needed, will keep the heater performing properly.

7. Keep the pool heater area clean and free of all combustible materials, gasoline and other flammable liquids and vapors.
8. Do not use the 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 gas control which has been under water.

Keep this manual in a safe place for future reference by you and your qualified service technician when inspecting or servicing the heater.

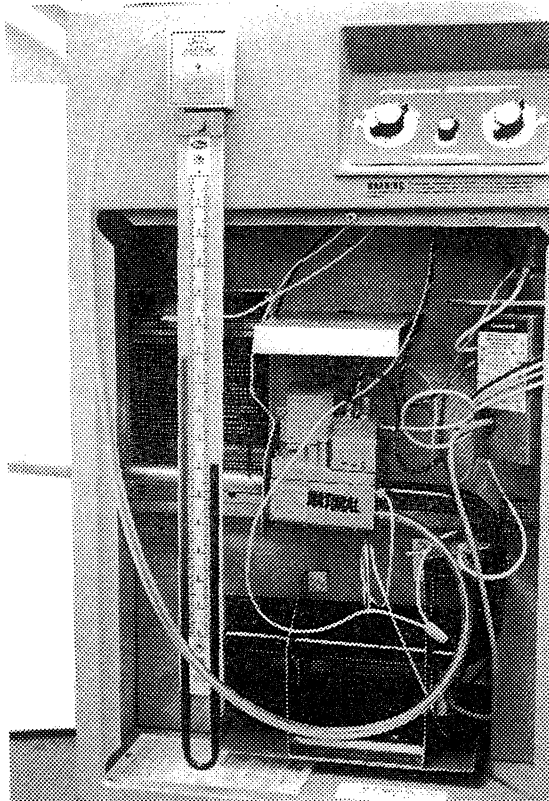
#### TESTING MAIN LINE GAS PRESSURE

1. Attach the manometer\* to the heater jacket.
2. Open both columns on the manometer.
3. Use the shut-off valve outside the heater jacket to shut off all gas supply to the heater.
4. Remove the 1/8" NPT test plug in the shut-off valve and replace it with the 1/8" NPT fitting from the manometer kit.
5. Attach one end of the manometer hose to the fitting on the gas valve and the other end to the manometer.
6. Open all gas supply valve to the heater and set the thermostat high enough to call for heat.
7. With the main burners firing, the manometer reading should be between 5" and 10" WC.



#### TESTING MANIFOLD GAS PRESSURE

1. Attach the manometer\* to the heater jacket.
  2. Open both columns on the manometer.
  3. Shut off gas supply to the heater outside the jacket.
  4. Remove the 1/8" NPT plug on the outlet side of the gas valve, and replace it with the 1/8" NPT fitting from the manometer kit.
  5. Attach one end of a manometer hose to the fitting on the gas valve and the other end to the manometer.
  6. Wait five minutes.
  7. Turn on gas supply to the heater, and set the thermostat high enough to call for heat.
  8. Move the toggle switch to ON. This should activate the main burners.
  9. The manometer reading for natural gas should be 4" for natural gas and 9" for propane gas.
  10. Move the toggle switch to OFF and refer to Section 4A-3 to shut down the system.
  11. Disconnect the manometer tubing from the gas valve and replace the 1/8" NPT fitting with the original plug.
- \* A dry gas pressure gauge may be used for either test.



## SECTION 5. Maintenance

**CAUTION:** This section contains material to be used by a qualified service technician for testing and repairing the Series One pool/spa heater. Step-by-step procedures for troubleshooting the electrical control system and other parts of the heater are included. All of these procedures should be reviewed before starting actual repairs.

### 5A. General

The service technician should remember that the other components in the pool system, such as the pump, filters and strainers, valves, gas supply, and time clocks, have an effect on heater operation. Before proceeding with the heater-related troubleshooting procedures, make sure the pump is operating properly, the filters and strainers are not clogged, there are no closed valves in the piping system, and the time clocks are adjusted. If all of these components check out, then proceed with the following troubleshooting procedures.

### 5B. Gas Pressure Tests

Use the procedure outlined on page 12 to check the main line and manifold regulated gas pressure. A manometer kit is available from Teledyne Laars (Part No. R00104) and instructions on how to use it come with the kit.

### 5C. Electrical Trouble-shooting

Trouble-shooting and repairing the EPC and EPS heaters should only be done by a qualified service technician. Before calling a service technician, the heater owner should check the following:

1. Be sure the system pump is operating and the filter is clean.
2. The heater circuit breaker and/or disconnect switch must be ON, and the switch on the heater control panel must be ON.
3. All external manual gas valves must be open, and the heater's gas valve must be in the ON position.

**IMPORTANT:** Disconnect power to the heater or pull the RED wire off the transformer secondary before removing or replacing any component or wire connection. If the power is not disconnected, "jumping" the gas valve or accidental grounding of the wire harness or component terminals to the heater frame or jacket could cause the fuse to blow.

### 5C-1. Control System Trouble-shooting Sequence Heater Does Not Come On (If Heater Will Not Shut Off, See Step 5)

#### Step One

Experience has shown that most complaints about heaters not coming on have nothing to do with the heater directly. Usually, something has reduced water flow through the heater, causing the protective switches in the heater system to shut down the heater.

Any of the following could cause the heater to not come on. Check these items first:

- a. Be sure the heater has been properly installed (see Section 2).
- b. Make sure the filter is clean. Build-up of residue on the filter element can lower the pressure through the heater, causing it to shut off.
- c. Make sure the pump is not airlocked, clogged or otherwise inoperative.
- d. Make sure the main drain and skimmer valves are open.
- e. Make sure the gas valve is ON and there is gas pressure in the line.
- f. Carefully inspect all electrical connections and wiring. Finding a loose connection or a charred wire can save a lot of time and money.
- g. Verify that the electrical circuit serving the heater is ON, and there is power to the heater.
- h. Make sure the switch on the heater control panel is in the ON position.
- i. Verify that the temperature controller is set high enough to call for heat.

If the pump and filter system is circulating water, and the rest of these items check out okay, the trouble could be in the heater control system. Go to the next step.

#### Step Two

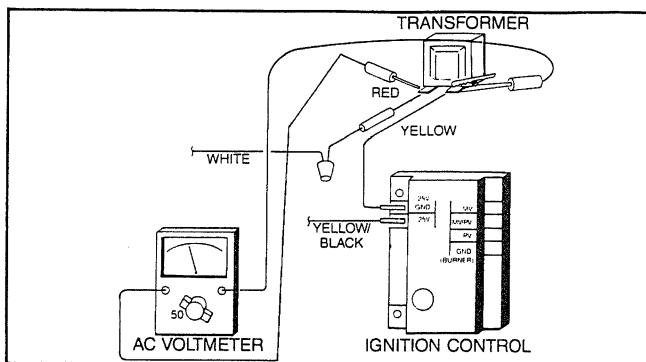
**NOTE:** Keep the filter pump running.

**Testing Transformer, Safety Fuses and Fusible Link, Limit Switches, and Pressure Switch (An A.C. voltmeter with a 50-volt range is required)**

#### a. Transformer

Clip one lead from the voltmeter to the yellow wire terminal on the transformer (this lead will stay connected to this terminal for all of these tests).





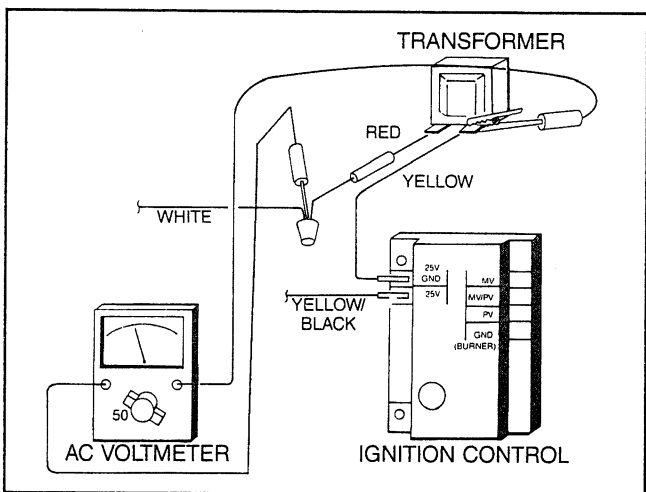
**Figure 22. Testing the Transformer**

Touch the other voltmeter lead to the red wire terminal (see Figure 22). The meter should register 20-28 volts. If no voltage is shown on the meter, replace the transformer.

If the voltage is less than 20V, the electrical circuit to the heater may be supplying less than 103V/207V. This could be due to high pump load, air conditioners or other appliances on the circuit. An electrician or utility company technician can help solve the problem.

#### **b. Safety Fuses (when used)**

To check the safety fuse and fusible link, touch the voltmeter lead to the junction of the white wires at the wire nut (see Figure 23). If the meter shows voltage, the safety fuse and fusible link are good.



**Figure 23. Testing the Fuses**

To test the safety fuse separately, place the voltmeter lead on the red wire terminal of the fusible link. If the meter shows voltage, the fuse is good. If no voltage is shown, replace the fuse with a 3AG, 1-1/4 amp normal blow fuse.

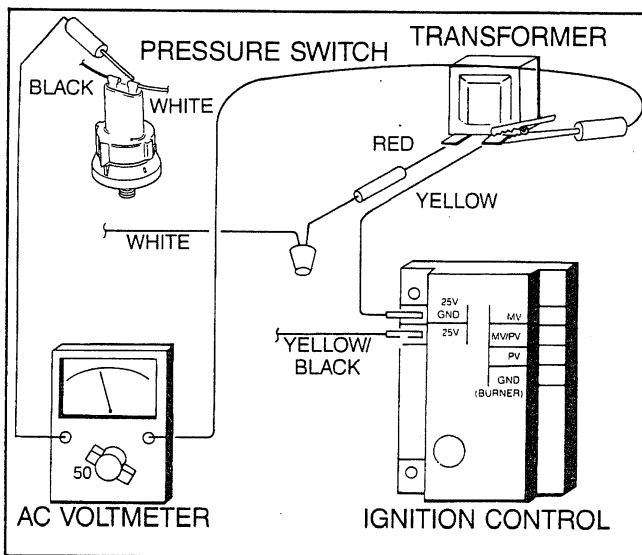
**NOTE:** Make sure the safety fuse is good before testing the fusible link.

To test the fusible link, place the voltmeter lead on the white wire terminal of the fusible link. If no voltage is indicated, replace the fusible link.

A main cause of fusible link opening is abnormal wind conditions. This could be caused by improper clearances to buildings and walls on outdoor installations. See Section 3B for proper clearances.

#### **c. Wire Harness/Limit Switches**

To test the white wire harness, which includes the high limit switches, touch the voltmeter lead to the white wire lead on the pressure switch. If the meter shows voltage, the wire harness is good. If no voltage registers, look for defective or loose terminals and broken or charred wires. Also, check the wiring on the field-installed Fireman Switch if there is one.



**Figure 24. Testing the Wire Harness & Hi-Limit Switches**

If the wiring and terminals are good, then the limit switches are keeping the heater off (see Figure 24).

The limit switches are located under the in/out header. It is necessary to remove the grate top to replace the switches (see Section 2A).

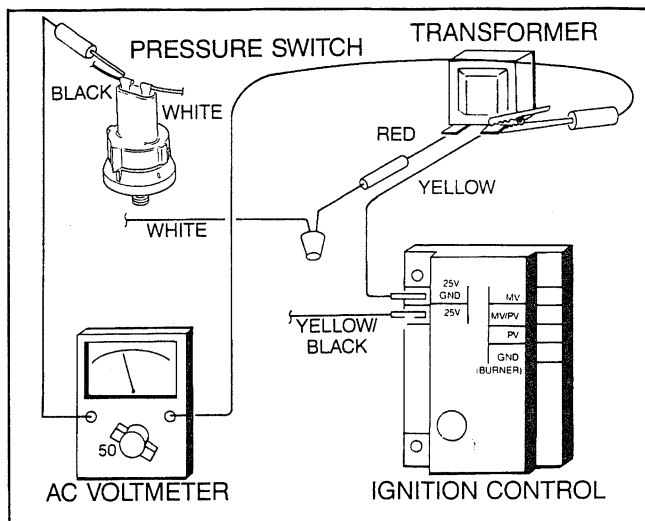
Remove the screw holding the limit switch cover, and set it aside. Slide the retaining bracket toward the rear of the heater until it comes free. remove the two high limits from their cavities. Test them using the following procedure:

#### **d. Pressure Switch**

Test the pressure switch by touching the free voltmeter lead to the black wire terminal on the pressure switch (see Figure 25). If the meter registers voltage, the switch is good. If not, check for proper flow. A 15 psi pressure gauge connected to the end of the syphon loop should typically read 2 psi or greater. If not, either the syphon loop is not cleared, or there is not proper flow through the heater (see Sections 3D and 3H). If there is 2 psi or greater, replace the pressure switch.

#### **Testing the Pressure Switch**

Turn the thermostat as high as it will go. Disconnect the white wire from the pressure switch and touch it to the white wire (see Figure 25) with the filter



**Figure 25. Testing the Pressure Switch**

pump running. If the heater fires, the contact points in the switch are open.

Use the following procedure to check it.

1. Back wash the filter before attempting to calibrate the pressure switch. Verify water flow by placing a hand in front of the pool return closest to the heater. If the filter is clean, a fast water flow should be evident.
2. Connect one voltmeter lead to the yellow wire terminal on the transformer and the other lead to the black wire terminal on the pressure switch.
3. Cycle the filter pump ON and OFF a few times. The meter needle should cleanly jump to full voltage when the pump cycles ON.
4. If the meter fails to register voltage, the needle rises or falls slowly or hesitates, either a defective pressure switch or clogged connector tube should be suspected.
5. To clean the connector tube, remove it from the heater and the switch.
  - a. Blow out the tube until clear.
  - b. Fill the connector tube and the switch with heavy, non-detergent oil, SAE 50 preferred, using a pump-type oil can. The connector tube should be filled as illustrated in Figure 42.
  - c. Install the connector tube to the heater and the pressure switch. The tube must be airtight.
  - d. Start the filter pump and re-test the pressure switch (Step 2 thru 4 above). If cleaning the connector tube does not correct the erratic

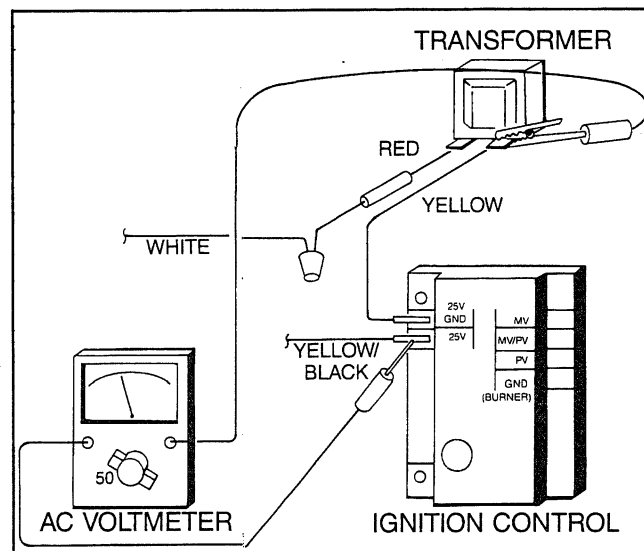
voltmeter reading, replace the pressure switch.

### Step Three

#### Temperature Control - EPS

The temperature control is a solid state device using an electronic water temperature sensing bulb called a thermistor. The thermistor sensor is located in the header.

Make sure the control panel switch is in either the HI or LO position, and that the corresponding temperature control knob is set at a higher temperature than the pool water.



**Figure 26. Testing the Temperature Control - EPS**

With one of the voltmeter leads still clamped to the yellow wire terminal on the transformer, touch the other lead to the black-yellow wire terminal on the ignition control as shown in Figure 26.

If the meter registers voltage, the temperature control is okay. If no voltage registers, shut off all electrical power to the heater and remove the temperature control panel, as shown in Figure 33 by removing the two screws attaching the control panel to the front of the heater.

Hold the control panel a few inches from the front of the heater and inspect the back of the board for obvious damage and loose wires. Make sure the three-wire connector is tight, and that the two gray thermistor wires are securely attached on the circuit board.

If there is obvious damage to the control board or the wire terminals, replace the entire temperature control panel.

The thermistor can be checked by disconnecting the two gray wires on the back of the control panel and temporarily connect a new thermistor.

#### Alternate method of checking Thermistor

A fixed resistor (6000-9000 ohms) can be used to check the temperature control board. Remove the

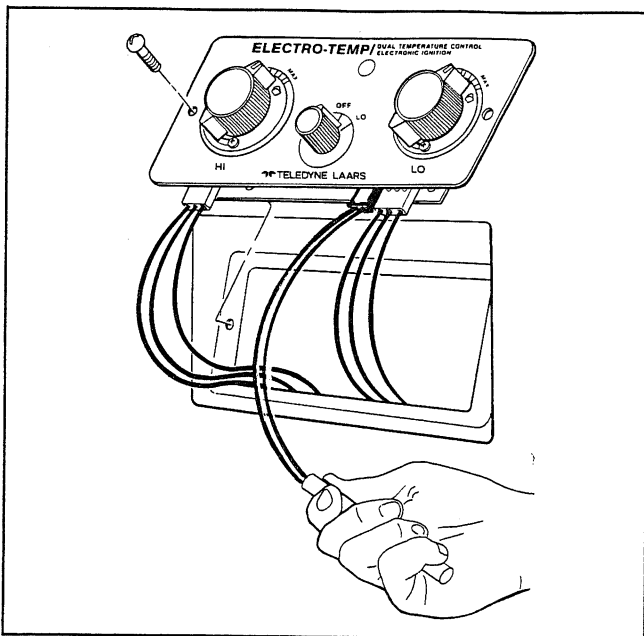


Figure 27. Thermistor Sensor Test

two gray wires and attach the resistor in the same location. The heater should operate with the temperature control knob in the center of the dial. If the heater fails to operate, replace the temperature control board.

Make sure the temperature control is properly wired, then turn on power to the heater holding the replacement sensor as shown in Fig. 27. The heater should fire with the temperature control knob set above the center of the dial (approximate body temperature).

If the heater operates, replace the thermistor. If the heater does not operate, replace the temperature control panel which is available as a quick-change assembly. When installing the new control panel, be sure the gasket is properly seated, and do not over-tighten the mounting screws. That will distort the mounting plate, which could lead to water leakage.

### EPC

To test the temperature control on the EPC model heaters, make sure that the toggle switch on the control panel is in the ON position and the temperature control knob is set at a higher temperature than the pool or spa water.

With one of the voltmeter leads still attached to the yellow wire terminal on the transformer, touch the other voltmeter lead to the yellow/black, 25V, wire terminal on the ignition control (see Figure 28).

If the meter registers voltage, the temperature control is okay. Proceed to Step 4.

If the meter does not register voltage, shut down the heater completely (see Section 3) and remove the temperature control board (see Figure 29). Inspect the back of the control panel for obvious damage and/or loose wires. If any problems are found, correct them and run the voltage test again. If the heater still does not come on, it will be necessary

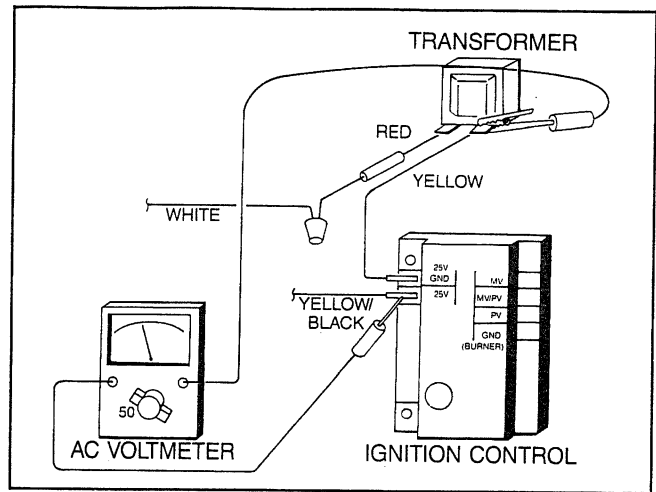


Figure 28. Temperature Control Test - EPC

to test the toggle switch and thermostat separately to see if one of them is the problem.

To test the thermostat, make sure one lead from the voltmeter is still attached to the yellow wire terminal on the transformer. Touch the other lead to the two terminals on the thermostat one at a time (see Figure 28). If no voltage registers on either terminals, the toggle switch is bad and should be replaced. If voltage registers on just one terminal, replace the thermostat, which includes the temperature sensor.

### Removal and Replacement of Temperature Control

If the two screws securing the temperature control panel have not been removed, remove them. Follow these instructions to complete the exchange:

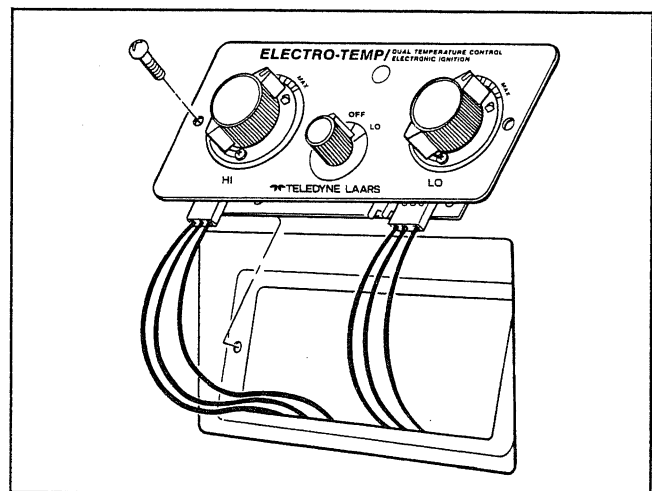


Figure 29. Temperature Control Removal - EPS

### EPS

In almost all cases where there has been a temperature control failure in the EPS heaters, the thermistor probe has not been damaged. If the probe has been tested and found to be okay (see above), there is no need to remove the draft hood (indoor installation), or vent cap/stack (outdoor installation),

and the top assembly.

Disconnect the black wire from the pressure switch, the yellow wire from the TR terminal on the gas valve, and the yellow/black wire from the 25V terminal on the ignition control.

Disconnect the two gray wires from the back of the temperature control panel, and remove the panel and its wires from the heater.

Place the new temperature control panel near the heater opening, and attach the two gray wires. Run the other three wires through the opening and attach them to the proper terminals on the gas valve, pressure switch, and ignition control.

Secure the panel to the front of the heater with the two screws, being careful to position the gasket properly.

If it is necessary to replace the thermistor probe, follow the instructions for removing the top assembly and probe removal under EPC. Carefully route the two gray wires down the side of the heat exchanger, keeping them as close to the inside wall as possible.

#### EPC

Disconnect the black wire from the pressure switch, and the other black wire from the 25V terminal on the ignition control.

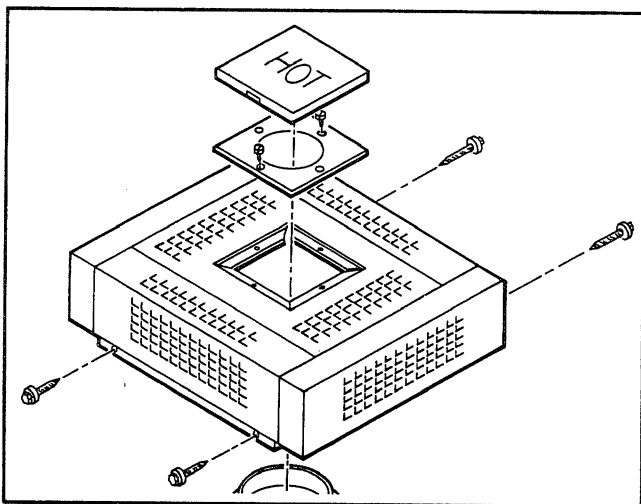


Figure 30. Top Assembly Removal

It is always necessary to replace the temperature sensing bulb, located in the header, when replacing the temperature control panel. If the heater is installed indoors, it is necessary to remove the draft hood. If the heater is installed outdoors with a vent cap/stack, the vent cap/stack must be removed. Then remove the top assembly by removing the screws attaching it to the heater (see Fig. 30).

Loosen the cap screw holding the retainer bracket and slide it off the sensor bulb flange (see Figure 2). Carefully remove the sensor bulb from the header, making sure the plastic sleeve comes with it. The entire temperature control unit can be removed from the heater.

Place the new unit in front of the control panel opening and run the copper tubing through the opening into the back of the heater.

Insert the new temperature sensing bulb in the header, being careful to keep the plastic sleeve on it, and replace the retainer bracket. Tighten the cap screw to secure it in place.

Carefully route the copper tubing down the inside of the heater back to the control panel.

Route the two black wires from the new temperature control unit through the opening and down to the pressure switch and the ignition control. The wire coming from the toggle switch attaches to the pressure switch, and the wire coming from the thermostat attaches to the ignition control.

Secure the new control panel to the front of the heater with the two screws, being careful to properly seat the gasket.

#### Step 4.

#### IGNITION CONTROL

If one lead from the voltmeter is attached to the yellow wire terminal on the transformer, and the other lead is touched to the yellow/black (black on the EPC) 25V terminal on the ignition control, and voltage registers, this indicates that the safety controls, the temperature control, and wire harness are not keeping the heater from firing.

Step 4 will determine if the ignition control is operating correctly. Before doing the electrical tests, make a visual check of the ignition control components:

**Pilot Burner.** Make sure it is positioned next to the main burner as shown in Figure 32, and is free of soot and dirt.

**Ignitor-Sensor Electrode.** The electrode is part of the pilot assembly and must be clean, the terminal connection tight, and the stainless steel lead at least

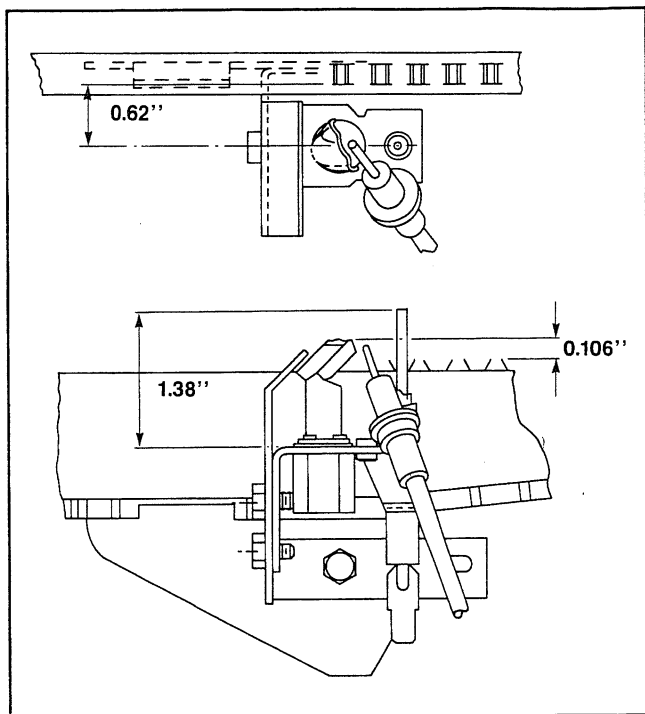


Figure 32. Pilot Location Dimension

3/8" from the heater chassis and other metal parts. Check for proper spark gap.

**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 3/8" from other metal objects.

To test the ignition lead, position the control panel switch to ON and make sure the temperature control knob is turned clockwise far enough to call for heat. There will be a loud clicking noise indicating the pilot electrode is sparking. If no sparking is heard, pull the ignition lead from the ignition control and hold the bare terminal 1/8" to 3/16" from the ignition 1/8 - 3/16" stud (see Figure 33). If a spark does not jump the gap, the ignition control is defective and must be replaced.

**NOTE:** The ignition control can not be repaired in the field. If it does not operate properly, replace it.

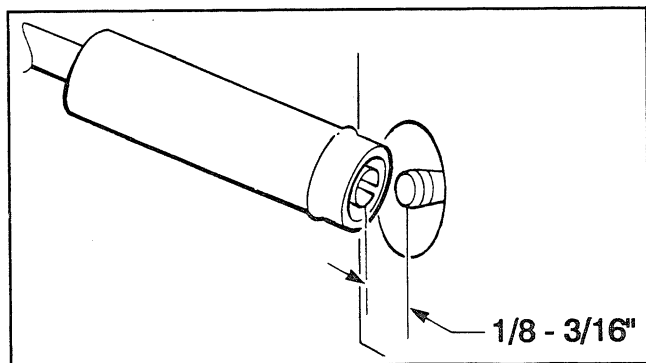


Figure 33. High Voltage Ignition Test

**Electrical Connections.** Make sure all of the wire connections on the ignition control and the gas valve are tight. Also, check to make sure the wiring agrees with Figures 11 or 12.

If sparking occurs at the ignitor electrode, but there is no pilot ignition after two or three minutes, check for voltage between the yellow wire terminal on the transformer and the orange wire terminal on the gas valve (see Figure 35). If the voltmeter does not show voltage, the ignition control is defective and must be replaced. If the meter registers between 20-28V volts but there is no pilot ignition, replace the gas valve.

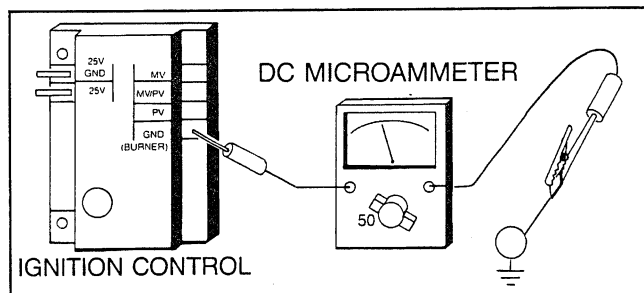


Figure 34. Flame Sensing Current Check

### PILOT BURNER LIGHTS, BUT NO MAIN BURNER IGNITION

When the pilot burner lights, the sparking should stop and the main burners should fire. If the sparking continues and the main burners do not fire, check all of the wire connections, ignition cable and use a mirror to make sure there is pilot flame. If everything appears okay, measure the flame sensing current by connecting a D.C. microammeter between a yellow ground wire and the "GND (BURNER)" terminal on the ignition control (see Fig. 34).

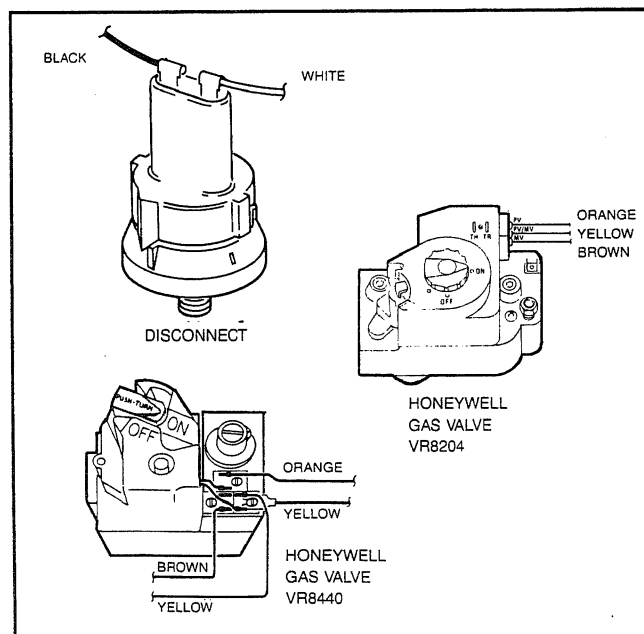


Figure 35. Gas Valve & Wire Harness Check

**NOTE:** The meter leads must be separated from each other and clear of the heater chassis for most of their length to properly perform this test.

When the pilot lights, the meter should indicate current of 1.5 microamps or more with or without the main burners firing. A smaller current could be caused by poor pilot flame, the position of the pilot electrode or bad cable and connectors.

If the pilot flame and sensor electrode are okay, but there is no main burner ignition, check for voltage between the yellow wire terminal on the transformer and the brown wire terminal on the gas valve with the voltmeter(see Figure 39). If the meter registers between 20-28V, but the main burners do not fire, replace the gas valve.

#### ON-OFF MAIN BURNER CYCLING

Poor wind conditions on an outdoor installation, pilot components out of position, or inadequate gas pressure can cause improper pilot flame. This can result in the main burners cycling on and off.

The pilot flame may appear to be okay until the main burners come on, then the pilot flame shrinks. This could be caused by an undersized gas supply line. See Table 6 for proper gas supply piping size.

#### 5C-2. HEATER WILL NOT SHUT OFF

If the heater stays on with the brown wire on the gas valve disconnected (see Figure 34), the gas valve is damaged and must be replaced. See Section 5D for replacement instructions.

**WARNING:** Disassembly of the gas valve will invalidate the manufacturers warranty.

If the gas valve is okay, disconnect one of the lead wires at the pressure switch (see Figure 35). If the heater goes off, turn off the filter pump and reconnect the pressure switch wire. If the heater comes back on, the problem is the pressure switch.

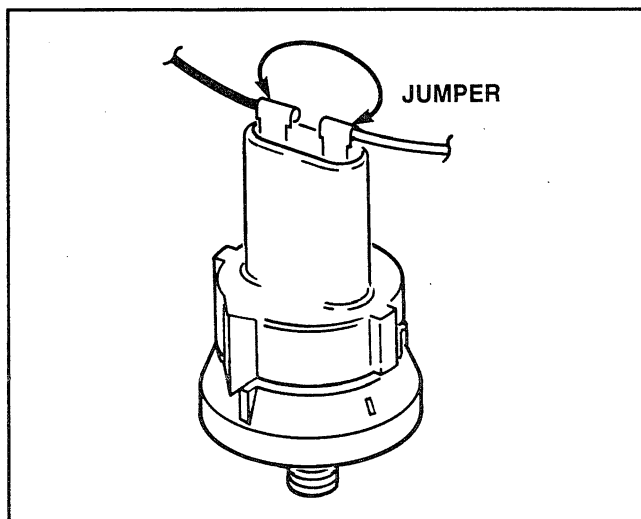


Figure 36. Testing the Pressure Switch

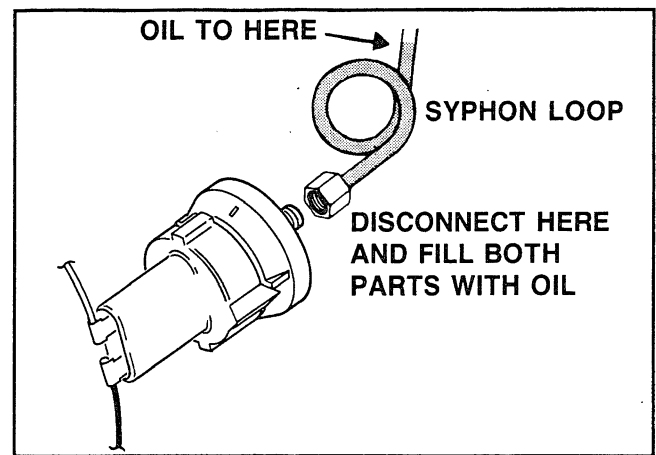


Figure 37. Pressure Switch Connector Tube

Make a visual inspection of the electrical components. Check for loose wires. Disconnect one of the lead wires on the gas valve. If the heater goes off, the wiring could be at fault. Repair or replace as necessary.

#### 5D. Pressure Switch

The pressure switch has been set at the factory for normal installations. Do not adjust the switch unless the installation involves special conditions:

1. If the top of the heater is installed three (3) feet or more below the surface of the pool.
2. If any part of the filter system piping is three (3) feet or more above the top of the heater jacket.

On some installations, the piping from the heater to the pool is unusually short, and the back pressure is too low to activate the pressure switch. If this occurs, it may be necessary to install a directional fitting where the return line enters the pool. This will increase back pressure enough for the heater to operate properly.

**Note:** If the heater is to be installed more than 15 feet below or 6 feet above the pool surface, the pressure switch adjustment shown in Figure 20 should not be made. Consult Teledyne Laars for recommendations.

#### 5E. Pressure Switch Adjustment

The pool filter must be clean before making this adjustment.

- a. Turn the toggle or rotary switch to OFF, and make sure the pressure switch is at its lowest setting. This is done by rotating the thumb wheel counterclockwise as far as it will go.
- b. Start the filter pump and confirm by means of hearing an audible click or with an ohmmeter that the pressure switch closes (if the switch fails

to close, replace it with a switch which has a lower minimum setting). If the system has a two-speed pump, the pump should be operated at low speed.

- c. Turn the thumbwheel clockwise until the contacts open.
- d. With the pump still running, reduce the pressure setting 1 or 2 psi to re-close the contact.
- e. Turn off the pump and verify that the pressure switch contacts open. The contacts must open immediately when the pump shuts off.

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.

Elevated spas are a special problem if the water surface is more than eight feet above the heater, because the pressure switch has a limit of 5 psi. A special pressure switch is available from the factory for these installations.

When the water surface is more than a few feet below the heater, a pressure switch with a minimum setting of 1 psi can be used.

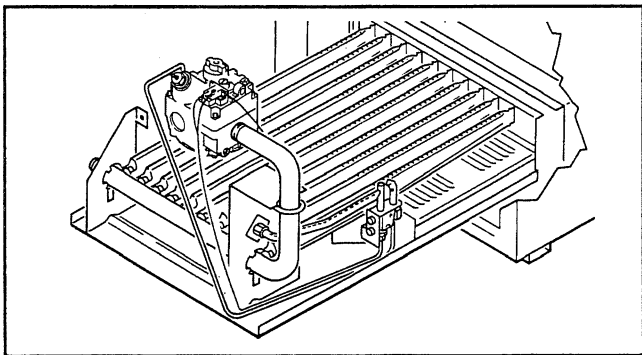


Figure 38. Burner Tray Removal

#### 5F. Gas Valve Replacement

**WARNING:** Never attempt to repair or convert the gas valve. Such attempts will void the warranty, and could lead to dangerous results. If the gas valve is found to be defective, replace it by following these instructions.

1. Turn off the main gas supply at the manual gas cock or the meter.
2. Follow the shutdown procedures to turn off the gas valve on the heater.
3. Disconnect the main gas pipe from the gas valve.
4. Remove the two screws securing the anti-rotation bracket on the left side of the gas valve.

5. Remove the pilot gas tube from the gas valve.
6. Remove all wires from the gas valve terminals.
7. Unscrew the gas valve from the manifold pipe.
8. Screw the new gas valve onto the manifold pipe, and finish the replacement by reversing the above procedure.
9. Before operating the heater, the complete gas supply system, including all fittings, must be tested for leaks using a soap solution.
10. Follow the lighting instructions on the label which is located on the inside panel.

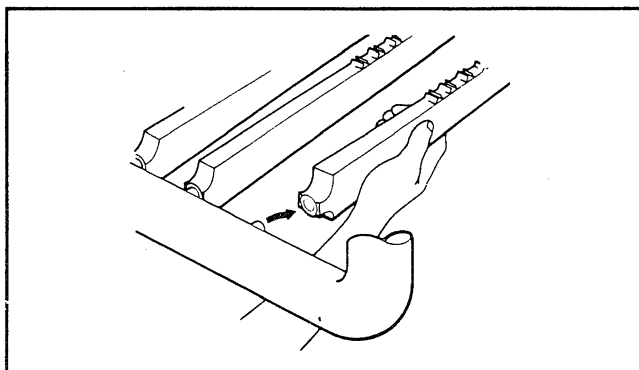


Figure 39. Burner Removal

#### 5G. Gas Burner Removal

1. Turn off all electrical power to the heater.
  2. Turn off the gas supply shutoff valve outside the heater jacket.
  3. Disconnect the service union in the gas line, and unscrew the gas supply pipe from the gas valve.
  4. Disconnect all wires to the gas valve and the pilot.
  5. Remove the two screws securing the anti-rotation bracket to the inner panel, and the three screws attaching the manifold bracket. Slide the burner tray out of the heater (see Figure 38).
- NOTE:** Due to sharp edges on the metal burner, wear protective gloves for the next steps.
6. Grasp the burner firmly, and push it away from the manifold until it is clear of the orifice. Slide it out of the burner tray (see Figure 39).



7. To replace the burner, insert the rear into the slot at the rear of the burner tray, line it up with the proper orifice and snap it into position.
8. Reinstall the burner tray by sliding it back into the heater and securing it with the two brackets.
9. Reconnect the gas piping, turn on the gas supply and check the system for leaks using a soap solution.
10. Reconnect the electrical wires to the gas valve and the ignition sensor lead to the ignition module according to the schematic on page 7.

**NOTE:** If the burner being removed is the one with the pilot attached, follow these additional procedures starting at Step 6.

1. Disconnect the pilot gas tube from the gas valve.
2. Detach the pilot burner assembly from the burner bracket and remove the burner according to the instructions in Step 6.
3. Install the pilot burner on the new burner, install it in the burner tray and reconnect the pilot gas tube to the pilot assembly and gas valve.

Scale can accumulate inside the heat exchanger tubes. The easiest method of determining the degree of scale buildup is to periodically inspect the tube having the highest temperature. This can be done by first opening the drain valve on the right side of the heater, then remove the drain valve as shown in Fig. 40. This inspection should be performed after sixty days of operation, and after 120 days of operation. This will make it possible to establish a regular inspection routine.

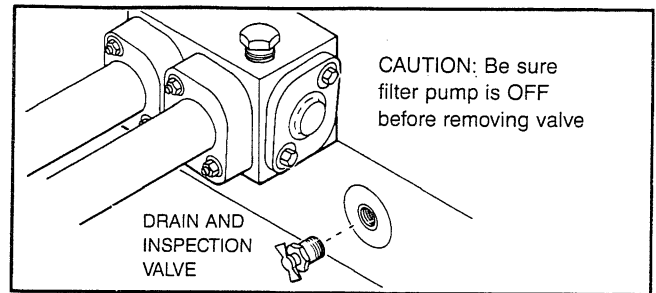
An inspection and cleaning of the complete heat exchanger can only be accomplished by removing it from the heater (see Fig. 2 and the instructions in Section 2.0).

**NOTE:** While the heat exchanger is out of the heater, inspect the firewall refractory insulation blocks for cracks, wear, and breakage. Replace if necessary.

## 5H. Cleaning the Heat Exchanger

**CAUTION:** Black carbon soot buildup on a dirty heat exchanger can be ignited by a random spark or flame. To prevent this happening, dampen the soot deposits with a wet brush or fine water spray before servicing the heat exchanger.

1. A light accumulation of soot or corrosion on the outside of the tubes can be easily removed with a wire brush after the heat exchanger baffles are removed.



**Figure 40. Scale Inspection**

2. There are two methods for cleaning the inside of the heat exchanger tubes:

### a. Acid Cleaning

1. After removing the heat baffles, water header castings, and bolts and washers, immerse the entire heat exchanger assembly in a properly inhibited muriatic acid solution (3-parts water to 1-part acid solution). The acid solution will dissolve some copper, but at a very slow rate.
2. After the tubes are cleaned, flush the assembly with a soda-ash solution.
3. Dry and paint the steel plates with a good quality rust inhibiting paint.

### b. Reaming

**NOTE:** Use only the correct carbide tipped reamers which are available from Teledyne Laars.

1. Dry the heat exchanger completely.
2. The insides of the tubes can be reamed as illustrated in Fig. 41.
3. Withdraw the reamer frequently to remove lime powder and prevent the drill from binding in the tube.
4. Install new gaskets. Do not attempt to re-use the old ones.
5. Tighten the header bolts progressively, starting with the two center bolts. Maximum torque is 20 foot-pounds; do not over-tighten.
6. Pressure test the heat exchanger for leaks with city water supply before re-installing (see Fig. 41).
7. When placing the heat exchanger back in the heater, carefully hold the refractory insulation blocks apart and lower the heat exchanger into place. Be sure the sheet metal covers which protect the insulation blocks are replaced carefully.

8. If a header bolt is stripped in the process of reassembly, it can be driven out of the header plate and replaced (see Section 6-D, Parts List).

### 5J. Automatic Flow Control Valve.

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

The valve has only one moving part, requires no normal service, and will withstand normal pool

water for many years. Extremely high acid or chlorine concentration could damage valve parts. Hard water could leave deposits on the valve parts which may make it sluggish or inoperative. Such a condition might overheat the water passing through the heater, but fail to heat enough water to raise the pool temperature to the desired level.

If water in the heat exchanger is over-heating because of a sticky valve, the high limit switch will open. If the automatic valve stays closed, too much water passes through the heater causing excess condensation on the tubes. Either condition can result in inadequate heating.

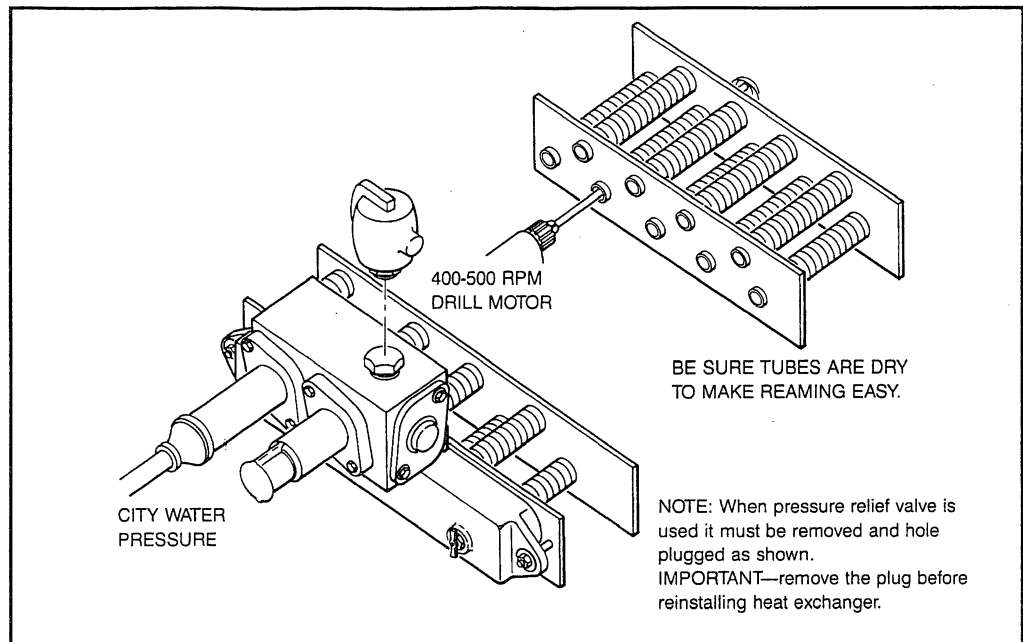


Figure 41. Heat Exchanger Testing & Cleaning

The automatic valve can be tested by removing the drain valve and bushing below the header casing and inserting a thermometer (see Figure 9).

When the filter pump is delivering a normal flow to the heater, the thermometer should read a temperature within the range specified in Table 2.

To determine if the valve is stuck open, shut off the filter pump and remove the flow control cap. Make a visual inspection of the disc. If it is not properly seated, disassemble the valve and overhaul it (see Figure 42). If parts are pitted due to corrosion by excessive acid or chlorine in the pool water, they should be replaced (see Section 6-B, Parts List).

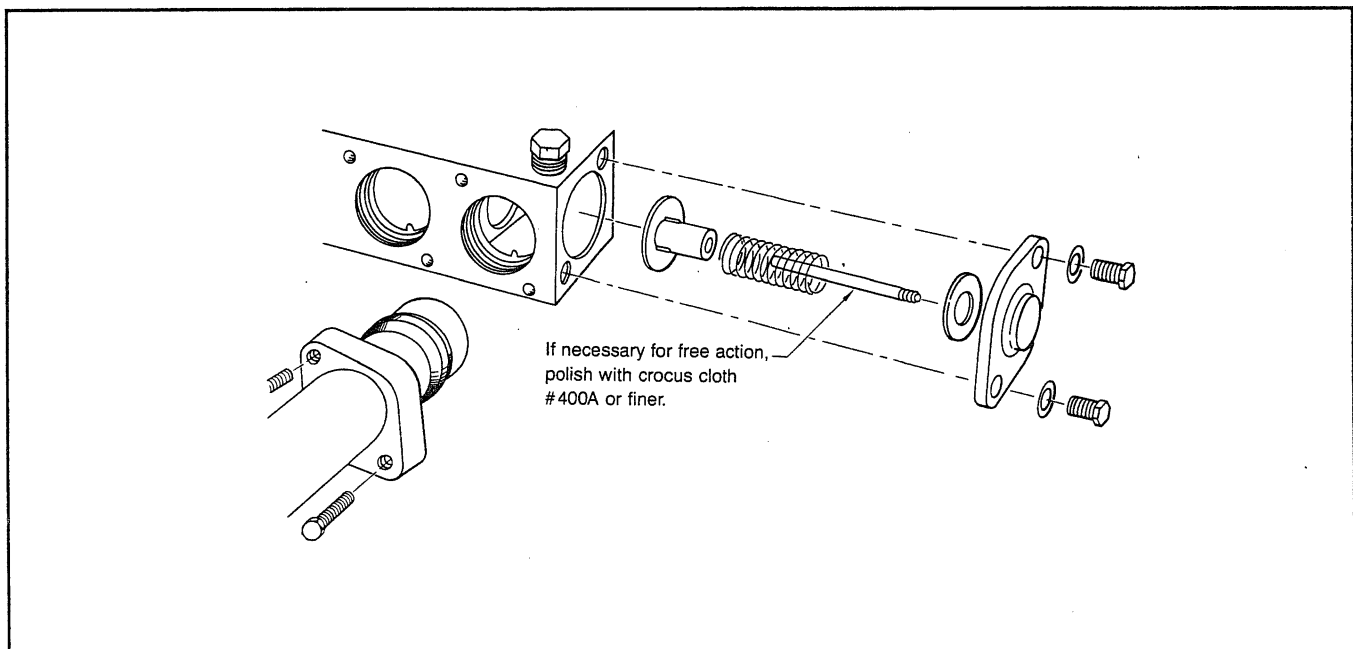
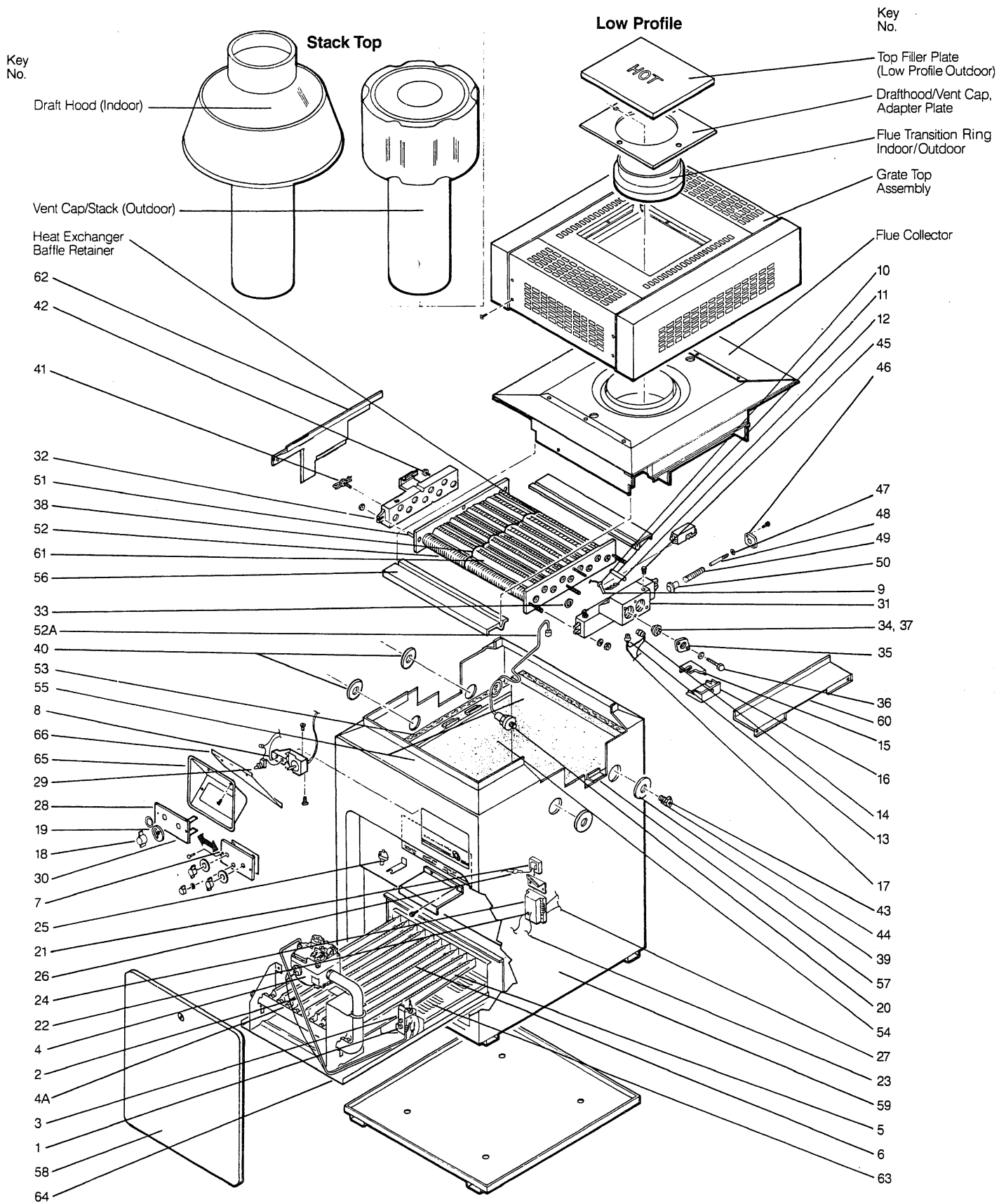


Figure 42. Flow Control Valve Disassembly and Overhaul

## This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



## SECTION 6. Parts List for Series One, Type EPS and EPC

Key No.	Description	Model Sizes	EPS	EPC	Key No.	Description	Model Sizes	EPC/EPS
PILOT GAS SYSTEM					WATER SYSTEM (CONT.)			
1	Pilot Burner/Electrode, H.W. Nat.	All	W00306		41	Drain Cock, Return Header	All	P00587
2	Tube, Pilot Gas, 1/8 OD	All	W00313		42	Drain Plug, Return Header	All	P00268
3	Ceramic Insulator Assy.	All	104188-05		43	Drain Cock, In/Out Header	All	P00587
MAIN GAS SYSTEM					44	Bushing, Drain Cock	All	P00185
4	Gas Valve, HW VR8204A-1/2x1/2	125-175	V00591		45	Plug, 3/4", In/Out Header	All	P00270
4	Gas Valve, HW VR8440K-3/4x3/4	250-400	V00567			Restrictor	125	S00003
4A	Gas Orifice, Nat. (see Note 1)	All	L00322		46	Cap,Flow Control (Casting S00691)	All	104522-01
5	Burner, Main w/Pilot Bracket	All	104575		47	Gasket, Flow Control	All	S00741
6	Burner, Main	All	L00523		48	Shaft, Flow Control (Note 3)	All	F00336
ELECTRICAL SYSTEM					49	Spring, Flow Control, White	125,175	S00614
7	Temp. Control Assy., Electronic	All	105393			Spring, Flow Control, Red	250	S00613
8	Temp. Control Assy.	All		E00971		Spring, Flow Control, Blue	325	S00612
9	Temperature Sensor	All	E01105			Spring, Flow Control, Black	400	S00701
10	"O" Ring, Temp. Sensor	All	E01164		50	Disc, Flow Control (Note 3)	All	S00692
11	Sleeve, Bulb Protector	All		104449	51	Bolt, Header, 2-3/4"	All	F00296
12	Clip, Retainer, Temp. Sensor	All	104473			Bolt, Header, 2-1/2"	All	F00283
13	High Limit Switch, 135°F (Note 4)	All	E00722			Bolt, Header, 2-3/4" Csk.	All	F00318
14	High Limit Switch, 150°F (Note 4)	All	E00639			Washer, Header	All	F00111
15	Retainer Clip, High-Limit	All	104184			Nut, Header	All	F00031
16	Cover, High-Limit	All	104183		52	Tube Assy., Heat Exchanger	125	104518-01
17	Wire Harness, High Limit	All	R00581			Tube Assy., Heat Exchanger	175	104518-02
18	Knob, Pointer, Black	All	E00945			Tube Assy., Heat Exchanger	250	104518-03
19	Stop Plate, TEMP-LOK	All	104567			Tube Assy., Heat Exchanger	325	104518-04
20	Pressure Switch, 2 psi (Standard)	All	R00145			Tube Assy., Heat Exchanger	400	104518-05
	1 psi (Special)	All	R00152		52A	Syphon Loop	All	105452
	1-10 psi (Special)	All	R00155		FIREBOX COMPONENTS			
21	Transformer, 115V-230V/24V	All	E00974		53	Insulation, Fiberglass	All	T00020
22	Ignition Control, HW S86E	All	E00941		54	Insulation, Block, Sides	All	T00214
23	High Voltage Ignitor Assy.	All	104495-05		55	Insulation, Block, Front	125	T00215-01
24	Fuse Packet, 1-1/4 amp	All	R00995			Insulation, Block, Front	175	T00215-02
25	Fusible Link Assy.	All	R00124			Insulation, Block, Front	250	T00215-03
26	Electrical Fuse Assy.	All	104800			Insulation, Block, Front	325	T00215-04
27	Wire Harness, Ignition Control	All	R00598			Insulation, Block, Front	400	T00215-05
28	Thermostat Dial	All	H01054	H01059		Insulation, Block, Rear	125	T00216-01
29	ON-OFF Switch	All		E00172		Insulation, Block, Rear	175	T00216-02
30	Plate Assy.	All	104563			Insulation, Block, Rear	250	T00216-03
VENT SYSTEM						Insulation, Block, Rear	325	T00216-04
						Insulation, Block, Rear	400	T00216-05
					JACKET COMPONENTS			
TOP & FLUE COLLECTOR ASSEMBLY					56	Insulation Block, Front & Rear Cover		103149
Low Profile—Outdoor					57	Tile Cover, Side Assy.		101673
Top Assembly					58	Door w/Latch	State Model	104489-1
Grating, Front & Rear (2 Required)								thru -05
Grating, Sides (2 Required)					59	Jacket Assy. less Top Assy.		104479-01
Top Panel								thru -05
Top Filler					60	Gap Closure, In/Out Side		104482
Flue Collector Assembly					61	Baffle, Heat Exchanger	125	104764-01
Outdoor/Indoor Adapters						Baffle, Heat Exchanger	175	104764-02
Flue Transition Ring						Baffle, Heat Exchanger	250	104764-03
Draft Hood/Vent Cap						Baffle, Heat Exchanger	325	104764-04
Adapter Plate						Baffle, Heat Exchanger	400	104764-05
Outdoor Vent Cap Stack						Baffle, Heat Exchanger, F-R	325	104504-06
Indoor Draft Hood						Baffle, Heat Exchanger, F-R	400	104504-07
					62	Gap Closure, Return Side	All	104483
					63	Burner Tray, Shelf Only	All	104543-01
								thru -05
							State Model	
					64	Burner Tray Assy., Nat. Gas		104583-01
								thru -05
						Touch-up Paint Can	All	X00160
						Heat Exchanger Support Cup	All	104570
					65	Bezel	All	S00698
					66	Rain Shield	All	104613
					NOTES:			
					1. Above 2000 Ft., consult factory for orifice size.			
					2. Key No.'s 34 & 37 available as Assy. R00211			
					3. Key No.'s 48 & 50 available as Assy. R00131			
					4. Key No.'s 13 & 14 available as Assy. R00232			

## Teledyne Laars Series One Limited Warranty

Your Teledyne Laars Series One heater is backed by this double warranty to assure your complete satisfaction.

1. Controls, copper heat exchanger tubes and firebox panels are warranted against defects in materials and workmanship for two (2) years from date of purchase.
2. All other parts are warranted against defects in materials and workmanship for five (5) years from date of purchase.

The above warranty applies only if the installation and operating instructions applicable to the model purchased are expressly and completely followed. These instructions are furnished with the unit and are also available by writing the Teledyne Laars factory. The liability of Teledyne Laars shall not exceed the repair or replacement of defective parts, and shall not include transportation to or from factory, field labor, and consequential or incidental damages. Ship inoperative parts or complete heater with Serial Number and purchase

date, transportation prepaid, directly to address below, attention Service Manager.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.



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