FOR YOUR SAFETY - This product must be installed and serviced by authorized personnel, qualified in pool/spa heater installation. Improper installation and/or operation can create carbon monoxide gas and flue gases which can cause serious injury, property damage, or death. Improper installation and/or operation will void the warranty.

Installation and Operation Manual

LX™ and LT™ Low NOx Gas-Fired Pool and Spa Heater

Model LX/LT-Low NOx Natural Gas Only

Model LX250-L Shown

⚠ WARNING

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

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

WHAT TO DO IF YOU SMELL GAS

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

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

Laars

H0256100-

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SECTION 1.
General Information

1.1 Introduction

This manual provides installation and operation instructions for the Laars LX and LT Low NOx pool and spa heaters. Read these installation and operation instructions completely before proceeding with the installation. Consult the Laars factory, or local factory representative, with any questions regarding this equipment.

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

The Laars LX and LT Low NOx heaters get their electrical power from an external 115VAC or 230VAC source and provide a dual electronic thermostat control system for pool/spa combinations or preheat convenience.

The Laars LX and LT Low NOx heaters are specifically designed for heating fresh water swimming pools and spas, and with proper installation and care, they will provide years of reliable service. Do not use the heater to maintain pool or spa water temperature below 70°F. Do not use it as a heating boiler or general service water heater or to heat salt water. Consult your dealer for the appropriate Laars products for these applications.

1.2 Consumer Information and Safety

The Laars LX and LT Low NOx heaters are designed and manufactured to provide many years of safe and reliable service when installed, operated and maintained according to the information in this manual and the installation codes referred to in later sections. Throughout the manual safety warnings and cautions are identified by the "⚠" symbol. Be sure to read and comply with all of the warnings and cautions.

1.2.1 Spa/Hot Tub Safety Rules

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

⚠ WARNING
The U.S. Consumer Product Safety Commission warns that elevated water temperature can be hazardous. Consult heater operation and installation instructions for water temperature guidelines before setting temperature.

⚠ AVERTISSEMENT
La U.S. Consumer Product Safety Commission indique que des températures de l'eau élevées peuvent être dangereuses. Voir la notice d'installation et de fonctionnement pour le réglage de la température.

1. Spa or hot tub 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 take note!** 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 1F° (1C°).
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

1.2.2 Swimming Pool Energy Saving Tips

Water Pik Technologies 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 4F° (2°C) , between 78°F and 82°F (26°C and 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 locking ring to discourage further adjustments. (LT only).

4. Set the pump 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 shutdown instructions found on the inside of 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.

1.3 Warranty

The Laars LX and LT Low NOx heaters are sold with a limited factory warranty. Details are specified on the back cover of this manual.

Make all warranty claims to an authorized 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.

The warranty does NOT cover damage caused by improper assembly, installation, operation or field modification. Also, damage to the heat exchanger by corrosive water is NOT covered by the warranty. See Section 8.1 for maintaining proper pool water chemistry.

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

1.4 Codes and Standards

The Laars LX and LT Low-NOx pool and spa heaters are design certified by CSA (Canadian Standards Association) as complying with the latest edition of the "Standard for Gas Fired Pool Heaters", ANSI Z21.56 in the USA and CAN1-4.7 in Canada.

All Laars heaters must be installed in accordance with the local building and installation codes as per the utility or authorities having jurisdiction. All local codes take precedence over national codes.

In the absence of local codes, refer to the latest edition of the following national codes for installation:

1. In the United States, "The National Fuel and Gas Code", ANSI Z223.1. Specifically, refer to Part 7, "Venting of Equipment".

2. In Canada, "The Installation Codes for Gas Burning appliances and Equipment", CAN/CGA B149.

The Laars LX and LT Low NOx pool and spa heaters exceed the requirements of energy conservation regulations such as those in California, Hawaii, New York, Oregon and other states which require that a pool heater have intermittent ignition. In addition, this heater complies with both the California South Coast Air Quality Management District's (CSAQMD) rule 1146.2 and the Title 30, Texas Administrative Code, Chapter 117, Section 117.465 for Nitrogen Oxide (NOx) emissions.

Any changes to the heater, gas controls, gas orifices, wiring, draft diverter, or improper installation may void the warranty. If change is required to any of the above, consult the factory.

1.5 Technical Assistance

Consult Water Pik Technologies or your local Laars distributor with any questions or problems involving the specifications, installation, and operation of your Laars equipment. An experienced technical support staff is ready to assist you in assuring the proper performance and application of Laars products. For technical support call the Water Pik Technologies, Technical Service Department at (707) 776-8200 extension 260.

1.6 Materials Installer Must Provide

1.6.1 Materials for All Applications

The following items are needed and are to be supplied by the installer for *all* LX/LT Low NOx heater installations:

1. The correct size gas pipe to supply gas from the meter to the heater (see Section 4.1 for correct gas pipe size).

2. A manually operated gas valve to be installed in the gas line outside of the heater jacket.

3. A suitable gas union joint to connect the heater to the gas line outside of the heater.

4. Plumbing items needed to provide a sediment trap (drip leg) in the gas line between the manual gas valve and the union to the heater (see Section 4.1).

5. A 115V AC or 230V AC power supply. A junction box is not needed at the heater, connections are made inside of the heater jacket.

1.6.2 Materials for Special Applications

In addition to the items listed above, the following items are needed for special applications.

1. A factory authorized vent collar and any vent pipe needed for indoor installations in the USA and outdoor shelter installations in Canada (see Section 3.3.2). Vent collars are available from any Laars distributor.

2. Primer and cement suitable for cementing CPVC pipe to PVC pipe and an appropriate coupling for connecting the factory supplied CPVC pipe nipples to PVC pool plumbing.

3. A non combustible platform for installation on combustible surfaces (see Section 2.3.3). Non combustible bases are available from your Laars distributor.

1.7 Specifications

1.7.1 General Specifications

1. Installation Location:
   Certified for use:
   In the USA:
   Natural Gas: Indoor and Outdoor
   In Canada:
   Natural Gas: Outdoor and Outdoor Shelter

2. Minimum Clearance From Combustible Material:
   See Table 1 in Section 2.3.2

3. *Gas Pipe/Heater Gas Valve Connection:
   Natural Gas: 3/4" NPT
   *For diameter of gas line from meter to heater see Table 4 in Section 4.1.

4. Supply Gas Type:
   Certified for use with:
   Natural Gas Only.

5. Inlet Gas Supply Pressure:

	Minimum	Maximum
Natural Gas:	6.0 "WC	10.5 "WC

6. Water Pipe/Heater Connection:
   *2" Unthreaded PVC or CPVC
   *Other size pipes may be used. See Section 5.5 for details

7. Water Flow Rate:
   Maximum: 125 gpm (475 lpm)
   Minimum: 30 gpm (110 lpm)

8. Working Water Pressure:
   Maximum: 75 psi

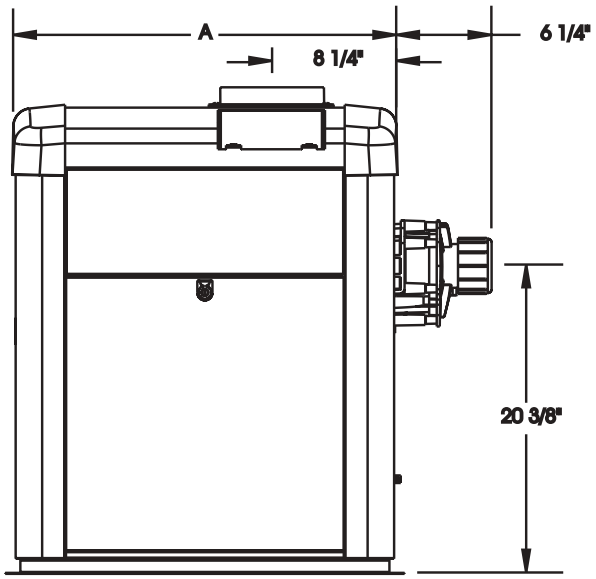
9. Exhaust Vent Connection Size:
   Model:
   250 7" Diameter
   400 9" Diameter

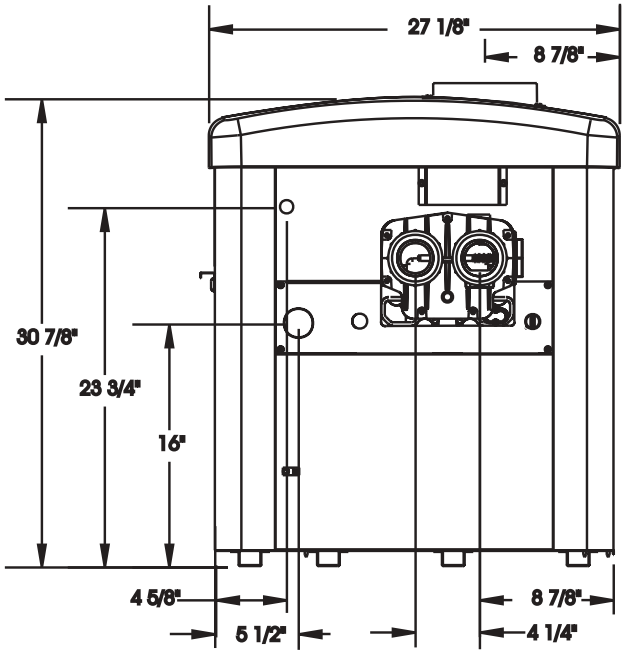
10. Electrical Supply:
    Either 115 volts AC or 230 volts AC.

11. Modification of Heater for High Altitude:
    None. Laars LX and LT Low-NOx heaters are not designed to operate at altitudes above 3000 feet.

1.7.2 Dimensions

See Figure 1 for a diagram showing the heater's exterior dimensions and dimensions to critical connections on the heater.





Model*	Heater Width Dim "A"		Heater Depth		Heater Height		Vent Diameter		Firing Rate	
	in	(cm)	in	(cm)	in	(cm)	in	(cm)	BTU/HR	(kcal)
250-L	28 1/4	(72)	27 1/8	(69)	30 7/8	(78)	7	(18)	250,000	63
400-L	34 1/4	(87)	27 1/8	(69)	30 7/8	(78)	9	(23)	400,000	101

* Values shown are for both LX and LT models.

Figure 1. General Configuration.

SECTION 2. Installation Instructions

2.1 Introduction

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

⚠ CAUTION
The Laars LX and LT Low NOx heaters are not designed to operate at altitudes above 3000 feet. For installations at elevations above 3000 feet, contact your Laars representative or Water Pik Technologies' Customer Service Department.

Install the Laars LX and LT Low NOx heaters and vent collars in accordance with the procedures in this manual, local codes and ordinances, and in accordance with the latest edition of the appropriate national code (see Section 1.4 "Codes and Standards").

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 (if required)
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.

2.2. Field Assembly

The Laars LX and LT Low NOx heaters can be installed in a variety of ways, some of them requiring preparation or assembly in the field. The heater is shipped from the factory with an exhaust vent configured for an outdoor installation. The Laars LX and LT Low NOx heaters are also design certified for "Indoor" installations in the United States and "Outdoor Shelter" installations in Canada when equipped with a vent collar and the appropriately sized exhaust vent.

Check the rating plate on the heater or the Parts List (Section 11.2) of this manual for the correct Laars vent collar part number. For specific installation information see Section 2.3.5 "Indoor and Outdoor Shelter Installations".

Water connections are provided on the right side of the heater but can be changed to the left side by reversal of the heat exchanger. It is best to handle these preparations before the heater is installed in its final location. See Section 5.4 "Reversible Water Connections" of this manual for instructions.

2.3 Location Requirements

2.3.1 Introduction

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

⚠ CAUTION
When pool equipment is located below the pool surface, a leak from any component can cause large scale water loss or flooding. Water Pik Technologies cannot be responsible for such water loss or flooding or resulting damage.

The Laars LX and LT Low NOx heaters may be installed indoors or outdoors as outlined in later sections. Location of the heater below *or above* the pool deck affects operation of its water pressure switch. See sections on water piping and heater start-up for more information about this.

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

All criteria given in the following sections reflect minimum clearances as stated in the national standards. However, each installation must also be evaluated, taking into account the prevailing local conditions such as wind speed and direction, proximity and height of walls that may block ventilation, and proximity to public access areas.

2.3.2 Clearances

The heater must be placed to provide clearances on all sides for maintenance and inspection. There must also be minimum distances maintained from combustible surfaces (see Table 1).

At least 18" (457mm) access must be available in front of the heater for burner removal.

If the heater is to be installed in a garage, or similar structure, all burners and burner ignition devices must have a minimum 18" (457mm) clearance above the floor.

This heater must be installed at least 5 feet (1.52m) from the inside wall of a pool unless the heater is separated from the pool by a solid fence, wall or other permanent solid barrier.

Ce chauffe-piscine doit être installé á au moins 5 pieds (1.52m) de la paroi interne de la piscine à moins d'être isolé de la piscine par une clôture, un mur ou autre barrière permanente.

Table 1. Minimum Heater Clearances From Combustible Surfaces
Table 1. Dégagements Minimaux à Assurer Entre les Parois de L'appareil et les Constructions Combustibles

SIDE OF HEATER	INDOOR (OUTDOOR SHELTER) INSTALLATION		OUTDOOR INSTALLATION	
	INCHES	CENTIMETERS	INCHES	CENTIMETERS
BLANK	4	10.2	4	10.2
REAR	4	10.2	4	10.2
PIPING	12	30.5	12	30.5
TOP	39	99.0	OPEN UNROOFED AREA	
FRONT	18	45.7	18	45.7

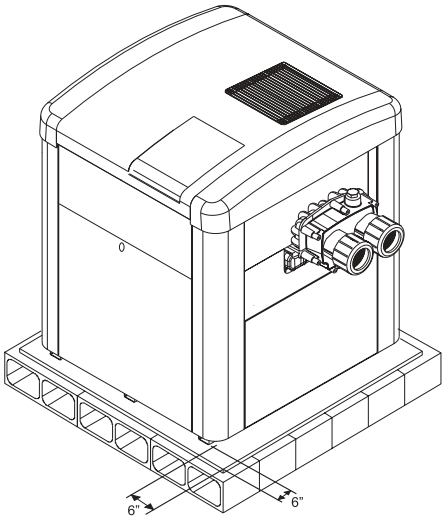
Note: Clearances listed in Table 1 are manufacturer's tested values. These are given as minimum values. Where local and national codes apply, and values are different than those listed in Table 1, use the greater value to ensure safe operation.

2.3.3 Flooring

The heater must be installed on a floor of noncombustible construction or on fire-resistant slabs or arches. Noncombustible flooring is defined as flooring material and surface finish not capable of being ignited and burning and with no combustible materials against the underside. Acceptable materials are those consisting entirely of a combination of steel, iron, brick, tile, concrete, slate, glass or plaster. **Do not** install the heater directly on a combustible wood or carpet floor without placing a noncombustible platform between the floor and the heater.

The heater can be installed on a combustible floor if a noncombustible base assembly, available from Laars, is used. See the heater rating plate or the Parts List (Section 11) of this manual for the appropriate base part number. **Heaters must never be installed directly on carpeting.**

As an alternative to the Laars noncombustible base plate, 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 6 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 2). If the heater is installed in a carpeted alcove, the entire floor of the alcove must be covered by a noncombustible panel.



Notes:

1. Blocks must be provide a 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.
3. Sheet metal must be at least 24 ga. and extend 6" beyound the heater jacket on all sides.

Figure 2. Non-Combustible Platform.

2.3.4. Outdoor Installation

The LX or LT Low NOx heaters can be installed in the outdoor configuration as received from the factory.

Locate the heater in an **open, unroofed area**. Do not install the heater under a deck. 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 four (4) feet (1.22 m) horizontally **and** four (4) feet (1.22 m) vertically between the heater exhaust point and any door, glass opening, or gravity inlet to a building. In Canada, the heater must be installed so that the exhaust point of the heater is at least ten (10) feet (3.0 m) from any building opening (see Figure 3).

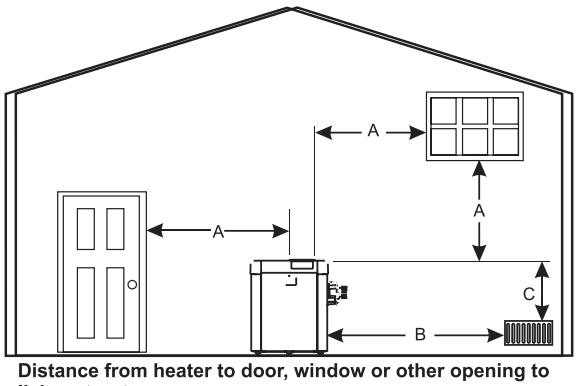
⚠ WARNING

United States

Do not install the heater with the top of the vent assembly within 4 feet (1.22 m) horizontally and 4 feet (1.22 m) vertically 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.



Distance from heater to door, window or other opening to living structure

Dimension '**A**'- USA - 4 ft (1.2m) Minimum,
CANADA - 10 ft (3.05 m) Minimum.

Distance from heater to forced air inlet or other vented opening

Dimension "**B**" - USA and CANADA - May be any distance if dimension "C" is 3 ft. (0.9 m) or more.

Dimension "**B**" - USA and CANADA - Must be at least 10 ft. (3.05 m) if dimension "C" is less than 3 ft. (0.9 m).

Figure 3. Outdoor Heater Installation.

The top surface of the heater must be at least three(3) feet above any forced air inlet, or intake ducts located within ten(10) feet horizontally.

If the heater is installed under an overhang, there must be a minimum clearance of 5 feet (1.5 m) above the top of the heater and the structure should not overhang the heater more than 12 inches (0.30 m). 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.

Ne pas installer ce chauffe-piscine sous une saillie mesurant moins de 3 pi de hauteur. La partie sous la saillie doit être ouverte sur 3 côtés.

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 irrigation sprinkler systems that could spray water on it. Water from sprinklers may cause damage to controls and electronic components.

Avoid locations where wind deflection off nearby structures might cause 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.

2.3.5. Indoor and Outdoor Shelter Installations

An outdoor shelter (Canada only) is an unoccupied enclosure which does not communicate directly with occupied areas. All indoor installations and outdoor shelter installations require the addition of a factory approved vent collar. The vent collar must be installed without modification and in accordance with the instructions provided by the manufacturer.

Une remise extérieure (au Canada seulement) est un endroit inoccupé qui ne communique pas directement avec les endroits occupés. Toutes les installations intérieures et remises extérieures exigent l'addition d'une cheminée approuvée par le manufacturier. La cheminée doit être installée sans aucune modification et selon les exigences fournies par le manufacturier.

These codes, standards and Water Pik Technologies require that the heater be properly vented as outlined in this manual. Proper ventilation of exhaust and combustion air are essential for the safe and efficient operation of the heater (See Section 3).

2.3.5.1 Converting the Grill to a Vent Collar

If the LX or LT Low NOx is to be installed either indoors or in an outdoor shelter, its exhaust discharge grill must be converted to a collar for vent pipe connection. The necessary vent collar, gasket and screws can be ordered as parts kit R0331403 for model 250 or R0331405 for model 400 (see parts list in Section 11 of this manual). The conversion can be done quite simply as follows:

1. Remove the vent exhaust grill by removing the four screws which retain it. The grill and the screws may be discarded (See Figure 4).
2. Replace the grill with the vent collar. Place the vent collar and gasket over the hole and fasten it in place with the 4 screws provided. Be sure that all components are properly aligned (See Figure 5).
3. Install the vent pipe on the indoor vent collar. The collar will accommodate vent piping of nominal 7" or 9" diameter (see Table 3), depending upon the model of your heater (See Figure 6). See vent installation section for important information on selecting proper pipe size.

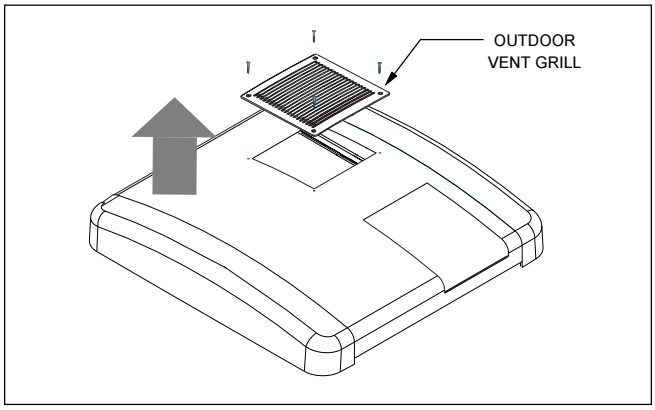


Figure 4. Removal of Outdoor Exhaust Grill.

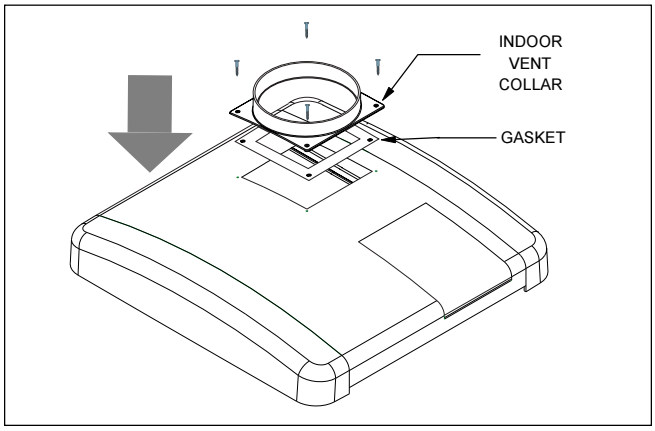


Figure 5. Vent Collar Assembly for Indoor and Outdoor Shelter Installation.

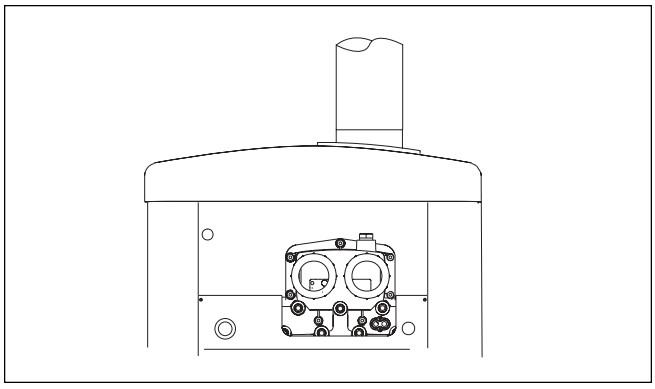


Figure 6. Vent Pipe Installation.

SECTION 3.
Venting

3.1. Combustion Air Supply

The heater location must provide sufficient air supply for proper combustion and ventilation of the surrounding area as outlined in the latest edition of ANSI standard Z223.1 or in Canada, CAN/CGA-B149.1 or .2, and any local codes that may be applicable.

In general, these requirements specify that the room in which a heater is installed should be provided with two permanent air supply openings; one within 12 inches (305mm) of the ceiling, the other within 12 inches (305mm) of the floor. All indoor installations must have openings to outside air for combustion, ventilation, and dilution of flue gases from inside the building (see Figure 7 and Table 2). Water Pik Technologies does not recommend indoor installations that do not provide combustion air from outside the building.

Table 2. Air Openings to Outside.

Required Net Free Open Area* for Combustion Air Openings				
	Direct from outside		Duct from outside	
Model	in^2	(cm^2)	in^2	(cm^2)
250-L	63	(406)	126	(813)
400-L	100	(645)	200	(1290)

*Area indicated is for one of two openings; one at floor level and one at the ceiling, so the total net free area would be double the figures indicated. For special conditions, refer to NFPA54 ANSI Z223.1. **In Canada refer to the National Standard CAN1-B149.1 or .2 which differs from this table.**

Note: If using screens and/or metal louvers, compensate by adding 50% additional area to each opening

If using wood louvers each opening must be at least four times the area indicated in the table above.

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. Water Pik Technologies does not recommend outdoor shelter installations that depend on internal air for combustion. Combustion air should be ducted to the heater from outside the structure.

Outside Air Supply: When combustion air is supplied directly through an outside wall, each opening should have a minimum free area of one square inch per 4,000 BTU/h (1.2kW) input of the total input rating of all appliances in the enclosed area. If air is provided through horizontal ducts, each opening and duct must provide one square inch of flow area for each 2000 BTU/h (0.6 kW). These requirements are summarized in Table 2. Note that the areas specified are net free areas and should be increased when the openings are covered by screens, louvers, grills or other protective covers (see Figure 7 and Table 2 notes).

Note: In Canada, follow Canadian Standard, CAN/CGA-B149.1, .2 or local codes.

Exhaust Fans or Vents: Any equipment which exhausts air from the room where the heater is installed can deplete the combustion air supply or reverse the natural draft action of the venting system. This could cause flue products to accumulate in the room. Additional air must be supplied to compensate for such exhaust.

The information in Table 2 is not applicable in installations where exhaust fans or blowers of any type are used. Such installations must be designed by qualified engineers.

The heater must be completely isolated and protected from any source of corrosive chemical fumes such as those emitted by trichlorethylene, perchloroethylene, chlorine, etc.

⚠ WARNING

Do not store any chemicals, cleaners, or other corrosive material near combustion air openings or in the room. Avoid locating dryer vents in the vicinity of combustion air openings. Failure to prevent corrosive materials from mixing with combustion air can result in reduced heater life and unsafe heater operation.

⚠ AVERTISSEMENT

Ne pas entreposer ni utiliser d'essence ni d'autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.

3.2 Exhaust Venting

When converted to indoor and outdoor shelter venting configuration, the LX and LT Low NOx heaters have a vent collar fitting. The diameter of the vent collar and, thus, the minimum diameter of the vent pipe to be used is determined by the model of heater installed. **The only correct procedure for vent pipe sizing is to do so in accordance with Table 3 and the applicable installation code as stated in the following "Danger" warning.**

Table 3. Vent Pipe Sizing Table

LX/LT Low NOx Model	Vent Pipe Diameter	
	inch	(cm)
250-L	7.0	17.8
400-L	9.0	22.9

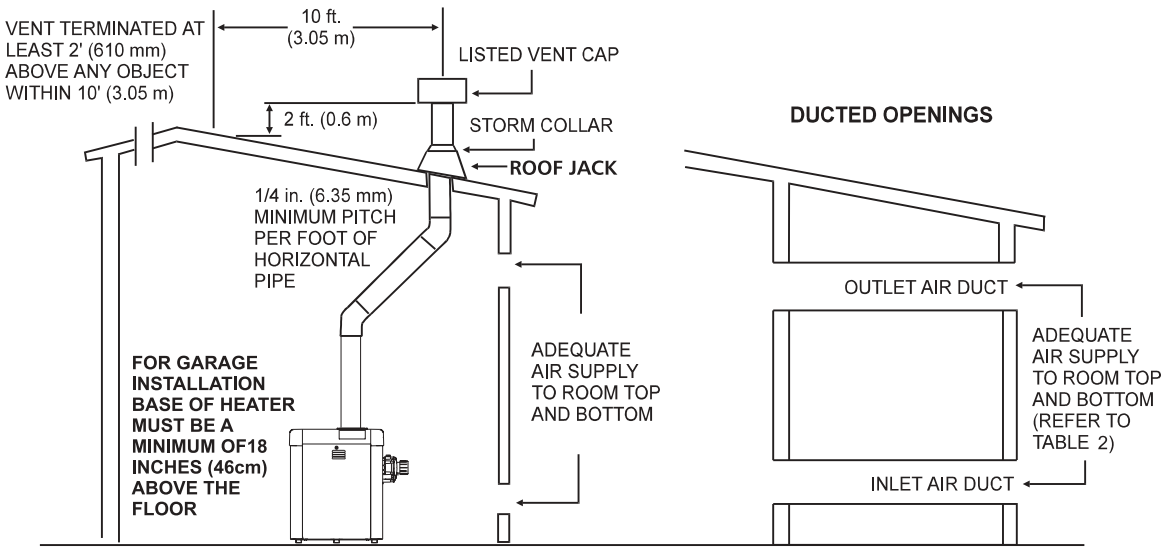


Figure 7. Indoor Installation Venting (USA), or Outdoor Shelter (Canada).

⚠ WARNING

Vent pipe diameter must be as required by the National fuel Gas Code Z223.1 or the Canadian Installation Codes for Gas Appliances CAN 1-B149.1 & 2. Undersize pipe can result in inadequate venting and oversize pipe can result in vent condensation. In either case the result can be release of combustion products to the indoors. This can cause serious injury or death by carbon monoxide poisoning or asphyxiation.

3.3 Vent Pipe Sizing and General Installation

As part of their certification, the LX and LT Low NOx heaters have been determined to be a Category I Fan-Assisted appliance. They are intended for standard vertical venting per tables provided in most local codes for Category I Fan-Assisted appliances. If the local code does not include such tables, refer to the National Fuel Gas Code Z223.1 or the Canadian Installation Codes for Gas Appliances CAN 1-B149.1 & 2. Note that the tables for fan-assisted appliances include both maximum and minimum vent loading figures. The primary purpose of the maximum ratings are to assure that the vent operates with negative pressure throughout its length. The minimum ratings are to assure that vent gases don't cool too much and thereby assure that condensation doesn't occur.

3.3.1. Outdoor Installations

For outdoor installations, exhaust venting considerations will determine the placement of the heater (See Section 2.3.4). If the heater cannot be placed so as to meet the requirements stated in Section 2.3.4, a vent collar may be added to the heater to move the exhaust vent opening to a position that complies with the requirements. In all cases, vent collars must be of the same diameter as the exhaust outlet of the heater. Approved vent collars may be obtained through your Laars distributor.

3.3.2. Indoor and Outdoor Shelter Installations

All indoor installations and outdoor shelter installations require the addition of a factory approved vent collar. The vent collar must be installed without modification.

All vent installations must be made in accordance with all local, state or provincial codes and with:

1. Chapter 7, " Venting of Equipment" of the national Fuel Gas Code, ANSI 223.1 latest edition, or the applicable provisions of the local building codes.
2. In Canada, CAN/CGA B149.1 or .2.

Avoid terminating heater vents near air conditioning or air supply fans. The fans can pick up exhaust flue products from the heater and return them inside the building, creating a possible health hazard.

Do not locate the vent terminal where flue products could strike against building materials and cause degradation.

Vent opening should be well away from trees or other obstructions that would prevent free air flow to and from vent terminal. Do not terminate the vent under decks, stairways, or car ports.

Be sure to support all venting so that connections will not separate and so that the weight of the vent pipe does not rest on the heater vent collar. All connections should be made with rustproof sheet metal screws. Do not weld or fasten the vent pipe to the heater vent collar. The vent collar and heater top must be easily removable for normal heater service and inspection.

The vent collar outlet is to be connected to an unobstructed vent pipe of the same diameter, terminating outside the building. The vent must terminate at least two (2) feet (0.6 m) above the highest point of the roof or other object that is within ten (10) feet (3.0 m) of the vent termination. The vent pipe must have a listed vent cap which allows a full equivalent opening for flue products (see Figure 7).

Type “B” double wall or equivalent vent pipe is recommended. However, single wall metal vent pipe may be used as specified in the latest edition of the National Fuel Gas Code ANSI Z 223.1 or in Canada CAN/CGA-B149.1 and B149.2

IMPORTANT NOTE: Do not use sheet metal screws at the snap lock joints of Type B gas vents.

When venting multiple appliances through one common duct, each appliance must have it's own vent temperature limit switch. All vent limit switches must be wired in series so as to prevent any appliance from firing in the event of a blocked vent. Refer to ANSI Z223.1 or, in Canada, to CAN/CGA B149.1 or 2 for more information on multiple venting.

SECTION 4. Gas Connections

4.1 Gas Supply and Piping

Review the following general instructions before continuing the installation.

⚠ WARNING
The Laars LX and LT Low-NOx pool and spa heater was designed for use only with natural gas. **DO NOT ATTEMPT TO CONVERT THIS HEATER FOR USE WITH ANY OTHER TYPE OF FUEL.**

1. Gas piping installation must be in accordance with the latest edition of ANSI Z223.1 and all local codes. In Canada, the installation must be in accordance with CAN- B149.1 or .2 and all local codes that apply.
2. Check the gas supply to be sure that only natural gas will be used to supply the heater. Laars LX and LT Low NOx heaters, as shipped from the factory, are certified to operate at an altitude of 0 to 3000 feet (0 to 915 m) for natural gas in the U.S. and 0 to 2000 feet (0 to 610 m) in Canada.

⚠ CAUTION
Permanent damage to the gas valve will occur if the following procedures are not followed.

3. Use the figures in Table 4 to size the gas inlet piping from the gas meter to the heater. Check all local codes for compliance before installing the heater.
4. Install a sediment trap (drip leg) ahead of the gas controls (see Figure 8). Fit the trap with a threaded cap which can be removed for cleaning.
5. Install a manual gas shutoff valve for service and safety. Do not use a restrictive gas cock. DO NOT USE FLEXIBLE GAS PIPING, it will restrict the gas flow to the heater.
6. 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.
7. If the gas supply pressure is less than required, check for undersized 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 5.

NOTE: The maximum inlet gas pressure must not exceed the specified value. The minimum value listed is for the purpose of input adjustment. Refer to Table 5.

8. To connect the gas supply line to the heater's gas valve, make sure the steel elbow (supplied with the manifold) is screwed into the inlet side of the gas valve. The heater is designed so that the gas supply line may enter through either side of the heater. Hand tighten the elbow until the desired orientation is achieved.

⚠ CAUTION
Do not overtighten the elbow. Over tightening will crack the gas valve. Do not use teflon tape to wrap the elbow threads.

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
Some leak test solutions (including soap and water) may cause corrosion or stress cracking. Rinse the piping with water after testing.

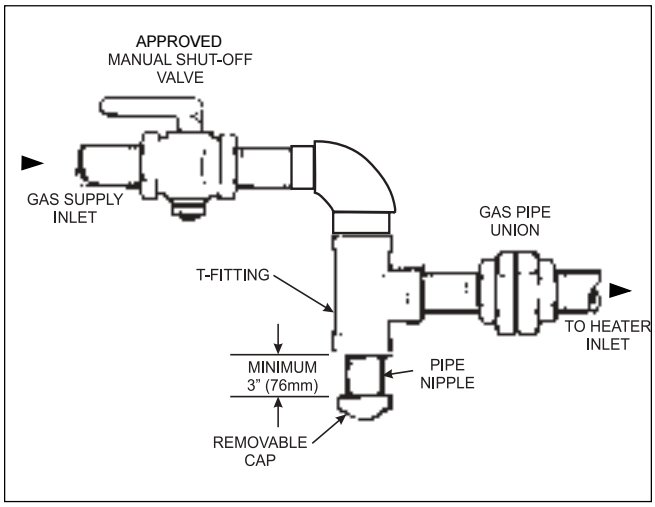


Figure 8. The Proper Design for a Sediment Trap/Drip Leg.

Table 4. Natural Gas Pipe Size Requirements

Heater Size	Distance from Gas Meter					
	0-50 feet (0-15 m)		50-100 feet (15-30 m)		100-200 feet (30-60 m)	
	in.	(mm)	in.	(mm)	in.	(mm)
250	1	(25)	1-1/4	(32)	1-1/4	(32)
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 (13mm) water column pressure drop. Check supply pressure with a manometer, and local code requirements for variations.
2. Check supply pressure and local code requirements before proceeding with work.
3. Pipe fittings must be considered when determining gas pipe sizing.

Table 5. Gas Supply Pressure Requirements

Supply Pressure	Minimum	Maximum
Natural Gas	5.0 Inches WC (1.5 kPa)	10.5 Inches WC (2.7 kPa)
Manifold Pressure	Nominal	
Natural Gas	3.0 Inches WC (1.0 kPa)	

4.2 Manifold Pressure

Confirm that gas supply pressure is correct. If the gas supply pressure is less than required, check for undersized pipe between the meter and the heater, a restrictive fitting, or an undersized gas meter. Gas supply pressures to the heater, when it is operating, are listed in Table 5.

⚠ CAUTION
Manifold gas pressure for the LX and LT Low NOx heaters should be set at **3"** WC. Standard model LX and LT heaters use 4" WC.

The manifold pressure may be checked by connecting a manometer to the pressure port on the outlet side of the valve. The pressure will be zero when the heater is not running. When the heater is operating the manifold gas pressure should be 3.0" WC. To adjust the manifold gas pressure, first remove the slotted cap next to the inlet pressure port on the inlet side of the gas valve. Under the slotted cap is a slotted plastic screw which increases the manifold pressure when turned clockwise and decreases the manifold pressure when turned counterclockwise. After measurements, and adjustments if necessary, have been made, make sure to replace the 1/8" NPT gas valve plugs on the inlet and manifold pressure ports, and the cap on the manifold pressure adjustment screw. It is extremely important to replace these parts before leaving the installation. Failure to do so can result in damage to property or injury or death. *With the heater firing*, the pressure must be within the range shown in Table 5. Also check the pressure with the heater off.

SECTION 5. Water Connections

5.1 Water Piping

Figure 9 illustrates typical piping for pool equipment in pool/spa combination pools. With its electronic control, the LX and LT Low NOx heaters are particularly suited for this type of pool installation.

The heater must be protected from back-siphoning of water, which can result in dry starts. If there is any chance of back-siphoning, provide a check valve between the pool and the filter pump inlet.

Arrangement of pool system components other than as illustrated in these diagrams can affect the operation of the heater's water pressure switch. Location of the heater above or below the pool water surface can also affect operation of the switch. In general, the pressure switch can be adjusted to accommodate this effect if the heater water connections are

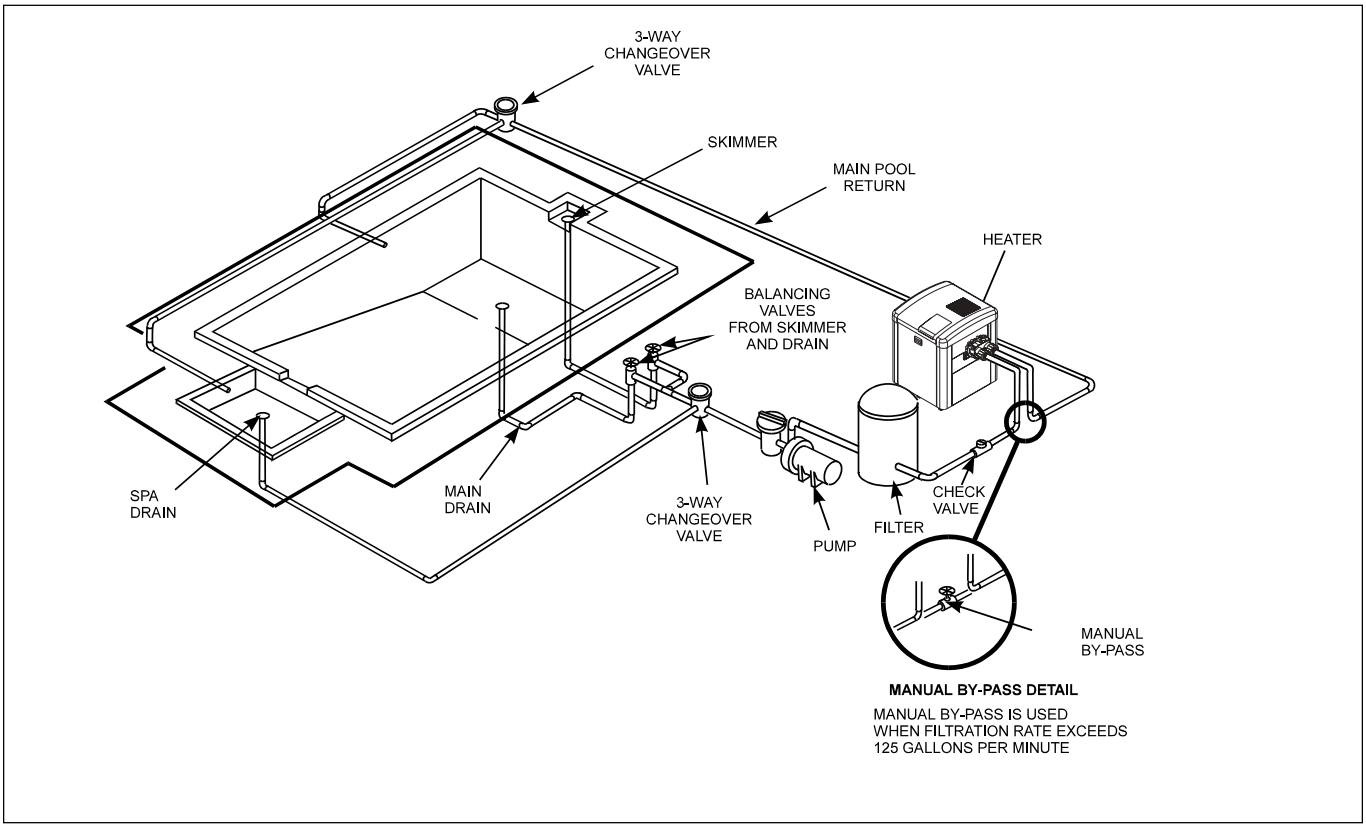


Figure 9. Typical Piping Installation.

no more than six feet below the pool water surface and no more than 15 feet above it. See instructions for pressure switch adjustment (Section 7.5) for more information about this.

Note that when pool equipment is located below the pool surface a leak can result in large scale water loss or flooding. Water Pik Technologies cannot be responsible for such water loss or flooding or the damage caused by either occurrence.

5.2 Check Valve Installation

For normal installations, do not install a shutoff valve or any kind of variable restriction in the water piping between the heater outlet and the pool/spa.

Install a check valve if there is any chance of back-siphoning when the pump stops. Do not install any other valve in the piping between the heater outlet and the pool, unless it is being used as a diverter valve. For special installations such as water connections below the water level of the pool, or for other questions contact the Water Pik Technical Service department at (707) 776-8200 ext. 260.

5.3 Automatic Flow Control Valve

The inlet/outlet header of the LX and LT Low NOx heater comes equipped with an 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) (475 liters per minute [LPM]). If the filter system flow rate is higher than approximately 125 GPM (475 LPM), install a manual bypass valve (see Figure 9), then perform a temperature rise test (see Section 7.6) and adjust the flow using the bypass valve until the proper temperature rise is obtained.

5.4 Reversible Water Connections

The LX and LT Low NOx heaters are shipped with water connections on the right side, but they can be modified in the field to provide left-side water connections. This procedure involves removing the heat exchanger headers and reinstalling them on opposite ends of the tube assembly. Some of the heater wiring and control components must be relocated, so this procedure must be done only by a trained service technician.

Heat exchanger reversals are generally done before the installation of power and water to the heater. If you need to reverse the heat exchanger on a previously installed heater be sure that all electrical power, the gas supply and water supply have been turned off before starting the procedure. These instructions have been written to include the steps needed when reversing the water connections on an existing installation. If you are reversing the headers on a new installation, some steps will be ignored. Water connection reversal is illustrated in Figures 10 and 11. Proceed as follows:

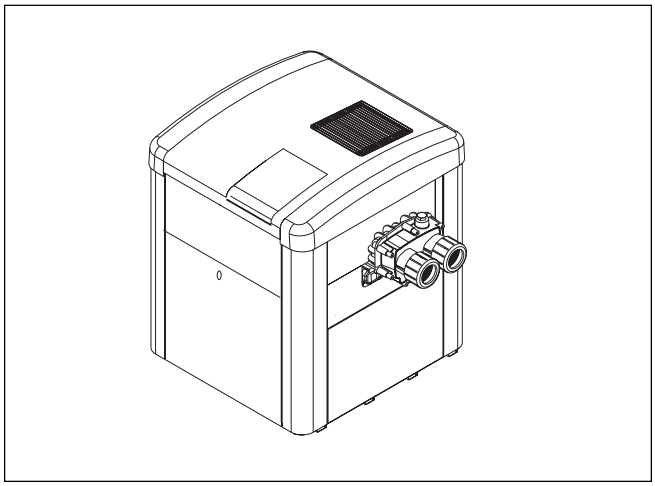


Figure 10. Water Connections as Shipped

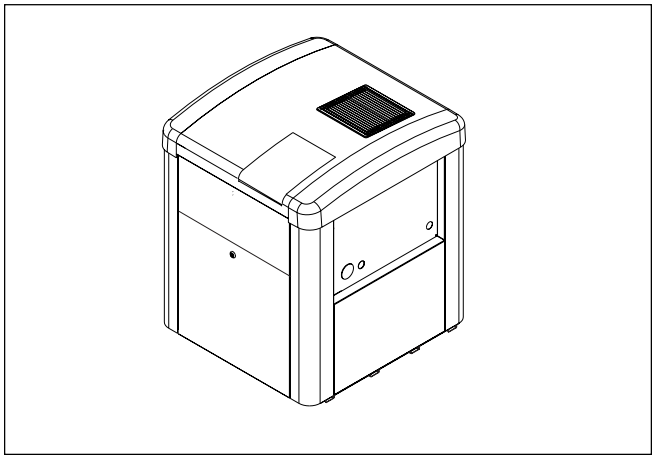


Figure 11. Water Connections Reversed

1. For an existing installation, drain the heater by removing the drain plug on the inlet/outlet header and the two drain plugs on the return header.

2. Remove the heater front panel (door).

3. Remove the two hex head screws that hold the raceway cover in place. They are located on the bottom flange of the raceway cover. Slide the raceway cover down to expose the raceway.

4. Remove the control panel assembly from the top panel (see figure 12 for panel identification). Lift the control panel cover. Remove the two philips head screws located at the front edge of the bezel. Lift the front of the bezel up until the entire assembly comes away from the top. Without removing any wires, slip the control assembly through the hole so that when the top is removed, the control assembly will stay with the heater.

5. Remove the four philips head screws that fasten the vent grill to the top. Remove the vent grill.

6. Remove the top. Remove the two hex head screws at the upper corners of the raceway. Now lift up on the front of the top and push it toward the rear of the heater. The top will slide off the heater.

7. Remove the water pressure switch's copper siphon loop tube from the header by first loosening the brass nut at the pressure fitting. Then carefully pull the tube out of the fitting. There should be about two inches of tubing inside the header. Be careful not to create any kinks in the tubing when handling it.

8. Clip the wire tie that bundles the wire harnesses leading from the control panel. Disconnect the two black temperature sensor wires from the back of the control panel. Coil the wires and place them on top of the flue collector.

9. Disconnect the high limit switch black wires from the wire harness leading to the control panel. There are quick disconnects at the end of the wires.

10. Remove the flat inlet/outlet header side cover plate located under the inlet/outlet header. There are four philips head screws, one in each corner, holding it in place.

11. Slide the upper right side panel up and out of the corner posts and place it aside.

12. For an existing installation, disconnect the gas supply pipe from the gas valve and remove it from the heater.

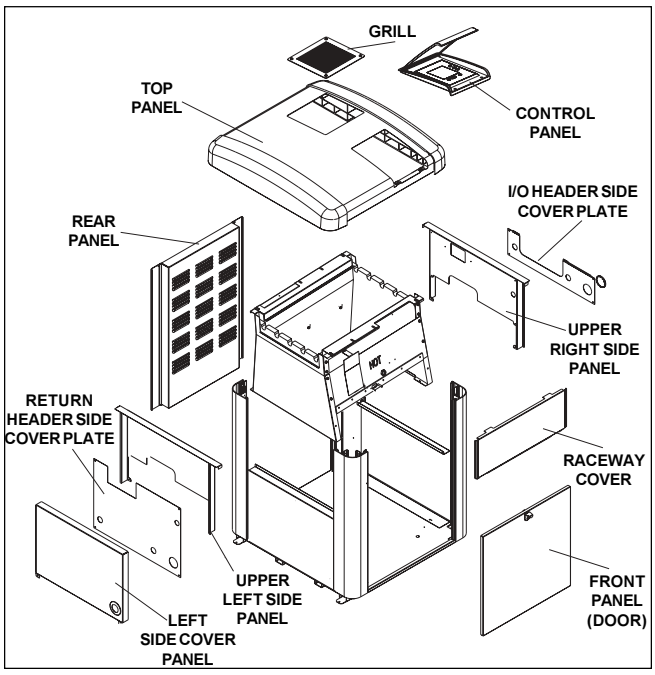


Figure 12. LX/LT Panel Identification

13. Remove the left side cover panel, held to the lower panel with two philips head screws at the corners.

14. Remove the flat return header side cover plate to expose the return header by removing the four philips head screws, one in each corner.

15. Slide the upper left side panel up and out of the corner posts and place it aside.

16 For an existing installation, remove the coupling nuts from the header and disconnect the water supply from the heater.

17. Remove the nine (9) bolts and washers from the inlet/outlet header and remove the header from the tube assembly.

18. Remove the nine (9) bolts and washers from the return header and remove the header from the tube assembly.

19. for an existing installation, inspect the header gaskets and clean the header's mating surface of any corrosion or debris. **Do not use any metal tools on the header surface.** Scratches may compromise the seal integrity.

20. Place the inlet/outlet header over the gasket on the left side of the tube assembly and align the holes in the header with the holes in the header bar.

21. Insert the nine (9) bolts with washers through the header and into the header bar. **Hand tighten the bolts.**

22. Place the return header over the gasket on the right side of the tube assembly and align the holes in the header with the holes in the header bar.

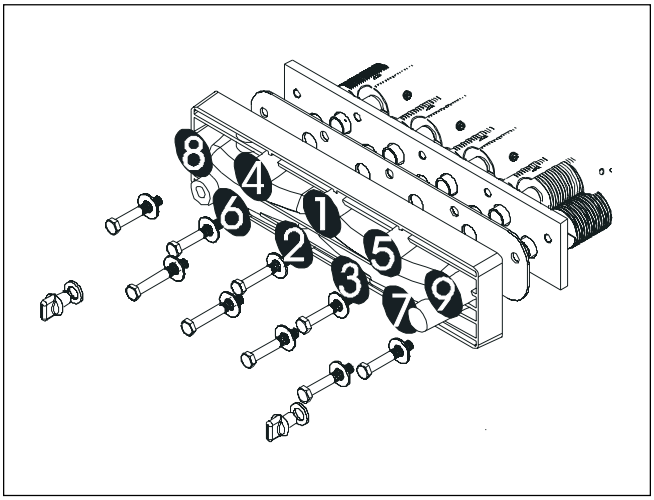


Figure 13. Header bolt tightening sequence.

23. Insert the nine (9) bolts with washers through the header and into the header bar. **Hand tighten the bolts.**

24. Use a torque wrench to tighten the bolts on each header to eleven (11) foot-pounds. The bolts must be tightened in the sequence indicated in figure 1.

25. After completing the entire sequence as indicated in step 21, repeat the tightening sequence torquing the bolts to eighteen (18) foot-pounds.

⚠ CAUTION
Failure to tighten the header as indicated in steps 24 and 25 may cause the header to leak or become permanently damaged from warping.

26. Carefully bend the water pressure switch's copper siphon loop tube so that it reaches the inlet/outlet header now on the left side of the heater. **Do not** straighten out the coil directly behind the raceway and **do not** "kink" the tubing. Straightening the coil or kinking the tubing may result in poor heater operation. Insert the end of the tube into the fitting on the header. Tighten the nut onto the fitting one half turn past hand tight.

27. Route the wires that attach to the high limit switches along the copper siphon loop, back to the right side of the heater. Reconnect the wires to the wire harness.

28. Route the wires that attach to the temperature sensor along the copper siphon loop, back to the right side of the heater. Reconnect the wires to the tabs on the back of the control panel (marked as J4-1 and J4-2).

29. Use plastic wire ties to refasten the temperature sensor and high limit switch wires to the copper siphon loop. Bundle the wires near the control panel and fasten them with a wire tie.

30. Slide the upper right side panel back into the corner posts on the right side of the heater. Push it down until the tabs on the panel lock into the top of the corner posts.

31. Install the flat return header side cover plate (removed from the left side of the heater) on the right side to cover the return header by replacing the four philips head screws, one in each corner.

32. Slide the upper left side panel back into the corner posts on the left side of the heater. Push it down until the tabs on the panel lock into the top of the corner posts.

33. Remove the button plug from the inlet/outlet side cover plate.

34. Reinstall the inlet/outlet header side cover plate located under the inlet/outlet header. It is held with four philips head screws, one in each corner.

Note: Only the small tab of the top groove will fit behind the upper panel.

35. Remove the button plug type washer from the left side cover panel. This panel will not be used in reassembling the heater after a heat exchanger reversal. However, the button plug washer will be needed. **Do not** replace the cover panel over the vent switch outlet. Doing so may cause the heater to malfunction.

36. The gas line may enter the heater from either the left side or the right side. Replace the button plug washer in the hole through which the gas line will enter the heater.

37. Use the button plug to cover the hole on the opposite side of the heater.

Note: Be sure that the white fiber gasket is positioned on the top flange of the exhaust vent.

38. Replace the top. While positioning the top, pull the control panel through the hole and place it on top of the panel. Be sure that the flange at the back of the top panel slides under the flange on the rear panel to hold the top securely. Fasten the top to the heater by replacing the two hex head screws at the upper corners of the raceway.

39. Position the vent grill over the exhaust vent. Replace the four philips head screws that fasten the vent grill to the top.

40. Reinstall the control panel assembly into the top panel. Slide the back of the bezel into place, then lower the front, aligning the holes in the bezel with the holes in clips on the tabs on the top panel. Replace the two philips head screws located at the front edge of the bezel.

41. Slide the raceway cover up to the top of the heater. Be careful not to pinch any wires. Replace the two screws on the bottom flange to hold the cover in place.

42. Replace the front panel (door).

5.5 Connections at Heater

The LX and LT Low NOx heaters have a standard two (2) inch water header and coupling design. With this feature, only nominal two inch PVC or CPVC may be connected to the heater. However, by installing the appropriate pipe adapters and two short pieces of two inch plastic pipe (supplied by the installer), any size existing pipe may be fitted to the heater.

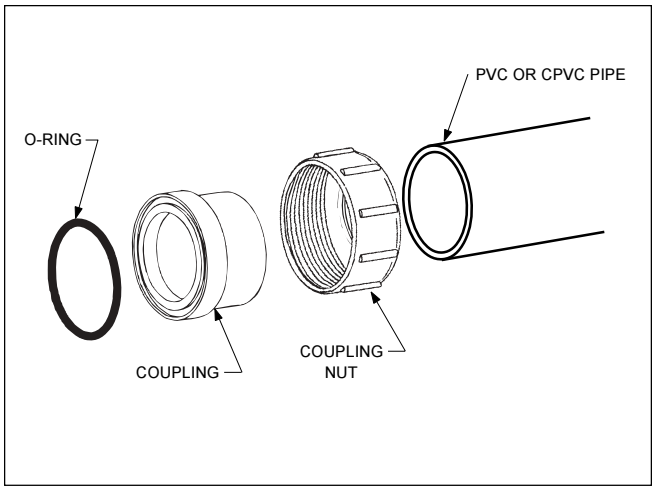


Figure 14. Piping to Heater

To connect a section of 2" PVC or CPVC pipe to the heater, first slip a coupling nut onto the pipe. Then prepare the end of the pipe with the proper PVC/CPVC primer and glue. Follow the manufacturer's instructions provided with the primer and glue for preparation procedures and curing times. Apply the slip-fit side of the coupling to the end of the pipe. Allow the glue to cure completely. Set the o-ring into the groove on the face of the coupling. Slide the coupling nut up to the coupling and tighten it to the threaded connection on the header (see Figure 14).

5.6 Pressure Relief Valve

A pressure relief valve (PRV) is recommended in all installations, and is mandatory in any installation in which the water flow can be shut off between the heater outlet and the pool/spa.

A pressure relief valve is not supplied with the Laars LX and LT Low NOx heaters. However, it is recommended that a pressure relief valve be installed and may even be required by local codes.

The pressure rating of the valve should be at or below the lowest working pressure of any component in the system. Any pressure relief valve installed must comply with provisions of the standard described in ANSI Z21.22 for the United Sates of CAN1-4.6 in Canada.

To install a pressure relief valve, do the following:

1. To protect the threads while drilling, screw the brass adapter (included with the Water Pik Technologies PRV kit) into the blind threaded hole on the top of the inlet/outlet header.

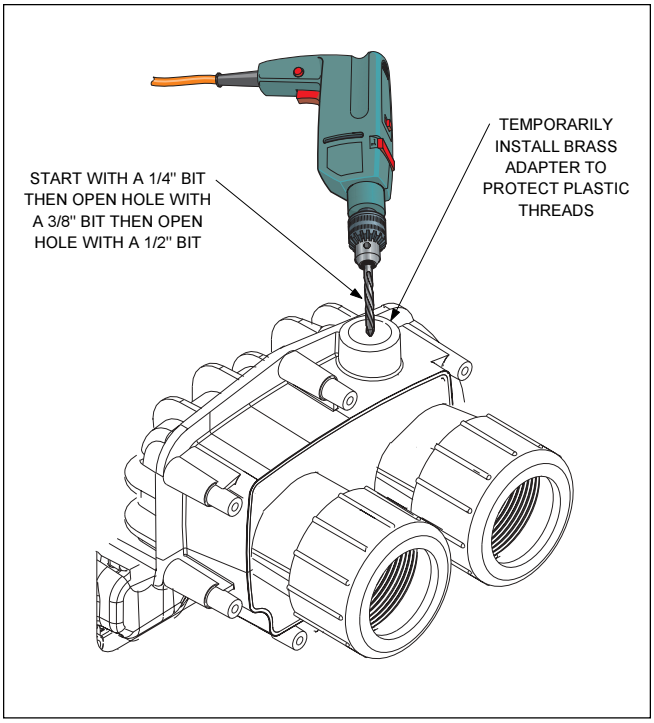


Figure 15. Drill Hole for Pressure Relief Valve

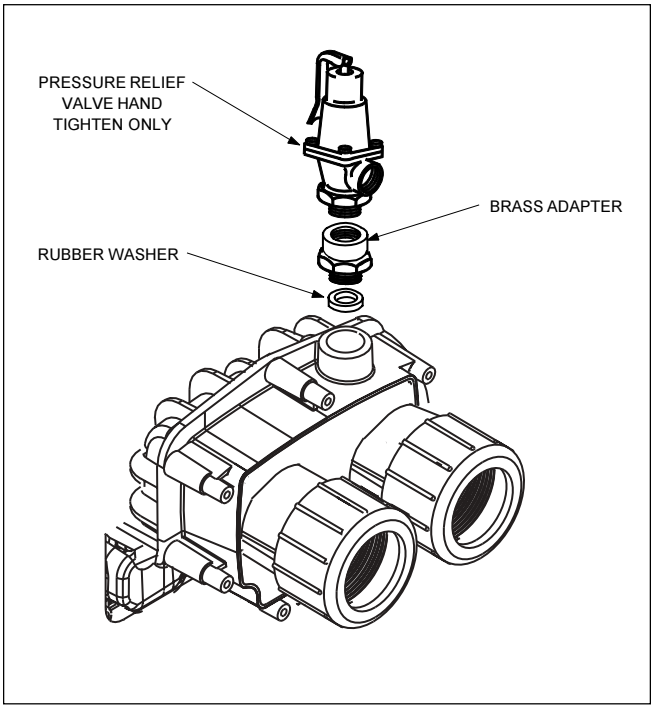


Figure 16. Pressure Releif Valve Installation

2. Using the countersink in the center of the blind hole as a guide, drill a 1/4 inch hole through the plastic (see Figure 15).

3. Open the hole by reaming it with a 3/8 inch drill bit.

4. Open the hole again by reaming it with a 1/2 inch drill bit.

⚠ CAUTION

Initially drilling a 1/2" hole without reaming may cause the bit to "grab" on the plastic. This may cause personal injury or damage the plastic header.

5. Remove the brass adapter and clean the cuttings out of the hole.

6. Install the rubber washer at the bottom of the hole (see Figure 16).

7. Thread the adapter into the hole and tighten so that it seals against the rubber washer.

8. With a permanent marker, place a mark on the adapter so that the mark faces the same direction as the water connections on the header.

9. Remove the adapter from the hole.

10. Coat the threads of the pressure relief valve (PRV) with an appropriate metal to metal thread sealant.

11. Install the adapter on the PRV and tighten using two wrenches. Use the mark made earlier on the adapter to orient the PRV to the desired direction in relation to the water connections on the header.

12. Wrap the threads of the adapter with a suitable teflon thread tape.

13. Reinstall the adapter, with the PRV, into the plastic threaded hole and tighten it until the mark on the adapter is once again facing the same direction as the water connections on the header.

⚠ CAUTION

Do not use any pipe compound or pipe dope on the threads of the adapter or any part that comes in contact with the plastic headers. These compounds may damage the header over a period of time.

DO NOT TIGHTEN WITH A WRENCH.

Overtightening may crack the header. Route the discharge piping so that steam from the pipe does not endanger anyone near the heater. Refer to your local installation codes for more detailed information. The valve setting should be at or below the maximum working pressure of any component in the filter system. The working pressure of the LX and LT Low NOx heater is 75 psig.

5.7 Auxiliary Components, Chlorinators, Ozone Generators, and Sanitizing Chemicals.

The LX and LT Low NOx heaters are manufactured with materials that are not compatible with high concentrations of ozone, chlorine, bromine, or other sanitizing chemicals. Heater damage caused by excessive chemicals or improper ozonization is not covered by the Laars warranty. Be sure to adhere to the following:

- When ozone is injected upstream of the heater, install an offgas mixing chamber, or an ozone bypass system between the heater and the ozone injector to prevent ozone and air from entering the heater.
- When chemical feeders are used, plumb the feeder downstream of the heater and install an in-line check valve between the heater and the feeder (a minimum of 18" is required between the heater and the check valve).
- Wire any electrical chemical feeder so that it cannot operate unless the filter pump is running. If the feeder has an independent clock control, synchronize it with the filter clock.
- Never deposit chemicals directly in the pool skimmer.

SECTION 6. Electrical

⚠ CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.
Verify proper operation after servicing.

⚠ ATTENTION

Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Des erreurs de câblage peuvent entraîner un fonctionnement inadéquat et dangereux.

6.1 General Information

Wiring connections must be made exactly as showing in the wiring diagram found on the inside of the heater door (see Figure 18). The heater 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.

6.2 Main Power

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.

The heater comes factory-wired intended for use with 230 Volt, 60 Hz AC field electrical supply. To use 115 Volt, 60 Hz AC requires the changing of the fifteen-pin connector assembly on the component raceway. This must be done by a certified electrician only, as with all wiring.

⚠ CAUTION

Do not provide power to the heater from the high voltage side of a time clock or pump relay. Doing so may cause damage to the heater or surrounding plumbing.

To wire the Laars LX and LT Low NOx heater to a 115V or 230V /60 Hertz (Hz) electrical source:

1. Remove the door of the heater.
2. Remove the screws that hold the raceway cover and allow the cover to slide down.
3. Connect the wires from the power source to the leads on the right side of the heater in the space behind the raceway. You may need to remove the control to gain access to the leads (See Fig. 17).

NOTE: No external junction box is required.

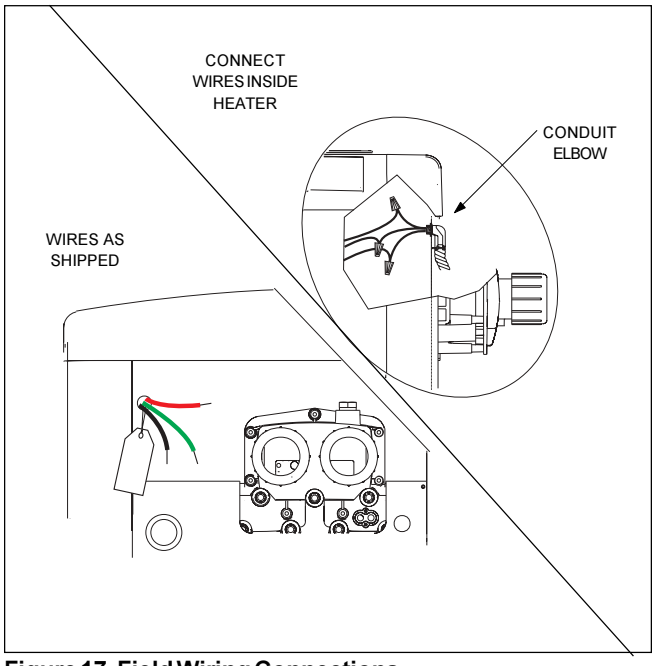


Figure 17. Field Wiring Connections

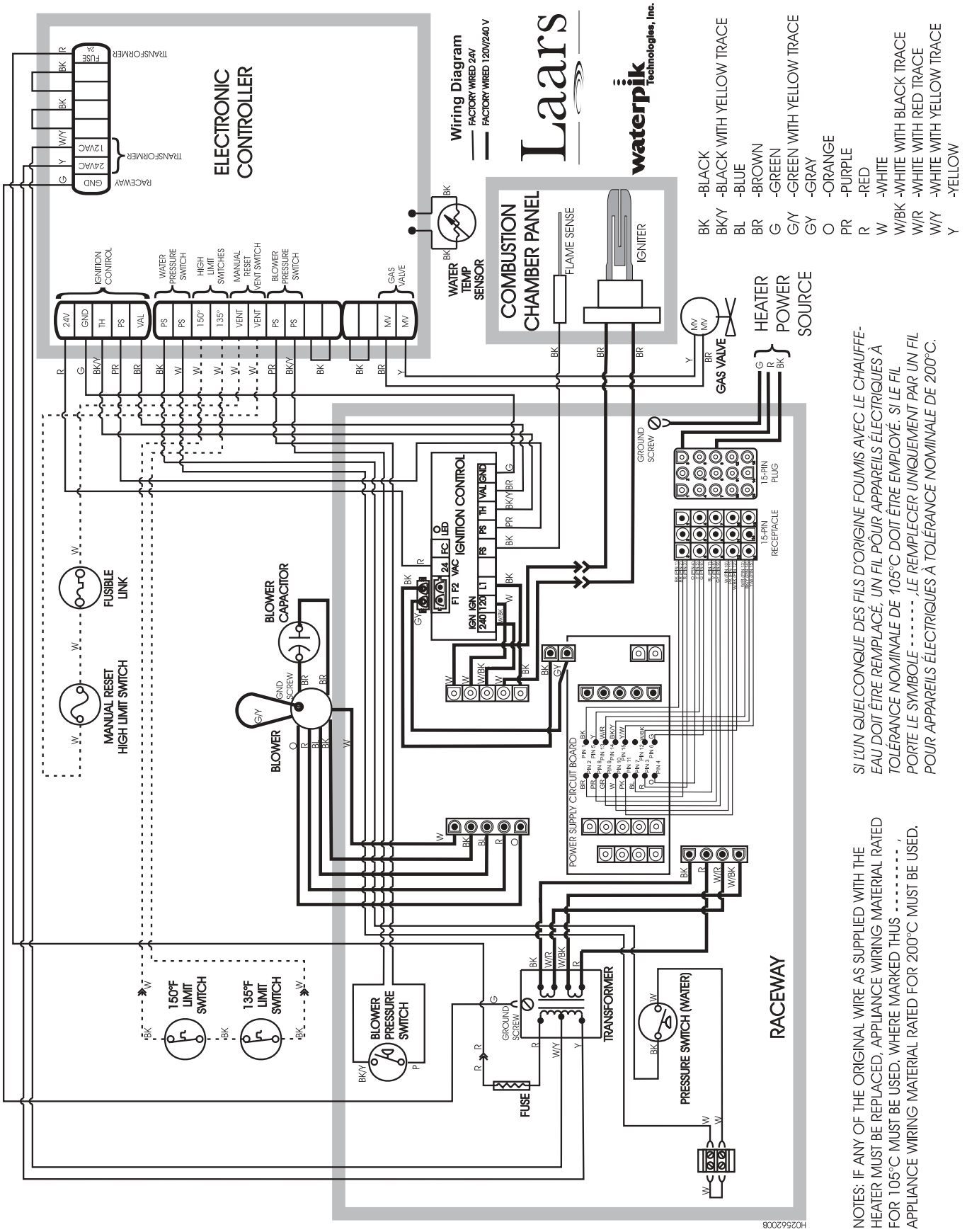


Figure 18. LX and LT Low NOx Connections/Schematic Wiring Diagram

6.2.1 Converting the Heater for a 115V Power Source

To convert the Laars LX and LT Low NOx heaters to 115 Volt, 60 Hz AC requires the changing of the fifteen-pin connector assembly on the component raceway. The following procedure should be performed **before** the heater is connected to a power source:

1. Remove the fifteen-pin connector from the receptacle located directly below the fan intake on the raceway. All the wires on the connector are red and the connector is marked "230V".

2. The fifteen-pin connector will have two wires that are routed behind the raceway and out the side of the heater. Pull the wires and the plug out of the heater.

3. Take the fifteen-pin connector assembly with the black wires from the installation and instructions package. It is marked "115V". Connect the two long wires to the two position terminal block. Either wire may be connected to either tab on the terminal block, the connections are not polarity sensitive.

4. Plug the fifteen-pin connector into the receptacle. The connector is keyed so it will fit in only one orientation.

6.3 Bonding

⚠ CAUTION
This heater must be connected to a bonding grid with a solid copper wire not smaller in diameter than 8 ga.

The National Electrical Code and most other codes require that all metallic components of a pool structure, including reinforcing steel, metal fittings and above ground equipment be bonded together with a solid copper conductor not smaller than a number 8 wire. The heater, along with pumps and other such equipment must be connected to this bonding grid. A special labeled bonding lug is provided on the right side of the heater to accommodate this requirement.

6.4 Auxiliary Time Clock Wiring

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

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.

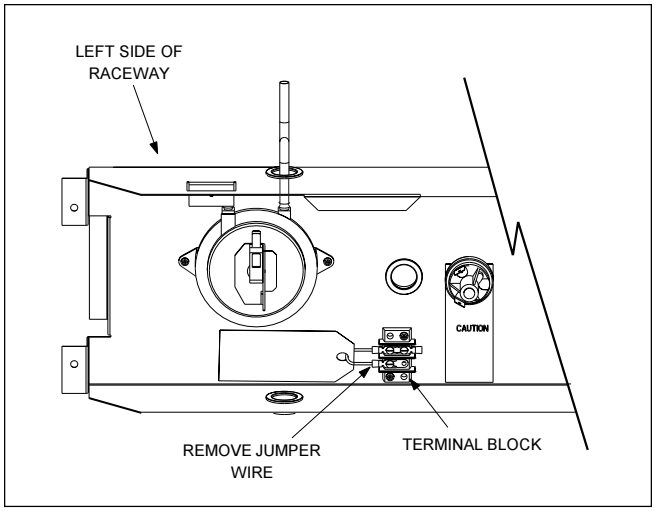


Figure 19. Remove Jumper from Terminal Block

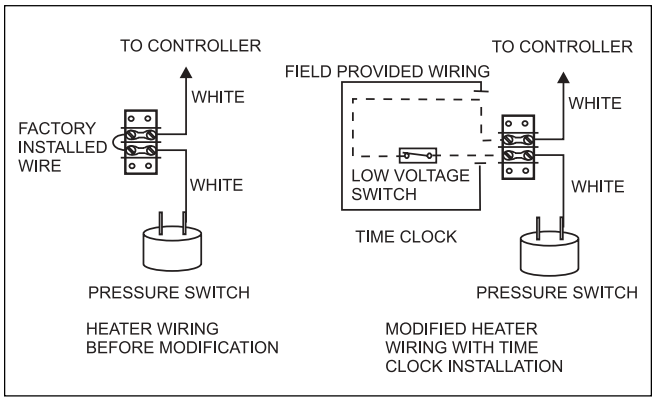


Figure 20. Typical Time Clock Wiring

To install a time clock auxiliary switch into the heater circuit, follow these instructions (see Figure 19):

1. Remove heater door.

2. Remove the factory installed jumper wire and tag from the terminal strip (see Figure 19).

3. Connect the low voltage 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 (see Figure 20).

If your time clock simply interrupts the high voltage power supply or has a high voltage output, **do not connect the power supply of the heater to the output side of the clock**. Doing so will prevent the blower from purging the residual heat from the heater when the heater turns off. This situation will damage the heater. The blower must be allowed to run for 45 seconds after the heater shuts off.

6.5 Remote Operation (Model LX Low NOx Only)

The Laars LX Low NOx pool/spa heater controls can be wired for remote operation. All Water Pik Technologies/Jandy RS Control Systems will permit the heater to be operated by remote control. If you are setting up a new pool or spa system, call your local distributor or the Water Pik Technologies/Jandy Customer Service Department for information on the correct RS Control System to meet your needs.

To connect a Laars LX Low NOx heater to an existing RS Control System, first determine the revision level the programmed chip in the RS Control System's Power Center Board. To check the revision level of the chip, press and hold the reset button on the side of the indoor control panel for 10 seconds then release it. A number will appear on the display for approximately 5 seconds. This first number can be ignored. After the first number disappears, a second number will appear in the display window. It will consist of 4 digits followed by a revision level ("#### REV _"). If the revision level displayed here is at "I" or higher it will accommodate a Laars LX Low NOx heater without any modification. If the chip is at a revision "H" or lower the chip will have to be replaced with a newer version. An alternate method for determining the revision level of the programmed chip in your RS control, is described in steps 1-4 below. An updated chip can obtained through Water Pik Technologies/Jandy by ordering the PPD Kit. Instructions for changing the chip are in the kit.

Do not connect more than two wires to any of the terminals in the RS Control System when connecting peripheral devices. If connecting the LX Low NOx heater to the RS Control System creates this situation, then a Multiplexing PCB kit must be used. Call your distributor or Water Pik Technologies to order the kit.

To connect the Laars LX Low NOx to your RS control System, follow the steps listed below (See fig. 21).

1. Turn off the power to the heater and the RS Control.

2. Open the RS Power Center Enclosure and remove the front dead panel.

NOTE: Only a revision "I", or higher, program chip in the RS system will support the LX Low NOx heater interface.

3. Remove the two screws holding the bezel in place. Turn the bezel over to view the circuit board on the back.

4. Locate the programmed chip on the Power Center Board (the larger square chip in the lower right corner of the circuit board). In the center of the chip is the revision letter. If the revision letter is "H" or higher go to step 5. If the revision level is "G" or lower, replace the chip. Directions for removal and installation of the chip are provided in the new PPD Kit .

NOTE: If ordering a new programmed chip, be sure to order the part number printed on the chip currently in your RS control .

5. Use 22 gauge 4-conductor wire (WP/J part # 4278) to run between the heater and the RS control, and match the wire color order.

6. The wires coming from the LX Low NOx heater can be “doubled up” on the red terminal bar with the four wires coming from the indoor controller.

NOTE: If you need to install more than two wires in each terminal, order a Water Pik Technologies/ Jandy Multiplex PCB Kit, which includes the Multiplex Board (WP/J part # 6584). Never put more than two wires into each of the pins of the terminal bar.

7. On the heater's electronic control board, verify that the water temperature sensor is connected (J4), and that jumper is in place on W0.

8. Check all wiring, then apply power to both the heater and the RS control system. Operation can be verified in either Service or Auto mode. See your RS Control System manual for instructions about operation.

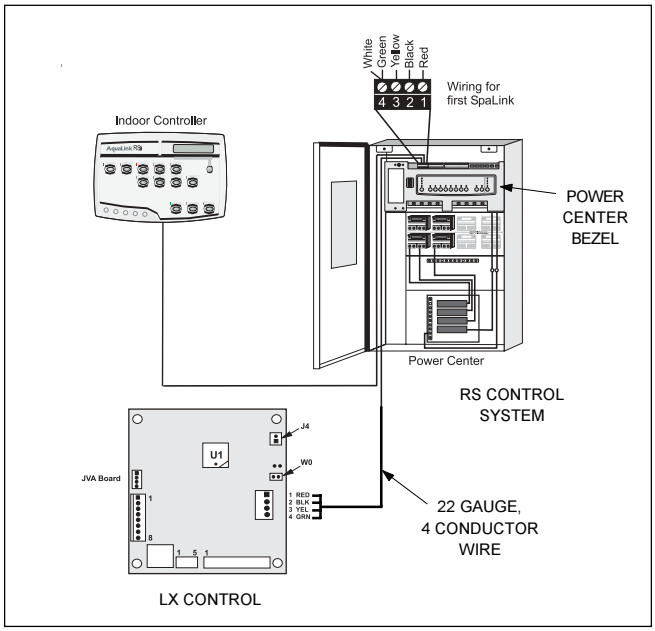


Figure 21. Wiring a Laars LX Low-NOx to a Jandy RS Remote

When the LX Low NOx heater is first powered, the display on the control will show "RS ONLINE". If there is an RS control connected to the heater, it will sense the RS unit and remain online. If an RS system is not connected to the LX Low NOx heater via the four conductor line, the message "RS ONLINE" will disappear after 15 seconds. When the display shows "RS ONLINE" all functionality of the control on the heater is disabled. The heater functions can be controlled only at the RS unit. However, sensor data is displayed at both the heater and the RS unit.

To temporarily use the heater controls, use a thin object to depress the button marked "RS SERVICE". The "RS ONLINE" indicator will disappear from the heater display. All functionality has now been returned to the control on the heater. In this mode the RS unit is no longer controlling the heater. To return the functionality to the RS unit, push the button again.

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 18) 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 perform any other function.

Consult with Water Pik Technologies Service Department with questions about installing remote controls manufactured by companies other than Water Pik Technologies.

SECTION 7. Operating Instructions

7.1 Normal Operation

The LX and LT-Low-NOx heaters are capable of automatic operation based on a call for heat at preset temperatures and an operator selection between pool or spa settings. Additionally, the heater may be controlled by a remote unit to anticipate bather load, changes in temperature settings, or a variety of other demands that might be encountered. The heater has an internal safety system which allows operation in a variety of conditions and prevents operation when certain adverse conditions are encountered. The heater is capable of diagnosing problems within the safety controls scheme, enabling faster service and less down time in the event of a failure.

When the heater is powered, water is flowing through the heater, and the temperature of the water entering the heater is below the temperature control setting, an operating cycle is initiated by the automatic control. The combustion blower is started and operates at high (normal) speed. If the blower pressure switch senses adequate airflow, the ignition sequence starts. First, a fifteen second pre-purge takes place. Next, the blower speed is reduced and the igniter is energized. After forty seconds of igniter heat-up time the gas valve is opened (approximately one minute after the call for heat). If flame is sensed at the burner within seven seconds, operation continues and the blower resumes high (normal) speed. Operation will continue until the temperature of the water entering the heater reaches the temperature control setting.

If ignition is unsuccessful, or if the flame fails during normal operation, the ignition control shuts off the gas valve. It imposes a post purge, initiates additional ignition cycles, and shuts down the system if ignition is not achieved in three cycles.

To reset the model LX Low NOx for another three cycles, press and release the mode button until the indicator on the LCD screen aligns with "OFF". Now press and release the button again until the indicator on the LCD screen aligns with the desired setting, either "POOL" or "SPA".

To reset the model LT Low NOx press and release the mode button until the indicator lights for the "SPA" and "POOL" settings are off. Then press and release it again until the indicator light for the desired setting is back on.

7.2 Start-Up

⚠WARNING

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

⚠ WARNING

Vent pipes, and heater tops get hot! These surfaces can cause serious burns. Do not touch these surfaces while the heater is in operation.

⚠ CAUTION

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

⚠ ATTENTION

N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.

⚠ CAUTION

Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the heater.

⚠ ATTENTION

En cas de surchauffe ou si l'alimentation en gaz ne s'arrête pas, fermez manuellement le robinet d'arrêt de l'admission de gaz.

⚠ CAUTION

Do not attempt repairs on the gas controls or appliance. Tampering is dangerous and voids all warranties.

⚠ CAUTION

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

Be sure that there is water in the pool and that the surface level is above the skimmer or other inlet of the pool's filter system.

Confirm that pool water is flowing normally through the pool system and equipment. 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. Start the heater in accordance with the Operating Instructions section of this manual, with particular attention to the lighting and shutdown instructions and temperature control operation.

The heater may not start on the first try. Air in the gas line or other start-up situations may cause it to cycle. It will lock out of ignition is not achieved in three attempts (see Section 9.2, "Service Codes"). To provide three additional attempts, use the mode button and follow instructions in section 7.1 to reset the controller.

When the heater starts, immediately feel the outlet header of the heater to confirm that there is adequate water flow. The header should not be hot. Normally, water temperature will rise only a few degrees as it passes through the heater, and a "hot" header or pipe indicates low water flow.

⚠WARNING

When the heater is fired for the first time, the combustion chamber refractory binder material is driven out by the heat of the flame. White smoke and/or sharp odors may be emitted from the vent during this period. Do not inhale combustion product fumes at any time, and especially when these fumes are being emitted. This "burn-in" period will last only a few minutes.

When raising the temperature of a cold pool, program the time clock to turn the pump off 23 hours after the start time (i.e. If the start time is 2:00 PM, then set the stop time at 1:00 PM.). 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.

7.3 Temperature Controls

The LX and LT Low NOx heaters have temperature controls that can be set to heat the pool and spa with independent temperature settings. The controls display information to indicate that the heater needs service, and diagnostic information for the service person (see Figure 22). The LX utilizes a liquid crystal display (LCD) screen to display the information while the LT uses indicator lights. The LX Temperature Control also displays pool/spa water temperature and allows for precise temperature settings of the heater.

The controls allow the heater to directly interface with all Water Pik Technologies/Jandy remote control units. The LX offers full remote control capabilities while the LT controls offer limited remote control.

Important: The temperature controls cannot be calibrated in the field. If the control is faulty, shut down the heater by following the procedures in Section 7.4 and have a qualified service technician replace the control. DO NOT use the thermostat switch to completely shut down the heater.

7.3.1 Information Displayed

The **Model LX** displays information on a **L**iquid **C**rystal **D**isplay (LCD) screen. The temperature control displays the water temperature of the pool or spa as well as the desired temperature (thermostat setting) in either Fahrenheit or Celsius. When there is water flowing through the heater (the filter pump is on), the water temperature is displayed in the rightmost of two bar graphs in the center of the screen. This bar graph is labeled as 'Water Temp'. The selected thermostatic setting (either Pool or Spa) is displayed as a bar graph directly to the left of the water temperature bar graph. This bar graph is labeled as 'Thermostat Setting'. Note that when neither thermostat is selected (the heater is in off mode) only the water temperature is displayed.

If there is no water flowing through the heater (the filter pump is off), then only the thermostat setting for the mode selected, pool, or spa, will be displayed.

The **Model LT** heater does not display water temperatures or thermostatic settings.

When the heater is unable to operate due to a problem, the temperature control will identify which limit is not satisfied. The **Model LX** displays this information on the left side of the LCD under the

LAARS LX logo. When the gas heater is firing, the LCD displays ‘Heating’ under the LAARS LX logo toward the center of the upper portion of the screen.

The **Model LT** displays this information by lighting a set of indicator lights located on the front of the control panel.

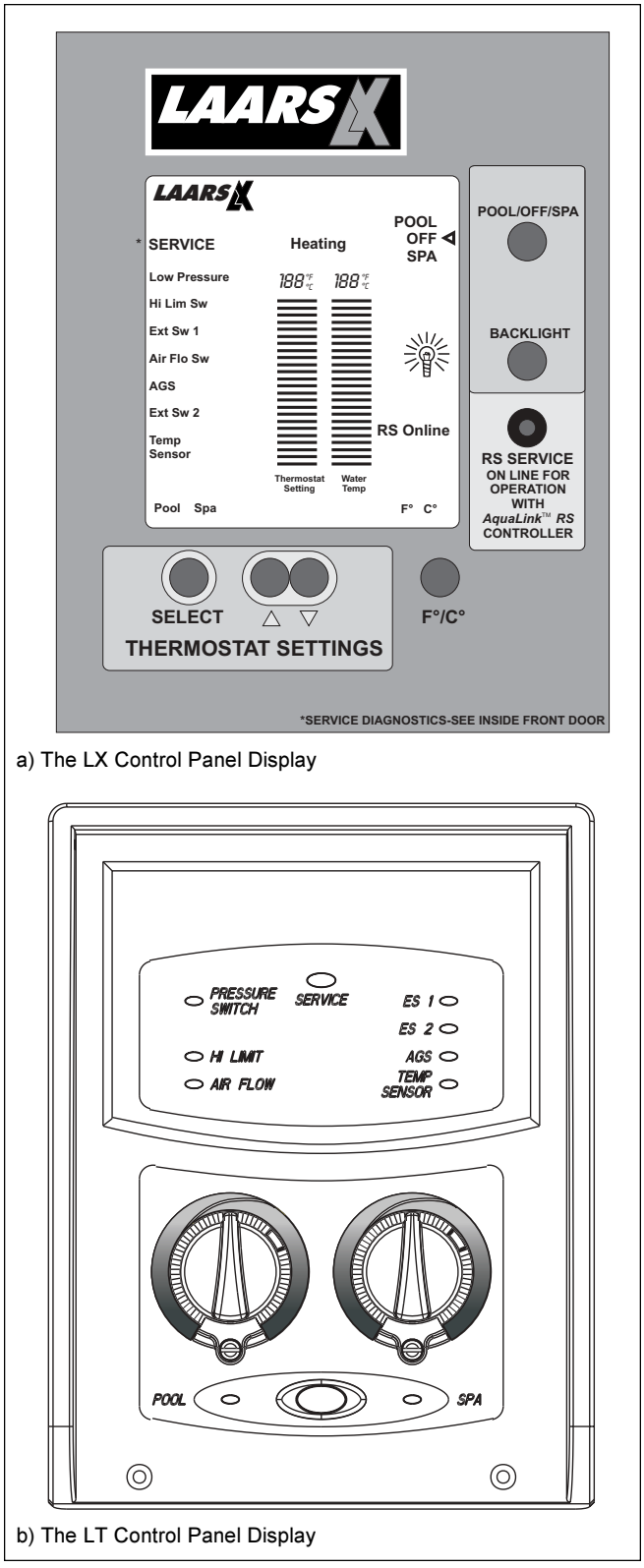


Figure 22. Temperature Control Panel

On the upper right-hand portion of the LCD screen on the **Model LX** is a selector arrow. Directly to the left of the selector arrow are three positions. They are ‘POOL’, ‘OFF’, and ‘SPA’. This part of the display indicates the mode of operation in which the heater is set.

The mode of operation of the **Model LT** is shown by two indicator lights labeled "SPA" and "POOL"

Underneath the mode selector on the **Model LX** display screen is a Backlight indicator. To turn the backlight on, press the middle button to the right of the screen, labeled "Backlight".

Below the Backlight indicator is an RS service indicator, which displays ‘RS Online’ when the heater is connected to an RS unit.

Directly below the RS Service indicator on the bottom right hand portion of the LCD screen is the Fahrenheit/Celsius temperature unit indicator.

The **Model LT** does not offer these features.

7.3.2 Turning the Heater On or Off

When power is supplied to the **Model LX** heater, the control goes into a diagnostic mode for approximately 15 seconds before the heater can be turned to the Pool or Spa mode. During this time the display will show "RS Online". If there is an RS control connected to the heater, it will sense the RS unit and remain online. If the control is not connected to an RS unit the "RS Online" indication on the display will disappear after the initial 15 seconds. When the display shows "RS ONLINE" all functionality of the control at the heater is disabled. The heater functions can be controlled only at the RS unit. However, sensor data is displayed at both the heater and the RS unit.

To temporarily use the heater controls when online with an RS control unit, use a thin object to depress the button marked "RS SERVICE". The "RS ONLINE" indicator will disappear from the heater display. All functionality has now been returned to the control at the heater. In this mode the RS unit is not controlling the heater. To return the functionality to the RS unit, push the button again.

When power is first supplied to the **Model LT** heater, it also runs through a circuit board diagnosis to make sure that the control is working correctly. Indicator lights will flash during the 10 second diagnostic sequence.

After the initial diagnostic sequence on the **Model LX**, the heater can be turned to Pool or Spa mode by pressing and releasing the top (mode) button to the right of the LCD screen so that the selector arrow is aligned with either the Pool or Spa setting as seen on the LCD screen.

The **Model LT** heater does not offer the remote control indicator function. To turn the heater on, press and release the button located between the "POOL" and "SPA" indicator lights. Repeat pressing the button

to achieve the desired mode of operation, shown by the indicator lights. When neither light is on, the heater is "OFF"

It is now necessary to set the thermostat to the desired pool or spa setting.

7.3.3 Setting Pool and Spa Temperatures, Changing from Fahrenheit to Celsius

The **Model LX** heater displays temperature in Fahrenheit units when powered-up. To switch to Celsius, press the 'F°/C°' button. Once the desired temperature units are selected, the thermostat can be set. The left-most button below the LCD screen, labelled "Select", will select either the Pool or the Spa thermostat when depressed. Either "Pool" or "Spa" will be displayed in the bottom left corner of the LCD screen. The 'up' and 'down' buttons will increase or decrease the thermostat setting.

The **Model LT** heater control is less quantitative and less automatic. The pool or spa water temperature will need to be monitored manually when the control is adjusted. Temperature adjustments are made by turning the knob associated with the mode labeled below it. Turning the knob clockwise will increase the temperature setting. Turning it counterclockwise will decrease the setting. Once the desired setting is achieved, set the temperature lock by loosening the screw located at the bottom of the knob and rotating the dial stop counterclockwise until it contacts the knob. Tighten the screw to lock the stop in place.

When the thermostat setting exceeds the temperature of the pool or spa, the heater will fire. The heater will fire continuously until the pool or spa water is heated to the selected thermostat temperature. The control will not allow the heater to fire again for five minutes even if there is a call for heat, unless the thermostat setting is increased. In this case, the heater will fire within two minutes. This is to prevent short-cycling, and thereby increase the life of the heater.

When the **Model LX** heater is firing, "Heating" will be displayed underneath the LAARS LX logo. Note that in both the "POOL" and "SPA" thermostat settings, the temperature cannot be raised above 104°F (40°C).

Note that if power is momentarily lost, the thermostat settings will remain the same.

Also note that the heater should not be used to maintain water temperatures at or below 70°F (21°C). This will damage the heater.

7.4 Lighting and Shutdown Procedures

⚠WARNING

Do not attempt to light the heater with the door off. Doing so may cause severe bodily injury.

Before starting your heater, be sure that all of the functions and limits of the LX and LT controllers have been set according to the previous section of this manual (Section 7.3). Once the controls are set to your preferences, follow the instructions outlined below. Read and follow all safety instructions first. A more detailed set of lighting and shutdown instructions are listed on the label located on the inside of the heater door and in Figure 23.

7.4.1 Lighting the Heater

Lighting instructions are as follows:

1. Turn off all electrical power to the heater at the main junction box.
2. Remove the heater door and turn the heater gas valve to off.
3. Wait 5 minutes before trying to start the heater.
4. Turn the gas valve control knob counterclockwise to ON (see Figure 24.)
5. Replace the heater door.
6. Turn on electrical power to the heater.
7. Turn on the filter pump.
8. Set the heater controls to the "SPA" position (mode). If the temperature of the water exceeds the thermostat setting it is necessary to increase the thermostat setting to exceed the water temperature. Adjust the thermostat setting (desired temperature) to be greater than the water temperature. The igniter lights the burner when the thermostat calls for heat.
9. Set the time clock, if one is installed.

7.4.2 Shutdown

Complete shutdown instructions are as follows:

1. Set both temperature controls to their lowest setting.
2. Press and release the mode button until the indicators show that the heater is off.
3. Turn off all electrical power to the heater at the junction box.
4. Open the heater door and turn the gas valve knob clockwise to off.
5. Shut off the external gas supply valve to the heater.

FOR YOUR SAFETY READ BEFORE OPERATING

⚠WARNING: If you do not follow these instructions exactly, a fire or explosion may result, causing property damage, personal injury or loss of life.

A. This appliance does not have a pilot light. It is equipped with an ignition device which automatically lights the heater. Do NOT try to light the burners by hand.

B. BEFORE OPERATING, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

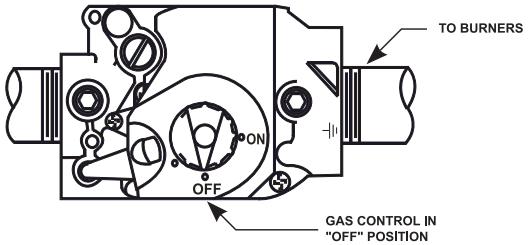
- **Do not try to light any appliance**
- **Do not touch any electric switch; do not use any phone in your building.**
- **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
- **If you cannot reach your gas supplier, call the fire department.**

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP! Read the safety information above on this label.**
2. **Set the thermostat to lowest setting and turn appliance switch to "OFF".**
3. **Turn off all electric power to the appliance.**
4. **This appliance is equipped with an ignition device which automatically lights the heater. Do not try to light the burners by hand.**
5. **Remove the heater door.**
6. **Turn gas control knob clockwise ↷ to "OFF".**
7. **Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to next step.**
8. **Turn gas control knob counterclockwise ↶ to "ON".**
9. **Replace control access panel**
10. **Turn on all electric power to appliance.**
11. **Set thermostat to desired setting and switch appliance from "OFF" to either "POOL" or "SPA".**
12. **If the appliance will not operate, check that the filter pump is on, the filter is clean and water is flowing to the pool. Otherwise, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.**



TO TURN OFF GAS TO APPLIANCE

1. **Set the thermostat to lowest setting and switch appliance to "OFF".**
2. **Turn off all electric power to the appliance if service is to be performed.**
3. **Turn gas control knob clockwise ↷ to "OFF".**
4. **Replace control access panel.**

Figure 23. Door Label

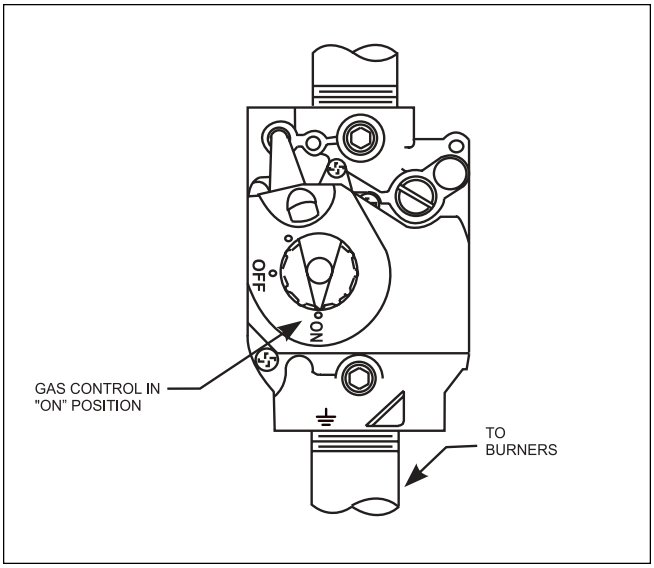


Figure 24. Gas Valve

7.5 Adjusting the Water Pressure Switch

⚠ CAUTION

The water pressure switch should be adjusted to turn the heater off when the pump is off. Setting the switch to close at too low of a flow can damage the appliance. Adjust the switch to turn the heater off, not on.

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

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:

To adjust the pressure switch, proceed as follows (see Figure 25).

1. Set the heater control to the "OFF" position.

2. Start the filter pump and confirm by means of an voltmeter that the pressure switch closes (if the switch fails to close, replace it with a switch which has a lower minimum setting).

3. Set the heater control to either 'Pool' or 'Spa'. Heater should start.

4. Pry out the top rubber dirt plug on the pressure switch.

5. Use a 7/32 inch Allen wrench to turn the adjustment screw very slowly clockwise until the heater goes off.

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

7. Check the adjustment by turning the filter pump OFF. The heater fan will continue to run but the burners should shut off immediately. If they do 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.

It may be necessary to repeat these steps to get a proper setting. The switch must be set so that the heater will not fire unless the pump is running. If a proper setting cannot be reached, contact the factory service department.

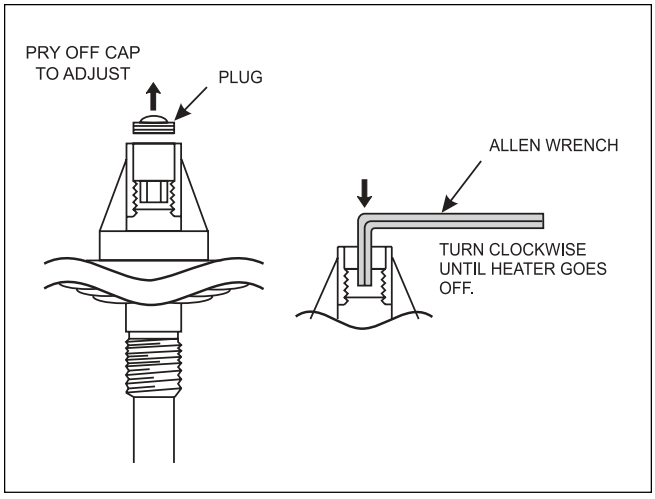


Figure 25. Adjustment of Pressure Switch

7.6 Temperature Rise

The Laars LX and LT-Low NOx pool and spa heaters have an internal bypass which accommodates a wide range of water flow. The bypass is easily adjustable to change the temperature rise for optimum performance and length of heater life. The bypass assures constant heat exchanger flow even though flow through the filter system will vary depending on how dirty the filter is.

For most installations, an external bypass valve is not needed in the heater water piping. This is due to the large size of the heater's internal bypass valve. If

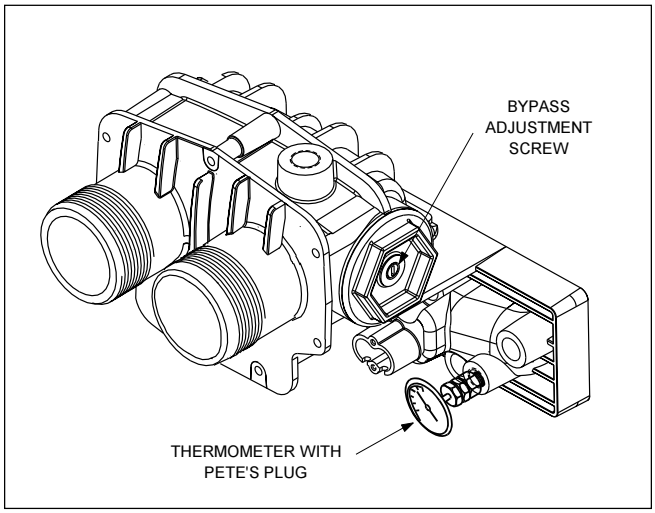


Figure 26. Temperature Rise Measurement

the pump flow rate is known to significantly exceed 125 gpm (7.9 l/s), an external bypass may be needed to assure proper heater operation.

Water flow should be confirmed upon start-up of the heater and in most servicing situations. If the flow is not normal, corrections must be made to the pool system. Flow is evaluated by determining the water temperature rise through the heat exchanger.

Before checking the temperature rise, make sure that the pool filter is clean. If necessary, clean all components of the filter system. Temperature rise is measured in the outlet of the far-right tubes when facing the inlet/outlet water heater. To measure the temperature rise, turn off the filter pump and remove the plastic plug to the right of, and just below the level of the outlet water pipe. This is mounted flush with the heater jacket (See Figure 26). With the plug removed, install the special thread adapter and "Pete's" plug fitting and insert a pocket thermometer. A temperature rise measurement kit is available through your Laars distributor. See section 11 of this manual for the correct kit number.

The internal bypass can be adjusted by means of a screw on the right hand side of the header. To adjust the temperature rise to within the ranges specified in table 6, proceed as follows:

1. If the piping system has an external bypass valve, close it.

2. Set the heater's control panel to the "Off" position.

3. Start the filter pump.

4. After three minutes, note and record the thermometer reading. This is the pool water temperature.

5. Start the heater by setting the control panel to either "Pool" or "Spa". Allow the heater to operate for five minutes or more. Note and record the thermometer reading. Subtract pool water temperature from this reading. This difference is the temperature rise. Refer to Table 6. If your measured temperature rise is within the range designated for your heater, skip steps 6 through 8.

6. Locate the bypass adjustment screw on the right-hand side of the header (see figure 26). Loosen the nut so that the screw can be adjusted. A slight water leak past the nut may be expected. Turn the screw counterclockwise to decrease the temperature rise, and clockwise to increase the temperature rise as needed to achieve the ranges in Table 6. After the adjustment, tighten the nut so that no leaks occur.

7. If the temperature rise is too low and cannot be raised by means of the adjustment screw, the flow is in excess of 125 GPM (7.9 l/s). An external bypass will need to be installed, or if one already exists, open the external bypass valve gradually until the temperature range in Table 6 is achieved.

8. If it was necessary to adjust the external bypass as outlined in step 6, scribe a line on the bypass shaft and case to mark the correct adjustment position. Wire or remove the valve handle to prevent tampering.

Table 6. Water Temperature Rise and Flow Rates (Measured at Input/Output Header)

Model	Minimum Temp Rise, °F (C)	Maximum Temp Rise, °F (C)	Minimum System Flow GPM (l/s)
250-L	24 (13)	28 (16)	30 (1.9)
400-L	36 (20)	40 (22)	30 (1.9)

In a system without external bypass, it may be necessary to make changes. If temperature rise is too low, a manual bypass must be installed. If temperature rise is too high, there is inadequate flow, possibly requiring a change to the piping system or a larger pump. Before proceeding with either remedy, verify proper heater operation. Low gas input results in low temperature rise and vice-versa. A problem with the heater internal bypass assembly also affects measured temperature rise.

SECTION 8. Maintenance

8.1 Water Chemistry

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.

The proper chemical balance in spa water is more critical than in a swimming pool heater operation. Due to the spa's size, high water temperature and heavy usage, chemical values in a spa can vary greatly. This chemical imbalance can result in unsanitary water conditions, and affect the life of the heater.

Proper chemical balances are necessary for sanitary bathing conditions as well as ensuring your heater's long life. Kits are available from your local pool supply dealer for making the various test for mineral content. One of these kits will detect copper in the system. The is usually a warning that corrosion is taking place, possibly due to a low pH value combined with other chemistry problems. The condition can be corrected by changing the spa water and closely monitoring the pH factor and chemical properties of the water. Be sure to keep your chemical levels within the values indicated in Table 7. **Laars does not warrant heat exchangers damaged by corrosive chemical levels or excess dissolved solids in pool or spa water.**

For spas, it is also necessary to perform water changes in addition to chemical treatment. It is recommended to change the spa water every 60 days for light usage and every 30 days if usage is heavy.

Table 7. Chemical Concentration Levels

Test	Recommended Level
Free Chlorine or	1.0 to 3.0 ppm
Bromine	3.0 to 5.0 ppm
pH	7.2 to 7.6
Total Alkalinity (TA)	80 to 120 ppm
Calcium Hardness (CH)	200 to 400 ppm
Langelier Saturation Index (SI)	-0.5 to +0.5
Cyanuric Acid	30 to 150 ppm
Total Dissolved Solids (TDS)	Less than 2000 ppm
Copper	0 ppm

8.2 Seasonal Care

⚠ CAUTION
Do not operate this heater outdoors at temperatures below 20 degrees Fahrenheit (°F) (-7 degrees Celsius [°C]).

8.2.1 Spring and Fall Operation

During periods when the pool is only going to be used occasionally, set the pool and spa control temperatures to 70°F (21°C) on the LX or the lowest setting possible on the LT. See Section 7.3.3. This prevents the pool water 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, or Figure 23 on page 25 of this manual.

8.2.2 Winterizing

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 to the heater, using the gas cock outside the heater jacket.
2. Remove heater door.
3. Shut down the heater following the shutdown instructions found on the inside of the heater or Figure 23 on page 25 of this manual.
4. Remove the drain plug from the right side of the inlet/outlet header (see Figure 27), and completely drain the heater before the first frost.
5. After all water has drained from the heater, check for mineral buildup in the openings.
6. Use compressed air to blow out any standing water remaining in the heat exchanger.
7. Inspect the gaskets on the drain plugs and reinstall plugs, but do not tighten.
8. Disconnect the pressure switch from the siphon loop (copper tubing) (see Figure 28).
9. Cover the vent grill so that snow will not accumulate in the combustion blower, where it may freeze.

8.2.3 Spring Start-up

To restart the heater in the spring, have a qualified professional technician reassemble the heater as follows:

1. Fill the siphon loop with approximately 5cc of SAE 50, non-detergent oil. Attach the copper tubing to the pressure switch (see Figure 28).
2. Tighten the drain plug.
3. Uncover the vent grill.
4. Make sure that power is supplied to the pump. Turn on the filter pump and circulate water through the heater for 5 minutes. Check for leaks while circulating.

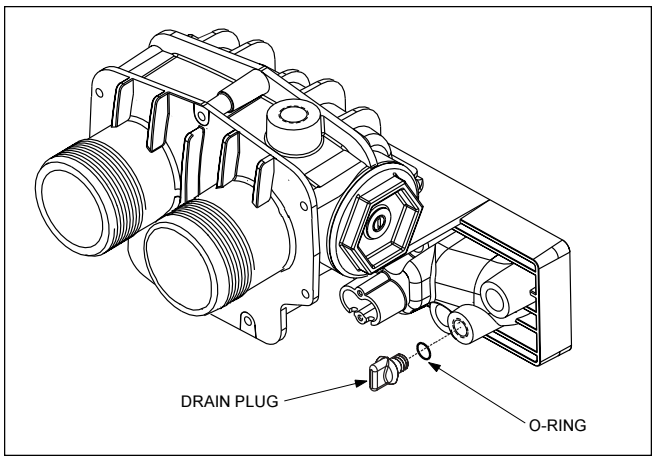


Figure 27. Draining the Heater

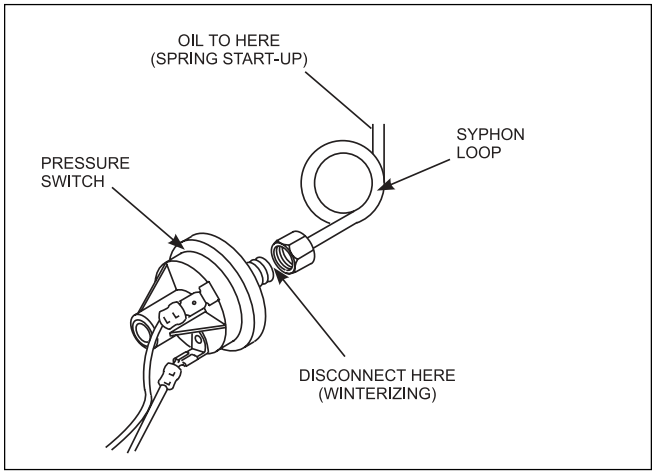


Figure 28. Winterizing the Pressure Switch

5. Turn on the main gas supply to the heater at the gas cock outside the heater jacket.

6. Turn on the heater following the lighting instructions found on the inside of the heater, or Figure 23 on page 25 of this manual.

8.3 Inspection and Service

Water Pik Technologies designs and constructs the Laars LX and LT Low NOx heaters to provide long performance life when installed and operated properly under normal conditions. Periodic inspections, especially at spring start-up, are important to keep your heater running safely and efficiently through the years. Improper maintenance can result in conditions where nausea or asphyxiation from carbon monoxide or flue gases could cause severe injury, property damage or death.

⚠ WARNING

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

8.3.1 Owner Inspection

Water Pik Technologies recommends that you inspect the heater on a continual basis and especially after abnormal weather conditions. The following basic guidelines are suggested for your inspection:

1. Keep the top and surrounding area of the heater clear of all debris.

2. Keep the area around and beneath the heater clean and free of all combustible materials such as paper, leaves, etc.

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

Ne pas entreposer ni utiliser d'essence ni d'autres vapeurs ou liquides inflammables à proximité de cet appareil ou de tout autre appareil.

4. Do not use this heater if any part has been underwater. Immediately call a qualified service technician to inspect the heater and replace any part of the control system and any gas control which has been underwater.

N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.

5. If the heater is equipped with a pressure relief valve, check for corrosion in and around the valve. Twice a year, with the filter pump on, lift the release lever on the top of the valve to make sure that water runs freely through it. If corrosion is found, replace the pressure relief valve. When replacing the valve, be sure that the pump is off. Install the valve so that the discharge is directed away from any area that may be damaged by water.

6. Be sure all combustion air and ventilation openings are not blocked. Check for spider webs and other debris inside the heater, in the vents on all sides of the heater jacket and in the exhaust outlet– especially after a long period of nonuse.

8.3.2. Professional Inspection

Inspections performed at least once a year by a qualified technician are required to maintain your heaters safe and efficient operation. The following basic safety checks must be performed.

1. Check for loose or broken wires and terminal connections.

2. Make sure that the pressure switch operates properly by shutting the filter pump off and on a few times. The burner should go off immediately after the pump stops. An ignition sequence should start shortly after the pump is turned back on.

3. Inspect the electrical controls, specifically the following:

   a. High limit controls.
   b. Water pressure switch.
   c. Exhaust temperature limit switch.
   d. Automatic gas valve.
   e. Fusible link.
   f. Temperature control.
   g. Control circuit fuse.
   h. Ignition control.
   i. Air pressure switch.

4. Inspect the venting system for blockage, leakage, and corrosion.

5. Inspect the combustion blower for damage.

6. Check for spider webs in or other obstructions in the main burner orifices – especially at Spring start-up. Clean with wire brush if necessary.

7. Conduct a normal operating cycle and observe that the sequence proceeds as intended.

⚠ CAUTION

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

8. If the heater is equipped with a pressure relief valve, clean any accumulated corrosion and make sure that water runs freely.

9. Inspect the outside of the combustion chamber and burner for corrosion and indication of improper operation.

10. Perform a temperature rise test in accordance with Section 7.6.

11. Regularly inspect electrical controls for deterioration. Repair and replace as necessary.

12. Make a visual check of the main burner flame. The flame can be seen in a view port on the front panel of the combustion chamber. When the blower is on low speed, the flame should be light blue in color and short (see Figure 29). When the blower is at full (high) speed, the flame will still be light blue in color, but will spread out and up over the burners (see Figure 30).

NOTE: After installation and first start-up, 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.

NOTE: Keep this manual in a safe place for future reference by you and your professional technician when inspecting and servicing the heater.

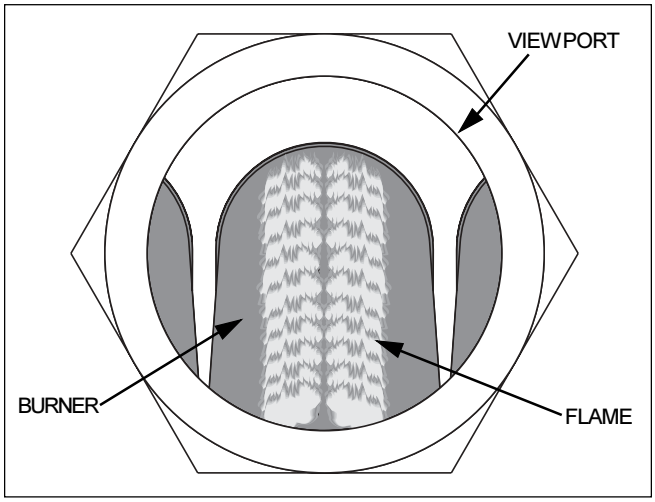


Figure 29. Flame view at low blower speed

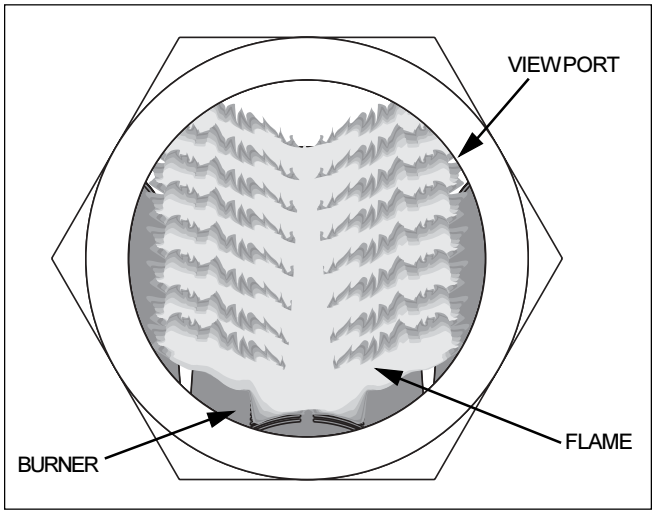


Figure 30. Flame view at high speed

SECTION 9. Troubleshooting

9.1 General Heater Troubleshooting

Table 9 lists some of the more common problems, causes and solutions encountered when running the heater. Most problems occur when the heater is being started for the first time after installation or at spring start-up. Careful installation and maintenance will help ensure years of trouble free use from your Laars LX or LT Low NOx heater.

9.2 Service Codes

The Laars LX and LT Low NOx controllers monitor several functions of the heater. In the event of a malfunction, the **LX** controller will display a service code on the left side of the LCD screen under the LAARS LX logo (see Figure 31). The model **LT** displays this information by lighting a set of indicator lights located on the front of the control panel (see Figure 32). Table 10 lists the LX and LT Low NOx

Heater Service Codes along with potential causes and remedies.

Note: When the service codes marked with an asterisk (*) are displayed, the controls are still operable and the heater will operate normally when the displayed condition is remedied. Fault codes without an asterisk (*) will shut down the heater and control panel, and a flashing "Service" icon will be displayed.

9.3 Ignition Control LED Service Codes

In addition to the service codes shown in the previous section, the ignition controller in both the LX and LT Low NOx model heaters has an LED light that flashes to indicate various different faults. Table 8 lists the LED codes and the corresponding fault description:

Table 8. Ignition Control LED Fault Codes

LED Code	Fault Description
The LED light is on continuously.	Ignition Control Fault. **Refer to qualified service personnel.**
LED single flash.	Air flow fault.
LED double flash.	Flame exists when there is NO call for heat. **Refer to qualified service personnel.**
LED triple flash.	Ignition lockout (heater has cycled three (3) times and locked out after the third try.

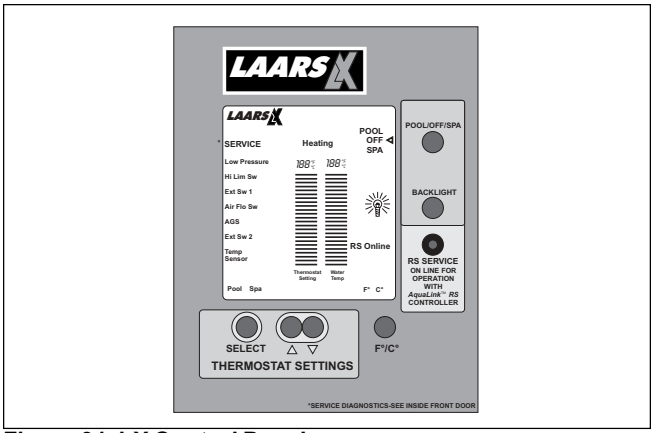


Figure 31. LX Control Panel

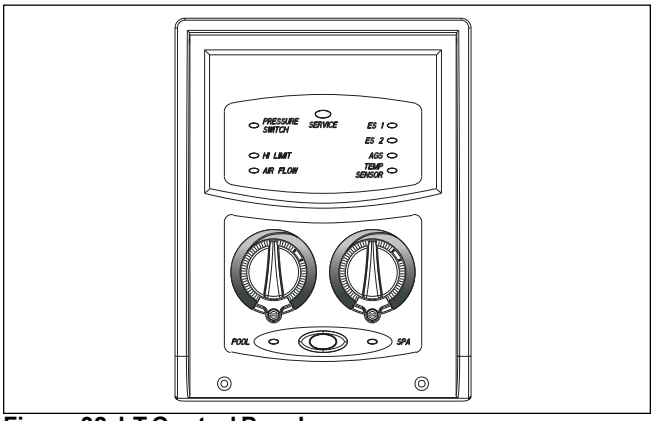


Figure 32. LT Control Panel

Table 9. Troubleshooting Guide

#	Symptom	Cause	Remedy
1.	Pump not operating	A. No power	A. Check circuit breakers and power source.
		B. Pump defective	B. Replace.
		C. Incorrectly wired	C. Recheck wiring.
		D. Time clock settings not synchronized with actual time	D. Check time clock setting.
2.	Flashback on start-up	A. Wrong gas	A. Make sure gas is natural.
		B. Burner damage	B. Replace burner.
3.	Flame has lazy yellow tip	A. Low primary air	A. Correct manifold pressure according to rating plate. Check blower operation. Clean burner ports dirty.
		B. Wrong gas	B. Make sure gas is natural.
4.	Not enough heat	A. Inadequate gas supply	A. Gas meter too small. Gas line from meter to heater too small.
		B. Low manifold gas pressure	B. Gas pressure on heater manifold, should be adjusted to 3.0"W.C. for natural gas.
		C. Heater size inadequate	C. Replace with heater of higher input.
5.	Heater pounding or knocking.	A. Water flow through heater too low	A. Check temperature rise between inlet and outlet heater piping. See section 7.6 for recommended range of temperature rise. If temperature rise is above the maximum recommended, increase pipe size or pump capacity or locate obstruction. Check for closed valve in system
6.	Heater condensing	A. Low water temperature	A. Flue product moisture will condense at the start-up until the heater water temperature reaches the normal operating conditions.
		B. Heater Plumbed backwards	B. Correct Plumbing
7 .	Igniter lights but main burners will not come on	A. Gas valve not at “on” position	A. Turn knob to “on” position.
		B. Air in gas line	B. Cycle ignition sequence until air is out of the gas line.
		C. Gas valve failed	C. Replace gas valve.

Table 10.

LX/LT HEATER SERVICE DIAGNOSTIC GUIDE

DISPLAY CODE	CAUSE	REMEDY
LOW PRESS * *(pressure switch)*	1. Pump is not running.	1. This is a normal display when the pump is **OFF**. **No Service Required.**
	2. Low pump pressure.	2. Clean filter or clear blockage/check position of valves in plumbing system.
	3. Device connected at "Fireman Switch" terminal block is open.	3. This is a normal display when a device connected to the "Fireman Switch" operates to open the safety circuit on the heater.
	4. Pressure switch fault.	4. Adjust or replace pressure switch. **Refer to qualified service personnel.**
	5. Failed fuse	5. Check heater wiring for shorts, replace fuse.
HI LIM SW *(hi-limit switch)*	1. Water temperature in heater exceeds the internal limit.	1. Identify and correct cause of overheating. **Refer to qualified service personnel.**
	2. Limit switch fault.	2. Identify and correct loose connections or replace switches. **Refer to qualified service personnel.**
EXT SW 1 *(extra switch 1)*	1. Flue gas vent switch tripped. (manual reset)	1. Verify proper fan operation. Check for restriction or blockage of flue. Reset switch after problem is corrected.
	2. Vent switch fault.	2. Identify and correct loose connections or replace switch. **Refer to qualified service personnel.**
	3. Fusible link fault	3. Identify and correct loose connections or replace fusible link. **Refer to qualified service personnel.**
AIR FLO SW *(air flow switch)*	1. Broken, split, pinched or disconnected fan/switch tubing.	1. Check tubing and replace if necessary.
	2. Fan not operating.	2. Correct fault or replace fan. **Refer to qualified service personnel.**
	3. Fan running slow or premature fan failure.	3. Verify proper wiring for 120VAC or 240VAC. **Refer to qualified service personnel.**
	4. Air flow restricted at intake or discharge.	4. Check for proper clearances around heater and for adequate room ventilation if enclosed. Inspect for blockage or restriction at discharge or flue. **Refer to qualified service personnel.**
AGS *(automatic gas shut-down)*	1. Oscillating pump pressure.	1. Clean filter or identify and repair cause of pump oscillation.
	2. Low gas supply pressure.	2. Identify and repair incorrect supply pipe size or pipe line blockage. **Refer to qualified service personnel**.
	3. No flame at burners.	3. Identify and correct loose wiring connections, or problems with igniter, flame sensor , gas valve, or ignition control. **Refer to qualified service personnel.**
EXT SW 2 *(extra switch 2)*	Not used in this model.	
TEMP SENSOR* *(temperature sensor)*	1. Faulty wiring or connection	1. Inspect Sensor wiring. Ensure sensor is plugged into back of control panel.
	2. Failed Sensor	2. Replace Temperature Sensor. **Refer to qualified service personnel**

* **NOTE:** When these messages are displayed, the Controls are still operable and the heater will operate normally when the displayed condition is remedied. Faults (shown above without an asterisk (*) will shut down the Heater and Control Panel and a flashing "SERVICE" is displayed.

SECTION 10. Professional Maintenance and Service

⚠ WARNING

SERVICING SAFETY

Some of the servicing procedures for the Laars LX and LT Low NOx heaters are hazardous because they involve fuel gas, electricity, moving parts and procedures which require testing or temporary bypass of safety controls. For this reason, the heater must be serviced only by a qualified professional service technician.

IMPROPER SERVICE HAZARD

The Laars LX and LT Low NOx heaters incorporate unique design features. Incorrect service of this heater can result in personal injury or damage to property. To avoid such hazards, the heater must be serviced only by a qualified professional service technician.

10.1 General Information

A qualified professional technician must service the Laars LX and LT Low NOx pool heaters using Water Pik Technologies service procedures. Before calling for service however, the owner should check for obvious problems. The other components in the pool system, including pump, filters and strainers, water valves, gas supply, electrical power and time clocks, have an affect on heater operation.

Confirm that the heater control is set to either 'POOL' or 'SPA' and that the corresponding temperature limit is set high enough to make the heater operate. Make sure the pump is operating, that the filter and strainers aren't clogged, that there are no mis-positioned water valves, that the gas or electric power supplies aren't shut off and that time clocks are properly adjusted. Also be sure that there is no blockage of the exhaust vent grill or rear louvers, which supply combustion air to the burners.

10.2 Induced-Draft Combustion System

The Laars LX and LT Low NOx pool and spa heaters have an induced-draft combustion system incorporating special burners and a combustion blower. The burners are of special design in which most of the combustion air passes through the burners, resulting in a "premix" process that produces very low NOx emission. This system is illustrated in Figure 33.

The system operates with a balanced combination of natural and induced draft. Air and gas are pulled into the burner venturis where they are mixed and conveyed to the combustion chamber. The combustion process produces heat and creates a negative pressure or "draft" condition. A small amount of secondary air is pulled into the chamber through holes and openings provided for that purpose. Hot combustion products pass through a highly efficient heat exchanger, where water absorbs most of the heat. Cooler products continue on and are pulled into the combustion blower, which exhausts them and stabilizes system flow. Exhaust is directly to the outdoor air through a grill, or for indoor heaters, through vent piping.

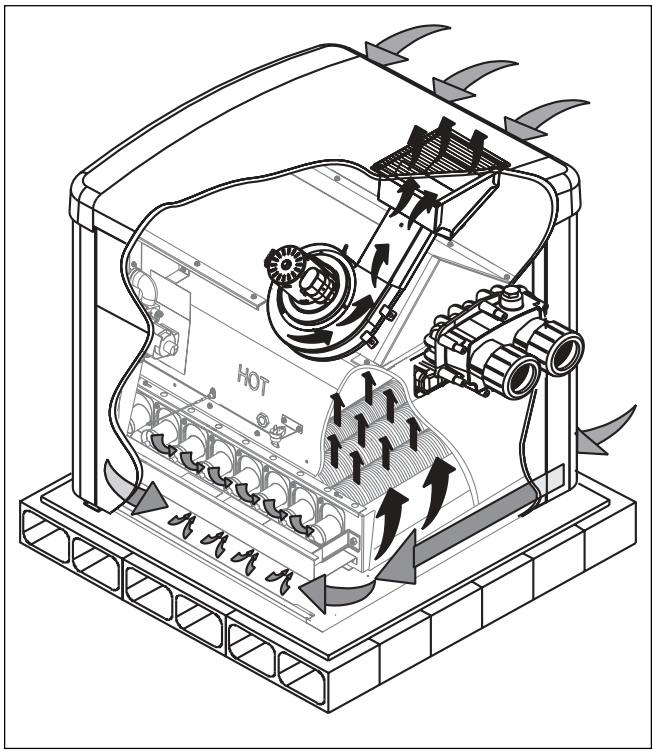


Figure 33. Induced Draft Combustion System.

10.3 Heater Components and Their Operation

1. **Gas Valve / Regulator -** The gas valve controls gas flow into the manifold. It provides flow only when the temperature control requires heat and only if all safety controls enable operation. It is also a positive pressure regulator. It regulates the gas pressure in the manifold to specifications addressed earlier in this manual. This is necessary for proper operation of the burner system.
2. **Temperature Control -** Both the LX and LT Low NOx heater models are equipped with an electronic control which senses water temperature by means of a thermistor and controls heater operation to bring the water to the temperature selected. It has an option for two separate thermostat settings which are typically used to set pool and spa temperatures.

3. **Ignition Control -** The ignition control provides energy for ignition of the air/gas mixture, monitors the flame and controls the gas valve. When the temperature control requires heat, the ignition control provides a pre-purge of the combustion chamber. Once the pre-purge is complete the ignition control lowers the blower speed and then applies electrical power to a "hot surface" igniter. When the igniter is hot enough, the ignition control opens the gas valve. It has sophisticated means to sense ignition and flame condition so that unburned gas will not escape. Once the ignition control has sensed flame, it de-energizes the igniter and returns the blower to full speed. After the burner is shut off, the ignition control continues blower operation to provide a post-purge period.
4. **Igniter -** The hot surface igniter is a crystalline element which becomes very hot when electrical power is applied to it. The hot surface igniter directly ignites the air/gas mixture in the combustion chamber.
5. **Limit Switches -** Two limit switches prevent excessive water temperature - one within the heat exchanger and one for water leaving the heater. If either senses excessive temperature, burner operation is interrupted.
6. **Water Pressure Switch** - This control senses whether or not water is available to the heater by measuring back pressure inside of the heat exchanger. If the pool water pump fails or the water filter is blocked, the pressure switch prevents operation of the burner. It can be affected by the installation
7. **Fusible Link -** This is a single-use switch which detects abnormal temperature in the component compartment of the heater. It is a fusible link which is held to the combustion chamber just above the burner tray by a sheet metal bracket. Excessive temperature in the component compartment, possibly due to a burner flash-back will cause the link to fail. This opens the safety circuit which shuts off the gas valve and shuts the heater down.
8. **Air Pressure Switch -** This switch verifies that air is flowing through the combustion system by sensing pressure. It shuts off the heater if air flow is inadequate.
9. **Flame Sensor -** The flame sensor is the electrode through which the ignition control detects "rectification" of current passed through the flame. Inadequate rectification indicates an unsatisfactory flame condition. The rectification signal can be measured by attaching the leads of a voltmeter to the tabs on the connecter on the ignition control labeled "FC". A wire harness, available from Water Pik Technologies, makes it easier to attach the voltmeter leads. The flame current should not be less than 1.5 micro-amps. If the flame signal is less than 1.5 micro-amps, you can adjust the throttle strip on the burner tray to allow more air into the combustion chamber. This can increase the flame signal.
10. **Manual Reset Vent Switch -** A manually resetable limit switch prevents exhaust temperatures in excess of 240°F (116°C). If it senses excessive temperature the switch opens and burner operation is interrupted. Once the cause of the excessive exhaust temperature has been corrected, the switch may be reset and used again.

10.4 Electrical Troubleshooting

This section describes procedures for checking the electrical power and control components of the heater one at a time and in the order they appear in the control circuit. It is important to follow the sequence of this trouble shooting guide because the safety circuit is connected in series.

These procedures require a Volt-Ohm meter with a minimum 0-250VAC voltage range, and 1-1000 Ohm resistance range. Figure 34 shows the power and control circuits and where to take measurements. Location numbers in circles have been added, and will be referenced in the following sections.

Where test points are shown at circuit board connectors, the probe of the meter can be carefully pushed into the connector along side of the wire at the connection to be measured.

The electrical power supply can be checked with the heater not set to fire. All other procedures need to be checked with power correctly supplied to the heater, the correct 15-pin power plug firmly seated in the receptacle and the heater's thermostat set so that there is a call for heat.

As stated at the beginning of the manual, some of these procedures are hazardous. Only a qualified service technician should service the heater.

10.4.1. Electrical Power Supply

The electrical components of the Laars LX and LT Low NOx pool heaters are designed to operate with supply voltage ranging from 98V to 126V at 60 Hz if connected to a nominal 115 volt power supply, or 196V to 253V at 60 Hz if connected to a nominal 230 volt power supply. Measure supply voltage at the power supply leads where they enter the heater (identified as points A, B and C on the wiring diagram in Figure 34.). Use the voltages in table 11 to verify that the correct voltage is supplied to the heater.

Table 11. Supply Voltage Measurements

MEASURE BETWEEN THESE POINTS	EXPECTED VOLTAGE WITH 230V SUPPLY	EXPECTED VOLTAGE WITH 115v SUPPLY
A and B	98 - 126 Volts	0
A and C	98 - 126 Volts	98 - 126 Volts
B and C	196 - 253 Volts	98 - 126 Volts

1. *Point A is the ground connection on the heater.*
2. *Point B is the location at which the red power lead enters the 15 pin connector.*
3. *Point C is the location at which the black power lead enters the 15 pin connector.*

If no voltage is present, correct this external power supply problem to the heater. Circuit breakers, time clock settings or similar devices may be the problem. Voltage outside of the above ranges may be due to poor wiring, poor connections, other loads such as air conditioning compressors or to an electric utility company problem. Arrange for correction of the voltage as appropriate.

When you are sure that the voltage supplied to the heater is correct, check the voltage being supplied to the transformer by the power supply circuit board. This can be done by measuring the voltage between the wires of the four-pin connector on the power supply circuit board. These points are designated as test points D, E, F, and G on figure 34. The voltages measured between any two of these four points will be determined by the voltage supplied to the transformer (see table 12 for expected voltages).

Table 12. Voltage Supplied To Transformer

MEASURE BETWEEN THESE POINTS	EXPECTED VOLTAGE WITH 115V SUPPLY	EXPECTED VOLTAGE WITH 230V SUPPLY
D and E	98 - 126 Volts	0
D and F	98 - 126 Volts	98 - 126 Volts
D and G	0	98 - 126 Volts
E and F	0	98 - 126 Volts
E and G	98 - 126 Volts	98 - 126 Volts
F and G	98 - 126 Volts	196 - 253 Volts

1. *Point D is the location at which the white wire with the black trace enters the 4 pin connector.*
2. *Point E is the location at which the white wire with the red trace enters the 4 pin connector.*
3. *Point F is the location at which the red wire enters the 4 pin connector.*
4. *Point G is the location at which the black wire enters the 4 pin connector.*

If the voltages measured do not fall within the limits shown in Table 12, then there is a problem with the power supply circuit board and the board must be replaced.

10.4.2. Controller

The controller must be operational in order to check the control circuits of the heater.

10.4.3. Control Circuit Troubleshooting

The heater controls are arranged in several 24V 60Hz circuits with some operating and safety controls arranged in series circuits.

Troubleshooting is done by probing for voltage between the common and various points in the circuit to determine which component is preventing operation. Check points are indicated on Figure 34. The black lead of the meter should be attached to the common tap on the secondary side of the transformer and may be left there throughout most of the procedure.

The recommended procedure steps through each circuit in a sequential way, and each section assumes that components from all previous sections have been tested and are operational. However, verifying voltage at any of the numbered points in that circuit confirms that all prior components of the circuit are operational.

10.4.3.1. Transformer

Attach the black lead of the voltmeter to the terminal on the secondary side of transformer with a yellow wire attached to it (common). This is test point 1 on Figure 34. Touch the free lead of the voltmeter to the terminal on the secondary side of transformer with a red wire attached to it (24V tap), test point 2. The voltmeter should read between 20-28 volts. Leave the black lead of the meter on the common tap (test point 1), and move the free lead of the voltmeter to the terminal on the secondary side of transformer with a white wire with yellow tracer attached to it (12V tap), test point 3. The meter should read 10-14 volts. If the voltage at either of the test points does not fall within the limits mentioned above replace the transformer.

10.4.3.2. Fuse

Leave the black voltmeter lead in place at test point 1. Touch the free lead of the voltmeter to test point 4, which is on the back of the controller where the red wire from the transformer enters the end of the connector. You will need to push the voltmeter lead into the back of the connector along side of the wire pin. The meter should read 20-28 volts. If there is no voltage, the fuse has failed. Inspect the rest of the wiring, especially the safety circuit, to be sure that there is no “short” such as contact of a terminal with the heater chassis or another terminal which may have caused the fuse to fail. Correct any such condition and replace the fuse. Use only a 2 amp, 1 1/4" long x 1/4" diameter, quick acting, glass tube type fuse.

10.4.3.3 Water Pressure Switch/External Interlocks or Fireman Switch Circuit

Start by checking the voltage at the two legs of this circuit at the back of the controller, (see test points 5 and 6 in Figure 34). Leaving the black lead of the meter on test point 1, check the voltage at test point 5, where the black wire from the pressure switch enters the ten-pin connector on the back of the controller. If there is not 20-28 volts at this point, either the controller or the ten-pin wire harness is faulty and must be replaced. If 20-28 volts is detected at test point 5, then move the red lead of the meter to test point 6 where the white wire from the fireman switch terminal block enters the ten-pin connector. If 20-28 volts is detected at this point, the devices in this circuit are closed and the circuit is working properly.

If there is no voltage, either the pressure switch contacts or the contacts of the external switch (fireman switch) are open. To determine which device is causing the fault, move the red lead of the meter to the contact on the water pressure switch where the black wire is connected, (test point 7). Voltage to this point means that the wire harness between the controller and the water pressure switch is good. If there is no voltage at test point 7, look for a loose connection or replace the ten-pin wire harness. If there is voltage at test point 7 then move the lead from test point 7 to the contact on the other side of the water pressure switch (test point 8). No voltage here means that the pressure switch contacts are open. This is almost always due to a water flow deficiency, the most common one being a blocked water filter or defective pump. However, sometimes it is due to blockage of the copper siphon loop tube or mis-adjustment of the switch. Investigate thoroughly, referring to Section 7.9 on "Adjustment of Pressure Switch". If there is no problem with the pool system or pressure switch adjustment, replace the pressure switch.

If test point 8 shows 20-28 volts, check the voltage going to the external device. Move the lead of the meter to the lower right terminal screw on the fireman switch terminal block (test point 9). No voltage means that there is a bad connection in the wire between the water pressure switch and the terminal block. If 20-28 volts is shown here, it ensures that the correct voltage is being supplied to the external switch. Now move the lead to the upper right terminal screw on the terminal block (test point 10). No voltage here means that the external device is not working properly. The time clock switch or other external interlock may be mis-adjusted, mis-connected or defective. Correct this external problem. If there is 20-28 volts at test point 10 then there is a bad connection between the terminal block and the controller. Replace the ten-pin connector wire harness.

10.4.3.4. Temperature Limit Switches Circuit.

Since the limit switches are not easily accessible, you can check the voltage between test point 1 and the two legs of the circuit at the controller (see test points 11 and 12 in Figure 34).

Leaving the black lead of the meter on test point 1, check the voltage at test point 11, where the white wire from the 150° limit switch enters the ten-pin connector on the back of the controller. If there is not 20-28 volts at this point, either the controller or the ten-pin wire harness is faulty and must be replaced. If 20-28 volts is detected at this point, then move the red lead of the meter to test point 12 where the white wire from the 135° limit enters the ten-pin connector. If 20-28 volts is detected at this point, the devices in this circuit are closed and the circuit is working properly.

If there is no voltage, one of the limit switches is open. This is normally due to excessive water temperature, which should be thoroughly investigated before replacement of limit switches. Excessive water temperature may be caused by low water flow. Water flow deficiency may be due to obvious problems such as a defective pump or blocked water filter. Alternatively, excessive water temperature may be due to over-firing, or to a problem with the water piping or the heater's internal bypass control. Over-firing might be a result of an incorrect gas orifice or supply of propane gas to a heater intended for natural gas.

If there are no such fundamental problems, identify which of the switches is open. Limit switch access is through the limit switch covers on the side of the heater to which water pipes are connected. Remove the limit switch covers from the header and gently remove the switches from the wells.

Note that the limit switches have different trip points, and it is important that replacements are correct. The 150°F switch has a red dot on the top of the brass fitting, and must be installed in the lower (horizontal) well in the header. The 135°F switch has no dot and must be installed in the upper (vertical) well in the header.

Leave one meter lead in place at test point 1. Move the other meter lead to the terminal connection on the 150° switch (test point 13) that is connected back to the controller. The voltmeter should read 20-28 volts. No voltage here means that the ten-pin wire harness is bad and should be replaced. If voltage is detected at this point move the lead to the other terminal of the switch (test point 14). If the voltmeter reads does not show voltage then the 150° limit is bad and should be replaced. If the meter reads 20-28 volts, move the lead to the terminal of the 135° limit that is connected to the wire that jumps between the two limit switches (test point 15). No voltage here means that the wire assembly is bad and needs to be replaced. 20-28 volts shows that the wire between the two limits is making a good connection. Now move the lead to the

other connection terminal on the 135° limit (test point 16). No voltage at this point indicates that the limit switch has failed and needs to be replaced. Voltage here would show that the limit is good and that the ten-pin wire harness may have a bad connection. Replace the wire harness if necessary.

10.4.3.5. Fusible Link/Manual Reset High Limit Switch Circuit

Since the manual reset limit switch is not easily accessible, you can check the voltage between test point 1 and the two legs of the circuit at the back of the controller (see test points 17 and 18 in Figure 34).

Leaving the black lead of the meter on test point 1, check the voltage at test point 17, where the white wire from the fusible link enters the ten-pin connector on the back of the controller. If there is not 20-28 volts at this point, either the controller or the ten-pin wire harness is faulty and must be replaced. If 20-28 volts is detected at this point, then move the red lead of the meter to test point 18 where the white wire from the manual reset high limit switch enters the ten-pin connector. If 20-28 volts is detected at this point, the devices in this circuit are closed and the circuit is working properly.

If there is no voltage, either the fusible link or the contacts of the manual reset switch are open. To determine which device is causing the fault, check the fusible link first.

Leave one lead of the meter at test point 1. Move the other lead of the meter to the contact on the fusible link where the wire is connected back to the controller, (test point 19). Voltage to this point means that the wire harness between the controller and the water fusible link is good. If there is no voltage at test point 19, look for a loose connection or replace the ten-pin wire harness. If there is voltage at test point 19 then move the lead to the contact on the other side of the fusible link (test point 20). No voltage here means that the fusible link is open. This indicates higher than normal temperatures in the component compartment (vestibule). Normal component compartment temperature is well below 300°F. The fusible link is designed to fail at temperatures above 305°F. Excessive temperatures are almost always due to flashback conditions caused by a damaged burner, manifold pressure being set too high or incorrect gas supply type. Check to be sure that the type of gas being supplied to the heater matches the designation on the rating plate. Thoroughly inspect the burners and orifices for damage. Finally, check and adjust the manifold pressure if necessary. Replace the fusible link. If test point 20 shows 20-28 volts, then the top of the heater must be removed to gain access to the manual reset exhaust limit switch.

To check the manual reset switch leave one lead of the meter at test point 1 and place the other lead on the contact of the manual reset switch (test point 21) that is connected to the wire leading to the fusible link. If test point 21 does not show 20-28 volts, then the wire assembly between the fusible link and the manual reset switch must be replaced. If 20-28 volts is detected, then move the lead to the other contact of the manual reset switch (test point 22). Voltage here means that the ten-pin connector wire harness is faulty and must be replaced. If no voltage is detected, the switch contacts have opened due to excessive exhaust temperatures. This condition is usually caused by a blocked exhaust vent. Be sure that the vent is clear of all debris, then push the red button on the switch to reset the circuit. If there is still no voltage detected, the manual reset switch must be replaced.

10.4.3.6. Blower Pressure Switch Circuit

The blower must be operating during the test procedure for the blower pressure switch. Start by checking the voltage between test point 1 and the two legs of this circuit at the back of the controller, (see test points 23 and 24 in Figure 34).

Leaving the black lead of the meter on test point 1, check the voltage at test point 23, where the purple wire from the blower pressure switch enters the ten-pin connector on the back of the controller. If there is not 20-28 volts at this point, either the controller or the ten-pin wire harness is faulty and must be replaced. If 20-28 volts is detected at this point, then move the red lead of the meter to test point 24 where the black wire with a yellow trace from the blower pressure switch enters the ten-pin connector. If 20-28 volts is detected at this point, the device in this circuit is closed and the circuit is working properly.

If there is no voltage, the pressure switch contacts are open. Leave one lead of the meter at test point 1. Move the other lead of the meter to the contact on the blower pressure switch (test point 25) where the purple wire is connected. Voltage to this point means that the wire harness between the controller and the blower pressure switch is good. If there is no voltage at test point 25, look for a loose connection or replace the ten-pin wire harness. If there is voltage at test point 25 then move the lead to the contact on the other side of the blower pressure switch (test point 26). No voltage here means that the pressure switch contacts are open. This is usually due to a blower speed problem or a problem with the air pressure tube connection between the blower housing and the switch

Be sure that the blower is on and that it is working properly. Check that the gray flexible tube between the blower pressure switch and the blower housing is connected at both ends and has no holes or splits. Replace the tube if necessary. If there is no problem with the blower or the tube, replace the pressure switch.

If test point 26 shows 20-28 volts, then there is a bad connection between the blower pressure switch and the controller. Replace the ten-pin connector wire harness.

10.4.3.7. Gas Valve Voltage

The gas valve will operate only when the there is a call for heat and all safety circuits have been satisfied. If the gas valve does not operate under these conditions, check the voltage going to the gas valve. Place one voltmeter lead in the four-pin connector on the back of the controller where the yellow wire is connected (test point 27). Touch the free lead of the meter to the gas valve terminal where the brown wire is attached at the gas valve (test point 28). This test point will have voltage present only during a trial for ignition or during normal operation. The meter should read 20-28 volts. If there is no voltage, then there is a bad connection between the gas valve and the controller. Replace the four-pin connector wire harness.

Listen closely to the gas valve when it is first energized (24V first appears at test point 28 during the trial for ignition). There should an audible "click" when the valve opens.

If there is voltage at test point 28, but the gas valve does not open, replace the valve.

10.4.3.8. Igniter/Ignition Control Circuit

⚠ WARNING

The igniter, power supply circuit board and some terminals of the ignition control utilize 115V or 230V power and require appropriate servicing precautions. Note that wires and terminals of these components may be “hot” even when the component is not operating.

With the igniter leads connected to the power supply board there will be voltage of 98-126 VAC between the quick disconnects at the ends of the igniter wires, test point H and test point I, if the heater is connected to a 115V supply. If the heater is connected to a 230V supply then the voltage reading between these two points will bo 98-126 VAC if read with an RMS meter, or 50-65 VAC if read with a non RMS meter. This voltage will be applied only when there is an attempt to ignite the burner or when the ignition control’s flame sensing system has determined that it is OK to allow burner operation. Even if voltage has been confirmed at the end of the safety circuit, the “trial for ignition” sequence is imposed by the ignition control. This sequence consists of a 15 second period of pre-purge, a 40 second period for heat-up of the igniter and a 7 second trial for ignition. During this last 47 seconds there is voltage between test point H and test point I. If satisfactory ignition is not achieved, the igniter is turned off and the system waits for a 15 second inter-purge period. The system may go through this cycle as many as three times, but thereafter it is “locked out” by the ignition control. Additional attempts will be made only if the call for heat is interrupted by turning off electrical power or setting the control to “Off” and then back to "Pool" or "Spa".

To trouble shoot the ignition control's igniter circuit, connect the voltmeter leads at test points H and I, and set the control to call for heat. Observe that the normal ignition sequence takes place. After the 15 second prepurge, note the voltage between test points H and I. Then look for the glow of the igniter through the view port on the front of the combustion chamber. If the correct voltage is detected between points H and I during the trial for ignition but the igniter does not glow, check the connections to the igniter.

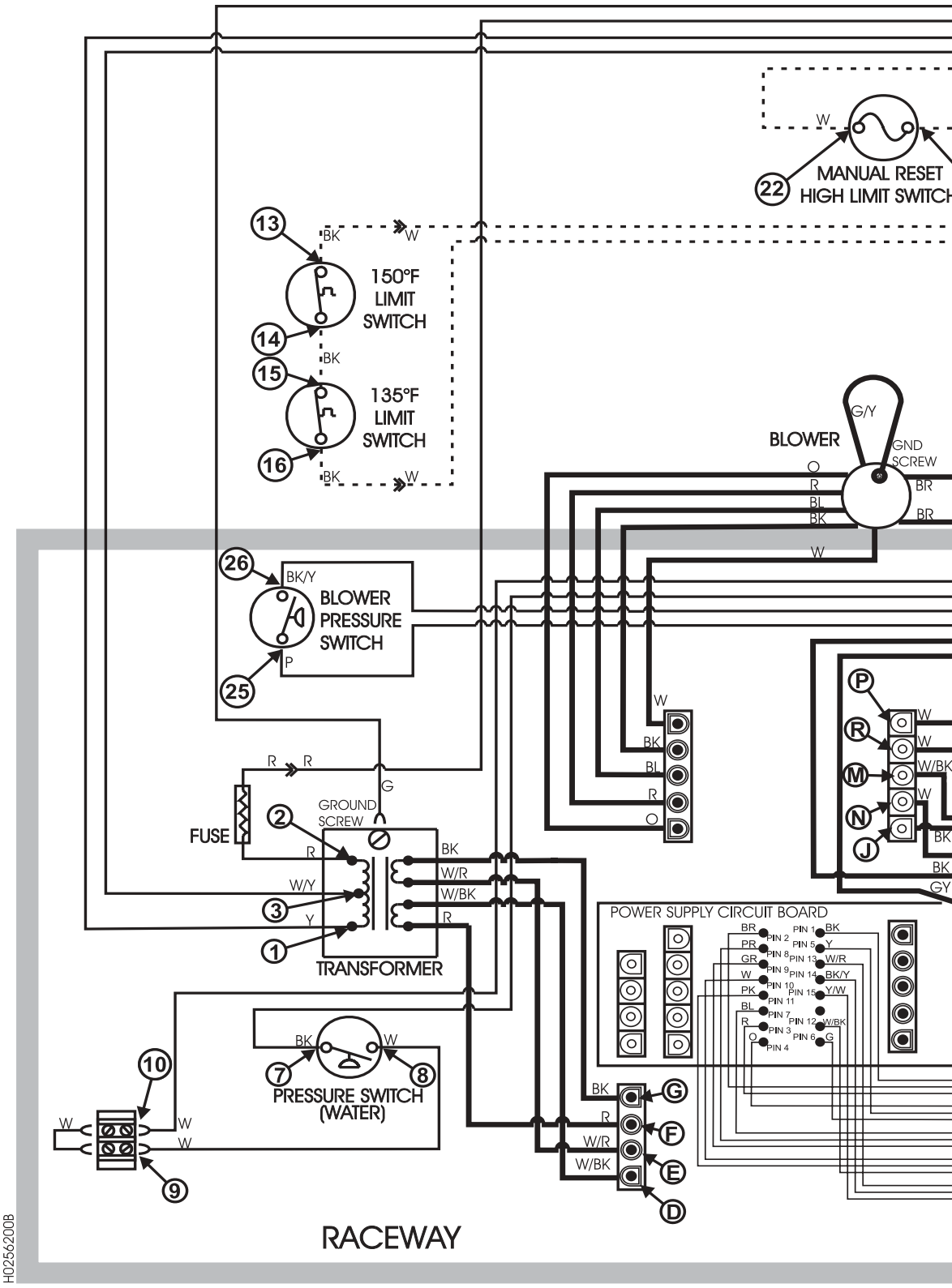
Check the igniter with the ohmmeter. Disconnect the igniter wires at the quick disconnects. Place one lead of the meter on each wire of the igniter. The resistance should read between 40 and 75 Ohms at ambient air temperature. If the meter reads outside of this range or shows an open or short circuit, replace the igniter.

If voltage doesn’t appear between points H and I during the trial for ignition, there may be a bad connection at the five-pin wire harness that connects the igniter and ignition control to the power supply circuit board. Check all connections on the wire harness for loose or corroded connections.

If your heater is connected to a 230 VAC supply, perform the following procedure. If your heater is connected to a 115 VAC supply, skip to the paragraph indicated with bold type. Place the black lead of the meter in the 15-pin connector at pin 7 (test point C). Place the red lead of the meter in the igniter five-pin connector on the back of the power supply circuit board where the black wire enters the connector (test point J). The meter should read 196-253 VAC. If the meter shows voltage outside of this range, then either the 15-pin connector or the power supply circuit board has a loose connection or has shorted. Check the connections or replace the components. If the meter shows voltage within the range above, then move the red lead to the L1 connection on the ignition control (test point K). Incorrect voltage here means that the igniter five-pin connector needs to be replaced. Voltage at test point K shows that voltage is getting to the ignition control. Now move the red meter lead to the IGN 240 connection on the ignition control (test point L). No voltage at this location means that the ignition control has failed and needs replacement. If the ignition control is working properly, it will have stepped the voltage down to 98-126 Volts for use by the igniter. If the correct voltage is shown then move the red lead to the igniter five-pin connector where the white wire with a black trace enters the connector (test point M). No voltage means that the wire harness is faulty and should be replaced. If the voltage is 98-126 VAC, move the red meter lead to the igniter five-pin connector where the white wire next to the black wire enters the connector (test point N). No voltage at this point means that the power supply circuit board or the 15-pin connector has shorted and needs to be replaced. If the voltage is correct, move the red lead to the connection at the igniter wire (test point H). No voltage here means that the five-pin wire

harness is shorted and should be replaced. If the correct voltage is detected, move the black lead of the meter to pin 3 of the 15-pin connector where the red power lead enters the connector (test point B). Place the red meter lead at the pin on the igniter five-pin connector, on the back of the power control circuit board, where the white wire enters the connector at the end position (test point P). The meter should show 198-153 volts. If it does not, then the 15-pin wire harness or the power supply circuit board is shorted or open. Replace these components. If the correct voltage is measured at this point, move the red meter lead to the igniter wire quick disconnect (test point I). No voltage here means that the igniter five pin connector is faulty and must be replaced.

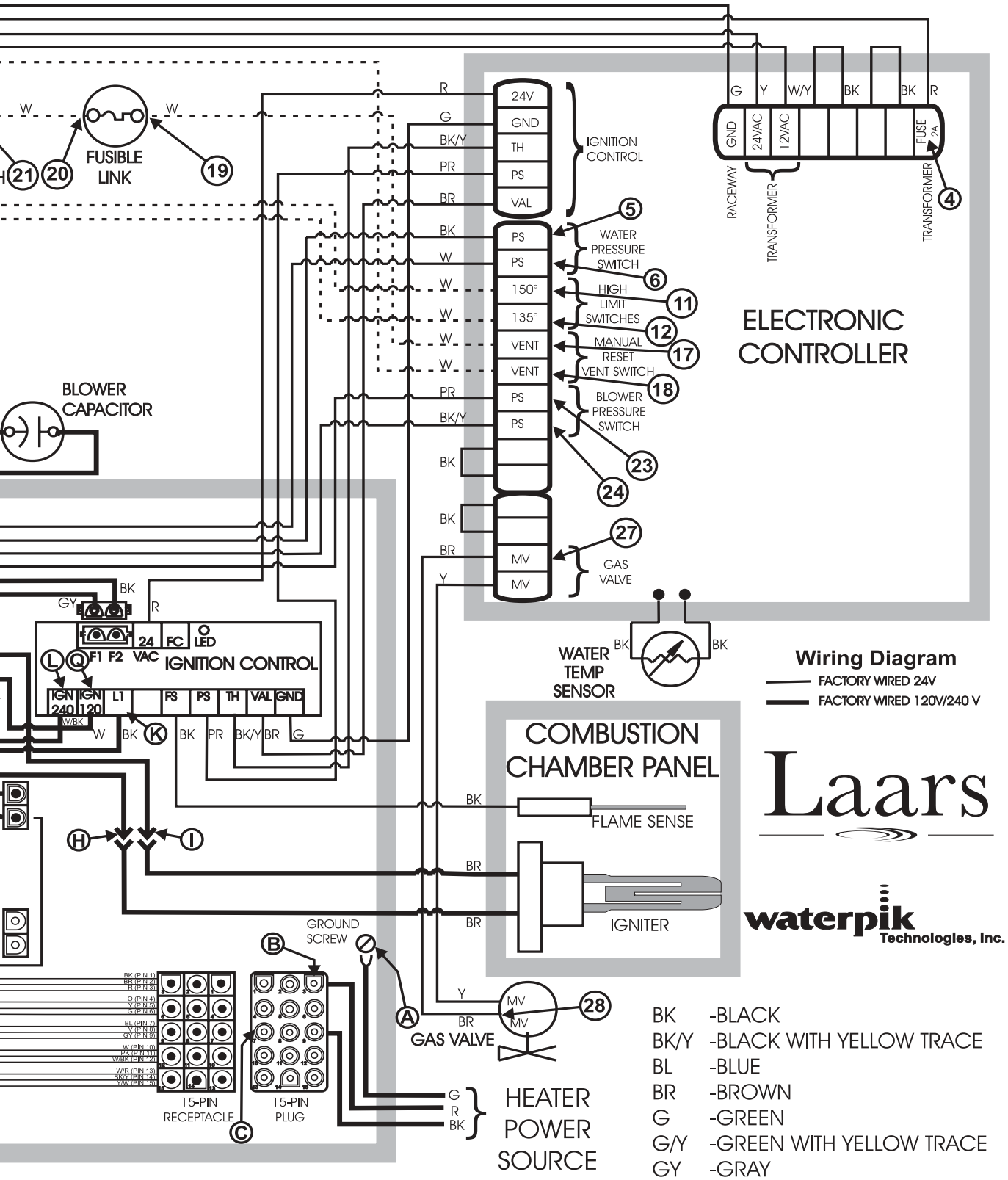
If your heater is connected to a 115 VAC supply, perform the following procedure. Place the black lead of the meter in the 15-pin connector at pin 7 (test point C). Place the red lead of the meter in the igniter five-pin connector on the back of the power supply circuit board where the black wire enters the connector (test point J). The meter should read 98-126 VAC. If the meter shows voltage outside of this range, then either the 15-pin connector or the power supply circuit board is has a loose connection or has shorted. Check the connections or replace the components. If the meter shows voltage within the range above, then move the red lead to the L1 connection on the ignition control (test point K). Incorrect voltage here means that the igniter five-pin connector needs to be replaced. 98-126 Volts at test point K shows that voltage is getting to the ignition control. Now move the red meter lead to the IGN 120 connection on the ignition control (test point Q). No voltage at this location means that the ignition control has failed and needs replacement. If the ignition control is working properly, it will pass the voltage, 98-126 Volts, for use by the igniter. If the correct voltage is shown then move the red lead to the igniter five-pin connector where the white wire from the IGN 120 connection on the ignition control enters the connector (test point R). No voltage means that the wire harness is faulty and should be replaced. If the voltage is 98-126 VAC, move the red meter lead to the igniter five-pin connector where the white wire next to the black wire enters the connector (test point N). No voltage at this point means that the power supply circuit board or the 15-pin connector has shorted and needs to be replaced. If the voltage is correct, move the red lead to the connection at the igniter wire (test point H). No voltage here means that the five-pin wire harness is shorted and should be replaced. If the correct voltage is detected, move the black lead of the meter to pin 3 of the 15-pin connector where the red power lead enters the connector (test point B). Place the red meter lead at the pin on the igniter five-pin connector, on the back of the power control circuit board, where the white wire enters the connector at the end position (test point P). The meter should show 96-126 volts. If it does not, then the 15-pin wire harness or the power supply circuit board is shorted or open. Replace these components. If the correct voltage is measured at this point, move the red meter lead to the igniter wire quick disconnect (test point I). No voltage here means that the igniter five pin connector is faulty and must be replaced.



NOTES: IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE HEATER MUST BE REPLACED, APPLIANCE WIRING MATERIAL RATED FOR 105°C MUST BE USED. WHERE MARKED THUS - - - - - - - - , APPLIANCE WIRING MATERIAL RATED FOR 200°C MUST BE USED.

SI L'UN QUELCON
EAU DOIT ÊTRE RE
TOLÉRANCE NOM
PORTE LE SYMBO
POUR APPAREILS

Figure 34. Test Point Identification Diagram



Laars

waterpik Technologies, Inc.

BK	-BLACK
BK/Y	-BLACK WITH YELLOW TRACE
BL	-BLUE
BR	-BROWN
G	-GREEN
G/Y	-GREEN WITH YELLOW TRACE
GY	-GRAY
O	-ORANGE
PR	-PURPLE
R	-RED
W	-WHITE
W/BK	-WHITE WITH BLACK TRACE
W/R	-WHITE WITH RED TRACE
W/Y	-WHITE WITH YELLOW TRACE
Y	-YELLOW

QUE DES FILS D'ORIGINE FOUMIS AVEC LE CHAUFFE-
EMPLACÉ, UN FIL PÔUR APPAREILS ÉLECTRIQUES À
MINALE DE 105°C DOIT ÊTRE EMPLOYÉ. SI LE FIL
LE - - - - - - ,LE REMPLECER UNIQUEMENT PAR UN FIL
ÉLECTRIQUES À TOLÉRANCE NOMINALE DE 200°C.

SECTION 11.
Replacement Parts

11.1 Ordering Information

To order or purchase parts for the Laars LX and LT Low NOx pool and spa heater, contact your nearest Laars dealer or distributor. See the Jandy web site at www.jandy.com for the nearest service center. If they cannot supply you with what you need, contact Customer Service at Water Pik Technologies, P.O. Box 6000, Petaluma, California, 94954, Telephone (707) 776-8200 extension 245.

NOTE: To supply the correct part it is important that you state the model number, serial number and type of gas when applicable. This information is on the rating plate inside the heater.

11.2 Parts List

Key No.	Description	Model No.	ORDER PART NO:
	Water Components		
1	Complete Heat Exchanger (Copper)	250,400	R0326303,05
2	Tube Assy.(Cu), w/Hdwr & Gskts	250,400	R0326603,05
3	Heat Exchanger Baffles (Set of ten including end baffles)	250,400	R0334403,05
4	Front Header, w/Hdwr & Gskts	All	R0326900
5	By-Pass Assy, w/Hdwr & Gskts	All	R0327100
6	Gasket, Bypass Assy	All	R0336700
7	Spring, Bypass	All	R0327200
8	Coupling Nut Kit, w/Gasket, (Set of two)	All	R0327300
9	Gasket, Coupling, (Set of two)	All	R0327400
10	Rear Header, w/Hdwr & Gskts	All	R0327000
11	Gasket, Header (front or rear)	All	R0327500
12	Header Drain Plug w/Gasket(Set of 3)	All	R0335900
13*	Heat Exch. Hardware Kit & Gaskets	All	R0327600
	Gas Components		
14	Burner Tray Assembly	250,400	R0386203,05
15	Burners (Ea.)	All	R0386400
16	Manifold, Gas w/Orifice	250,400	R0386303,05
17	Orifice (0-3K ft) (Set of 8)	All	R0386500
18	Gas Valve Nat w/ Street Ell	All	R0386600
	Exhaust System		
19	Flue Collector	250,400	R0386703,05
20	Blower Assy.	All	R0329800
21	Gasket w/Blower Mntg Hdwr	All	R0329900
22	Flue Vent Assy.	All	R0331500
23	Indoor Vent Collar	250,400	R0331403,05
24	Outdoor Grill	All	R0328500
25*	Vent Hardware Kit	All	R0331600
	Electrical		
26	Transformer	All	R0061100
27*	Fuse Assy, In-line	All	R0337100
28	Blower Pressure Switch	All	R0302000
29	Temperature Sensor w/Sleeve & Gskt	All	R0011800
30	Gasket, Temperature Sensor	All	E0116400
31	Plastic Sleeve, Temperature Sensor	All	10444900
32	Retainer Bracket, Temp. Sensor	All	10447300
33	Screw, Retainer Bracket	All	F0009100
34	Ignition Control	All	R0386800

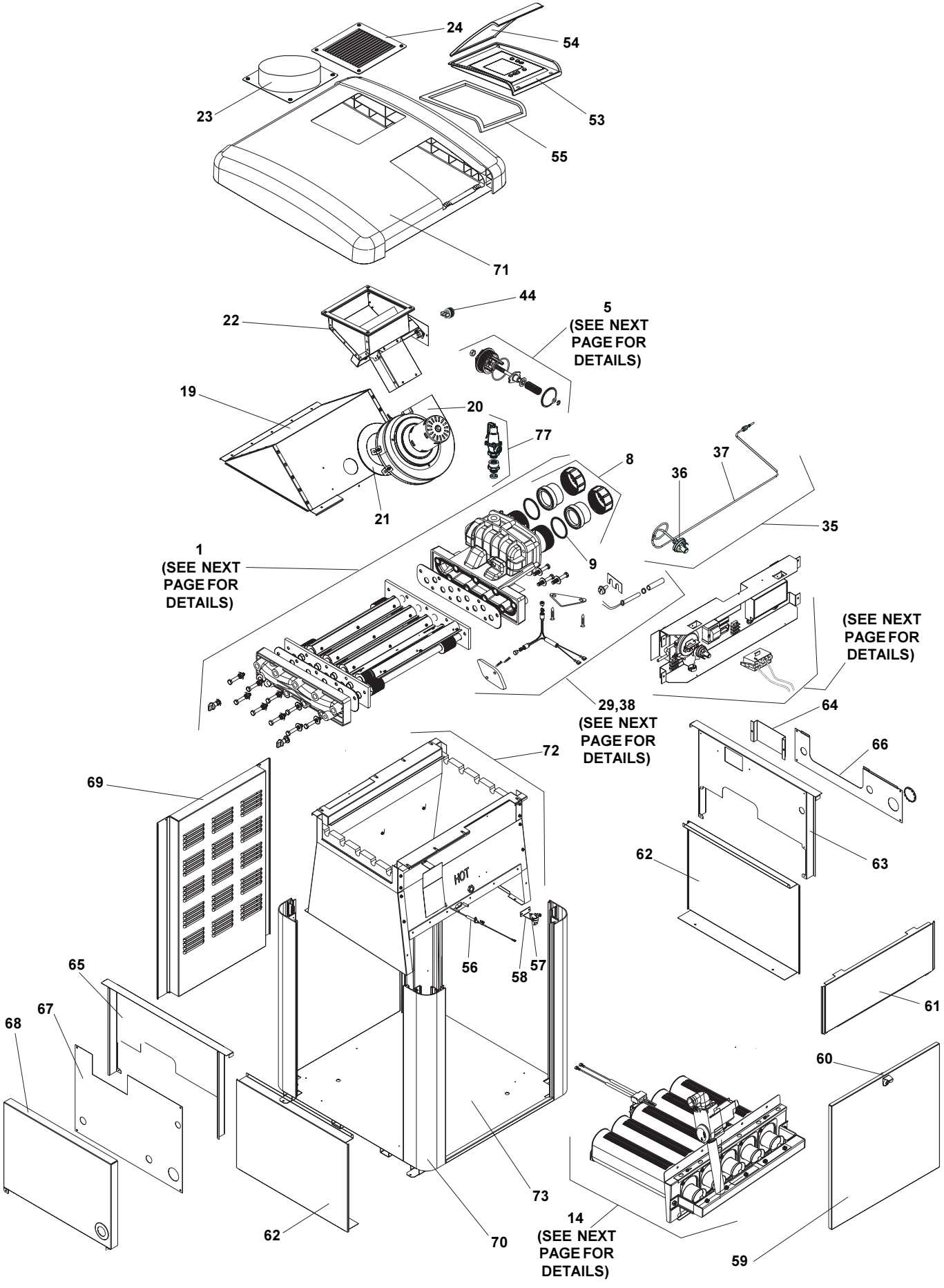
Key No.	Description	Model No.	ORDER PART NO:
	Electrical (continued)		
35	Pressure Switch Assy	All	R0334500
36	Pressure Switch, 2 psi	All	R0013200
37	Siphon Loop	All	R0334600
38	High Limits Set	All	R0023200
39	High Limit 135°F	All	R0022700
40	High Limits 150°F	All	R0023000
41	Harness, High Limit Switch	All	R0334700
42	Retainer Plates, High Limit (Set of 2)	All	R0336500
43	Hot Surface Ignitor	All	R0386900
44	Exhaust Temp. Limit Switch	All	R0329400
45*	Wire Harnesses Complete	All	R0329500
46*	Wire Harness, Power Transformer	All	R0330900
47*	Wire Harness, Ignition Control	All	R0331000
48*	Wire Harness, Gas Valve	All	R0331100
49*	Wire Harness, Safety Loop	All	R0331200
50	Wire Harness, 120 Volt Power Plug	All	R0336200
50	Wire Harness, 240 Volt Power Plug	All	R0336300
51	Wire Harness, 15 Pin Connector	All	R0336400
52	Terminal Block for Fireman's Switch	All	R0097800
53	Temperature Control W/ Bezel, Gasket & Cover **-LX**	All	R0329600
53*	Temperature Control W/ Bezel, Gasket & Cover **-LT**	All	R0350500
54	Cover, Temperature Control	All	R0330600
55	Gasket, Temp Control/Top	All	R0387600
56	Flame Sense Rod	All	R0334800
57	Fusible Link	All	R0012200
58	Bracket, Fusible Link	All	R0337200
	Jacket Assy.		
59	Door w/ Latch	250,400	R0387103,05
60	Door Latch Assembly w/ Handle	All	R0334900
61	Cover Panel, Raceway	250,400	R0335103,05
62	Panel, Side, Lower (fits left or right)	All	R0330100
63	Panel, Right Side, Upper	All	R0330200
64	Cover Panel, Exhaust Switch	All	R0336600
65	Panel, Left Side, Upper	All	R0335200
66	Cover Plate, I/O Header Side	All	R0335300
67	Cover Plate, Return Header Side	All	R0335400
68	Cover Panel, Left Side	All	R0335500
69	Rear Panel	250,400	R0330303,05
70	Corner Posts	All	R0330400
71	Top Assy.	250,400	R0330503,05
72	Combustion Chamber Assy.	250,400	R0387203,05
73	Base Panel	250,400	R0335608,10
	Optional		
74*	Non Comb. Base	250,400	R0330803,05
75*	Touch-up Paint	All	R0335800
76*	Temperature Rise Measurement Kit	All	R0336000
77	Pressure Relief Valve	All	R0336100
78*	High Temp Silicone Sealant	All	R0382800

* PARTS NOT SHOWN ON KEY VIEW

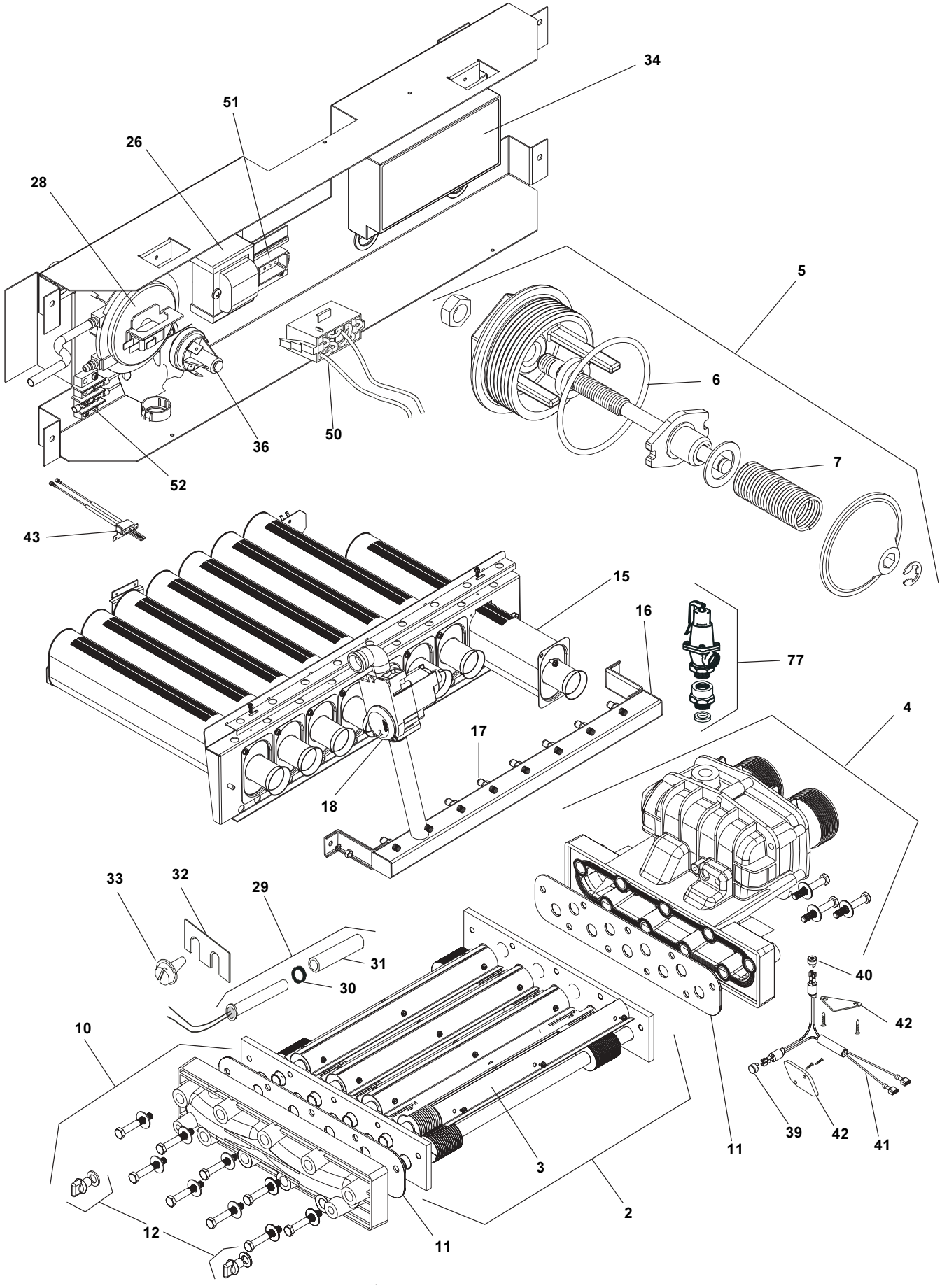
NOTES:

1. When ordering a kit for a model 250 specify as R#####-03, When ordering a kit for a model 400 specify as R#####-05,
2. All hardware sets contain all pieces necessary for assembly, including gaskets. Not shown.
3. Gaskets and hardware are included in all kits that involve the removal of a gasket as part of the procedure to replace a part.

11.3 General Exploded View



11.4Detailed Exploded View



NOTES

LIMITED WARRANTY

These warranties extend only to the first retail purchaser of Laars and Jandy products that have not been moved from their original installation sites. Laars and Jandy warrants all parts to be free from manufacturing defects in material and workmanship as detailed below for the designated time frame, commencing from the date of installation. If any parts are found to have manufacturing defects, Laars and Jandy will provide replacement of such defective parts.

	1 year	2 years	3 years	5 years	Lifetime
Cleaners:					
Ray-Vac®		X			
Others	X				
Control Systems:					
AquaLink® RS and Accessories	X				
AquaLink® RS (w/Surge Protection)	X	X($50 Deductible)	X($75 Deductible)		
AquaSwitch®, Pool Control, Ji, and Solar Control	X				
Filters:	X			Tank	
Heaters:					
Lite2		Controls, Firebox Panels, Heat Exchanger, Burners		All Other Parts	
LX, Hi-E2		Controls, Firebox Panels, Heat Exchanger, Fan Motor, Burners		All Other Parts	
Hot Shot	X				
Oil-Fired, XL-2, XL-3	Oil Burner, Controls Heat Exchanger, Firebox			All Other Parts	
Pumps:	X	Motor (from Manufacturer)			
Jandy Valve Actuator:	X				
Valves:					
NeverLube®					X
Others	X				
Water Features:	X				

EXCLUSIONS:

The liability of Laars and Jandy shall not exceed the repair or replacement of defective parts and does not include any costs for labor to remove and reinstall the defective part, transportation to or from the factory, and any other materials required to make the repair.

This warranty does not cover failures or malfunctions resulting from the following:

1. Failure to properly install, operate or maintain the product(s) in accordance with our published Installation, Operation and Maintenance Manuals provided with the product(s);
2. The workmanship of any installer of the product(s);
3. Not maintaining a proper chemical balance [pH level between 7.2 and 7.8, Total Alkalinity (TA) between 80 to 120 ppm, Total Dissolved Solids (TDS) less than 2000];
4. Abuse, alteration, accident, fire, flood, lightning, rodents, insects, negligence or acts of God;
5. Scaling, freezing, or other conditions causing inadequate water circulation;
6. Operating the product(s) at water flow rates outside the published minimum and maximum specifications;
7. Use of non-factory authorized parts or accessories in conjunction with the product(s);
8. Chemical contamination of combustion air or improper use of sanitizing chemicals such as, introducing sanitizing chemicals upstream of the heater and cleaner hose or through the skimmer;
9. Overheating, incorrect wire runs, improper electrical supply, collateral damage caused by failure of O-Rings, DE grids, or cartridge elements, damage caused by running the pump with insufficient water;
10. The installation of a surge protection kit does not extend the warranty of the original product(s).

LIMITATION OF LIABILITY:

This is the only warranty given by Laars and Jandy. No one is authorized to make any other warranties on Laars and Jandy behalf. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY. LAARS AND JANDY EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL, INCIDENTAL, INDIRECT OR PUNITIVE DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY**. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state or by province.

WARRANTY CLAIMS:

For prompt warranty consideration, contact your dealer and provide the following information: proof of purchase, model number, serial number and date of installation. The installer will notify the factory for instructions regarding the claim and for the location of the nearest Laars and Jandy designated service center. If the dealer is not available, you can locate a service center in your area by visiting www.jandy.com or you can call the Technical Support Department at (707) 776-8200 ext. 260 for assistance. All returned parts must have a Returned Material Authorization number in order to be considered for warranty evaluation. If there are any questions about the coverage of this warranty, please contact Laars and Jandy at the address below.

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480 S. Service Road West, Oakville, Ontario, Canada L6K 2H4 • 905.844.8233 FAX 905.844.2635

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