

IN GROUND POOL/SPA GAS HEATERS INSTALLATION & OPERATIONS MANUAL

FOR YOUR SAFETY:

▲ WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, injury, or death.

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

WHAT TO DO IF YOU SMELL GAS:

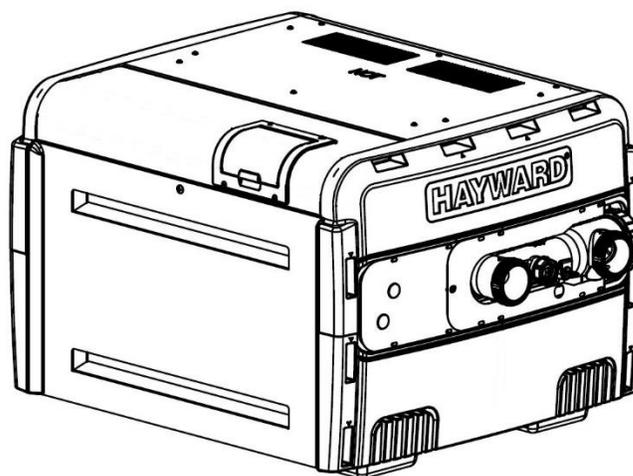
- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

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 that can cause serious injury, property damage, or death.

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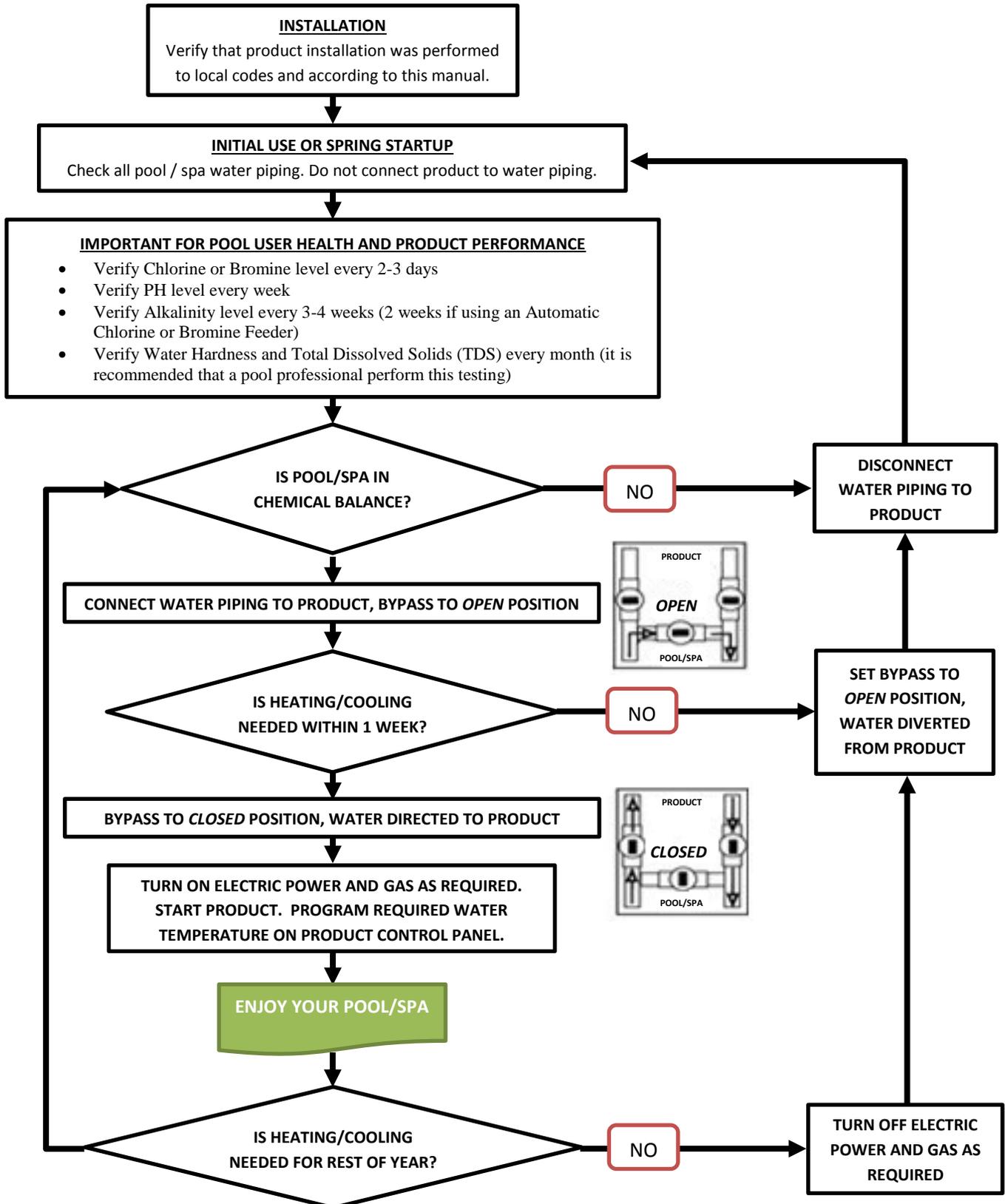
SAVE THESE INSTRUCTIONS



GETTING STARTED

WHAT TO EXPECT WHEN OPERATING YOUR POOL HEATER

This flow chart provides guidance to protect pool users and product by maintaining good water quality.



PLEASE READ BEFORE PROCEEDING

Basic safety precautions should always be followed, including the following:
Failure to follow instructions can cause death and/or severe injury.

 This is the safety-alert symbol. When you see this symbol on your equipment or in this manual, look for one of the following signal words and be alert to the potential for personal injury.

 **WARNING** warns about hazards that **could** cause death and/or severe injury or major property damage and if ignored presents a potential hazard.

 **CAUTION** warns about hazards that **could** cause minor or moderate personal injury and/or property damage and if ignored presents a potential hazard. It can also make consumers aware of actions that are unpredictable and unsafe.

NOTICE indicates special instructions that are important but not related to hazards.

See product rating plate for manufactures information.

HEATER CONSTRUCTION

Figure1: Sub-Assemblies

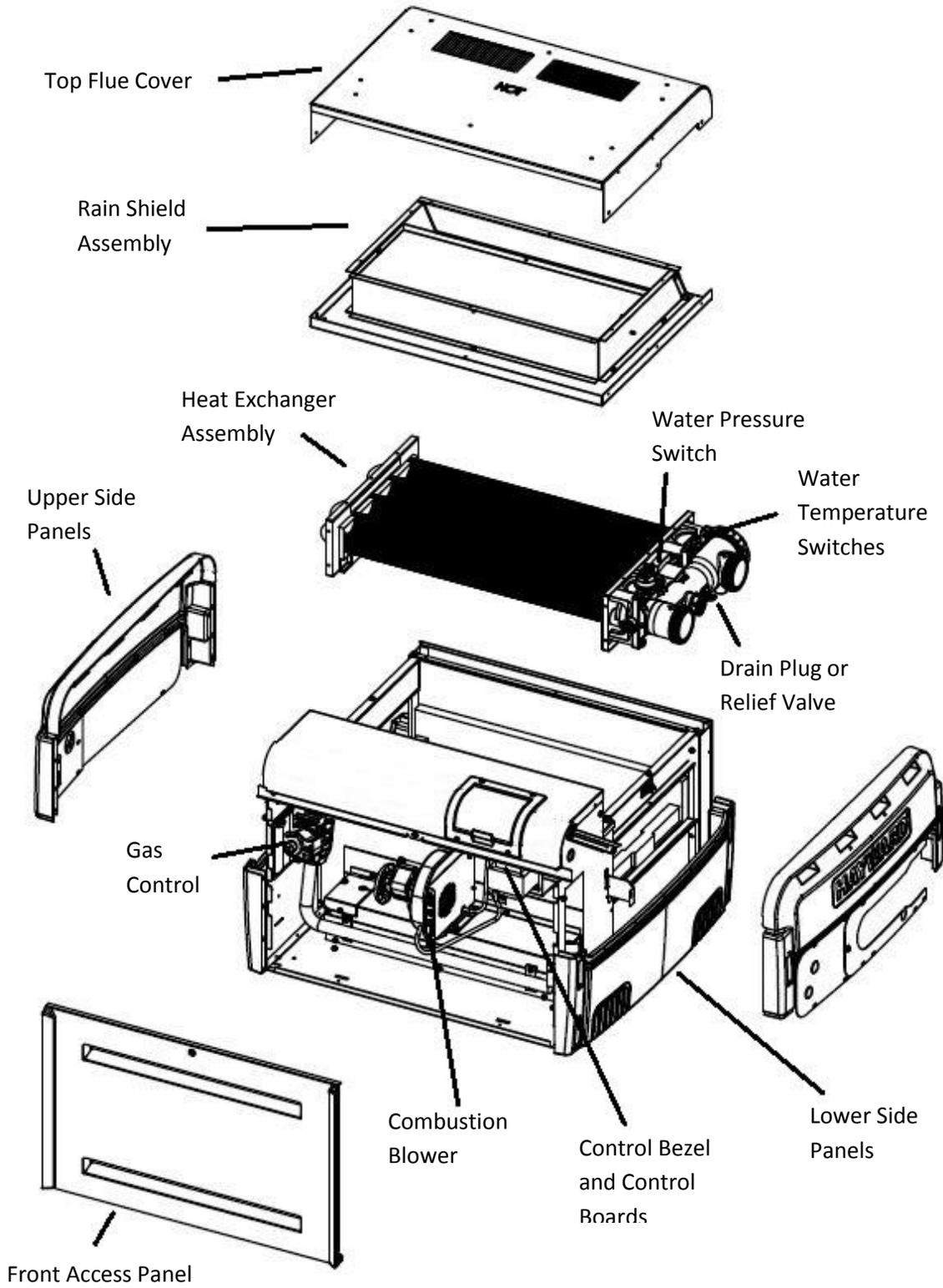


Table1: SPECIFICATIONS**Features:**

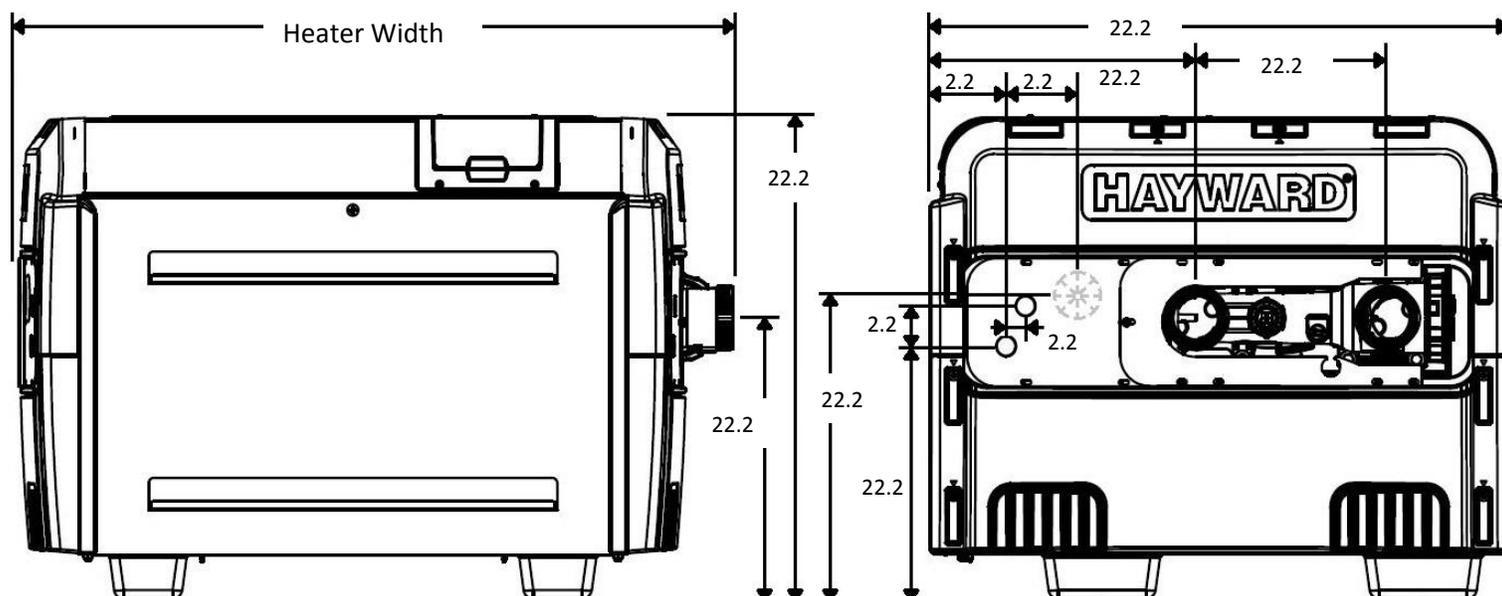
- 120 or 240VAC, 60Hz, 1-phase, 5.5A maximum current
- Forced draft combustion with silicon nitride hot surface ignition
- Cupronickel water tubes standard
- Integral low loss bypass, maximum water flow for all models is 125 GPM

Model	Gas Input Natural or Propane	Minimum Water Flow	Thermal Efficiency	Heater Width	Heater Weight
xxx	btu/hr	gpm	%	in.	lbs.
150	150,000	20	82.7	19	135
200	199,900	20	83	22	140
250	250,000	25	84	25	165
300	300,000	25	82.7	26	175
350	350,000	30	83	31	195
400	399,900	30	84	34	195
500	500,000	40	83	40	245
250ASME	250,000	25	84	28	195
400ASME	400,000	30	84	36.5	225
500ASME	500,000	40	83	40.5	260

GAS REQUIREMENTS

OPERATING PRESSURES	Natural Gas (inwc)	Propane Gas (inwc)
Gas Manifold Pressure*	1.8 - 2.2	6.8 - 7.0
Gas Inlet Pressure, Minimum	4.5	10.0
Gas Inlet Pressure Maximum	10.5	13.0
GAS ORIFICE DRILL SIZES	#25	#43
GAS ORIFICE DRILL SIZES (500kbtu/hr)	#22	2.3mm

*Pressure range for allowable heating value variation.



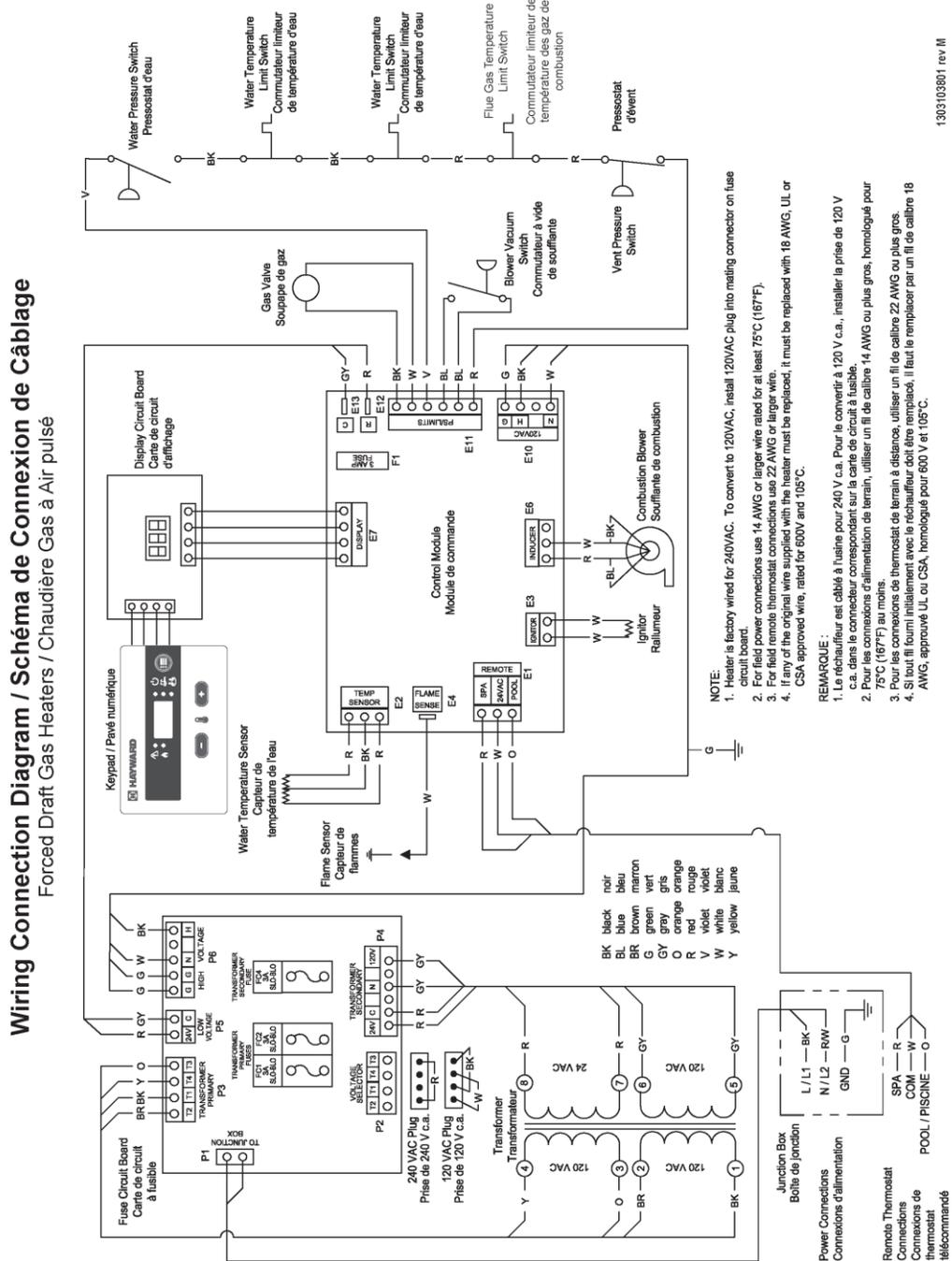
Wiring Connection Diagram



▲ WARNING - Risk of Electric Shock Before working on any electrical equipment, turn off power supply to the equipment.

▲ WARNING - Risk of Electric Shock. All electrical wiring MUST conform to applicable local codes, regulations, and the National Electric Code (NEC). Hazardous voltage can cause death, shock, burn, and/or serious property damage. To reduce the risk of electric shock, do NOT use an extension cord to connect unit to electric supply. Provide a properly located electrical receptacle. To reduce the risk of electric shock replace damaged wiring immediately. Locate conduit to prevent abuse from lawn mowers, hedge trimmers and other equipment. Do NOT ground to a gas supply line.

Figure2: Wiring Diagram



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Table2: CERTIFICATION AND COMPLIANCE

CERTIFICATION CODES AND STANDARDS	USA	CANADA
DESIGN CERTIFIED	CSA	CSA
DESIGN COMPLIANT	ANSI Z21.56	CSA 4.7
INSTALLATION COMPLIANT GAS	NFPA 54/ANSI Z223.1 NFPA 58	CAN/CSA-B149.1-2
INSTALLATION COMPLIANT ELECTRIC	ANSI/NFPA 70 NEC	CSA C22.1 – Canadian Electrical Code, Part I
EMISSIONS	SCAQMD 1146.2	
SHIPPING COMPLIANT	ISTA 3B	ISTA 3B

CONFORMANCE WITH CODES: The heater shall be installed in accordance with all local and state codes and with the requirements of the authority having jurisdiction of the installing site. The heater installation must conform to the latest edition of the above listed installation codes.

SAFETY INFORMATION



▲ WARNING – Read, Understand, and Follow all instructions in this manual and on the equipment.
Failure to follow instructions can cause severe injury and/or death.

▲ WARNING – Suction Entrapment Hazard.

Suction in suction outlets and/or suction outlet covers which are damaged, broken, cracked, missing, or unsecured can cause severe injury or death due to the following entrapment hazards:



Hair Entrapment- Hair can become entangled in suction outlet cover.

Limb Entrapment- A limb inserted into an opening of a suction outlet sump or suction outlet cover that is damaged, broken, cracked, missing, or not securely attached can result in a mechanical bind or swelling of the limb.



Body Suction Entrapment- A negative pressure applied to a large portion of the body or limbs can result in an entrapment.



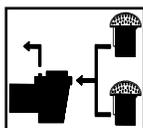
Evisceration/ Disembowelment - A negative pressure applied directly to the intestines through an unprotected suction outlet sump or suction outlet cover which is damaged, broken, cracked, missing, or unsecured can result in evisceration/disembowelment.



Mechanical Entrapment- There is potential for jewelry, swimsuit, hair decorations, finger, toe or knuckle to be caught in an opening of a suction outlet cover resulting in mechanical entrapment.

▲ WARNING - To Reduce the risk of Entrapment Hazards:

- o When outlets are small enough to be blocked by a person, a minimum of two functioning suction outlets per pump must be installed. Suction outlets in the same plane (i.e. floor or wall), must be installed a minimum of three feet (3') [1 meter] apart, as measured from near point to near point.
- o Dual suction fittings shall be placed in such locations and distances to avoid “dual blockage” by a user.
- o Dual suction fittings shall not be located on seating areas or on the backrest for such seating areas.
- o The maximum system flow rate shall not exceed the flow rating as listed in TABLE1: SPECIFICATIONS.
- o Never use Pool or Spa if any suction outlet component is damaged, broken, cracked, missing, or not securely attached.
- o Replace damaged, broken, cracked, missing, or not securely attached suction outlet components immediately.
- o Install two or more suction outlets per pump in accordance with latest ASME, APSP Standards and CPSC guidelines. Follow all applicable National, State, and Local codes.
- o Installation of a vacuum release or vent system, which relieves entrapping suction, is recommended.



▲ WARNING – Failure to remove pressure test plugs and/or plugs used in winterization of the pool/spa from the suction outlets can result in an increase potential for suction entrapment as described above.

▲ WARNING – Failure to keep suction outlet components clear of debris, such as leaves, dirt, hair, paper and other material can result in an increase potential for suction entrapment as described above.

▲ WARNING – Suction outlet components have a finite life, the cover/grate should be inspected frequently and replaced at least every seven years or if found to be damaged, broken, cracked, missing, or not securely attached.

▲ CAUTION – Components such as the filtration system, pumps and heater must be positioned so as to prevent their being used as means of access to the pool by young children. To reduce risk of injury, do not permit children to use or climb on this product. Closely supervise children at all times. Components such as the filtration system, pumps, and heaters must be positioned to prevent children from using them as a means of access to the pool.



▲ WARNING – Hazardous Pressure. Pool and spa water heating and circulation systems operate under hazardous pressure during start up, normal operation, and after pump shut off. Stand clear of circulation system equipment during pump start up. Failure to follow safety and operation instructions could result in violent separation of the pump housing and cover, and/or filter housing and clamp due to pressure in the system, which could cause death, severe personal injury and/or property damage. Before servicing pool and spa water circulation system, all system and pump controls must be in off position and filter manual air relief valve must be in open position. Before starting system pump, all system valves must be set in a position to allow system water to return back to the pool. Do not change filter control valve position while system pump is running. Before starting system pump, fully open filter manual air relief valve. Do not close filter manual air relief valve until a steady stream of water (not air or air and water) is discharged.



▲ WARNING – Separation Hazard. Failure to follow safety and operation instructions could result in violent separation of pump and/or filter components. Strainer cover must be properly secured to pump housing with strainer cover lock ring. Before servicing pool and spa circulation system, filters manual air relief valve must be in open position. Do not operate pool and spa circulation system if a system component is not assembled properly, damaged, or missing. Do not operate pool and spa circulation system unless filter manual air relief valve body is in locked position in filter upper body. **Never operate or test the circulation system at more than 50 PSI. Do not purge the system with compressed air.** Purging the system with compressed air can cause components to explode, with risk of severe injury or death to anyone nearby. Use only a low pressure (below 5 PSI), high volume blower when air purging the pump, filter, or piping.



▲ WARNING – Risk of Electric Shock. All electrical wiring MUST be in conformance with applicable local codes, regulations, and the National Electric Code (NEC). Hazardous voltage can shock, burn, and cause death or serious property damage. To reduce the risk of electric shock, do NOT use an extension cord to connect unit to electric supply. Provide a properly located electrical receptacle. Before working on any electrical equipment, turn off power supply to the equipment. To reduce the risk of electric shock replace damaged wiring immediately. Locate conduit to prevent abuse from lawn mowers, hedge trimmers and other equipment. Do NOT ground to a gas supply line.

▲ WARNING – Risk of Electric Shock. Failure to ground all electrical equipment can cause serious or fatal electrical shock hazard. Electrically ground all electrical equipment before connecting to electrical power supply.

▲ WARNING – Risk of Electric Shock. Failure to bond all electrical equipment to pool structure will increase risk for electrocution and could result in injury or death. To reduce the risk of electric shock, see installation instructions and consult a professional electrician on how to bond all electrical equipment. Also, contact a licensed electrician for information on local electrical codes for bonding requirements.

Notes to electrician: Use a solid copper conductor, size 8 or larger. Run a continuous wire from external bonding lug to reinforcing rod or mesh. Connect a No. 8 AWG (8.4 mm²) [No. 6 AWG (13.3 mm²) for Canada] solid copper bonding wire to the pressure wire connector provided on the electrical equipment and to all metal parts of swimming pool, spa, or hot tub, and metal piping (except gas piping), and conduit within 5 ft. (1.5 m) of inside walls of swimming pool, spa, or hot tub.

IMPORTANT - Reference NEC codes for all wiring standards including, but not limited to, grounding, bonding and other general wiring procedures.

▲ WARNING – Risk of Electric Shock. The electrical equipment must be connected only to a supply circuit that is protected by a ground-fault circuit-interrupter (GFCI). Such a GFCI should be provided by the installer and should be tested on a routine basis. To test the GFCI, push the test button. The GFCI should interrupt power. Push reset button. Power should be restored. If the GFCI fails to operate in this manner, the GFCI is defective. If the GFCI interrupts power to the electrical equipment without the test button being pushed, a ground current is flowing, indicating the possibility of an electrical shock. Do not use this electrical equipment. Disconnect the electrical equipment and have the problem corrected by a qualified service representative before using.

▲ CAUTION – These heaters are intended for use with permanently-installed pools and may be used with hot tubs and spas if so marked. Do not use with storable pools. A permanently-installed pool is constructed in or on the ground or in a building such that it cannot be readily disassembled for storage. A storable pool is constructed so that it is capable of being readily disassembled for storage and reassembled to its original integrity.

▲ WARNING – Risk of Hyperthermia. To avoid hyperthermia the following “Safety Rules for Hot Tubs” are recommended by the U.S. Consumer Product Safety Commission.

1. Spa or hot tub water temperatures should never exceed 104°F [40°C]. A temperature of 100°F [38°C] is considered safe for a healthy adult. Special caution is suggested for young children. Prolonged immersion in hot water can induce hyperthermia.
2. Drinking of alcoholic beverages before or during spa or hot tub use can cause drowsiness, which could lead to unconsciousness and subsequently result in drowning.
3. Pregnant women beware! Soaking in water above 100°F [38°C] can cause fetal damage during the first three months of pregnancy (resulting in the birth of a brain-damaged or deformed child). Pregnant women should adhere to the 100°F [38°C] maximum rule.
4. Before entering the spa or hot tub, users should check the water temperature with an accurate thermometer; spa or hot tub thermostats may err in regulating water temperatures by as much as 4°F (2.2°C).
5. Persons taking medications, which induce drowsiness, such as tranquilizers, antihistamines or anticoagulants, should not use spas or hot tubs.
6. If the pool/spa is used for therapy, it should be done with the advice of a physician. Always stir pool/ spa water before entering the pool/spa to mix in any hot surface layer of water that might exceed healthful temperature limits and cause injury. Do not tamper with controls because scalding can result if safety controls are not in proper working order.
7. Persons with a medical history of heart disease, circulatory problems, diabetes or blood pressure problems should obtain a physician’s advice before using spas or hot tubs.
8. Hyperthermia occurs when the internal temperature of the body reaches a level several degrees above normal body temperature of 98.6°F [37°C]. The symptoms of Hyperthermia include: drowsiness, lethargy, dizziness, fainting, and an increase in the internal temperature of the body.

The effects of Hyperthermia include:

- Unawareness of impending danger.
- Failure to perceive heat.
- Failure to recognize the need to leave the spa.
- Physical inability to exit the spa.
- Fetal damage in pregnant women.
- Unconsciousness resulting in danger of drowning.

DEFINITIONS:

Suction Outlet: The Suction Outlet is a fitting, fitting assembly, cover/grate and related components that provide a means for water to exit the pool and return into the pump circulating system. This fitting may also be referred to as the “Main Drain”

Bypass Valves: A valve or series of valves that direct the pool water to flow or not flow through the heater.

CSA: Canadian Standards Association

CGA: Canadian Gas Association

ANSI: American Nation Standards Institute

NFPA: National Fire Protection Association

NEC: National Electric Code

SCAQMD: South Coast Air Quality Management District

ISTA: International Safe Transit Association

Pressure measurement units:

Inches of Mercury (inHg) is typically used with atmospheric pressure measurements.

Pounds per square inch (PSI) is typically used with water “pressure”, “suction” or system measurements.

Inches of Water (inwc) is typically used with gas or air pressure measurements

(1.0 inHg = .49 PSI = 13.5inwc)

INSTALLATION:

This manual contains instructions for installation, operation, maintenance, troubleshooting, and parts lists for the proper operation of the swimming pool/spa/hot tub heaters. It is strongly recommended that the installer read the manual before installing the swimming pool/spa/hot tub heater. If after reviewing the manual any questions remain unanswered, contact tech services or local representative. Following heater installation, the installer should leave all manuals with the consumer for future reference.

NOTICE: The installation instructions are intended for the use of a qualified technician, specifically trained and experienced in the installation of this type of heating equipment. Some states or provinces require that installer be licensed. If this is the case in the state or province where heater is located, the contractor must be properly certified.

THE USE OF A POOL COVER IS RECOMMENDED. A pool cover reduces heat loss, conserves chemicals, lowers the load on filter systems and may provide a valuable safety feature

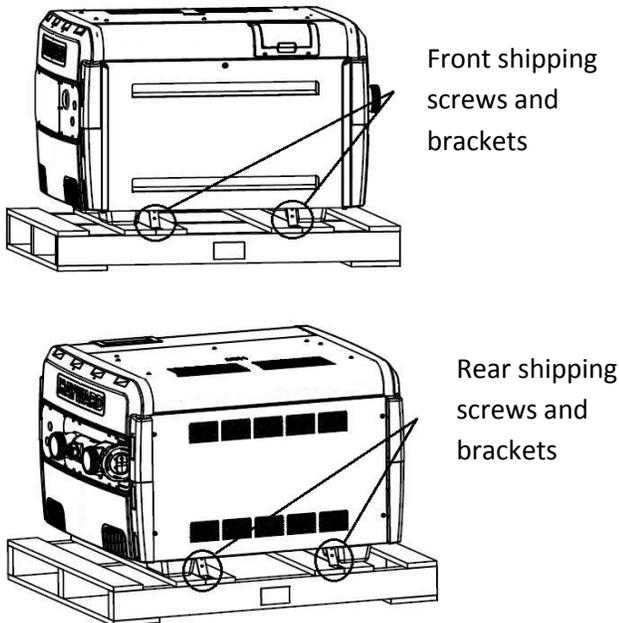
EQUIPMENT INSPECTION: On receipt of the heater, inspect the heater carton(s) for damage. If any carton(s) is damaged, note it when signing for it. Remove the heater from the carton(s) inspect it and advise the carrier of any damages at once.

NOTICE: Do not drop the heater from a pickup truck tailgate to the ground. This may damage the heater.

UNCRATING THE HEATER: Follow these steps to remove the shipping carton from the heater:

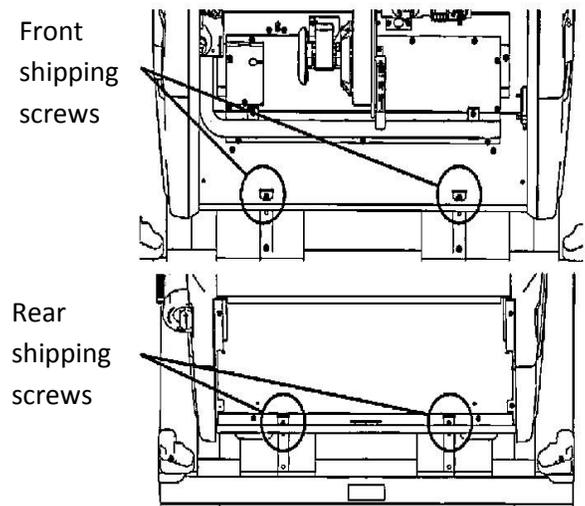
1. Remove the corrugated carton from the heater. The carton, top pad, bottom pad, and the four corner posts can be recycled.
2. There are four (4) external screws (see figure3) used to secure the heater to the wood pallet. All four must be removed to separate the heater from the pallet.

Figure3: External Shipping Screw Locations



3. To access the four (4) internal screws (see figure4), open the front access panel by removing the single top screw. Then remove the two (2) screws and brackets which hold the heater base pan to the pallet shown in Figure3. Next open the rear access panel by removing the four (4) screws holding this panel. Then remove the two (2) screws and brackets which hold the heater base pan to the pallet as shown in Figure3.
4. Lift the heater clear of the corrugated bottom pad and off of the pallet. Discard bottom corrugated tray and pallet appropriately.

Figure4: Internal Shipping Screw Locations



SPRINKLER HEADS: The heater is designed to handle the wettest weather conditions that are typical of rain and high humidity. Sprinkler heads force high-pressure water into the unit from the side at an odd angle. Make sure there are no sprinkler heads near the heater that will spray on or into the unit. Many sprinkler systems are connected to a well system, whose water is high in minerals, Sulphur, salt and other aggressive contaminants, that will leave a buildup on the unit and electronics causing corrosion and shortens life.

NOTICE: Damage from sprinkler interaction is not covered under the warranty agreement. Make sure that sprinklers are placed at a sufficient distance away so that normal wind will not carry the mist to the Heater.

NOTICE: If located in an oceanfront area, the Heater should be placed out of direct spray of sand and salt. This will clog, damage, and corrode the unit. You may also consider protecting the unit by creating a physical barrier outside of the minimum clearances between the unit and the prevailing beachfront wind. Damage caused by sand or salt spray is not covered by the warranty.

LOCATING THE HEATER:

Locate the pool/spa heater in an area where leakage of the heat exchanger or connections will not result in damage to the area adjacent to the heater or to the structure. When such locations cannot be avoided, it is recommended that a suitable drain pan, with drain outlet, be installed under the heater. The pan must not restrict airflow. This heater must be installed at least (5) feet from the inside wall of a pool (in-ground or above-ground)/spa/hot tub unless separated from the pool/spa/hot tub by a solid barrier. The heater must be installed such that the location of the exhaust gas vent assembly outlet relative to adjacent public walkways, adjacent buildings, openable windows, and building openings complies with the National Fuel Gas Code (ANSI Z223.1/NFPA 54) and/or CAN/CGA B149 installation codes.

1. Level surface for proper rain water draining and removal.
2. Suitable electrical supply line. See rating plate on the heater for electrical specifications. A junction box is not needed at the heater; connections are made inside the unit electrical compartment. Minimum wire size to be selected per NEC.
3. Electric disconnect switch that will interrupt all power to the unit. This switch MUST be within line of sight of the heater.
4. The heater does not require additional vent piping when installed outdoors.
5. Do not install in a location where growing shrubs may in time obstruct a heater's combustion air and venting areas.
6. Do not install this appliance under an overhang less than 72in from the top of the appliance. The area under the overhang must be open on (3) sides.
7. Do not install the heater where water spray from ground level can contact the heater. The water could reach the controls causing electrical damage.
8. Do not install under a deck.
9. Do not install within 24in of any outdoor HVAC equipment.
10. Do not install where water may run-off a roof into the heater. A gutter may be needed to protect the heater.

▲ CAUTION: Make sure the heater is not located where large amounts of water may run-off from the roof into the unit. Sharp sloping roofs without gutters will allow massive amounts of rainwater, mixed with debris from the roof to be forced through the unit. Failure to follow the instructions may result in property damage and void warranty.

11. Any enclosure around the heater must provide a combustion air vent large enough to accommodate input ratings of all gas appliances in the enclosure. See AIR SUPPLY section for more detail
12. For minimum exhaust vent clearances for all building openings, including but not limited to vented eaves, doors, windows, or gravity inlets, see Figure5. **In Canada, the heater must be installed with the top of the vent at least 10 feet (3m) below, or to either side of, any opening into a building.**

OUTDOOR AND INDOOR INSTALLATION AND SERVICE

CLEARANCES: For both outdoors and indoors installations, the installation clearances from combustible materials and service clearances shown in Table3 and Figure5 must be maintained. Do not install heater in a closet or enclosed space (consult NFGC)

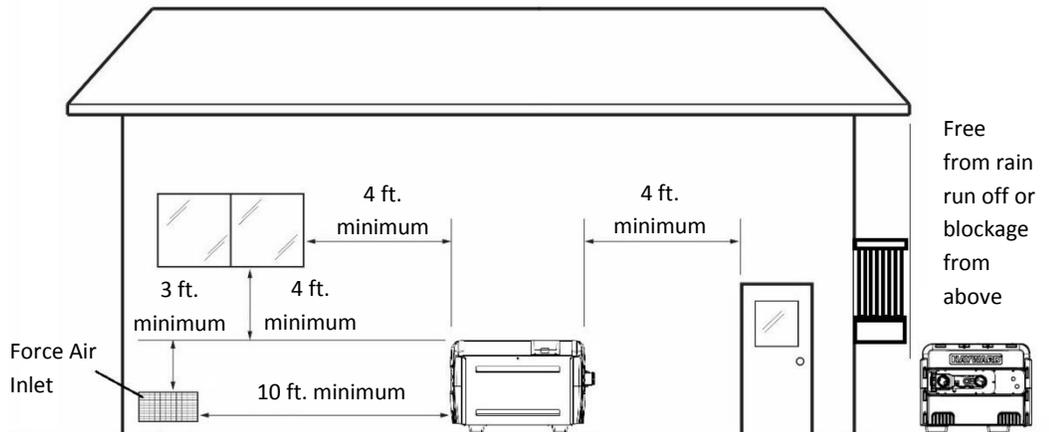
*If the heater is to be installed with vinyl siding at back, increase the clearance in Table3 to 12 inches to avoid potential discoloration of siding

Heater Panel	Outdoor Clearance	Indoor Clearance
Top	Unobstructed	36
Front	18	18
Back*	6	6
Water Side Connection	12	12
Opposite Water Side Connection	6	6

EQUIPMENT PAD: Place the heater on a level surface such as concrete or a fabricated slab (pad). This allows proper drainage of condensation and rainwater from the base of the unit. If possible, the pad should be placed at the same level or slightly higher than the filter system equipment pad.

FLOORING: This heater may be installed on either non-combustible flooring or combustible flooring that does not reduce the bottom clearance of the heater. Ultralite™ or equivalent concrete-over-foam HVAC pads are acceptable.

Figure5: Outdoor Minimum Clearances



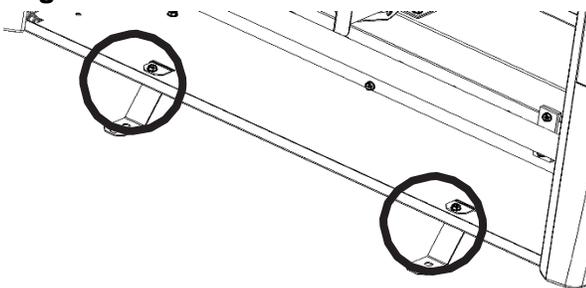
ANCHORING: The heater is equipped for installation of factory supplied tie-down brackets when required by local codes. Follow all relevant Local, State and National requirements regarding wind load anchoring. The brackets are shipped in the consumer kit. You will need the following to complete the installation:

Tie-down brackets	(FACTORY-SUPPLIED, qty = 4)
Sheet metal screws	(FACTORY-SUPPLIED, qty = 4)
Concrete tapping screws	(FIELD-SUPPLIED, Tapcons®, qty = 4, stainless steel, size to be 1/4" diameter with a minimum length of 1-1/2")
Fender washers	(FIELD SUPPLIED, stainless steel, qty = 4, size to be at least 1-1/2")

INSTALLING TIE-DOWN BRACKETS:

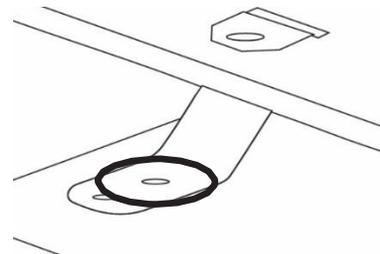
1. Locate the tie-down brackets and the sheet metal screws.
2. Obtain the Tapcons®. Be sure the overall length of the concrete tapping screw is at least 1-1/2".
3. Remove the front (1 screw) and rear access panel (4 screws).
4. Position the heater on the pad so that all Tapcons® can "bite" into the pad. Observe local codes regarding pad construction, some jurisdictions specify a minimum thickness for concrete pads.
5. Position the tie-down brackets into the slots in the front of the heater base pan so they are positioned as shown in Figure6. Install the sheet metal screws through the holes in the bracket to secure the bracket to the heater base pan.
6. Install the Tapcons® through the inner set of holes in the tie-down brackets into the pad (see figure7).
7. Repeat Steps 6 & 7 at the rear of the heater.
8. Tie down is completed when (4) brackets are secured to the heater and the pad. Re-install the access panels in locations (front and rear), front shown

Figure6: Tie-Down Installation Locations



Install supplied screws at these locations.

Figure7: Use 2nd Hole for Ground Mount of Tie-Down Brackets with 2 Holes



GAS CONVERSION:

Where permitted by local codes, the factory-installed gas train may be changed from natural gas to propane or from propane to natural gas, using the appropriate conversion kits. Gas conversions are to be performed only by a qualified service agency. Detailed instructions are included with each kit.

ALTITUDE OF INSTALLATION:

Heaters may be installed at any altitude up to 10,100 ft. above sea level, provided the appropriate modification(s) are performed. The altitudes which require modification vary depending on the model. Parts necessary to convert the heater for outdoor installation at altitudes up to 7,700 ft. (minimum) are included with the heater.

▲ WARNING: Failure to comply with the appliance and vent package installation instructions and service instructions in this manual may result in equipment damage, fire, asphyxiation, or carbon monoxide poisoning. Exposure to products of incomplete combustion (carbon monoxide) can cause cancer and birth defects or other reproductive harm.

Conversion is accomplished by replacement of the blower air inlet plate, and for indoor applications, installation of the appropriate vent pressure switch. The blower air inlet plates are clearly marked with the compatible heater model(s), vent configuration(s), and altitude range(s). Care should be taken to verify the correct plate and vent pressure switch is being used to ensure proper heater performance. The vent pressure switch will be provided with the indoor adapter kit, or if you have an older indoor adapter kit, order p/n FDXLVPS1931 for the high-altitude indoor vent pressure switch. Table4 lists the maximum altitudes for which each model is designed with: a) no modifications, b) the included conversion plate installed, and c) the accessory conversion kit FDXLHAK1930 installed (sold separately).

Model	Outdoor Installation			Indoor Installation *		
	No Modifications to Heater	Included Conversion Plate Installed	Kit FDXLHAK1930 Installed	No Modifications to Heater	Included Conversion Plate Installed	Kit FDXLHAK1930 Installed
150FDN	7,700	N/A	10,100	10,100	N/A	N/A
150FDP	7,700	N/A	10,100	2,000	10,100	N/A
200FDN	10,100	N/A	N/A	10,100	N/A	N/A
200FDP	5,400	10,100	N/A	2,000	10,100	N/A
250FDN	5,400	10,100	N/A	2,000	10,100	N/A
250FDP	2,000	7,700	10,100	2,000	7,700	10,100
300FDN	10,100 ¹	N/A	N/A	10,100	N/A	N/A
300FDP	2,000	10,100	N/A	2,000	10,100	N/A
350FDN	2,000	10,100	N/A	2,000	10,100	N/A
350FDP	2,000	7,700	10,100	2,000	7,700	10,100
400FDN	10,100	N/A	N/A	10,100	N/A	N/A
400FDP	2,000	7,700	10,100	2,000	7,700	10,100
500FDN	10,100	N/A	N/A	10,100	N/A	N/A
500FDP	5,400	7,700	10,100	5,400	7,700	10,100

* All indoor installations at altitudes above 2,000 require a vent pressure switch to be installed in addition to the blower inlet plate. The vent pressure switch is included with the appropriate indoor vent kit (UHXNEGVT1xxx or UHXPOSHZ1xxxx), or the high-altitude vent pressure switch kit FDXLVPS1931.

High-Altitude Conversion Procedure:

1. Identify the altitude of the installation site. This may be done using a GPS device, or by looking up the altitude for the geographic location. Altitudes for all locations in the United States and Canada may be found using the zip/postal code database at www.zip-codes.com. If the altitude for the installation site is greater than 10,100 ft., the heater may not be installed. Note that if installing outdoors, some heaters may be compatible with your altitude without modification. Table4 lists the altitude ranges for heaters without modification. All indoor heaters installed above 2,000 ft. require the appropriate vent pressure switch, see indoor installation kit instructions.
2. Select the appropriate blower air inlet plate to use based on the heater model, vent configuration (outdoor or indoor), and altitude needed. Extra plate(s) are included with the heater, packaged in the plastic bag with this manual. Each plate has a label which identifies which model(s), vent configuration(s), and altitude range(s) for which it is designed. Table4 lists the maximum installation altitudes using the included conversion plate(s). If installing above 7,700 ft., the high-altitude kit FDXLHAK1930 (sold separately) may be necessary.
3. If installing indoors, select the appropriate high-altitude indoor vent pressure switch from the indoor adapter kit or from the FDXLVPS1931 kit. Each switch has a label which identifies which model(s) and altitude range(s) for which it is designed.
4. If connected, turn pump, main gas valve, and heater power off, remove heater front access door.
5. Remove the 4 #10 hex head screws that fasten the blower air inlet plate to the blower, and remove the blower air plate and discard. Save the 4 screws as they will be needed to install the new plate. See Figure29: Blower
6. Install the appropriate blower plate from the kit using the 4 screws. It may be helpful to drive the screws in and out of the plate outside of the heater first to "thread" the holes before installing it in the heater.
7. If the installation is configured for indoor venting, a special high-altitude vent pressure switch must be installed. Follow the instructions provided in listed vent kits (see Tables 6 and 9), and use the appropriate blower air inlet plate and vent pressure switch for your altitude.
8. Re-install heater front door, if connected, turn pump, main gas valve, and heater power back on.
9. Activate heater and check for proper operation.

AIR SUPPLY:

Indoor installations and outdoor shelters (confined spaces) must be provided with adequate combustion and ventilation air openings to assure proper heater operation. These openings must be sized according to the requirements stated in paragraphs below (ALL AIR SUPPLY FROM INSIDE THE BUILDING or ALL AIR SUPPLY FROM OUTDOORS whichever applies to the installation). These air openings must never be obstructed when heater is in operation. These confined spaces shall be provided with 2 permanent openings, one commencing within 12 inches of the bottom and one commencing within 12 inches of the top of the enclosure. The openings shall communicate directly or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors. Ducts shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall not be less than 3 inches. When air blowers are used in spa/hot tub installations and are located in proximity to the heater, caution must be observed to ensure sufficient combustion air is available to the heater for proper combustion. A separate blower air duct is recommended. Table 3 indoor clearances apply.

ALL AIR SUPPLY FROM INSIDE THE BUILDING: The confined space shall be provided with 2 permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space (a space whose volume is not less than 50 cubic feet per 1,000 btu/hr of total input all gas utilization equipment installed in the combined space shall). Each opening shall have a minimum free area of 1 square inch per 1,000 btu/hr of the total input, but not less than 100 square inches. See Table5 and Figure8.

ALL AIR SUPPLY FROM OUTDOORS: When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch per 2,000 btu/hr of total input See Table5 and Figure9B. When communicating with the outdoors (either directly or through vertical ducts), each opening shall have a minimum free area of 1 square inch per 4,000 btu/hr of total input rating of all equipment in the enclosure. See Table5 and Figure9A. When installing a heater below ground (in a pit, for use with Natural Gas only), combustion and ventilation air openings must be provided as shown in Figure10.

Free Area per Total Btu Requirement	Total Input (Btu/hr)	Combustion Air Free Area Required	Ventilation Air Free Area Required
1 sq. in. per 1,000 Btu/hr (Indoor Air)	150,000	150	150
	200,000	200	200
	250,000	250	250
	300,000	300	300
	350,000	350	350
	400,000	400	400
1 sq. in. per 2,000 Btu/hr (Outdoor Air thru Horz duct)	150,000	75	75
	200,000	100	100
	250,000	125	125
	300,000	150	150
	350,000	175	175
	400,000	200	200
1 sq. in. per 4,000 Btu/hr (Outdoor Air direct or thru Vert duct)	150,000	37.5	37.5
	200,000	50	50
	250,000	62.5	62.5
	300,000	75	75
	350,000	87.5	87.5
	400,000	100	100
	500,000	125	125

*For detailed methods of providing combustion and ventilation air, see latest edition of the National Fuel Gas Code (ANSI Z223.1/NFPA 54).

Figure8: Air from Inside Building Installation
1 square inch per 1,000 btu/hr of the total input
 Table3 Indoor Clearance Apply

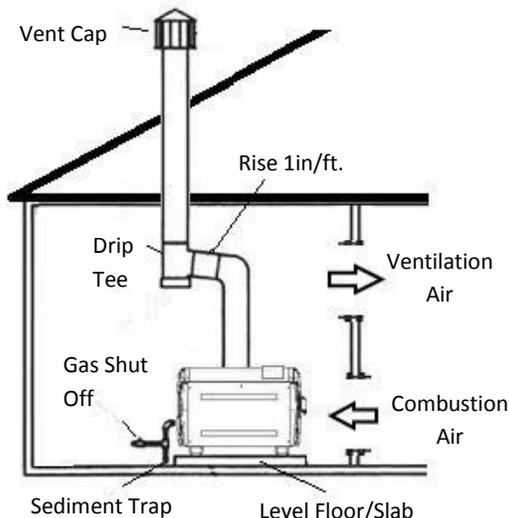


Figure10: Air Below-Ground
(Pit for Natural Gas only Installations)
1 square inch per 4,000 btu/hr of total input
 Table3 Indoor Clearance Apply

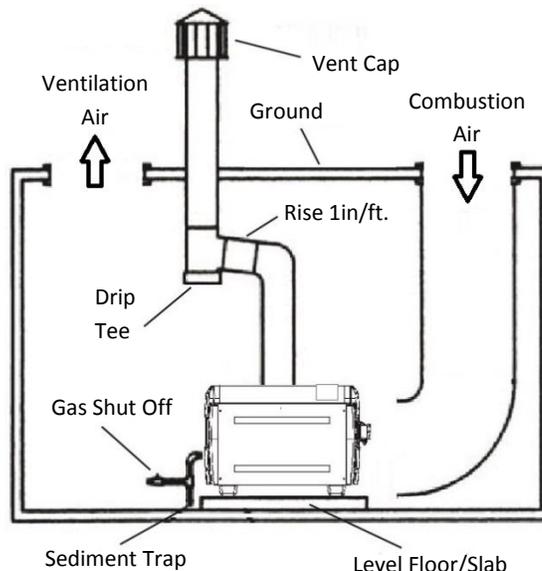
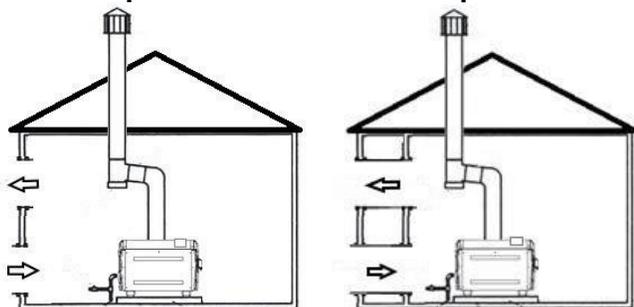


Figure9: Air from Outside Building Installation
A) 1 square inch per 4,000 btu/hr of total input
B) 1 square inch per 2,000 btu/hr of total input



FLUE GAS VENTING:

For installation outdoors, no additional venting is required for operation. Ensure top of unit remains unobstructed.

INDOOR INSTALLATION WITH NEGATIVE (CATI) OR POSITIVE (CATIII) PRESSURE VENTING SYSTEMS: The heater is designed such that it may be vented using either a negative-pressure or a positive-pressure venting system. The appropriate system of venting for a particular site will depend on many factors such as vent termination needs (horizontal/vertical), clearance of vent termination, length of vent and the cost of venting system. Table6 (CATI) and Table9 (CATIII) list the required indoor venting kits available for each system. Multiple forced- or induced-draft units should never be vented using common venting or vent terminations. Never common vent this heater with other gas-burning appliances.

NEGATIVE PRESSURE (VERTICAL ONLY, CATI) VENTING:

NEGATIVE PRESSURE CATI VENT SIZING: Size the vent pipe according to the venting Tables in the National Fuel Gas Code (ANSI Z223.1/NFPA 54) for a Category I gas appliance using single-wall or double-wall (Type B) gas vent. Vent pipe diameter should not be less than the size of the vent pipe adapter on the heater with the appropriate vent kit adapter installed (see Table6). Single-wall vent may be used in conditioned spaces only. Clearance to combustible materials for single-wall vent is 9 inches. Double-wall (Type B) vent may be used in conditioned spaces, but must be used in non-conditioned spaces. Clearance to combustible materials for double-wall vent is 6 inches. Smaller clearances may be available; consult the National Fuel Gas Code.

Models	Indoor Vent Kit Part Number	Vent Dia(in)	Description	Vent Pipe Application	Vent Pipe Material	Vent Termination Requirement
150	UHXNEGVT11506	6	Indoor Vent Adapter Kit, Negative Pressure CATI, Vertical Venting Applications	Vent pipe to be installed according to the venting Tables in the National Fuel Gas Code (ANSI Z223.1/NFPA 54) for a Category I gas	Single or Double Wall, Galvanized, Non-Sealed Vent Pipe	Vertical Only
200	UHXNEGVT12006	6				
250	UHXNEGVT12506	6				
300	UHXNEGVT13008	8				
350	UHXNEGVT13508	8				
400	UHXNEGVT14008	8				
500	UHXNEGVT15008	8				

CATI MECHANICAL DRAFT SYSTEMS: Vent systems requiring power venting must use mechanical draft systems listed in accordance with UL378 Draft Equipment. Selection of power venter and required clearances from combustible materials must follow draft equipment manufacture's instructions, National Fuel Gas Code, local codes and the information in this manual.

NEGATIVE PRESSURE CATI VENT TERMINATION: Any vent extending through a roof or wall must be listed double-wall (Type B) vent, and pass through an approved roof jack, or roof thimble. A listed vent cap must be used. Terminations for Gas vents with listed 12in or less diameter size and located not less than 8ft from a vertical wall or similar building feature shall terminate per Figure11 and Table7 using the roof pitch to find the minimum termination height value of **H**. Terminations for Gas vents with listed 12in or less diameter size located less than 8ft from a vertical wall or similar building feature shall terminate not less than 2ft above the highest point where they pass through the roof and not less than 2ft above any portion of a building within 10ft horizontally

Figure11: Minimum Height from Roof for Vent Cap

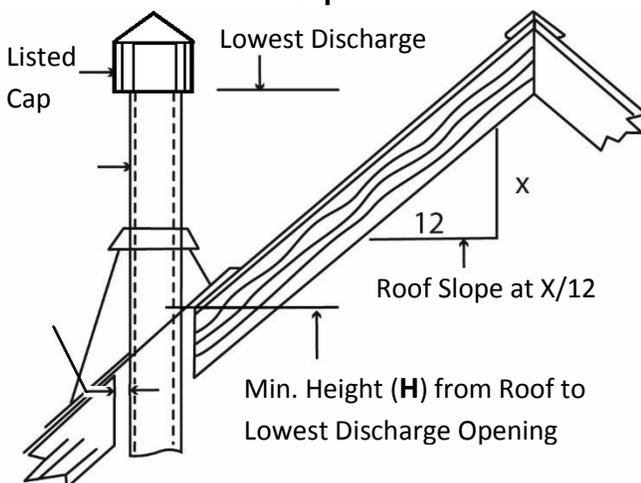


Table7 Height Requirements for Negative Pressure (CATI) Vent Caps (see Figure11)

Roof Slope	Min. Height H from Roof to Lowest Discharge Opening	
	(ft.)	(m)
Flat to 6/12	1.0	0.30
Over 6/12 to 7/12	1.25	0.38
Over 7/12 to 8/12	1.5	0.46
Over 8/12 to 9/12	2.0	0.61
Over 9/12 to 10/12	2.5	0.76
Over 10/12 to 11/12	3.25	0.99
Over 11/12 to 12/12	4.0	1.22
Over 12/12 to 14/12	5.0	1.52
Over 14/12 to 16/12	6.0	1.83
Over 16/12 to 18/12	7.0	2.13
Over 18/12 to 20/12	7.5	2.27
Over 20/12 to 21/12	8.0	2.44

POSITIVE PRESSURE (HORIZONTAL OR VERTICAL, CATIII) VENTING:

When installed according to the following instructions, heaters meet the criteria for category III venting.

VENT SIZING: Vent pipe diameter must match the vent pipe diameter on the heater (see Table9). The vent pipe must be single or double-wall stainless steel sealed vent as listed in Table9. Double-wall vent must be used in non- conditioned spaces. The maximum total length of vent pipe, and number of 90-degree elbows cannot exceed the limits specified in Table8. The venting system must be installed in accordance with the vent manufacturer's installation instructions and guidelines. The installer is urged to visit the vent system manufacturer's website (see below) and review the installation information found there.

Table8 Positive-Pressure (CATIII) Indoor Vent Maximum Vent Lengths Using Specified Positive Pressure Indoor Vent Kits	
Number of 90- degree Elbows	Maximum Vent Pipe Length horizontal & vertical (ft.)
0	50
1	50
2	40
3	30

VENT TERMINATION: The vent system must terminate with a vent terminal approved for this pool heater. Termination may be either horizontal or vertical. See Table9a for approved vent terminals and 9b for termination locations.

OBTAINING VENT PIPE AND TERMINATIONS: A variety of vent components, including terminals, elbows, and straight lengths, are available for use with this appliance. Approved parts are listed in Table9 and in the service parts section in the back of this manual. If you need more specialized fittings, you may order them directly from the manufacturer, or one of their authorized dealers. To locate an authorized dealer for venting parts, contact the appropriate manufacturer at:

M&G DuraVent Inc.
6 Jupiter Ln.
Colonie, NY 12205
(800) 835-4429
www.duravent.com
DuraVent FasNSeal (W2)

OR

Selkirk Corporation
Heatfab Division
130 Industrial Blvd
Turners Falls, MA 01376
(800) 772-0739
www.heatfab.com
Heatfab Saf-T Vent EZ
Seal (CI Plus)

Notes for Table9 Positive-Pressure (CATIII) Indoor Vent Kits with Vent Pipe & Terminal Specifications

- * For Heatfab single-wall vent pipe section length, "x" to be: 1, 2, 4, 5, or 7, where 1=6 inches, 2=12 inches, 4=18 inches, 5=24 inches, and 7=36 inches.
- ** For Heatfab double-wall vent pipe section length, "x" to be: 06, 09, 12, 18, 24, or 36, indicating the length of the vent pipe section in inches.
- † For DuraVent vent pipe section length, "x" to be: 6, 12, 18, 24, or 36, indicating the length of the vent pipe section in inches.
- ‡ For these horizontal terminals, the wall penetration is included from the vent manufacturer. On all others, it must be ordered separately.

Table9 Positive-Pressure (CATIII) Indoor Vent Kits with Vent Pipe & Terminal Specifications

Heater Model	Indoor Vent Kit Part Number	Maximum Installation Altitude (ft.)	Vent Pipe Dia. (in)	Appliance Adapter	Vent Pipe Type	Heatfab Saf-T Vent EZ Seal (CI Plus) or DuraVent FasNSeal (W2)		
						Vent Pipe Part Number	Horizontal Vent Terminal Part Number	Vertical Vent Terminal Part Number
150 200	UHXPOSHZ1 1506 UHXPOSHZ1 2006	10,100	6	Heatfab adapter included in kit	Single-Wall	HeatfabP/N 960x *	HeatfabP/N 9614TERM	HeatfabP/N 5600CI
					Double-Wall	HeatfabP/N CCA06Lx **	HeatfabP/N 9614TERM	HeatfabP/N CCA06RC
250	UHXPOSHZ1 2506	10,100	6	Heatfab adapter included in kit	Single-Wall	HeatfabP/N 960x *	HeatfabP/N 5690CI ‡	HeatfabP/N 5600CI
					Double-Wall	HeatfabP/N CCA06Lx **	HeatfabP/N CCE06WP ‡	HeatfabP/N CCA06RC
250-FDN (NAT ONLY)	UHXPOSHZ1 2504	2,000	4	UHXDVA004 (4" DuraVent adapter)	Single-Wall	DuraVentP/N FSVLx04 †	DuraVentP/N FSTT4	DuraVentP/N FSRC4
					Double-Wall	DuraVentP/N W2-x04 †	DuraVentP/N FSTT4	DuraVentP/N W2-RC4
				UHXHFA004 (4" Heatfab adapter)	Single-Wall	HeatfabP/N 940x *	HeatfabP/N 9414TERM	HeatfabP/N 5400CI
					Double-Wall	HeatfabP/N CCA04Lx **	HeatfabP/N 9414TERM	HeatfabP/N CCA04RC
300 350 400	UHXPOSHZ1 3008 UHXPOSHZ1 3508 UHXPOSHZ1 4008	10,100	8	Heatfab adapter included in kit	Single-Wall	HeatfabP/N 980x *	HeatfabP/N 5890CI ‡	HeatfabP/N 5800CI
					Double-Wall	HeatfabP/N CCA08Lx **	HeatfabP/N CCE08WP ‡	HeatfabP/N CCA08RC
400	UHXPOSHZ1 4006	2,000	6	UHXDVA006 (6" DuraVent adapter)	Single-Wall	DuraVentP/N FSVLx06 †	DuraVentP/N FSTT6	DuraVentP/N FSRC6
					Double-Wall	DuraVentP/N W2-x06 †	DuraVentP/N FSTT6	DuraVentP/N W2-RC6
				UHXHFA006 (6" Heatfab adapter)	Single-Wall	HeatfabP/N 960x *	HeatfabP/N 9614TERM	HeatfabP/N 5600CI
					Double-Wall	HeatfabP/N CCA06Lx **	HeatfabP/N 9614TERM	HeatfabP/N CCA06RC
500	UHXPOSHZ1 5006	10,100	6	UHXDVA006 (6" DuraVent adapter)	Single-Wall	DuraVentP/N FSVLx06 †	DuraVentP/N FSTT6	DuraVentP/N FSRC6
					Double-Wall	DuraVentP/N W2-x06 †	DuraVentP/N FSTT6	DuraVentP/N W2-RC6
				UHXHFA006 (6" Heatfab adapter)	Single-Wall	HeatfabP/N 960x *	HeatfabP/N 9614TERM	HeatfabP/N 5600CI
					Double-Wall	HeatfabP/N CCA06Lx **	HeatfabP/N 9614TERM	HeatfabP/N CCA06RC

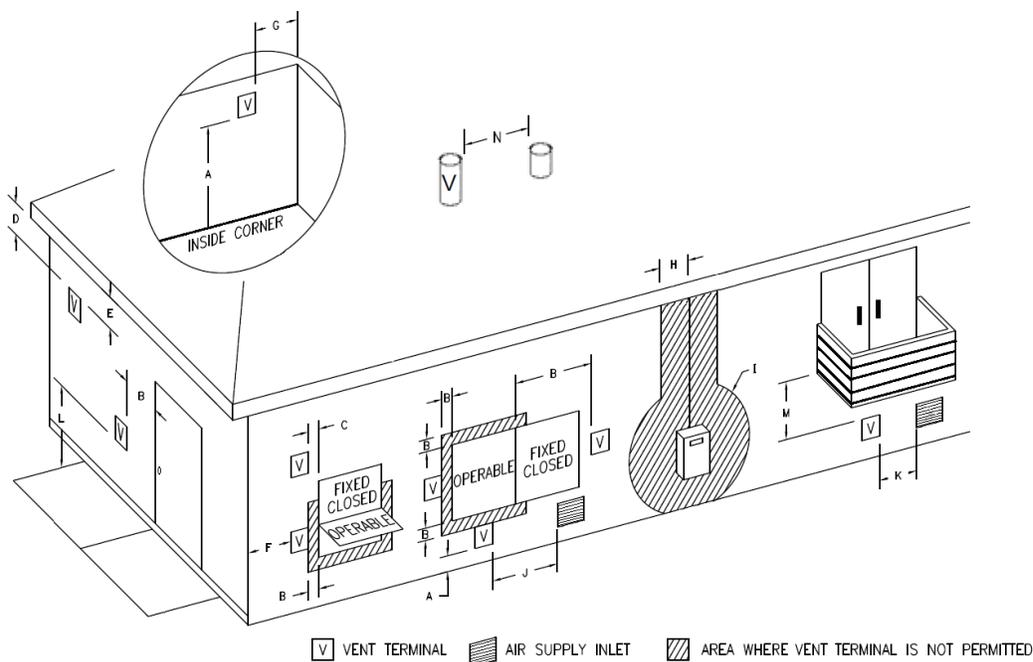


Table 9b Positive-Pressure (CATIII) Vent Termination Clearances

DIM	Clearance Description	U.S. Installation (1)	Canadian Installation (2)
A	Clearance above grade, veranda, porch, deck, balcony or anticipated snow level	12 in. (305 mm)	12 in. (305 mm). 18 in. (457 mm) above roof surface.
B	Clearance to a window or door that may be opened	12 in. (305 mm) for appliances > 500,000 Btuh (15 kW)	36 in. (914 mm) for appliances > 100,000 Btuh (30 kW)
C	Clearance to a permanently closed window	For clearances not specified in ANSI Z223.1/NFPA 54 or C A N / CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier	For clearances not specified in ANSI Z223.1/NFPA 54 or C A N / CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier
D	Vertical clearance to a ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the centerline of the terminal		
E	Clearance to an unventilated soffit		
F	Clearance to an outside corner		
G	Clearance to an inside corner		
H	Clearance to each side of the centerline extended above electrical meter or gas service regulator assembly	3 ft. (.9 M) within 15 ft. (4.6 M) above the meter/regulator assembly	3 ft. (.9 M) within 15 ft. (4.6 M) above the meter/regulator assembly
I	Clearance to service regulator vent outlet	For clearances not specified in ANSI Z223.1/NFPA 54 or C A N / CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier	3 ft. (.9 M)
J	Clearance to non ---mechanical air supply inlet to building or the combustion air inlet to any other appliance	9 in. (229 mm) for appliances > 10,000 Btuh (3kW) and <= 50,000 Btuh (15 kW), 12 in. (305 mm) for appliances > 50,000 Btuh (15 kW)	12 in. (305 mm) for appliances > 10,000 Btuh(3kW) and <= 100,000 Btuh (30 kW), 36 in. (914 mm) for appliances > 100,000 Btuh (30 kW)
K	Clearance to a mechanical air supply inlet	3 ft. (.9 M)	6 ft. (1.8 M)
L	Clearance above paved sidewalk or paved driveway located on public property	For clearances not specified in ANSI Z223.1/NFPA 54 or CAN/CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier	7 ft. (2.1 M). A vent shall not terminate above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
M	Clearance under a veranda, porch, deck, or balcony	For clearances not specified in ANSI Z223.1/NFPA 54 or C A N / CSA B149.1, clearances shall be in accordance with local installation codes and the requirements of the gas supplier	12 in. (305 mm). Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.
N	Clearance from a plumbing vent stack	3 ft. (.9 M)	3 ft. (.9 M)

(1) In accordance with the current ANSI Z223.1.NFPA 54, National Fuel Gas Code

(2) In accordance with the current C A N / CSA B 149.1, Natural Gas and Propane Installation Code.

WARNING:

1. The vent for this appliance shall not terminate:.. Over public walkways; or Near soffit vents of crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or property damage; or Where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.
2. When locating vent terminations, consideration must be given to prevailing winds, location, and other conditions which may cause recirculation of the combustion products of adjacent vents. Recirculation can cause poor combustion, inlet condensate problems, and accelerated corrosion of the heat exchangers.
3. Do not vent under a deck or large overhang. Recirculation could occur and cause performance or system problems.

GAS SUPPLY:

The heater is shipped from the factory with the gas connection located on the left side of the heater cabinet. The gas connection can also be configured from the right. Insert the pipe to the gas valve through the grommet in the cabinet side (see Figure13.) A union should be installed outside the heater cabinet for easy removal of the gas manifold assembly during service. A CSA certified main gas shutoff valve must be installed outside the cabinet and within 6 feet of the heater. This valve must have an I.D. large enough to supply the proper amount of gas volume to the heater. See Figure12. Reduction of gas supply pipe or tubing to the inlet to the heater gas valve must be made at the valve only and must match the valve inlet size (3/4" or 1" NPT). If more than one appliance is installed on the gas line, consult the local gas company or appropriate technical service for the proper gas line size.

▲ CAUTION: Apply joint compound (pipe dope) sparingly and only to the male threads of pipe joints. Do not apply joint compound to the first two threads. Use joint compounds resistant to the action of liquefied petroleum gas. Do not overtighten the gas inlet pipe or damage may result.

NOTICE: Use Only CSA approved flexible outdoor gas appliance connectors marked with BTUH capacity (which must be equal to or greater than the heater rated input) and appropriate gas type (natural and/or LP).

Figure12: Gas Piping with Shut Off & Trap

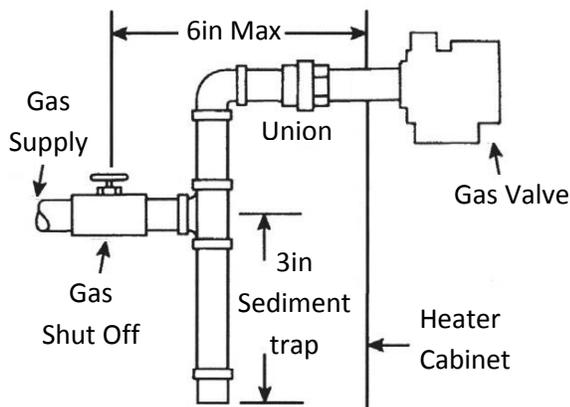
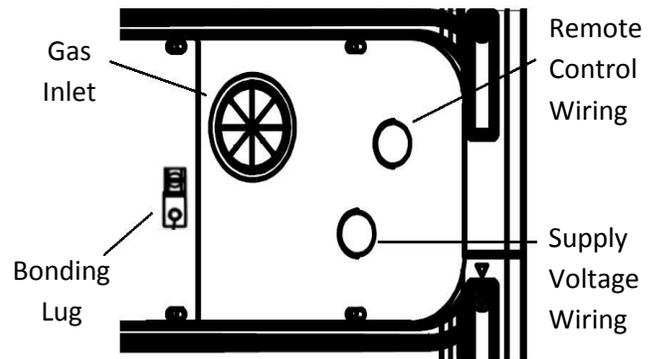


Figure13: Gas Entry and Junction Box Cover



NATURAL GAS: The gas meter must have the capacity to supply enough gas to the pool heater and any other gas appliances if they are on the same pipeline (Example: 225 meter = 225,000 BTUH). If doubt exists as to the meter or regulation sizes, consult the local gas utility for assistance. Natural gas must be "pipeline quality" supplied from a natural gas utility company.

NOTICE: Manufacturer is not responsible for heaters that are damaged if connected to a natural gas well.

PROPANE GAS: All propane gas tanks must be located outdoors and away from pool/spa structure and in accordance with the standard for storage and handling of propane gas, ANSI/NFPA 58 (latest edition) and applicable local codes. If the propane gas tank is installed underground, the discharge of the regulator vent must be above the highest probable water level. Propane tanks must have sufficient capacity to provide adequate vaporization for the full capacity of the equipment at the lowest expected temperatures. Consult a propane expert for accurate pipe and pressure sizing. Make sure that 1st and 2nd stage regulators are large enough to handle the BTUH input listed for the heater(s) being used

NOTICE: Manufacturer is not responsible for heaters that soot due to improper gas line or propane tank sizing or regulation control resulting in improper gas volume.

GAS SUPPLY AND PIPING: To properly size the gas piping for the heater, refer to Tables 10, 11, 12, and 13, depending on natural or propane gas, and single-stage or 2-stage regulation. Follow local gas codes for proper gas line material selection (copper, iron, plastic, etc.). It is VERY IMPORTANT when installing a propane heater on a 2-stage regulation system to follow the gas line sizing data in Tables 12 or 13 without exception

btu/hr input		150,000	200,000	250,000	300,000	350,000	400,000	500,000
Gas Line Material		Iron or Plastic Pipe						
Distance from Gas Meter to Gas Valve Inlet (ft.)	0 to 50	3/4	1	1	1-1/4	1-1/4	1-1/4	1-1/4
	50 to 100	1	1	1-1/4	1-1/4	1-1/4	1-1/4	1-1/2
	100 to 200	1-1/4	1-1/4	1-1/4	1-1/2	1-1/2	1-1/2	2
	200 to 300	1-1/4	1-1/4	1-1/2	2	2	2	2

Based upon an inlet gas pressure of 0.5 psig or less at a pressure drop of 0.5 inwc

btu/hr input		150,000		200,000		250,000		300,000		350,000		400,000		500,000	
Gas Line Material		Iron Pipe	Tubing	Iron Pipe	Iron Pipe										
Distance from Tank Regulator to Gas Valve Inlet (ft.)	0 to 50	3/4	7/8	3/4	7/8	1	1-1/8	1	1-1/8	1	1-1/8	1	1-1/8	1	1
	50 to 100	3/4	1-1/8	1	1-1/8	1	1-1/8	1	---	1-1/4	---	1-1/4	---	1-1/4	1-1/4
	100 to 200	1	1-1/8	1	---	1-1/4	---	1-1/4	---	1-1/4	---	1-1/4	---	1-1/4	1-1/4
	200 to 300	1	---	1-1/4	---	1-1/4	---	1-1/4	---	1-1/4	---	1-1/4	---	1-1/2	1-1/2

Based upon an inlet gas pressure of 11 inwc at a pressure drop of 0.5 inwc

btu/hr input		150,000	200,000	250,000	300,000	350,000	400,000	500,000	
Gas Line Material		Iron or Plastic Pipe							
Distance of 1st Stage then 2nd Stage to Gas Valve Inlet (ft.)	First Stage *	0 to 50	1/2	1/2	1/2	1/2	1/2	1/2	
		50 to 100	1/2	1/2	1/2	1/2	3/4	3/4	3/4
		100 to 150	1/2	1/2	1/2	3/4	3/4	3/4	3/4
	Second Stage **	0 to 10	3/4	3/4	3/4	3/4	3/4	3/4	1

* Based upon an inlet gas pressure of 2 psig at a pressure drop of 1 psi

** Based upon an inlet gas pressure of 10 inwc at a pressure drop of 0.5 inwc

btu/hr input		150,000		200,000		250,000		300,000		350,000		400,000		500,000		
Gas Line Material		Iron Pipe	Tubing	Iron Pipe	Tubing	Iron Pipe	Tubing	Iron Pipe	Tubing	Iron Pipe	Tubing	Iron Pipe	Tubing	Iron Pipe	Tubing	
Distance of 1st Stage then 2nd Stage to Gas Valve Inlet (ft.)	First Stage +	0 to 50	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	
		50 to 100	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	5/8	1/2	5/8	1/2	5/8
		100 to 150	1/2	1/2	1/2	1/2	1/2	1/2	1/2	5/8	1/2	5/8	1/2	5/8	1/2	5/8
	Second Stage +	0 to 10	1/2	5/8	1/2	5/8	1/2	3/4	3/4	3/4	3/4	7/8	3/4	7/8	3/4	1

+ Based upon an inlet gas pressure of 10 psig at a pressure drop of 1 psi

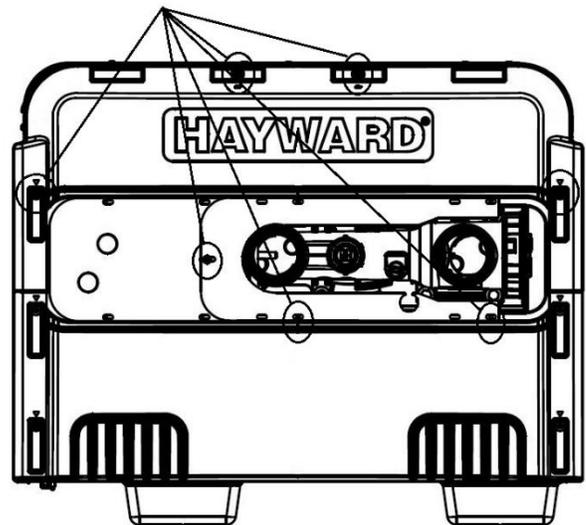
*+ Based upon an inlet gas pressure of 11 inwc at a pressure drop of 0.5 inwc

WATER PIPING:

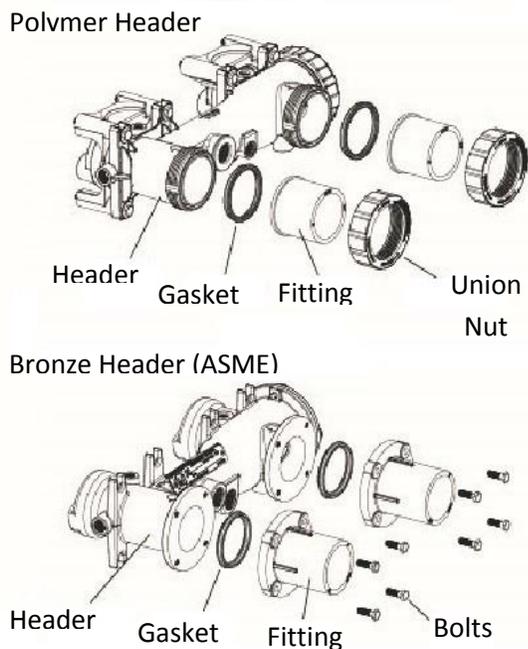
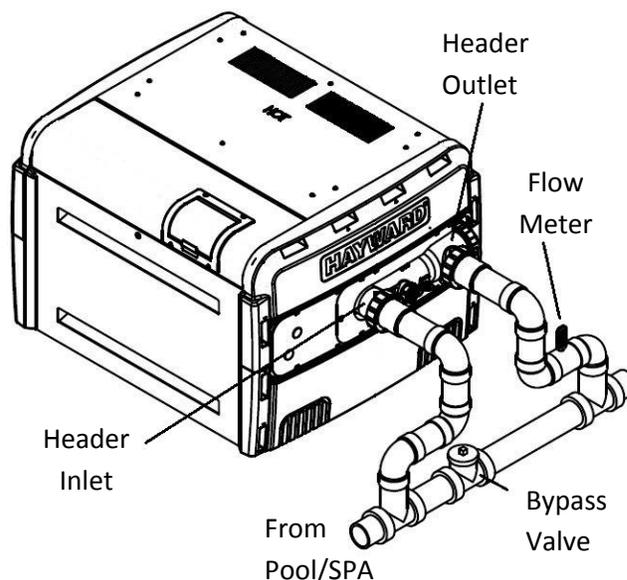
REVERSIBLE WATER CONNECTIONS: This heater is designed so that it can be installed with the water connections located on either the right or left side. Heaters are factory-shipped with right-side water connections. To move the connections to the left side follow the instructions below and reference Figures 1 and 14 as needed. A trained service technician must perform these steps before the heater is installed.

1. Before beginning, be aware that it is not necessary to remove the water header from the heat exchanger to perform this manipulation. When this procedure is complete, the water inlet will be located at the BACK of the heater. The water outlet will be located at the FRONT.
2. Remove screws and remove both of the upper plastic heater side panels (see Figure 14). Note the wires that pass through a hole in the heater side panel go through a split-bushing, which will allow separation of the wires from the panel without disconnecting them.
3. Disconnect the 2 wires connecting the heater wire harness to the heat exchanger header. One is located on the water pressure switch and one is located on the temperature limit switch, both on the top of the header. Pull these wires into the heater cabinet from the hole in the right-hand metal side panel in the heater, and re-route them out through the left-hand metal side panel in the heater.
4. Remove countersunk screws on the heater top and remove louvered exhaust panel on heater top (see Figure 1).
5. Remove the heater top flue cover by removing 3 screws on each side of the heater (see Figure 1).
6. Remove screws and remove rain shield assembly (see Figure 1). Note that there are screws which hold the rain shield assembly to the heat exchanger tube sheets, which also must be removed.
7. Remove the front access panel (see Figure 1).
8. Disconnect water temperature sensor plug from the ignition control board located inside the heater (see Figure 1).
9. Pull the water temperature sensor wires out of the heater cabinet through the hole in the right-hand metal side panel.
10. Lift and **rotate** the heat exchanger 180 degrees. Do not flip. Use care when setting the heat exchanger in place do not damage the white sealing gaskets or combustion chamber refractory.
11. Route the water temperature sensor wires into the heater cabinet through the hole in the left-metal side panel, and re-connect to the ignition control board.
12. Re-connect the heater wire harness to the water pressure switch and temperature limit.
13. Reverse the above disassembly steps to reassemble the heater.

Figure 14: Screw Locations on Side of Unit



NOTICE: The heater is for use with pool and spa/hot tub water furnished by municipal water distribution systems only. Do not use with mineral water, seawater (PPM>5000), or other non-potable waters which invalidate the warranty. Do not install any restriction in the water pipe between the heater outlet and the pool/spa with the exception of; three-way switching valve, in-line chlorinator and/or chlorinator check valve.

Figure15: Water Connections**Figure16: Bypass Valve(s)**

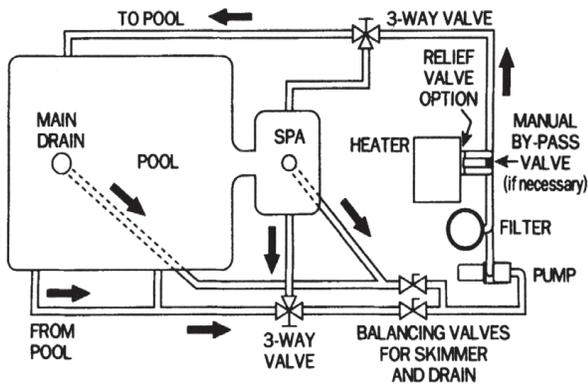
▲ WARNING: EXPLOSION HAZARD Blockage of water flow from heater return to pool may result in fire or explosion causing property damage, personal injury, or loss of life.

The heater is equipped with CPVC flanged pipe nipples to accommodate water piping to and from the pool or spa. These pipe nipples will accept piping by solvent welding (PVC glue). The fittings will accept either a 2" pipe, or a 2 1/2" pipe fitting, and seal to the heater header with rubber gaskets. On plastic headers, the fittings are secured in place with supplied plastic union nuts, and on bronze headers (ASME models), the fittings are secured in place with bolts. Assemble these parts to the heater prior to plumbing. Tighten union nuts (or bolts) securely before gluing fittings to the ends of the pipe nipples. See Figure15. The CPVC flanged pipe nipples must be installed on the heater inlet and outlet without modification. Pipe, fittings, valves, and any other element of the filter system may be made of plastic materials, if acceptable to the authority having jurisdiction. Heat sinks, heat tapes, firemen switches, and check valves are not required on the heater. However, if there is any chance of "back-siphoning" of hot water when the pump stops running, it is suggested that a check valve be used on the heater outlet pipe down stream of bypass system. The built-in bypass inside the header will maintain proper flow through the heat exchanger if the flow rate is within the range specified in the specification in the Getting Started section. The minimum flow rate is to be calculated or measured with the in-floor cleaning system in use, if the pool is so equipped, as well as any other jets or other demands on the water flow. If the normal pump and filter system flow rate exceeds 125gpm then a manual bypass valve must be installed as shown in Figure16. Damage caused by flow rates outside this range will void the manufacturer's warranty. Bypass valve setting may be accomplished by temporarily installing a flow meter on the outlet line of the heater. Then adjust the manual bypass valve until the flowrate through the heater is within the flow rate range specified. Once the manual bypass valve is set, note the position and remove the valve handle to prevent accidental adjustment.

▲ CAUTION: Improperly adjusted manual bypass valves will result in damage to the heater if the flow rates are not maintained under all operating conditions as specified in Table1: Specifications. The heat exchanger will fail and this damage will not be covered under the manufacturer warranty.

Figure17 illustrates a typical pool piping diagram and layout for the pool equipment. Figure18 illustrates a multiple heater installation for very large pools with and without a manual bypass valve.

Figure17: Typical Plumbing to Pool or Spa



INSTALLATION ABOVE POOL/SPA SURFACE: If the heater is installed less than three (3) feet above the surface of the pool/spa water, install eyeball fittings or directional flow fittings on the end of the return water line to the pool/spa to create adequate back pressure at the heater to operate the pressure safety switch when the pump is running. If the heater is installed more than three (3) feet above the surface of the pool/spa water, install a loop as shown in Figure19 to prevent drainage of water in the heater during a filter change. For installation above or below the pool/spa surface, refer to START UP section for proper pressure switch setup.

Figure19: Installation Above Pool or Spa

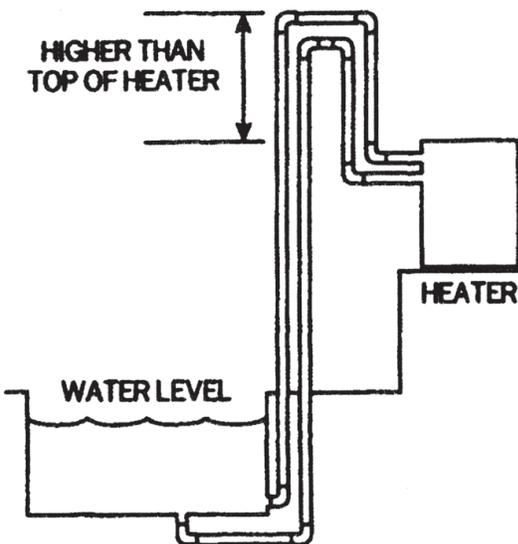
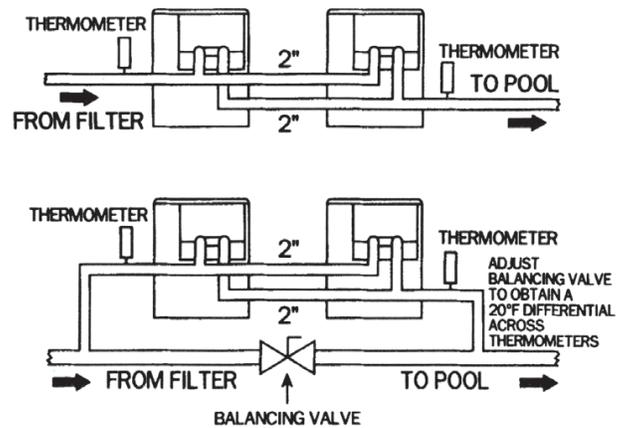


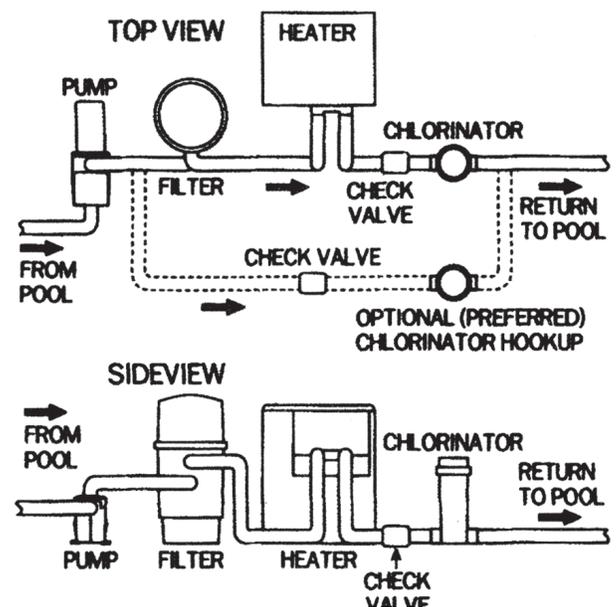
Figure18: Multiple Heater System



AUTOMATIC CHLORINATORS AND CHEMICAL FEEDERS:

If used, a chlorinator must be installed downstream from the heater in the pool return line and at a lower elevation than the heater as shown in Figure20. Install a separate positive seal corrosion resistant check valve between the heater outlet and the chlorinator to prevent highly concentrated sanitizer from back siphoning into the heater. Back siphoning may occur when the pump is shut off and a pressure differential is created.

Figure20: Automatic Chlorinator



DRAIN VALVE INSTALLATION (ASME MODELS ONLY):

If installing an ASME model heater, a 3/4" brass drain valve must be installed. A drain valve is included separately with all ASME heaters. Apply a suitable amount of pipe thread sealant or Teflon tape to the threads and install as shown in Figure21.

PRESSURE RELIEF VALVE (ASME MODELS ONLY): If installing an ASME model heater, a 3/4" pressure-relief valve having a discharge capacity greater than or equal to the Btu/hr input of the heater, and a pressure rating equal to or less than the working pressure must be installed. See the rating plate located inside the front access panel on the heater for the input rating and working pressure. An appropriate pressure relief valve is included separately with all ASME heaters. Apply appropriate pipe thread sealant or Teflon tape to the threads and assemble as shown in Figure21.

Please note that the drain valve must be installed before the pressure relief valve. Install the pressure relief valve with the discharge connection facing the ground. If necessary, connect a pipe (of the same size as the valve outlet) to the outlet and run it to a code appropriate place of discharge. Do not install any shut-off or restriction in this pressure relief discharge line.

PRESSURE RELIEF VALVE (NON-ASME MODELS ONLY): Some local building codes require a pressure relief valve for non-ASME pool/spa heaters. The plastic header has a 3/4" port which can be used for this purpose (see Figure21 for location of port). A 3/4" pressure relief valve having a discharge capacity greater than or equal to the Btu/hr input of the heater, and a pressure rating equal to or less than the working pressure is recommended. See the rating plate located inside the front access panel on the heater for the input rating and working pressure. If desired, you may order the pressure relief valve; order p/n CHXRLV1930. Remove the factory-installed pipe plug, and install the pressure relief valve using an appropriate amount of pipe thread sealant or Teflon tape on the threads. Install the pressure relief valve with the discharge connection facing the ground. If necessary, connect a pipe (of the same size as the valve outlet) to the outlet and run it to a code appropriate place of discharge. Do not install any shutoff or restriction in this pressure relief discharge line.

ELECTRICAL CONNECTIONS:

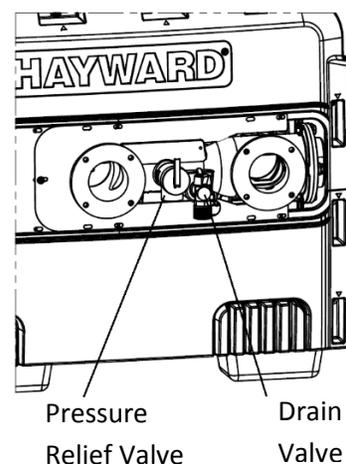
GENERAL INFORMATION: An external supply of power is required to operate the control system of the heater. The electrical specifications for this heater are 120 or 240VAC, 60Hz, 1-phase, 5.5A maximum current. It is recommended that circuit protection for the heater circuit be rated at 15 Amperes. The heater is shipped from the factory wired for use with 240VAC, 60 Hz field power supply. To convert the heater to 120VAC, 60 Hz operation remove the 240VAC voltage selector jumper from the ignition control board and replace it with the 120VAC jumper. These jumpers are tie-wrapped together and are located on the fuse board. See Figure23 for location of the fuse board. All wiring connections to the heater must be made in accordance with the latest edition of the National Electrical Code ANSI/NFPA 70, unless local code requirements specify otherwise. In Canada, follow CSA C22.1 Canadian Electrical Code, Part 1. The heater must be electrically grounded and bonded in accordance with local codes or, in the absence of local codes, with National Electrical Code, ANSI/NFPA 70. Wiring connections must be made as shown in the wiring diagram found inside the heater cabinet, and a copy is provided for convenience in the GETTING STARTED section at the beginning of the manual. The heater must also have an independent ground and bond connection. There is a ground lug inside the control box adjacent to the power connections per figure22 and a bonding lug on the side of the heater per figure13. Use a solid copper conductor, size No. 8 AWG (8.4 mm²) solid copper bonding wire or larger for bonding conductor. Run a continuous wire from external bonding lug to reinforcing rod or mesh. Connect to the grounding lug provided and to all metal parts of swimming pool or spa, and to all electrical equipment, metal piping (except gas piping), and conduit within 5 ft. (1.5 m) of inside walls of swimming pool or spa. **IMPORTANT** - Reference NEC codes for all wiring standards including, but not limited to, grounding, bonding and other general wiring procedures.



WARNING: Risk of Electric Shock Review all safety information provided in the GETTING STARTED section of this manual prior to servicing. Always disconnect power circuit before servicing. This heater contains wiring that carries high voltage. Contact with these wires could result in death or personal injury.

ELECTRICAL CONNECTIONS: The heater may be installed with the electrical service and optional remote control wiring entering the heater cabinet on either the left side

junction box or right side using the floating junction box. There are (4) openings for electrical entry. The junction box must be used for field power wiring. Plug any unused openings with the

Figure21: Drain and relief valve locations

supplied caps. The power connections are to be made to the supplied wires inside the junction box (see Figure22a) using field supplied wire nuts. All connections are to be stored within junction box attached to side panel.

REMOTE CONTROL CONNECTION: Remote control can be accomplished via a 2-wire or 3-wire connection (see Figure22b). The 2-wire connection allows thermostat control where the remote temperature is sensed and calls for heat when needed. The 3-wire remote switches function between “POOL” and “SPA”. The set point temperatures for “POOL” and “SPA” operation are still controlled locally. The 3-wire remote simply provides a convenient way to manage the “POOL” or “SPA” mode selection. Remote wiring is accomplished using the factory supplied remote wire harness. Remote wiring must be run in a separate conduit from power supply. Use 22 AWG wire for runs less than 30 feet. Use 20 AWG wire for runs over 30 feet. The maximum allowable run is 200 feet.

2-WIRE REMOTE CONTROL CONNECTION: Connect the appropriate wires from the remote control to the factory harness ORANGE wire (“POOL”) and WHITE wire (“COM”). To configure the heater for 2-wire remote thermostat control, use the “MODE” key on the heater keypad to put the control into “STANDBY” mode. Then simultaneously press and hold the “(-)” and “MODE” keys for 3 seconds until the display shows the code “bo” (bypass operation). Once in bypass operation, press the ‘MODE’ button until ‘POOL’ or ‘SPA’ LED is illuminated. The control is now ready to operate in 2-wire remote thermostat control. The heater’s thermostat will only function to limit the return water temperature to a maximum of 104°F.

3-WIRE REMOTE CONTROL CONNECTION: Connect the appropriate wires from the remote control to the factory harness ORANGE wire (“POOL”), WHITE wire (“COM”), and RED wire (“SPA”). No control ‘MODE’ configuration setting is needed, only connection of all three remote control wires. To operate the heater with a remote 3-wire switch, the heater’s control must be in “STANDBY” mode. The “STANDBY” LED will be illuminated. When the remote switch is set to “Pool” the “POOL” LED will be illuminated and the water temperature will be displayed. When the remote switch is set to “Spa” the “SPA” LED will be illuminated and the water temperature will be displayed. The heater will use its internal thermostat to regulate the water temperature to the set point of the mode selected.

CHECK-OUT & START-UP:

GENERAL: The heater is equipped with a control system that automatically monitors the “Pool” and “Spa” temperature set points and control devices. Then when heat is needed, turns on the combustion air blower, hot surface igniter and gas valve to light the burners and monitor the flames. Figure23 provides a summary of heater components and their locations. Some of the following procedures will require the heater to be operating. The Full lighting and shutdown instructions are included in this manual as well as on the lighting and operating label affixed to the inside of the front access panel of the heater. Water must be flowing through the heater during any operation. Check that the pump is operating and the system is filled with water and purged of all air prior to starting the heater.

Figure22a: Junction Box Connections

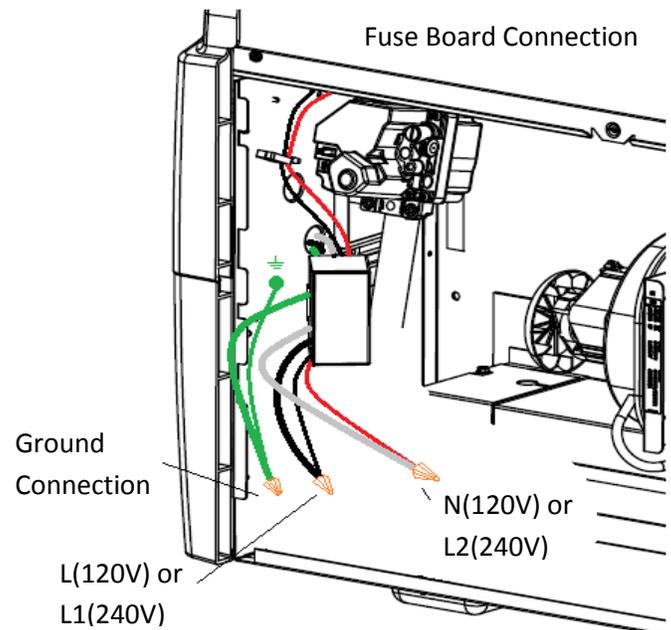


Figure22b: Remote Control Connections

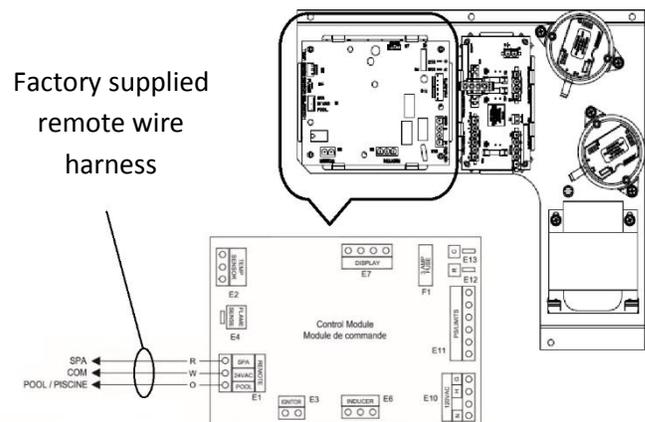
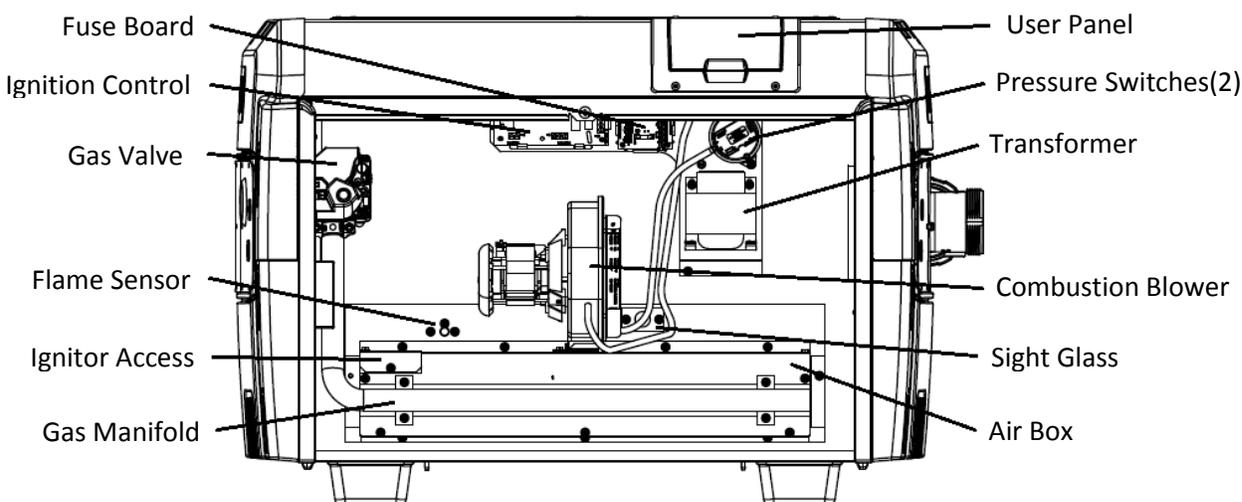


Figure23: Location of Components

CONTROL SETUP

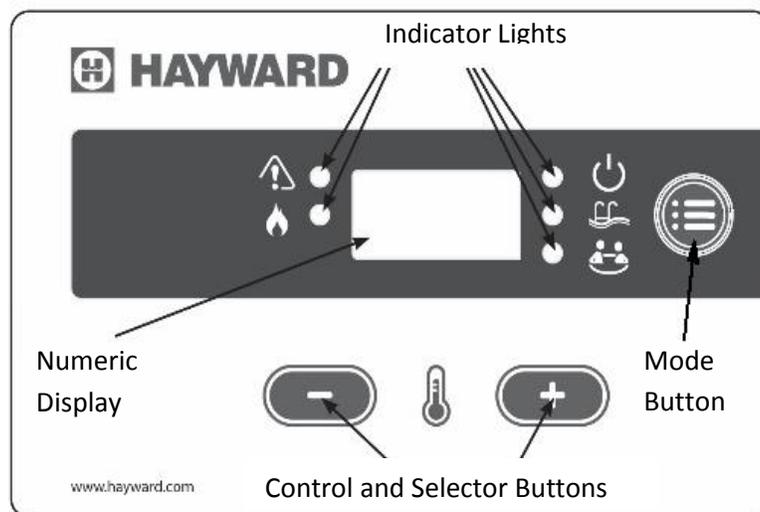
This pool heater is equipped with a digital thermostat which allows the user to select the desired water temperature (see figure24). The heater will then function automatically to maintain the desired temperature. The heater has 4 modes of operation:

1. **STANDBY:** in this mode, the heater will not function to heat the water.
2. **SPA:** in this mode, the heater will automatically function to maintain the water temperature setting for SPA mode.
3. **POOL:** in this mode, the heater will automatically function to maintain the water temperature setting for POOL mode.
4. **BYPASS OPERATION "bo"** is displayed. In this mode the heater will respond to a remote call for heat for set point control and monitor the local thermostat for high return water temperature (maximum of 104°F).

Use the **MODE** button to change STANDBY/POOL/SPA modes. The indicator lights will illuminate to show which mode is currently active.

USER PANEL AND KEYPAD INPUTS: The control accepts user inputs via user panel (figure24).

1. When changing the mode from "STANDBY" to either "SPA" or "POOL" (see Figure24) there may be up to a 10- second delay before the heater starts operating. The control performs an internal self-test and then verifies that the blower vacuum switch contacts are open before energizing the blower.
2. It is normal for the heater to encounter a 1- to 2-second delay in responding to any user panel input.
3. It is normal for the heater to encounter up to a 5-second delay when the user panel is used to reset the control to clear an error code.
4. The control will accept a mode change during lockout after 5 seconds. The control will continue to display the error code and remain in lockout until it is reset. At reset the control will go to the last saved mode.

Figure24: User Panel

NORMAL OPERATION FOR POOL & SPA MODES: The control continually compares the water temperature with the set point and the high limit temperature. When the water temperature is more than 1°F below the set point a call for heat is generated and a heating cycle is initiated.

1. The control checks for open contacts at the blower vacuum switch.
2. The control energizes the blower and the igniter. The igniter heat-up time is approximately 20 seconds. The blower is running a pre-purge cycle during this time.
3. The control checks for closed contacts at the blower vacuum switch.
4. When the igniter reaches the proper temperature a 4-second trial for ignition begins. The control opens the gas valve and monitors flame current. The igniter is turned off when flame is sensed or after 4 seconds.
5. The blower vacuum switch, temperature limit switches, vent pressure switch, water pressure switch, the water temperature sensor, and the flame sensor are constantly monitored during a call for heat to assure the heater is operating properly.
6. When the thermostat is satisfied and the call for heat ends the control immediately de-energizes the gas valve and flame extinguishes.
7. The control operates the blower during a 30-second post-purge period.

FAHRENHEIT OR CELSIUS: The temperature can be displayed in Fahrenheit or Celsius. To change the display, use the “MODE” button to place the heater in “STANDBY”. Then press and hold the “(+)” and “MODE” buttons until the display shows the °F/°C selection. Press the “(-)” button to toggle between selections. To accept the selection, press the “MODE” button. If the user does not act, the selection will be automatically accepted after 60 seconds.

TEMPERATURE ADJUSTMENT: This control allows the user to have 2 individual pre-set temperature settings, “SPA” and “POOL”. To adjust the temperature while in “SPA” or “POOL” mode, use the (+) and (-) buttons. The numeric display will flash while the temperature is being adjusted. When the numeric display is not flashing, the actual measured water temperature is being displayed. The temperature settings for both “SPA” and “POOL” modes are initially set at the factory to 65°F. The minimum allowed settings for “SPA” and “POOL” modes are both 65°F. The maximum allowed settings for “SPA” and “POOL” modes are adjustable up to 104°F using the TEMPERATURE MAXIMUM SET POINT feature (see below).

TEMPERATURE MAXIMUM SET POINT: The digital thermostat in this pool heater allows the user to lock the maximum temperature setting allowed. This feature is useful for preventing unauthorized users from manually adjusting the temperature settings higher than desired. On a new heater, the maximum allowed temperature lock settings are initially set at the factory to 90°F for “POOL” mode, and 104°F for “SPA” mode. To adjust these settings, use the following procedure:

1. Use the MODE button to put the heater in “STANDBY” mode.
2. Press and hold both the (+) and (-) buttons at the same time.
3. After 3 seconds, the thermostat enters maximum temperature lock adjustment mode.
4. The “SPA” indicator light illuminates and the numeric display shows the current “SPA” mode maximum temperature lock setting. Both the “SPA” indicator light and the numeric display flashes rapidly when in adjustment mode.
5. Use the (+) and (-) buttons to set the desired maximum temperature lock setting. When finished, press the MODE button.
6. The “POOL” indicator light illuminates and the numeric display shows the current “POOL” mode maximum temperature lock setting. Both the “POOL” indicator light and the numeric display flashes rapidly when in adjustment mode.
7. Use the (+) and (-) buttons to set the desired maximum temperature lock. When finished, press the MODE button.
8. The heater will return to “STANDBY” mode

FAILURE TO LIGHT – RETRY: If the first ignition attempt fails during a normal heating cycle the control will make two (2) additional ignition attempts:

1. The control de-energizes the gas valve after the 4-second ignition trial ends.
2. The control operates the blower during a 30-second post-purge period.
3. The control monitors for open contacts at the blower vacuum switch.
4. The control performs a gas valve relay check.
5. A normal ignition sequence resumes with Item #2 in NORMAL OPERATION FOR POOL & SPA MODES (see above). If the third ignition trial fails the control enters a safety lockout (or “hard” lockout) after the post purge period of the third failed trial.
6. The error code “IF” is displayed and the “SERVICE” indicator is illuminated.
 - a. The control automatically resets and clears the “IF” error code without any user intervention after 60 minutes. If there is a call for heat after reset, the control will make three (3) trials for ignition. If ignition is not established the control will again enter safety lockout for 60 minutes. This cycle will continue until ignition is established or the call for heat is removed.
 - b. The user can reset the control and clear the “IF” error code by pressing the “MODE” button to move through “STANDBY” and return to the previous mode (“POOL” or “SPA”).

LOSS OF FLAME – RECYCLE: If flame is established and then lost, the control will make ten (10) attempts at ignition. If flame is lost within ten (10) seconds of ignition, the control will respond within 2 seconds. If flame is lost more than ten (10) seconds after ignition the control will respond within 0.8 seconds.

1. The control de-energizes the gas valve and the blower.
2. The control monitors for open contacts at the blower vacuum switch.
3. The control performs a gas valve relay check.
4. A normal ignition sequence resumes with Item #2 in NORMAL OPERATION FOR POOL & SPA MODES (see above).
5. If the tenth ignition trial fails the control enters a safety lockout (or “hard” lockout) after the post- purge period of the tenth failed trial.
6. The error code “IF” is displayed and the “SERVICE” indicator is illuminated.
 - a. The control automatically resets after 60 minutes. If there is a call for heat after reset the control will make three (3) trials for ignition. If ignition is not established the control will again enter safety lockout for 60 minutes. If flame is established but is lost the control will make ten (10) attempts at ignition. This cycle will continue until ignition is established or the call for heat is removed.
 - b. The user can reset the control and clear the “IF” error code by pressing the “MODE” button to move through “STANDBY” and return to the previous mode (“POOL” or “SPA”).

AUTOMATIC RESET TIME: The heater will automatically reset when an error condition is corrected and resume operation as detailed in NORMAL OPERATION FOR POOL & SPA MODES (see above). The heater can be manually reset using the keypad by cycling the mode button through “STANDBY” and back to the original operating mode (“SPA” or “POOL”).

GAS TESTING:

GAS LINE TESTING: The appliance and its gas connection must be leak tested before placing the appliance in operation. The heater must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressure equal to or less than ½ psig (3.45 kPa). Gas supply line must be capped when not connected. After pressure testing, reconnect the gas piping to the gas valve. Turn gas supply “ON” and test all pipe and tubing joints for leaks. Use a soap and water solution.



WARNING: EXPLOSIVE HAZARD. The use of an open flame to check for gas leaks could cause an explosion resulting in severe injury and/ or death. Shut off gas and fix even the smallest leak right away. Be sure to leak test the heater gas manifold fittings using the above procedure once the heater is in operation.

GAS PRESSURE TESTING: The following gas pressure requirements are important for the operation of the burners in gas heaters. Improper gas pressure or gas volume may create the following conditions:

1. Flame burns totally yellow.
2. Flame lift off burner.
3. Heat exchanger soot's up. The gas pressure regulator on all heaters is preset at the factory, but the setting should be verified by the installer to ensure proper operation.

NOTICE: If inlet gas pressure is inadequate, check for underrsize piping between the gas meter and the heater or for a low-capacity gas meter (see GAS SUPPLY section of this manual).

Figure25: Lighting & Operating Instructions Label

<p>FOR YOUR SAFETY READ BEFORE LIGHTING</p> <p>WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.</p> <p>A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.</p> <p>B. BEFORE LIGHTING 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.</p> <p>WHAT TO DO IF YOU SMELL GAS:</p> <ul style="list-style-type: none"> * Do not try to light any appliances. * 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. 	<p>POUR VOTRE SÉCURITÉ LIRE AVANT L'ALLUMAGE</p> <p>AVERTISSEMENT: Si vous ne suivez pas exactement ces instructions, un incendie ou une explosion pourrait survenir et causer des dommages à la propriété, des blessures corporelles ou la perte de la vie.</p> <p>A. Cet appareil n'a pas de pilote. Un mécanisme d'allumage automatique pour les brûleurs. N'essayez pas d'allumer les brûleurs à la main.</p> <p>B. AVANT L'ALLUMAGE, sentir tout autour de l'appareil pour détecter d'éventuelles odeurs de gaz. S'assurer de sentir près du plancher parce que les gaz plus lourds que l'air, se concentrent au niveau du plancher.</p> <p>QUE FAIRE EN PRÉSENCE D'ODEURS DE GAZ:</p> <ul style="list-style-type: none"> * Ne pas essayer d'allumer l'appareil. * Ne pas toucher à un commutateur électrique; ne pas utiliser le téléphone dans la maison. * Appeler immédiatement fournisseur de gaz chez un voisin. Suivre les instructions du fournisseur de gaz. * Si le fournisseur ne peut pas être atteint, appeler le service des incendies.
<p>OPERATING INSTRUCTIONS</p> <p>1. STOP! Read the safety information on this label. information on this label. If you don't smell gas, go to the next step.</p> <p>2. Change the "MODE" on the control panel to "STANDBY".</p> <p>3. Remove the heater's front access panel.</p> <p>4. This appliance is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.</p> <p>5. Move the gas control switch to "OFF".</p> <p>GAS CONTROL SWITCH SHOWN IN "OFF" POSITION</p>  <p>6. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "B" in the safety</p>	<p>INSTRUCTIONS D'ALLUMAGE</p> <p>1. STOP! Lire les consignes de sécurité sur cette étiquette.</p> <p>2. Changer le MODE du tableau de commande à STANDBY.</p> <p>3. Retirer le panneau d'accès avant de l'appareil de chauffage.</p> <p>4. Cet appareil est pourvu d'un dispositif d'allumage qui allume automatiquement les brûleurs. Ne pas tenter d'allumer manuellement les brûleurs.</p> <p>5. Déplacer l'interrupteur de commande de gaz sur OFF (fermé).</p> <p>COMMUTATEUR DE COMMANDE DE GAZ MONTRÉ EN POSITION "FERMÉ" (OFF)</p>  <p>6. Attendre cinq (5) minutes que tout gaz se dissipe.</p>
<p>TO TURN OFF GAS TO APPLIANCE</p> <p>1. Change the "MODE" on the control panel to "STANDBY".</p> <p>2. Remove the heater's front access panel.</p> <p>3. Move the gas control switch to "OFF".</p> <p>4. Replace the heater's front access panel.</p>	<p>POUR FERMER LE GAZ SUR L'APPAREIL</p> <p>1. Changer le MODE du tableau de commande à STANDBY.</p> <p>2. Retirer le panneau d'accès avant de l'appareil de chauffage.</p> <p>3. Déplacer l'interrupteur de commande de gaz sur OFF (fermé).</p> <p>4. Remplacer le panneau d'accès avant l'appareil de chauffage.</p>

GAS PRESSURE TEST PROCEDURE: Follow the lighting instructions on the unit (or from Figure25). Refer to Figure23: Location of Components for the location of the gas valve. See figure26 for pressure regulation adjustment for use in this procedure. Note that even though the valves look different, the required pressure taps and regulation adjustment screws are present on every gas valve.

1. Obtain the necessary equipment; Qty (2) manometers to read pressure in inches of water column, Qty (2) 1/8"NPT pipe barbed fitting, silicon or EPDM hose to fit on barb fittings, 3/16" hex wrench, 7/16 open end wrench, and medium flat screw driver.
2. Turn off gas supply to heater. Access the gas valve and remove the 1/8" plugs from the gas valve inlet pressure and manifold pressure taps and install the barb fittings into the tap openings.
3. Securely connect the hoses and manometers to the barb fittings. Make sure the manometers have ample range and accuracy to properly read the gas inlet pressure and manifold pressure per Table14.
4. Turn on gas and water to heater and start the heater following the lighting & operating instructions on the label affixed inside the front access panel. If there is more than one pool/spa heater connected to the gas supply line, turn each of those appliances "ON" while testing the heater.
5. Take pressure readings with the heater(s) running, the pressure values should agree with those in Table14. If the pressures are within the stated ranges, then no further adjustment is needed. If the manifold gas pressure does not meet the values in Table14, the gas valve regulator must be adjusted.
6. To adjust the gas valve regulator perform the following:
 - a. Remove the screw cap over the regulator adjustment screw (see Figure26).
 - b. Turn the inner regulator adjustment screw clockwise to increase pressure and counterclockwise to decrease pressure as required.
 - c. Replace the screw cap over the regulator adjustment screw.
 - d. Cycle the heater on/off multiple times and repeat measurements to ensure regulation springs are set.

NOTICE: If proper pressures cannot be achieved by adjusting the gas valve regulator, the installer must contact the gas supplier and request that the inlet pressure to the heater(s) be provided to within the gas pressure range listed.

7. Remove the barb fittings and replace the original 1/8" pipe plugs. Turn on gas and water to heater and start the heater to check for gas leaks.

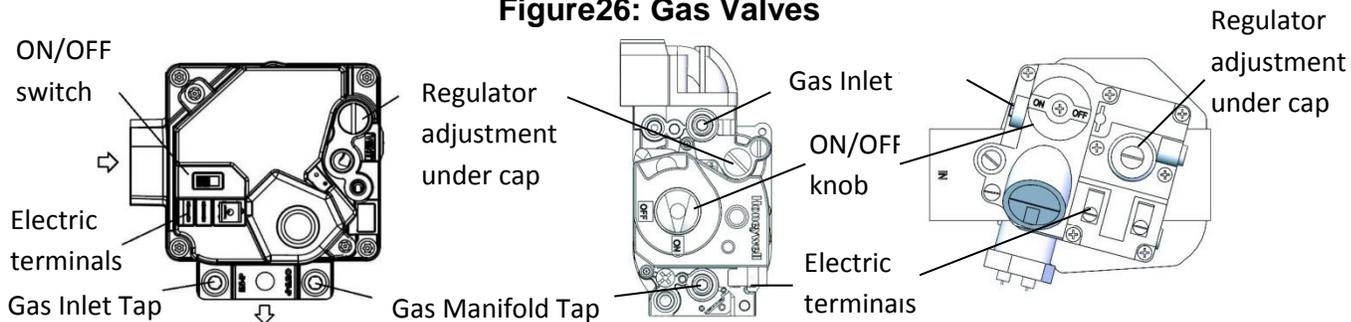
Measurement	Natural	Propane
Manifold Pressure*	+1.8 to 2.2	+6.8 to 7.0
Inlet Pressure, Minimum	+4.5	+10.0
Inlet Pressure, Maximum	+10.5	+13.0
Blower Vacuum, minimum	-0.50	-0.50
Vent Pressure, (Models150-400) maximum	+0.45	+0.45
Vent Pressure, (Model-500) maximum	+0.30	+0.30

*Pressure range for allowable heating value variation.

 **WARNING: EXPLOSION HAZARD** Do not remove the measurement tap screws with the valve in the "ON" position and gas supplied to heater. No gas pressure must be present when the taps are open to atmosphere. Removal of the taps screws or barb fittings with gas present could cause an explosion resulting in severe injury and/or death.

 **WARNING: EXPLOSION HAZARD** Gas pressures in excess of those listed in Table14 could cause a gas leak or diaphragm rupture. Gas leakage could cause an explosion resulting in severe injury or death.

Figure26: Gas Valves



For all valves, adjust regulator pressure by removing the screw cap and turning the adjustment screw clock wise for increase in pressure and counter clock wise for decrease in pressure

WATER TESTING:

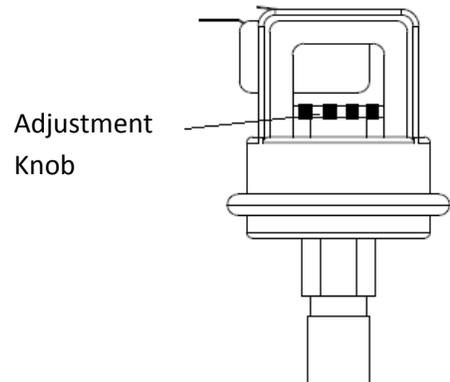
WATER PRESSURE SWITCH TEST / ADJUSTMENT PROCEDURE:

The pressure switch is preset at the factory for most typical deck level installations. When the heater is located above or below the level of the pool or spa, the pressure switch will require adjustment to compensate for the change in static pressure. The following procedure is recommended when the switch needs adjustment and/or is replaced;

1. Be sure the filter is clean before making any adjustment.
2. Turn "ON" the filter pump and ensure all air is out of the water lines, and ensure water flow rate is at least the rated minimum (see SPECIFICATION SECTION).
3. Turn "ON" the heater and adjust the temperature control to create a call for heat.
4. For Installations with Heater above water level: If the heater does not light, adjust the pressure switch by turning the adjustment knob on the pressure switch counter-clockwise until the heater lights. Turning the adjustment knob counterclockwise decreases the pressure needed to close the switch (see Figure27).
4. For Installations with Heater below water level: Turn the adjustment knob on the pressure switch clockwise, until the heater turns off, then turn the knob ¼ turn counter-clockwise, so that the heater turns back on. Turning the adjustment knob clockwise increases the pressure needed to close the switch

5. Check the function of the pressure switch by turning the filter pump on and off several times and confirming that the heater turns off immediately when the pump is turned off. Never allow the heater to operate with less than the minimum rated water flow rate.

Figure27: Water Pressure Switch



TWO-SPEED PUMP: In a few cases the pressure from a two-speed pump is below the 1-pound minimum required to operate the water pressure switch on the heater. This is apparent when the pressure switch cannot be further adjusted. In these cases the pump must be run at high speed to operate the heater. If the pump and piping arrangement are such that the required 1-pound minimum pressure cannot be obtained, do not attempt to operate the heater. Correct the installation.

NOTICE: Heater installation, checkout, and start-up should now be completed. BE SURE to leave this manual with the pool owner.

MAINTENANCE & SERVICE

PERIODIC INSPECTION: The heater is designed and built for long performance life when installed and operated according to the manufacturer's directions. Regular inspection by qualified service personnel is recommended to keep the heater working properly. The following inspection points are suggested to help maximize heater life.

1. Periodically check the venting on outdoor heaters. The heater's venting areas (the louvered top panel) must never be obstructed in any way and minimum clearances must be observed to prevent restriction of combustion and ventilation air. Remember that shrubs grow and in time may obstruct a heater's venting areas.
2. Check the venting of indoor heaters for looseness and possible leaks. Keep all openings for combustion and ventilation air clear and unobstructed.
3. Keep the entire pool heater area clean and free of all debris, combustible materials, gasoline, and other flammable vapors and liquids. Remove any leaves or paper from around the heater.
4. Do not store chlorine, other pool chemicals, or other corrosives in the vicinity of the heater.
5. If the heater is operating on propane gas, the tank must not fall below 30% full or damage to the heater may occur. Manufacturer will not be responsible for heaters that soot up due to improper gas level in the tank resulting in inadequate gas volume.
6. If another appliance is added to the gas line at a later date, consult the local gas company to be sure the gas line will have the capacity to supply both units at full input rating at the same time.
7. Do not use the heater if any part has been under water. Contact a qualified service technician to inspect the entire heater and replace any part of the control system or gas valve that was under water. If heater has been totally submerged in water it must be removed and the entire heater must be replaced.
8. An inspection program is a good preventative maintenance measure. Keep this manual in a safe place for future reference for yourself as well as for a service technician to consult when inspecting or servicing the heater. Any additional inspection procedures are to be performed by a qualified service technician.

WATER CHEMISTRY:

▲ WARNING: WATER CHEMISTRY Failure to maintain proper water chemistry may cause premature heat exchanger damage or failure

The heat exchanger in your pool heater is made from the highest quality of copper and nickel (Cupronickel) materials. This premium material and the exacting processes used to manufacture the heat exchanger is state of the art in pool heater design and manufacture. However, it remains vital that the heat exchanger be protected from damaging or corrosive chemicals, insufficient water flow or improperly balanced water chemistry. Heat exchanger damage or failure resulting from improper flow, improperly balanced pool water or the improper addition of sanitizer into the water is NOT covered under the terms of the warranty. The following factors are critical to heat exchanger protection. Follow the guidelines in Table15 to help prevent pre-mature damage to or failure of your heater and heat exchanger.

- 1. WATER FLOW THROUGH HEATER:** Water must be flowing through the heater at the minimum rated flow rate during operation. Check that the pump is operating and the system is filled with water and purged of all air prior to starting the heater. The minimum flow rates are listed in the specifications section. Some installations may require an adjustment to the water pressure switch for proper low-flow protection. Test your system and if necessary, adjust the water pressure switch as described in WATER TESTING SECTION OF MANUAL.
- 2. WATER CHEMISTRY:** The chemistry balance and mineral content of swimming pool and spa water changes rapidly due to the addition of sanitizing chemicals, user loads, exposed rain, runoff, and the amount of sun - to name a few. Improper chemistry (see Table15) balance and mineral content can cause scaling and deposits to form on pool walls, in the filtration system, in the heat exchanger tubes, and additionally can promote corrosive action to all metals in the water path. Changing spa water regularly and maintaining the correct chemical balance in your pool/spa will keep the pool/spa safe and sanitary and will help heat exchanger longevity. Use a 4-way pool/spa water test kit to check your water frequently (at least weekly). Use the following guidelines to help maintain proper water chemistry:

Chemical	Recommended Level	Effect of Low Levels	Effect of High Levels
Chlorine	1 - 3 ppm	hazy water, algae growth, bacteria causing infections	swimmer irritation, bleaching of clothes/hair, corrosive to heat exchanger
Bromine	2 - 4 ppm		
pH	7.4 - 7.6	corrosive to heat exchanger, swimmer irritation	cloudy water, scaling of heat exchanger, reduced sanitizer effectiveness
Total Alkalinity	80 - 120 ppm	corrosive to heat exchanger, large fluctuations in pH	scaling of heat exchanger
Calcium Hardness	200 - 400 ppm	corrosive to heat exchanger	scaling of heat exchanger
Salt	2700 - 5000 ppm	poor salt chlorinator performance	corrosive to heat exchanger

- 3. SKIMMER CHLORINATION:** Placing chlorine or bromine Tablets directly into the skimmer may result in high chemical concentrations flowing through the heater. DO NOT place chlorine or bromine Tablets in the skimmer.
- 4. CHLORINATOR INSTALLATION:** Chlorinators must be installed downstream of the heater, and a check valve must be installed between the heater and chlorinator to prevent high chemical concentrations from back flowing into the heater. Make sure your piping arrangement meets the chlorinator installation requirements shown on page 26.
- 5. BYPASS VALVE:** Bypass heater until water chemistry is properly balanced, so that corrosive and potentially damaging water will not flow through the heater and therefore the heat exchanger. Close the bypass valve once the water is properly balanced.

▲ WARNING: BYPASS. Failure to close the bypass valve when attempting to operate the heater will result in extensive damage to the heat exchanger

Ensure water flow through the heater is restored before operating the heater. A bypass feature is also advantageous for service needs and for the ability to remove the heater from the water path when not heating.

WINTERIZATION:

In moderate climates, the heater can continue to operate during short-term cold spells. Do not use the heater to maintain the water temperature just above freezing or for freeze protection. Care must be taken to avoid freeze-up in the heater. When it is used during freezing weather, the pump must run continuously. The heater is not warranted against freeze-ups. In regions where freezing temperatures are encountered, all water must be drained from the heater when it is out of service to prevent damage to the heater and piping. Draining the heat exchanger is recommended as part of the season's shutdown procedures.

NOTICE: A heater damaged by freezing is not covered under the manufacturer warranty.

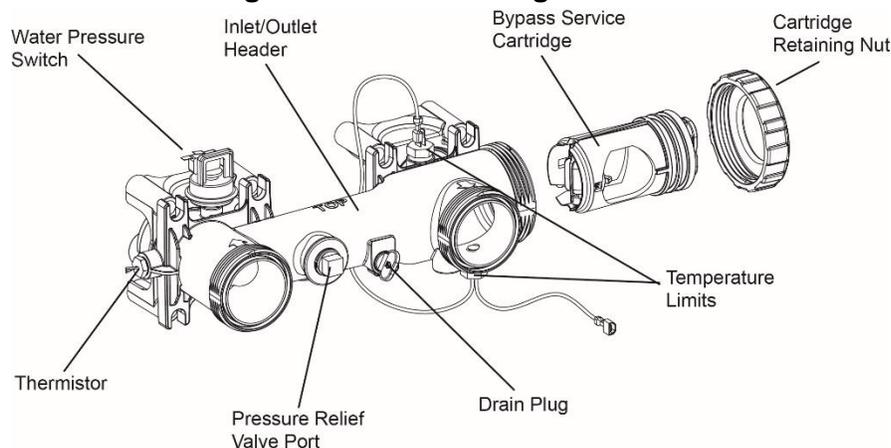
DRAINING THE HEAT EXCHANGER: This procedure applies to installations where the heater is located higher than the pool water level. If it is necessary to drain a pool heater located below the pool water level, you must either partially drain the pool, or isolate the pool heater from the pool using valves, then follow these steps.

1. Set the heater to STANDBY mode using the keypad.
2. Turn the electricity to the heater OFF at the circuit breaker panel.
3. Turn the heater gas valve OFF using the knob or switch on the valve (see Figure26).
4. Turn the heater's gas supply OFF at the main shut-off valve outside the heater cabinet.
5. Be sure the circulating pump is OFF.
6. On models with plastic headers, remove the plastic drain plug (see Figure28). On models with bronze headers (ASME models), open the brass drain valve located on the header (see Figure21).
7. Allow all water to drain from the heater.
8. On models with plastic headers, re-install the plastic drain plug. On models with bronze headers (ASME models), close the brass drain valve located on the header.

SPRING START-UP: This procedure should be performed annually to ready your heater for the upcoming season. In addition to the steps outlined below, it is recommended that a **PERIODIC INSPECTION** also be performed.

1. Inspect and clean the heater, being sure the heater is free of leaves and debris prior to startup.
2. Be sure inlet and outlet piping are properly attached to the heater and the drain valve is closed.
3. Turn the filtration system pump "ON" and allow the system to run long enough to purge all the air from the lines.
4. Turn the gas supply to the heater "ON".
5. Set the temperature control using the keypad to "POOL" or "SPA" and adjust the set point to the desired temperature setting.
6. If operating difficulties are encountered, contact a qualified service company for assistance.

Figure28: Heat Exchanger Header



COMPONENT SERVICE

▲ WARNING: Only qualified service technicians, with appropriate test equipment, should be allowed to service the heater. All of the components that comprise the system have an effect on heater operation. Before proceeding with heater related troubleshooting tips, be certain that the pump is operating correctly, the filters and strainers are not blocked, the valves in the piping are properly positioned, and the time clocks are properly set.



▲ WARNING: EXPLOSION HAZARD Do not attempt to repair broken or faulty components of this heater. Do not modify the heater or its components in any manner. To do so may result in a malfunction that could result in death, personal injury, or property damage. Check with the pool owner to see if any part of the heater has been under water. Replace any electrically operated component that has been under water.

SERVICE OF HEATER: The following service procedures: **HEAT EXCHANGER INSPECTION AND CLEANING** and **BURNER INSPECTION AND CLEANING** are recommended to be performed as part of annual heater maintenance to ensure proper heater operation and long life.

HEAT EXCHANGER INSPECTION AND CLEANING: Remove the louvered exhaust cover panel (see Figure1: Sub-Assemblies) and inspect the external surfaces of the heat exchanger for debris or soot accumulation. If heat exchanger needs cleaning perform the following procedure:



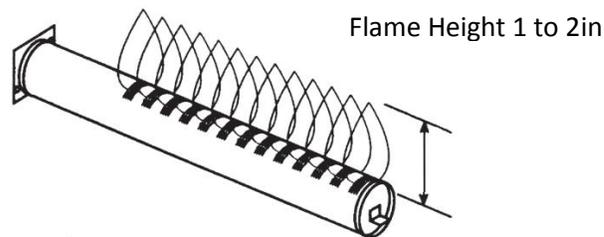
⚠ WARNING: BURN HAZARD: Let heater cool before performing any disassembly or servicing of the heater. Wear proper PPE when servicing heater.

1. Turn pump, main gas valve and heater power "OFF". Perform only DRY cleaning with heat exchanger in heater. WET cleaning requires that the heat exchanger be removed from heater.
2. For DRY cleaning remove debris by hand, soft-tipped brush or shop VAC.
3. For WET cleaning remove heat exchanger by following the "Reversible Water Connections" procedure found in the **WATER PIPING** section of this manual. Use a soft-tipped brush (such as a paint brush), to apply a degreaser to the entire heat exchanger surface (top and bottom). Allow the heat exchanger to sit for a period of time to allow the degreaser to loosen the debris. Wash the heat exchanger using a garden hose at a medium to low pressure setting. Ensure both the top and bottom surfaces are cleaned.
4. Check combustion chamber refractory is still in a single-piece casting with no cracks or holes. This evaluation can be performed with heat exchanger in place with additional lighting or with heat exchanger removed from unit. If combustion chamber refractory is damaged, the entire chamber must be replaced.
5. Re-assemble the heater by reversing the disassembly steps. Turn pump, main gas valve and heater power "ON". Test fire heater.

NOTICE: Although the heat exchanger should be cleaned of soot and reinstalled, the fact that soot occurred should be investigated. It may indicate other problems such as: Insufficient air supply; Inadequate venting; High or low gas pressure; Blockage of burner tubes or orifices; Blockage of blower inlet; Low voltage supply causing blower to "spin" slower; Improper heater location / installation; Incorrect gas supply pipe size; Excessive water flow through heat exchanger; Or an LP tank below 30% full level.

BURNER INSPECTION AND CLEANING: With the heater "ON", remove the front access panel and make a visual inspection of the main burners through the sight glass (see Figure23: Location of Components.) The main burner flames should be about 1" to 2" in height and should not "lift" off the burner ports (see Figure29: Burner Flame Characteristics). A normal flame is blue, without yellow tips. Yellow tips or a totally yellow or "lazy" flame may be an indication of an incorrect fuel / air mixture. Check the heater for restrictions to the air supply, heat exchanger, vent system, burner body and/or gas orifices.

Figure29: Burner Flame Characteristics



BURNER REMOVAL AND REPLACEMENT: Refer to Figure1, Figure12, and Figure23 as needed.

1. Turn pump, gas supply, and heater power "OFF". Turn gas valve knob "OFF".
2. Remove the front access panel.
3. Disconnect the union joint in the gas supply piping outside the heater cabinet.
4. Disconnect the wiring terminals from the gas valve and blower
5. Remove the gas manifold assembly. It is attached to the air box using (4) screws.
6. Remove the screws from the igniter access panel and pull it out of the way. Do not disconnect the wires.
7. Remove the air box cover. Do not remove the blower from the air box cover.
8. Remove the (2) screws securing each burner to the combustion chamber front.
9. Pull the burners straight out of the heater.
10. Reverse the above procedure to re-install the burners.
11. Turn the gas supply "ON". Use a soapy water solution to check for leaks. Bubbles forming indicate a leak.



⚠ WARNING: EXPLOSION HAZARD The use of an open flame to check for gas leaks could cause an explosion resulting in severe injury and/or death

12. Turn pump, gas valve knob and heater power "ON". Test fire heater by following the **GAS PRESSURE TEST PROCEDURE**.

GAS VALVE REPLACEMENT: Refer to Figure1: Sub-Assemblies, Figure23: Location of Components and Figure26: Gas Valves as needed.

1. Turn pump, gas supply, and heater power "OFF".
2. Disconnect the union joint in the gas supply piping outside the heater cabinet.
3. Remove the front access panel.
4. Disconnect the wiring terminals from the gas valve.
5. Remove the gas manifold assembly. It is attached to the air box using (4) screws.
6. Unscrew the gas valve from the gas manifold pipe.
7. Reassemble the gas manifold assembly using the new gas valve. Only use liquid pipe thread sealant on the male threads of the gas manifold pipe. Do not place pipe dope on the first two threads of any joint.
8. Reverse the above procedure to re-install the gas manifold. Turn pump, main gas, gas valve and heater power "ON". Test fire heater by following the GAS PRESSURE TEST PROCEDURE. Check for leaks using soap and water

IGNITER REPLACEMENT: Refer to Figure1: Sub-Assemblies and Figure23: Location of Components as needed.

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the front access panel.
3. Disconnect the igniter wires from the ignition control board.
4. Remove the screws from the igniter access panel. Working from the underside of the panel, press the bushing out of the hole in the sheet metal panel.
5. Slide the igniter wires through the slot on the panel and pull the panel free.
6. Remove the (2) screws that secure the igniter.
7. Pull the igniter straight back until it is free of the combustion chamber refractory and out of the air box.
8. Replace the igniter and reverse the above procedure to reassemble unit.

FLAME SENSOR REPLACEMENT: Refer to Figure1: Sub-Assemblies and Figure23: Location of Components as needed.

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the front access panel (4 screws).
3. Disconnect the flame sensor wire from the ignition control board.
4. Remove the screws that secure the flame sensor to remove the sensor.
5. Replace the flame sensor and reverse the above procedure to reassemble unit.

BURNER ORIFICE REPLACEMENT: Refer to Figure1: Sub-Assemblies and Figure23: Location of Components as needed.

1. Turn pump, gas supply, and heater power "OFF".
2. Disconnect the union joint in the gas supply piping outside the heater cabinet.
3. Remove the front access panel.
4. Disconnect the wires from the terminals on the gas valve.
5. Remove the gas manifold assembly. It is attached to the air box using (4) screws.
6. Remove the orifices using a 7/16" wrench.
7. After cleaning or replacing orifices re-install into the gas manifold pipe being careful not to cross-thread or over tighten as a leak may result.

NOTICE: Do not enlarge orifice holes.

NOTICE: All replacement wiring must be replaced with manufacturer supplied replacement parts.

IGNITION CONTROL SYSTEM: The control system in this heater consists of 4 components (ignition control board, display board, fuse board and membrane keypad). The locations of these components are shown in Figure23: Location of Components. The ignition control board functions as the heater's thermostat control, safety control system, and gas ignition and combustion monitoring system.

To remove/replace the ignition control board or the fuse board:

1. Turn pump, gas supply, and heater power OFF.
2. Remove the front access panel.
3. Disconnect all wires from the printed circuit board.
4. Detach the board from the sheet metal panel by compressing the plastic standoffs.
5. Replace the board and reverse the above procedure to reassemble unit.

BLOWER VACUUM SWITCH: The blower vacuum switch is a safety device that prevents the ignition sequence from continuing unless the blower is developing sufficient airflow for combustion. Figure23: Location of Components shows the location of the blower vacuum switch in the heater cabinet. When the blower achieves sufficient airflow, the negative pressure created in the blower housing closes the contacts on the blower vacuum switch, indicating to the ignition control board that it is safe to continue the ignition sequence. A silicone tube connects the blower vacuum switch with the blower as shown in Figure23: Location of Components.

To remove the blower vacuum switch:

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the front access panel.
3. Remove the wires from the vacuum switch.
4. Pull the tubing from the hose barb on the switch.
5. Remove the (2) screws that secure the pressure switch to the control panel.
6. Replace the pressure switch and reverse the above procedure to reassemble unit.

HIGH LIMIT SWITCHES: The heater is equipped with two automatic high limits, located on the water header. These high limits are automatically resetting safety devices wired in series with the thermostat and gas valve. See Figure28: Heat Exchanger Header. If the water temperature exceeds the limit set point, the gas valve will be closed, shutting off gas supply to the burners. Erratic high limit operation is an indication of water flow issues. Reduced flow may be caused by a clogged filter or strainer, excessive flow through the external bypass (if one is used), or lime scale accumulation in the heat exchanger.

To replace a high limit switch:

1. Turn pump, gas supply, and heater power "OFF".
2. Drain the heat exchanger of all water.
3. Unplug the high limit wires from the wiring harness.
4. Unscrew the high limit switch from the header.
5. Replace the high limit switch. Use new sealant on the high limit switch threads before reinstalling.
6. Reverse the above procedure to reassemble unit.

VENT PRESSURE SWITCH: The vent pressure switch is a safety device that disables the unit when the flue opening is blocked, which prevents sufficient combustion gas flow through the unit. Figure23: Location of Components shows the location of the vent pressure switch in the heater cabinet. When the flue is blocked, pressure is created and opens the contacts on the vent pressure switch, directing the ignition control board to deactivate the unit. A silicone tube connects the vent pressure switch to the blower as shown in Figure23: Location of Components.

To remove the vent pressure switch:

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the front access panel.
3. Remove the wires from the pressure switch.
4. Pull the tubing from the hose barb on the switch.
5. Remove the (2) screws that secure the pressure switch to the heater.
6. Replace the pressure switch and reverse the above procedure to reassemble unit.

EXHAUST GAS TEMPERATURE LIMIT: The exhaust gas temperature limit monitors the flue gas temperature above the heat exchanger and opens when the temperature rises high enough to indicate that the heat exchanger is no longer transferring heat to the pool water effectively. If the temperature limit opens, effort must be made to assess and rectify the condition that activated the temperature limit and potentially damaged the heat exchanger. The condition is generally low water flow and/or scaling of the heat exchanger cupronickel tubes from poor water chemistry. Replace the limit as well as the heat exchanger, if needed, before operating the unit again.

To replace the exhaust gas temperature limit:

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the upper end cap on the header side of the unit (see Figure1: Sub-Assemblies).
3. Unplug the two wires from the exhaust gas temperature limit located in the flue collector panel above the middle of the header.
4. Unscrew the (2) screws securing the limit to the panel and remove the limit and gasket.
5. Place the new limit and gasket in place and reverse the above procedure to reassemble unit.

THERMISTOR: The thermistor monitors the return water temperature to thermostatically control pool and spa water to the selected temperature and to shut the heater off as the return water reaches 104 F. See Figure28: Heat Exchanger Header.

To replace the thermistor:

1. Turn pump, gas supply, and heater power "OFF".
2. Drain the heat exchanger of all water.
3. Remove the front access panel.
4. Unplug the thermistor connector from the ignition control board.
5. From outside the heater, pull the thermistor leads out of the control box and through the hole in the heater chassis.
6. Unscrew the thermistor from the inlet side of the header.
7. Replace the thermistor. Use new sealant on the thermistor threads before re-installing.
8. Reverse procedure above to reassemble unit.

WATER PRESSURE SWITCH: The water pressure switch (see Figure28: Heat Exchanger Header) is preset at the factory for most typical, deck level installations. When the heater is located above or below the level of the pool or spa, the pressure switch may require adjustment to compensate for the change in static head pressure. If adjustment is needed, the procedure is detailed in WATER PRESSURE SWITCH TEST / ADJUSTMENT PROCEDURE.

NOTICE: Do not operate the pool heater without the function of a properly adjusted pressure switch or flow switch.

To replace the pressure switch:

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the (4) screws securing the upper end panel and remove the panel.
3. Remove the (2) screws securing metal trim panel to the upper trim panel.
4. Remove the wires from the pressure switch.
5. Unscrew switch from header.
6. Replace the pressure switch. Use new sealant on the pressure switch threads before re-installing.
7. Reverse procedure above to reassemble unit.

TRANSFORMER: The transformer converts the field supply voltage (either 240 VAC or 120 VAC) to a 120 VAC output for blower and igniter power, and a 24 VAC output for powering the ignition control board, control circuits, and gas valve. See Figure23: Location of Components for its location.

To replace the transformer:

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the front access panel.
3. Unplug transformer from the fuse board
4. Remove the (2) screws that secure the transformer to the control box.
5. Replace the transformer.
6. Reverse procedure above to reassemble unit.

BYPASS SERVICE CARTRIDGE: The following procedure details how to remove and replace the internal pressure bypass valve in the header. This procedure applies only to plastic (non-ASME) headers. On bronze (ASME) headers, the bypass service cartridge is not field-replaceable. Please contact technical support for more information.

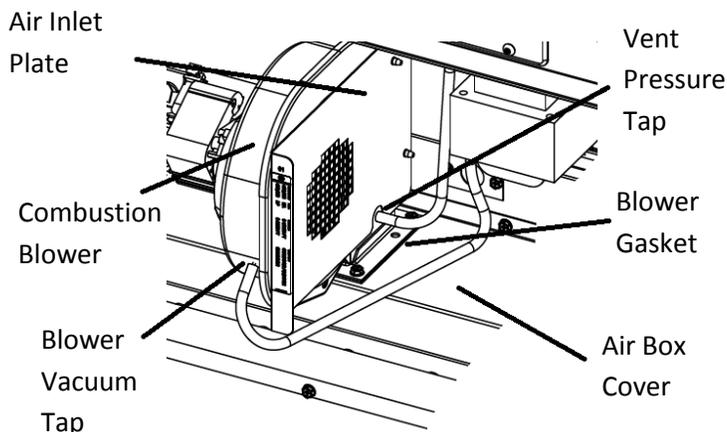
1. Turn pump, main gas valve, and heater power off.
2. Drain heat exchanger according to instructions in Section III of this manual.
3. Remove 6 screws and remove the upper plastic heater side panel, to allow access to the header.
4. Remove the cartridge retaining nut from end of header (see Figure28).
5. Slide out the bypass cartridge from the end of the header (see Figure28).
6. Check the function of the bypass valve to ensure the valve flaps rotate smoothly on the shaft, and the spring fully closes the valve.
7. Apply silicone O-ring grease (Jack's 327 Multilube p/n SP032712, or equivalent) on O-ring seals on the bypass cartridge before inserting into the header.
8. Insert bypass cartridge into header with the arrow on the end of the cartridge pointing up.
9. Re-install cartridge retaining nut. Nut should be tightened hand-tight only. DO NOT OVER-TIGHTEN.
10. Re-install the upper plastic heater side panel.
11. Reverse procedure above to reassemble unit.

COMBUSTION BLOWER: The blower provides the air that mixes with the gas in the burners for the combustion process. The blower operates during the pre-purge time (approximately 30 seconds) at the beginning of each ignition cycle, during the entire time the gas valve is open and the burners are firing, and for 30 seconds after the gas valve closes. See Figure23: Location of Components and Figure30: Blower.

To replace the blower:

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the front access panel.
3. Disconnect the blower wire harness from the ignition control board.
4. Disconnect the tubing from the hose barb on the blower housing.
5. Remove the blower from the air box cover (4 screws).
6. Remove the blower air inlet plate from the blower (4 screws).
7. Be sure the blower outlet gasket is in place before proceeding. Reverse the above procedure to reassemble the blower.

Figure30: Combustion Blower



TROUBLESHOOTING:

Error and Display Codes: See Table16: Display Code Index.

Troubleshooting the unit: See Table17: Troubleshooting Lookup Chart.

AUTOMATIC RESET TIME: The heater will automatically reset when an error condition is corrected and resume operation. The heater can be manually reset using the keypad by cycling the MODE button through “STANDBY” and back to the original operating mode (“POOL” or “SPA”).

⚠ WARNING: These instructions are intended for the use of qualified personnel trained and experienced in the installation and servicing of this type of heating equipment and its related system components. Some states may require installation and service personnel to be licensed. Persons not qualified should not attempt to repair this equipment according to these instructions. These instructions and procedures are not for the use of “do-it-yourself” consumers.



⚠ WARNING: BURN HAZARD The operation of the heater with the pump shut off could cause heater overheating and fire. Never operate heater with the pump shut off.

NOTICE: As a preliminary check, make sure that all wire connections are clean and tight and that all wiring conforms to the wiring diagram.

FUSE SPECIFICATIONS: The fuse designations are printed on the power board and the ignition control board. See Figure23: Location of Components for board locations. Fuses are available as common hardware items or may be purchased from manufacturer in a service parts kit. The fuse specifications are:

- F1 fuse (low voltage): 3A blade style fast-acting automotive fuse, type 257
- FC1 & FC2 (transformer primary) and FC4 (transformer secondary):3A slo-blo fuse, 5 x 20 mm

INTERNAL WIRING: If the heater display is blank after the electrical has been installed, refer to Troubleshooting Lookup Chart to determine the cause. Note, the ribbon cable between the display board and the ignition control board is keyed to ensure correct connection.

SUPPLY WIRING: If the heater is connected to the line side of the circuit it will be powered at all times. In this situation, when the pump shuts down the heater will display a fault code of “LO”. If there is a call for heat and the pump then restarts there will be a 2-minute delay for the heater to fire. After the pump has been running for at least 2 minutes there is no delay for heater operation. Wiring the heater to the load side of the timer or controller will not result in a 2-minute delay if the pump primes quickly enough to activate the heater’s water pressure switch. If the pump is slow to prime the heater may display an “LO” fault code and will take 2 minutes to automatically restart. If the pump has primed, this wait can be avoided by manually clearing the error code via the keypad by changing the mode through the “STANDBY” setting and returning to the initial setting (“SPA” or “POOL”).When a heater is wired to the line side of the power circuit (continuous power) the blower will not operate when the pump is cycled via a time clock or other switch method.

Table16: Display Code Index

NOTE: Continuation of control sequence is immediate after error is corrected. Automatic reset may take up to 2min for control self-diagnostics to complete. Lockout recover may take up to 60 min.

Code	Description	Information
AC	Air switch circuit closed error	Blower vacuum switch closed when expected open. If the blower vacuum switch is closed before blower has started, the ignition control board will not start the blower until circuit is opened.
AO	Air switch circuit open error	Blower vacuum switch open when expected closed. If the blower vacuum switch does not close after the blower starts for ignition or opens unexpectedly during operation / post purge the ignition control board will shut off gas and air flow and attempt a new ignition. If the blower vacuum switch does not close after the blower starts for ignition the ignition control board will suspend the ignition trial and go into lockout. The blower will continue to run.
bd	Ignition control board data error	If the ignition control board does not satisfy self-diagnostic or input data values are corrupted on power up or initial trial for ignition, the ignition control board will lockout until error condition is corrected..
bd	Gas valve sensed as "ON" error	If gas valve is powered when it should be off the heater will shut down and go into lockout. Blower will operate until error condition is corrected.
bd	Gas valve sensed as "OFF" error	If gas valve is unpowered but flame is sensed the blower will run for 5 s then start a new ignition sequence. If error occurs 10 times during a call for heat the ignition control board will go into lockout.
bo	Bypass operation mode	This is normal display when heater is being controlled by a remote thermostat. No service is required. If heater is not being controlled by remote thermostat, change setting by using the MODE key to put the heater into STANDBY. Press and hold the DOWN key and then press and hold the MODE key. Hold down both keys for 3 seconds until the indication "bO" is removed from the display.
CE	Communication error	If communication between the ignition control board and the display board is not established within 3 s of power-up or is lost for 30s during operation unit will shut down and error will be displayed. The error code will be cleared upon a valid data exchange between boards.
EE	EEPROM error	An error was detected in the ignition control board.
HF	High flame sensor signal error	If flame is sensed with the gas valve off the ignition control board will go into lockout. The blower will run until error condition is corrected. When corrected, the ignition control board will run blower for 5 s then automatically restart after 2 minutes.

Table16: Display Code Index

NOTE: Continuation of control sequence is immediate after error is corrected. Automatic reset may take up to 2min for control self-diagnostics to complete. Lockout recover may take up to 60 min.

HS	High temperature sensing error	A) Inlet water temperature sensor is reporting a temperature in excess of 104°F. Normal operation resumes 2 minutes after inlet water temperature sensor reports temperatures of 104°F or less. This error functions for both normal and remote thermostat modes. or B) Inlet water temperature sensor is reporting a temperature change at a rate faster than 6°F in 60 seconds or less while the heater is firing, indicating a potentially damaging low water flow condition. Normal operation resumes when temperatures stabilize. If this condition is detected 3 times in a one hour period, the heater will lockout.
IF	Ignition failure error	If the maximum number of ignition retries is exceeded, the heater will shut down and go into lockout. Automatic reset is 60 minutes.
IO	Igniter open error	If the ignition control board is not in lockout and senses that the igniter circuit is open when the blower is running the ignition control board will turn off the blower and go into lockout. Automatic restart 2 min after error is corrected.
LO	Limit string open error	If the limit string opens the heater shuts down and goes into lockout. Automatic restart is 2 minutes after the error condition is corrected and the limit string closes.
PF	Electrical power supply wiring error	This code will display if supply power polarity is reversed, low voltage is detected, or if the ground path is not sufficient. Reset is immediate after error is corrected.
Sb	Keypad stuck button error	If one of the keypad buttons is closed (or pressed) for more than 30 s the unit will shut down. The error code will be cleared when the condition is corrected.
SF	Temperature sensor failure error	If an excessive temperature difference between the redundant thermistors (5 °F or more) or a sensor "out of bounds" condition with either thermistor (less than 10°F or greater than 180°F) will result in unit shut down and the error code displayed. Automatic restart is 2 minutes after the error is corrected.

Table17: Troubleshooting Lookup Chart

Code/ Fault	Diagnostic Step	Suggested Troubleshooting Action
No code displayed Heater will not power up	1. Check for Low & High voltage output from fuse board	Disconnect plug from P5 connector from Fuse Board. Measure for 24VAC between pins of receptacle on Fuse Board. Reconnect plug. Disconnect plug from P6 of Fuse Board. Measure for 120VAC between pin 3 and 5 of receptacle on Fuse Board. Reconnect plug. If OK, proceed to section titled "Low voltage circuit fault". Otherwise, proceed to step 2.
	2. Ensure power supply to heater is turned on.	Measure for field supply voltage across terminals of TB1 terminal block on Fuse Board. If OK, proceed to step 3
	3. Check for faulty fuse board wiring.	Inspect Fuse Board wiring. Ensure all plugs are securely fastened to Fuse Board. If OK, proceed to step 4.
	4. Verify that FC1 and FC2 fuses on fuse board are working	Remove FC1 and FC2 fuses from fuse holder. Measure continuity across fuse. If fuses are open, proceed to section titled "Open FC1 and/or FC2 Fuses". If fuses are OK, reinstall them and proceed to step 5.
	5. Verify that voltage selector plug is installed	Check that proper Voltage Selector Plug 120 or 240 VAC is installed in Fuse Board. If OK, proceed to step 6
	6. Check for defective transformer.	Disconnect plug from P4 connector from Fuse Board. Measure for 24VAC between pins 1 & 2 of plug of Transformer and 120VAC between pins 4 & 6. If 24VAC or 120VAC is not present, replace Transformer. Otherwise, proceed to step 7.
	7. Fuse Board is defective	Replace Fuse Board.
No code displayed Low voltage circuit fault.	1. Check for Low Voltage Output from Fuse Board	Disconnect plug from P5 connector from Fuse Board. Measure for 24VAC across pins. Reconnect plug. If OK, proceed to step 2. Otherwise, proceed to step 5.
	2. Check for faulty ignition control board wiring.	Inspect ignition control board wiring. Ensure all plugs are securely fastened. If OK, proceed to step 3.
	3. Verify low voltage input to ignition control board	Verify 24VAC across R and C terminals on ignition control board. If not OK, replace harness. If OK, proceed to step 4.
	4. Verify that F1 Fuse on ignition control Board is not open.	Remove F1 fuse from fuse holder. Measure continuity across fuse. If OK, replace ignition control board. If fuse is open, proceed to section titled "Open FC3 or FC1 Fuses".
	5. Verify that FC3 on Fuse Board is not open	Remove FC3 fuse from fuse holder. Measure continuity across fuse. If fuse is open, proceed to section titled "Open FC3 or FC1 Fuses". If OK, reinstall fuse and proceed to step 6.
	6. Check for defective Transformer.	Disconnect plug from P4 connector from Fuse Board. Measure for 24VAC between pins 1 & 2 of plug from transformer. If 24VAC is not present, replace Transformer. Otherwise, proceed to step 7.
	7. Fuse Board is defective	Replace Fuse Board

Table17: Troubleshooting Lookup Chart

Code/ Fault	Diagnostic Step	Suggested Troubleshooting Action
No code displayed Open FC1 and/or FC2 Fuses.	1. Verify that 120VAC Voltage Selector Plug is not installed with a 240VAC field power supply.	Check that proper Voltage Selector Plug is installed. If OK, proceed to step 2. If 120VAC plug is installed and field supply voltage is 240VAC, FC1 and FC2 fuses may be blown. Install the correct Voltage Selector Plug and new FC1 and FC2 fuses.
	2. Check for faulty Transformer wiring.	Inspect Transformer wiring. Ensure insulation on wiring is not worn. If OK, proceed to step 3.
	3. Defective Transformer	Replace Transformer.
No code displayed Open FC3 and/or F1 Fuses	1. Check for faulty Gas Valve wiring.	Inspect Gas Valve wiring. Ensure insulation on wiring is not worn. If OK, proceed to step 2.
	2. Verify that Gas Valve is not defective.	Measure for resistance across Gas Valve terminals and between each terminal and ground. If short exists, replace Gas Valve. If OK, proceed to step 3.
	3. Check for faulty ignition control board wiring.	Inspect ignition control board wiring is to supplied wiring diagram. Ensure insulation on wiring is not worn and no bare wire is exposed. If OK proceed to step 4.
	4. Ignition control board is defective.	Replace ignition control board.
No code displayed Open FC4 Fuse.	1. Check for faulty Igniter wiring.	Inspect Igniter wiring. Ensure insulation on wiring is not worn. If OK, proceed to step 2.
	2. Check for faulty Blower wiring.	Inspect Blower wiring. Ensure insulation on wiring is not worn. If OK, proceed to step 3.
	3. Check for defective Igniter.	Disconnect Igniter plug from ignition control board. Measure resistance across Igniter. Resistance should be 10.9-19.7 ohms at 77°F. If out of this range, replace igniter. If OK, proceed to step 4
	4. Check for defective Blower.	Disconnect Blower plug from ignition control board. Measure resistance across Blower windings. Winding resistance across lead should be in the following range: Red-to-White: 4 to 5 ohms. If measured values vary substantially from these values, blower is defective. Replace. Otherwise proceed to step 5.
	5. Ignition control board is defective.	Replace ignition control board.
AC displayed Air switch circuit closed error	1. Check for defective blower on relay or ignition control board.	Disconnect Blower plug from ignition control board. With heater off, measure continuity across pins 1 and 2 of receptacle on ignition control board. If closed, ignition control board relay is defective. Replace ignition control board. If OK, proceed to step 2.
	2. Vacuum switch is defective.	Replace blower vacuum switch.

Table17: Troubleshooting Lookup Chart

Code/ Fault	Diagnostic Step	Suggested Troubleshooting Action
AO displayed Air switch circuit open error	1. Check for faulty vacuum switch tubing	Check tubing and replace if necessary. If OK, proceed to step 2.
	2. Check for faulty vacuum switch wiring or connection.	Inspect vacuum switch wiring. Ensure wire harness terminals are securely fastened to spade terminals on vacuum switch. If OK, proceed to step 3.
	3. Check for faulty blower wiring or connection	Inspect blower wiring. Ensure plug on blower is securely fastened to ignition control board. If OK, proceed to step 4.
	4. Check for defective vacuum switch	Disconnect Blower plug from ignition control board. Measure resistance across Blower windings. Winding resistance across lead should be in the following range; Red-to-White: 4 to 5 ohms. If measured values vary substantially from these values, Blower is defective. Replace. If OK, proceed to step 5.
	5. Check for defective blower relay.	Disconnect Blower plug from ignition control board. Place heater in Pool or Spa Mode. Lower set point temperature to generate call for heat. During pre-purge period, measure for 120VAC across pins 1 and 2. If 120VAC is not present, ignition control board relay is defective. Replace ignition control board. If OK, proceed to step 6
	6. Vacuum switch is defective	Replace blower vacuum switch.
bd displayed Ignition control board data error	1. Verify that FC4 Fuse on Fuse Board is not open.	Remove FC from fuse holder. Measure continuity across fuse. If OK, reinstall fuse and proceed to step 2. If Fuse is open, proceed to section titled "Open FC4 Fuse".
	2. Verify high voltage output from Fuse Board.	Disconnect plug from P6 connector of Fuse Board. Measure for 120VAC across pins 3 and 5 of P6 receptacle on Fuse Board. If OK, reconnect plug and proceed to step 3. If not OK, go to step 4.
	3. Check for defective Harness.	Disconnect plug from E10 connector of ignition control board. Measure for 120VAC across pins 1 and 3 of Plug on Harness. If OK, replace ignition control board. If not OK, replace Harness.
	4. Check for defective Transformer.	Disconnect plug from P4 connector of Fuse Board. Measure for 120VAC between pins 4 and 6 of plug from Transformer. If OK, proceed to step 5. If not OK, replace Transformer.
	5. Fuse Board is defective	Replace Fuse Board.
bo displayed Bypass Operation	1. Check to see if Ignition control board is in Bypass Operation	This is normal display when heater is being controlled by a remote thermostat. No service is required. If heater is not being controlled by remote thermostat, change setting by using the MODE key to put the heater into STANDBY. Press and hold the DOWN key and then press and hold the MODE key. Hold down both keys for 3 seconds until the indication "bo" is removed from the display.

Table17: Troubleshooting Lookup Chart

Code/ Fault	Diagnostic Step	Suggested Troubleshooting Action
CE displayed Control to display communica- tion error	1. Disconnect and then re- connect power to heater.	Reset communication between Display Interface and Ignition control board
	2. Check for faulty wiring or connection.	Inspect Display Interface Wiring. Ensure Display Interface Plug is securely attached to ignition control board. If OK, proceed to step 3.
	3. Display Interface and/or Ignition control board are defective.	Replace Display Interface and/or ignition control board
EE displayed	1. EEPROM error Defective ignition control board	Replace ignition control board.
HF displayed High flame sensor signal error	1. ignition control board is defective	Using the sight glass, check to see if the flame is present in the unit. If not, replace ignition control board. If flame is present, use a voltmeter to determine if 24 VAC is present at the gas valve connections. If so, replace ignition control board. If not, move to step2.
	2. Gas Valve is defective	Replace Gas Valve
HS displayed High temp. sensing Error	1. Check remote thermostat setting	Verify set point setting of remote thermostat is at or below 104°F. If set point of remote thermostat is OK, or if heater is not configured for remote thermostat, proceed to step 2.
	2. Verify that the water flow is adequate	Verify that water flow to heater is above minimum required (see SPECIFICATION in Getting Started Section). Note that intermittent periods of low water flow will cause this error. If OK, proceed to step 3.
	3. Check inlet water temperature sensor	Compare the heater's temperature reading to the pool water temperature with an accurate thermometer. If significantly different, replace inlet water temperature sensor.
IF displayed Ignition failure error	1. Ensure gas supply shut off valves are open.	Ensure that main gas shutoff installed adjacent to heater is open. Ensure that knob on gas valve inside unit is in "on" position. If OK, proceed to step 2.
	2. Check for low gas supply press.	Ensure inlet gas supply pressure is between the minimum and maximum values indicated on rating plate. If OK, proceed to step 3.
	3. Check for faulty flame sense connection.	Inspect flame sense wiring. Ensure wire harness terminals are securely fastened to flame sense and to ignition control board. If OK, proceed to step 4.
	4. Check for faulty gas valve connection	Inspect gas valve wiring. Ensure wire harness terminals are securely fastened to spade terminals on gas valve. If OK, proceed to step 5.
	5. Check for gas valve failure or gas valve relay failure.	1. Measure voltage across gas valve during trial for ignition. If 24VAC is present and gas valve does not open, gas valve is defective. Replace gas valve.
		2. If 24VAC is not present, gas valve relay on ignition control board is defective. Replace ignition control board.
6. Check for blockage	Inspect gas orifices for blockages which could prevent gas flow. Remove and inspect burners for blockages.	
IO displayed Igniter open error	1. Check for faulty connection.	Inspect Igniter wiring. Ensure Igniter Plug is securely attached to ignition control board. If OK, proceed to step 2.
	2. Igniter is defective	Replace Igniter.

Table17: Troubleshooting Lookup Chart

Code/ Fault	Diagnostic Step	Suggested Troubleshooting Action
LO displayed Water Pressure Switch Fault	1. Verify that the pump is running.	This is a normal display when the pump is off. Turn pump on. LO code should clear. If LO does not clear, proceed to step 2.
	2. Verify that water flow is adequate	Verify that water flow rate to heater is above minimum required (see SPECIFICATION in Getting Started Section). If OK, proceed to step 3
	3. Check for faulty wiring or connection.	Inspect water pressure switch wiring. Ensure wire harness terminals are securely fastened to spade terminals on water pressure switch. If OK, proceed to step 4.
	6. Check for correct water pressure switch setting.	Adjust water pressure switch setting as presented in Manual (only if heater is above or below water level). If LO does not clear, proceed to step 7.
	7. Water pressure switch is defective	Replace water pressure switch.
LO displayed Vent Pressure Switch Fault cont...	1. Check for faulty wiring or connection.	Inspect vent pressure switch wiring. Ensure wire harness terminals are securely fastened to spade terminals on vent pressure switch. If OK, proceed to step 2.
	2. Verify state of vent pressure contacts.	Remove wire leads from vent pressure switch and jumper leads. Operate heater. Measure continuity across vent pressure switch. If closed, LO code is not caused by vent pressure switch fault. If open, proceed to step 3. Remove jumper from wire leads and reconnect wire leads to vent pressure switch.
	3. Check for restricted or blocked flue.	Ensure that flue is not blocked or restricted. See indoor vent sizing requirements in installation manual. Verify heat exchanger is not blocked. Verify burners are not blocked. If OK, proceed to step 4.
	4. Vent pressure switch is defective.	Replace vent pressure switch.
LO displayed Temp. Limit Switch Fault cont...	1. Check for faulty wiring or connection.	Inspect temperature limit switch wiring. Ensure wire harness terminals are securely fastened to spade terminals on temperature limit switches. If OK, proceed to step 2.
	2. Verify state of temperature limits' contacts	Remove wire leads from limit switch and jumper leads. Operate heater. Measure continuity across limit switches. If closed, LO code is not caused by temperature limit switch fault. If open, proceed to step 3. Remove jumper from leads and reconnect leads to temperature limits.
	3. Verify that water flow is adequate	Verify that water flow rate to heater is above the minimum required (see SPECIFICATION in Getting Started Section). If OK, proceed to step 4.
	4. Temperature limit switch is defective.	Replace temperature limit switch.

Table17: Troubleshooting Lookup Chart

Code/ Fault	Diagnostic Step	Suggested Troubleshooting Action
LO displayed Exhaust Gas Temp. Limit Fault cont...	1. Check for faulty wiring or connection	Inspect temperature limit switch wiring. Ensure wire harness terminals are securely fastened to spade terminals on temperature limit switch located in the flue collector panel above the center of the header. If OK, proceed to step 2.
	2. Verify state of temperature limit's contacts	Remove wire leads from limit switch and measure continuity across limit switch contacts. If closed, LO code is not caused by exhaust gas temperature limit switch fault. If open, proceed to step 3.
	3. Heat exchanger has been damaged	This is generally due to low water flow, poor water chemistry, or other factors. Correct issues with water flow through the heater and water chemistry and then replace the heat exchanger and exhaust gas temperature limit. Continuing to run the heater after this limit has tripped will cause damage to the entire unit and will not be covered by the warranty.
PF displayed	1. Polarity reversed	Reverse L and N (120vac) or L1 and L2 (240VAC).
	2. Insufficient ground continuity	Check for proper ground to unit and at service disconnect box
	3. Low voltage detected	Check that proper Voltage Selector Plug is installed.
	4. Ignition control board damaged	
Sb displayed	1. Keypad stuck button error, keypad is defective	Replace Display Interface Assembly.
SF displayed Temp. sensor failure error	1. Check for faulty wiring or connection.	Inspect sensor wiring. Ensure sensor is plugged into back of ignition control board. If OK, proceed to step 2.
	2. Sensor is defective	Replace temperature sensor.

⚠ WARNING: Pool heaters are heat producing appliances. To avoid possible over heating of the outer jacket and damage or injury with such an event: (1) no materials should be stored against the jacket and (2) care should be taken to avoid unnecessary contact (especially by children) with the jacket.

⚠ WARNING: When lighting a gas heater, the lighting instructions must be followed exactly to prevent "flashback" of excess gas in the heater. Electronic ignition heaters and electric heaters must have the power shut off when making adjustments for servicing, or coming into contact with the heater.

⚠ WARNING: UNDER NO CIRCUMSTANCES SHOULD FLAMMABLE MATERIALS, SUCH AS GASOLINE OR PAINT THINNERS, BE USED OR STORED IN THE VICINITY OF THE HEATER OR IN ANY LOCATION FROM WHICH FUMES COULD REACH THE HEATER.

PARTS:

Figure31: Service Parts Exploded View

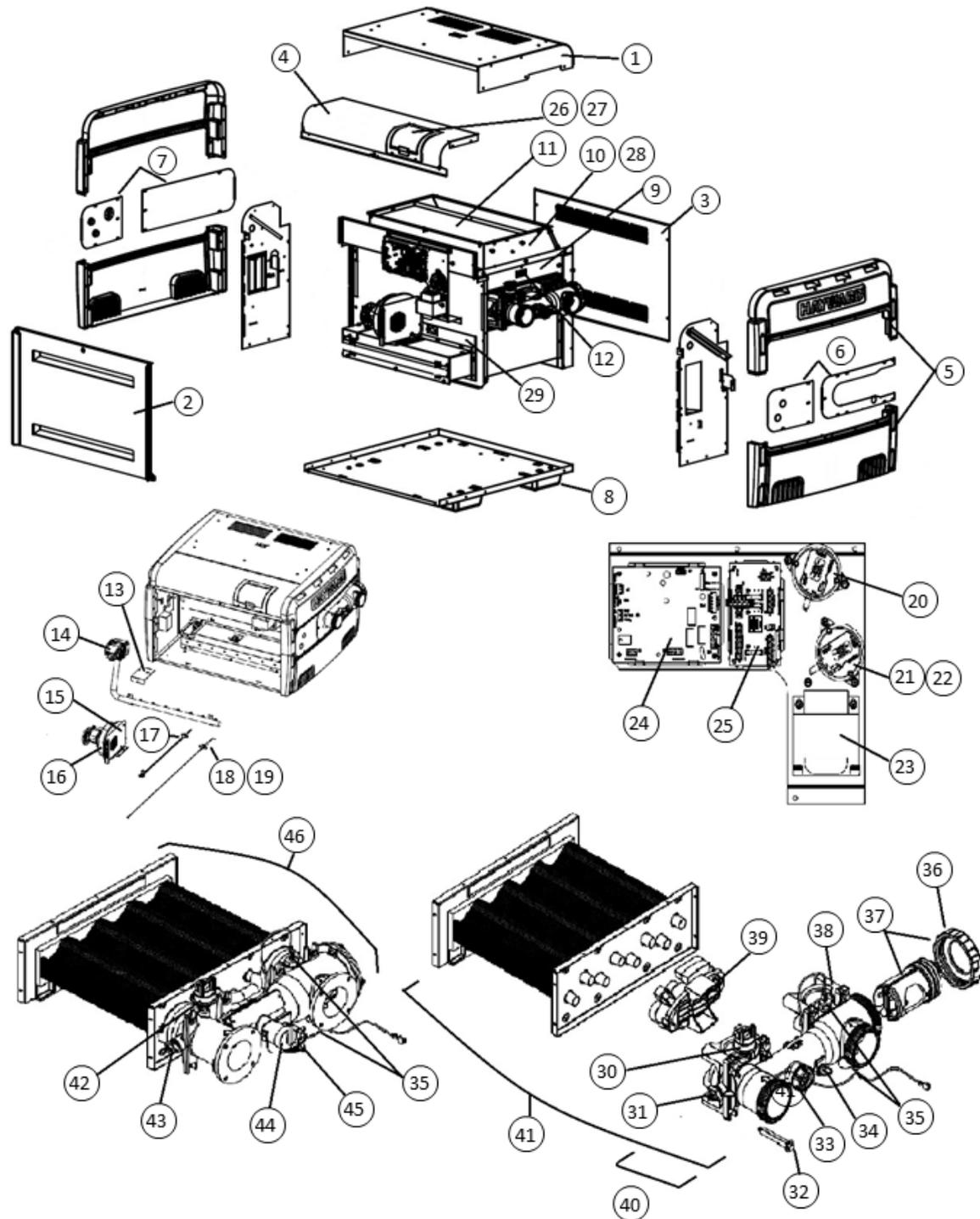


Table18: Service Kits

#	Item Description	150	200	250 250ASME	300	350	400 400ASME	500 500ASME
1	TOP FLUE COVER (PLASTIC HEADER)	FDXLJKT 1150	FDXLJKT 1200	FDXLJKT 1250	FDXLJKT 1300	FDXLJKT 1350	FDXLJKT 1400	FDXLJKT 1500
	ASME (BRONZE HEADER) *	N/A		FDXLJKT 1250A	N/A		FDXLJKT 1400A	FDXLJKT 1500A
2	FRONT ACCESS DOOR ASSY (PLASTIC HEADER)	FDXLFAD 1150	FDXLFAD 1200	FDXLFAD 1250	FDXLFAD 1300	FDXLFAD 1350	FDXLFAD 1400	FDXLFAD 1500
	ASME FRONT ACCESS DOOR ASSY (BRONZE HEADER) *	N/A		FDXLFAD 1250A	N/A		FDXLFAD 1400A	FDXLFAD 1500A
3	REAR ACCESS DOOR ASSY (PLASTIC HEADER)	FDXLRAD 1150	FDXLRAD 1200	FDXLRAD 1250	FDXLRAD 1300	FDXLRAD 1350	FDXLRAD 1400	FDXLRAD 1500
	ASME REAR ACCESS DOOR ASSY (BRONZE HEADER) *	N/A		FDXLRAD 1250A	N/A		FDXLRAD 1400A	FDXLRAD 1500A
4	TOP FRONT PANEL (PLASTIC HEADER)	FDXLTFP 1151	FDXLTFP 1201	FDXLTFP 1251	FDXLTFP 1301	FDXLTFP 1351	FDXLTFP 1401	FDXLTFP 1501
	ASME TOP FRONT PANEL (BRONZE HEADER) *	N/A		FDXLTFP 1251A	N/A		FDXLTFP 1401A	FDXLTFP 1501A
5	BOTH END CAPS	FDXLBEC1930						
6	HEADER SIDE TRIM PANELS	FDXLHTP1931						
7	RETURN SIDE TRIM PANELS	FDXLRTP1931						
8	BASE LEG	FDXLPBL1930						
9	FLUE COLLECTOR SIDE PANEL W/ TEMPERATURE LIMIT	FDXLFCS1931						
10	RAIN GUARD ASSEMBLY	FDXLRGK 1151	FDXLRGK 1201	FDXLRGK 1251	FDXLRGK 1301	FDXLRGK 1351	FDXLRGK 1401	FDXLRGK 1501
11	HEAT BARRIER PANEL	FDXLHBP 1150	FDXLHBP 1200	FDXLHBP 1250	FDXLHBP 1300	FDXLHBP 1350	FDXLHBP 1400	FDXLHBP 1500
12	EXHAUST GAS TEMPERATURE	FDXLEGL1930						
13	IGNITER ACCESS COVER	FDXLIAC1930						
14	CONVERSION KIT, NA TO LP, QUICK-CHANGE	FDXLGCK 2150NP	FDXLGCK 2200NP	FDXLGCK 2250NP	FDXLGCK 2300NP	FDXLGCK 2350NP	FDXLGCK 2400NP	FDXLGCK 1500NP
	CONVERSION KIT, LP TO NA, QUICK-CHANGE	FDXLGCK 2150PN	FDXLGCK 2200PN	FDXLGCK 2250PN	FDXLGCK 2300PN	FDXLGCK 2350PN	FDXLGCK 2400PN	FDXLGCK 2500PN
* ASME parts for ASME models only								

Table18: Service Kits

#	Item Description	150	200	250 250ASME	300	350	400 400ASME	500 500ASME
15	BLOWER INLET BAFFLE	FDXLBBN 1150	FDXLBBN 1200	FDXLBBN 1250	FDXLBBN 1300	FDXLBBN 1350	FDXLBBN 1400	FDXLBBN 1500
16	COMBUSTION BLOWER	FDXLBWR1930						FDXLBWR 1500
17	IGNITOR	FDXLIGN1930						
18	FLAME SENSOR	IDXLFLS1930						
19	GASKET KIT, BLOWER/IGN	FDXLGSK1930						
20	BLOWER VACUUM SWITCH	FDXLBVS1930						
21	VENT PRESS SWITCH, OUTDOOR AND INDOOR, 0-2000	FDXLVPS1930						
22	VENT PRESS SWITCH, INDOOR, 2,000-10,100	FDXLVPS1931						
23	TRANSFORMER	IDXL2TRF1930						
24	IGNITION CONTROL BOARD	FDXLICB1930						
25	FIELD WIRING PANEL	FDXLFWP1930						
26	BEZEL & KEYPAD ASSEMBLY	FDXLBKP1932						
27	GASKET KIT, BEZEL	FDXLGSK1932						
28	GASKET KIT, FLUE/RAIN GRD	FDXLGSK1931						
29	GASKET KIT, CC FRONT/AIR BOX	FDXLGSK1934						
30	WATER PRESSURE SWITCH	FDXLWPS1931						
31	THERMISTOR	FDXLTER1931						
32	HEADER HARDWARE KIT	FDXLHDW1930						
33	PLUG	CHXPLG1930						
34	DRAIN PLUG WITH GASKET	SPX400FG						
35	HIGH LIMIT KIT	FDXLHLI1930						
36	BYPASS CARTRIDGE RETAINING NUT	FDXLCRN1930						
37	BYPASS CARTRIDGE KIT	FDXLBPK1930						
38	HEADER MOUNTING BASE KIT	FDXLHBM930						
* ASME parts for ASME models only								

Table18: Service Kits

#	Item Description	150	200	250 250ASME	300	350	400 400ASME	500 500ASME
39	RETURN MANIFOLD REPLACEMENT KIT	FDXLPRM1930						
40	INLET/OUTLET HEADER ONLY	FDXLFHD1930						
	INLET/OUTLET HEADER ASSY	FDXLFHA1930						
41	HEAT EXCHANGER ASSY (PLASTIC HEADER)	FDXLHXA 1150	FDXLHXA 1200	FDXLHXA 1250	FDXLHXA 1300	FDXLHXA 1350	FDXLHXA 1400	FDXLHXA 1500
42	ASME WATER PRESSURE SWITCH*	N/A		FDXLWPS 1930	N/A		FDXLWPS 1930	FDXLWPS 1930
43	THERMISTOR*	FDXLTER1930						
44	ASME PRESSURE RELIEF VALVE *	N/A		CHXRLV 1930	N/A		CHXRLV1930	
45	ASME DRAIN VALVE, *	N/A		FDXLDRV 1930A	N/A		FDXLDRV1930A	
46	ASME HEAT EXCHANGER ASSY (BRONZE HEADER) *	FDXLHXA 1150	FDXLHXA 1200	FDXLHXA 1250A	FDXLHXA 1300	FDXLHXA 1350	FDXLHXA 1400A	FDXLHXA 1500A
* ASME parts for ASME models only								

Table18: Service Kits (Items Not Shown in Diagram)

Item Description	150	200	250 250ASME	300	350	400 400ASME	500 500ASME
ASME UNION FLANGE KIT (INCL. FITTINGS, BOLTS, GASKETS) *	N/A		FDXLUNK1930A	N/A		FDXLUNK1930A	
UNION FLANGE KIT (INCLUDES FITTINGS, UNION NUTS, GASKETS)	SPX3200UNKIT						
TIE-DOWN KIT	FDXLTDK1930						
BURNER	FDXLBRN1930 (qty8) / FDXLBRN1931 (qty1)						
INSULATION, RETURN SIDE TUBE SHEET	FDXLGSK1933						
HEADER 0-RING KIT	FDXLFOR1930						
VOLTAGE SELECTOR JUMPER	FDXLVSJ1930						
FUSE SERVICE KIT	FDXLFSK1930						
FUSE KIT, 3.0A, FOR FIELD WIRING PANEL (QTY 10)	FDXLFSKF30						
FUSE KIT, 3.0A, FOR IGNITION CONTROL BOARD (QTY 10)	FDXLFC30						
HIGH ALTITUDE CONVERSION KIT, 2,000-10,100	FDXLHAK1930						
WIRING HARNESS KIT, COMPLETE	FDXLWHA1930						

* ASME parts for ASME models only

Table18: Service Kits (Items Not Shown in Diagram)

Item Description	150	200	250 250ASME	300	350	400 400ASME	500 500ASME
INDOOR VENT ADPTR KIT, NEG-PRESS CATI (VERTICAL)	UHXNEGVT 11506 6"dia	UHXNEGVT 12006 6"dia	UHXNEGVT 12506 6"dia	UHXNEGVT 13008 8"dia	UHXNEGVT 13508 8"dia	UHXNEGVT 14008 8"dia	UHXNEGVT 15008 8"dia
INDOOR VENT 4"dia ADPT KIT POS-PRESS CATIII (HORZ/VERT) ‡	N/A		UHXPOSZ 12504	N/A			
HeatFab SS 4"dia Adapter	N/A		UHXHFA 004	N/A			
DuraVent SS 4"dia Adapter	N/A		UHXDVA 004	N/A			
INDOOR VENT 6"dia ADPT KIT, POS-PRESS CATIII (HORZ/VERT)**	UHXPOSHZ 11506	UHXPOSHZ 12006	UHXPOSHZ 12506	N/A			
INDOOR VENT 6"dia ADPT KIT, POS-PRESS CATIII (HORZ/VERT) ‡	N/A					UHXPOSHZ 14006	UHXPOSHZ 15006
HeatFab SS 6"dia Adapter	N/A					UHXHFA 006	
DuraVent SS 6"dia Adapter	N/A					UHXDVA 006	
INDOOR VENT 8"dia ADPT KIT, POS-PRESS CATIII (HORZ/VERT)**	N/A			UHXPOSHZ 13008	UHXPOSHZ 13508	UHXPOSHZ 14008	N/A

‡Adapter kit requires additional vent adapter selection of appropriate UHXHFA or UHXDVA

** See Table9 for Heatfab part numbers included in adapter kits

