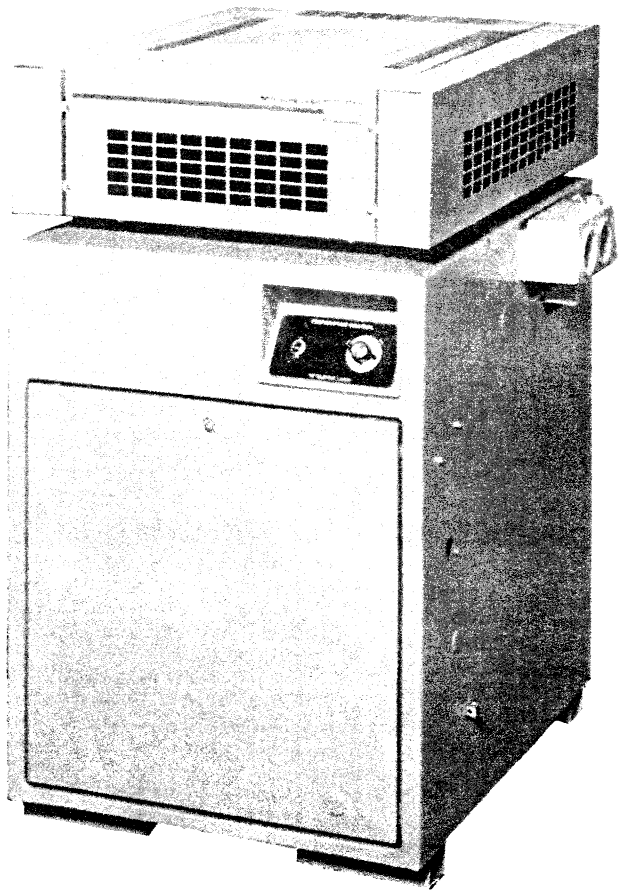
FOR YOUR SAFETY - This product must be installed and serviced by a professional service technician, qualified in pool heater installation. Improper installation and/or operation could cause serious injury or death. Improper installation and/or operation will void your warranty.

Installation, Operation and Service Manual

Pool and Spa Heater Series One EPG, EPM



WARNING: If the information in 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

H00991

TELEDYNE LAARS

This page intentionally left blank.

Contents

SECTION 1. GENERAL INFORMATION **Page**

1A. Introduction 3
1B. Description 3
1C. Warranty 3
1D. Heater Selection 3

SECTION 2. ASSEMBLY INSTRUCTIONS

2A. Reversible Water Connections 3
2B. Vent Cap/Stack Draft Hood 5

SECTION 3. INSTALLATION INSTRUCTIONS

3A. General 5
3B. Outdoor Installation 5
3C. Indoor Installation 6
3D. Gas Supply and Piping 7
3E. Electric Wiring 7
3F. Water Piping 8
3G. Pressure Relief Valve 10
3H. Special Adjustment of Pressure Switch 10

SECTION 4. OPERATING INSTRUCTIONS

4A. Lighting and Shutdown 11
4B. Start-Up Procedure 12
4C. Inlet-Outlet Temperatures 12
4D. Temperature Controls 12
4E. Spring and Fall Operation 13
4F. Water Chemistry 13
4G. Therapeutic Pools (Spas) Safety Rules 14
4H. Swimming Pool Energy Savings Tips 14
4 I. Periodic Inspection 15

SECTION 5. MAINTENANCE

5A. General Precautions 16
5B. Regulated Gas Pressure 16
5C. Electrical Trouble Shooting 17
5D. Replacing the Gas Valve 21
5E. Temperature Control Testing and Replacement 21
5F. Removal and Replacement of Temperature Controls 22
5G. Removal of Gas Burners 22
5H. Periodic Inspection of Heat Exchanger Water Passages 23
5 I. Cleaning The Heat Exchanger 23
5J. Automatic Flow Control Valve 24

TABLES AND FIGURES

Table 1. Sizing Chart, Pools 1
Table 2. Sizing Chart, Spas 1
Table 3. Air Supply, Combustion-Ventilation 5
Table 4. Gas Supply 5
Table 5. Temperature Rise, 1-1/2" Headers 8
Table 6. Temperature Rise, 2" Headers 8

Figure 1. Top Assembly 2
Figure 2. Heat Exchanger Removal 2
Figure 3-7. Vent Cap/Stack Installation 3
Figure 8. Non-Combustible Base 4
Figure 9. Heater Location Diagram 4
Figure 10. Indoor Installation with Draft Hood 4
Figure 11. Wiring Diagram, EPG 6
Figure 12. Wiring Diagram, EPM 6
Figure 13. Time Clock Wiring 6
Figure 14. Typical Piping Diagram 7
Figure 15. Piping Diagram, Pools with Spa 7
Figure 16. Plastic Pipe Use 7
Figure 17. Pipe Connections 7
Figure 18. Temperature Check 7
Figure 19. Pressure Relief Valve 8
Figure 20. Pressure Switch Adjustment 8
Figure 21. Gas Valve 9
Figure 22. Lighting Pilot 9
Figure 23. Pilot Flame Pattern 10
Figure 24a. EPG Temperature Control 10
Figure 24b. EPM Temperature Control 11
Figure 25. Heater Drains 11
Figure 26. Flame Patterns 13
Figure 27. Manometer Attachment 14
Figure 28a. EPG Pictorial Wiring Diagram 14
Figure 28b. EPM Pictorial Wiring Diagram 15
Figure 29. Gas Valve Terminal Identification 15
Figure 30. Gas Valve Wiring Identification 16
Figure 31. High Limit Test 16
Figure 32. Thermostat and Toggle Test 16
Figure 33. Pressure Switch Test 17
Figure 34. Limit and Pressure Switches Test 17
Figure 35. Thermostat, Toggle Switch, Pressure Switch Test 17
Figure 36. Thermostat, Toggle Switch, High Limit Test 17
Figure 37. Millivolt Meter Attachment 18
Figure 38. Fusible Link, Redundant High Limit Test 18
Figure 39. Redundant High Limit Test 18
Figure 40. Removing Gas Valve 19
Figure 41a. EPG Temperature Control with Toggle Switch 19
Figure 41b. EPM Temperature Control with Rotary Switch 19
Figure 42. Typical Control Panel Removal 20
Figure 43. Thermostat Bulb Removal 20
Figure 44. Removal of Burner Tray 20
Figure 45. Burner Removal 20
Figure 46. Fusible Link Replacement 21
Figure 47. Scale Check 21
Figure 48. Cleaning Heat Exchanger 21
Figure 49. Automatic Flow Control Valve 22

Section 1. GENERAL INFORMATION

1A. Introduction

This manual supplies assembly, installation, and operation information for the Teledyne Laars Series One swimming pool/spa heater. The information in this manual applies to the Model EPG and the Model EPM millivolt heaters. It is strongly recommended that the owner/installer read Section 3 (INSTALLATION INSTRUCTIONS), and check local and State codes before beginning installation of the heater. History has shown that most service calls are caused by improper installation.

1B. Description

The Series One is a compact, high-performance pool and spa heater. Electrical power is provided by the pilot generator which converts heat energy from the pilot flame to electrical energy, thereby eliminating the need for connection to an external electrical power source. The heater incorporates a special water bypass mechanism to balance the water velocity in the heat exchanger, preventing the formation of scale internally, and condensation of water products externally. The unit is specifically designed for the heating of swimming pools and spas, and should not be used as a heating boiler, general service water heater or for heating salt water pools. Consult your dealer for the appropriate Teledyne Laars products for these functions.

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.

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 found inside the front access door. 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.

1D. Heater Selection

Before installing the heater, make sure it has sufficient capacity for the expected use and pool size. (use Table 1 to determine the proper pool heater for your installation. Table 2 should be used to estimate spa water heating time).

Table 1. Sizing Chart — Pool Heaters

First, determine the difference between the desired pool water temperature and the average air temperature during the coldest month the pool is to be heated. Next, calculate the surface area of the pool in square feet (length times width). **Table 1** lists the maximum square footage recommended for each heater model to achieve the desired water temperature. For example: The desired pool water temperature is 74°F. The average air temperature in the coldest month is 53°F. That's a difference of 21 degrees. The square footage of the pool is 1000 feet, 20 feet wide by 50 feet long. The chart recommends a Model 325.

		MODEL NUMBER				
		125	175	250	325	400
TEMPERATURE DIFFERENCE °F	15	667	933	1333	1733	2133
	20	500	700	1000	1300	1600
	25	400	560	800	1040	1280
	30	333	467	667	867	1067
	35	286	400	571	743	914
		Pool Area in Square Feet				

Table 2. Sizing Guide — Spas and Hot Tubs

This guide is based on spa/hot tub gallonage, and shows how many minutes are required to raise the water temperature 10 degrees, depending on the heater model you have installed. For example: You have a 650 gallon spa and a Model 250 heater. It will take 16 minutes to raise the water temperature 10 degrees. If you wanted to raise the water temperature 45 degrees, from 55 degrees to 100 degrees, you would multiply that 16 minute figure by 4.5 (45 degrees divided by 10 minutes) to get a total time of 72 minutes. This time does not take into account such factors as evaporation, wind, and ground temperature, all of which can have a significant effect on heating time.

HEATER MODEL	SPA SIZE IN GALLONS												
	250	300	350	400	450	500	550	600	650	700	750	800	850
125	13	15	18	20	22	25	28	30	32	35	38	40	42
175	9	11	12	14	16	18	20	21	23	25	27	29	30
250	6	8	9	10	11	13	14	15	16	18	19	20	21
325	5	6	7	8	9	10	11	12	13	14	15	16	17
400	4	5	6	6	7	8	9	9	10	11	12	12	13
	Time in Minutes to Raise Spa Water Temperature 10 Degrees												

Section 2. ASSEMBLY INSTRUCTIONS

Section 2A. Reversible Water Connections

The Series One Pool/Spa heater can be installed with the water connections located on either side. The unit is shipped from the factory 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 maintenance. To make this change, it is necessary to rotate the Heat Exchanger assembly 180 degrees. This procedure can best be accomplished prior to installation, and by a trained service technician. Follow these step-by-step instructions and accompanying illustrations.

a. Open the front cover.

b. Remove the hex-head screws shown in Fig. 1 and lift the grate top assembly straight up.

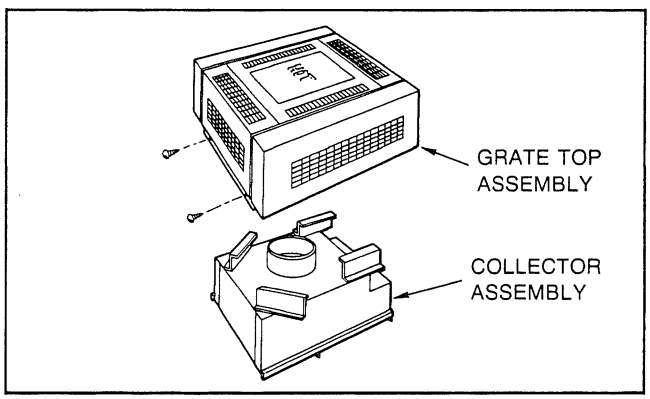


Fig. 1 Top Assembly Exploded View

c. The collector assembly can now be removed by lifting it out of the chassis.

d. Remove the 5 screws securing the gap closures (2) (3) and put them aside. You will only use four of these screws in the new installation.

e. Remove the three grommets (6) (7).

f. Remove the drain valve (5) (large hex) located under the water connections.

g. Gently pry off the large cap located on the right side.

h. Disconnect the yellow wires from terminals TH/TP and the coil connection on the gas valve. 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.

i. Remove the temperature sensing bulb from the back of the header by loosening the cap screw and sliding the retainer bracket off the bulb flange (1). Retain the fiberglass insulation under the retainer bracket. Remove the bulb from the header and rotate it out of the way.

j. Remove the screw holding the clip behind the pressure switch on the back panel. Disconnect the pressure switch wiring on the back of the header by loosening the top hex nut. Place the whole assembly in a safe location for the time being.

k. Lift out the heat exchanger assembly, rotate it 180 degrees, and reseat the unit in the heater with the water connections on the left side.

l. Reconnect the pressure switch copper tubing on the back of the header, and locate the switch in its original position, carefully straightening the copper tubing as necessary. Fasten the tubing to the rear panel using the location clip and screw.

m. Re-install the temperature sensing bulb, and fiberglass insulation, in the header, securing it with the retainer bracket and cap screw. Route the copper tubing carefully along the inside of the heater jacket. Cover the back of the header with insulation, and replace the insulation retainer.

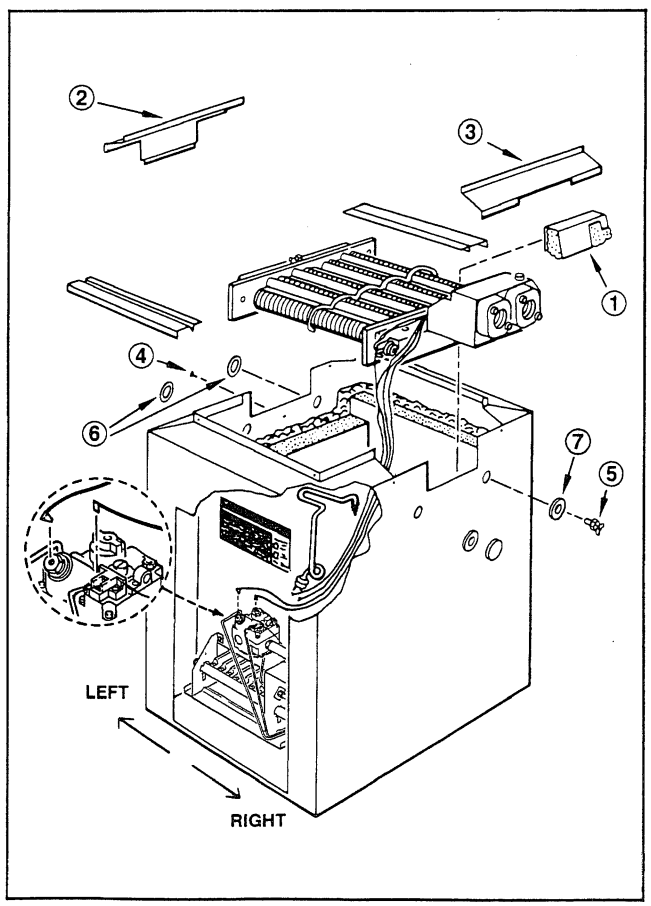


Fig. 2 Heat Exchanger Removal Diagram

n. Reroute the wiring harness alongside the heat exchanger and back down to their previous location, being careful to keep the wires away from all heat producing surfaces. Reconnect the yellow wires to terminal TH/TP and the coil connection on the gas valve. Connect the white wire to the pressure switch and twist the other end together with the other white wire and secure the two with the wire nut.

o. Replace the front and rear insulation block covers.

p. Replace the gap closures and tighten the screws securely.

q. Replace the three grommets and the cap.

r. Reinstall the drain plug.

s. Slip the collector assembly back down inside the enclosure.

t. Check to make sure the wiring is not pinched against sharp edges, or resting on the collector assembly.

u. Replace the top assembly and secure it with the 4 hexhead screws.

Section 2B. Vent Cap/Stack Draft Hood Installation

The heater is shipped with the top assembly configured for an outdoor installation. If either the Teledyne Laars draft hood (a draft hood is required on all indoor installations) or the optional vent cap/stack (outdoor installation) is to be installed, follow this procedure:

a. Remove the top filler plate, stamped "HOT", by slipping a fine-blade screw driver into the slot at the rear of the plate and gently prying it up.

b. Remove the 2 screws attaching the adapter plate to the top assembly and lift it out.

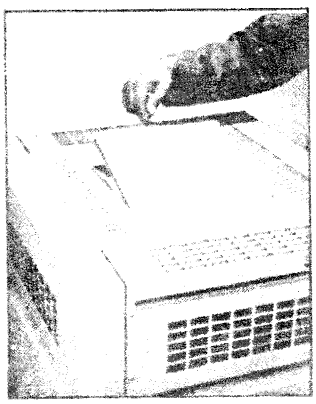


Fig. 3 Removing Top Filler Plate

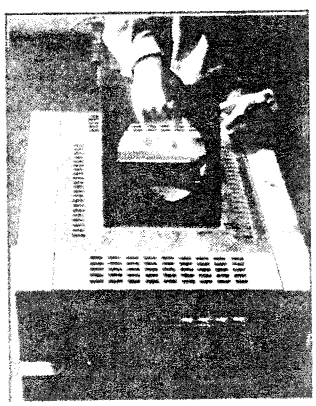


Fig. 4 Removing Adapter Plate

c. Remove the vent cap/stack or draft hood from its package.

d. Disengage the flue transition ring (If Teledyne Laars equipment is being installed, this ring is supplied by the factory) from the stack extension and place it on top of the collector assembly as shown in Fig. 5.

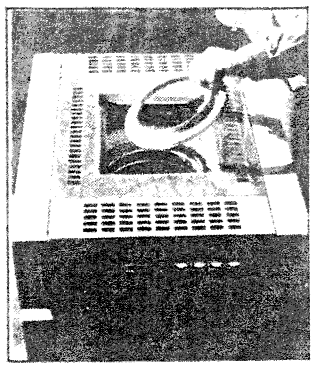


Fig. 5 Inserting Flue Transition Ring

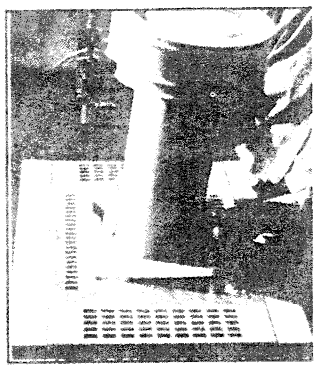


Fig. 6 Inserting Adapter Plate

e. Slide the adapter plate over the bottom of the stack extension as shown in Fig. 6. Fit the stack extension down over the flue transition ring. Seat the adapter plate on the top assembly and secure it with two screws.

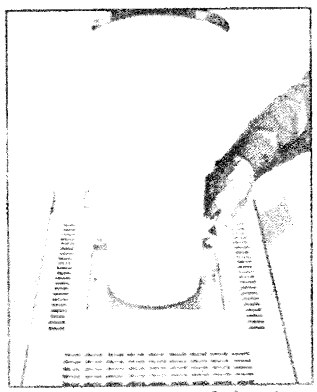


Fig. 7 Putting Adapter Plate in Position

SECTION 3. INSTALLATION INSTRUCTIONS

3A. General

The heater must be installed in accordance with all local codes and ordinances and the most recent edition of the National Fuel Gas Code, ANSI Z223.1

3B. Outdoor Installation

3B.1 Heater Clearance

The heater must be located in an open, unroofed area, 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. 15217-01 through -05).

IMPORTANT: The heater shall be installed on a floor of non-combustible construction with non-combustible flooring and surface finish and with no combustible materials against the underside, or on fire-resistant slabs or arches having no combustible materials against the underside unless listed for installation on a combustible floor.

All heaters must be installed on a non-combustible surface. That means a surface not capable of being ignited and burning, such as surfaces consisting entirely or a combination of steel, iron, brick, tile, concrete, slate, glass or plaster.

They can be installed on a combustible floor if a non-combustible base assembly, available from Teledyne Laars, is used. See the heater rating plate for the appropriate base part number. Heaters must not be installed on carpeting.

As an alternative to the Teledyne Laars non-combustible base plate, 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, covered with sheet metal at least 24 ga. in thickness. Such masonry must be laid with ends unsealed, and joints matched in such a way as to provide a free circulation of air from side to side through the masonry. See Figure 8.

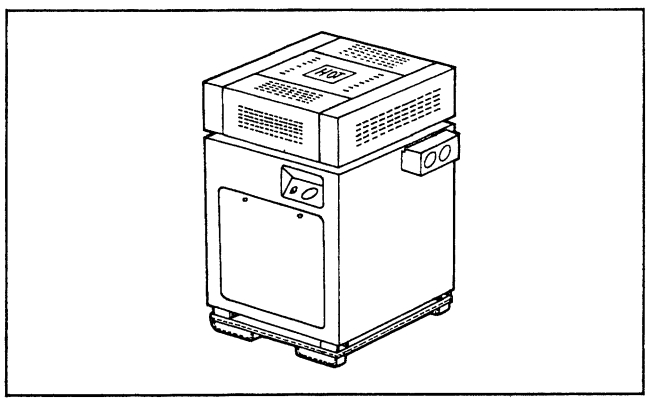


Fig. 8 Heater Installation on Non-Combustible Floor Base

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

The heater should not be placed in close proximity to sprinklers; the water could damage the controls and/or 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 (see Figure 9 for minimum clearances). There must be rain gutters to protect the heater from direct water drainage.

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

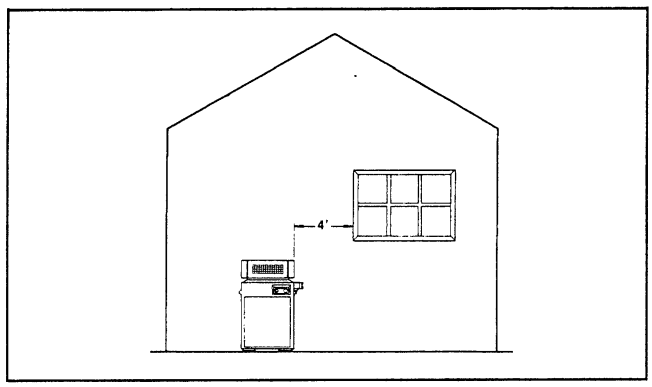


Fig. 9 Heater Location Diagram

3C. Indoor Installation

The Series One heater is design-certified for indoor installation when equipped with a draft hood, which must be installed without modification. Check the rating plate on the heater for correct Teledyne Laars part number.

The draft hood must be connected to a vent pipe of the same or larger size. The vent pipe should terminate at least two feet above the highest point of the roof or other object that is within ten feet of the vent. It should have a listed cap installed which allows a full equivalent opening for flue products (see Fig. 10).

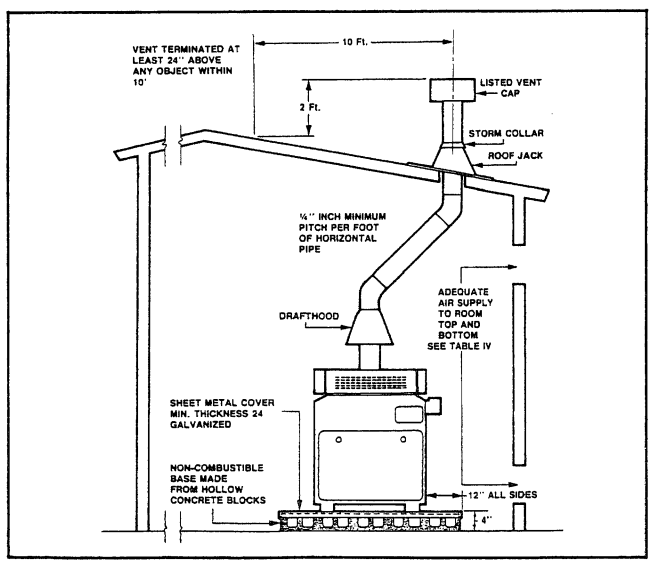


Fig. 10 Indoor Installation of Draft Hood Module

3C-1. Heater Clearance - Indoor Installation

The following clearances should be maintained:

Top of Heater	44" minimum clearance
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. (Closet installation not permissable)
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. 15217-01 through -05).

3C-2. Combustion and Ventilation Air Supply

In all indoor installations, there must be uninterrupted openings to **outside air** for combustion and ventilation. Table 3 shows the net free opening areas required at **both ceiling and floor** for the different heater models. Teledyne Laars does not recommend indoor installations that depend on ducted air for combustion.

Table 3. Air for Combustion and Ventilation Required Net Free Opening Area (Square Inches)

MODEL	DIRECTLY FROM OUTSIDE	DUCTED FROM OUTSIDE
125	32	63
175	44	88
250	63	125
325	82	163
400	100	200

3C-3. Special Precautions for LP Gas Heaters

Liquified petroleum gas is heavier than air. Therefore, pool heaters using LP gas should not be installed in pits or other locations where gas might accumulate. Heaters must be located a safe distance from LP gas storage and filling equipment. Consult local codes and fire protection authorities relative to specific installation restrictions.

3D. Gas Supply and Piping

Heaters are shipped from the factory to operate 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.

Teledyne Laars recommends the gas supply pipe sizes in Table 4. Check local codes for compliance before installing the heater.

Table 4. Recommended Gas Supply Pipe Sizes

HEATER MODEL	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"

NOTE: For LP gas use one size smaller pipe except on the Model 125 which requires 3/4" from 0-50'.

Provide a union on the gas supply line outside the heater jacket, including a drip leg and a manual shutoff valve. Before installing the heater, pressure test the gas line in accordance with local codes. Do not use a restrictive gas cock.

After installing the heater, the complete gas supply system, including all connections, must be tested for leaks using a soap solution at a maximum pressure of 0.5 psi. The test should be repeated after the heater is operating.

3D-1. Automatic Chlorinators

Any concentration of chlorine in the pool heater can be very destructive. Heater damage caused by an excessive concentration of chlorine is not covered by the Teledyne Laars warranty.

IMPORTANT: The chlorinator should be equipped with an anti-syphoning device so that chlorine will not syphon into the heater after the pump shuts off.

An electric chlorinator should be wired so that it cannot operate unless the filter pump is running. If the chlorinator has an independent clock control, be sure the filter and chlorinator clocks are synchronized.

If the chlorinator is equipped with its own pump, it should be installed so that it introduces the chlorine downstream from the heater, and, if possible, below the level of the heater outlet fitting.

3E. Electric Wiring

Warning. Do not connect the heater to any external source of electricity. The Teledyne Laars Series One EPG/EPM heater has a built-in thermoelectric generator. It provides a completely self-contained electrical system. Any attempt to make external electrical connections will damage the heater, and could be hazardous. See Figures 11 and 12 for typical wiring diagrams of the EPG/EPM heater.

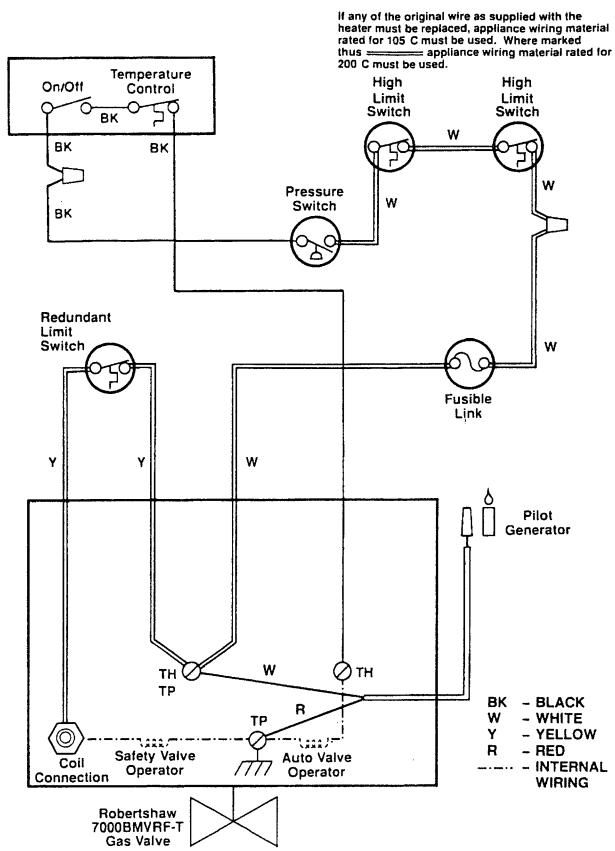


Fig. 11 Wiring Diagram, EPG

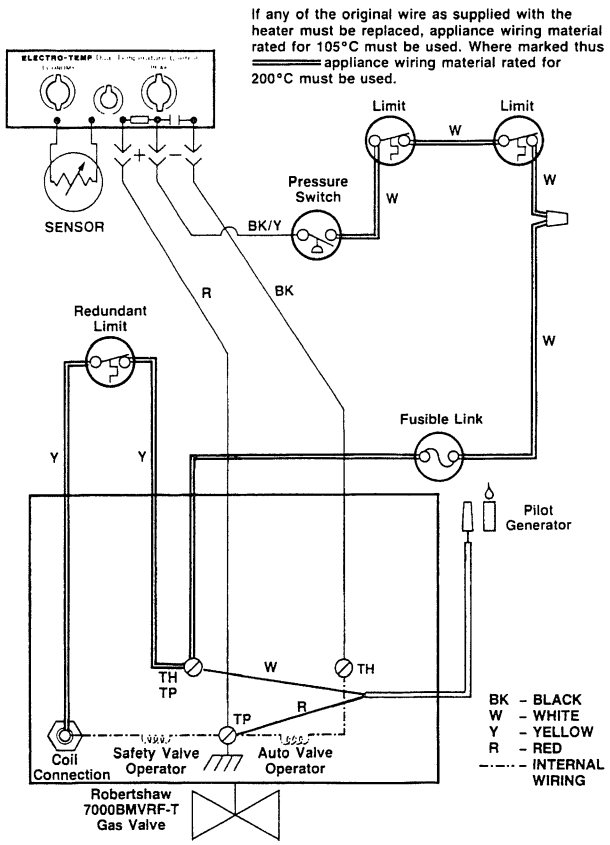


Fig. 12 Wiring Diagram, EPM

3E-1. Auxiliary Time Clock Wiring

If a time clock is used to control filter pump operation, it is recommended that the clock have its own low voltage (Fireman's) switch to turn off the heater before turning off the pump. This allows the residual heat to be carried into the pool water, and prevents excessive heat build-up in the heat exchanger. The switch should shut off the heater approximately 15 minutes before the filter pump.

To incorporate a time clock auxiliary switch into the heater wiring, follow these steps (see Fig. 13):

1. Remove the front access door.
2. Remove the factory installed wire nut, tagged "Connect Wires from Fireman's 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.

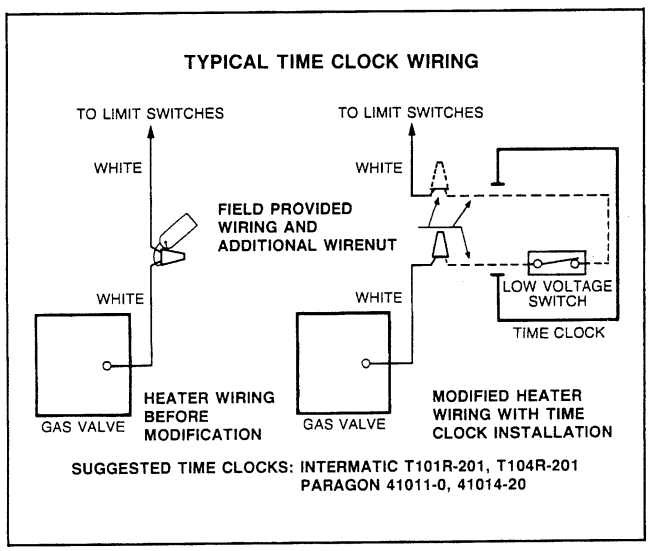


Fig. 13 Time Clock Wiring

The length of the wire between the heater and the time clock should not exceed 15 feet on the EPM Models and 30 feet on the EPG, or the resistance of the wire will reduce available millivoltage to a level which will not support reliable operation of the gas valve. The contact points of the time clock switch should be silver, or a low resistance alloy.

3F. Water Piping

Figs. 14 and 15 illustrate typical water piping for a pool with a therapeutic spa and the deckside equipment. Fig. 14 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. An automatic, built-in by-pass valve maintains proper flow through the heater at flow rates less than 125 gallons per minute.

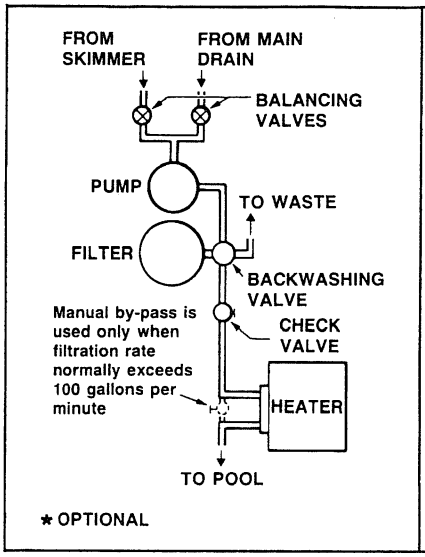


Fig. 14 Typical Piping Diagram

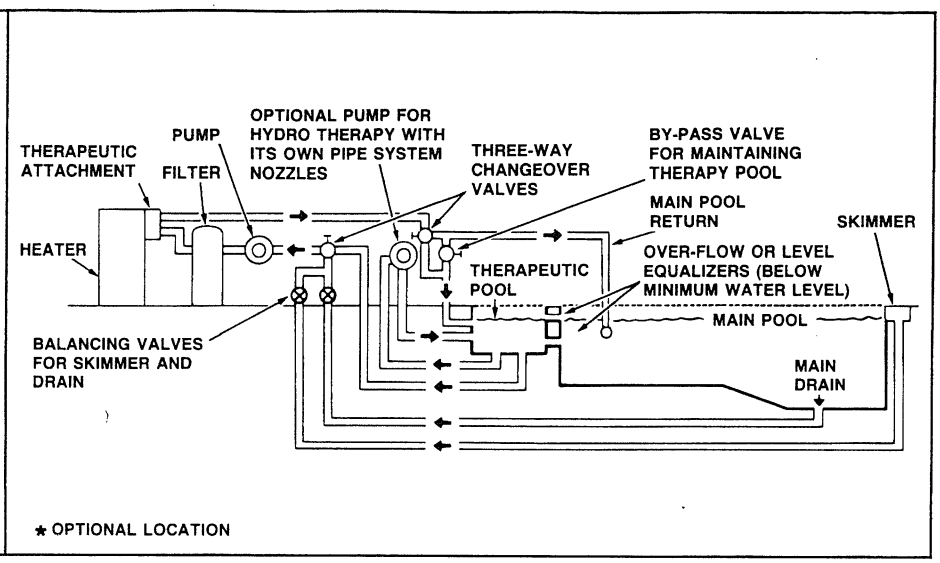


Fig. 15 Piping Diagram for Spa Pools

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 Fig. 16.

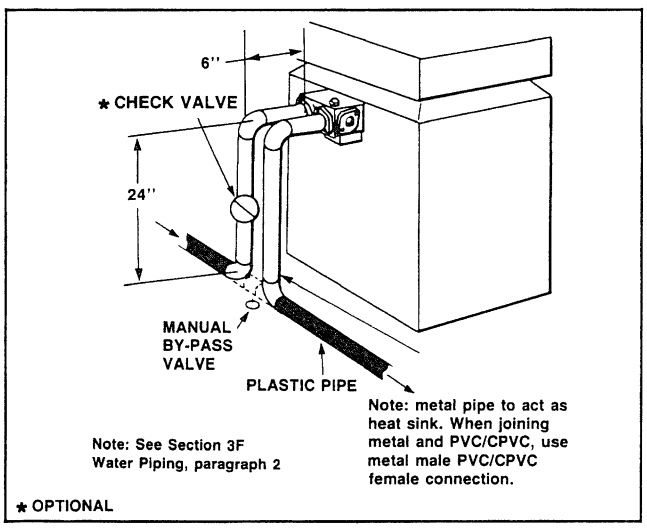


Fig. 16 Use of Plastic Pipe (Where Permitted by Code)

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.

The heater is equipped with either 1-1/2" or 2" universal header couplings. The 1-1/2" coupling accepts threaded 1-1/2" pipe, unthreaded 1-1/4" pipe and 1-1/2" copper pipe without an adapter. The 2" coupling accepts threaded 2" pipe, unthreaded 1-1/2" pipe and 1-1/2" or 2" copper pipe without an adapter. See Fig. 17.

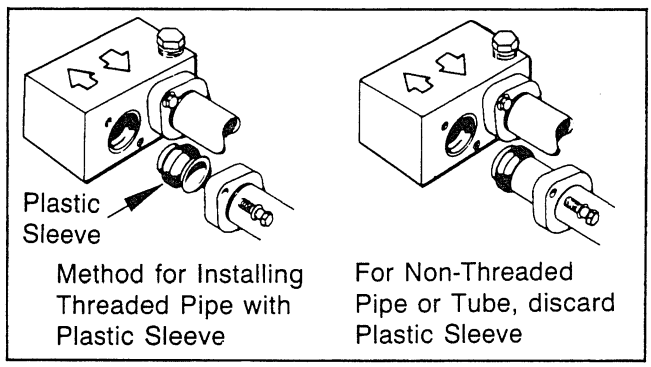


Fig. 17 Pipe Connections

Do not install any valve or variable restriction in the piping between the heater outlet and the pool, unless it is necessary to increase back pressure.

No water flow adjustments are necessary unless an external by-pass valve is required when the normal filtration rate exceeds 125 GPM. To set the by-pass valve, follow this procedure:

1. Clean the pool filter.
2. With the filter pump off, remove the drain valve located on the right side of the header, and install a thermometer (see Fig. 18).

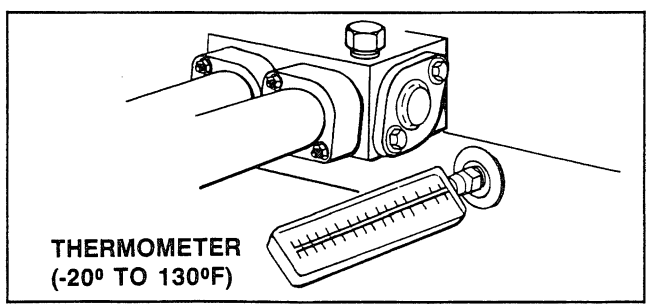


Fig. 18 Temperature Check

3. Close the manual by-pass valve.
4. Turn off the heater by moving the toggle switch to the "OFF" position.

5. Start the filter pump.
6. After 3 minutes, note and record the thermometer reading (this represents pool water temperature).
7. Turn the heater back on.
8. Gradually open the manual by-pass valve, counting the rotations, until the temperature rise shown in Table 5 or 6 depending on header size is obtained (the temperature rise is the difference between the first reading and this one).
9. Be sure the thermometer reading remains constant for at least 3 minutes.

Table 5. Temperature Rise & Minimum Flow Rates with 1-1/2'' header.

MODEL	TEMPERATURE RISE, °F		MINIMUM FLOW RATE (GPM)
	MINIMUM	MAXIMUM	
125	22	28	20
175	24	36	20
250	24	38	25
325	28	38	30
400	30	38	30

Table 6. Temperature Rise & Minimum Flow Rates with 2'' Header

MODEL	TEMPERATURE RISE, °F		MINIMUM FLOW RATE (GPM)
	MINIMUM	MAXIMUM	
125	27	36	20
175	33	42	20
250	33	42	25
325	28	38	30
400	30	39	30

10. Scribe a line on the by-pass valve stem and body to record the position in case it is necessary to repeat the procedure. Remove the handle from the by-pass valve.

Once the manual by-pass valve is set, the internal automatic by-pass valve in the heater will maintain proper flow.

3G. Pressure Relief Valve

A pressure relief valve is not furnished with the Series One 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 Fig. 19). The pressure relief setting of the valve should be at or below the lowest working pressure of any component in the filter system.

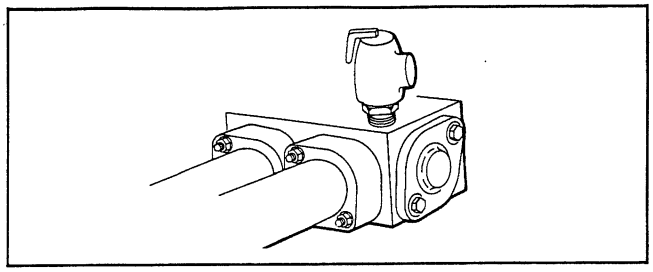


Fig. 19 Pressure Relief Valve

3H. Special Adjustment of Pressure Switch

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

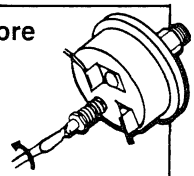
1. If the top of the heater is installed three (3) feet or more below the surface of the pool.
2. If any part of the filter system piping is three (3) feet or more above the top of the heater jacket.

If either of the above conditions exists, follow the detailed instructions in Figure 20.

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.

Pool Filter must be clean before making this adjustment



1. Turn toggle switch to OFF.
2. Set the pool thermostat to MAX.
3. Start the filter pump.
4. Turn toggle switch to ON. Heater should start.
5. Turn the pressure switch adjustment screw counter-clockwise very slowly until the heater goes off.
6. Turn the pressure switch adjustment screw clockwise 1/4 turn. The heater should come back on.
7. **Caution**. Check the adjustment by turning the filter pump off. The heater should shut off immediately. If it does not, restart the filter pump and repeat **Steps 6 and 7**. Recheck the adjustment.
8. Return the pool thermostat to the desired temperature.
9. When the pressure switch is properly adjusted, the heater should come on about 10 seconds after the filter pump is started, and shut off immediately after the pump shuts off.

Fig. 20 Pressure Switch Adjustment

SECTION 4. OPERATING INSTRUCTIONS

Section 4A. Lighting and Shutdown

FULL LIGHTING AND SHUTDOWN INSTRUCTIONS ARE INCLUDED ON THE LIGHTING INSTRUCTIONS LABEL ATTACHED TO THE BACK OF THE CONTROL COMPARTMENT DOOR.

When lighting or relighting the pilot, always turn the temperature control to its lowest setting. Turn the gas valve and the toggle switch to OFF. WAIT FIVE (5) MINUTES.

WARNING. For your safety when lighting the heater, it is always a safe practice to keep the head and face well away from the lower firebox opening to prevent any risk of personal injury when lighting the heater.

WARNING: Vent pipes, draft hoods, grate tops, and water fittings get hot, and have the potential to burn. 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-1. Lighting

NOTE: Should overheating occur, or gas supply fail to shut off, refer to Section 4A-3 for complete shut down instructions.

1. Remove the service door on the front of the heater. Verify that the gas control knob is in the OFF position. If not, turn the knob clockwise to the PILOT position, depress the spring on the side of the knob and turn the knob further clockwise to the OFF position. (See Figure 21.)

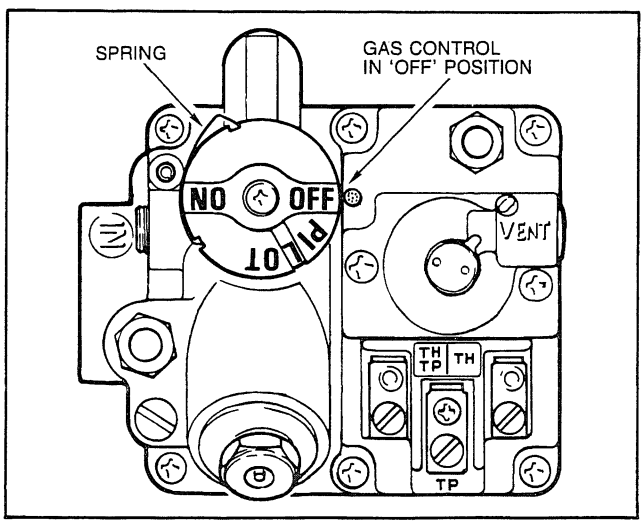
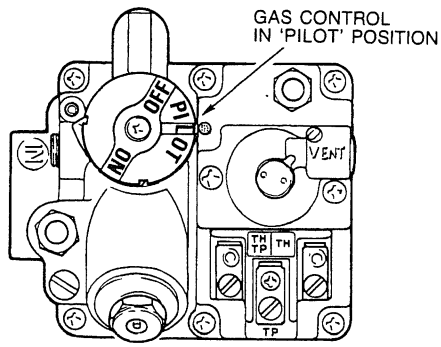


Fig. 21 Gas Valve

2. Wait 5 minutes. That's how long it takes for the natural air flow to clear any accumulation of unburned gases from the combustion chamber. These gases could ignite if you attempt to light the heater too soon.
3. Turn the gas valve counter-clockwise to the PILOT position.
4. To light the pilot, depress the control knob and, at the same time, light the gas at the VISOFLAME tube. Hold the knob down for thirty seconds, then release.



The VISOFLAME lighter tube permits ignition of the pilot at arms length without bringing the head or face near the firebox opening or the burner tray. The VISOFLAME tube can also be used to prove pilot ignition; depress the knob on the gas valve. Flame will return to the VISOFLAME tube if the pilot is lit.

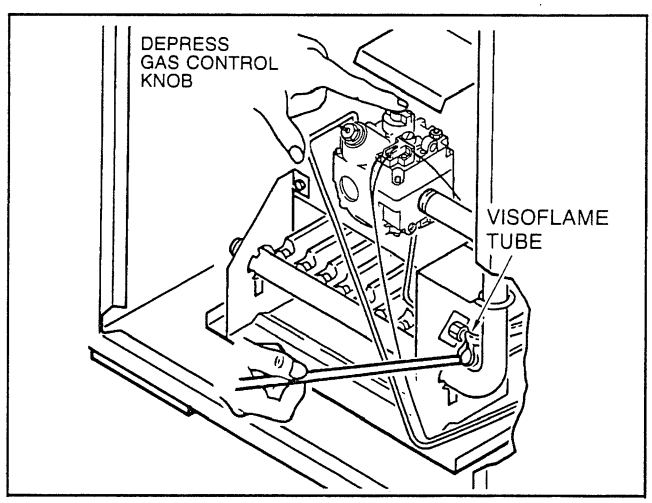


Fig. 22 Lighting Pilot

5. Rotate the gas valve knob counter-clockwise to the ON position. Replace the service door, and position the toggle switch to ON. Turn the temperature control to the appropriate setting to activate the main burners.

NOTE: The ON/OFF toggle switch must be in the ON position for the heater to operate.

4A-2. Relighting

If the pilot should go out, repeat steps 1 through 5.

4A-3. Shutdown

To shut off the main burners only, you can either position the toggle switch on the EPG or rotary switch on the EPM to OFF, or open the service door and rotate the gas valve knob to PILOT.

For a complete shutdown, open the service door, rotate the gas valve knob clockwise to PILOT, depress the spring on the side of the knob and rotate it further clockwise to OFF, or turn off the manual shutoff valve located outside the heater.

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 remove any installation residue from the water, so it's a good idea to clean the filter at the end of this operation before starting the heater. When raising the temperature of a cold pool, all time clock settings should be removed so that the filter system and heater can operate continuously until the desired water temperature setting on the thermostat is achieved. When that occurs, the heater will automatically shut off, and 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. Open the service door and make sure the pilot has a stable, sharp blue flame by checking it with a mirror or the VISOFLAME.

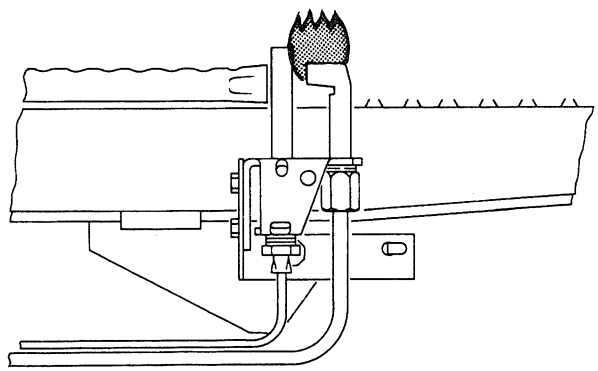


Fig. 23 Pilot Flame Pattern

3. If the gas valve is still in the PILOT position, rotate it counter-clockwise to the ON position.
4. Replace the service door.
5. Position the toggle switch to ON.
6. 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 degrees, there will be considerable water condensate dripping from the heat exchanger into the firebox.
7. Re-set the time clock to provide for a single filter cycle every 24 hours according to the recommendations of the filter manufacturer.

4C. Inlet-Outlet Temperatures

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 is bypassed. For that reason, the piping will not feel hot to the touch.

4D. Temperature Controls

4D-1. Model EPG

The temperature control is calibrated at the factory. Use an accurate pool thermometer to determine the optimum water temperature. After positioning the control knob at the desired setting, use the TEMP-LOK to keep it there.

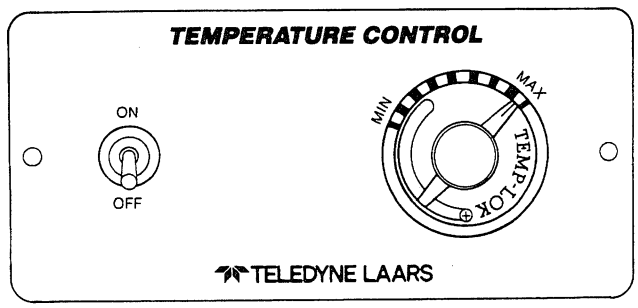


Figure 24a EPG Temperature Control

4D-2. Model EPM

The Model EPM heater is equipped with dual temperature controls, permitting two temperature settings. The controls operate in the same temperature range as the EPG, and give the user the option of setting one control for normal and the other for standby operation, or one could be set for pool temperature and the other for a spa. Thermostat selection is accomplished by means of a rotary switch located between the two control knobs. Once the thermostats have been set at the desired temperatures, use the TEMP-LOK to keep them there.

The controller samples and reacts to the water temperature approximately every six seconds, so there will not be an immediate reaction when the thermostat knob is turned to a new setting. At the end of each six-second cycle, the controller either switches the gas valve on or off or leaves it in its existing condition. A green indicator light behind the face plate flashes every six seconds, visually indicating the heater is properly powered, in operation, and that the pilot is lit. It is recommended that the knob be turned just a little ways at a time, giving the controller time to act on the new information.

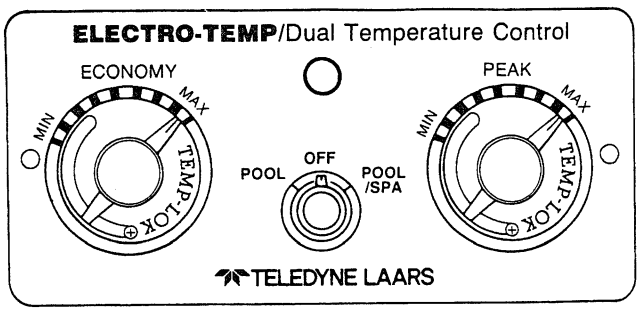


Figure 24b EPM Temperature Control

4E. Spring and Fall Operation

During periods when the pool is only going to be used intermittently, it is best to turn the thermostat down to the MIN setting. This will prevent the pool from becoming "chilled," and still require the least amount of time to raise the water back up to swimming temperature.

If the heater is not going to be used for a long period of time, it should be shut down completely, following the instructions in Sec. 4A-3.

CAUTION: In areas where freezing temperatures occur, the heater should be completely drained prior to the first frost.

To drain the heater, shut off all gas valves, and open all of the drain valves (see Fig. 25). Leave the drain valves open until it is time to use the heater again. Grease the threads in the header and on the plugs for winter protection.

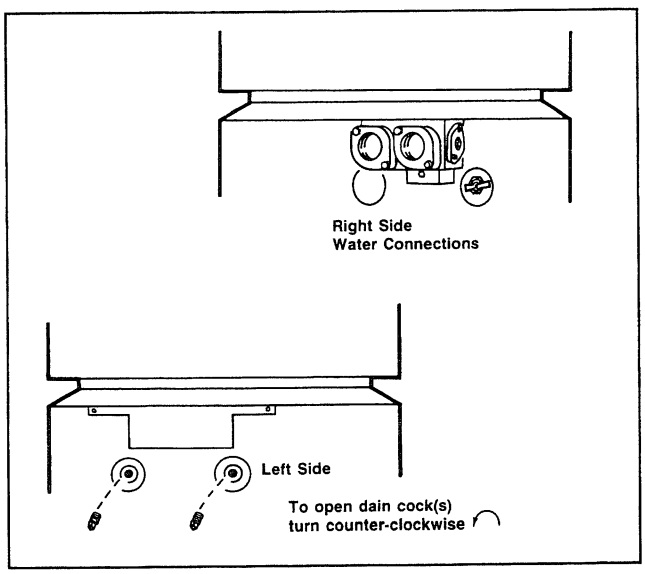


Fig. 25 Heater Drains

Disconnect the copper tubing at the pressure switch. See Section 3-H for re-attaching it.

In areas subject to only occasional short cold snaps, the heater should be turned off and the filter pump ran continuously for the length of the cold period. If you prefer to not maintain pool temperature, shut down and drain the entire system as described above.

4F. Water Chemistry

4F-1. For Pool

The mineral content of swimming pool water increases daily, due to natural evaporation and the addition of algaecidal and sanitizing chemicals. If the mineral concentration in the pool is allowed to get too high, the minerals will precipitate out of the water and deposit on the walls of the pool, in the filter system, and in the heater tubes. Take the precaution of maintaining the pH factor of the pool water between 7.4 and 7.6.

4F-2. For Spa

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

The spa is more like a large bathtub than a small swimming pool, because usage density in a spa is many times greater than that for a swimming pool. For example, 5 persons using a 500-gallon spa is equivalent to 250 people using a typical 25,000-gallon residential swimming pool. Because of its size, the elevated water temperature, and the heavy usage, chemical values can differ greatly. This chemical imbalance can result in unsanitary water conditions, and affect the life of the heater.

Maintaining sanitary water conditions in a spa can only be accomplished by regular water changes and the addition of sanitizing chemicals.

4F-2a. Corrosivity

The corrosive action of spa water is increased by the following:

a. Low pH - acidity
b. Low Total Alkalinity - bicarbonates
c. Low Calcium Hardness 'soft' - water

Low pH. The pH measurement is the most important test for maintaining correct spa water balance, and should be taken frequently. Values below 7.4 are considered acidic.

Total Alkalinity. Water with low total alkalinity is corrosive, even if the pH factor is correct. At normal pH levels, total alkalinity is a measure of bicarbonates in the water. Low bicarbonate levels will also permit the pH to vary widely when other chemicals are added. Conversely, correct alkalinity levels will stabilize the pH.

Calcium Hardness. Hard water can cause scale formation and reduce heater efficiency. Soft water, on the other hand, is very corrosive. In areas where the water is known to be soft, this must be checked and adjusted to an acceptable value each time the spa water is changed.

NOTE: Teledyne Laars does not warrant heat exchangers damaged by corrosive water.

4F-3. Testing

Teledyne Laars recommends that spa owners purchase a test kit and use it regularly. A minimum kit is one which will measure chlorine and pH levels.

TEST	MINIMUM LEVEL	RECOMMENDED LEVEL	MAXIMUM LEVEL
Free Chlorine or Total Bromine	2 ppm	3 to 5 ppm	
pH		7.4 to 7.6	
Total Alkalinity (T.A.)	80 ppm	100 to 120 ppm	140 ppm
Calcium Hardness (CA)		150 to 300 ppm	
Langlier Saturation Index (SI)		-0.5 to +0.5	
Cyanuric Acid		40 to 100 ppm	
Total Dissolved Solids (TDS)		1500 ppm	
Copper		0 ppm	

Low TA values are corrosive, and will cause pH levels to fluctuate; adequate levels will prevent large pH variations when sanitizers are added. Sodium bicarbonate, or baking soda, is used to raise the total alkalinity.

Calcium hardness is more of a problem in locations that use 'soft' water, and spas installed in these areas should test and adjust the CH every time the water is changed. CH can be raised by the addition of calcium chloride to the water, and lowered by adding Tri-Sodium Phosphate or its equivalent. Consult your chemical dealer.

The corrosivity of water is measured by the S.I. This is calculated by the Langelier formula which takes into account these factors:

1. Operating temperatures
2. Total Alkalinity
3. pH
4. Calcium hardness
5. Total dissolved solids

The optimum S.I. value is zero. Negative values are considered corrosive. Consult your spa dealer for the necessary equipment to measure the S.I.

Cyanuric acid is commonly referred to as chlorine stabilizer. It delays the decay of liquid chlorine sanitizers. Most solid sanitizers already contain stabilizers. Excessive levels of cyanuric acid will reduce the sanitizer efficiency, and can only be corrected by changing the spa water.

The mineral content of spa water increases gradually as chemicals are added to the water. Excessively high levels can reduce sanitizer efficiency. If the T.D.S. level becomes too high, change the spa water.

There is a kit available from your local spa dealer for detecting copper in the water. This is usually a warning that corrosion is taking place in the piping system, fixtures, and heater caused by low pH values in combination with other chemistry imbalances. The condition can be corrected by changing the spa water, closely monitoring the pH, and correcting any chemical imbalance.

4F-4. Water Changing

Teledyne Laars recommends regular changing of spa water every 60 days if usage is light, and every 30 days during heavy usage. The cost of water to fill a spa is low, equal to the water usage by an average family for 3 to 4 days. Be sure to re-stabilize the water chemistry after every water change. For any spa water chemistry problems, it is generally less expensive, and more effective, to change the water than to continue adding corrective chemicals.

4G. Therapeutic Pools (Spas) Safety Rules

Therapeutic pools, or 'spas', are usually piped and controlled so that very warm or hot water, often with air injection, is forced into a confined area of a swimming pool or into a small separate pool at high velocity. The use of these pools can be hazardous unless the following "Safety Rules for Hot Tubs," recommended by the U.S. Consumer Product Safety Commission, are observed.

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.

4H. Swimming Pool Energy Savings Tips

Teledyne Laars offers the following recommendations to help in fuel conservation, and in minimizing the cost of operating your pool heater without sacrificing comfort.

1. Set the heater thermostat no higher than 78°F. The National Swimming Pool Institute and the American Red Cross maintain that the healthiest water temperature for swimming is 78°F. Be certain you are using an accurate pool thermometer, because a variance of 4 degrees, from 78°F to 82°F will use as much as 40% more gas.
2. Carefully monitor the water temperature of your pool in the summertime, because heater usage can be reduced due to warmer air temperatures.
3. Find the proper setting on the pool heater temperature control and use the TEMP-LOK to discourage further adjustments.
4. Set the filter time clock to start the pump no earlier than 6:00 AM during the pool heating season. This is the time when nightly heat loss stabilizes.
5. If the pool is only going to be used on weekends, reduce the heater thermostat setting by 8 or 10 degrees during the week. It should be reset to the 78° level before expected usage, keeping in mind allowing enough lead time for the water to reach the desired temperature.
6. During the winter, and when on vacation for longer than a week, follow the instructions in Section 4A-3 to completely shut down the heater.
7. Where possible, shelter the pool from prevailing winds with well-trimmed hedges or other landscaping, cabanas, or fencing.
8. Always use a pool cover when practical. Besides providing a valuable safety feature, a pool cover will reduce heat loss, conserve chemicals, and reduce the load on filter systems.

4I. Periodic Inspection

The Teledyne Laars Series One heater has been designed and constructed to provide long performance life when installed and operated properly under normal conditions. Regular inspections by trained service personnel is 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 to remove any accumulation of flammable materials, leaves, paper, etc. from beneath the heater.
2. Check the venting on indoor heater installations for looseness and leaks. Be certain that all openings to outside air are unobstructed.
3. Inspect the internal surfaces of the heat exchanger tubes annually, and remove any accumulation of scale.
4. 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 accumulation corrected.
5. Check for spider webs in the pilot and main burner orifices especially at Spring start-up.
6. Make a periodic visual check of the main burner and pilot flame patterns. They should resemble that shown in Fig. 26.

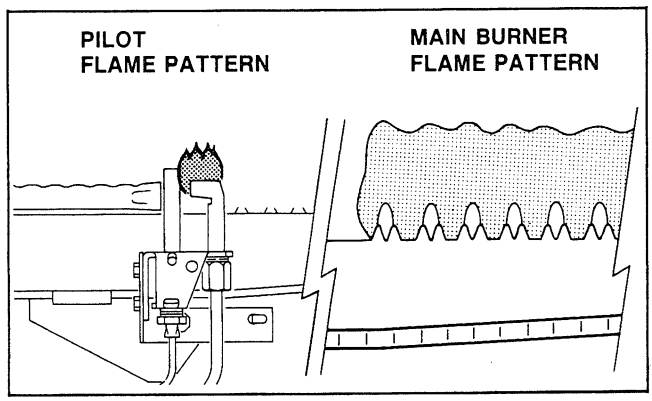


Fig. 26 Flame Patterns

7. Inspect the gas and millivolt controls annually to assure safe and dependable operation. Specifically, check the following:
   a. High Temperature Limit Switch (see Section 5C-3)
   b. Water Pressure Switch (see Section 5C-3)
   c. Automatic Gas Valve (see Figure 40)
   d. Temperature Control (see Section 5E)

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

8. Keep the pool heater area clean, and free of all combustible materials, gasoline and other flammable vapors and liquids.
9. Do not use the heater if any part has been under water. Immediately call a qualified service technician to inspect the heater and to 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.

SECTION 5. MAINTENANCE

Section 5A. General Precautions

CAUTION: This section contains material to be used by a qualified service technician for testing and repairing the heater. Step-by-step procedures for troubleshooting the electrical control system and other parts of the heater are included. These procedures should be reviewed prior to undertaking actual repairs.

The service technician should keep in mind that all of the other components of the pool system have an effect on heater operation. These components include the pump, filters and strainers, valves, gas supply, and time clocks. So before proceeding with these heater-related troubleshooting procedures, make sure the pump is operating properly, the filter and strainers aren't clogged, there are no closed valves in the piping system, and the time clocks are properly adjusted. If all of these components check out satisfactorily, then the service technician should proceed with the following troubleshooting procedures.

5B. Regulated Gas Pressure

Using the procedures outlined below check the manifold regulated pressure to verify that it is adequate to operate the heater. A manometer kit is available from Teledyne Laars, and instructions for its use are included in the kit.

1. Attach the manometer* to the heater jacket.
2. Open both valves on the manometer.
3. Shut off the gas supply to the heater at the source.
4. Remove the 1/8" NPT test plug on the right side of the gas valve (marked "PRESS TAP"), and screw in 1/8" NPT fitting from the manometer kit. Connect one end of the manometer hose to the fitting and the other end to one of the manometer valves.
5. Wait five minutes.
6. Refer to Section 4A, or the rating plate, for instructions on lighting the pilot.
7. Move the toggle switch to ON. This should activate the main burners.
8. Manometer readings should be:
   4" WC - Natural gas
   9" WC - LP gas
9. Move the toggle switch to OFF, and refer to Section 4A-3 to shut down the system.
10. Disconnect the manometer tubing from the 1/8" NPT fitting in the gas valve, and remove the fitting. Replace it with the 1/8" NPT plug.

* A dry gas pressure gauge may be used.

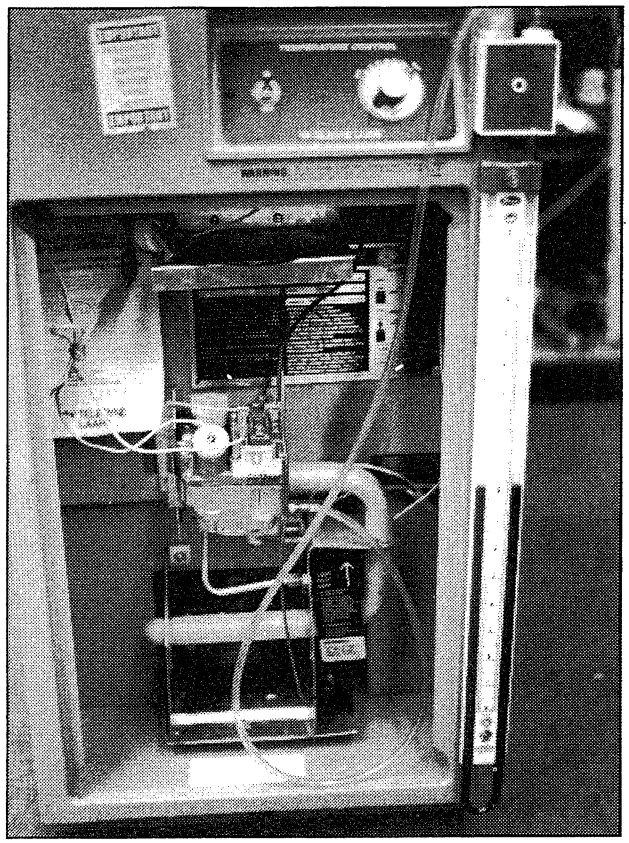


Fig. 27 Manometer Attachment

5C. Electrical Trouble Shooting

The electrical trouble shooting procedures which follow are based on the wiring layout in Figs. 28 and 29.

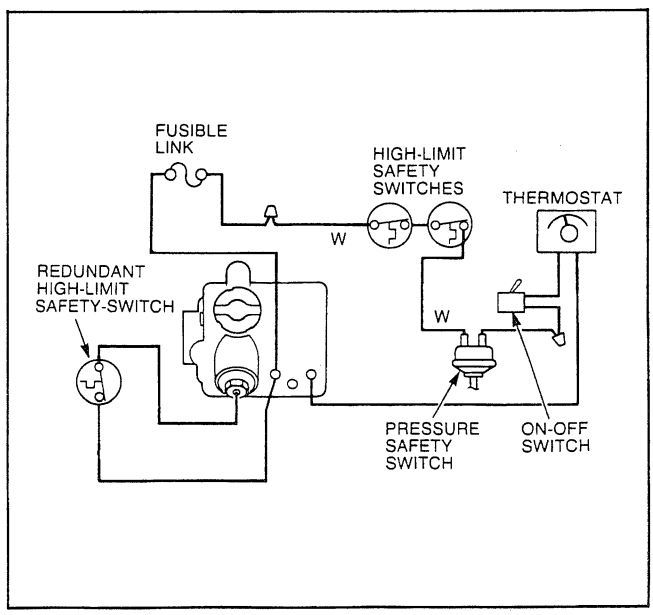


Fig. 28a EPG Pictorial Wiring Diagram

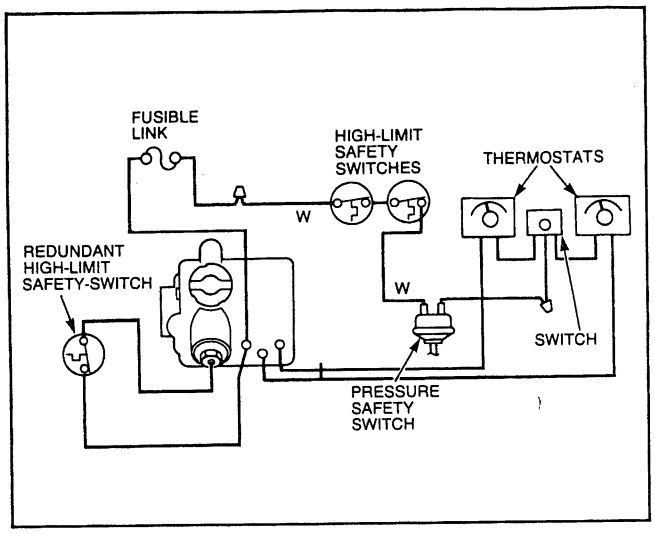


Fig. 28b EPM Pictorial Wiring Diagram

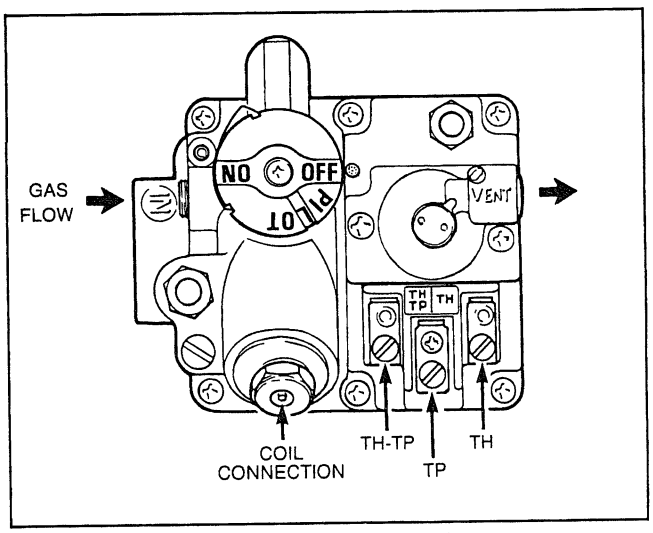


Fig. 29 Gas Valve Terminal Identification

These step-by-step procedures are designed to quickly isolate problems which may cause common heater malfunctions. Before starting these procedures, review all of the information in the Installation and Operating Manual which accompanied the heater. Additional copies of the manual are available from Teledyne Laars or your local dealer. Be sure every other component in the pool system is operating properly before initiating these procedures.

Six problems will be addressed in this part of the trouble shooting guide:

5C-1. Pilot will not light.

5C-2. Pilot will not stay lit.

5C-3. Main burners will not light.

5C-4. Heater will not shut off when filter pump is not on.

5C-5. Intermittent operation.

5C-6. Fusible Link and Redundant High Limit Switch.

5C-1. Pilot Will Not Light

Possible causes:

External

a. Improper installation
b. Gas meter too small
c. Gas line too small or restricted
d. Inadequate gas pressure
e. Too many appliances sharing gas line
f. Manual gas valves closed
g. Air in gas line

Internal

a. Dirty pilot burner
b. Dirty VISOFLAME tube
c. Flue collector mis-placed
d. Incorrect pilot orifice
e. Loose or detached pilot burner gas tube.

First, verify that there is proper gas pressure reaching the heater by running the gas pressure test outlined in Section 5B, and check the possible external causes.

Next, turn off the gas supply to the heater. Open the heater cabinet door and remove the burner tray assembly by removing the two gas valve bracket screws and the three manifold bracket screws. Unscrew the main gas supply pipe from the gas valve. Disconnect all wires from the gas valve. Slide the burner tray out of the heater.

Visually inspect the pilot burner and the VISOLAME tube for dirt, bugs and spider webs which could impede gas flow. If any obstruction is discovered, use a pin or other small device to clean the orifice. Replace the burner tray, and secure it with the three manifold bracket screws. Reattach the anti-rotation bracket, and the wiring. Screw the main gas supply pipe back into the gas valve.The pilot should now light.

5C-2. Pilot Will Not Stay Lit

If the pilot refuses to stay lit when the gas valve knob is released, the problem could be a faulty pilot generator or gas valve. Perform the following electrical test procedure to determine which.

First, set the temperature control valve to the lowest setting and turn the toggle switch to OFF.

Remove the black wire from terminal TH and the yellow wire from the Coil Connection. Remove both yellow wires from terminal TH/TP. Attach a temporary jumper between the Coil Connector and terminal TH/TP. See Fig. 30.

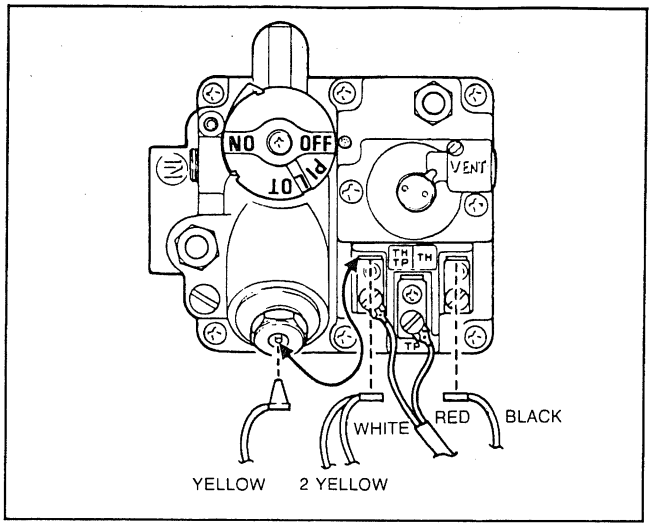


Fig. 30 Gas Valve Wiring Identification

Turn the gas valve to PILOT. Follow the lighting instructions in Section 4A-1.

If the pilot does not stay lit when the gas valve knob is released, replace the pilot generator. If it still refuses to stay lit, replace the gas valve and relight the pilot.

Remove the jumper wire and replace the black wire to terminal TH, the yellow wire to the Coil Connector, and the two yellow wires to terminal TH/TP.

It is possible for the pilot to stay lit, after releasing the gas valve knob, until the main burner fires and then go out. This would indicate that the pilot generator is shorting out under load, and should be replaced.

5C-3. Main Burners Will Not Light

If the main burners fail to light when there is a call for heat, check the following possible causes before initiating the electrical check.

a. Is the filter pump ON?
b. Is the filter clean, and is water flowing to the pool?
c. Is the toggle switch ON?
d. Is the gas valve knob positioned at ON?
e. Is the thermostat set to the maximum position?
f. Is the "Fireman" switch and time clock ON?
g. Are all accessory items turned ON (remote thermostat, air switch, override switch, etc.)?
h. Is the pilot ON?

If the answer to all of the above questions is YES, then check the electrical connections listed below to make sure there are no loose, broken, or grounded wires.

a. Wires and terminals on the gas valve.
b. Wires and terminals on the "Fireman" switch and time clock.
c. Wire nut connections.

The next series of tests is designed to verify the condition of the high limit switches, the thermostat, and the pressure switch.

High Limit Switches

Attach a jumper wire between the Coil Connector pin on the Robertshaw valve and the white wire terminal on the pressure switch (see Fig. 31). If the heater fires, the problem could be a restricted water flow affecting the High Limit switches. Check for lime buildup in heat exchanger tubes, and repair or replace if necessary.

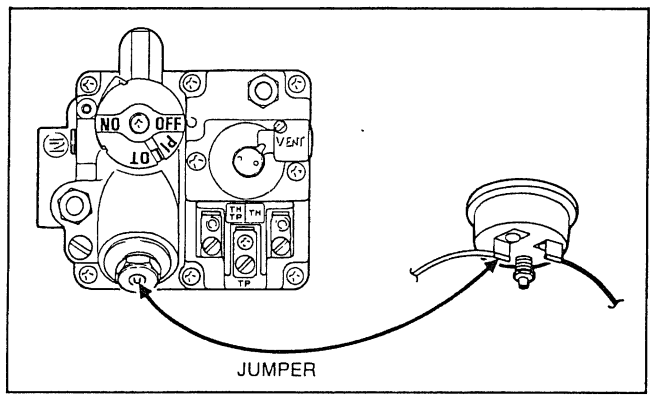


Fig. 31 High-Limit Test

If the heater does not fire, remove the jumper wire and check the thermostat and toggle switch.

Thermostat and Toggle Switch

Attach a jumper wire between the TH terminal on the Robertshaw valve and the black wire terminal on the pressure switch (see Fig. 32). If the heater fires, the thermostat, toggle switch, or both are preventing the heater from firing. The toggle switch can be tested independently by removing it from the circuit. If the heater fires, the toggle switch is defective. Replace it. If the heater still does not fire, the problem could be the thermostat.

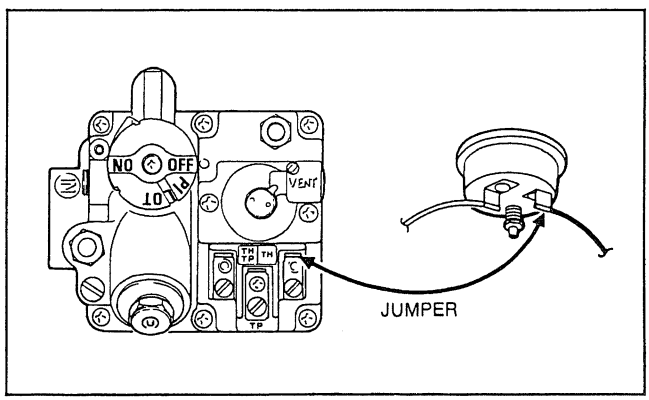


Fig. 32 Thermostat and Toggle Switch Test

Pressure Switch

Attach a jumper wire between the terminals on the pressure switch. If the heater fires, the pressure switch is out of adjustment, defective, or the pressure switch tube could be clogged. Repair, replace, or adjust as necessary. (See Fig. 33)

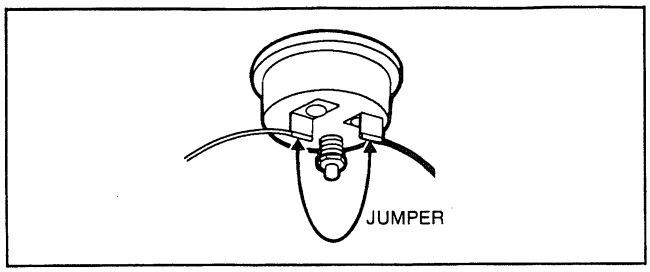


Fig. 33 Pressure Switch Test

If these steps did not reveal the problem, it is possible that more than one control may be defective. Remove any jumpers in the system, and use the following procedures to check the controls in various combinations to locate the problem.

Limit Switches and Pressure Switch

Attach a jumper wire between terminal Coil Connector Pin on the gas valve and the black wire terminal on the pressure switch (see Fig. 34). If the heater fires, the high-limit switches and the pressure switch are faulty. Repair or replace as necessary. Remove the jumper wires.

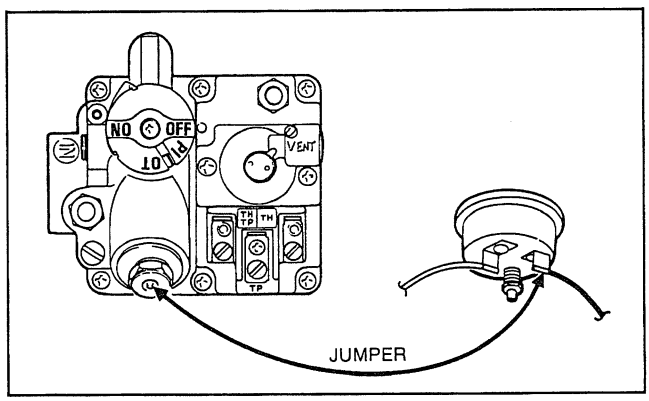


Fig. 34 Limit and Pressure Switches Test

Thermostat, Toggle Switch, and Pressure Switch

Attach a jumper wire between terminal TH on the gas valve and the white wire on the pressure switch (See Fig. 35). If the heater fires, these controls are defective. Repair or replace as necessary.

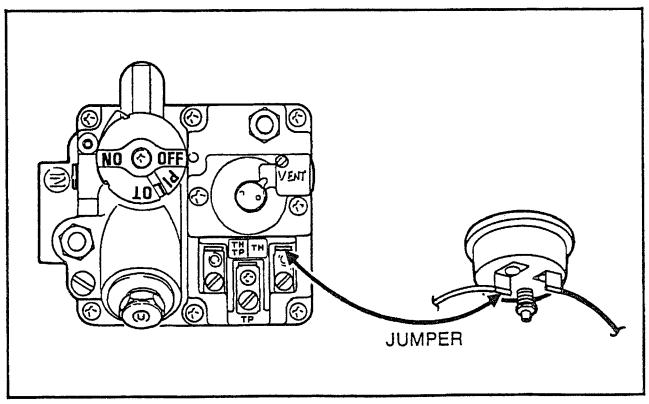


Fig. 35 Thermostat, Toggle Switch, Pressure Switch Test

Thermostat, Toggle Switch, and High-Limit Switches

Two jumper wires are required for this test. Attach one jumper wire between Coil Connector Pin on the gas valve and the white wire terminal on the pressure switch. Connect the second jumper wire between terminal TH on the gas valve and the black wire terminal on the pressure switch (see Fig. 36). If the heater fires, these controls are defective. Remove the jumper wires, and repair or replace them. If the heater does not fire, attach a third jumper wire between the two terminals on the pressure switch (see Fig. 36). If the heater fires, remove all of the jumper wires, and replace all of the affected controls.

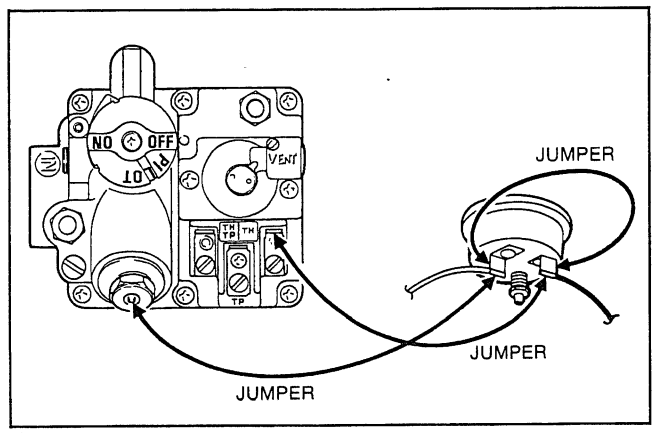


Fig. 36 Thermostat, Toggle Switch and High-Limit Test

Accessory Equipment

Disconnect all accessory equipment from the heater, such as time clocks, verify that the heater is properly wired according to the applicable schematic. If the heater fires, the problem is in the accessory equipment and not the heater. Replace or repair the equipment as needed.

If the heater still does not fire, repeat the above electrical troubleshooting procedures without the accessory equipment wired in to the circuitry. If it still fails to light, consult your local dealer or Teledyne Laars.

5C-4. Heater Will Not Shut Off When the Pump is Not Running

It is essential that the main burners on the heater do not fire unless the filter pump is running. If it does, there could be an installation problem, or the pressure switch may be out of adjustment. To correct the problem, see Section 3H.

5C-5. Intermittent Operation

High resistance in the safety circuit can cause intermittent operation of the heater, and is a warning of future problems. The following test will determine if there is an excessive voltage drop (resistance) in any contact or control. The test must be performed with the filter clean, the pump running, and the main burners firing.

Connect a millivolt meter to the Coil Connector pin and terminal TH on the gas valve. A reading of 20MV or less on the low range scale is acceptable. This represents the total voltage drop through the safety controls and wire harness.

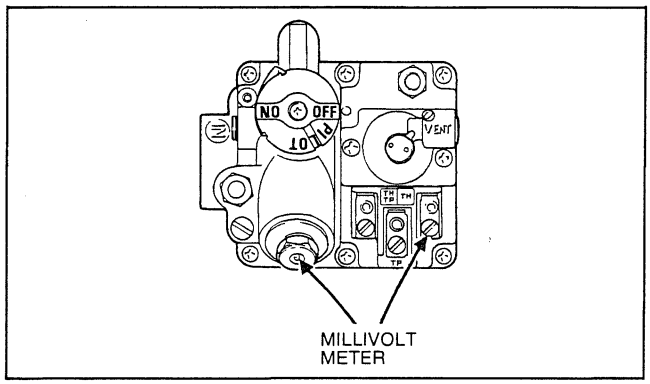


Fig. 37 Millivolt Meter Attachment

Locate the source of the voltage drop by using the millivolt scale on a volt-ohm-meter. Use leads to jumper across the pressure switch, thermostat, and the high limit switches one at a time. When all of the voltage drop values are obtained and added up, the total should be the same as what was found in the previous paragraph.

If there is more than a 10MV drop across the pressure switch, make sure the terminals are tight. If this does not reduce the voltage drop, remove the adjustment screw and clean the tip to remove any contamination. Replace the screw, and tighten it until the heater comes on. Rotate the screw a 1/2 turn back and forth a few times to make sure the contacts are clean. Readjust the pressure switch per the instructions in Section 3H.

If there is more than a 10MV drop across the thermostat, check and clean the spade terminals and tighten the terminal screws on the thermostat. If this procedures fails to reduce the voltage drop, replace the thermostat.

If there is more than a 10MV drop across the toggle switch, flip the switch off and on several times. If this fails to reduce the voltage drop, replace the switch.

If there is more than a 10MV drop across the two high-limit switches, check each switch individually as explained in Section 5E. Make sure the quick connect terminals are firmly attached to the wire and the terminals. If there is more than a 5MV drop from either of the high-limit switches, replace it.

5C-6. Fusible Link and Redundant High Limit Switch

An open or defective fusible link or redundant high limit switch will cause the heater to shut down. If this occurs, first check the fusible link. Do this by removing the wire nut from the splice in the white wire between the link and the limit switch (See Fig. 38). Attach one end of a jumper wire to the exposed wires and the to terminal TH/TP on the gas valve. If the heater fires, then the fusible link should be replaced, and the cause of its opening determined. Usually, opening of the fusible link is caused by abnormal wind conditions, possibly in connection with improper clearances to buildings and wall on outdoor installations. See Section 3B for proper installation clearances.

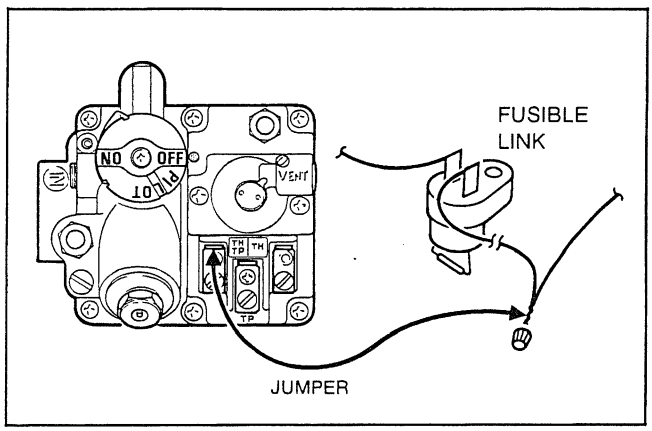


Fig. 38 Fusible Link and Redundant High-Limit Test

Check the redundant high limit switch by placing one end of a jumper to terminal TH/TP and the other end to the Coil Connector pin. (See Fig. 39) If the heater fires, replace the redundant high limit switch.

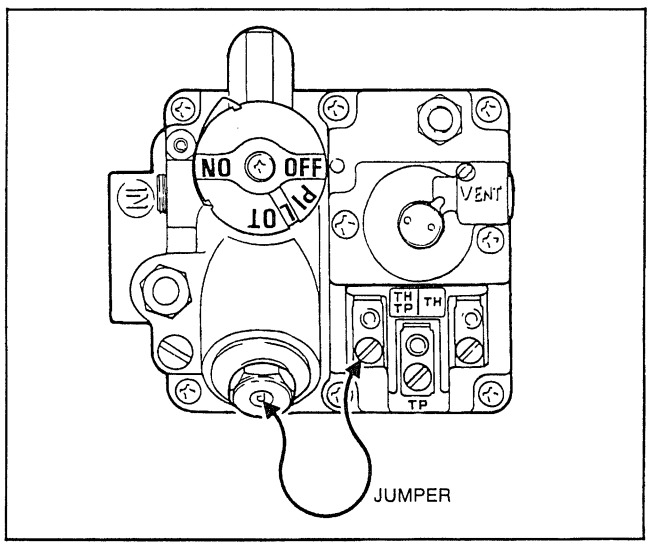


Fig. 39 Redundant High-Limit Test

5D.Replacing the Gas Valve

WARNING: Never attempt to repair the gas valve. Such attempts will void the warranty, and could possibly 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 on the rating plate to turn off the gas valve on the heater.

3. Disconnect the main gas pipe from the gas valve. (See Fig. 40)

4. Remove the two screws securing the anti-rotation bracket on the left side of the gas valve.

5. Remove the pilot gas tube and the pilot lighter gas tube from the gas valve.

6. Remove all wires from the gas valve terminals.

7. Unscrew the gas valve from the manifold pipe.

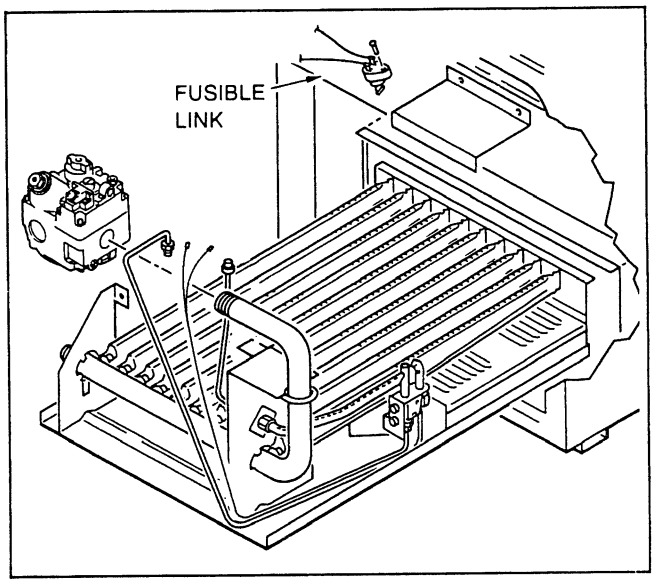


Fig. 40 Removing Gas Valve

8. Screw the new gas valve onto the manifold pipe, and finish the replacement by reversing the above instructions.

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 rating plate.

5E. Temperature Control Testing and Replacement

The condition of the temperature control(s) can be tested with a millivoltmeter using the following procedure.

1. Loosen the TEMP-LOK screw.
2. Make sure the pump is running, and has been circulating water through the heater for at least 15 minutes.
3. Rotate the control knob counter-clockwise as far as it will go to shut off the heater.

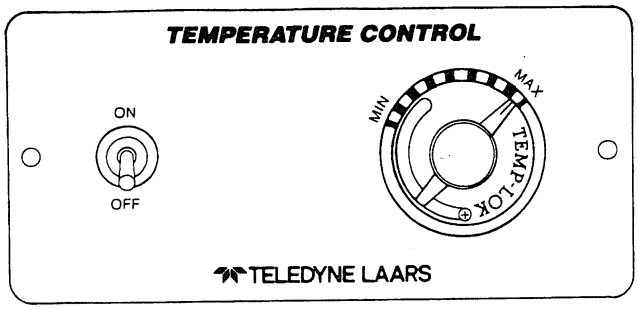


Fig. 41a EPG Temperature Control and ON/OFF Switch

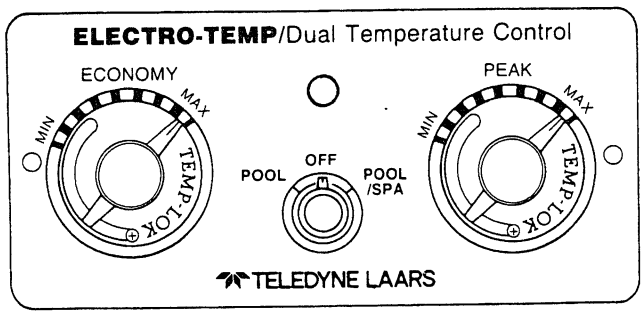


Fig. 41b EPM Temperature Control and Rotary Switch

4. Connect the millivoltmeter to Terminals TH and TH/TP on the gas valve (On the EPM, first terminals TH and TH/TP, then TP & TH/TP). The meter should read between 500-750 millivolts.
5. Watch the millivoltmeter while rotating the control knob clockwise slowly. When the thermostat turns the heater "ON", the meter's needle should move cleanly to between 200-250 millivolts.
6. Rotate the knob counter-clockwise slowly until the needle moves smoothly back to between 500-750 millivolts. The knob should not have to be rotated more than one mark on the dial for the meter reading to change. If the knob has to be moved more than two marks, or the millivoltmeter needle falters either way, replace the thermostat.

5F. Removal and Replacement of Temperature Controls

If the thermostat is discovered to be faulty, use this procedure to replace it.

1. Remove the two screws holding the control panel.
2. Gently pull the control panel away from the front of the heater for easier access.
3. Loosen the thermostat knob's set screw and remove the knob.
4. Remove the two screws holding the thermostat assembly.

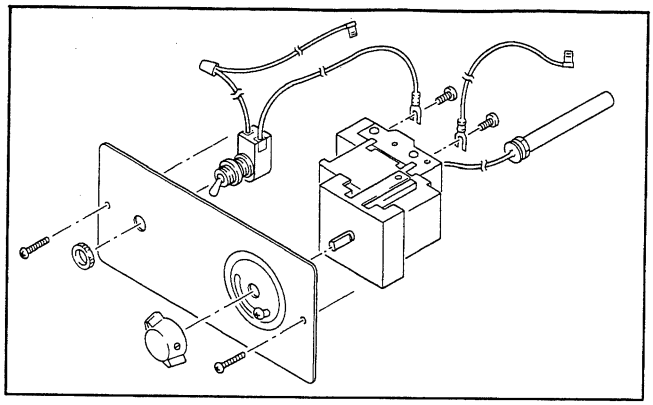


Fig. 42 Typical Control Panel Removal

5. Disconnect both black wires from the terminals.
6. Remove the thermostat bulb from the header. To do this, the vent cap/stack must be removed if there is one installed, and the top must be lifted off the heater. Loosen the cap screw holding the retainer bracket, and slide it off the bulb flange. The thermostat bulb can now be replaced with a new one, and the copper tubing routed to the control pane.

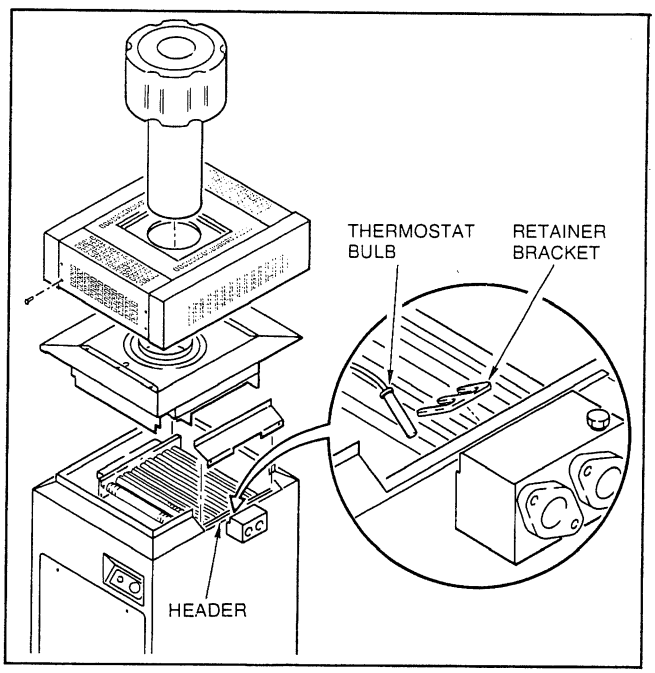


Fig. 43 Thermostat Bulb Removal

7. Secure the new thermostat to the control panel with the two screws, and reattach the two black wires to their terminals.
8. If it is determined that the toggle switch (rotary on the EPM) is faulty, replace it by first disconnecting the black wire going from the ON/OFF switch to the thermostat, and removing the wire nut from the other black wire. Then loosen the hex nut located behind the control panel, and remove the knurled nut on the front of the panel. Replace the switch and rewire it as before. In the case of the rotary switch on the EPM, it is held in place by a set screw. Loosen the set screw, then remove the hex nut behind the control panel.
9. The entire control panel can be replaced in the heater and secured with the two screws.

5G. Removal of Gas Burners

1. Turn off the main line gas valve.
2. Disconnect the service union in the gas line, and unscrew the gas supply pipe from the gas valve.
3. Disconnect all wires to the gas valve.
4. 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 Fig. 44).

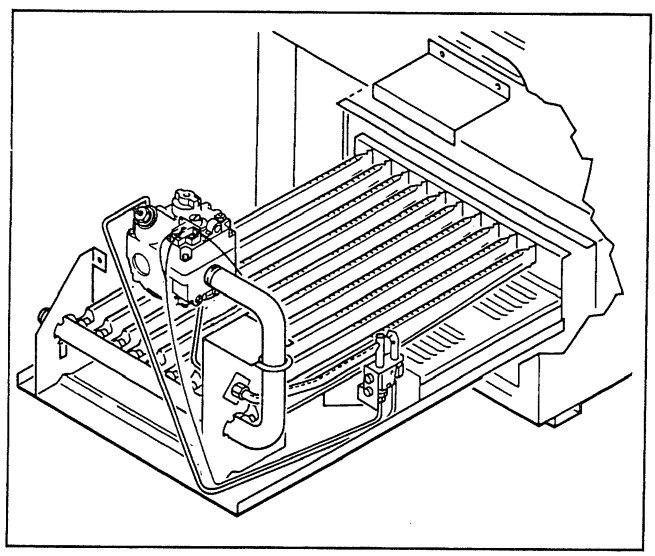


Fig. 44 Removal of Burner Tray

5. 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 Fig. 45).

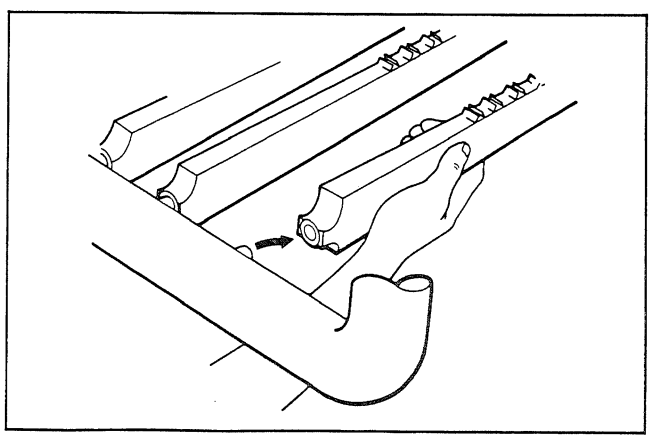


Fig. 45 Burner Removal

6. 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.
7. Reinstall the burner tray by sliding it back into the heater and securing it with the two brackets.
8. Reconnect the gas piping, turn on the gas supply and check the system for leaks using a soap solution.
9. Reconnect the electrical wires and the ignition lead to the gas valve according to the schematic on page 8.

NOTE: If the burner being removed is the one with the pilot attached, follow these additional procedures starting at Step 5.

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.

5G-1. Testing and Replacement of Fusible Link

1. With the filter pump running, turn the thermostat to its maximum setting.
2. The fusible link is located on heat shield behind the gas valve. Attach a jumper wire across the fusible link.
3. If the heater fires, the fusible link may be open. First, verify there are no loose or broken wires or terminals.

NOTE: Opening of the fusible link could be an indication of an unsafe installation resulting in an adverse "roll-out" condition. Correct any such condition before replacing the fusible link.

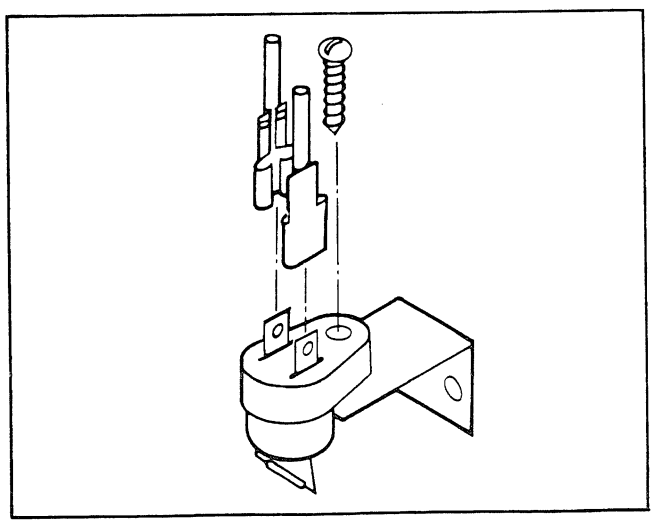


Fig. 46 Replacement of Fusible Link

4. To replace the fusible link, remove the screw attaching it to the bracket and release the two wires.
5. Replace it with a Teledyne Laars Part No. E00994-03.

5H. Periodic Inspection of Heat Exchanger Water Passages

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 and bushing as shown in Fig. 47. 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.

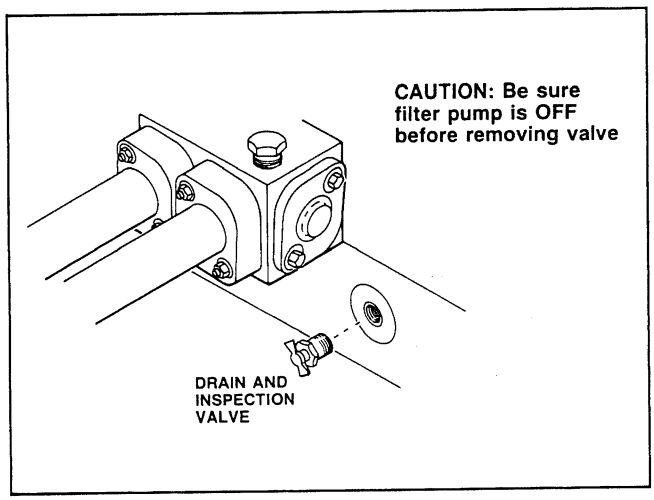


Fig. 47 Scale Check

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 where necessary.

5I. 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 baffles are removed.

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 steal plates with a good quality rust inhibiting paint.

   b. Reaming

   1. Dry the heat exchanger completely.
   2. The insides of the tubes can be reamed as illustrated in Fig. 48.

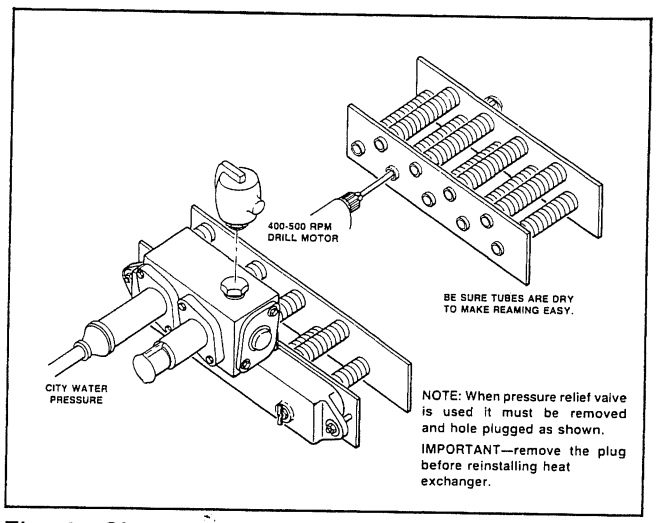


Fig. 48 Cleaning Heat Exchanger

   3. Withdraw the reamer frequently to remove lime powder and prevent the drill from binding in the tube.

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

   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 pounds; do not over-tighten.
   6. Pressure test the heat exchanger for leaks with city water supply before re-installing.
   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.

The automatic valve can be tested by removing the drain valve and bushing below the header casing and inserting a thermometer (see Fig. 18).

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

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 Fig. 49). If parts are pitted due to corrosion by excessive acid or chlorine in the pool water, they should be replaced (see Section 6-D, Parts List).

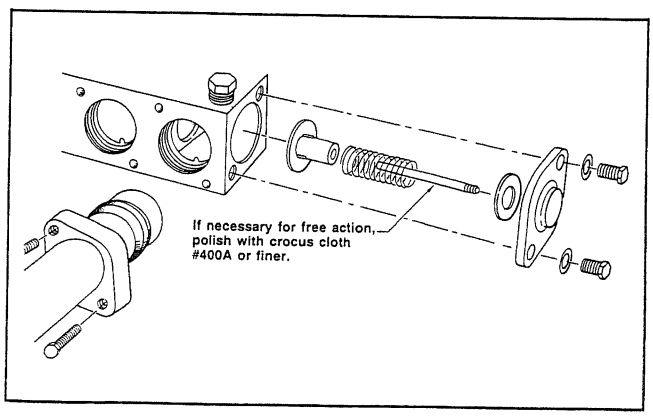


Fig. 49 Disassembly Procedure and Light Overhaul-Automatic Flow Control Valve

TROUBLE SHOOTING GUIDE

Use this chart for quick reference for maintenance and service problems.

HEATER WILL NOT COME ON

See Figures 30 through 36.

HEATER WILL NOT SHUT OFF - See Figures 37 through 39.

What To Look For	Why Did This Happen	What To Do
1. Pressure switch does not open.	Switch failed/syphon loop restricted	1. See Sec. 5C-4
2. Short in wire harness.		2. Check wiring.
3. Defective gas valve.	Possible debris in gas line.	3. Replace gas valve. See Sec. 5D.

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 Sec. 5I Adjust water flow. See Section 5J.
2. Lack of adequate air supply.		2. Provide adequate air supply to heater. See Sec. 3B-1.
3. Improper venting.		3. Provide proper venting of heater. See Sec. 3B-1.
4. Burner air inlet throat.	Possible restriction by small animal lint or dirt.	4. Clean burners.
5. Gas burning at orifice (flashback).	Improper air supply.	5. Check name plate for correct gas. See Sec. 3C-2.
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 Sec. 3E-1. Clean heat exchanger See Sec. 5I
7. Collapsed firebox.		7, Replace firebox. See Fig. 50 for access procedure
8. Gas regulator out of adjustment.	Pressure too high.	8. See Fig. 23 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. See Sec. 4F Clean heat exchanger. See Sec. 5I Repair valve. See Sec. 5J

HEATER WILL NOT BRING POOL UP TO DESIRED TEMPERATURE

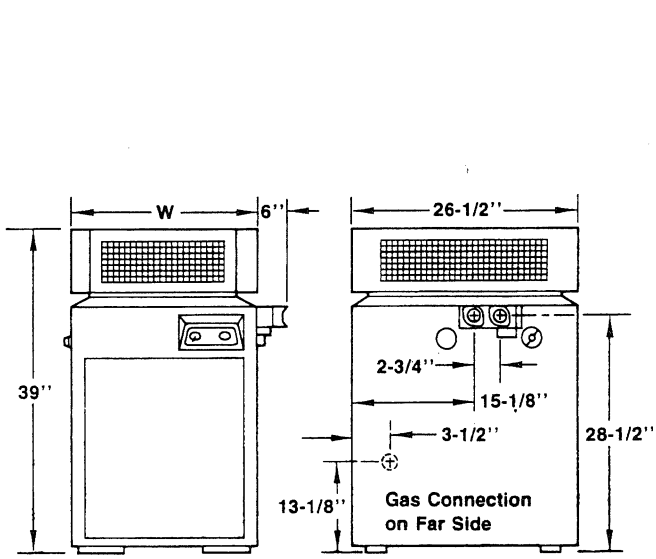
What to Look For	Why Did This Happen	What To Do
1. Filter not operating long enough to permit heater to heat pool	Time clock incorrectly set.	1. Re-set time clock. See Sec. 3E-1.
2. Filter clogged up rapidly, thus reducing flow and pressure and shutting off heater.	Filter is not being cleaned often enough.	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 Sec. 5E.
4. Pressure switch inoperative		4. Test pressure switch. Replace if necessary. See Sec. 5C-3.
5. Gas line too small		5 Check gas pipe size chart. See Sec. 3D.
6. Heater too small		6. Check pool sizing chart, Install larger heater if necessary See Table 1.

SCALE HAS FORMED IN ONE OR MORE TUBES IN THE HEATER

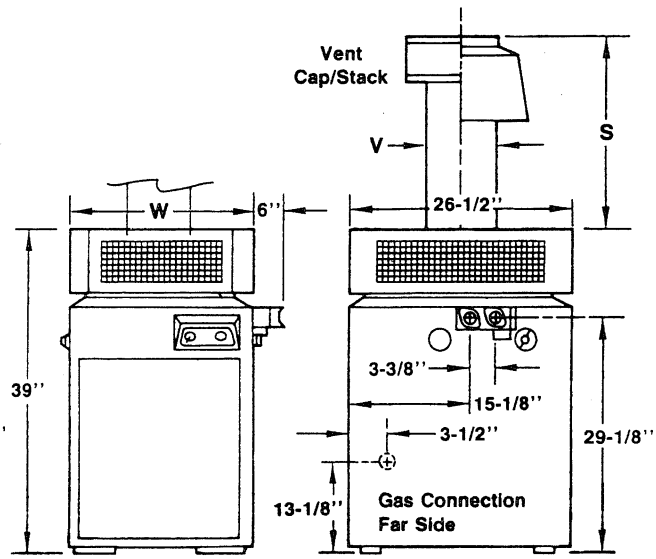
What To Look For	Why Did This Happen	What To Do
1. Unnecessary manual by-pass valve installed		1. Close by-pass valve and remove handle. See Sec. 3F.
2. Manual by-pass valve out of adjustment.		2. Adjust by-pass valve properly. See Sec. 3F.
3. Excessive hardness in pool water Total alkalinity of pool water should be kept in 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 heater tubes regularly.
4. Heater improperly installed.		4. See Section 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. Sec. 3D-1, 5J.
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 Sec. 5C-3.
7. Chlorinator is connected upstream of heater.		7. Install chlorinator downstream of heater. See Sec. 3D-1.

6-B. CAPACITIES AND DIMENSIONS

NOTE: SEE SECTION 3 FOR REQUIRED CLEARANCES



HEATER w/1-1/2" HEADER



HEATER w/2" HEADER

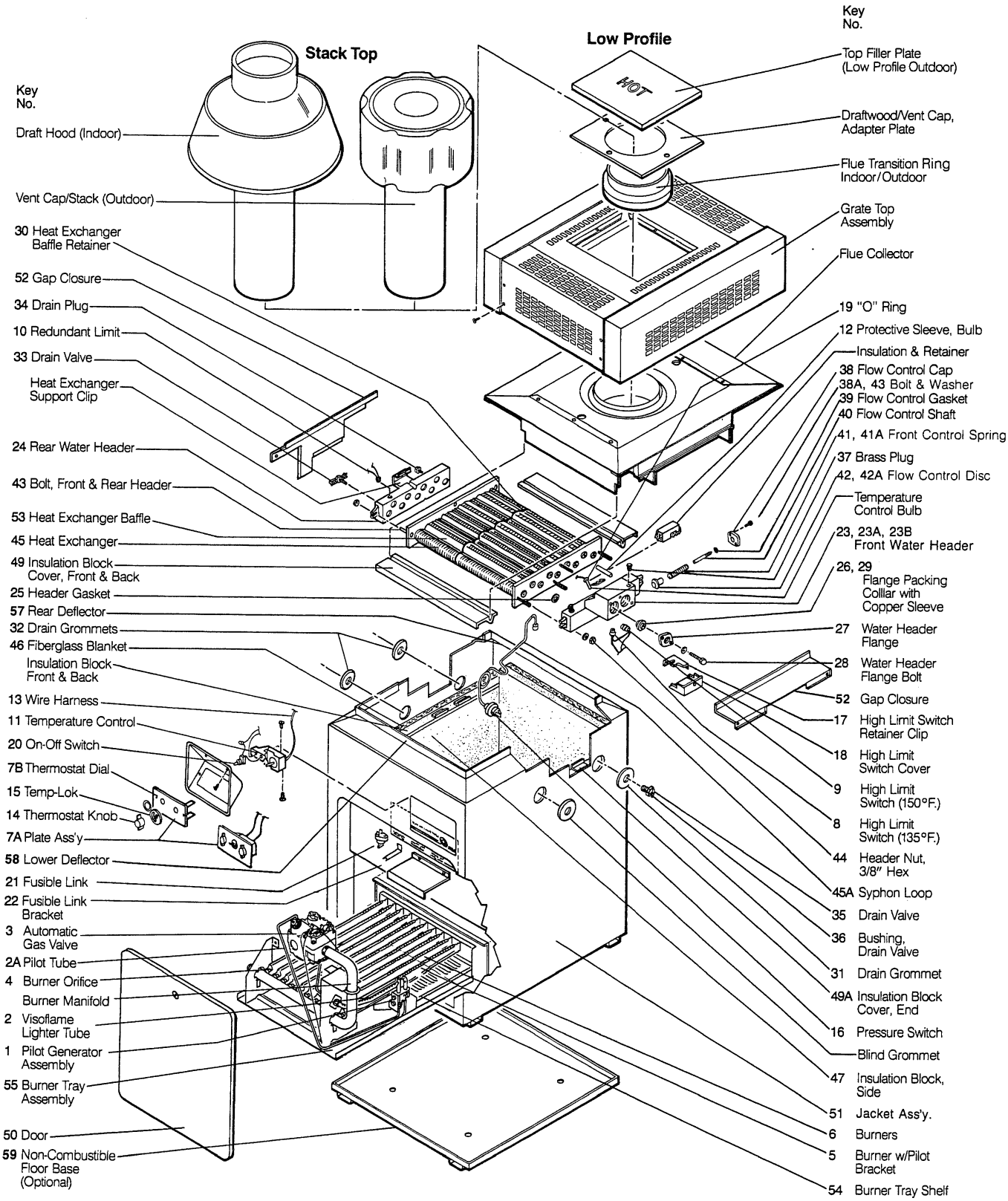
Model No.	Vent (V)	Width (W)	Stack (S) Outdoor	Stack (S) Indoor	BTU/Hr. Input[3,5]	Shipping Weight[6]
125	5	15	13	16-9/16	125,000	215
175	6	18	13-9/16	23-1/2	175,000	240
250	7	22-1/2	18-5/8	24-3/4	250,000	270
325	8	26-3/4	19-3/16	25-7/8	325,000	310
400	9	31-3/4	22-5/8	26-7/8	400,000	345

NOTES:

1. The Series One is design-certified by A.G.A. as a swimming pool heater for both natural gas and propane gas.
2. The Series One is constructed for 75 psi working pressure.
3. Derate But/hr. input and output 4% for every 1000 ft. installation altitude is above sea level. No derating necessary up to 2000 ft. elevation.
4. The Series One is design-certified by A.G.A. for indoor or outdoor use.
5. Ratings shown are for both natural and propane gas.
6. Shipping weight includes heater and separate package for draft hood.
7. The heater is equipped with either 1-1/2" or 2" universal header couplings. The 1-1/2" coupling accepts threaded 1-1/2" pipe, unthreaded 1-1/4" pipe and 1-1/2" copper pipe without an adapter. The 2" coupling accepts threaded 2" pipe, unthreaded 1-1/2" pipe and 1-1/2" or 2" copper pipe without an adapter.
8. Gas pipe size at valve is 3/4" NPT for natural gas and 1/2" NPT for propane gas. **Gas supply pipe must be larger (see Section 3C).**
9. Series One models are rated at 80% as affirmed by laboratory testing. Series One heaters have the highest average energy efficiency of any gas heaters on the market today. Testing is done in accordance with the Standard for Gas-Fired Pool Heaters, ANSI Z21.56.

6-C. Series One Pool and Spa Heater—Type EPG, EPM

Exploded Drawing of Components



6-D. Parts List for Series One, Type EPG, EPM

TO OBTAIN OR ORDER PARTS FOR THE SERIES ONE HEATER

Check with your nearest TELEDYNE LAARS dealer or distributor. They have many of the commonly needed parts in stock. If your dealer cannot supply you, contact Customer Service Manager, TELEDYNE LAARS, 6000 Condor Drive, Moorpark, CA 93021 Telephone (805) 529-2000.

Key No.	Description	For Model Sizes	Part No. EPM	Part No. EPG
	PILOT GAS SYSTEM			
	Visoflame Tubing	All	103696	103696
1	Pilot Assembly, R/S, Natural (W00368/388)	All	R-00279	R-00279
1	Pilot Assembly, R/S, LPG (W00366/368)	All	R-00280	R-00280
1	Pilot Generator, Cartridge	All	R-00255	R-00255
1A	Pilot Burner, R/S Natural (W00366)	All	R-00270	R-00270
1B	Pilot Burner, R/S LPG (W00367)	All	R-00271	R-00271
2	Lighter Tube Orifice, Natural	All	W-00188	W-00188
2	Lighter Tube Orifice, LPG	All	W-00189	W-00189
2	Visoflame Lighter Tube	All	W-00162	W-00162
2A	Pilot Tubing	All	W-00313	W-00313
	MAIN GAS SYSTEM			
3	Gas Valve, R/S 7000 BHMVF, ¾" 100% Shut-off-Natural (V00703)	All	R-00273	R-00273
3	Gas Valve, R/S 7000 BRMVF, ¾" 100% Shut-off-LPG (V00706)	All	R-00274	R-00274
4	Gas Orifice, Natural (see Note 1)		L-00322	L-00322
4	Gas Orifice, LPG (see Note 1)		L-00329	L-00329
5	Burner, Main w/Pilot Bracket	All	104572	104572
6	Burner, Main	All	L-00523	L-00523
	ELECTRICAL SYSTEM			
7A	Plate Assembly	All	105805	104563
7B	Thermostat Dial	All	H-01053	H-01053
8	High-Limit Switch, set at 135F *(Note 5)* (E-00722)	All	R-00227	R-00227
9	High-Limit Switch, set at 150F *(Note 5)* (E-00639)	All	R-00230	R-00230
10	High-Limit Switch, set at 275F (Redundant) (105235)	All	R-00128	R-00128
11	Temp. Control, Laars, 70F-110F (E-00971)	All		R-00582
11	Temp. Control Ass'y, Elec./MV (E01104)	All	105947	
11A	Temp. Sensor Assembly	All	E-01105	
12	Protector Sleeve, Bulb	All	104449	104449
13	Wire Harness	All	105806	R-00580
14	Knob, Pointer, Black	All	E-01106	E-00945
15	Stop Plate, "TEMP-LOK"	All	104567	104567
	Screw, Stop Plate	All	F-00333	F-00333
16	Pressure Switch, 2 psi (Standard) (104088-02)	All	R-00132	R-00132
16	Pressure Switch, 1 psi} Consult Factory (104088-01)		R-00113	R-00113
16	Pressure Switch, 3 psi} Ref. (104088-03		R-00130	R-00130
17	High-Limit Switch Retainer Clip	All	104184	104184
	High-Limit Switch Retainer	All	S-00989	S-00989
18	Cover, High-Limit Switches	All	104183	104183
19	"O" Ring (Temperature Control Bulb)	All	E-00363	E-00363
20	ON/OFF Switch (E-00770)	All	R-00941	R-00941
21	Fusible Link Assembly (E00994-03)	All	R-00122	R-00122
22	Fusible Link, Bracket	All	104799	104799

VENT SYSTEM

TOP & FLUE COLLECTOR ASSEMBLY	Models 125	175	250	325	400
Low Profile — Outdoor Top Assembly (Complete)	R-00810	R-00811	R-00812	R-00813	R-00814
Grating, Front & Rear (2 Required)	105632-01	105632-02	105632-03	105632-04	105632-05
Grating, Sides (2 Required)	105181	105181	105181	105181,	105181
Top Panel	105178-01	105170-02	105178-03	105178-04	105178-05
Top Filler	105352-01	105352-02	105352-03	105352-04	105352-05
Flue Collector Assembly	105648-01	105648-02	105648-03	105648-04	105648-05
Outdoor/Indoor Adapters					
Flue Transition Ring	105155-01	105155-02	105155-03	105155-04	105155-05
Draft Hood/Vent Cap Adapter Plate	105353-01	105353-02	105353-03	105353-04	105353-05
Outdoor Vent Cap Stack	105815-01	105815-02	105815-03	105815-04	105815-05
Indoor Draft Hood	105814-01	105814-02	105814-03	105814-04	105814-05

WATER SYSTEM

	Pressure Relief Valve, ¾ NPT, 75 psi *(Note 2)* (A-00633)	All	R-00404	R-00404
23	In/Out Header (Casting S-00686)	All	R-00584	R-00584
23A	In/Out Header, Bronze (S-00780)	All	R-00547	R-00547
23B	In/Out Header (Casting S-00794) 2" OPG's	All	R-00564	R-00564
24	Return Header (Casting S-00688)	All	R-00583	R-00583
24A	Return Header, Bronze (S-00759)	All	R-00546	R-00546
25	Header Gasket (S-00708)	All	R-00508	R-00508
26	Packing Collar for Flange *(Note 3)*	All	S-00531	S-00531
26A	Gasket, Flange, 2"	All	S-00780	S-00780
27	Flange *(Note 8)*	All	S-00533	S-00533
27A	Flange, 2" (105735)	All	S-00779	S-00779
28	Flange Bolts, 2" Long	All	F-00317	F-00317
29	Sleeve for Flange *(Note 3)*	All	S-00280	S-00280
29A	Sleeve (2") Adapter	All	S-00782	S-00782
30	Clip for Tube Baffles	All	S-00761	S-00761
31	Grommet for Drain Plug (7/8" Hole)	All	S-00988	S-00988
32	Grommet for Drain Plug (9/16" Hole)	All	S-00899	S-00899
33	Drain Cock, Return Header	All	P-00587	P-00587
34	Drain Plug, Return Header	All	P-00268	P-00268
35	Drain Cock, In/Out Header	All	P-00587	P-00587
36	Bushing for P-00587	All	P-00185	P-00185
37	Brass Pipe Plug ¾", In/Out Header Restrictor	All 125	P-00270 S-00003	P-00270 S-00003
38	Flow Control Cap (Casting S-00691)	All	104522-01	104522-01
38A	Bolt 3/8-18 x 1" HxHd	All	F-00339	F-00339
39	Flow Control Gasket	All	S-00741	S-00741
40	Flow Control Shaft	All	F-00336	F-00336
41	Flow Control Valve Spring, White (See 41A)	125,175	S-00614	S-99614
41	Flow Control Valve Spring, Red	250	S-00613	S-00613
41	Flow Control Valve Spring, Blue	325	S-00612	S-00612
41	Flow Control Valve Spring, Black	400	S-00701	S-00701
41A	Flow Control Valve Spring, F/2" Header Only	125	S-00799	S-00799
42	Flow Control Disc	All	S-00692	S-00692
42A	Flow Control Disc, F/2" Header Only	All	S-00795	S-00795
43	Bolt, Rd Hd Sq Neck, 2¼" for Headers *(Note 6)*	All	F-00296	F-00296
43	Bolt, Rd Hd Sq Neck, 2½", Front Header, Lower *(Note 6)*	All	F-00283	F-00283
43	Bolt, Csk, Sq Neck, 2¼" for Headers *(Note 6)*	All	F-00318	F-00318
43	Washer for Header *(Note 6)*	All	F-00111	F-00111
44	Nut, for Header *(Note 6)*	All	F-00031	F-00031
45	Heat Exchanger Tube Assembly *(Note 6)*	125	104518-01	104518-01
45	Heat Exchanger Tube Assembly *(Note 6)*	175	104518-02	104518-02
45	Heat Exchanger Tube Assembly *(Note 6)*	250	104518-03	104518-03
45	Heat Exchanger Tube Assembly *(Note 6)*	325	104518-04	104518-04
45	Heat Exchanger Tube Assembly *(Note 6)*	400	104518-05	104518-05
45A	Syphon Loop	All	105452	105452
	FIREBOX COMPONENTS			
46	Insulation, Fiberglass Blanket for Sides	All	T-0020	T-0020
47	Insulation, Block, Sides, 22 1/8" x 16½"	All	T-00214	T-00214
48	Insulation, Block, Front, 9¼" x 18 9/16"	125	T00215-01	T00215-01
48	Insulation, Block, Front, 12 1/8" x 18 9/16"	175	T00215-02	T00215-02
48	Insulation, Block, Front, 16 5/8" x 18 9/16"	250	T00215-03	T00215-03
48	Insulation, Block, Front, 20 7/8" x 18 9/16"	325	T00215-04	T00215-04
48	Insulation, Block, Front, 25 1/8" x 18 9/16"	400	T00215-05	T00215-05
48	Insulation, Block, Rear, 9 1/8" x 22 13/16"	125	T00216-01	T00216-01
48	Insulation, Block, Rear, 12 1/8" x 22 13/16"	175	T00216-02	T00216-02
48	Insulation, Block, Rear, 16 5/8" x 22 13/16"	250	T00216-03	T00216-03
48	Insulation, Block, Rear, 20 7/8" x 22 13/16"	325	T00216-04	T00216-04
48	Insulation, Block, Rear, 25 7/8" x 22 13/16"	400	T00216-05	T00216-05
	JACKET COMPONENTS			
49	Insulation, Block Front/Rear Cover	All	103149	103149
49A	Tile Cover Side	All	101673	101673
50	Door, W/Latch — State Model	All	104489-01 thru -05	104489-01 thru -05
51	Jacket Assembly (Less Top Assembly) — State Model	All	104479-01 thru -05	104479-01 thru -05
52	Gap Closure In/Out side	All	104482	104482
52	Gap Closure, Return Side	All	104483	104483
53	Heat Exchanger Baffle, 9 1/16"	125	104764-01	104764-01
53	Heat Exchanger Baffle, 12 1/16"	175	104764-02	104764-02
53	Heat Exchanger Baffle, 16 9/16"	250	104764-03	104764-03
53	Heat Exchanger Baffle, 10 7/16", Inner	325	104764-04	104764-04
53	Heat Exchanger Baffle, 12 15/16", Inner	400	104764-05	104764-05
53	Heat Exchanger Baffle, Outer, 10 7/16"	325	104504-06	104504-06
53	Heat Exchanger Baffle, Outer, 13 15/16"	400	104504-07	104504-07
54	Burner Tray Shell Only — State Model	All	104502-01 thru -05	104502-01 thru -05
55	Burner Tray Ass'y- Nat. Gas *(Note 1)* — State Model	All	105780-01 thru -05	105780-01 thru -05
56	Burner Tray Ass'y- L.P. Gas *(Note 1)* — State Model	All	105781-01 thru -05	105781-01 thru -05
	Touch Up Paint Can — State Model	All	X-00160	X-00160
	Heat Exchanger Support Clip — State Model	All	104570	104570
56	Rear Deflector	All	105837-01 thru -05	105837-01 thru -05
57	Lower Deflector	All	105838-01 thru -05	105838-01 thru -05
	OPTIONAL COMPONENTS			
58	Non-Combustible Floor Base } *State Model*	All	105217-01 thru -05	105217-01 thru -05

Notes:
1. For altitudes higher than 2000 feet above sea level consult factory for orifice size
2. See paragraph 3H, Document 3071.
3. Key Nos. 28 & 29 available as Assembly No. R-00211.
4. Key Nos. 40 & 42 available as Assembly R-00131.
5. Key Nos. 8 & 9 available as Assembly R-00232.
6. Order Assembly R-00570 for complete set of bolts.

This page intentionally left blank.

This page intentionally left blank.

Teledyne Laars Series One Limited Warranty

Your Teledyne Laars Series One pool 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 also are 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, together with Serial Number and purchase date, transportation prepaid, directly to address below. Attention: Service Manager.

This warranty gives you specific legal rights, and 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.

TELEDYNE LAARS

6000 Condor Drive, Moorpark, CA 93021 • (805) 529-2000
Teledyne Laars Canada • 480 S. Service Road West, Oakville, Ontario, Canada L6K 2H4 • (416) 844-8233

TELEDYNE LAARS

☐ 6000 Condor Drive, Moorpark, CA 93021 • (805) 529-2000 FAX (805) 529-5934
☐ 480 S. Service Road West, Oakville, Ontario, Canada L6K 2H4 • (416) 844-8233 FAX (416) 844-2635
☐ 20 Industrial Way, Rochester, N.H. 03867 • (603) 335-6300 FAX (603) 335-3355