



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.

FOR YOUR SAFETY:

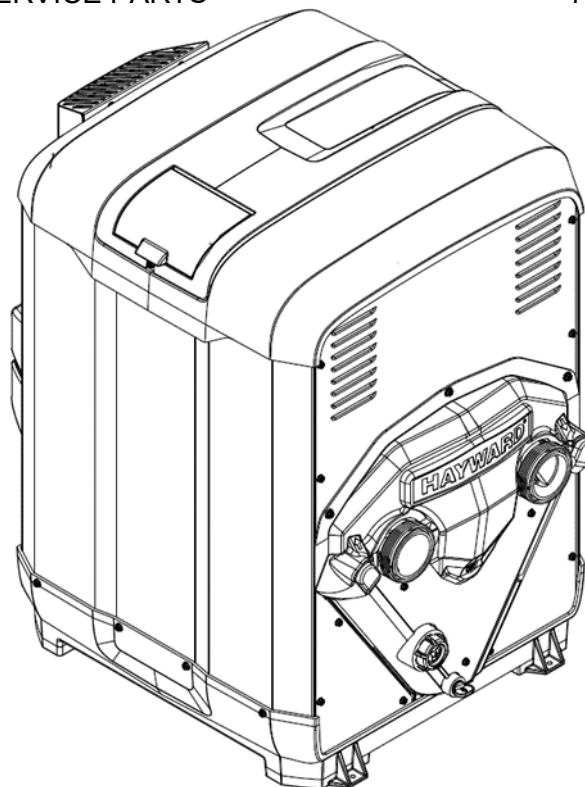
This product must be installed and serviced by authorized personnel, qualified in pool/spa heater installation. Improper installation and/or operation can create carbon monoxide gas and flue gases that can cause serious injury, property damage, or death.



Intertek

**SAVE THESE
INSTRUCTIONS**

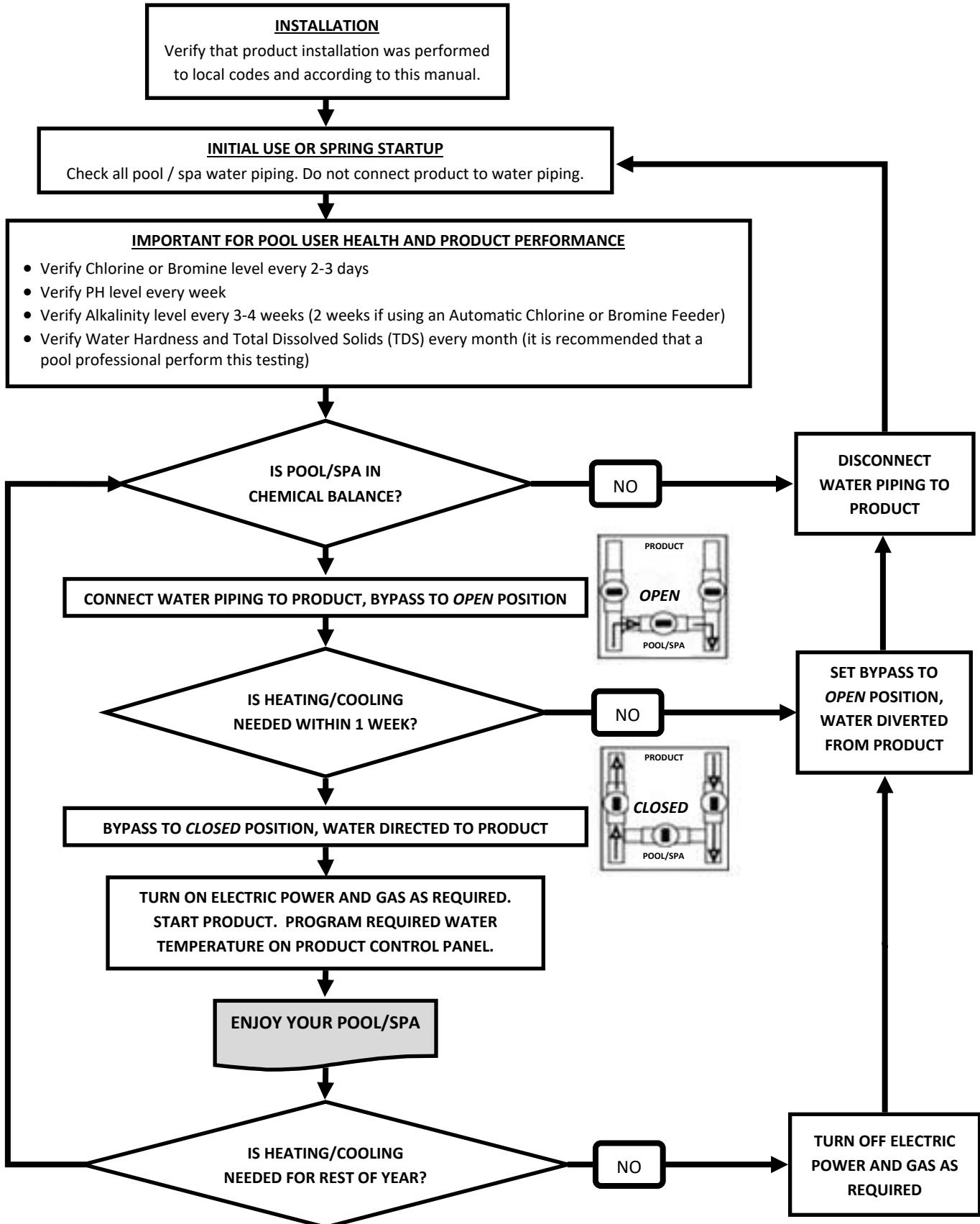
CONTENTS	Pg
GETTING STARTED	2
INSTALLATION	11
LOCATING THE HEATER	12
GAS CONVERSION PROCEDURE	15
ALTITUDE OF INSTALLATION	16
AIR SUPPLY	16
FLUE GAS VENTING	18
GAS SUPPLY	22
WATER PIPING	23
ELECTRICAL CONNECTIONS	25
CHECK-OUT & START-UP	29
CONTROL SETUP	29
GAS TESTING	31
WATER PRESSURE SWITCH SETUP	34
MAINTENANCE & SERVICE	35
WATER CHEMISTRY	35
WINTERIZATION	36
SPRING START-UP	35
TROUBLESHOOTING	41
SERVICE PARTS	44



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 manufacturer's information.



Figure 1: HEATER CONSTRUCTION AND SUB-ASSEMBLIES

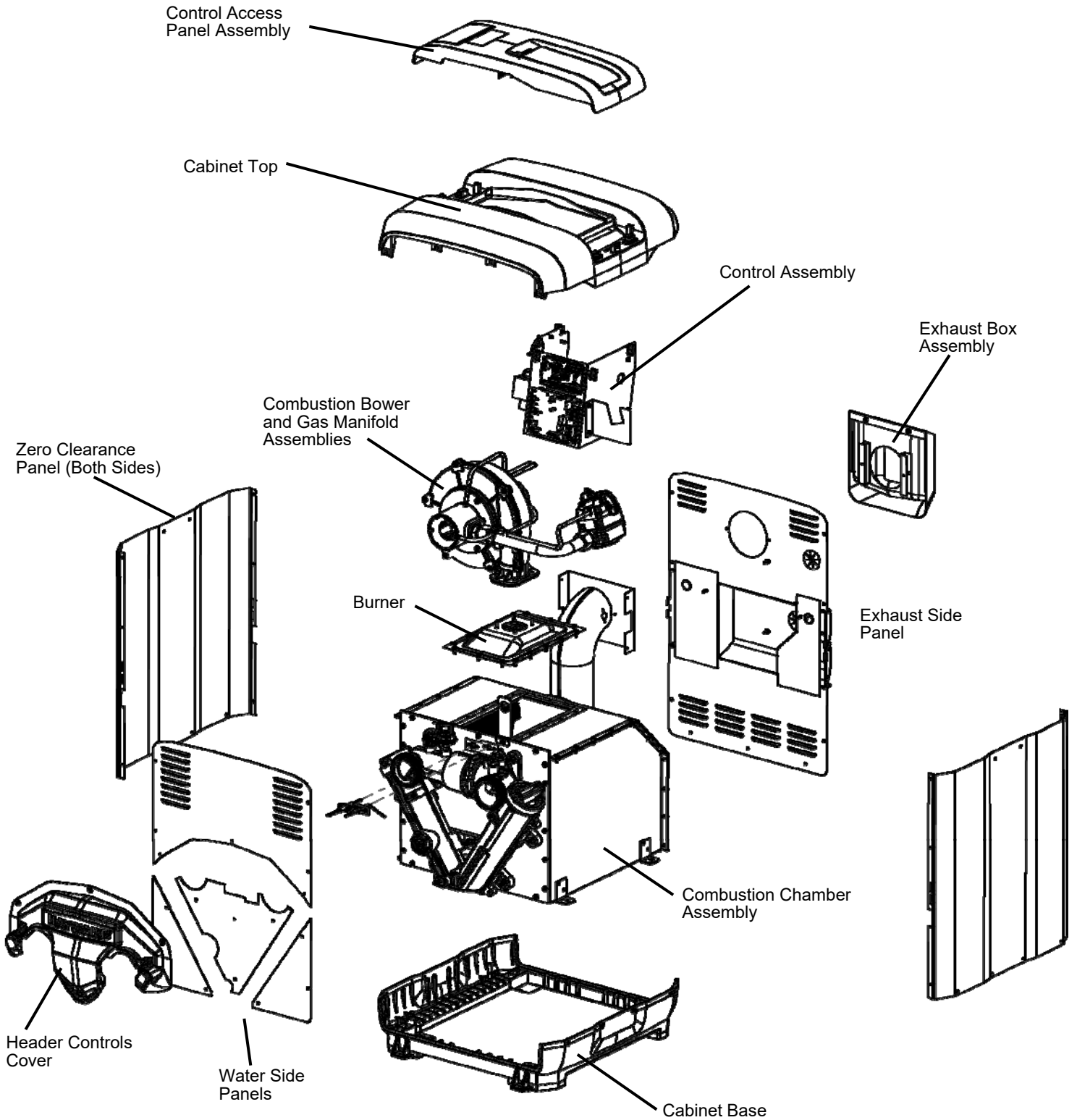



Table 1: SPECIFICATIONS
FEATURES:

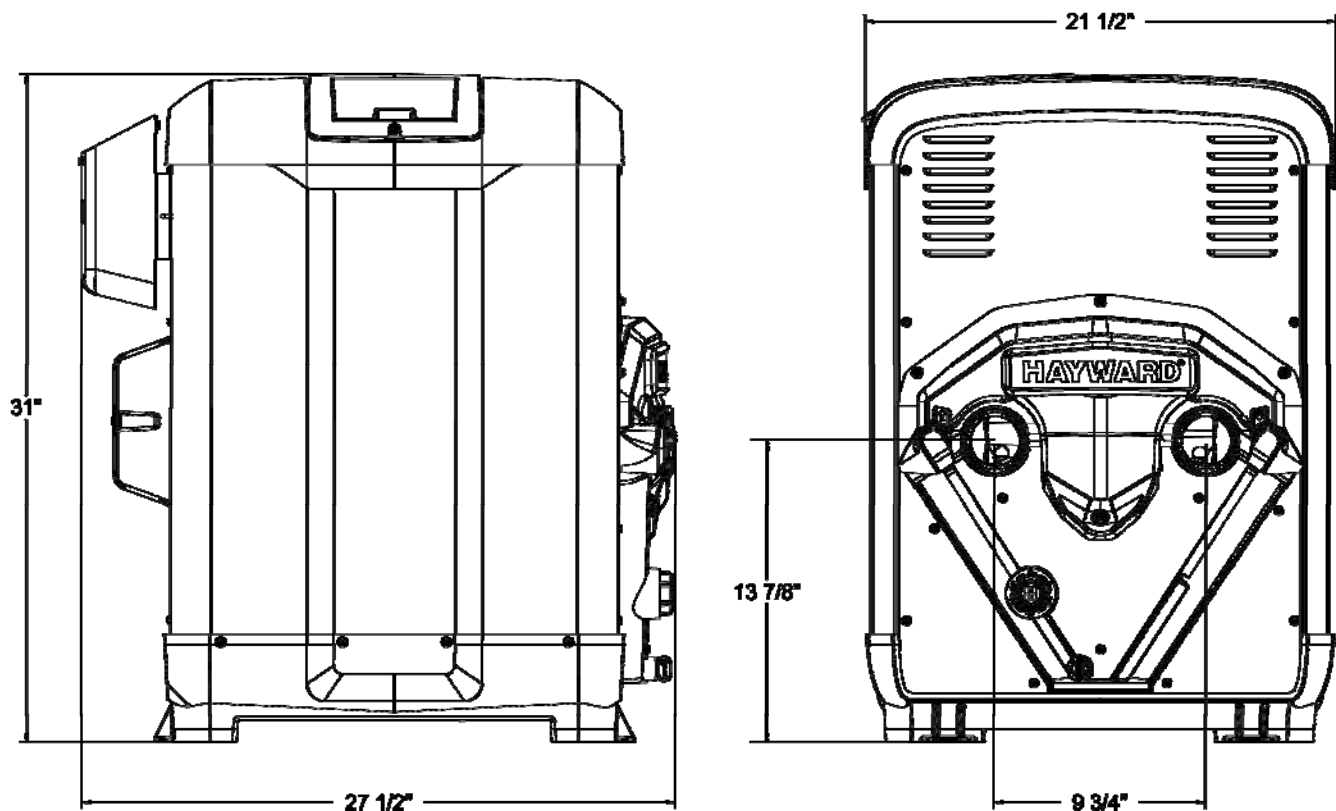
- 120 or 240VAC, 60Hz, Single phase power, 5.5A maximum current
- Pre-mix combustion with silicon nitride hot surface ignition
- Cupronickel heat exchanger tubes standard
- Integral water bypass to maintain correct water flow through the heat exchanger. **Maximum water flow through the unit is 125 GPM.**

Model	Gas Input Natural or Propane	Minimum Water Flow	Thermal Efficiency	Heater Width	Heater Weight
	Btu/hr	GPM	%	in.	lbs.
HDF400	400,000	30	84	21	135

GAS REQUIREMENTS

OPERATING PRESSURES	Natural Gas	Propane Gas
Gas Manifold Pressure* [in. wc]	-0.1 to -0.3	
Gas Inlet Pressure, Minimum [in. wc]	4.0	4.0
Gas Inlet Pressure, Maximum [in. wc]	14.0	14.0
Gas/Air Orifice Service SKU	HDXFMXN400	HDXFMXP400

*Negative pressure regulation, range shown for allowable heating value variation





WIRING CONNECTION DIAGRAM



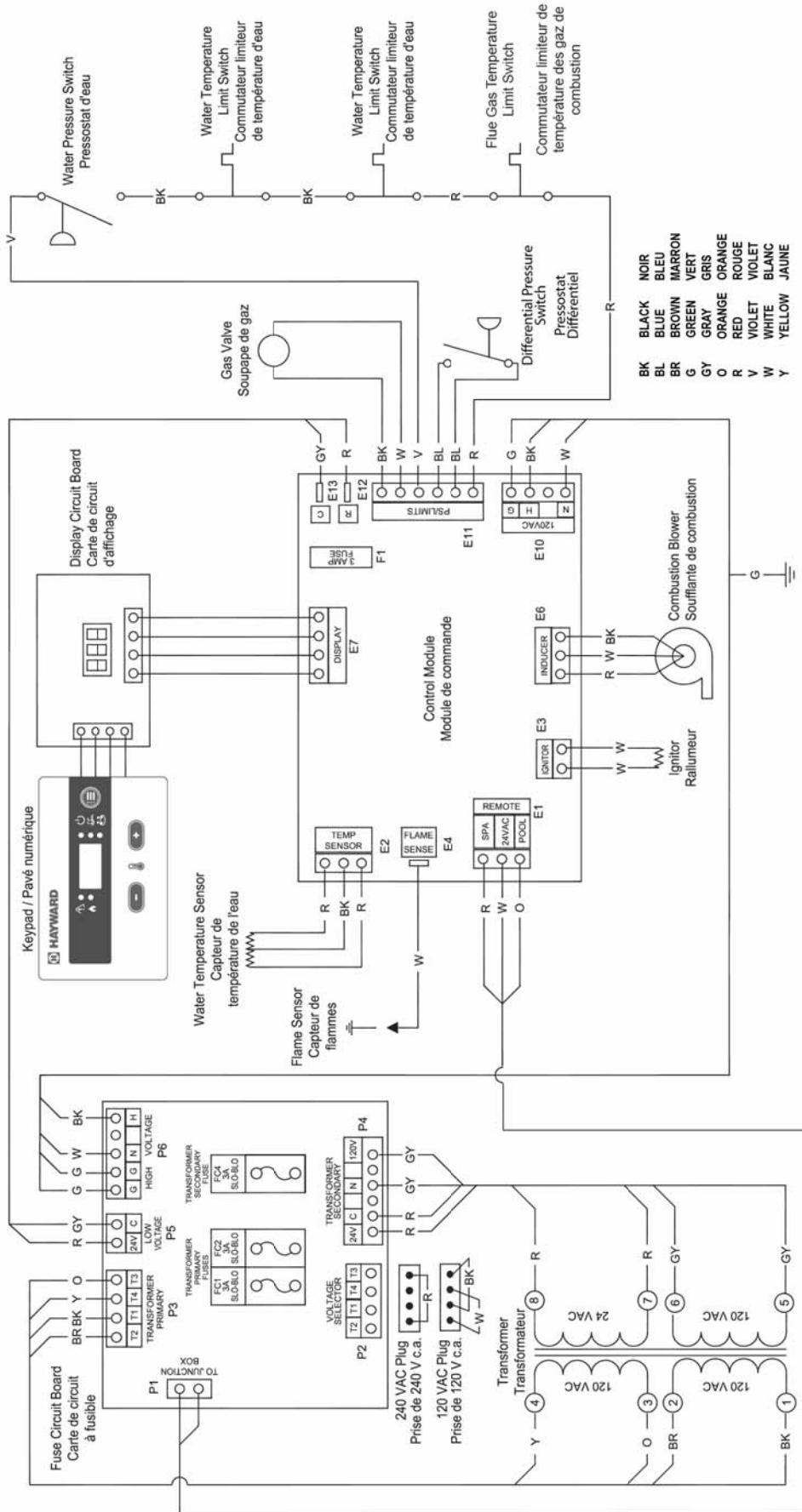
WARNING - Risk of Electric Shock Before working on any electrical equipment, turn off power supply to the equipment.

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.

The unit wiring diagram is shown in Figure 2. A separate diagram is included in the electrical accessory kit supplied with your unit. This kit is located in the low voltage junction box on the exhaust side of the unit. For more detailed troubleshooting and service instructions. Please refer to HDF Service Kit Instructions supplied with any service part and available on Hayward's website.

Wiring Connection Diagram / Schéma de Connexion de Câblage

HDFXXX Gas Heaters / Chaudière Gas à HDFXXX



- NOTE:**
1. Heater is factory wired for 240VAC. To convert to 120VAC, install 120VAC plug inot mating connector on fuse circuit board.
 2. For field power connections use 14 AWG or larger wire rated for at least 167°F (75°C).
 3. For field remote thermostat connections use 22 AWG or larger wire.
 4. If any of the original wire supplied with the heater must be replaced, it must be replaced with 18 AWG, UL or CSA approved wire, rated for 600V and 105°C.

REMARQUE:

1. Le réchauffeur est câblé à l'usine pour 240 V c.a. Pour le convertir à 120 V c.a., installer la prise de 120 V c.a. dans le connecteur correspondant sur la carte de circuit à fusible.
2. Pour les connexions d'alimentation de terrain, utiliser un fil de calibre 14 AWG ou plus gros, homologué pour 75°C (167°F) au moins.
3. Pour les connexions de thermostat de terrain à distance, utiliser un fil de calibre 22 AWG ou plus gros.
4. Si tout fil fourni initialement avec le réchauffeur doit être remplacé, il faut le remplacer par un fil de calibre 18 AWG, approuvé UL ou CSA, homologué pour 600 V et 105°C.

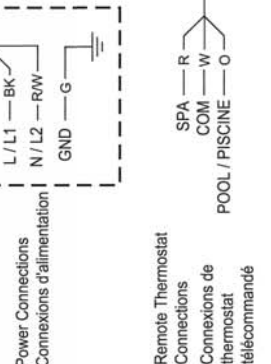




TABLE 2: CERTIFICATION AND COMPLIANCE


CERTIFICATION CODES AND STANDARDS	USA	CANADA
DESIGN CERTIFIED	ETL	ETL
DESIGN COMPLIANT	ANSI Z21.56-2019	CSA 4.7-2019
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 covers.

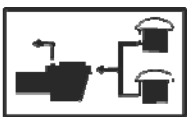
 **Limb Entrapment** - A limb inserted into an opening of a suction outlet sump or suction outlet cover that is damaged, broken, cracked, missing, or not securely attached can result in a mechanical bind or swelling of the limb.

 **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:



- 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.
- Dual suction fittings shall be placed in such locations and distances to avoid "dual blockage" by a user.
- Dual suction fittings shall not be located on seating areas or on the backrest for such seating areas.
- The maximum system flow rate shall not exceed the flow rating as listed in TABLE 1: SPECIFICATIONS.
- Never use Pool or Spa if any suction outlet component is damaged, broken, cracked, missing, or not securely attached.
- Replace damaged, broken, cracked, missing, or not securely attached suction outlet components immediately.
- 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.
- 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 anti-coagulants, 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 for damage. If any carton is damaged, note it when signing for it. Remove the heater from the carton 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.

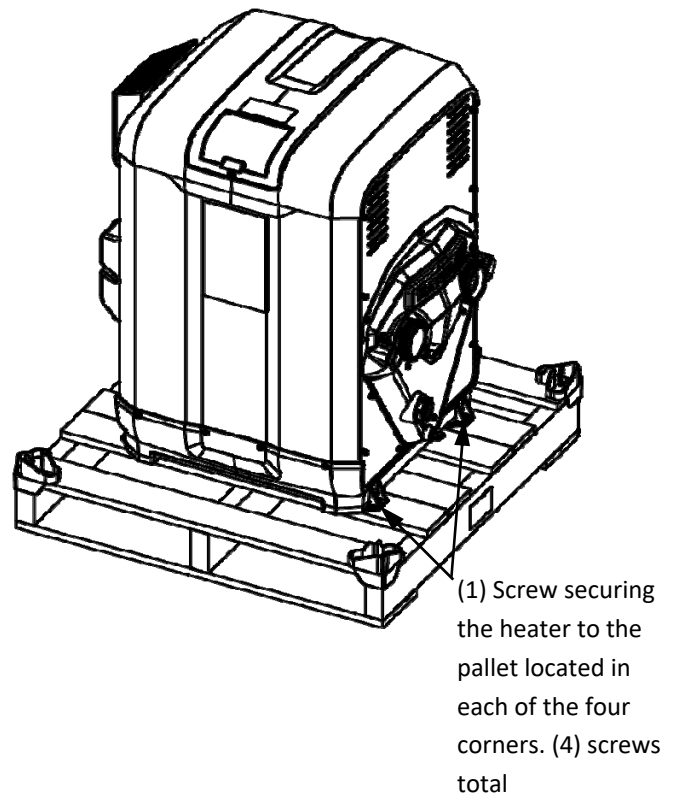
1. Open the top of the corrugated carton and remove the consumer kit.
2. Remove the corrugated carton from the heater. The carton, top pad, bottom pad, and the four corner posts can be recycled.
3. There are four (4) external screws (see Figure 3) used to secure the heater to the wood pallet. All four must be removed to separate the heater from the pallet.
4. Discard pallet appropriately.

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 shortening 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.

Figure 3: Pallet Screw Locations





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 24 inches 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 Figure 4. **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 Table 3 and Figure 4 must be maintained. Do not install heater in a closet or enclosed space (consult NFGC)

Table 3: Installation Required Clearances (in.)		
Heater Panel	Outdoor Clearance	Indoor Clearance
Top	Unobstructed	36
Front (User Interface)	18	18
Back*	0**	0**
Water Side Connection	12	12
Exhaust Side Connection*	6	6

* If the heater is to be installed with vinyl siding behind or on the exhaust side of the heater, increase the clearance in Table 3 to 12 inches to avoid potential discoloration of siding.

** While the heater is designed for no clearance to combustible surfaces, it is recommended to leave a small gap for non-binding removal of the top access panels.



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. Do not install on carpet. Ultralite™ or equivalent concrete-over-foam HVAC pads are acceptable.

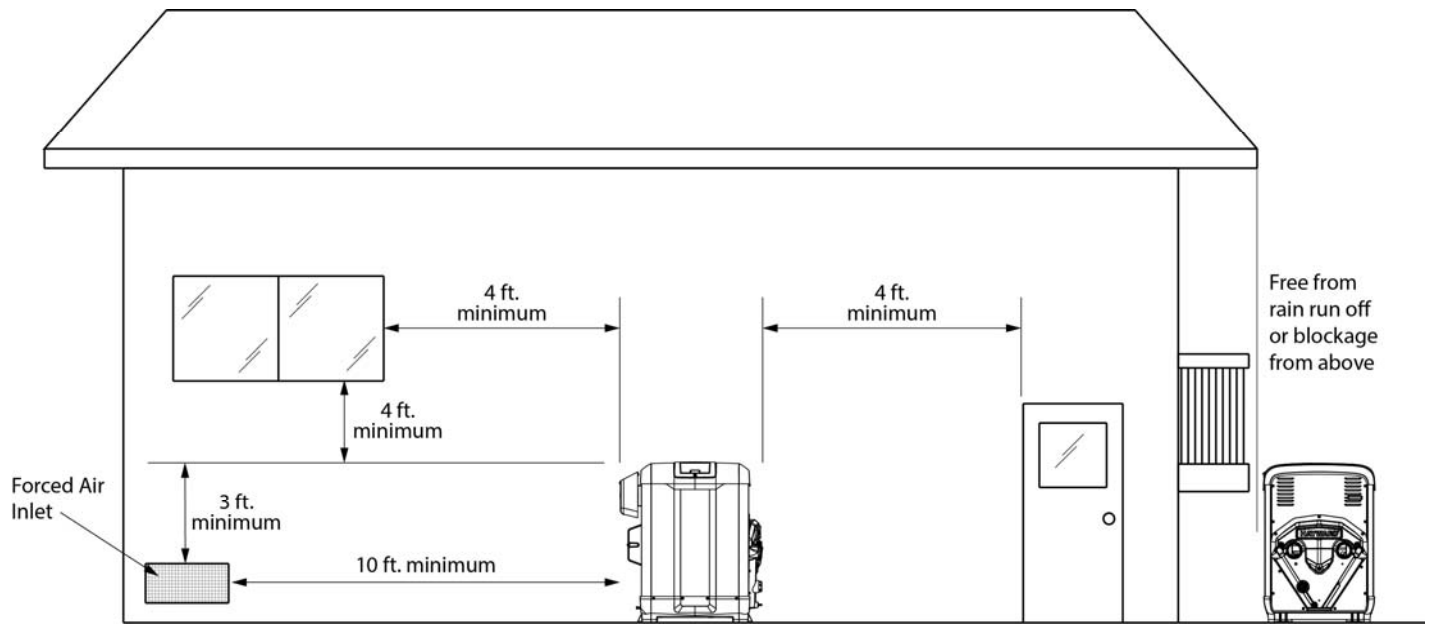


Figure 4: Outdoor Minimum Clearances

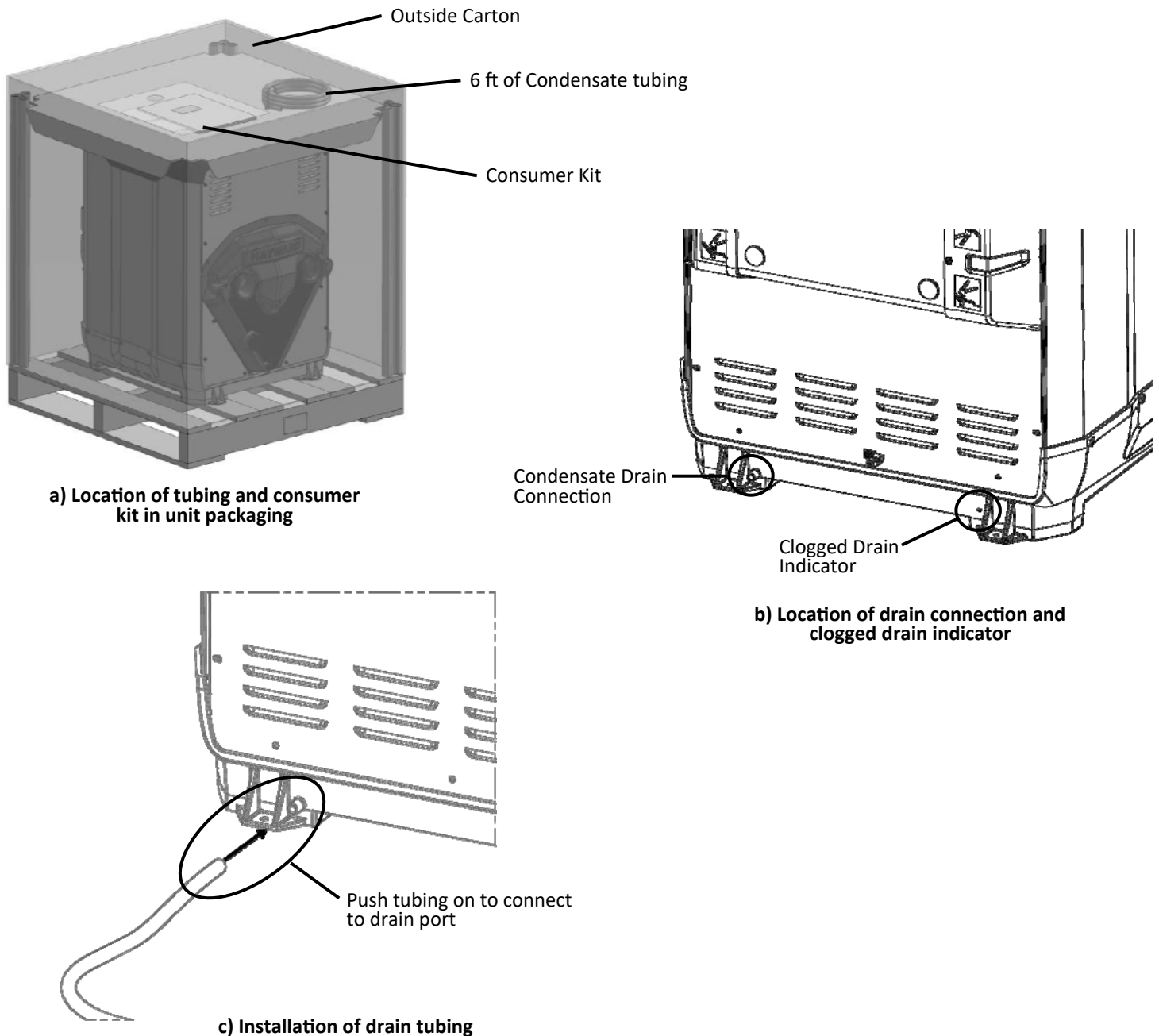
ANCHORING: The heater is equipped to be anchored to a concrete equipment pad when required by local codes. Follow all relevant Local, State and National requirements regarding wind load anchoring. Anchor your heater to the pad through the same anchor point used to secure the heater to the pallet when it was delivered. You will need the following to complete the installation:

Concrete tapping screws: (FIELD-SUPPLIED, Tapcons®, qty = 4, stainless steel, size to be ¼" diameter with a minimum length of 1-1/2")
 Fender washers: (FIELD SUPPLIED, stainless steel, qty = 4, size to be an OD of 0.75")

1. Obtain Tapcons®. Be sure the overall length of the concrete tapping screw is at least 1-1/2".
2. 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.
3. Install the Tapcons® through the provided holes in the flanges of the heater feet with the washers on the top of the mounting flanges into the equipment pad.
4. Anchoring is completed when all (4) feet are secured to the pad with washers and Tapcons®.

CONDENSATE MANAGEMENT:

In certain running conditions, any pool heater can produce condensate while it is running or sweat during an off-cycle. The formation of moisture on the heat exchanger depends on many factors including water temperature, humidity, flow rate, and ambient temperature which cannot be controlled. Because of this, observations of how much condensation is created by the unit will vary greatly. Consideration has gone into the design of Hayward's HDF series pool heater to allow any moisture in the combustion chamber to drain out of the unit. Not allowing moisture to dwell in the unit will increase the life and reliability of your new pool heater. The condensate formed during combustion will be slightly acidic, about the same pH as a cup of black coffee. If condensate from the unit needs to be routed off the equipment pad or into a drain, the unit has been supplied with a 6 foot length of rubber hosing and a connection on the bottom of the exhaust side of the unit. If a longer length is needed, any 3/8" ID rubber hose can be connected to the drain of the unit. An overflow indicator has also been molded into the base of the unit. If a hose is connected to the drain and water drips from the overflow port, the drain hose is likely clogged and needs to be cleaned out. This can be done using a garden hose or compressed air after the tube is disconnected from the unit. Figure 5 shows the location of the rubber tubing in the packaging as well as the drain and overflow locations on the unit.

Figure 5: Condensate Drain Installation

GAS CONVERSION PROCEDURE:

These instructions are intended to be used only with the HDF gas pool heaters from Hayward. All HDF heaters are shipped from the factory ready to be installed and used with Natural Gas. If your application requires the use of propane gas (LP), the fuel/air mixer installed in the combustion blower inlet must be replaced with the fuel/air mixer designed for use with propane. The propane mixer is included with every unit and can be found in the consumer kit shipped in the top of the carton with your HDF gas heater.

WARNING: DO NOT SUPPLY AND OPERATE THE UNIT WITH PROPANE GAS BEFORE INSTALLING THE CORRECT FUEL/AIR MIXER COMPONENT. Attempting to install and operate the heater in a propane gas application without installing the correct fuel/air mixer according to the instructions in this manual may result in a fire or explosion causing property damage, injury, or death.

WARNING: This conversion kit shall be installed by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. The information in these instructions must be followed to minimize the risk of fire or explosion or to prevent property damage, personal injury or death. The qualified service agency is responsible for the proper installation of this kit. The installation is not proper and complete until the operation of the converted appliance is checked as specified in these instructions.

NOTE: For units being installed in Canada, the conversion shall be carried out in accordance with the requirements of the provincial authorities having jurisdiction and in accordance with the requirement of the *Natural Gas and Propane Installation Code*, CSA B149.1.

Components required to convert the heater from Natural Gas to Propane are supplied in the consumer kit shipped with your new heater. The location of the consumer kit in the heater carton is shown in Figure 5. Only two components, a molded fuel/air mixer and the appropriate field conversion label, are needed to convert the unit to run on propane. Make sure the mixer installed on the unit has the correct fuel gas for your application molded into its face.

TO INSTALL PROPANE FUEL/AIR MIXER (REFERENCE FIG. 6):

1. Disconnect the electrical power to the unit.
2. Turn off the gas supply.
3. Remove the Header Control Cover (4 screws).
4. Remove the Water Side Top Panel (4 screws).
5. Disconnect the reference pressure hose from the front of the combustion blower assembly.
6. Unlock the natural gas fuel/air mixer by turning it 90° **clockwise**. The mixer can be turned by applying torque to the hose barb and the boss feature across from it. The hose barb should point towards the ground when the mixer is in the unlocked position.
7. Remove the natural gas fuel/air mixer by pulling it straight out from the combustion blower inlet.
8. Insert the LP fuel/air mixer with the hose barb facing down. Lock the mixer in place by turning it 90° **counter-clockwise**.
9. Connect the reference pressure hose removed in step 5 to the hose barb on the newly installed fuel/air mixer.
10. Verify that the mixer being inserted is marked with the correct fuel gas and the capacity rating matches that on the rating plate of the heater.
11. Verify manifold pressure after converting the unit to operate with Propane. Instructions for manifold pressure measurements can be found in the **GAS TESTING** section of this manual on page 31.
12. Close the unit by reversing steps 3 and 4.
13. Fuel gas conversion is completed by applying the field gas conversion label (supplied in the consumer kit) next to the heater's rating plate.

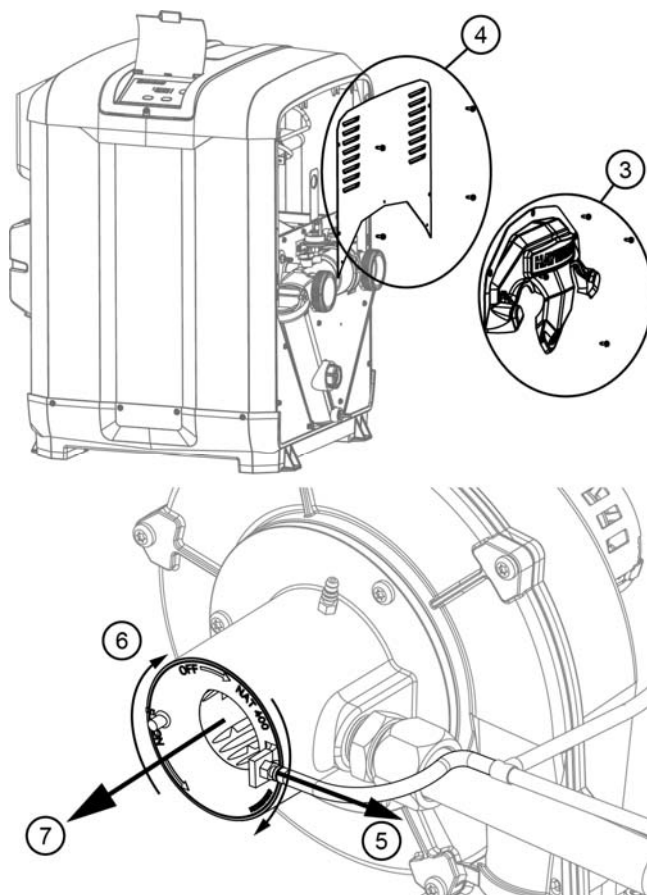


Figure 6: Fuel/Air Mixer Removal



ALTITUDE OF INSTALLATION:

Hayward's HDF heaters are rated for installations up to, and including, 2,000 ft above sea level.

⚠ WARNING: Failure to comply with the appliance installation 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.

AIR SUPPLY:

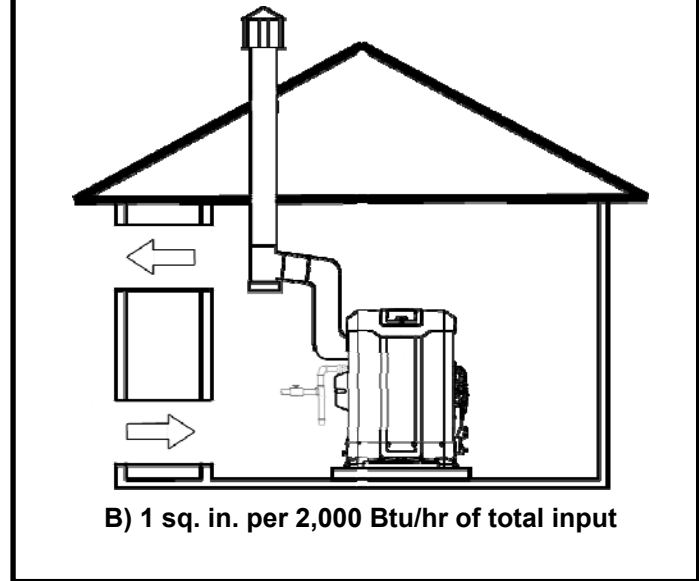
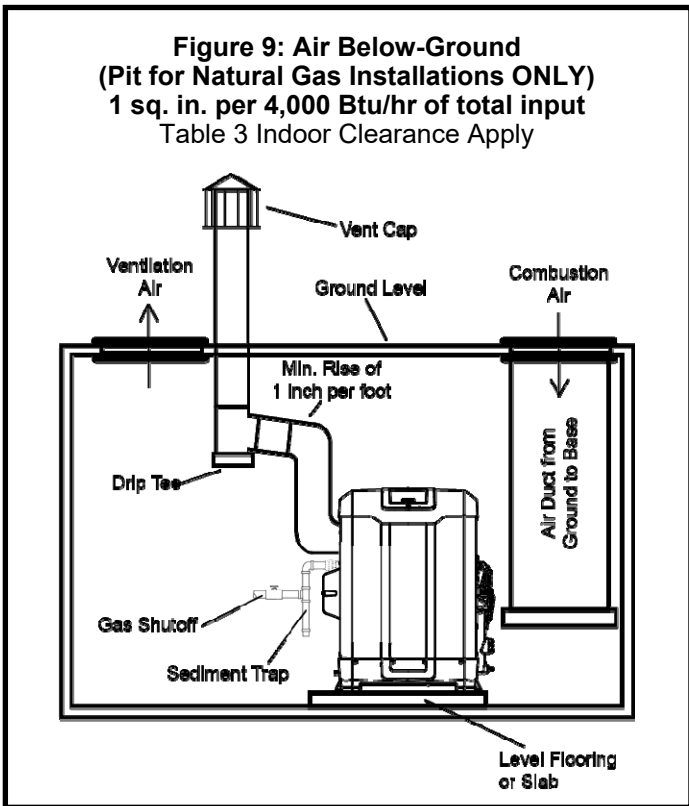
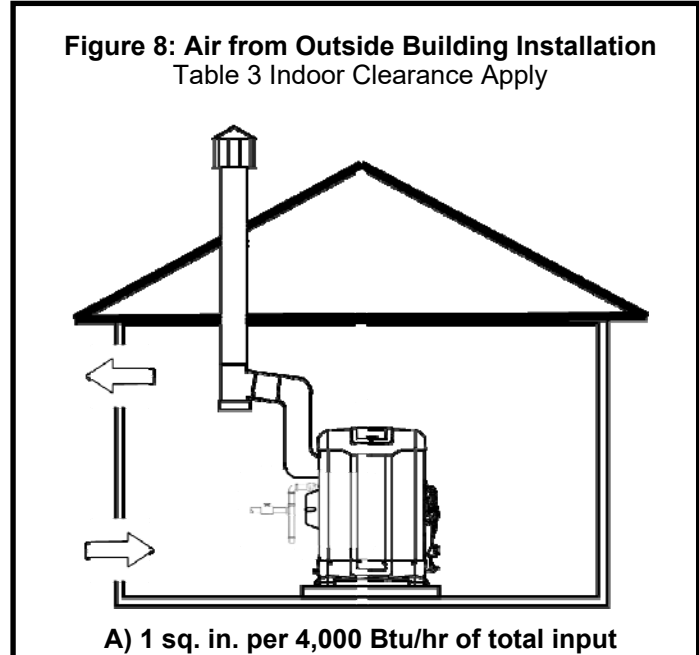
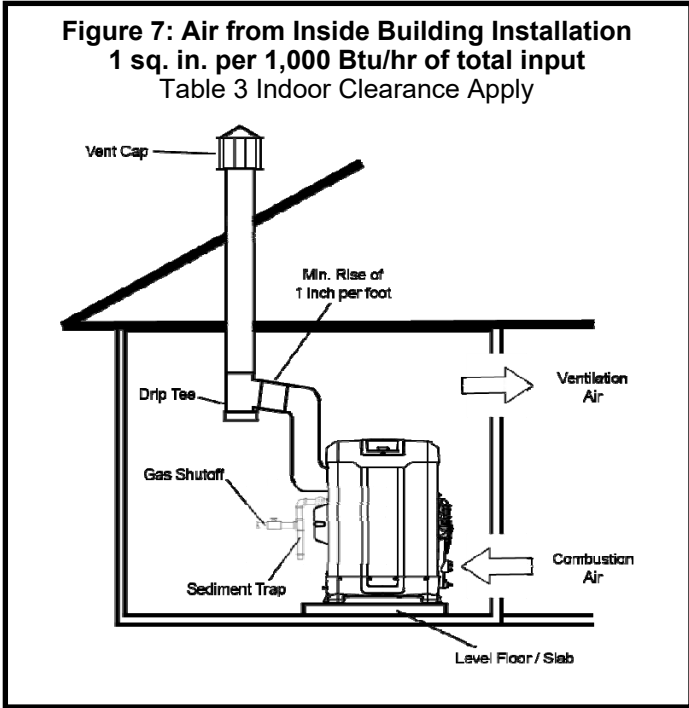
Indoor installations and outdoor shelters (confined spaces) must be provided with adequate combustion and ventilation air openings to assure proper heater operation. These openings must be sized according to the requirements stated in paragraphs below (ALL AIR SUPPLY FROM INSIDE THE BUILDING or ALL AIR 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. Minimum installation clearances shown in Table 4 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 Table 4 and Figure 7.

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 Table 4 and Figure 8B. 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 Table 4 and Figure 8A. 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 Figure 9.

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)	400,000	400	400
1 sq. in. per 2,000 Btu/hr (Outdoor Air thru Horz duct)		200	200
1 sq. in. per 4,000 Btu/hr (Outdoor Air direct or thru Vert duct)		100	100

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





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. Table 5 (CATI) and Table 8 (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, CAT I) VENTING:

NEGATIVE PRESSURE CAT I 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 Table 5). 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.

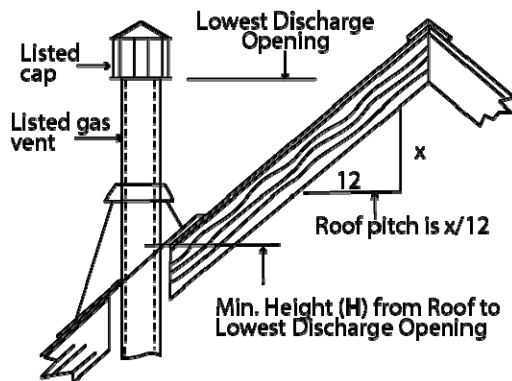
Table 5: Negative Pressure (CAT I) Indoor Vent Pipe & Terminal Specifications

Model	Vent Dia (in)	Description	Vent Pipe Application	Vent Pipe Material	Vent Termination Requirement
HDF400	8	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 appliance.	Single or Double Wall, Galvanized, Non-Sealed Vent Pipe	Vertical Only

CAT I 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 manufacturer's instructions, National Fuel Gas Code, local codes and the information in this manual.

NEGATIVE PRESSURE CAT I 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 12 inches or less diameter size and located not less than 8ft from a vertical wall or similar building feature shall terminate per Figure 10 and Table 6 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.

Figure 10: Minimum Height from Roof for Vent Cap



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 Table 8). The vent pipe must be single or double-wall stainless steel sealed vent as listed in Table 8. 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 Table 7. 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.

VENT TERMINATION: The vent system must terminate with a vent terminal approved for this pool heater. Termination may be either horizontal or vertical. See Table 8 for approved vent terminals and orientations.

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 Table 8 and in the service part instructions supplied with any service kit. They can be ordered directly from the manufacturer, or one of their authorized dealers. To locate an authorized dealer for venting parts, contact the appropriate manufacturer at:

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)

Table 6: Height Requirements for Negative Pressure (CAT I) Vent Caps (see Figure 11)

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

Table 7: Positive-Pressure (CAT III) Indoor Vent Maximum Vent Lengths Using Specified Positive Pressure Vent Components

Number of 90° Elbows	Maximum Vent Pipe Length, Horizontal & Vertical (ft.)
0	45
1	45
2	35
3	25



Notes for Table 8 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 these horizontal terminals, the wall penetration is included from the vent manufacturer. On all others, it must be ordered separately.

Table 8: Positive Pressure (CAT III) Approved Indoor Vent Pipe & Terminal Specifications

Heater Model	Maximum Installation Altitude (ft.)	Vent Pipe Dia. (in.)	Vent Pipe Type	Heatfab Saf-T Vent EZ Seal (CI Plus) Part Numbers			
				Appliance Adapter	Vent Pipe Part Number	Horizontal Vent Terminal Part Number	Vertical Vent Terminal Part Number
400	2,000	4	Single-Wall	9401ICP	940x*	9414TERM	5400CI
			Double-Wall	9401ICP	CCA04Lx**	9414TERM	CCA04RC

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.

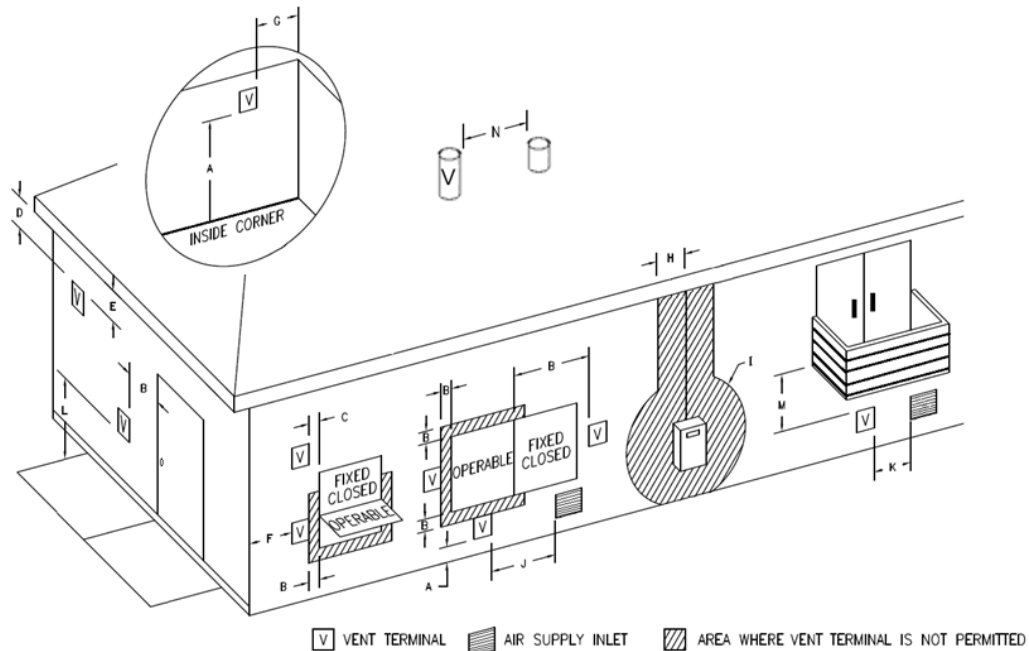


Table 9: Positive-Pressure (CAT III) Vent Termination Clearances

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 > 1,00,000 Btuh (30 kW)
C	Clearance to a permanently closed window	See note*	See note*
D	Vertical clearance to a ventilated soffit located above the terminal within a horizontal distance of 2 ft (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 (0.9m) within 15 ft (4.6m) above the meter/regulator assembly	3 ft (0.9m) within 15 ft (4.6m) above the meter/regulator assembly
I	Clearance to service regulator vent outlet	See note*	3 ft (0.9m)
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	9 in. (229mm) for appliances > 10,000 Btuh (3kW) and ≤ 50,000 Btuh (15kW), 12 in. (305mm) for appliances > 50,000 Btuh (15 kW)	12 in (305mm) for appliances > 10,000 Btuh (3kW) and ≤ 100,000 Btuh (30 kW), 36 in. (914mm) for appliances > 100,000 Btuh (30kW)
K	Clearance to a mechanical air supply inlet	3 ft (0.9m)	6 ft. (1.8m)
L	Clearance above paved sidewalk or paved driveway located on public property	See note*	7 ft. (2.1m). 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	See note*	12 in. (305mm). 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. (0.9m)	3 ft. (0.9m)

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

(2) In accordance with the current CAN/CSA B149.1, Natural Gas and Propane Installation Code

* 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

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, see instructions for changing the heater’s connection orientation in the *REVERSIBLE WATER CONNECTIONS* section on page 23 . Insert the pipe to the gas valve through the grommet in the cabinet side. 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 Figure 11. 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” 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).

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 Table 10. 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 Table 10 without exception.

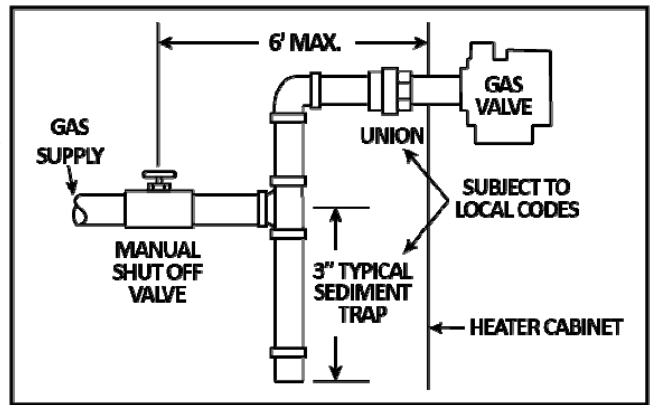


Figure 11: Gas Piping with Shut Off & Trap

Table 10: Pipe Sizing (dia. In inches) for 400,000 Btu/hr Gas Appliance

Regulation Type		Low-Pressure, Single-Stage		High-Pressure, 2-Stage			
		Natural Gas	LP	Natural Gas	LP		
Fuel Type		Iron or Plastic Pipe	Iron Pipe	Iron or Plastic Pipe	Iron Pipe	Tubing	
Gas Line Material							
Distance from tank regulator to gas valve inlet (ft) or 2nd stage regulator	Total piping length or length of First Stage*	0 to 50	1-1/4	1	1/2	1/2	1/2
		50 to 100	1-1/4	1-1/4	3/4	1/2	5/8
		100 to 150	N/A	N/A	3/4	1/2	5/8
		100 to 200	1-1/2	1-1/4	N/A	N/A	N/A
	200 to 300	2	1-1/2	N/A	N/A	N/A	
	Second Stage**	0 to 10	N/A	N/A	3/4	3/4	7/8



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 modify the heater to have water connection on the left side of the unit, a single screw and panel must be removed and rotated. To complete this alteration, follow the instructions below and reference Figures 1 and Figure 13 as needed.

Before beginning, be aware that regardless of the arrangement of connections in the installation, the electric junction boxes and exhaust will ALWAYS be opposite from the water connections.

1. Remove the single screw securing the top access panel to the cabinet top (see Figure 12).
2. Lift the front lip of the top access panel several inches. The front of the panel is where the user interface is located and the same side the screw was removed from in step 1.
3. With the front of the top access panel elevated, slide the panel toward the rear of the unit until the tabs holding the rear side down are disengaged from the cabinet top.
4. Carefully lift the top access panel free of the unit, ensuring excess tension is not placed on the ribbon cable attached to the ignition control board inside the heater cabinet, and rotate it 180 degrees so that the user interface is now on the opposite side of the heater.
5. Secure the top access panel to the heater in the new orientation by installing the screw removed in Step 1 in the new location.

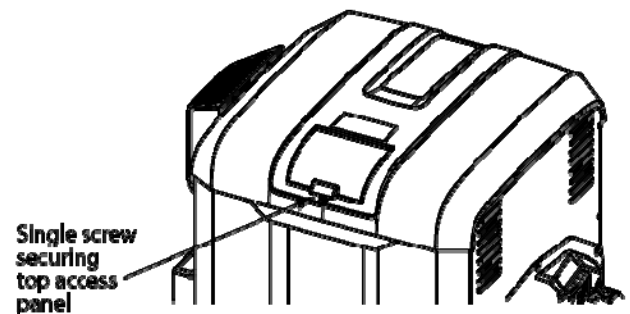


Figure 12: Top Access Panel Screw Location

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 a three-way switching valve, in-line chlorinator and/or chlorinator check valve.

Figure 13: Water Connections

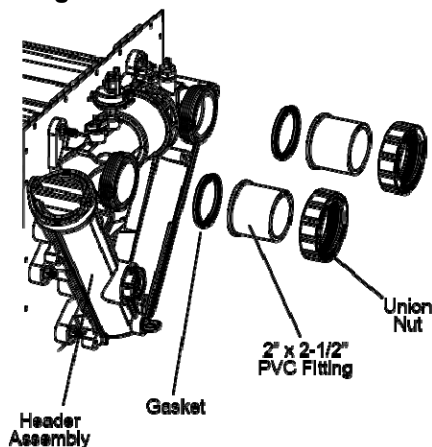
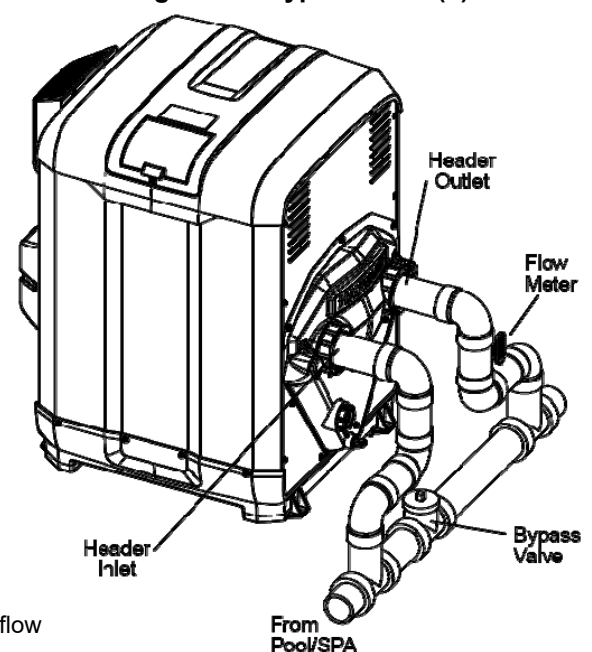


Figure 14: Bypass Valve(s)



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. The fittings are secured in place with supplied plastic union nuts. Assemble these parts to the heater prior to plumbing. Tighten union nuts securely before gluing fittings to the ends of the pipe nipples (see Figure 13). 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 *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 125 gpm, then a manual bypass valve must be installed as shown in Figure 14. 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 Table 1: Specifications. The heat exchanger will fail and this damage will not be covered under the manufacturer warranty.

Figure 15 illustrates a typical pool piping diagram and layout for the pool equipment. Figure 16 illustrates a multiple heater installation for very large pools with and without a manual bypass valve.

Figure 15: Typical Plumbing to Pool or Spa

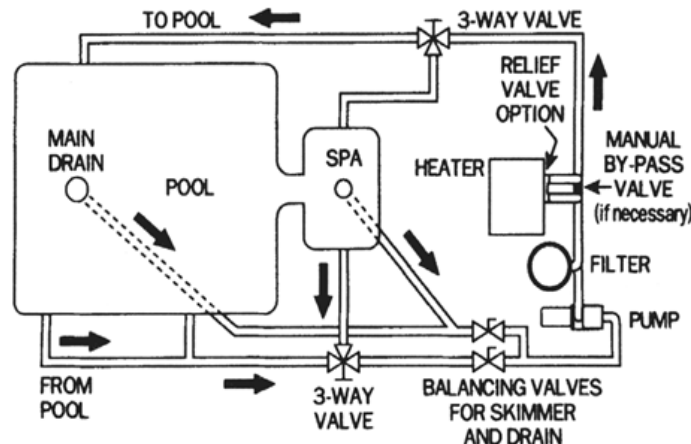
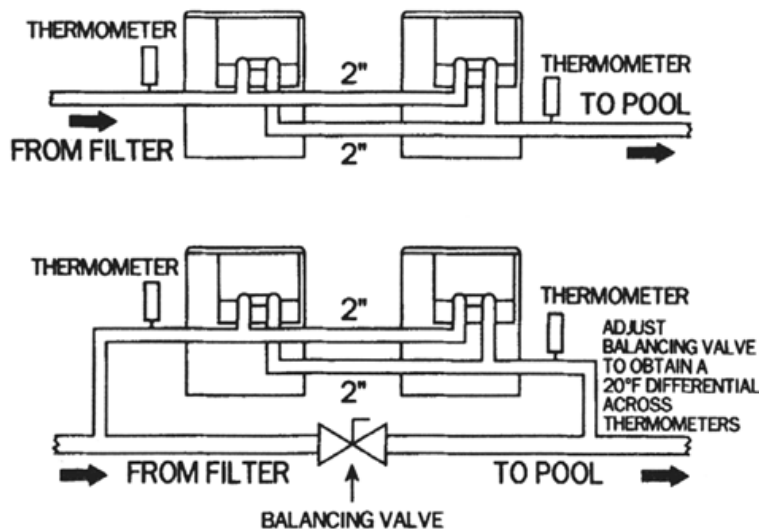


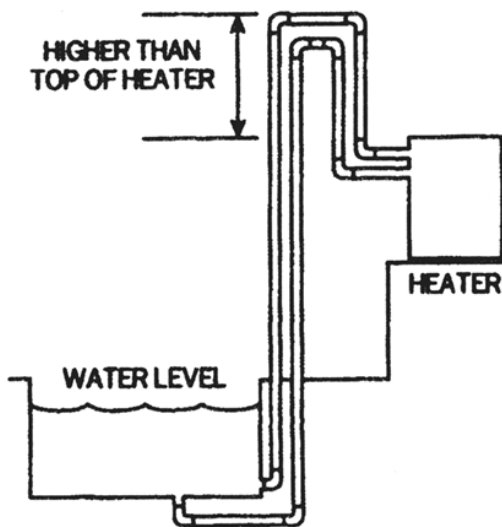
Figure 16: Multiple Heater System





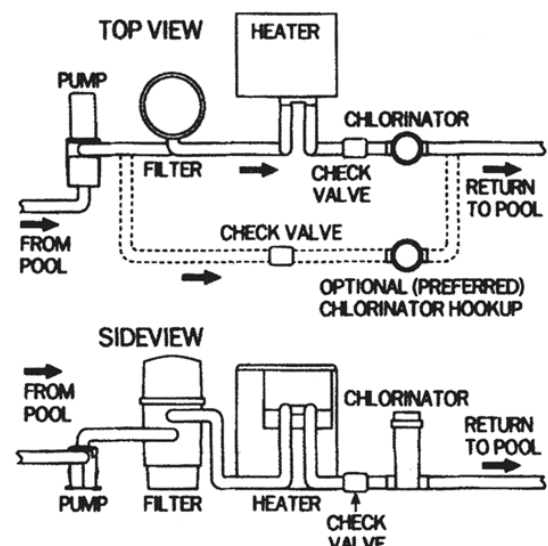
INSTALLATION ABOVE POOL/SPA SURFACE: If the heater is installed less than three (3) feet above the surface of the pool/spa water, install eyeball fittings or directional flow fittings on the end of the return water line to the pool/spa to create adequate back pressure at the heater to operate the pressure 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 Figure 17 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.

Figure 17: Installation Above Pool or Spa



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 Figure 18. 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.

Figure 18: Automatic Chlorinator



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 fuse board and replace it with the 120VAC jumper. These jumpers are tie-wrapped together. See Figure 20 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 as Figure 2 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 in the junction boxes adjacent to the power connections and a bonding lug on the side of the heater. 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 connections for electrical service and optional remote control wiring are located on the side of the heater opposite the water connections. The heater is shipped from the factory with electrical connections on the left side of the heater.

The electrical and water connection orientation can be reversed as described in the *REVERSIBLE WATER CONNECTIONS* section on page 23. There are (2) openings for electrical entry. The junction box must be used for field power wiring. Plug any unused openings with the supplied caps. The power connections are to be made to the supplied wires inside the high voltage junction box using the wire nuts supplied in the electrical accessory kit. All connections are to be stored within the closed junction box.

REMOTE CONTROL CONNECTION: Remote control can be accomplished via a 2-wire or 3-wire connection. 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 "bo" (bypass operation) is displayed. 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. To switch back to local thermostat control, use the "MODE" button on the keypad to put the control into "STANDBY" mode. Then simultaneously press and hold the "(-)" and "MODE" buttons for 3 seconds until "bo" disappears from the display. Using the "MODE" button to put the heater in either "POOL" or "SPA" mode will start the heater on local thermostat.

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.

**Figure 19: Location of Components
(Top and Side Panels removed for Clarity)**

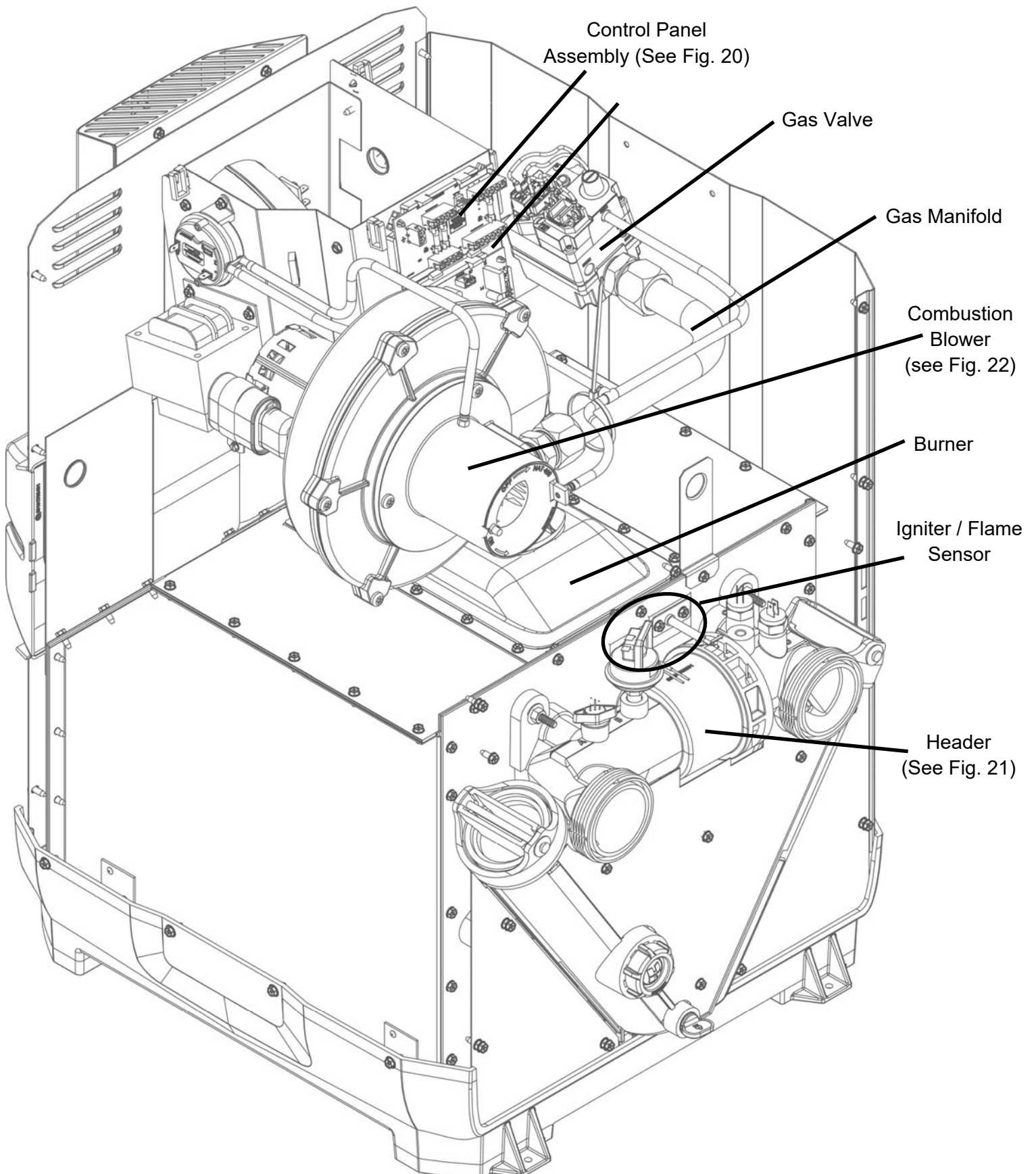


Figure 20: Control Assembly Components
(Wiring Hidden for Clarity)

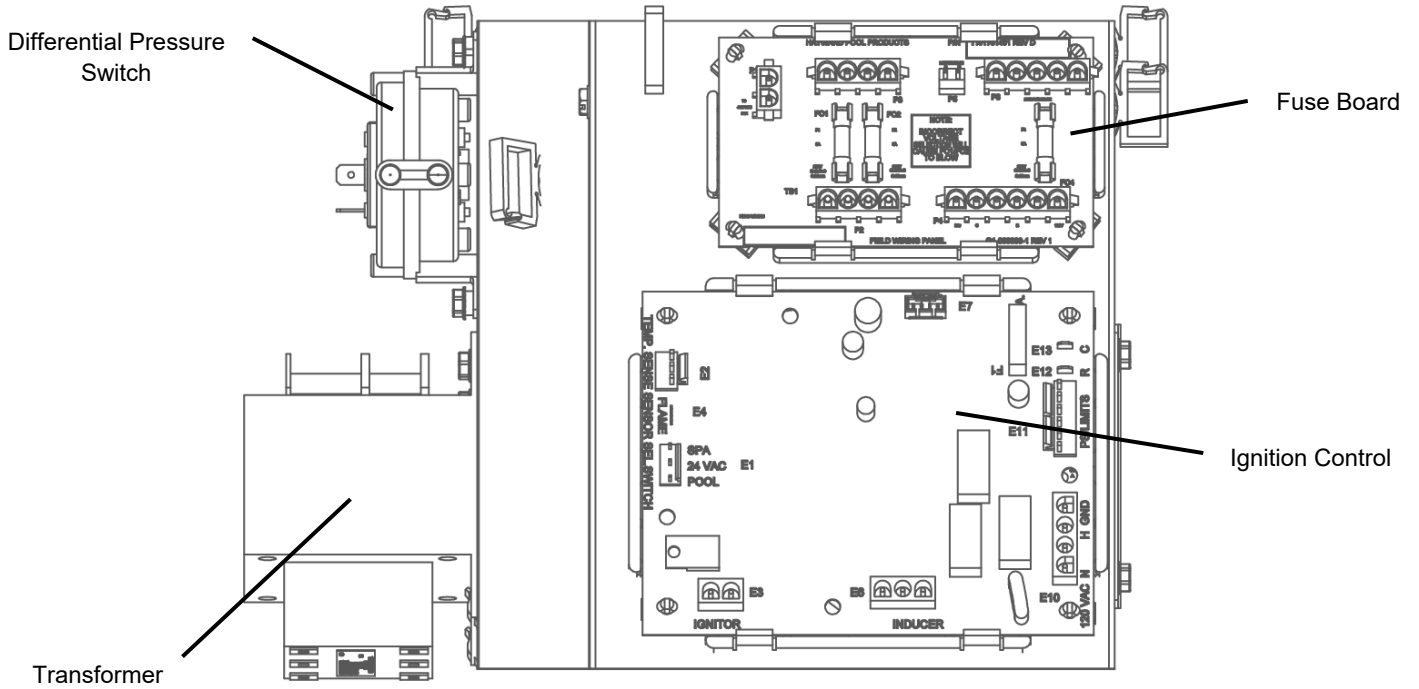


Figure 21: Header Assembly Components

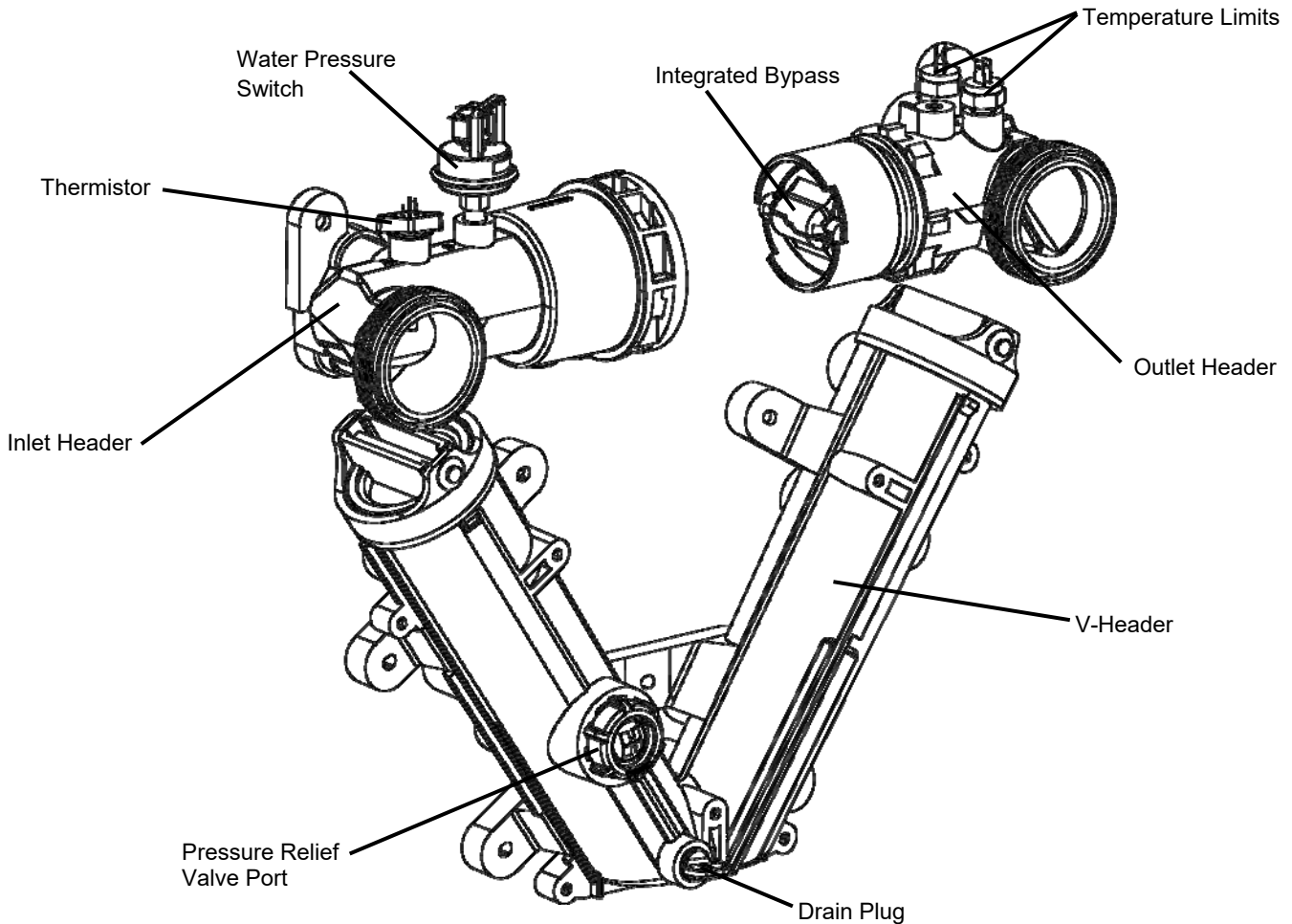
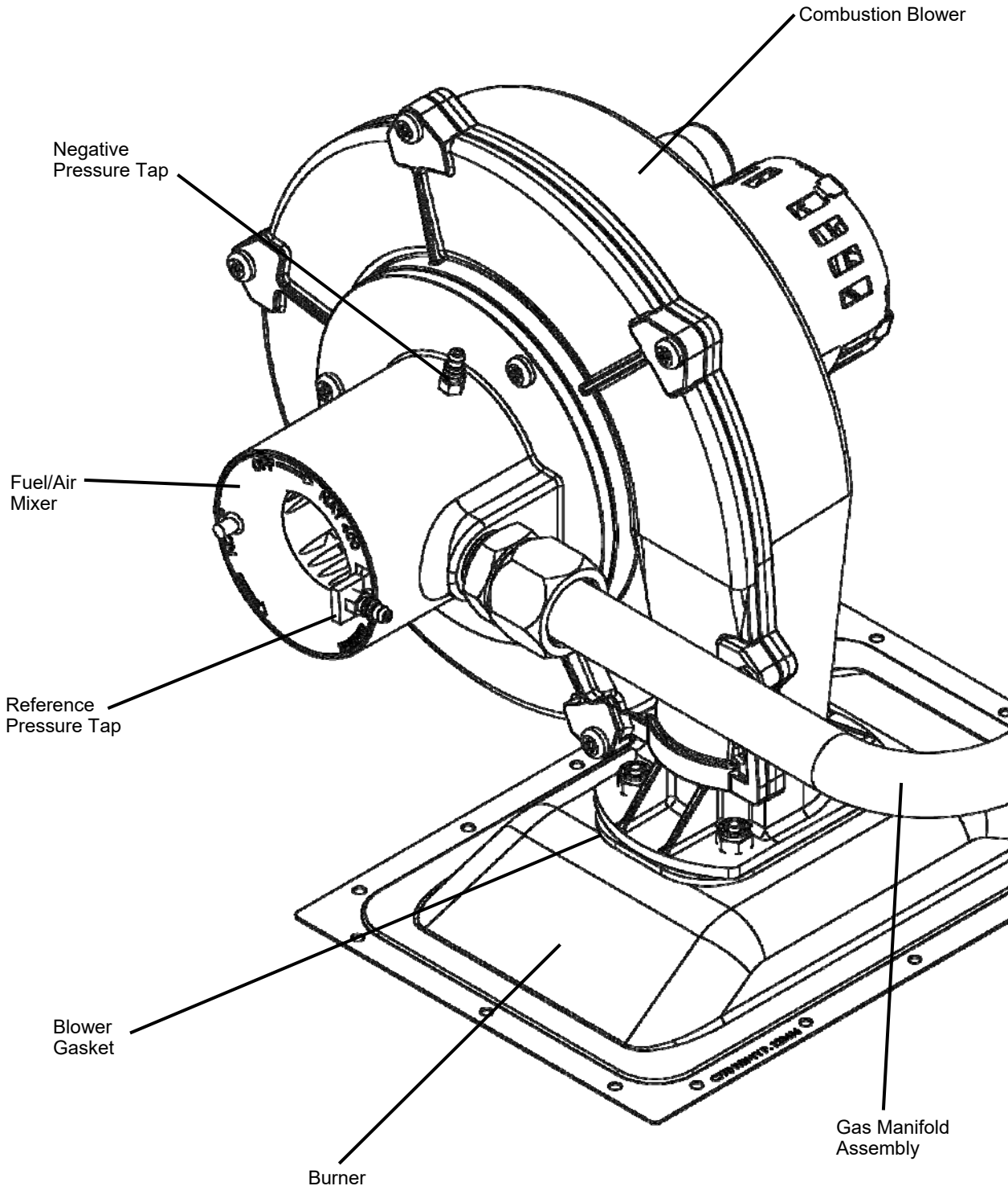


Figure 22: Combustion Blower Assembly Components



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. Figures 19 - 22 provide a summary of heater components and their locations. Some 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 top water side 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.

CONTROL SETUP

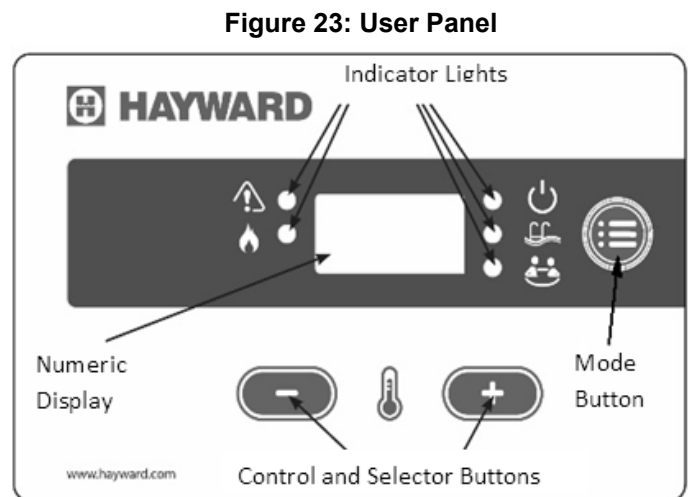
This pool heater is equipped with a digital thermostat which allows the user to select the desired water temperature (see Figure 23). The heater will then function automatically to maintain the desired temperature. The heater has 4 modes of operation:

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 the user panel (Figure 23).

1. Use the mode button to change from “STANDBY” to either “SPA” or “POOL” (see Figure 21). 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.

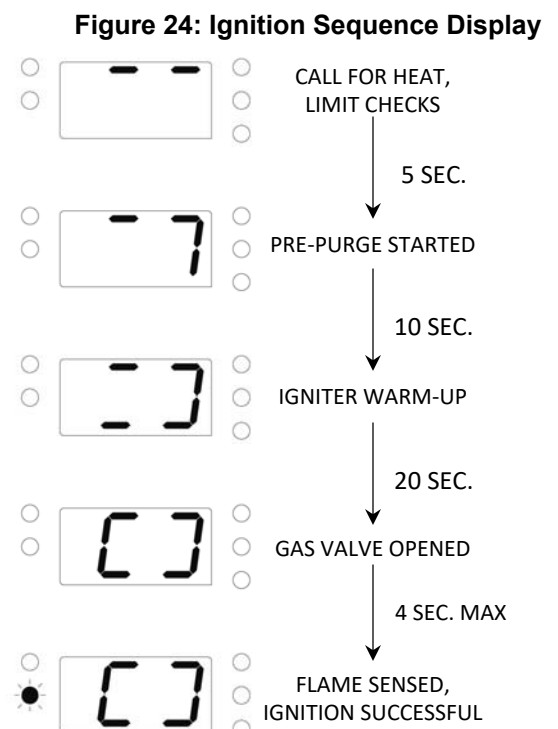


NORMAL OPERATION FOR POOL & SPA MODES:

The control continually compares the water temperature with the set point and the high limit temperature. When the sensed water temperature is more than 1°F below the set point, a call for heat is generated and a heating cycle is initiated. When a call for heat starts, the numeric display on the user panel (see Fig. 23) will show a series of lines to indicate the progression of the unit’s ignition sequence. The displayed indicators, along with approximate times between each step are shown in Figure 24. When the ignition sequence completes successfully, the current water temperature will be displayed again. The temperature set point cannot be adjusted while the ignition sequence indicators are active.

1. The control checks the differential pressure switch for open contacts and then energizes the blower. After the blower is energized, the contacts are checked again to ensure they are closed and the 30 sec. pre-purge timer is started.
2. The control energizes the igniter during the pre-purge cycle and allows it to reach ignition temperature, approximately 20 seconds.
3. The control energizes the gas valve to permit the flow of gas for the 4 sec. trial for ignition and monitors flame current.
4. The igniter is turned off when flame current is sensed or when the trial for ignition is completed.

During a heating cycle, the differential pressure switch, limit string, water temperature sensor, and flame current are constantly monitored to assure the heater is operating properly. When the thermostat is satisfied and the call for heat ends, the control immediately de-energizes the gas valve and flame extinguishes. The control operates the blower an additional 30 seconds as a post-purge.



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 described 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 after a call for heat, 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. 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 undersize piping between the gas meter and the heater or for a low-capacity gas meter (see GAS SUPPLY section of this manual).

GAS PRESSURE TEST PROCEDURE: Follow the lighting instructions on the unit. Refer to Figure 19: Location of Components for the location of the gas valve. See Figures 25 and 26 for pressure regulation adjustment for use in this procedure.

1. Obtain the necessary equipment; Qty (2) manometers to read pressure in inches of water column, Qty (2) 1/8"NPT pipe barbed fitting, Qty (1) barbed tee for use with 3/16" silicon hose, 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 tap and the plug marked as "pressure" on the outlet side of the valve (see Fig. 26) and install barbed fittings into the tap openings.
3. Remove the factory installed silicon hose from the fitting on the outlet side of the gas valve marked as "vent" (see Fig. 26) and place hoses, a barbed tee, and a manometer in line with the original hose as shown in Figure 25.
4. 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 Table 11.
5. Turn on gas and water to heater and start the heater following the lighting & operating instructions on the label affixed inside the water side top panel and in Figure 27. 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.
6. Take pressure readings with the heater running, the pressure values should agree with those in Table 11. 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 Table 11, the gas valve regulator must be adjusted. Take note that the target manifold pressure is **NEGATIVE**.
7. To adjust the gas valve regulator perform the following:
 - a. Remove the screw cap over the regulator adjustment screw (see Figure 26).
 - 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.

8. Turn the gas supply to the heater off and remove the barb fittings. Replace the original 1/8" pipe plugs and connect tubing as shipped from the factory. Turn on gas and water to heater and start the heater to check for gas leaks.



WARNING: EXPLOSIVE 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: EXPLOSIVE HAZARD Gas pressures in excess of those listed in Table 11 could cause a gas leak or diaphragm rupture. Gas leakage could cause an explosion resulting in severe injury or death.



Table 11: Required Gas Pressures (in. wc.)		
Measurement	Natural Gas	Propane
Manifold Pressure*	-0.1 to -0.3	
Inlet Pressure, Minimum	+4.0	+4.0
Inlet Pressure, Maximum	+14.0	+14.0

Figure 25: Manifold Pressure Connections

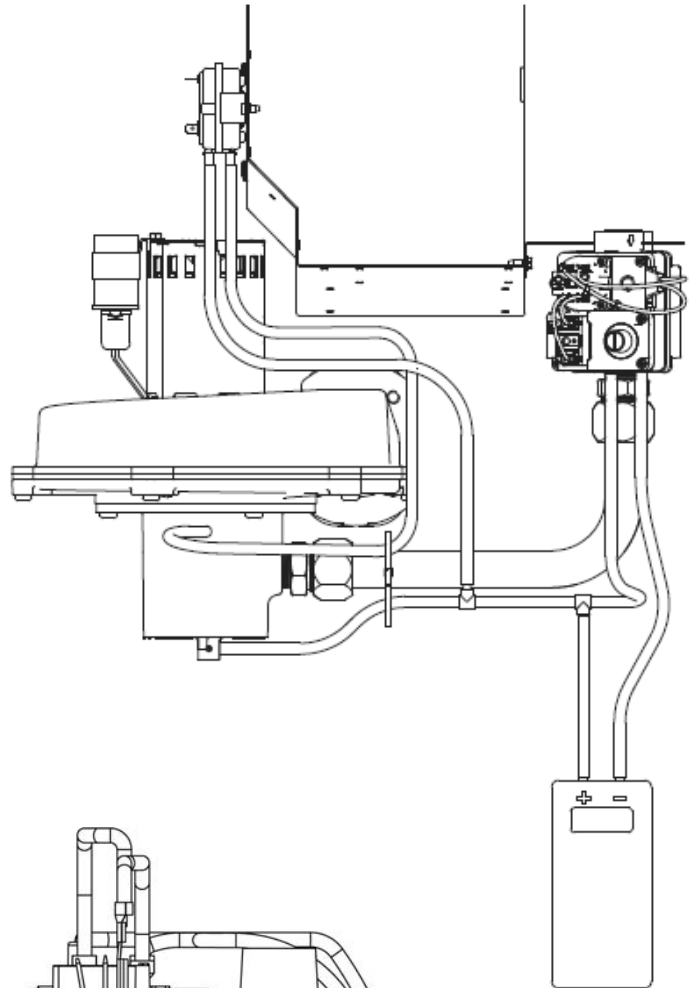


Figure 26: Gas Valve

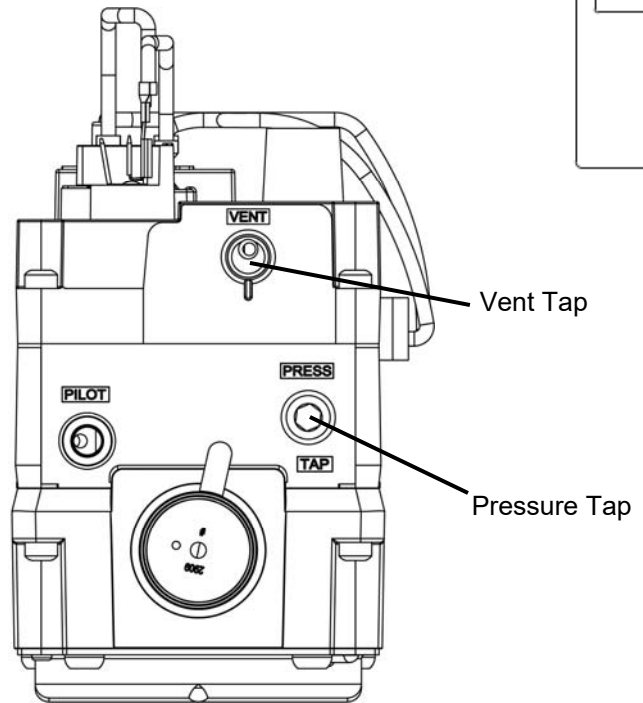
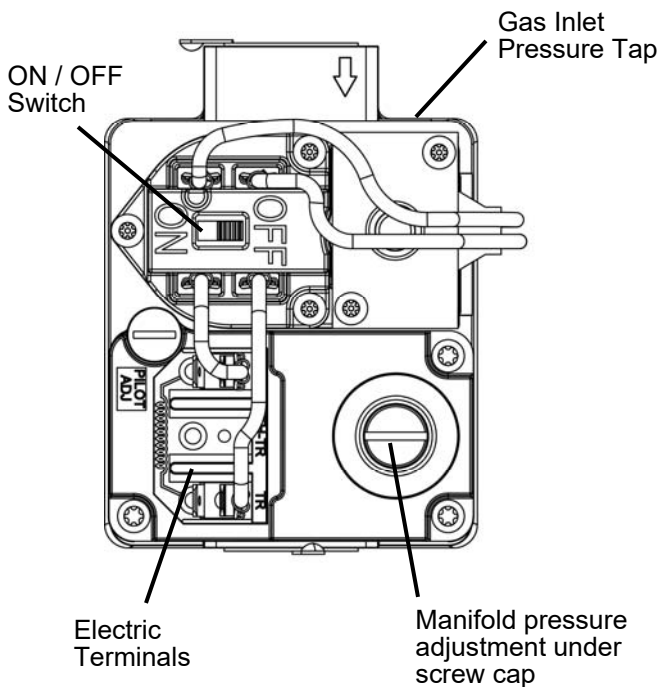


Figure 27: Lighting and Operating Instruction Label
(This label is also located on the inside surface of the Water Side Top Panel)

FOR YOUR SAFETY READ BEFORE LIGHTING

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

- 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.
 - 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.
- WHAT TO DO IF YOU SMELL GAS:**
- * 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.
- Use only your hand to turn the gas control knob. Never use tools. If the knob will not turn by hand, don't try to repair it; call a qualified service technician. Force or attempted repair may result in a fire or explosion.
 - Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.
 - Should over-heating occur, or the gas supply fails to shut off, turn off manual gas valve to the appliance.

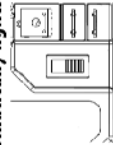
POUR VOTRE SÉCURITÉ LIRE AVANT L'ALLUMAGE

AVERTISSEMENT: Si vous ne 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.

- 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.
 - AVANT L'ALLUMAGE**, sentez tout autour de l'appareil pour déceler 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.
- QUE FAIRE EN PRÉSENCE D'ODEURS DE GAZ:**
- * 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 incendies.
- Utiliser uniquement les mains pour actionner les boutons de commande du gaz. Ne jamais utiliser d'outils. Si le bouton ne s'enfoncé pas ou ne se tourne pas à la main, ne pas essayer de le réparer. Appeler un technicien qualifié. L'utilisation de la force ou une tentative de réparation pourrait causer un incendie ou une explosion.
 - Ne pas utiliser cet appareil si une des composantes a été immergée dans l'eau. Appeler immédiatement un technicien qualifié pour vérifier l'appareil et remplacer toute composante du système de commande ou de gaz qui aurait été immergée dans l'eau.
 - Si le système surchauffait ou si le gaz refusait de se fermer, placer le robinet d'arrêt manuel de gaz de l'appareil en position "FERME" (OFF).

OPERATING INSTRUCTIONS

- STOP! Read the safety information on this label.
- Change the "MODE" on the control panel to "STANDBY".
- Remove the heater's control access panel.
- This appliance is equipped with an ignition device which automatically lights the burners. Do not try to light the burners by hand.
- Move the gas control switch to "OFF".



GAS CONTROL SWITCH
SHOWN IN "OFF" POSITION

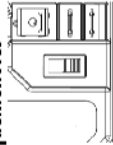
- Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "B" in the safety information on this label. If you don't smell gas, go to the next step.
- Move the gas control switch to "ON".
- Replace the heater's control access panel.
- Set the "MODE" on the control panel to "SPA" or "POOL".
- Set the set point temperature on the control panel to the desired setting.
- If the appliance does not operate, repeat steps 2 thru 10. If the appliance still does not operate, follow instructions "TO TURN OFF GAS TO APPLIANCE" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

- Change the "MODE" on the control panel to "STANDBY".
- Remove the heater's control access panel.
- Move the gas control switch to "OFF".
- Replace the heater's control access panel.

INSTRUCTIONS D'ALLUMAGE

- STOP! Lire les consignes de sécurité sur cette étiquette.
- Changer le MODE du tableau de commande à STANDBY.
- Retirer le panneau d'accès aux commandes de l'appareil de chauffage.
- Cet appareil est pourvu d'un dispositif d'allumage qui allume automatiquement les brûleurs. Ne pas tenter d'allumer manuellement les brûleurs.
- Déplacez l'interrupteur de commande de gaz sur OFF (fermé).



COMMUTATEUR DE COMMANDE DE GAZ
MONTRE EN POSITION "FERME" (OFF)

- Attendre cinq (5) minutes que tout gaz se dissipe. Arrêter si l'on sent alors une odeur de gaz. Suivre B dans les consignes de sécurité de cette étiquette. Passer à l'étape suivante en l'absence d'odeur de gaz.
- Placer l'interrupteur de commande de gaz sur ON (OUVERT).
- Remplacer le panneau d'accès aux commandes de l'appareil de chauffage.
- Régler le MODE du tableau de commande à SPA ou à POOL.
- Établir la valeur de réglage sur le tableau de commande à la température désirée.
- Si l'appareil ne fonctionne pas, répéter les étapes 2 à 10. Si l'appareil refuse toujours de "FERME" fonctionner, dissipe. Suivre les instructions POUR FERMER LE GAZ SUR L'APPAREIL et appeler votre technicien de service ou votre fournisseur.

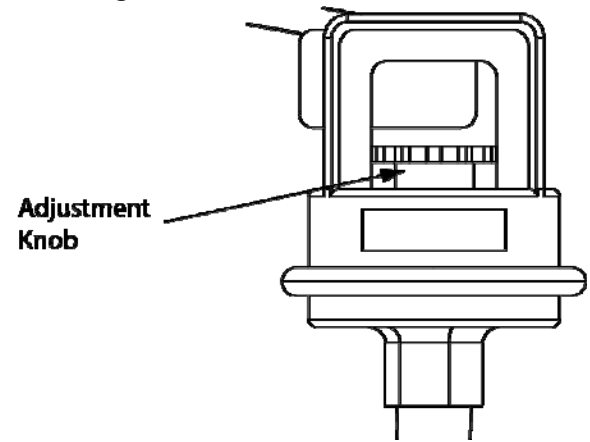
POUR FERMER LE GAZ SUR L'APPAREIL

- Changer le MODE du tableau de commande à STANDBY.
- Retirer le panneau d'accès aux commandes de l'appareil de chauffage.
- Déplacer l'interrupteur de commande de gaz sur OFF (fermé).
- Remplacer le panneau d'accès aux commandes de l'appareil de chauffage.

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 Figure 27).
5. 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 $\frac{1}{4}$ turn counter-clockwise, so that the heater turns back on. Turning the adjustment knob clockwise increases the pressure needed to close the switch.
6. 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.

Figure 28: Water Pressure Switch

TWO- OR VARIABLE-SPEED PUMPS: In some cases the pressure from lower speed settings are 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 AND 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 Table 15 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 the *WATER PRESSURE SWITCH ADJUSTMENT PROCEDURE* in this manual.
2. **WATER CHEMISTRY:** The chemistry balance and mineral content of swimming pool and spa water changes rapidly due to many factors including, but not limited to, the addition of sanitizing chemicals, user loads, exposed rain, runoff, and the amount of sun. Improper chemistry (see Table 15) 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 guidelines in Table 15 to help maintain proper water chemistry:

Table 12: 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

- 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.
- 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 on page 23.
- 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.

- Set the heater to STANDBY mode using the keypad.
- Turn the electricity to the heater OFF at the circuit breaker panel.
- Turn the heater gas valve OFF using the switch on the valve (see Figure 23).
- Turn the heater's gas supply OFF at the main shut-off valve outside the heater cabinet.
- Be sure the circulating pump is OFF.
- Remove the drain plug (see Figure 26).
- Allow all water to drain from the heater.
- Re-install drain plug.

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.

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: Loosen the flare nut holding the gas manifold assembly to the combustion blower. Remove the blower and burner sub-assembly (see Figure 1: Sub-Assemblies) and inspect the exposed 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".
2. Remove debris by hand, soft-tipped brush or shop VAC.
3. Check combustion chamber refractory is still in good shape with no pieces missing or damaged, no holes, and no large cracks extending through the entire thickness of the pieces. This evaluation can be performed with heat exchanger in place with additional lighting. If combustion chamber refractory is damaged, the entire chamber must be replaced.
4. 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, 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 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:

Turn the heater "OFF" and allow enough time for the heater to cool down before performing the following process. Allowing the filter pump to remain running will speed up the cooling process.

1. Turn pump, main gas valve, and heater power "OFF".
2. Loosen the flare nut securing the gas manifold to the blower assembly (see Figure 19: Location of Components).
3. Remove the blower wiring harness from the control board.
4. Remove the screws securing the burner to the combustion chamber and remove the blower and burner from the unit as a single sub-assembly.
5. Remove the four nylon lock nuts securing the blower and burner together.
6. Clean the burner by blowing shop air backwards through the burner (see Figure 28).
7. Dump any debris that becomes dislodged through the inlet opening of the burner and use a shop vac to remove any dust or small particles remaining.
8. Be sure to inspect the fiberglass burner mounting gasket and the silicone gasket between the burner and blower before re-assembling. If either gasket has any damage. Replace it before putting the heater back into service.

NOTICE: It is highly recommended to replace the burner and blower mounting gaskets each time the components are disassembled for cleaning, inspection, or service.

9. Re-assemble the heater by reversing the above steps.

Tighten the four nuts securing the blower to a torque of **5 ft-lbs**.

Tighten the flare nut securing the gas manifold to the blower to a torque of **50 ft-lbs**.

10. Turn the gas supply "ON". Use a soapy water solution to check for leaks. Bubbles forming indicate a leak.

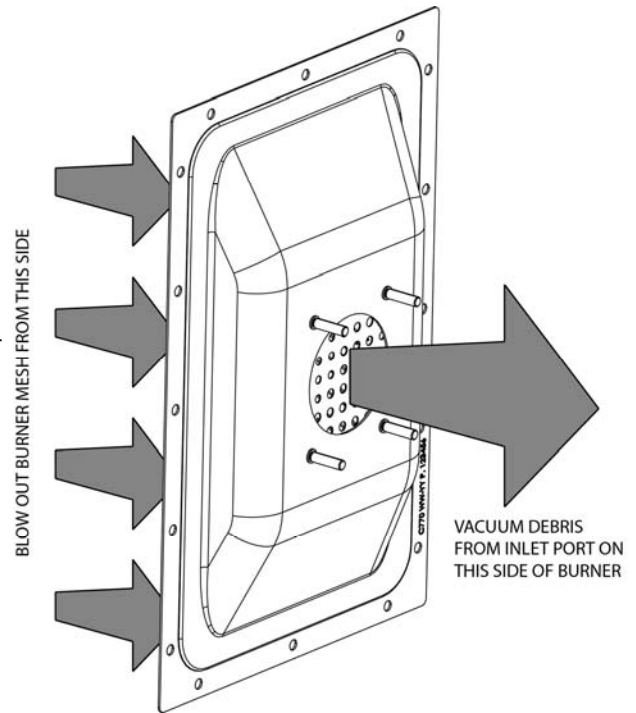



Figure 29: Burner Cleanout

 **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

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

IGNITER AND/OR FLAME SENSOR REPLACEMENT: Refer to Figures 1, 19, 20, and 21 as needed.

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the molded Header Controls Cover by removing the four screws securing it to the water head side sheet metal.
3. Remove the Control Access Cover on top of the unit.
4. Disconnect the igniter and flame sensor wires from the ignition control board.
5. Remove the two screws securing the igniter to the front of the combustion chamber.
6. Remove the two screws securing the flame sensor to the front of the combustion chamber.
7. Pull the igniter straight back until it is free of the combustion chamber refractory and header.
8. Pull the flame sensor straight back until resistance is felt. Rotate the flame sensor 180° and lift up and out to remove it from the combustion chamber.
9. Remove the old gasket from the front of the combustion chamber.
10. Replace the gasket, igniter, and flame sensor and reverse the above procedure to reassemble unit.

FUEL/AIR MIXER REPLACEMENT: Refer to Figures 1, 19, 20, and 21 as needed.

1. Turn pump, gas supply, and heater power "OFF".
2. Remove the Header Control Cover (4 screws).
3. Remove the Water Side Top Panel (4 screws).
4. Disconnect the reference pressure hose from the front of the combustion blower assembly.
5. Unlock the fuel/air mixer by turning it 90° **clockwise**. The mixer can be turned by applying torque to the hose barb and the boss feature across from it. The hose barb should point towards the ground when the mixer is in the unlocked position.
6. Remove the fuel/air mixer by pulling it straight out from the combustion blower inlet.
7. Install new fuel/air mixer by reversing the above steps.
8. Verify that the mixer being inserted is marked with the correct fuel gas and the capacity rating matches that on the rating plate of the heater.
9. Verify manifold pressure after replacing the fuel/air mixer. Instructions for manifold pressure measurements can be found in the **GAS TESTING** section of this manual on page 31 and following.

NOTICE: Do not enlarge orifice holes.

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

TROUBLESHOOTING

Error and Display Codes: See Table 13: Display Code Index

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 Figure 20: Control Assembly 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 not fire. If there is no call for heat, the UI will continue to display the water temperature when the pump is off. No “LO” code will be displayed. If there is a call for heat and the pump is off, an “LO” fault code will be displayed until the pump turns on. There will be a 2 minute delay after the water pressure switch is closed for the heater to fire. After 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”).



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.

Table 13: 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	Differential Pressure Switch closed when expected open. If the switch is closed before the blower has started, the ignition control board will not start the blower until the circuit is opened.
A1	Air switch circuit open before ignitor warm-up	Differential Pressure Switch open when expected closed. This code indicates the switch circuit never closed when the blower turned on or re-opened within 10 seconds of the blower starting.
A2	Air switch open after ignitor warm-up	Differential Pressure Switch open when expected closed. This code indicates the switch opened during the heating cycle.
A3	Air switch open during post-purge	Differential Pressure Switch open when expected closed. This code indicates the switch opened after the heating cycle was completed but before the post-purge time (30 sec.) could be completed.
b1	Ignition control board data error	If the ignition control board does not satisfy self-diagnostic on power up or initial trial for ignition, the ignition control board will lockout until error condition is corrected.
b2	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. The blower will operate until error condition is corrected.
b3	Gas valve sensed as "OFF" error	If gas valve is unpowered but flame is sensed, the blower will run for 5 seconds then start a new ignition sequence. If error occurs 10 times during a call for heat, the ignition control board will go into lockout.
b4	Data retrieval error	If input data values are corrupted on power up or initial trial for ignition, the ignition control board will lockout until error condition is corrected.
bo	Bypass operation mode	This is a normal display when the heater is being controlled by a remote thermostat. No service is required. If the heater is not being controlled by a remote thermostat, change the setting according to the instructions in the ELECTRICAL CONNECTIONS section of the manual.
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.

Table 13: 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
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.
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.

SERVICE PARTS LIST

The following repair parts are available from Hayward and through your local distributor. When ordering parts, include the complete pool heater model number listed on the unit's rating plate, located near the junction boxes on the exhaust side of the heater. (Example: HDF400) **All service must be performed by a qualified technician.**

CABINET PARTS

- Control Access Panel
- Cabinet Top
- Header Controls Cover
- Water Side Trim Panels
- Cabinet Base

ELECTRONIC CONTROLS

- Ignition Control Board
- Display Board and Ribbon Cable
- Field Wiring Panel (Fuse Board)
- Inlet Water Thermistor
- Water Pressure Switch
- High Temperature Limits
- Exhaust Temperature Limit
- Differential Pressure Switch
- Transformer
- Ignitor and Flame Sensor
- Voltage Selector Jumper
- Fuses
- Wiring Harnesses
- Electrical Accessory Kit

HEATING COMPONENTS

- Blower
- Fuel/Air Mixers (Natural or LP)
- Burner
- Gas Valve
- Gas Manifold
- Complete Combustion Chamber
- Exhaust Box Assembly
- Exhaust Pipe Assembly

WATER MANIFOLD COMPONENTS

- V-Header Assembly
- Inlet/Outlet Header Assembly
- Union Flange Kit
- Pressure Relief Port Plug
- Drain Plug

MISC. KITS

- Blower & Burner Gasket Kit
- Silicone Tubes for Pressure Switch and Valve Reference
- Header O-Ring Kit