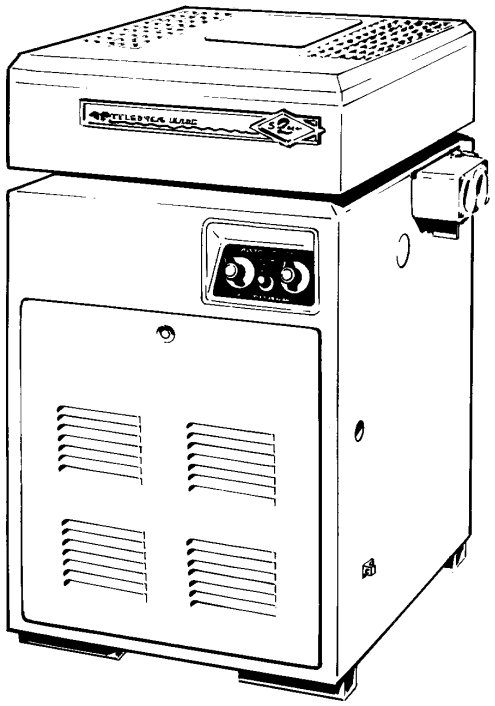
FOR YOUR SAFETY - This product must be installed and serviced by a professional service technician, qualified in heating boiler installation. Improper installation and/or operation could create carbon monoxide gas in flue gases which could cause serious injury, property damage, or death. Improper installation and/or operation will void the warranty.

Installation and Operation Manual

Series 2
Model ESC
Pool and Spa Heater

Natural Gas
LP Gas (Outdoor Only)



⚠WARNING

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

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

WHAT TO DO IF YOU SMELL GAS

- **Do not try to light any appliance.**
- **Do not touch any electrical switch; do not use any phone in your building.**
- **Immediately call your gas supplier from a nearby 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 authorized personnel.

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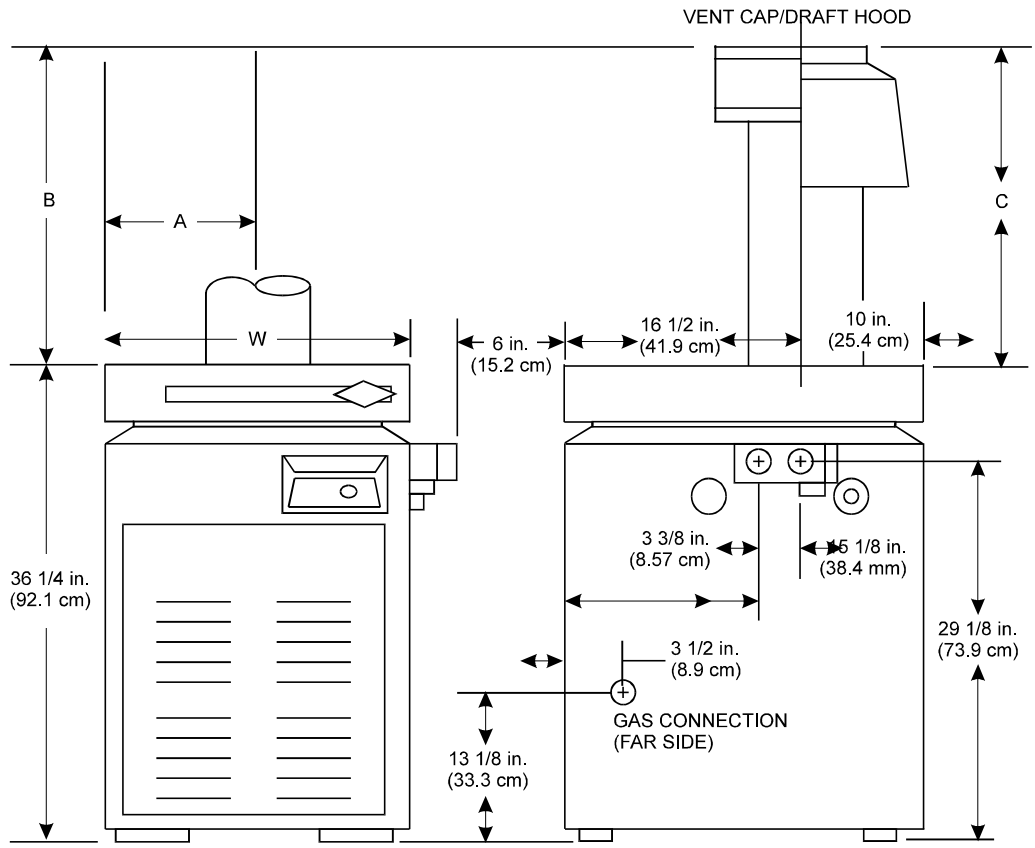
TELEDYNE LAARS

TABLE OF CONTENTS

SECTION 1.
General Information

1A. Introduction

This manual provides installation and operation instructions for the Series 2 Model ESC pool and spa heater. Review all application and installation procedures completely before proceeding with the installation. Consult the Teledyne Laars factory, or local factory representative, with any questions regarding this equipment. Experience has shown that most operating problems are caused by improper installation.



Model Size	Heater Width		Venting Dimensions								Firing Rate / Hr. (1,000's)		Shipping Weight	
			Vent Dia.		Dim "A"		U.S. Outdoor Dim "B"		U.S. Indoor or CAN Outdoor Shelter Dim "C"					
	in	cm	in	cm	in	cm	in	cm	in	cm	BTU	kcal	lbs	kg
125	15	38.1	5	12.7	7 1/2	19.1	8 3/4	22.2	16 1/4	41.3	125	31.5	180	82
175	18	45.7	6	15.2	9	22.9	9 3/8	23.8	2418	61.3	175	44.1	220	100
250	22 1/2	57.2	7	17.8	11 1/4	28.6	9 5/8	24.4	25 1/4	64.1	250	63	235	107
325	26 3/4	67.9	8	20.3	13 3/8	34	10 1/8	25/7	26 1/2	67.3	325	81.9	280	127
400	31 3/4	80.6	9	22.9	15 7/8	40.3	12 7/8	32.7	27 1/2	69.9	399	100.6	310	141

Notes:

1. In Canada, derate BTU/Hr input and output 10 percent for altitudes of 2,000 to 4,500 feet (609 to 1372 m) above sea level. No derating necessary up to altitude of 2,000 feet (609 m). In United States derate input 4 percent for each 1,000 feet (305 m) above sea level, starting at 2000 feet (609m).
2. The ESG is constructed for 75 psi working pressure.
3. Ratings shown are for both natural and propane gas.

Figure 1. General Configuration

The Series 2 Model ESC heater is design certified by International Approval Services (formerly American Gas Association and Canadian Gas Association) as complying with the latest edition of the Standard for Gas-Fired Pool Heaters, ANSI Z21.56, and in Canada with CAN1-4.7-M85.

Certain sections of this manual are specific to either United States or Canadian installations, and are labeled as such.

1B. Description

The ESC heater gets electrical power from an external 120 or 240 volt (V) source. The ESC provides a dual thermostat Flex-Temp control system for pool/spa combinations or pre-heat convenience. Series 2 ESC heaters meet the California, New York, Hawaii, and Oregon state energy requirements for intermittent ignition gas appliances.

The ESC heater is specifically designed for heating swimming pools and spas. Do not use it as a general service water heater or for heating salt water pools. Consult your dealer for the appropriate Teledyne Laars products for these applications.

1C. Warranty

The ESC heater is sold with a limited factory warranty. Details are specified on the back cover of this manual. A copy of the warranty and a warranty registration card are included in the plastic bag shipped with the heater. Fill out and return the warranty registration card.

Make all warranty claims to an authorized Teledyne Laars representative or directly to the factory. Claims must include the heater serial number and model (this information can be found on the rating plate), installation date, and name of the installer. Shipping costs are not included in the warranty coverage.

Damage caused by improper installation or assembly, or to the heat exchanger by corrosive water, is NOT covered by the Warranty. See Section 3E for maintaining proper pool water chemistry.

1D. Technical Assistance

Consult Teledyne Laars or your local distributor with any questions or problems involving the specifications, installation, and operation of your Teledyne Laars equipment. An experienced technical support staff is ready to assist in assuring the proper performance and application of Teledyne Laars products.

SECTION 2. Installation Instructions

2A. General Information

Install the ESC heaters in accordance with the procedures in this manual (or the Teledyne Laars warranty may be voided), local codes and ordinances. In the absence of such codes, install the heaters in accordance with the latest edition of the National Fuel Gas Code, ANSI Z223.1. In Canada, the installation must be in accordance with CAN1-B149.1 or .2 and local codes. The authority having jurisdiction may require the installation conform to the Standard for Gas-Fired Heaters, ANSI Z21.56. Any changes to the heater, gas controls, gas orifices, wiring or draft diverter may void the warranty. If field conditions require change to any of the above, consult the factory.

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

1. Field assembly (if required)
2. Appropriate site location (clearances) and flooring
3. Sufficient combustion and ventilation air
4. Properly sized gas meter and piping
5. Proper electrical wiring
6. Adequate water flow

This manual provides the information needed to meet these requirements. Review all application and installation procedures completely before continuing the installation.

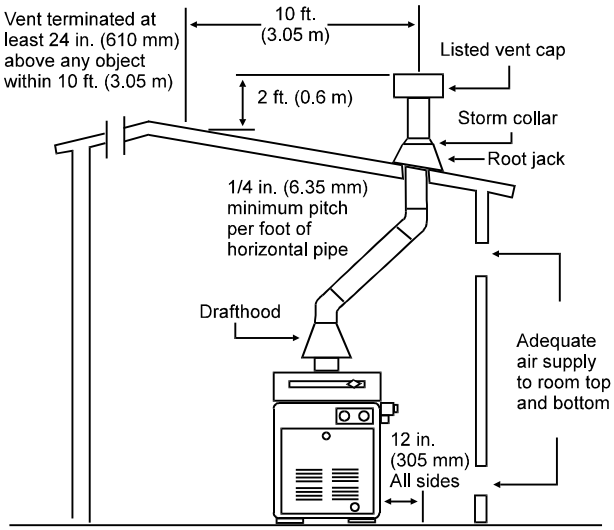
2B. Field Assembly

The ESC heater is shipped from the factory with the top assembly in the low-profile configuration. The ESC heater is design certified for indoor installation when equipped with a drafthood, which must be installed without modification.

The ESC heater is also certified for installation in an outdoor shelter (Canada only) when equipped with a drafthood. An outdoor shelter is an enclosure not normally occupied which does not communicate directly with occupied areas.

Check the rating plate on the heater for the correct Teledyne Laars part number. See instructions supplied with the drafthood for installation and attachment. When the draft hood is used, locate the heater so as to be in the same atmospheric pressure zone as the combustion air inlet to the heater.

If a drafthood is used, it must be connected to a vent pipe which stops at least 2 feet (0.61 meters [m]) above the highest point of the roof or other object that is within 10 feet (3.05 m) from the vent termination. The vent pipe must have a vent cap which allows a full equivalent opening for flue products (see Figure 2 and Table 1).



Notes:
1. An Underwriters' Laboratories listed vent cap is required to prevent downdraft and allow the heater to function properly and safely.
2. Use approved roof jack.

Figure 2. Indoor Installation Venting

Table 1. Air Openings to Outside

Required Net Free Open Area for Combustion Air Openings				
Model	Direct from Outside		Duct from Outside	
	in	cm	in	cm
125	32	206	64	413
175	44	284	88	568
250	63	406	126	813
325	82	529	164	1058
400	100	645	200	1290
Note: If using screens or louvers, compensate by adding 50% additional area to each opening				

2C. Site Location

2C-1. Installation Information

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

Avoid placing the heater in locations where it can be damaged by water or condensate leakage. If this is not possible, provide a suitable drain pain to catch and divert any leakage. The pan must not block natural flow of air around the heater.

Locate the heater to provide adequate clearance on all sides for inspection, service and to provide adequate air circulation for proper operation.

Locate the heater so the clearances from combustible surfaces shown in Table 2 are met.

2C-2. Outdoor Installation

ESC heaters can be installed in the low-profile, grate top configuration as received from the factory, or with an optional vent cap/stack.

Locate the heater in an **open, unroofed area**. Do not locate the heater below or adjacent to any doors, glass openings, louvers, grills, etc., which connect in any way with an inhabited area of a building, even though the access might be through another structure (e.g., a garage or utility room. In the United States there must be a minimum of 4 feet (1.22 m) horizontally and vertically between the heater and any door, glass opening, or gravity inlet to a building (see Figure 3).

⚠WARNING
United States
Do not install the heater with the top of the vent assembly within 4 feet (1.22 m) of any opening into a building.
Canada
Do not install the heater with the top of the vent assembly within 10 feet (3.05 m) of any opening into a building.

If the heater is installed under an overhang, there must be a minimum clearance of 3 feet (0.91 m) above the top of the heater. The area under the overhang must be open on three sides. This prevents combustion gases from being diverted into living areas through doors, windows, or gravity inlets.

If the heater is installed close to a structure, protect it from rain water runoff with rain gutters on the roof or other measures. Do not locate the heater near sprinkler systems that could spray water on it.

Table 2. Minimum Heater Clearances From Combustible Surfaces

	Indoor (Outdoor Shelter) Installation				Outdoors Installation			
	U.S.		Canada		U.S.		Canada	
Side of Heater	inch	cm	iInch	cm	inch	cm	inch	cm
Blank	6	15.2	6	15.2	6	32	6	15.2
Rear	6	15.2	6	15.2	6	32	6	15.2
Piping	12	30.5	18	45.7	12	30.5	18	45.7
Top	44	111.7	44	111.7	---	---	---	---
Front	18	45.7	36	91.4	18	45.7	36	91.4

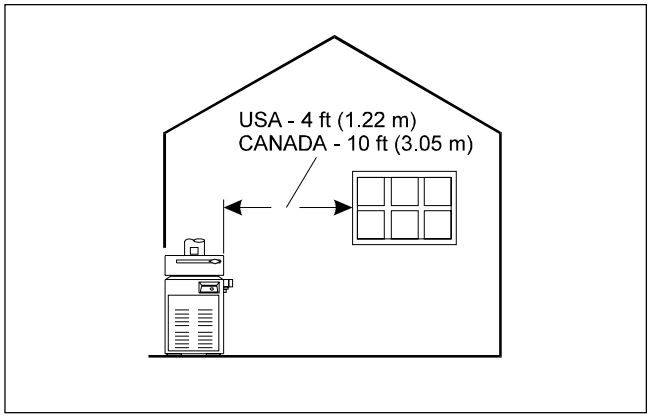


Figure 3. Outdoor Heater Installation

Avoid locations where wind deflection off nearby structures might cause wind loading and downdraft conditions. Where downdraft conditions exist, locate the heater at least 3 feet (0.91 m) from vertical surfaces (e.g., nearby buildings and walls). The addition of a vent cap may be necessary.

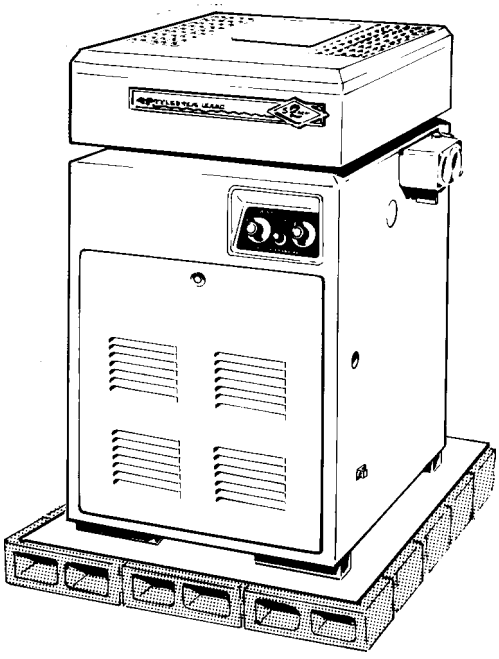
2C-3. Flooring - Typical Installation

In the United States, the National Fuel Gas Code allows a heater to be placed on a combustible surface when there is a platform under the heater made of hollow masonry no less than 4 inches (102 millimeters [mm]) thick, covered with sheet metal at least 24 gauge thick and extending beyond the full width and depth of the heater by at least 3 inches (76.2 mm) in all directions. The masonry must be laid with ends unsealed, and joints matched to provide free circulation of air from side to side through the masonry (see Figure 4). **Do not** install the heater directly on a combustible wood or carpet floor without placing a non-combustible platform between the carpeting and the heater. If the heater is installed in a carpeted alcove, the entire floor of the alcove must be covered by a non-combustible panel. The panel must be strong enough to carry the total weight of the heater and all piping, pumps, and any other equipment attached to the heater.

2D. Combustion and Ventilation Air Supply

All indoor installations must have openings to outside air for combustion, ventilation, and dilution of flue gases from inside the building (see Figure 2 and Table 1). Teledyne Laars does not recommend indoor installations that do not provide combustion air from outside the building.

All outdoor shelter installations (Canada only) must have uninterrupted openings to outside air for combustion and ventilation. The installation must be in accordance with the latest edition of CAN/CGA B149. Teledyne Laars does not recommend outdoor shelter installations that depend on infiltration air for combustion.



Notes:
1. Blocks must provide solid base and be braced so they cannot slip out of place.
2. Air openings in blocks must be arranged to provide unrestricted opening through entire width or length of base.

Figure 4. Non-Combustible Platform

If the heater is installed in a residential garage, or where flammable vapors will be present, the burners must be 18 inches (457 mm) above the garage floor. Refer to the latest edition of the National Fuel Gas Code for more information. In Canada, refer to the latest edition of the Gas Installation Code, CAN/CGA B149.

⚠ Caution
The heater shall not be operated outdoors at temperatures below 20 degrees Fahrenheit (°F) (-7 degrees Celsius [°C]).

2E. Gas Supply and Piping

2E-1. General Instructions

Review the following general instructions before continuing the installation.

⚠ WARNING
Do not convert this heater from natural gas to propane gas, or propane to natural. Field conversion could create carbon monoxide gas which can cause property damage, serious injury, or death.

1. Gas piping installation must be in accordance with the latest edition of ANSI Z223.1. In Canada, the installation must be in accordance with CAN-B149.1 or .2 and all local codes that apply.

2. Check the rating plate to make sure the heater is fitted for the type of gas being used. Teledyne Laars heaters shipped from the factory are certified to operate at an altitude of 0 to 2000 feet (0 to 609 m), or if so ordered, at higher altitudes. In the United States, the heater manifold is marked with a tag or sticker indicating one of the following high altitude operation codes:

   a. High altitude (H) - 2,000 to 6,000 feet (609 to 1829 m)

   b. High altitude (J) is 6,000 to 10,000 feet (609 to 3048 m)

3. In Canada, the heater rating plate is marked for specific altitude requirements: high altitude (H) is 2,000 to 4,500 feet (609 to 1372 m) above sea level.

4. Use the figures in Table 3 to size the gas inlet piping from the gas meter to the heater. Check all local codes for compliance before installing the heater.

5. Install a sediment trap (drip leg) ahead of the gas controls (see Figure 5). Fit the trap with a threaded cap which can be removed for cleaning.

6. Install a manual gas shutoff valve for service and safety. Do not use a restrictive gas cock. Check the local codes. DO NOT USE GASFLEX PIPING.

7. Disconnect the heater and its individual shutoff valve from the gas supply system during pressure testing of the system at pressures higher than 1/2 pounds per square inch (psi) (3.45 kilopascals [kPa]). If the test pressure is equal to or less than 1/2 psi (3.45 kPa), close the manual shutoff valve on the heater during the piping pressure test.

NOTE: Permanent damage to the gas valve, inside the heater, will occur if these procedures are not followed.

8. If the gas supply pressure is less than required, check for under-sized pipe between the meter and the heater, a restrictive fitting, or an undersized gas meter. Gas supply pressures to the heater are listed in Table 4.

NOTE: The maximum inlet gas pressure must not exceed the specified value. The minimum value listed is for the purpose of input adjustment.

Table 3. Natural Gas Pipe Size Requirements

Distance from Gas Meter						
Model Size	0-50 feet (0-15 m) Nat.		50-100 feet (15-30 m) Nat.		100-200 feet (30-60 m) Nat.	
	in.	mm	in.	mm	in.	mm
125	1/2	19	1	25	1	25
175	1	25	1	25	1-1/4	32
250	1	25	1-1/4	32	1-1/4	32
325	1-1/4	32	1-1/4	32	1-1/2	38
400	1-1/4	32	1-1/2	38	1-1/2	38

Notes:
1. These numbers are for natural gas (0.65 Sp. Gr.) and are based on 1/2 inch (13 mm) water column pressure drop. Check supply pressure with a manometer, and local code requirements for variations. For liquefied petroleum gas, reduce pipe diameter one size, but maintain a 1/2 inch (13 mm) minimum diameter. Model 125 requires 3/4 inch (19 mm) from 0 to 50 feet (0 to 15 m).
2. Check supply pressure and local code requirements before preceding with work.
3. Pipe fittings must be considered when determining gas pipe sizing.

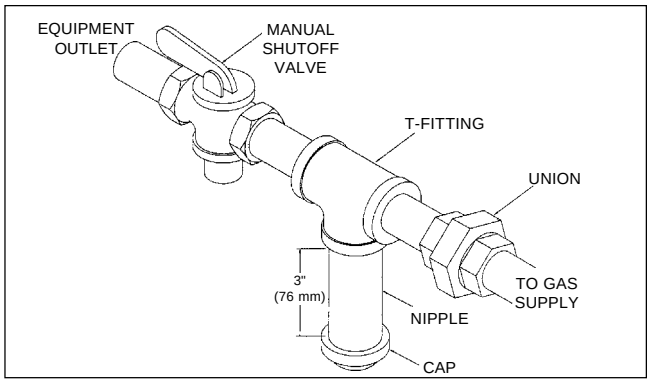


Figure 5. T-Fitting and Sediment Trap

9. Before operating the heater, test the complete gas supply system and all connections for leaks using a soap solution. Do not use an open flame.

> **⚠Caution**
> Since some leak test solutions (including soap and water) may cause corrosion or stress cracking, rinse the piping with water after testing.

Table 4. Gas Supply Pressure Requirements

Supply Pressure Water Column	Natural Gas		Propane Gas	
	in.	mm	in.	mm
Minimum Size125	5	127	10	254
Sizes 325 - 400	6	152	10	254
Maximum	14	356	14	356

2E-2. Special Precautions for Propane Gas

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

2F. Electrical Wiring

2F-1. General Information

Wiring connections must be made exactly as shown in the wiring diagram found on the inside of the heater (see Figure 6 for typical example) and must include a definite means of grounding. There is a bonding lug on the right side of the heater, where a bond wire must be attached.

Electrical wiring must be in accordance with the latest edition of the National Electric Code (NEC), ANSI/National Fire Protection Association (NFPA) 70, unless local code requirements indicate otherwise.

To wire the ESC heater:

1. Wire the heater to either a 120V/60 Hertz (Hz) or 240V/60 Hz electrical source.

2. Connect the wires from the source to the leads on the right side of the heater in the space behind the ignition control (see Figure 7).

3. Remove the screw located to the lower right of the transformer and open the hinged cover.

NOTE: No external junction box is required.

2F-2. Auxiliary Time Clock Wiring

If you install a time clock to control the filter pump operation, it is recommended that the time clock have its own low voltage (Fireman's) switch to turn off the heater before turning off the pump. The switch should shut off the heater about 15 minutes before the filter pump shuts off. This will allow for a more efficient operation by removing any residual heat contained in the heat exchanger back to the pool.

To install a time clock auxiliary switch into the heater wires (see Figure 8):

1. Remove heater door.

2. Remove the factory installed wire between terminals 1 and 2 on the terminal strip (see Figure 6).

3. Connect the wires from the time clock auxiliary switch to the two terminals. Use American Wire Gage (AWG) No. 14 gauge stranded copper wire with a temperature rating of 221°F (105°C) or greater.

The length of the wire between the heater and the time clock should not exceed 15 feet (4.57 m). The contact points of the time clock switch should be silver, or a low resistance alloy.

2F-3. Remote Operation

The ESC pool/spa heater controls can be wired for remote operation. The CS-02 remote control permits switching from one temperature controller to the other and turning the heater on and off from a remote location. The CS-04 includes the same features as the CS-02 plus a remote temperature controller. Contact your dealer or Teledyne Laars representative for further information. Reference part numbers CS-02 and CS-04.

An interrupt (on/off) type remote can be connected by removing the jumper wire on the terminal block located in the control compartment (see Figure

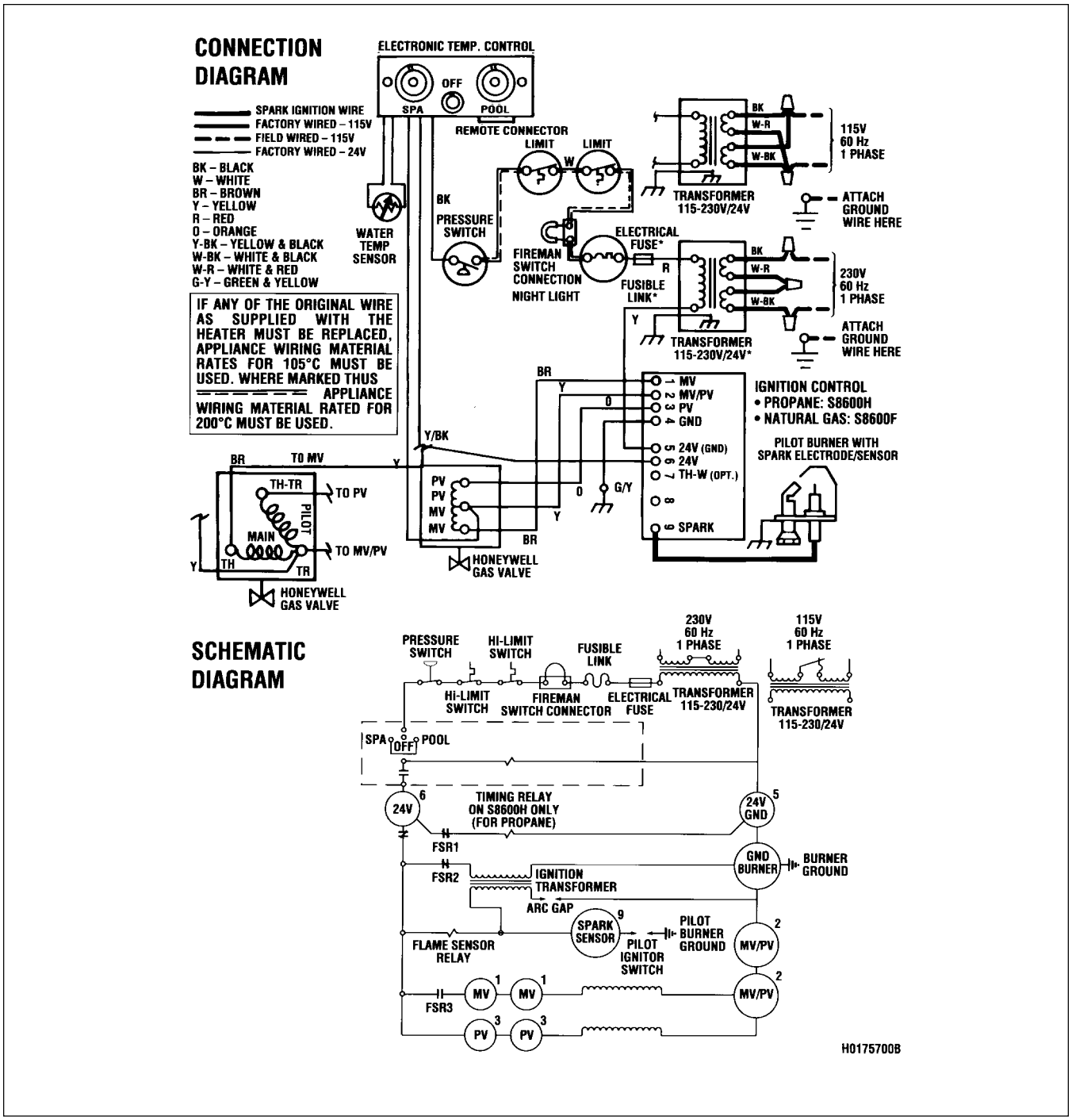


Figure 6. ESC Wiring Diagram

6) and connecting the two wires from the remote to the two terminals on the terminal block. This type of remote control will turn the heater on or off, but will not switch between the two temperature controllers on the Flex-Temp control panel.

To connect a 3-wire remote (not supplied by Teledyne Laars), order a wire harness assembly (part No. E0120000) which connects to the flex-temp control panel. Installation instructions are included with the wire harness assembly.

2G. Water Flow System

2G-1. Flange Installation

The high temperature plastic piping (CPVC Schedule 80) can be connected directly to the inlet/outlet header if local codes allow it, and the controls keep the filter pump running at least 15 minutes after the heater is turned off.

To install “No Sweat” flanges (see Figure 9):

1. Remove the metal flanges from the heater.

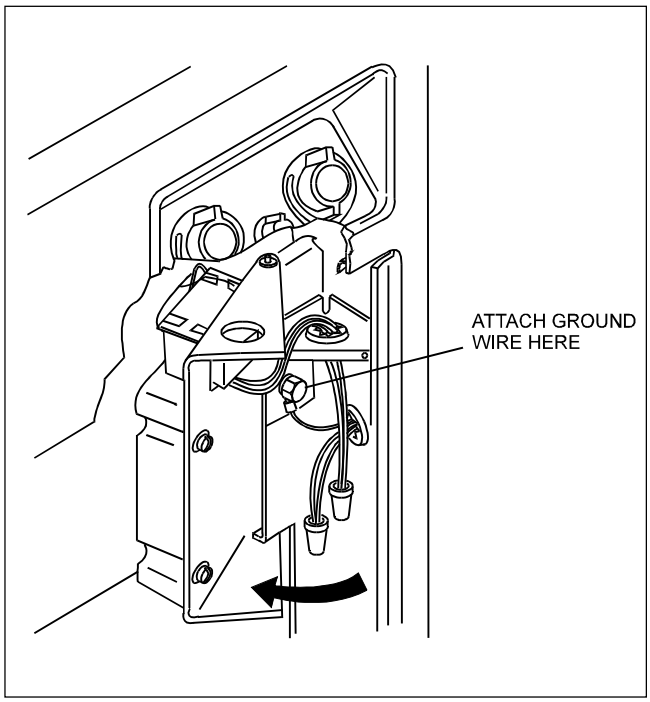


Figure 7. Field Wiring Connections

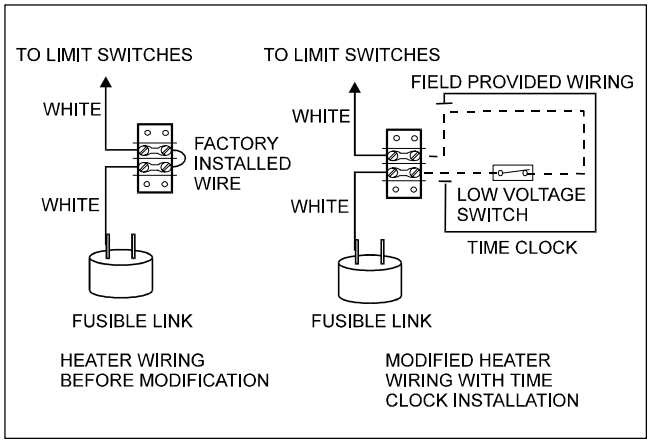


Figure 8. Time Clock Wiring

2. Remove the black rubber doughnut, plastic insert and screws and washers from the flanges. Save for later use.

NOTE: Do not use the smaller inside diameter rubber doughnuts in the plastic bag.

3. Remove “No Sweat” flanges from plastic bag. It is possible that there will be threaded or non-threaded flanges.

4. Position the black rubber doughnut, with the plastic insert in it, in the header side of the flange.

5. Fasten the flanges to the inlet/outlet header with the screws and washers removed in step 2. Do not over-tighten the screws.
6. Coat the 2 inch (51 mm) CPVC plastic pipe PVC cement.

NOTE: It may be necessary to rough up the inside of the non-threaded plastic flange before inserting the pipe.

7. Screw or slide the CVPC pipe into the flanges.

2G-2. Reversible Water Connections

Teledyne Laars ships the ESC heater with the water connections on the right side. The ESC heater can be installed with the water connections on either side. It could be necessary, or helpful, to switch the connections to the left side to improve access for installation service. Perform this modification before installing the heater using the following procedures:

1. Remove heater door.

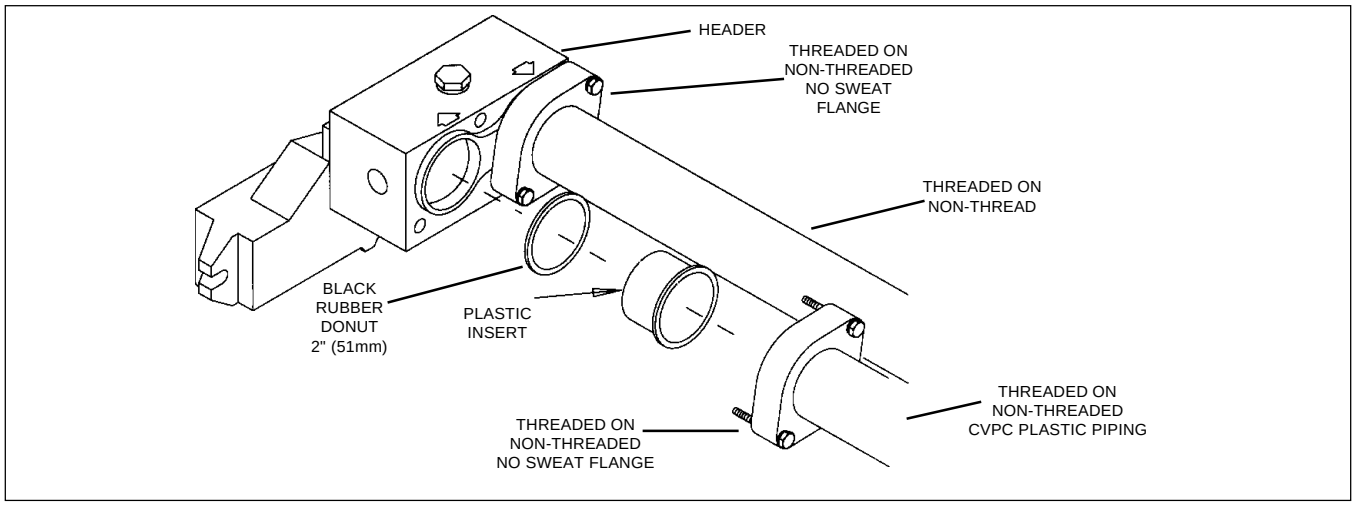


Figure 9. Piping Installation

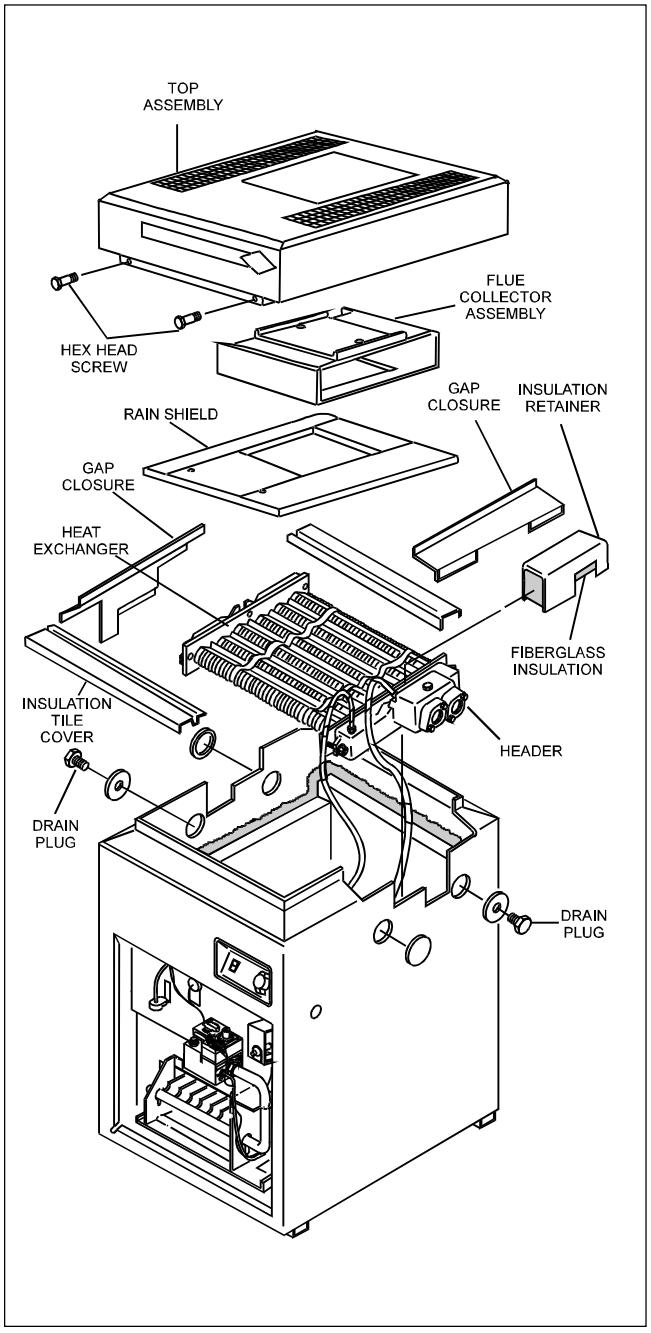


Figure 10. Heat Exchanger Reversal

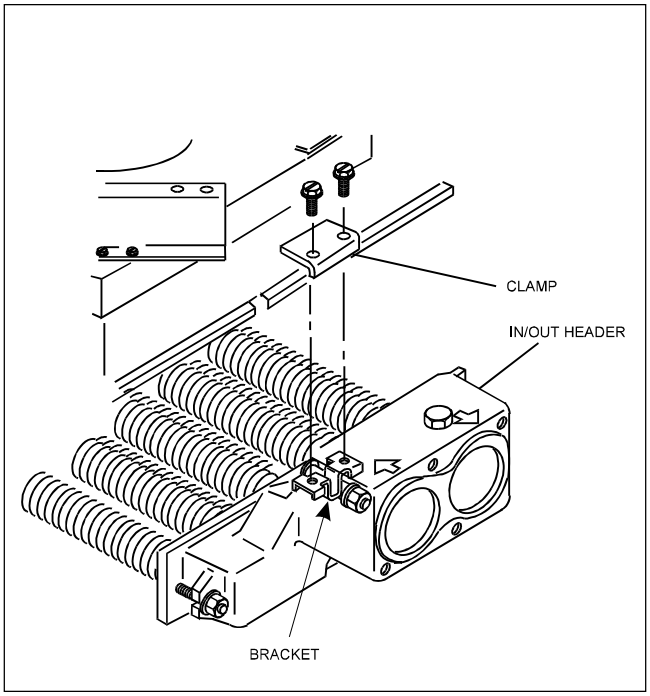


Figure 11. Flue Collector Holddown Brackets

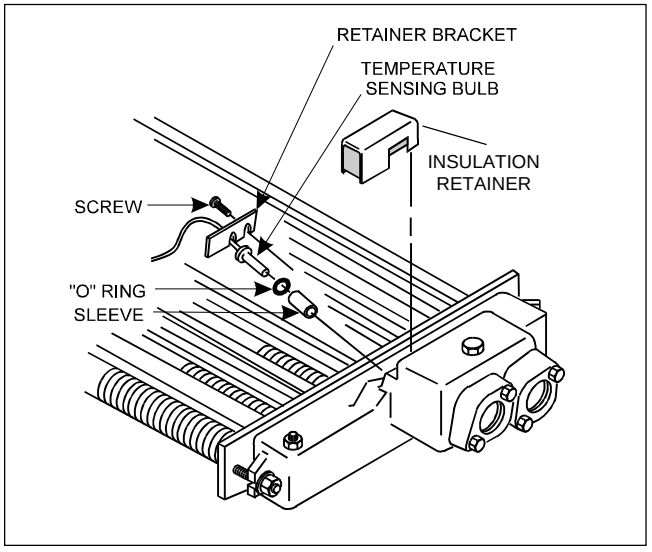


Figure 12. Temperature Sensing Bulb

2. If there is a vent cap or drafthood (indoor) on top of the heater, remove it.

3. Remove all hex-head screws fastening the top and lift the top assembly straight up (see Figure 10).

4. Remove the rainshield assembly and set it aside.

5. Remove screws that fasten the gap closures and put them aside. Remove gap closures.

6. Remove the fiberglass insulation and insulation retainer covering header sensors (see Figure 12).

7. Remove the screws securing the two flue collector holddown clamps and remove the clamps (see Figure 11). Remove flue collector.

8. Remove the front and rear firebox tile covers and set them aside.

9. Remove the three jacket/plug grommets and drain plugs (see Figure 10). One set is located under the water connections on the right side. The other is on the left side toward the front of the heater.

10. Tag and disconnect the white wire on the pressure switch (PS) and the white wire on the Fireman's switch terminal (see Figure 6) which leads to the high limit switch.

11. Pull the white wires out of the front compartment through the vestibule cover and coil them on the heat exchanger.

12. Unscrew the brass compression fitting securing the pressure switch. Remove tube from header and gently bend it out of the way.

13. Loosen the screw securing the temperature sensing bulb retainer bracket. Slide the retainer bracket off the bulb flange and remove the bulb from the header. Place the bulb out of harm's way (see Figure 12).

⚠Caution
It may be necessary to have help lifting the heat exchanger out and replacing it.

14. Lift out the heat exchanger assembly and set is aside.

15. Remove the metal jacket/plug from the front hole on the right side of jacket. Re-install it in the back hold on the left side of the jacket.

16. Re-install heat exchanger 180 degrees from it's original position (header left).

17. Pull pressure switch tube through vestibule cover hole first, then pull thermostat bulb through same hole.

18. Re-route controls through hole in left side of cover in reverse order.

19. Remove pressure switch retainer from vestibule panel (allow pressure switch to float).

20. Re-install the temperature sensing bulb in the header, and fasten it with the retainer bracket and screw.

21. Re-install the compression fitting at end of pressur switch line into header.

22. Re-cover the header sensors with fiberglass insulation, and replace the insulation retainer.

23. Route the white wiring beside the heat exchanger and down to the original location. Be careful to keep the wires away from the flue collector.

24. Connect the white wire labeled PS to the pressure switch and the other white wire to its original location on the Fireman's switch.

25. Replace the front and rear firebox tile covers.

26. Replace jacket/plugs grommets, and re-install the drain plugs. Tighten securely..

27. Install the flue collector assembly. Be sure the bottom lips are inside the grooves on the front and rear tile covers and are not pinching any wires.

28. Attach the flue collector holddown clamps to the clips located under the two center header bolts.

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

30. Double-check to make sure the wiring is not pinched against sharp edges, or resting on the flue collector assembly.

31. Re-install rainshield assembly.

32. Replace the top assembly. Make sure the tabs are outside the heater jacket. Fasten the top assembly with the hex-head screws.

33. Install plastic tie wraps on wiring.

34. Install heater door.

35. Reinstall the vent cap or drafthood, if one was removed.

2G-3. Valve Installation

Install a check valve if there is any chance of back-siphoning when the pump stops. Do not install any other valve or variable restriction in the piping between the heater outlet and the pool, unless it is being used as a diverter valve.

2G-4. Automatic Chlorinators

An excessive concentration of chemicals in the pool heater can be very destructive. Heater damage caused by excessive chemicals is not covered by the Teledyne Laars warranty. All chlorinators should be downstream of the heater.

- Equip an automatic chlorinator with an anti-siphoning device so that chlorine will not siphon into the heater after the pump shuts off.
- Wire the chlorinator so it cannot operate unless the filter pump is running. If the chlorinator has an independent clock control, synchronize it with the filter clock.
- If the chlorinator is equipped with its own pump, install it so that it introduces the chlorine downstream from the heater, and, if possible, below the level of the heater outlet fitting.
- Do not deposit chemicals in the pool skimmer. This could cause damage to the heat exchanger and void the warranty.

2G-5. Pressure Relief Valve

A pressure relief valve is not furnished with the Series 2 ESC heater, except in Canada, however, it is recommended and may be required by local codes.

To install a pressure relief valve, remove the 3/4 inch (19 mm) brass plug on the in/out header with the valve (see Figure 13). The setting of the valve should be at or below the lowest working pressure of filter system components.

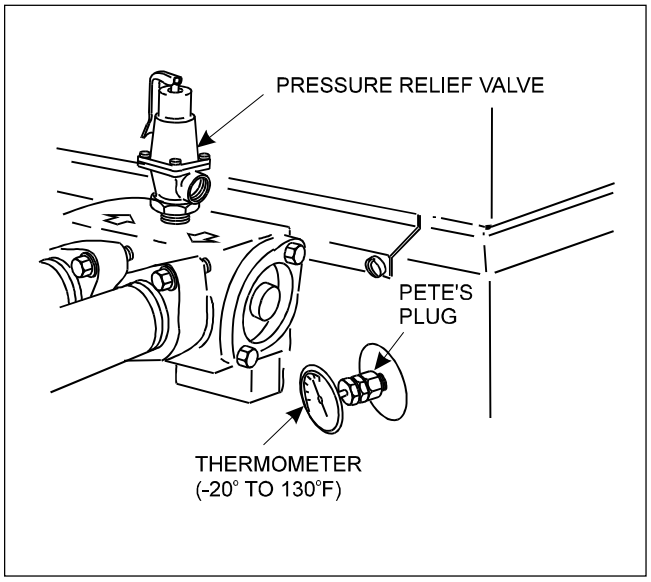


Figure 13. Thermometer and Pressure Relief Valve

2G-6. Adjusting the Pressure Switch

The pressure switch is preset at the factory for activation at 2 psi (14 kPa). Adjust the pressure switch only if:

1. The top of the heater is installed 3 feet (0.91 m) or more below the surface of the pool.

2. Any part of the filter system piping is 3 feet (0.91 m) or more above the top of the heater jacket.

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

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

⚠Caution
The pressure switch should be adjusted tot urn the heater off when the pump is off. Setting the switch to close at too low of a flow can damage the appliance.

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

1. Turn the control panel rotary switch to OFF (see Figure 14).

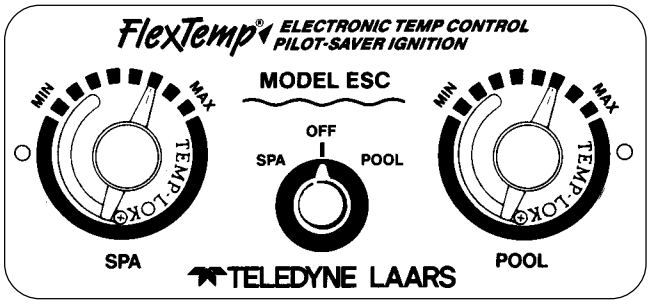


Figure 14. ESC Temperature Controls.

2. Turn filter pump on. If a two-speed pump is used, make sure it is at high speed.

3. Turn rotary switch to ON. Heater should start.

4. Pry out the top rubber dirt plug.

5. Use a 7/32 inch (5.55 mm) Allen wrench to turn the adjustment screw very slowly clockwise until the heater goes off (see Figure 15).

6. Slowly turn the pressure switch adjustment screw **counter-clockwise** one-quarter turn. The heater should come back on.

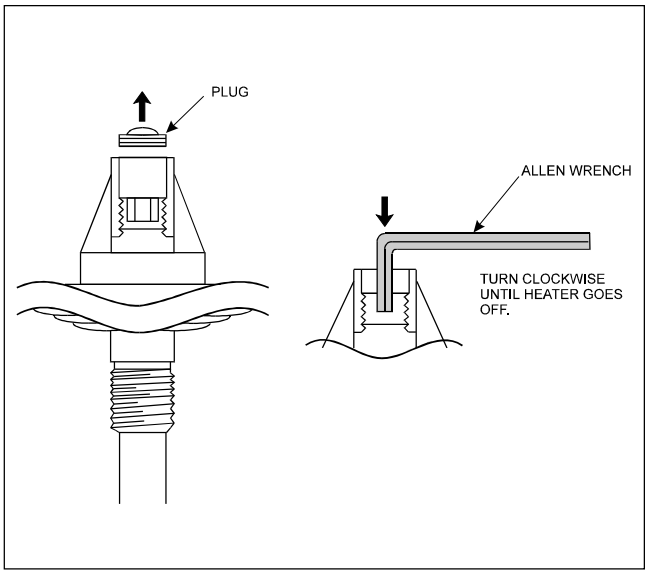


Figure 15. Pressure Switch Adjustment

7. 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. Check the adjustment again.

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

2G-7. Automatic Flow Control Valve

The automatic flow control valve maintains the proper flow through the heater at rates up to approximately 125 Gallons Per Minute (GPM) (474 liters per minute [LPM]). If the system filter-flow rate is higher than approximately 125 GPM (474 LPM), install a manual bypass valve (see Figure 16), then perform a temperature rise test (see Section 2G-8) and adjust the flow with the bypass valve until the proper temperature rise is obtained.

2G-8. Temperature Rise

A temperature rise test confirms proper water flow through the heater. The temperature rise is the difference between the temperature of the pool or spa water before and after heating, as measured in the header. Perform the following temperature rise test when the installation is complete:

1. Make sure the pool filter is clean.

2. Set the rotary switch on the temperature control panel (see Figure 14) to OFF.

3. Turn the filter pump off.

4. Remove the drain plug located on the right-hand side of the heater and replace it with a Pete's plug (see Figure 13).

5. Insert a pocket thermometer (see Figure 13) through the Pete's plug into the header.

6. Turn the filter pump on and wait 3 minutes. The heater is turned off.

7. Record the temperature indicated by the thermometer (cold water).

8. Turn the heater ON following the lighting instructions found on the inside of the heater.

9. Allow the heater to run for about 3 minutes. Record the new temperature reading (heated water).

10. Subtract the first temperature reading (cold water) from the second temperature reading (heated water). The difference between the two readings is the ***temperature rise***. The temperature rise should be within the range shown in Table 6.

Table 6. Temperature Rise & Minimum Flow Rates

Size	Min GPM	Min LPM	Minimum °F	Minimum °C	Maximum °F	Maximum °C
125	20	76	27	15	36	20
175	20	76	33	19	42	24
250	25	95	33	19	42	24
325	30	114	28	16	38	21
400	30	114	30	17	39	22

11. If the temperature rise is below the minimum range indicated, two possibilities arise:

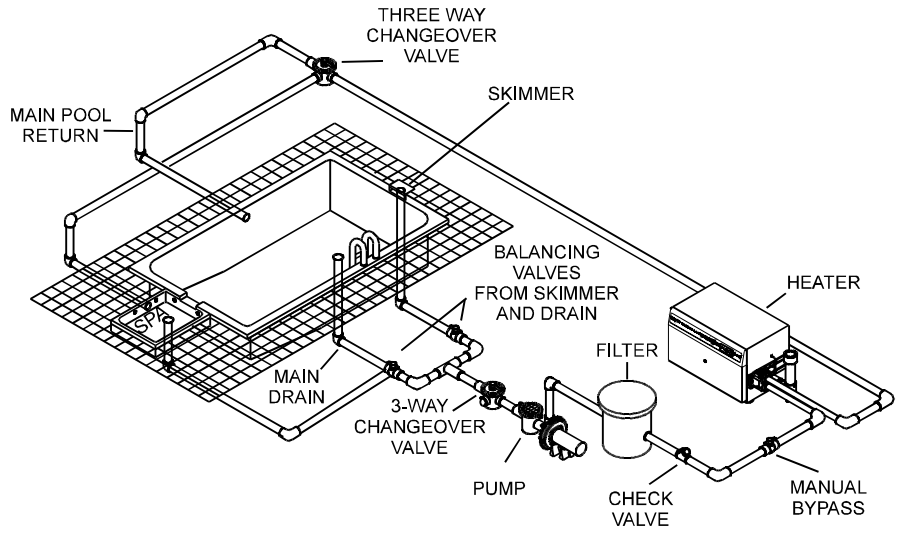
    a. The supply gas volume is too low.

    b. The system's water flow exceeds 125 GPM (474 LPM), and requires a manual bypass valve for proper operation (see Figure 16).

12. If the temperature rise is above the maximum, there is not enough water flowing through the heater. Check for clogging in the water filter or restriction in the water pipes.

⚠Caution

Operation with the temperature rise above maximum or below the minimum can damage the heater and may void the warranty.



Note: When using metal pipe as heat sink, join metal and PVC/CPVC, using metal male and PVC/CPVC female connection.

Figure 16. Typical Installation

13. If the temperature rise is within the correct range, complete the procedure as follows:

    a. Turn the heater off.

    b. Wait 3 minutes, then turn the filter pump off.

    c. Remove the thermometer and the Pete's plug.

    d. Replace the drain plug.

2G-9. Adjusting the Manual Bypass Valve

After the manual bypass valve is installed, use the following procedures to adjust the bypass valve:

1. Clean the pool filter.

2. Remove the drain plug located on the right-hand side of the heater and replace it with a Pete's plug.

3. Insert a pocket thermometer (see Figure 13) through the Pete's plug into the header.

4. Close the manual bypass valve.

5. Turn the rotary switch to the OFF position.

6. Repeat steps 6 through 12 of the temperature rise test (see Section 2G-8).

7. Open manual bypass valve until temp rise falls between the min. and max. range.

8. Once the temperature is within the correct range, remove the handle from the manual bypass valve, and tag valve to prevent change in the water low.

SECTION 3. Operating Instructions

3A. General Information

With any new pool or spa installation, operate the filter pump with the heater off long enough to completely clean the water. This will remove any installation residue from the water. Clean the filter at the end of this operation before starting the heater. When raising the temperature of a cold pool, remove all time clock settings. This lets the filter system and heater operate continuously until the water reaches the temperature setting on the temperature control. When that happens, the heater will automatically shut off, but the filter pump will keep running. The filter pump must continue running for at least 15 minutes after the heater shuts off to prevent damage to the system piping.

3B. Lighting and Shutdown Procedures

3B-1. Lighting the Heater

⚠WARNINGS

Vent pipes, drafthoods, and heater tops get hot! These surfaces can cause serious burns. Do not touch these surfaces while the heater is in operation. Adding a vent cap reduces the temperature on the top.

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

Keep all objects off the top of the heater. Blocking air flow could damage the heater, and may void the warranty.

LP GAS: To avoid possible injury, fire and explosion, read and follow these precautions and all instructions on this heater before lighting. This heater uses LP gas which is heavier than air and will remain at ground level if there is a leak. Before lighting, sniff at ground level.
If you smell gas, follow these rules:

1. DO NOT light matches. DO NOT turn electric lights or switches on or off in area. DO NOT use an electric fan to remove the gas from area.
2. Shut off gas at LP tank.
3. Telephone gas company and fire department for instructions. Give your name, address and phone number.

If your LP tank runs out of fuel, turn off gas at the heater. After the tank is refilled, the heater must be re-lit following the instructions found on the inside of the heater. DO NOT attempt repairs on the gas control or heater. Tampering is dangerous and voids all warranties.

Lighting instructions can also be found on the inside of the heater. To start up the heater:

1. Remove heater door.

2. Wait 5 minutes to clear out any gas, then smell for gas, including near the floor. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

NOTE: The ESC heater does not need manual pilot lighting. It is done automatically by the ignition control when the temperature control calls for heat.

3. Turn the gas valve control knob counter-clockwise to ON (see Figure 17).

4. When raising the temperature of a cold pool, remove all time clock settings. This lets the filter system and heater operate continuously until the water reaches the temperature setting on the temperature control. When that happens, the heater will automatically shut off, but the filter pump will keep running. The filter pump must continue running for at least 15 minutes after the heater shuts off to prevent damage to the system piping. Even though the heater will be running, the outlet piping will not feel hot to the touch.

5. Install heater door.

6. Turn on electrical power to the heater.

7. Turn on the filter pump.

8. Turn of the main gas supply valve to the heater, outside heater jacket.

9. Set the temperature control to the desired setting and turn the rotary switch to ON. Until the water reaches a temperature of about 70°F (21°C), it is normal to have some water accumulating in the base of the heater.

10. Set the time clock, if one is installed.

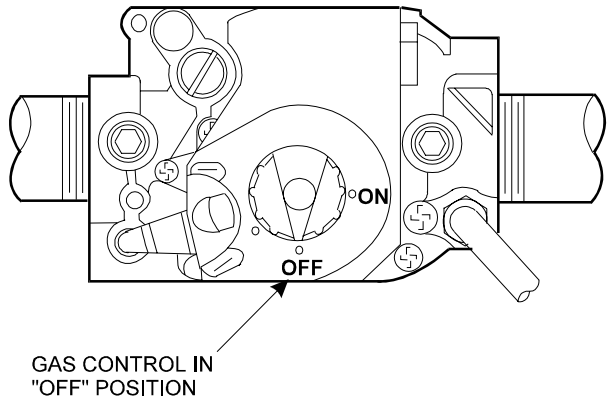


Figure 17. ESC Gas Valve

NOTE: On LP gas heaters, if pilot ignition does not occur within 90 seconds, the system will lock out and turn off power to the whole system.

3B-2. Shutting the Heater Down

To completely shut the heater down:

1. Set the temperature control to its lowest setting.
2. Turn the rotary switch on the temperature control panel to OFF.
3. Open heater door and turn the gas valve control knob clockwise to OFF.
4. Turn off all electrical power to the heater at the main junction box.
5. Turn off main gas supply valve to the heater, outside heater jacket.

3B-3. Setting the Temperature Control

The temperature control (see Figure 14) is calibrated at the factory and covers a range from approximately 70 to 104°F (21 to 40°C). Use an accurate pool thermometer to determine the best water temperature for your uses.

The ESC heater has dual temperature controls, which allows two different temperature settings, selected by the rotary switch in the middle of the panel. One control can be set for normal use and the other for standby; or one can be set for pool and the other for a spa. Placing the rotary switch in the middle turns off the heater (see Figure 14).

IMPORTANT: The temperature controls cannot be calibrated in the field. If the control is faulty, shut down the heater and have a qualified service technician replace the control. DO NOT use the thermostat switch to completely shut down the heater.

3C. Seasonal Care

3C-1. Spring and Fall Operation

During periods when the pool is only going to be used occasionally, turn the temperature control down to the MIN setting. This prevents the pool from becoming chilled, and minimizes the time required to raise the pool water back up to the desired temperature.

If the heater is not going to be used for a long period of time, shut it down completely. Follow the instructions found on the inside of the heater.

3C-2. Winter Operation

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

1. Turn off the main gas supply valve to the heater, outside the heater jacket.
2. Remove heater door.
3. Shut down the heater following the shutdown instructions found on the inside of the heater.
4. Remove the drain plug from the return side (see Figure 18), loosen the drain plug from the inlet-outlet side, and completely drain the heater before the first frost.
5. After all water has drained from the heater, remove the drain plug from the inlet/outlet side. Check for mineral buildup in the openings.

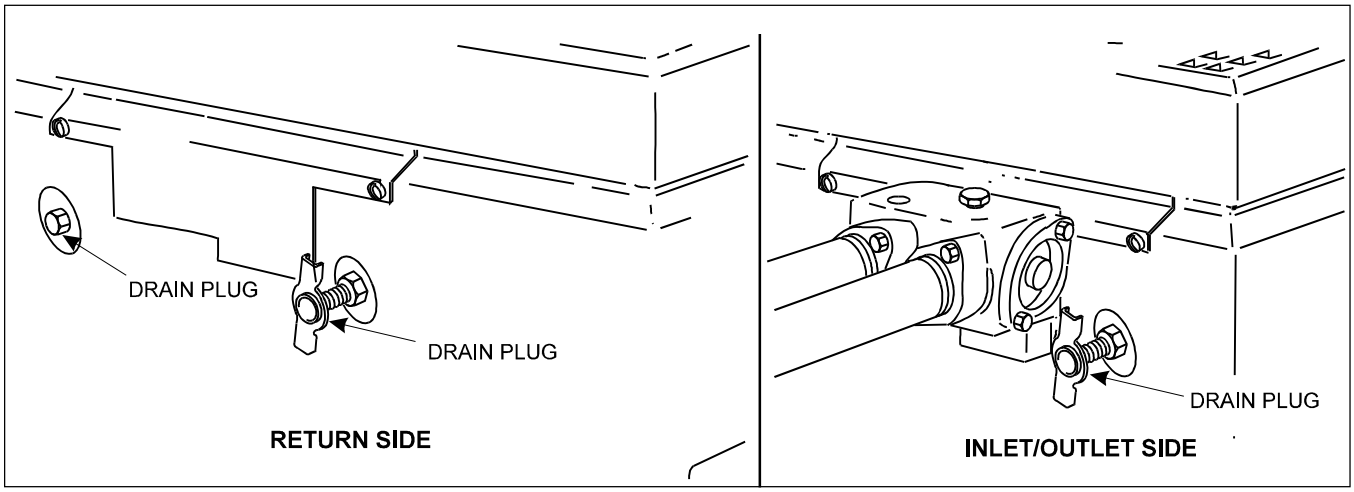


Figure 18. Heater Drain Locations

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

7. Grease the threads in the drain plugs and reinstall plugs, but do not tighten.

8. Disconnect the pressure switch copper tubing (see Figure 19).

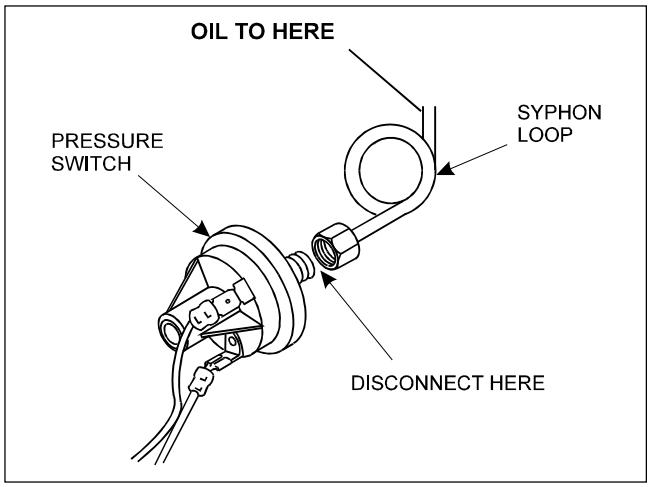


Figure 19. Pressure Switch Copper Tubing

3C-3. Spring Start-up

To restart the heater in the Spring, have a professional service technician reassemble the heater as follows:

1. Attach the copper tubing to the pressure switch and fill the loop with SAE 50, non-detergent oil (see Figure 19).

2. Tighten the drain plugs.

3. Turn on the main gas supply valve to the heater, outside the heater jacket.

4. Turn on the heater following the lighting instructions found on the inside of the heater.

3D. Water Chemistry

3D-1. For Pool

The mineral content of swimming pool water increases daily, due to natural evaporation and the addition of sanitizing chemicals. If the mineral concentration in the pool gets too high, the excess minerals will deposit on the walls of the pool, in the filter system, and in the heater tubes. To protect the heater from damage, keep the pH factor of the pool water between 7.2 and 7.8.

3D-2. For Spa

The proper chemical balance in a spa is more critical than in a swimming pool for satisfactory heater operation.

Due to the spa's size, high water temperature, and heavy use, chemical values in a spa can differ greatly. The lack of the right chemical content can result in unsanitary water conditions, and affect the life of the heater.

Maintaining sanitary water conditions in a spa can only be done by regular water changes and the proper addition of sanitizing chemicals. See Table 7 for the recommended levels for certain mineral concentrations.

Table 7. Mineral Concentration Levels

Test	Recommended Level
Free chlorine	1.0 to 3.0 ppm
Bromine	3.0 to 5.0 ppm
pH	7.2 to 7.8
Total alkalinity (TA)	80 to 120 ppm
Calcium hardness (CH)	200 to 400 ppm
Langelier saturation index (SI)	-0.5 to +0.5
Total dissolved solids (TDS)	Less than 2000 ppm
Cyanuric acid	30 to 150 ppm
Copper	0 ppm

3D-3. Spa Water Changing

Teledyne Laars recommends regular changing of spa water every 60 days if usage is light, and every 30 days during heavy usage. Be sure to stabilize the water chemistry after every water change.

3D-4. Corrosion

The corrosive action of spa water is increased by low pH (acidity), low total alkalinity (bicarbonates), and low calcium hardness (soft water).

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

3D-5. Testing

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

The pool or spa owner should have a professional service technician perform more extensive chemical testing and water changing.

3E. Spa/Hot Tub Safety Rules

The following "Safety Rules for Hot Tubs," recommended by the U.S. Consumer Product Safety Commission, should be observed when using the spa:

1. Spa or hot tube water temperature should never exceed 104°F (40°C). One hundred degrees Fahrenheit (100°F [38°C]) 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 (38.5°C) 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 (38°C) maximum.

4. The water temperature should always be checked with an accurate thermometer before entering a spa or hot tub. Temperature controls may vary by as much as 4°F (-16°C).

5. Persons with a medical history of heart disease, diabetes, circulatory or blood pressure problems should consult their physician before using a hot tub or spa.

6. Persons taking any medication which induces drowsiness (e.g., tranquilizers, antihistamines, or anticoagulants) should not use spas or hot tubs.

7. Prolonged immersion in hot water can induce hyperthermia.

Hyperthermia occurs when the internal body temperature reaches a level several degrees above the normal body temperature of 98.6°F (37°C). Symptoms include dizziness, fainting, drowsiness, lethargy, and an increase in the internal body temperature. The effects of hyperthermia include:

- Lack of awareness of impending hazard
- Failure to perceive heat
- Failure to recognize need to leave spa
- Physical inability to leave spa
- Fetal damage in pregnant women
- Unconsciousness resulting in a danger of drowning

3F. Swimming Pool Energy Saving Tips

Teledyne Laars offers the following recommendations to help conserve fuel and minimize the cost of operating your pool heater without sacrificing comfort.

1. The American Red Cross recommends a maximum water temperature of 78°F (25°C). Use an accurate pool thermometer. A difference of 4 degrees, from 78 to 82°F (25 to 28°C), will use as much as 40% more gas.

2. Carefully monitor the water temperature of your pool in the summertime. You can reduce heater usage 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 balances.

5. If the pool is only going to be used on weekends, reduce the heater temperature control setting by 8 or 10 degrees during the week. Reset it to the 78°F (25°C) level a day or so before you plan to use the pool.

6. During the winter or when on vacation for longer than a week, shut down the heater by following the shut-down instructions found on the inside of the heater.

7. Where possible, shelter the pool from prevailing winds with well-trimmed hedges or other land scaping, 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.

3G. Periodic Inspection

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

Teledyne Laars designs and constructs the Series 2 ESC heater to provide long performance life when installed and operated properly under normal conditions. The following basic guidelines are suggested for your inspection:

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

2. Keep the pool heater area clean and free of all combustible materials, gasoline, and other liquids and vapors (see Table 2 for minimum clearances).

3. Inspect the venting system for blockage, leakage, and corrosion at least once a year.

4. Be sure all combustion air and ventilation openings are not blocked.

5. Check for spider webs in the pilot and main burner orifices - especially at Spring startup.

6. Inspect the gas and millivolt controls annually, specifically the following:

   a. High limit temperature switch
   b. Pressure switch
   c. Automatic gas valve
   d. Temperature control

   Controls can deteriorate over a period of years. A regular inspection schedule, with repair or replacement as needed, will keep the heater performing properly.

7. Inspect the external surfaces of the heat exchanger tubes for black carbon soot buildup by placing a mirror between and under the burners when the heater is firing. Remove any soot that has collected on the tubes, and correct the cause.

NOTE: After installation and first startup, check the heat exchanger for black carbon soot buildup after the following periods of operation: 24 hours, 7 days, 30 days, 90 days, and once every 6 months thereafter).

8. At startup and every 6 months after, look at the pilot and main burner flame. If the flame is yellow or burner surface is glowing red, call a professional service technician. Characteristics of a good flame are:

   a. Blue in color

   b. 1 to 4 inches (25 to 102 mm) high above burner surface

   c. Dark-colored burner surface with occasional glow of fibers on surface

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

10. Keep this manual in a safe place for future reference when inspecting or servicing the heater.

SECTION 4.
Parts List for ESC Heater

4A. General Information

To purchase parts or obtain a comprehensive maintenance manual for the Teledyne Laars ESC heater, contact your nearest Teledyne Laars dealer or distributor. If they cannot supply you with what you need, contact the Customer Service Manager, Teledyne Laars, 6000 Condor Drive, Moorpark, California, 93021, Telephone (805) 529-2000.

Description	Part Number
PILOT GAS SYSTEM	
Pilot Tube	R0096200
Pilot Burner	
Nat, 0.018	R0312400
LP, 0.010	R0312500
Pilot Bracket Adapter	R0312300
Ceramic Insulator Assy.	R031200
MAIN GAS SYSTEM	
Burner, Main	L0052300
Burner, Main w/ Pilot Brkt.	10457500
Gas Valve	
Nat.	125175-R0039200
	250-400-R0099400
LP	R0095900
Manifold Assy., Gas	
Model 125	L0052200
Model 175	L0006300
Model 250	L0006400
Model 325	L0006500
Model 400	L0006600
Gas Orifice	
Nat., 0 - 3,000 ft.	L0032200
Nat., 3,000 - 6,000 ft.	L0032600
Nat., 6,000 - 10,000 ft.	L0050300
LP, 0 - 5,000 ft.	L0032900
LP, 5,000 - 10,000 ft.	L0032800
Burner Tray Assembly	
Nat.	R0312901 thru 05
LP	R0313001 thru 05
Burner Tray Weldment	R0313101 thru 05
ELECTRICAL SYSTEM	
Cover, High-Limit Switch	10418300
Bracket, High-Limit Switch	10418400
High Voltage Lead Assy.	R0098900
Wire Harness, High-Limit Switch	10419300
Disc, High-Limit	
150°F	R0023000
135°F	R0022700
Bracket, Insulation Retainer	10462200
Retainer Bracket	10447300
O Ring, Temp Control Bulb	E0116400
Sleeve, Temp. Control Bulb	10444900
Temperature Control Assy.	R0011700
Knob, Pool/Spa	R0313800
Knob, Thermostat	R0010700
TEMP-LOK Disc	10583100
Casting, Temp. Control Bezel	S0069800
Fusible Link Assy.	R0012200
Fusible Link Bracket	10479900
Pressure Switch/Siphon Loop	R0097600
Pressure Switch, 2 psi	R0097700
Tube, Siphon Loop	10545200
Terminal Block	R0097800
VENT SYSTEM	
Top Closure Weldment	R0313201 thru 05
Top Filler Plate	10535201 thru 05
Flue Collector Assy.	R0313301 thru 05
Rainshield, Front	R0098001 thru 05
Rainshield, Rear	R0098101 thru 05
Rainshield, Side	R0098201 thru 05
Baffle, Heat Exchanger (8)	10697401-05
Clip, Baffle Retainer	S0083900
Clamp, Holddown	10726200
Bracket, Holddown	10726300
Vent Cap Kit	R0313701-05
Draft Hood Kit	R0313601-05
WATER SYSTEM	
Heat Exchanger, Tube Assy.	R0018101-05
Connector Assy.	P0019700
Plug, 3/4 In. NPT	P0027000
Header, Inlet/Outlet	
Cast Iron	R0056400
Bronze	R0016800
Header, Return	
Cast Iron	R0058300
Bronze	R0054600
Gasket, Header (18)	R0050800
Bolt, Dome 2-1/2 In.	F0046100
Nut, 3/8 - 16, Hex	F0003100
Flange Assy.	R0055000
Bolt, Flange	F0031700
Washer, Flange	F0011100
Flange	10573500
No Sweat Flange	R0100000
Gasket, Flange, 2 In.	S0078000
Sleeve, Flange	S0078200
Gasket, Adapter, 2 In. x 1-1/2 In.	S0078100
Heat Exchanger Assy.	10606401-05
Plug, Button	F0035300
Flow Valve Assy.	10701301-05
Flow Valve Assy, Bronze	10701401-05
Cap, Flow Control	10452201
Cap, Flow Control, Bronze	10557400
Bolt, Hex-Hd. 3/8 In., 16 x 1In.	F0041600
Spring, Bypass	
Purple, Model 125	S0079900
White, Model 175	S0061400
Red, Model 250	S0061300
Blue, Model 325	S0061200
Black, Model 400	S0070100
Gasket, Flow Control	R0011400
Disk, Flow Control	R0011500
Rod, Flow Control	S0079800
Restrictors (2), Model 125 only	S0000300
Pressure Relief Valve, 3/4 In. NPT,	
75 psi	A0063300
FIREBOX COMPONENTS	
Tile	
Front / Rear	T0021501 thru 05
Side	T0021400
Tile Cover	
Front, Rear	10314901 thru 05
Side	10167300
Insulation, Fiberglass (State Model)	T0027100
JACKET COMPONENTS	
Jacket Assy, Less Top Assy.	10831201 thru 05
Gap Closure,	
Inlet/Outlet	10448200
Return	10448300
Bracket, Anti-Rotation	10835900
Door With Latch	R0313401 thru 05
Grommet	
Drain	S0069900
Slitted	S0071100
Drain Plug	P0026800
Non-Combustible Base	10521701 thru 05

TELEDYNE LAARS SERIES 2
LIMITED WARRANTY

Your Teledyne Laars Series 2 pool/spa heater is backed by this double warranty to assure your complete satisfaction.

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

2. All other parts are warranted against defects in materials and workmanship for five (5) years from date of purchase.

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

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

TELEDYNE LAARS

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NQA ISO9002 REGISTERED COMPANY — NATIONAL ACCREDITATION OF CERTIFICATION BODIES *

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