ELU Duo®

Commercial Boilers

Installation

Start-Up

Maintenance

Parts

Warranty



Heat Exchanger Bears the ASME "H" Stamp

ELUD-285 / 301 / 399 Models*

***"F" Denotes Floor Mount Models,**

"B" Denotes Boiler Models,

"N" Denotes Natural Gas, and "LP" Denotes Propane

Example Model: ELUD-285FBN

ULTRA Low NOx Emissions SCAQMD Rule 1146.2

AHRI CERTIFIED® www.ahridirectory.org

Globally Recognized. Industry Respected.

⚠ DANGER

This manual must only be used by a qualified installer / service technician. Read all instructions in this manual before installing. Perform steps in the given order. Failure to do so could result in substantial property damage, severe personal injury, or death.

⚠ WARNING

Improper installation, adjustment, alteration, service, or maintenance could void product warranty and cause property damage, severe personal injury, or death.

California Proposition 65 Warning: This product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

NOTICE

HTP reserves the right to make product changes or updates without notice and will not be held liable for typographical errors in literature.

NOTE TO CONSUMER: PLEASE KEEP ALL INSTRUCTIONS FOR FUTURE REFERENCE.

272 Duchaine Blvd. New Bedford, MA 02745 www.htproducts.com
lp-769 Revision Date 11.22.2023

⚠ WARNING

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

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

WHAT TO DO IF YOU SMELL GAS

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

Improper installation, adjustment, alteration, service, or maintenance can cause injury, property damage, or death. Refer to this manual. Installation and service must be performed by a qualified installer, service agency, or gas supplier.

FOR YOUR SAFETY READ BEFORE OPERATING

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

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

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

WHAT TO DO IF YOU SMELL GAS

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

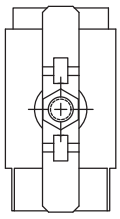
C. Use only your hand to turn the gas control knob. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

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

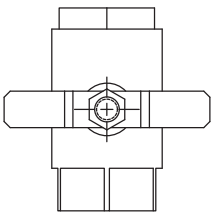
OPERATING INSTRUCTIONS

1. **STOP! Read the safety information above.**
2. **Set the thermostat to lowest setting.**
3. **Turn off all electric power to the appliance.**
4. **This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.**

GAS VALVE ON



GAS VALVE OFF



5. **Remove front cover.**
6. **Turn gas shutoff valve to "off". Handle will be across the piping, do not force.**
7. **Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to next step.**
8. **Turn gas shutoff valve to "on". Handle will be in line with piping.**
9. **Install Front Cover.**
10. **Turn on all electric power to appliance.**
11. **Set thermostat to desired setting.**
12. **If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.**

TO TURN OFF GAS TO APPLIANCE

1. **Set the thermostat to lowest setting.**
2. **Turn off all electric power to the appliance if service is to be performed.**
3. **Remove Front Cover.**
4. **Turn gas shutoff valve to "off". Handle will be across the piping. Do not force.**
5. **Install Front Cover.**

LP-175 Rev. 4 3-11-08

SPECIAL ATTENTION BOXES

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels or to important product information.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in serious personal injury or death.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in personal injury or death.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor personal injury.

CAUTION

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

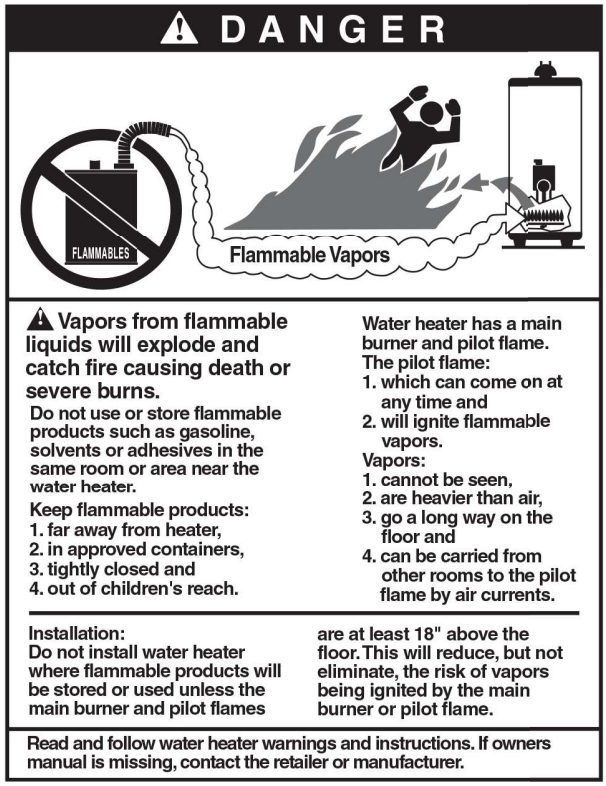
NOTICE

NOTICE is used to address practices not related to personal injury.

Foreword

This manual is intended to be used in conjunction with other literature provided with the boiler. This includes all related control information. It is important that this manual, all other documents included in this system, and additional publications including the *National Fuel Gas Code - ANSI Z223.1* (latest versions), be reviewed in their entirety before beginning any work.

Installation should be made in accordance with the regulations of the Authority Having Jurisdiction, local code authorities, and utility companies which pertain to this type of water heating equipment.



Authority Having Jurisdiction (AHJ) – The AHJ may be a federal, state, local government, or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department or health department, building official or electrical inspector, or others having statutory authority. In some circumstances, the property owner or his/her agent assumes the role, and at government installations, the commanding officer or departmental official may be the AHJ.

NOTE: HTP reserves the right to modify product technical specifications and components without prior notice.

For the Installer

This boiler must be installed by qualified and licensed personnel. The installer should be guided by the instructions furnished with the boiler, and by local codes and utility company requirements. In the absence of local codes, preference should be given to the *National Fuel Gas Code - ANSI Z223.1* in the United States and the *Natural Gas and Propane Installation Code - B149.1* in Canada (latest versions).

Installations Must Comply With:

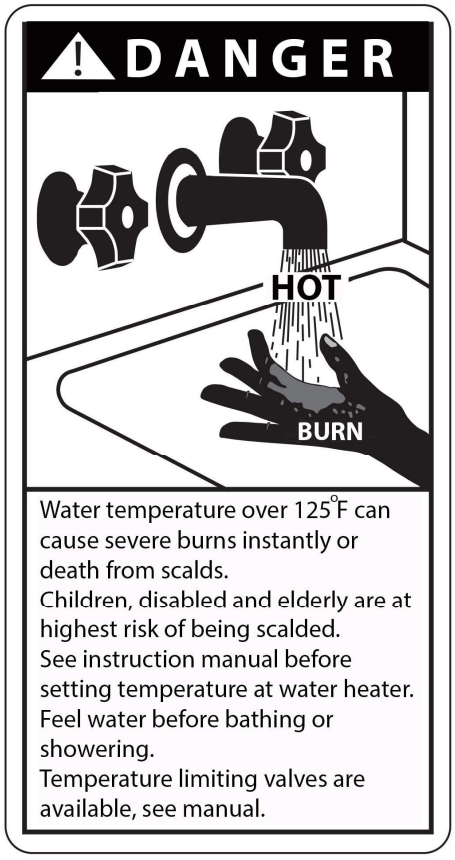
Local, state, provincial, and national codes, laws, regulations, and ordinances.

The latest version of the *National Fuel Gas Code, ANSI Z223.1*, from American Gas Association Laboratories, 8501 East Pleasant Valley Road, Cleveland, OH 44131.

The latest version of the *National Electrical Code, NFPA No. 70*.

In Canada - The latest versions of the *Natural Gas and Propane Installation Code, CSA B149.1*, and the *Canadian Electrical Code, C22.1*, from CSA Group, 178 Rexdale Blvd, Toronto, Ontario, Canada M9W 1R3.

NOTE: The gas manifold and controls met safe lighting and other performance criteria when undergoing tests specified in *ANSI Z21.13* - latest edition.



NOTICE

The CSD-1 ASME Code, Section CW-400 requires that hot water heating and supply boilers have a) a UL 353 temperature control device, b) at least one (1) temperature-actuated control to shut off the fuel supply when system water reaches a preset operating temperature, c) a high temperature limit control that prevents the water temperature from exceeding the maximum allowable temperature by causing a safety shutdown and lockout, and d) its own sensing element and operating switch.

The temperature control system integrated into the 928 control provided with this heating appliance complies with the requirements of CSD-1 Section CW-400 as a temperature operation control. The control monitors the temperature difference between the inlet and the outlet sensor, which is affected by boiler water flow. If this temperature difference exceeds 55°F (typically because of low water flow or very low heat load), the control will reduce the maximum fan speed. If the temperature difference exceeds 60°F, the control will effectively sense there is little or no water flow or heat load and shut the boiler down. The controller will restart automatically once the temperature difference has dropped below 55°F and the minimum off time (anti-cycle time) has expired. In addition, if the control senses that the outlet water temperature has reached 210°F, the boiler is put into a hard lockout and requires manual reset to restart.

IMPORTANT

In accordance with Section 325 (f) (3) of the Energy Policy and Conservation Act, HTP has provided this boiler with multiple features designed to save energy by reducing the boiler water temperature as heating load decreases.

These features include:

- **A modulating combustion system that adjusts firing rate based on heat demand.**
- **Adjustment of boiler set point based on inferred heat load as determined by an outdoor sensor. The outdoor sensor is supplied by HTP with this boiler.**
- **This boiler does not include a standing pilot.**
- **This boiler is designed and shipped to assure the highest efficiency operation possible. Such high efficiency is achieved by limiting heating circuit water temperature to 140°F when there is no anticipated heat load, based upon the outdoor sensor and the Outdoor Reset Curve (sensor response curve) in the boiler software.**
- **This feature may be over-ridden as described below in specific installations:**
- **The boiler control is equipped with an outdoor sensor override for use with building management systems or in cascaded systems (for systems with total input of 300,000 BTU/hr or greater).**

See statement below for an important notice on the use of the override.

IMPORTANT

In accordance with Section 325 (f) (3) of the Energy Policy and Conservation Act, this boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases. This feature is equipped with an override which is provided primarily to permit the use of an external energy management system that serves the same function. THIS OVERRIDE MUST NOT BE USED UNLESS AT LEAST ONE OF THE FOLLOWING CONDITIONS IS TRUE:

- **An external energy management system is installed that reduces the boiler water temperature as the heating load decreases.**
- **This boiler is not used for space heating.**
- **This boiler is part of a modular or multiple boiler system having a total input of 300,000 BTU/hr or greater.**
- **This boiler is equipped with a tankless coil.**

⚠ WARNING

The hydronic supply and return connections of these products are for installation in closed loop systems ONLY! Use of this product in any manner other than described in this manual may result in premature product failure, substantial property damage, severe personal injury, or death. Damage or failure of this product (or the system in which it is installed) due to unauthorized use **IS NOT COVERED BY WARRANTY.**

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Part 1 - General Safety Information

This boiler is approved for indoor installations and is not intended for use as a pool heater. Clearance to combustible materials: 0" top, bottom, sides, and back. Boiler must have room for service: 24" front, rear, and left and right sides and 6" top are minimum recommended service clearances. (A combustible door or removable panel is acceptable front clearance.) This boiler has been approved for installation on combustible flooring. Do not install on carpeting. Install the boiler in a location where temperature and pressure relief valve discharge or a leak will not result in damage to the surrounding area. If such a location is not available, install an auxiliary catch pan.

This appliance is rated Category IV (pressurized vent, likely to form condensate in the vent) and requires a special vent system designed for pressurized venting. **Use only Category IV vent systems.**

⚠ WARNING

Installer - Read all instructions in this manual before installing. Perform steps in the given order.

User - This manual is for use only by a qualified heating installer / service technician. Have this boiler serviced / inspected annually by a qualified service technician.

FAILURE TO ADHERE TO THE GUIDELINES ON THIS PAGE CAN RESULT IN SUBSTANTIAL PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.

NOTE: Obey all local codes. Obtain all applicable permits before installing the boiler.

NOTE: Install all system components and piping in such a manner that does not reduce the performance of any fire rated assembly.

A. Operation and Installation Warnings

To avoid serious injury or death, read, understand, and follow all of the precautions listed here.

⚠ DANGER

Vapors from flammable liquids will explode and cause a fire, resulting in personal injury or death. The boiler has a burner that can come on at any time and ignite vapors. DO NOT use or store flammable liquids around the boiler.

Improper venting can cause a build-up of carbon monoxide. Breathing carbon monoxide can result in brain damage or death. DO NOT operate the boiler unless it is properly vented to the outside and has an adequate fresh air supply for safe operation. Inspect the exterior exhaust gas outlet port and fresh air inlet port on a regular basis to ensure they are functioning properly.

A concentration of carbon monoxide as small as .04% (400 parts per million) in the air can be fatal. When making high fire or low fire adjustments, CO levels must be monitored using a calibrated combustion analyzer such that a CO level of no more than 150 ppm is exceeded at any time during operation.

Adjusting the "low fire offset" or the "main flow restrictor" in small increments can result in a significant increase in CO concentration. To avoid serious injury or death, DO NOT make any adjustments to the gas valve without monitoring the exhaust gases with a fully functional and calibrated combustion analyzer.

Failure to follow these instructions will result in property damage, severe personal injury, or death.

⚠ WARNING

This boiler must be installed by a qualified service technician. Improper installation and/or operation can cause a potentially hazardous situation, which if not avoided will void the warranty and could result in serious injury or death.

The manufacturer cannot anticipate every circumstance that might involve a potential hazard. Each installation has its own specialized characteristics, requirements, and possible hazards. Therefore, all possible incidents are not included in these warnings. Proper and safe installation, operation, and service are the responsibility of the qualified service technician.

Proper care of the boiler is the user's responsibility. Ensure the user carefully reads and understands the User's Information Manual before operating the boiler.

Make sure the user knows the location of the gas shut-off valve and how to operate it. Immediately close the gas shut-off valve if the appliance is subjected to fire, overheating, flood, physical damage, or any other damaging condition that might affect the operation of the unit. Have the appliance checked by a qualified service technician before resuming operation.

Do not power up the unit unless the gas and water supply valves are fully opened. Make sure the fresh air intake port and exhaust gas port are open and functional.

No one but a qualified service technician should attempt to install, service, or repair this boiler. There are no serviceable parts which can be changed by the user / owner.

User / Owner: Contact the original qualified service technician if the boiler needs repair / maintenance. If the original technician is unavailable, ask your gas supplier for a list of qualified service providers.

DO NOT store or place newspapers, laundry, or other combustible items near the appliance or the exterior exhaust gas outlet and/or fresh air inlet port.

⚠ WARNING

The owner should inspect the system monthly for damage, water stains, signs of rust, corrosion, and exhaust vent and air intake blockage. If inspection of the unit shows signs of damage, the boiler should be shut off until the problem is repaired by a qualified technician.

After installation, all appliance safety devices should be tested.

The boiler is certified for indoor installations only. The boiler consists of gas ignition system components which must be protected from water (dripping, spraying, etc.) during operation and service. Carefully consider installation location and the placement of critical components (circulators, condensate neutralizers, etc.) before installing the boiler.

DO NOT allow children to operate this boiler. DO NOT use this boiler if it does not appear to be operating correctly. A qualified service technician should service and inspect the boiler annually.

NOTE: If the boiler is exposed to fire or water (or is any way damaged), do not operate. Immediately call a qualified service technician. Failure to follow this information could result in property damage, severe personal injury, or death.

DO NOT USE THIS BOILER IF ANY PART HAS BEEN SUBMERGED IN WATER. Immediately call a qualified service technician. The boiler MUST BE replaced if it has been submerged. Attempting to operate a boiler that has been submerged could create numerous harmful conditions, such as a potential gas leakage causing a fire and/or explosion, or the release of mold, bacteria, or other harmful particulates into the air. Operating a previously submerged boiler could result in property damage, severe personal injury, or death.
NOTE: Boiler damage due to flood or submersion is considered an Act of God, and IS NOT covered under product warranty.

DO NOT alter or modify the appliance or appliance controls. Altering any HTP boiler with parts not manufactured by HTP WILL INSTANTLY VOID the boiler warranty and could result in property damage, personal injury, or death.

CAUTION

Due to low water content of the boiler, improperly sizing the boiler in regard to heating load will result in excessive boiler cycling and accelerated component failure. HTP DOES NOT warrant failures caused by improperly sized boiler applications. DO NOT oversize the boiler to the system. Modular boiler installations greatly reduce the likelihood of boiler oversizing.

High heat sources (sources generating heat 100°F / 37°C or greater, such as stove pipes, space heaters, etc.) may damage plastic components of the boiler as well as plastic vent pipe materials. Such damages ARE NOT covered by warranty. It is recommended to keep a minimum clearance of 8" from high heat sources. Observe heat source manufacturer instructions, as well as local, state, provincial, and national codes, laws, regulations and ordinances when installing this boiler and related components near high heat sources.

Do not use this boiler for anything other than its intended purpose (as described in this manual). Doing so could result in property damage and WILL VOID product warranty.

NOTICE

This appliance provides an overheat shutdown limit. In the event the appliance water temperature exceeds the setpoint of the control limit, the cutoff will trip and the appliance will shut down. Certain local codes require additional temperature limits. In addition, certain types of systems may operate at temperatures below the minimum setpoint of the limit provided with the appliance. Contact the manufacturer for additional overheat controls.

B. Improper Combustion

⚠ WARNING

Do not obstruct the flow of combustion and ventilating air. Adequate air is necessary for safe operation. Failure to keep the exhaust vent and combustion air intake clear of ice, snow, or other debris could result in property damage, serious personal injury, or death.

C. Gas

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

D. When Servicing the Boiler

⚠ WARNING

Be sure to disconnect electrical power before opening boiler cabinet or performing service. Label all wires while performing service to ensure proper re-wiring of the appliance. Wiring errors can cause improper or dangerous operation. Failure to do so could result in electrical shock, improper boiler or system operation, property damage, serious personal injury, or death.

- To avoid electric shock, disconnect electrical supply before performing maintenance.
- To avoid severe burns, allow boiler and associated equipment to cool before servicing.
- Do not use petroleum-based cleaning or sealing compounds in boiler system. Gaskets and seals in the system may be damaged, possibly resulting in substantial property damage.
- Do not use "homemade cures" or "boiler patent medicines". Substantial property damage, damage to boiler, and/or serious personal injury may result.
- Always verify proper operation after servicing the boiler.

NOTE: When inquiring about service or troubleshooting, reference the model and serial numbers from the boiler rating label.

E. Boiler Water

- Thoroughly flush the system (without the boiler connected) to remove sediment. The high-efficiency heat exchanger can be damaged by build-up or corrosion due to sediment. The manufacturer recommends a suction strainer in this type of system.
- Do not use petroleum-based cleaning or sealing compounds in boiler system. Gaskets and seals in the system may be damaged, possibly resulting in substantial property damage.
- Do not use "homemade cures" or "boiler patent medicines". Substantial property damage, damage to the boiler, and/or serious personal injury may result.
- Continual fresh make-up water will reduce boiler life. Mineral buildup in the heat exchanger reduces heat transfer, overheats the stainless steel heat exchanger, and causes failure. Addition of oxygen from make-up water can cause internal corrosion in system components. Leaks in the boiler or piping must be repaired at once.

NOTE: DO NOT add cold make up water to the system when the boiler is hot. Thermal shock can potentially cause cracks in the heat exchanger. Such damage IS NOT covered by warranty.

F. Water Chemistry Requirements*

⚠ WARNING

Chemical imbalance of the water supply may affect efficiency and cause severe damage to the appliance and associated equipment. It is important that the water chemistry on both the domestic hot water and central heating sides are checked before installing the appliance. Water quality must be professionally analyzed to determine whether it is necessary to treat the water. Various solutions are available to adjust water quality. Adverse water quality will affect the reliability of the system. In addition, operating temperatures above 135^{O}F will accelerate the build-up of lime scale and possibly shorten appliance service life. Failure of an appliance due to lime scale build-up, low pH, or other chemical imbalance IS NOT covered by the warranty.

Closed loop water must be free of corrosive chemicals, sand, dirt, and other contaminates. It is up to the installer to ensure the water does not contain corrosive chemicals or elements that can damage the heat exchanger.

If you suspect that your water is contaminated in any way, discontinue use of the appliance and contact an authorized technician or licensed professional.

- **Water pH between 6.5 and 8.5**
  - pH levels below 6.5 can cause an increase in the rate of corrosion. pH of 8.5 or higher can potentially cause lime scale build-up.
  - Maintain water pH between 6.5 and 8.5. Check with litmus paper or have it chemically analyzed by a local water treatment company.
  - If the pH is not between 6.5 and 8.5, consult a local water treatment company for solutions.
- **Hardness between 5 and 12 grains (71.3 and 205 mg/L)***
  - Hardness levels above the required amounts can lead to lime scale build-up throughout the system. Water below 5 grains/gallon (71.3 mg/L) may be over softened.
  - Consult local water treatment companies for unusually hard water areas (above the required amounts) or for other treatment solutions if water is being over softened (below 5 grains/gallon [71.3 mg/L]).
- **Chloride concentration less than 150 ppm (mg/L)**
  - Do not fill appliance or operate with water containing chlorides in excess of 150 ppm (mg/L).
  - Using chlorinated fresh water should be acceptable as levels are typically less than 5 ppm (mg/L).
  - Do not connect the appliance to directly heat swimming pool or spa water.
- **Total Dissolved Solids (TDS) between 100 and 450 ppm (mg/L)***
  - Total dissolved solids are minerals, salts, metals, and charged particles that are dissolved in water.
  - The greater the amounts of TDS present, the higher the corrosion potential due to increased conductivity in the water.
  - If using softened water to fill the appliance, it is still possible to have high TDS. This water can be corrosive. Consult local water treatment companies for other treatment solutions to reduce this affect.

***NOTE:** The amount of Hardness ppm (mg/L) + TDS ppm (mg/L) must be less than 450 ppm (mg/L) total. For Example:

WATER CHEMISTRY NOTES:

1. Avoid exposing the heat exchanger water tubes to oxygen to prevent internal corrosion. System leaks and continuous make-up water will introduce oxygen into the system, increasing the opportunity for internal corrosion and possibly reducing the life of the heat exchanger and system components.
2. Leaks in the boiler or piping must be repaired at once to prevent excessive make-up water. It is recommended to install a water meter to regularly check the amount of make-up water entering the system. Make-up water volume should not exceed 5% of the total system volume per year. When make-up water is added, ensure chemical

additives (glycol, corrosion inhibitors, etc.) are added to maintain the correct level.
3. Regularly monitoring pH, chlorides, TDS, and hardness levels can prolong the life of the appliance by reducing mineral scale buildup, corrosion, and erosion. Mineral buildup in the heat exchanger reduces heat transfer, overheats the stainless steel heat exchanger, and causes failure.
4. A corrosion inhibitor approved for use with stainless steel heat exchangers (comparable to Sentinel X100 or Fernox F1) is recommended at the correct concentration and in the manner recommended by the manufacturer.

G. Freeze Protection

CAUTION

Consider piping and installation when determining boiler location. Damages resulting from incorrect installation or from use of products not approved by the manufacturer ARE NOT covered by warranty. Failure of the boiler due to freeze related damage IS NOT covered by product warranty.

⚠ WARNING

NEVER use any toxic chemical, including automotive, standard glycol antifreeze, or ethylene glycol made for hydronic (non-potable) systems. These chemicals can attack gaskets and seals in water systems, are poisonous if consumed, and can cause personal injury or death.

NOTE: Loops Serving Indirect Water Heaters (IWHs)

Glycol used in IWH loops should be food grade propylene glycol, FDA rated as "generally recognized as safe" (GRAS). If using a glycol / potable water mix, the water chemistry must meet the requirements in this manual. The glycol content of the liquid must not exceed 50%, unless the manufacturer specifies a different ratio. Glycol should be checked periodically to prevent it from becoming acidic. Please refer to guidelines provided by the glycol manufacturer regarding glycol maintenance.

NOTE: Glycol not recognized as GRAS may only be used in closed loop CH applications.

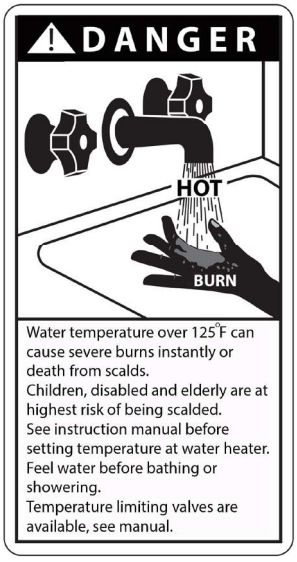
NOTE: HTP DOES NOT WARRANT THE BOILER AGAINST FREEZE-RELATED DAMAGE.

The boiler control is equipped with freeze protection that activates based on internal water temperature.
NOTE: Freeze protection will not be active if the boiler loses power.

H. Scalding

Boilers Serving Indirect Water Heaters

This boiler can deliver scalding water to the indirect water heater. Be careful whenever using hot water to avoid scalding injury. Certain appliances such as dishwashers and automatic clothes washers may require increased water temperatures. By setting the thermostat on this boiler or the indirect water heater to obtain the increased water temperature required by these appliances you may create the potential for scald injury.
To protect against injury, install a mixing valve in the water system. This valve will reduce point of use discharge temperatures by mixing cold and hot water in branch supply lines. Such valves are available from your local plumbing supplier.
Table 1 details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.



⚠ WARNING

The risk of scalding increases when raising DHW temperature. Use a water tempering or mixing valve when raising DHW temperature to lessen the chance of scalds. Consult codes for conformance. Failure to install a temperature limiting or mixing valve and follow these instructions could result in property damage, severe personal injury, or death due to scalds.

Approximate Time / Temperature Relationships in Scalds	
120°F	More than 5 minutes
125°F	1 1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1 1/2 seconds
155°F	About 1 second

Table 1 - Approximate Time / Temperature Relationships in Scalds

I. High Elevation Installations

This boiler is designed to operate at its maximum listed capacity in installations located at 0 - 2000 ft above Sea Level. Since the density of air decreases as elevation increases, maximum specified capacity should be de-rated for elevations above 2000 ft (610 m) in accordance with the table below.

Elevations	2001 ft (610 m)	3000 ft (914 m)	4000 ft (1219 m)	4500 ft (1372 m)	5000 ft (1524 m)
In Canada[1], de-rate by:	10%	10%	10%	10%	may vary
In USA[2], de-rate by:	-	12%	16%	18%	20%

NOTES:
[1]Canada: Elevations between 2000 - 4500 ft (610 - 1372 m), de-rate by 10%. Consult local authorities for de-rating for elevations above 4500 ft (1372 m).
[2]USA: If elevation is above 2000 ft (610 m), de-rate capacity by 4% for every 1000 ft (305 m).

Table 2 - De-Rate % for High Elevations

⚠ WARNING

Combustion - At elevations above 2000 ft, the combustion of the boiler must be checked with a calibrated combustion analyzer to ensure safe and reliable operation. **It is the Installer's responsibility to check and adjust the combustion in accordance with this manual.** Failure to follow these instructions may result in property damage, serious personal injury, or death.

Part 2 - Before You Start

NOTICE

UNCRATING THE BOILER - Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

Remove the boiler and accessories from the shipping crate. Take care to place the boiler and accessories in a safe location prior to installation to prevent damage to the mechanical connections.

A. What's in the Box

Components included with the boiler:

- Outdoor Sensor (7250P-319)
- System Sensor (7250P-324)
- Indirect NTC Sensor (7250P-325)
- Intake / Exhaust Screens (7550P-995)
- Temperature and Pressure Gauge (7500P-098)
- Installation Manual and Warranty
- User's Information Manual
- Cascade Quick Start (420020227800)
- HTP Link Instructions (lp-712)

B. How the Boiler Operates

The Elite Ultra Duo boiler features condensing technology that intelligently delivers highly efficient hydronic heating by measuring data from the heating system. Its specialized design utilizes two heating boiler modules to provide the highest turn-down and efficiency available in the heating market today.

Dual Heating Boiler Modules

The Elite Ultra Duo boiler combines two heating boiler modules in one enclosure. Both modules are tied into single connections for gas, condensate, electrical, intake and exhaust venting, and heating supply and return. This dual module design provides built-in redundancy, an extremely high efficiency of 96%, and a turn-down ratio as high as 20 to 1 – all from a single compact unit.

Patented XtraTech Stainless Steel Heat Exchangers

The XtraTech Heat Exchanger is truly an innovation in design over traditional water or fire tube heat exchangers. Its durable construction and larger water circuits offer long term reliability and low pressure drop. This highly efficient heat exchanger is designed to extract the last bit of heat from the cold water return.

Modulating Combustion System

The dual heating module combustion systems modulate output during operation to meet system demand and achieve the control setpoint while in operation. This setpoint can be changed by internal or external signals to enhance overall system performance.

Control System

The integrated control monitors the system and regulates the fan speed of both boiler modules to maintain overall output. This allows the boiler to deliver only the heat energy required for maximum efficiency and nothing more. The system can be further enhanced by installing an indirect water heater to provide domestic hot water.

The control's internal cascade program manages the output of each heating module. This allows the two modules to function as one larger boiler, increasing overall efficiency and turndown ratio (20 to 1) to meet very small zone requirements in the same heating system design. The internal cascade program also provides a redundant back-up if either of the heating modules locks out for any reason. This allows for minimized downtime and maximized efficiency.

The control can also regulate the output of multiple boilers through its cascade system function. The cascade system can connect up to four (4) boilers (eight [8] heating modules) to function as one boiler system. This allows for even greater turn down ratios (up to 80 to 1) and further redundancy.

The cascade system works by establishing one boiler as the master and the others as followers. The master requires a system sensor and a system pump in addition to its own boiler pump. Each of the follower boilers requires its own pump to provide maximum flow and control heat exchanger flow rate.

Electronic Touchscreen Display with Status Indicators

The full color resistive touchscreen display makes programming and set up easy. The display allows the user to quickly change system parameters and monitor system operation. The internal safeties of the boiler can be tested and verified through the display, avoiding the expensive additional controls and wiring required to meet most local standards.

Gas Valves

Each module has its own gas valve which senses suction from the blower, allowing gas to flow only when powered and combustion air is flowing.

Integrated Gas Mixing System

Each module is equipped with its own gas mixing system to control air and gas flow into the burner.

Burners

Each module has its own high-grade stainless-steel burner. Both burners are designed to use premixed air and gas for a wide range of firing rates.

Spark Ignition System with High Output Ignition Transformer

The burner is ignited through our high voltage ignition transformer to provide reliable, quiet ignition every time.

Dual Supply Water Temperature Sensor / High Limit Water ECO

Each module is equipped with a dual sensor which monitors the outlet water temperature (System Supply) and acts as a high safety limit by monitoring two sensors on the pipe sensor body. The control adjusts boiler firing rate to ensure the supply temperature matches the boiler setpoint. The dual sensor in combination with the 928 control meets all the requirements of a UL 353 water limiting control, eliminating the need for a mechanical ECO and increasing safety and reliability.

Return Water Temperature Sensor

Monitors module return water temperature (System Return).

Temperature and Pressure Gauge

Allows the user to monitor system temperature and pressure.

Electrical Field Connections with Terminal Strips

The electrical cover facilitates wiring the boiler with access to clearly marked line voltage and low voltage terminal strips.

Supplied Condensate Collection System with Clean Out

The boiler is extremely efficient and will produce condensate. The condensate collection system has an internal float to prevent combustion gas from exiting the trap. Each module is provided with a switch to monitor the condensate level and prevent condensate from backing up into the combustion system.

High-Resolution Flow Switch

The high-resolution flow switch protects the boiler during low flow conditions. The boiler control also monitors flow through the heat exchanger through the return and supply sensors and will shut down the burner before overheating occurs.

Outdoor Sensor

The control can increase efficiency by adjusting the setpoint based on the outdoor temperature measured by this sensor.

System Sensor

The system sensor provides highly accurate temperature feedback to the boiler control. This ensures that the boiler meets the exact target temperature required, increases comfort, and improves overall system efficiency.

NOTE: It is required to install the system sensor on every system.

Install the sensor on the outlet of the boiler or in the secondary system loop outside of the closely spaced tees. Wrap pipe insulation around the system sensor to improve temperature measurement accuracy and increase overall system efficiency.

0-10 Volt Input
Allows the installer to connect a BMS (Building Management System) that utilizes a 0-10V analog signal to control the boiler.
0-10 Volt Pump Output
Variable speed pump support is available on the primary boiler / CH loop of all models. This feature controls pump speed via an analog 0-10VDC signal supplied via the 0-10V PUMP+/- connections on the Field Connection Board.
UL 353 Internal Low Water Cutoff (LWCO)
Each module is supplied with an Internal Low Water Cutoff. This in conjunction with the 928 control meets UL 353 requirements to function as a safety, locking out the boiler when water level is inadequate for safe operation. See Service Mode, this manual, to test LWCO function.
Boost Timer Function
Temporarily overrides the outdoor reset curve to satisfy a thermostat call in a shorter amount of time. This is especially useful on relatively warm days.
Flue Temperature Modulation
As an additional safety feature, if the flue temperature exceeds 200ºF, the control will modulate the boiler down based on the vent temperature rather than the supply temperature. If the flue temperature exceeds 210ºF the control will block the boiler from operating until the over temperature condition is resolved.

HTP Link
HTP Link allows the installer to connect the boiler to WiFi, providing the user / installer with tools to remotely monitor the system, optimize efficiency, and aid in troubleshooting. For more details see the HTP Link Instructions included with the boiler.
Indirect Tank Sensor (Optional)
Monitors storage tank temperature.

C. Optional Equipment

Optional equipment available from HTP (and Part #):

- 4" Stainless Steel Vent Termination Kit (V2000)
- 6" Stainless Steel Outside Termination Vent Kit (V3000)
- 8" Stainless Steel Elbow (7550P-067)
- 8" Stainless Steel to PVC / CPVC Vent Pipe Adapter (7550P-064)
- Alarm System Kit (to monitor any failure) (7350P-602)
- 928 PC Connection Kit (7450P-330)
- Condensate Neutralizer (7350P-611)
- Condensate Removal Pump (554200)
- Isolation Valve Kit (7550P-985)
- MODBUS / BACnet Adapter (7350P-636)
- NG to LP Conversion Kit (All Units) (3255014)
- LP to NG Conversion Kit (All Units) (3255013)

Part 3 - Prepare the Boiler

Remove all sides of the shipping crate to allow the boiler to be moved into its installation location. The boiler is heavy. At least two individuals and special equipment are needed to properly handle the boiler. If surface flooring is rough, take care not to damage the boiler when moving it into position.

CAUTION

COLD WEATHER HANDLING - If the boiler has been stored in a very cold location (BELOW 0ºF) before installation, handle with care until the components come to room temperature. Failure to do so could result in damage to the boiler.

Carefully consider installation when determining boiler location. Please read the entire manual before attempting installation. Failure to properly take factors such as boiler venting, piping, condensate removal, and wiring into account before installation could result in wasted time, money, and possible property damage and personal injury.

A. Locating the Boiler

⚠ WARNING

DO NOT INSTALL this boiler outdoors. Installing the boiler outdoors WILL VOID the warranty, and could result in property damage, severe personal injury, or death.

Incorrect ambient conditions can lead to damage to the heating system and put safe operation at risk. Ensure that the installation location adheres to the information included in this manual. Failure to do so could result in property damage, serious personal injury, or death. Failure of boiler or components due to incorrect operating conditions IS NOT covered by product warranty.

This boiler must be installed upright in the vertical position as described in this manual. DO NOT attempt to install this boiler in any other orientation. Doing so will result in improper boiler operation and property damage, and could result in serious personal injury or death.

1. Installation Area (Mechanical Room) Operating Conditions
   - Ensure ambient temperatures are higher than 32ºF / 0ºC
   - Prevent the air from becoming contaminated by the products, places, and conditions listed in this manual
   - Avoid continuously high levels of humidity
   - Never close existing ventilation openings
   - Ensure a minimum 1" clearance around hot water and exhaust vent pipes

   NOTE: To prevent condensing in the fan, it is recommended to avoid prolonged exposure to temperatures below 45ºF

⚠ WARNING

This boiler has a condensate disposal system that may freeze if exposed to sustained temperatures below 32ºF. Precautions should be taken to protect the condensate trap and drain lines from sustained freezing conditions. Failure to take precautions could result in property damage, severe personal injury, or death.

2. Check for nearby connections to:
   - System water piping
   - Venting connections
   - Gas supply piping
   - Electrical power
   - Condensate drain
3. Check area around boiler. Remove any combustible materials, gasoline, and other flammable liquids.

⚠ WARNING

Failure to keep the boiler area clear and free of combustible materials, liquids, and vapors can result in substantial property damage, severe personal injury, or death.

CAUTION

High heat sources (generating heat 100°F / 37°C or greater, such as boiler flue pipes, space heaters, etc.) may damage plastic components of the boiler as well as plastic vent pipe materials. Such damages ARE NOT covered by warranty. It is recommended to keep a minimum clearance of 8" from high heat sources. Observe heat source manufacturer instructions, as well as local, state, provincial, and national codes, laws, regulations, and ordinances when installing this boiler and related components near high heat sources.

The service life of the boiler's exposed metallic surfaces, such as the casing, as well as internal surfaces, such as the heat exchanger, are directly influenced by proximity to damp and salty marine environments. In such areas higher concentration levels of chlorides from sea spray coupled with relative humidity can lead to degradation of boiler components. In these environments, boilers must not be installed using direct vent systems which draw outdoor air for combustion. Such boilers must be installed using room air for combustion. Indoor air will have a much lower relative humidity, and hence potential corrosion will be minimized.

Failure of the boiler or components due to incorrect operating conditions IS NOT covered by product warranty.

4. Gas control system components must be protected from dripping water during operation and service.
5. If the boiler is to replace an existing boiler, check for and correct any existing system problems, such as:
   - System leaks
   - Location that could cause the system and boiler to freeze and leak
   - Incorrectly sized expansion tank
6. Clean and flush system when reinstalling a boiler.

CAUTION

Always take future maintenance into consideration when locating the boiler. If the boiler is located in an installation location with limited clearances, it may be necessary to remove the boiler from the space to perform maintenance. Failure to consider maintenance when determining installation location could result in property damage.

NOTE: When installing in a minimum clearance location, it may not be possible to read or view some product labeling. It is recommended to make note of the boiler model and serial number.

NOTE: A combustible door or removable panel is acceptable front clearance.

⚠ WARNING

Use extreme care not to drop the boiler or cause bodily injury while lifting the boiler. Failure to follow these instructions could result in property damage, severe personal injury, or death.

B. Flooring

⚠ WARNING

Ensure that the floor and structure of the installation location are sufficient to support the full installed weight of the boiler, including water content of the heat exchanger and related piping. Failure to ensure the floor and structure of the installation location are structurally sound before installation of the boiler can result in structural failure, substantial property damage, severe personal injury, or death.

C. Leveling

CAUTION

In order for the condensate to properly flow out of the collection system, the area where you locate the boiler must be level. Location must also fully support the weight of the filled boiler. See Figures 1 - 2.

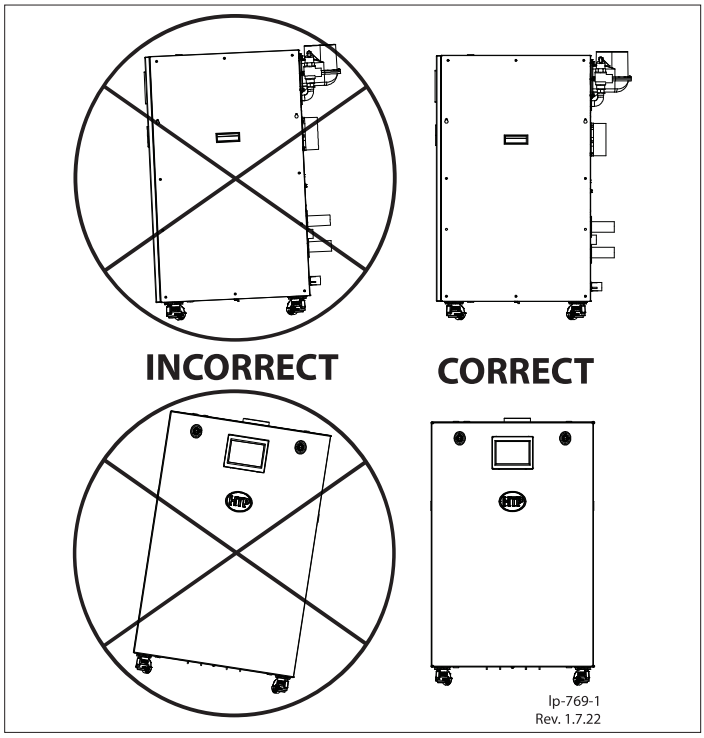


Figure 1 - Leveling

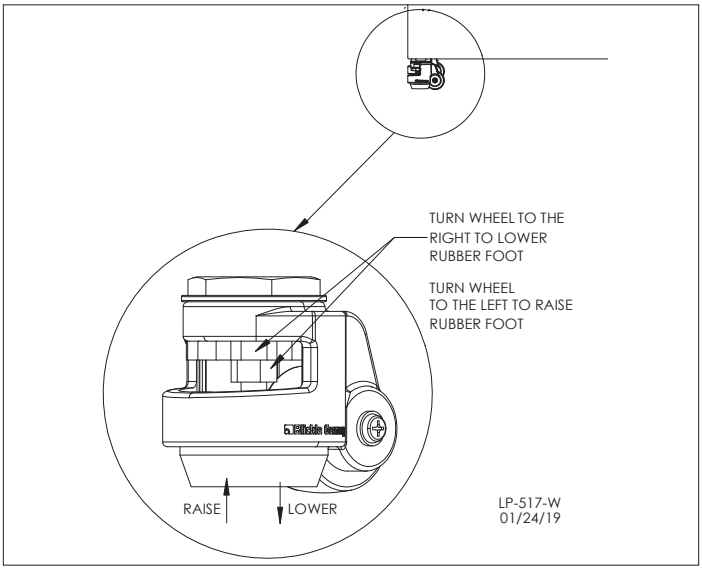


Figure 2 - Caster Wheel Adjustment

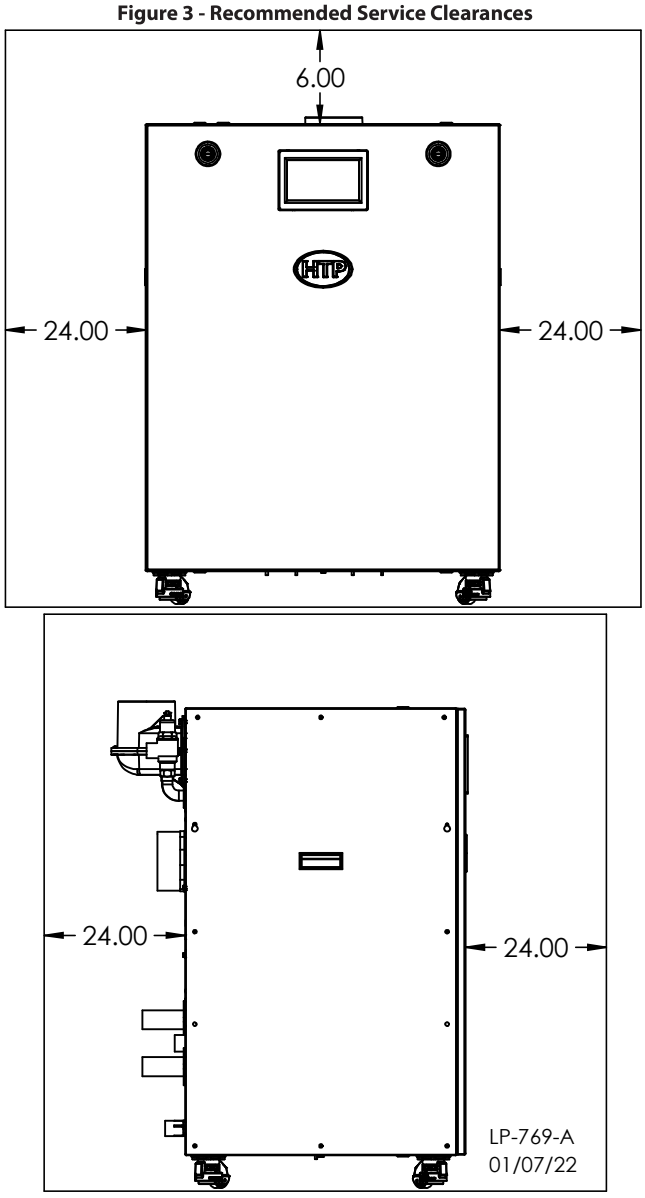
D. Clearances for Service Access

⚠ WARNING

The space must be provided with combustion / ventilation air openings correctly sized for all other appliances located in the same space as the boiler. The boiler cover must be securely fastened to prevent the boiler from drawing air from the boiler room. This is particularly important if the boiler is in a room with other appliances. Failure to comply with the above warnings could result in substantial property damage, severe personal injury, or death.

NOTE: If you do not provide the minimum clearances shown in Figure 3 it might not be possible to service the boiler without removing it from the space.

Figure 3 - Recommended Service Clearances



NOTE: For closet installations, a combustible door or removable panel is acceptable front clearance. A 3" minimum clearance must be provided from the appliance front cover to the removable panel or combustible door.

Minimum Clearances from Combustible Materials

- Hot water pipes - at least 1" from combustible materials
- Exhaust vent pipe - at least 1" from combustible materials

CAUTION

All boilers eventually leak. Locate the boiler where any leakage from the relief valve, related piping, tank, or connections will not result in damage to surrounding areas or lower floors of the building. Any boiler should be installed in such a manner that if it should leak the resulting flow of water will not cause damage to the area in which it is installed. If the boiler is installed in a location where a leak could cause damage, it is required to provide containment measures. Such measures include but are not limited to: a properly sized drain pan installed beneath the boiler and piped to an open drain line, or installing the boiler on a concrete floor pitched to a free flowing drain. Failure to provide containment measures is the sole responsibility of the owner and/or installer. Leakage damages ARE NOT covered by warranty.

In addition, water leak detection devices and automatic water shutoff valves are readily available at plumbing supply houses. IT IS HIGHLY RECOMMENDED BY THE MANUFACTURER TO INSTALL WATER LEAK DETECTION DEVICES AND AUTOMATIC SHUTOFF VALVES IN ANY BOILER INSTALLATION WHERE A LEAKAGE OF WATER COULD RESULT IN PROPERTY DAMAGES.

NOTE: In multiple boiler installations, it is recommended to keep an 18" minimum clearance between boilers.

Boiler Area Ventilation Air Openings - Closet Installations

If the boiler is installed in a closet or alcove the boiler area/room must be ventilated.

EXCEPTION: If the boiler area/room has a volume of 150 ft^3 or greater, ventilation of the boiler area/room is not required.

Each ventilation air opening must meet the minimum requirements of 1 in^2 per 1000 BTU/hr., but not less than 100 in^2. The lower ventilation opening must be located within 6 in. of the floor, while the upper opening must be located 6 in. from the top of the space.

⚠ WARNING

If the boiler area has a volume less than 150 ft^3, it is considered a Closet or Alcove. In the US/Canada, PVC vent pipe and fittings SHALL NOT BE USED within the closet or alcove. Only approved CPVC, Polypropylene, or Stainless Steel vent pipe and fittings may be used. See Table 10 for a list of approved materials. Under all circumstances proper ventilation must be provided.

The space must be provided with correctly sized combustion/ ventilation air openings for all other appliances located in the space with the boiler. For power venting installations using room air for combustion, refer to the boiler venting section, this manual, for descriptions of confined and unconfined spaces. Do not install the boiler in an attic. The boiler cover must be securely fastened to prevent the boiler from drawing air from the boiler room. This is particularly important if the boiler is in a room with other appliances. Failure to comply with the above warnings could result in substantial property damage, severe personal injury, or death.

Alcove Installations

Alcove installations have the same minimum dimensions as closet installations, except the installation must be completely open to the room at a distance no greater than 18 in. (457 mm) from the front of the boiler and the room must be at least three (3) times the size of the alcove. Provided these conditions are met, the boiler requires no extra ventilation air openings to the space. If these conditions are not met, follow the requirements for Closet Installations.

E. Residential Garage and Closet Installations

CAUTION

Check with your local Authority Having Jurisdiction for requirements when installing the boiler in a garage or closet. Please read the entire manual before attempting installation. Failure to properly take factors such as venting, piping, condensate removal, and wiring into account before installation could result in wasted time, money, and possible property damage and personal injury.

Precautions

If the boiler is located in a residential garage, per ANSI Z223.1:

- Install the boiler burner and ignition devices a minimum of 18" above the floor of the garage. This will ensure the burner and ignition devices are well off the floor.
- When raising the boiler ensure the entire bottom and fully filled weight of the boiler are fully supported.
- Locate or protect the boiler so it cannot be damaged by a moving vehicle.

F. Exhaust Vent and Intake Pipe

The boiler is rated ANSI Z21.13 Category IV (pressurized vent, likely to form condensate in the vent) and requires a special vent system designed for pressurized venting.

NOTE: The venting options described here (and further detailed in the Venting section, this manual) are the lone venting options approved for this boiler. Failure to vent the boiler in accordance with the provided venting instructions will void the warranty.

⚠ DANGER

Failure to vent the boiler properly will result in serious personal injury or death.

⚠ WARNING

Do not attempt to vent this boiler by any means other than those described in this manual. Doing so will void the warranty and may result in severe personal injury or death.

The exhaust discharged by this boiler may be very hot. Avoid touching or other direct contact with the exhaust gases of the vent termination assembly. Doing so could result in severe personal injury or death.

Vents must be properly supported. Boiler exhaust and intake connections are not designed to carry heavy weight. Vent support brackets must be within 1' of the boiler and the balance at 4' intervals. Boiler must be readily accessible for visual inspection for first 3' from the boiler. Failure to properly support vents could result in property damage, severe personal injury, or death.

1. Direct Vent of Exhaust and Intake

If installing a direct vent option, combustion air must be drawn from the outdoors directly into the boiler intake and exhaust must terminate outdoors. There are three basic direct vent options detailed in this manual: 1. Side Wall Venting, 2. Roof Venting, and 3. Unbalanced Venting.

Be sure to locate the boiler such that the exhaust vent and intake piping can be routed through the building and properly terminated. Different vent terminals can be used to simplify and eliminate multiple penetrations in the building structure (see Optional Equipment in Venting Section). The exhaust vent and intake piping lengths, routing, and termination methods must all comply with the methods and limits given in the Venting Section, this manual.

When installing a combustion air intake from outdoors, care must be taken to utilize uncontaminated combustion air. **To prevent combustion air contamination, see Table 3.**

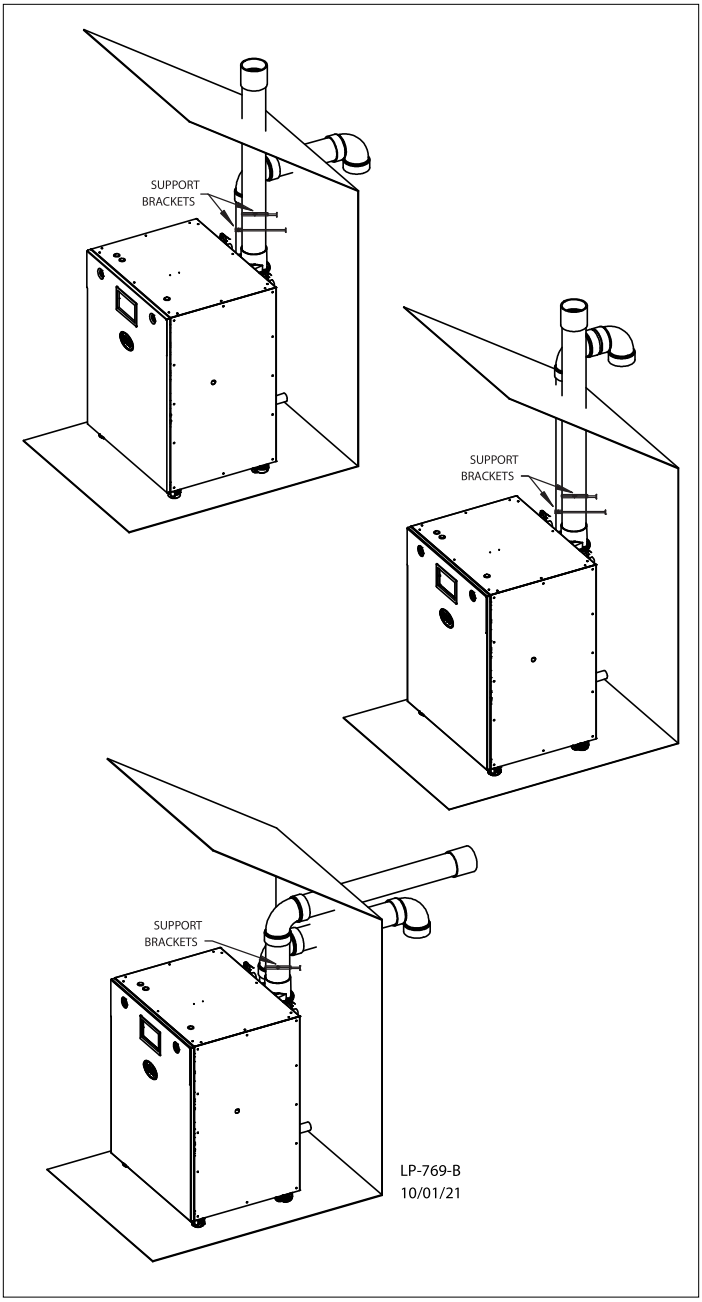


Figure 4 - Direct Vent Examples

2. Power Venting, Indoor Combustion Air in Confined or Unconfined Space

This boiler requires fresh, uncontaminated air for safe operation and must be installed in a mechanical room where there is adequate combustion and ventilating air. **NOTE: To prevent combustion air contamination, see Table 3.**

Combustion air from the indoor space can be used if the space has adequate area or when air is provided through a duct or louver to supply sufficient combustion air based on the boiler input. Never obstruct the supply of combustion air to the boiler. If the boiler is installed in areas where indoor air is contaminated (see Table 3) it is imperative that the boiler be installed as direct vent so that all combustion air is taken directly from the outdoors into the boiler intake connection.

Unconfined space is space with volume greater than 50 cubic feet per 1,000 BTU/hr (4.8 cubic meters per kW) of the total input rating of all fuel-burning appliances installed in that space. Rooms connected directly to this space through openings not furnished with doors are considered part of the space. See Venting Section for details.

Confined space is space with volume less than 50 cubic feet per 1,000 BTU/hr (4.8 cubic meters per kW) of the total input rating of all fuel-burning appliances installed in that space. Rooms connected directly to this space through openings not furnished with doors are considered part of the space.

When drawing combustion air from inside a conventionally constructed building to a confined space, such space should be provided with two permanent openings: one located 6" (15 cm) below the space ceiling, the other 6" (15cm) above the space floor. Each opening should have a free area of one square inch per 1,000 BTU/hr (22cm^2/kW) of the total input of all appliances in the space, but not less than 100 square inches (645cm^2).

If the confined space is within a building of tight construction, air for combustion must be obtained from the outdoors as outlined in the Venting section of this manual.

CAUTION

When drawing combustion air from the outside into the mechanical room, care must be taken to provide adequate freeze protection.

⚠ WARNING

Failure to provide an adequate supply of fresh combustion air can cause poisonous flue gases to enter the living space, resulting in severe personal injury or death. To prevent combustion air contamination, see Table 3.

G. Carbon Monoxide Detectors

In the Commonwealth of Massachusetts and As Required by State and Local Codes:

Installation of Carbon Monoxide Detectors: At the time of installation or replacement of the vented gas fueled appliance, the installing plumber or gas fitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas appliance is installed, unless the appliance is located in a detached, uninhabitable structure separate from the dwelling, building, or structure used in whole or in part for residential purposes.

In addition, the installing plumber or gas fitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on each additional level of the dwelling, building, or structure served by the vented gas appliance. It shall be the responsibility of the property owner to secure the service of qualified licensed professionals for the installation of hard wired carbon monoxide detectors.

a. In the event that the vented gas fueled appliance is installed in a crawl space or attic, the hard wired carbon monoxide detector with alarm and battery back-up shall be installed on the next adjacent floor level.

b. In the event that these requirements cannot be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.

⚠ WARNING

Do not attempt to vent this appliance by any means other than those described in this manual. Doing so will void the warranty and may result in severe personal injury or death.

Approved Carbon Monoxide Detectors: Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 70 and be ANSI/UL 2034 listed and IAS certified.

H. Prevent Combustion Air Contamination

Install intake air piping for the boiler as described in the Venting Section, this manual. Do not terminate exhaust in locations that can allow contamination of intake air.

⚠ WARNING

Ensure that the intake air will not contain any of the contaminants in Table 3. Contaminated air will damage the boiler, resulting in possible substantial property damage, severe personal injury, or death. For example, do not pipe intake air near a swimming pool or laundry facilities. These areas always contain contaminants.

Products to Avoid	Areas Likely to Have Contaminants
Spray cans containing fluorocarbons	Dry cleaning / laundry areas and establishments
Permanent wave solutions	Swimming pools
Chlorinated waxes / cleaners	Metal fabrication plants
Chlorine-based swimming pool chemicals	Beauty shops
Calcium chloride used for thawing	Refrigeration repair shops
Sodium chloride used for water softening	Photo processing plants
Refrigerant leaks	Auto body shops
Paint or varnish removers	Plastic manufacturing plants
Hydrochloric or Muriatic acid	Furniture refinishing areas and establishments
Cements and glues	New building construction
Antistatic fabric softeners used in clothes dryers	Remodeling areas
Chlorine-type bleaches, laundry detergents, and cleaning solvents	Garages and workshops
Adhesives used to fasten building products	

Table 3 - Products and Areas Likely to Have Contaminants

NOTE: DAMAGE TO THE BOILER CAUSED BY EXPOSURE TO CORROSIVE VAPORS IS NOT COVERED BY WARRANTY. (Refer to the limited warranty for complete terms and conditions.)

I. Removing a Boiler from a Common Vent System

⚠ DANGER

Do not install the boiler into a common vent with any other appliance. This will cause flue gas spillage or appliance malfunction, resulting in possible substantial property damage, severe personal injury, or death.

⚠ WARNING

Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

When removing an existing boiler, follow the steps below.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch to determine if there is blockage, leakage, corrosion, or other deficiencies that could cause an unsafe condition.

3. If practical, close all building doors, windows, and doors between the space in which the boiler remains connected to the common venting system and other spaces in the building. Turn on clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, at maximum speed. Do not operate a summer exhaust fan. Close all fireplace dampers.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust the thermostat so the appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle or smoke from a cigarette.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined, return doors, windows, exhaust fans, fireplace dampers, and any other gas burning appliances to their previous condition of use.
7. Any improper operation of the common venting system should be corrected to conform to the National Fuel Gas Code, ANSI Z223.1. When resizing any portion of the common venting system, the system should approach the minimum size as determined using the appropriate tables in Appendix G of ANSI Z223.1.

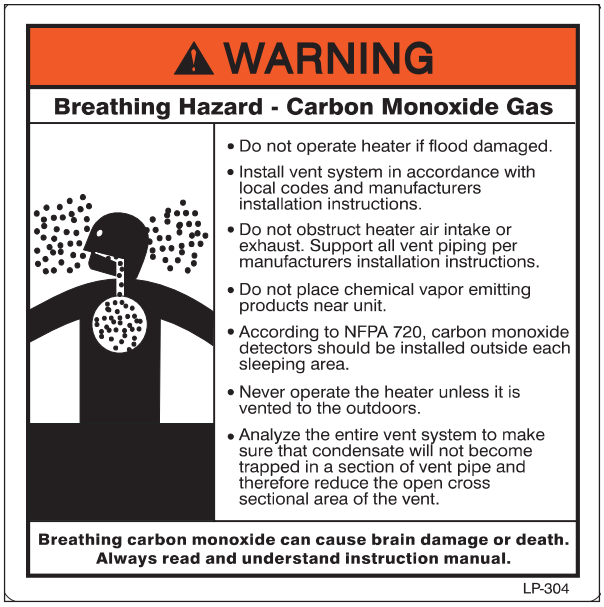


Figure 5 - CO Warning Label

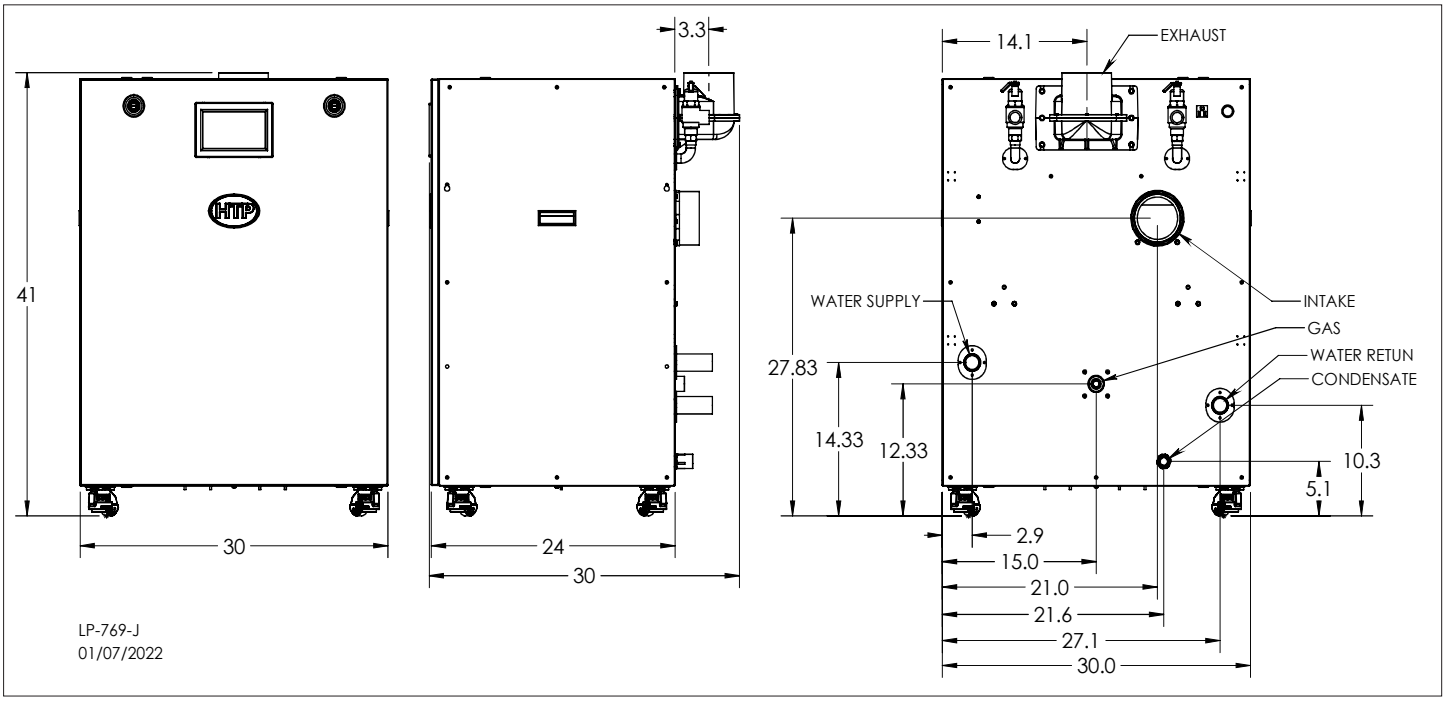


Figure 6 - ELX Specifications and Dimensions - NOTE: All Dimensions Are Approximate - *FOR REFERENCE ONLY

Model	Water Connection	Vent Size	Air Intake	Gas Connection	Condensate
285	1-1/2" COPPER SWT	4"	4"	3/4" NPT	3/4"
301					
399					

Table 4 - ELX Adapter Dimensions and Specifications

J. Technical Specifications

Model		ELUD-285FBN	ELUD-301FBN	ELUD-399FBN
Installation		Indoor, Floor Standing, Fully Condensing		
Minimum / Maximum Input (Btu/Hr)[1]		19,900 / 285,000	19,900 / 301,000	19,900 / 399,000
DOE AFUE / Thermal Efficiency (TE)[2]		95% AFUE	95% TE	95% TE
Heating Capacity (HC) / Gross Output (GO) (MBH)[1, 2]		265 HC	286 GO	379 GO
Net AHRI Rating, Water (MBH)[2]		230	N/A	N/A
Flue System		Category IV, Sealed Combustion Direct Vent, Power Vent		
Min - Max Exhaust Vent Run[3]		4" (10 - 150 feet)		
Min - Max Intake Air Pipe Run[3]		4" (0 - 150 feet)		
Approved Exhaust Vent Materials[3]		PVC, CPVC, PP, Stainless Steel		
Packaging Dimensions (in Inches)	W	35"		
	H	47.5"		
	D	35"		
Shipping Weight (lbs)		355.5		
Gas Supply Pressure	NG	3.5" to 10.5" WC		
	LP	8" to 13" WC		
Manifold Pressure	Min / Max	NG/LP: -0.08" WC		
Power Supply		120V 60 Hz, 20A		
Customer Connection Board Fuse Amperage Ratings		2 Amps		
General Operating Conditions		Ambient Temperature Range: 33 – 104°F (0.6 – 40°C) Product Approvals and Requirements: ANSI Z21.13 / CSA 4.9		
Ignition System		Direct Electronic Spark Ignition / Flame Rectification		
Burner System		Premixed Fuel Modulation / Stainless Steel Burner		
Gas Valve System		Air Ratio Valve		
Dimensions (in Inches)	W	30		
	H	41		
	D	24		
Boiler Water Content (Gallons)		5.4		
Boiler Setpoint Temperature Range		50 – 190°F / 32 - 190°F (with Outdoor Reset Curve)		
DHW Indirect Setpoint Temperature Range		70 – 185°F		
Water Pressure (PSI)	Heat Exchanger MAWP	55		
	Pressure Relief Valve	50		
Control Panel		7" Full Color Touch Screen		
Main Controller		928 SIT Control		
Connection Sizes	Supply / Return	1-1/2" Copper Male Sweat		
	Gas Inlet	3/4" NPT		
Materials	Cabinet	Powder Coated Galvanized Steel		
	Heat Exchanger	Type 441 Stainless Steel Water Tube		
Safety Devices*		Flame Rectifier Probe, Dual Water Supply Temperature Sensor / High Limit (210°F), Freeze Protection, Condensate Trap, Blocked Condensate Pressure Switch, Flue Temperature High Limit Sensor (210°F), Blocked Vent Pressure Switch, Internal UL 353 Low Water Cut-Off, High Resolution Flow Switch, Pressure Relief Valve		

Table 5 - Technical Specifications - *Each heat exchanger features the safety devices listed above.

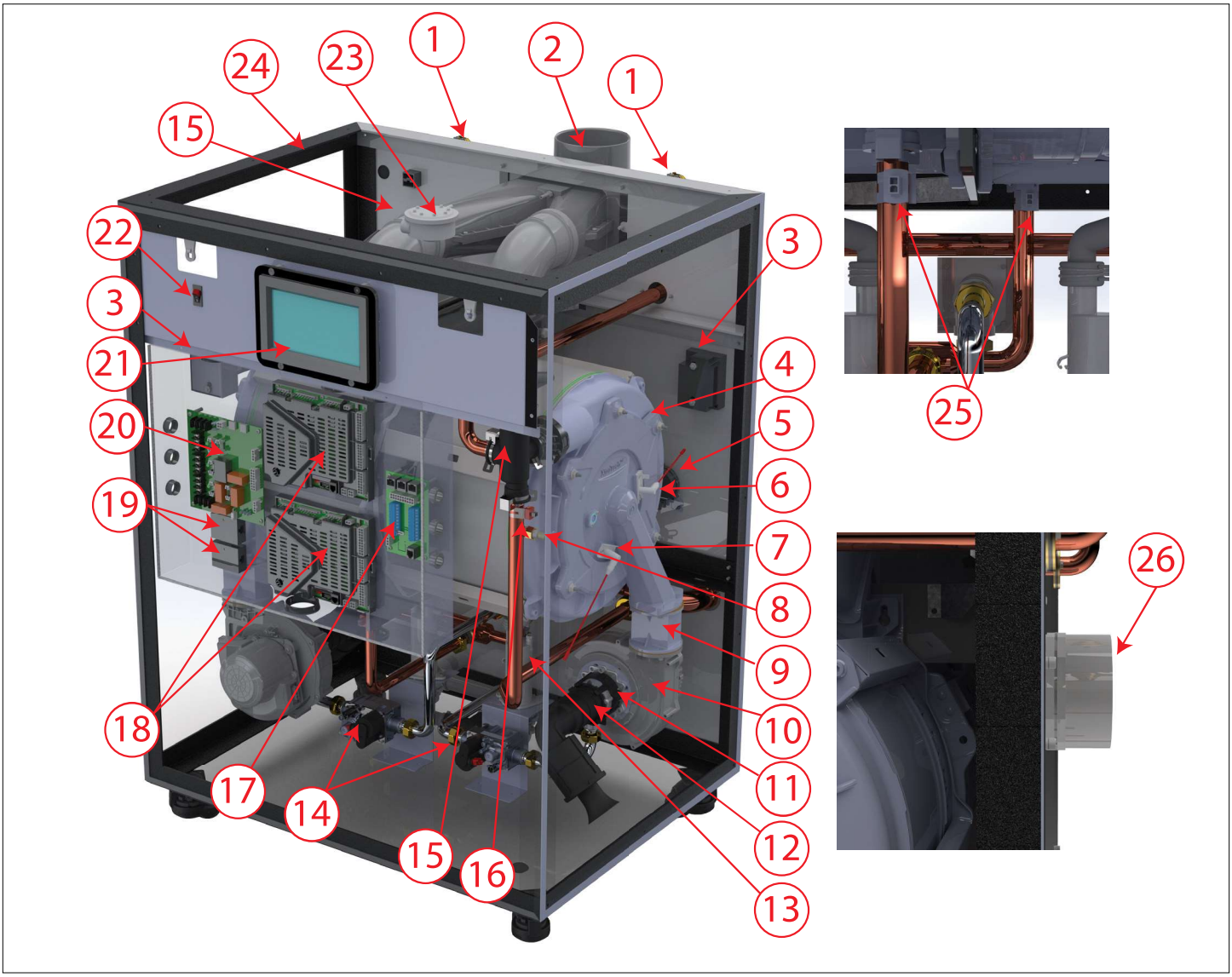
NOTES:

[1]Listed Input and Output Ratings are at minimum vent lengths at an altitude of 0 - 2000 ft. Numbers will be lower with longer venting and/or altitudes greater than 2000 ft.

[2]Ratings based on standard test procedures prescribed by the US Department of Energy.

[3]The ELU Duo requires a special venting system. Use only the vent materials and methods detailed in these installation instructions.

Boiler Components



Number	Description	Number	Description
1	Pressure Relief Valve	14	Gas Valve
2	Exhaust Vent Connection	15	Air Eliminator
3	Spark Generator	16	Dual Supply Sensor
4	Main Heat Exchanger	17	Low Voltage Customer Connection Board
5	Condensate Air Pressure Switch	18	928 Control Board
6	Ignition Electrode	19	WiFi Dongle
7	Flame Detection Electrode	20	High Voltage Customer Connection Board
8	Low Water Cut-Off (LWCO)	21	7" Touchscreen Display
9	Flapper Adapter / Non-Return Valve	22	Power Switch
10	Modulating Fan	23	Vent Air Pressure Switch
11	Air / Gas Mixer	24	Frame
12	Silencer	25	Return Temperature Sensor
13	Condensate Trap	26	Air Intake Connection

Figure 7 - Component Locations and Descriptions

Part 4 - Piping

⚠ WARNING

Failure to follow the instructions in this section WILL VOID the warranty and may result in property damage, severe personal injury, or death.

The National Standard Plumbing Code, the National Plumbing Code of Canada, and the Uniform Plumbing Code limit heat transfer fluid pressure to less than the minimum working pressure of the potable water system up to 30 PSI maximum. In addition, the heat transfer fluid must be water or another non-toxic fluid having a toxicity of Class 1, as listed in Clinical Toxicology of Commercial Products, 5th Edition. Failure to follow this warning could result in property damage, severe personal injury, or death.

CAUTION

Dielectric unions or galvanized steel fittings must not be used in a system with this boiler. Doing so WILL VOID the warranty. Use only copper, brass, or stainless steel fittings. Teflon thread sealant must be used on all connections.

Plumbing of this product should only be done by a qualified, licensed plumber in accordance with all local plumbing codes. The boiler may be connected to an indirect water heater to supply domestic hot water. HTP offers indirect water heaters in either stainless steel or glass-lined construction.

A. General Plumbing Information

CAUTION

The building piping system must meet or exceed the piping requirements in this manual.

The control module uses temperature sensors to provide both high limit protection and modulating temperature control. The control module also provides low water protection by sensing the water level in the heat exchanger. Some codes/jurisdictions may require additional external controls.

Use two wrenches when tightening water piping at boiler. Use one wrench to prevent the boiler return or supply line from turning. Failure to prevent piping connections from turning could cause damage to boiler components.

The water connections must be installed in accordance with all local and national plumbing codes, or any applicable standard which prevails.

- Pipe material must be suitable to meet local codes and industry standards.
- The pipe must be cleaned and without blemish before any connections are made.
- Isolation (shut-off valves) should be used to ease future servicing.
- All piping should be insulated.

It is recommended to install a shut-off valve and a union in the return and supply piping to ease future servicing. If there is a backflow preventer or any type of a no return valve in the system, install an additional tee here suitable for an expansion tank.

NOTE: The addition of a high temperature limiting device is important if the boiler is to be connected to a domestic hot water system.

B. Relief Valve

Connect discharge piping to a safe disposal location by following these guidelines.

⚠ WARNING

Do not thread a cap or plug into the relief valve or relief valve line under any circumstances! Explosion and property damage, serious injury, or death may result.

⚠ WARNING

RE-INSPECTION OF RELIEF VALVES: Valves should be inspected AT LEAST ONCE EVERY THREE YEARS, and replaced if necessary, by a licensed plumbing contractor or qualified service technician to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occuring conditions may corrode the valve and its components over time, rendering the valve inoperative. Such conditions can only be detected if the valve and its components are physically removed and inspected. **Do not attempt to conduct an inspection on your own.** Contact your plumbing contractor for a re-inspection to assure continued safety.

FAILURE TO RE-INSPECT THE RELIEF VALVE AS DIRECTED COULD RESULT IN UNSAFE TEMPERATURE AND/OR PRESSURE BUILD-UP WHICH CAN RESULT IN PROPERTY DAMAGE, SERIOUS PERSONAL INJURY, OR DEATH.

To avoid water damage or scalding due to relief valve operation:

- Discharge line must be connected to relief valve outlet and run to a safe place of disposal. Terminate the discharge line in a manner that will prevent possibility of severe burns or property damage should the relief valve discharge.
- Discharge line must be as short as possible and the same size as the valve discharge connection throughout its entire length.
- Discharge line must pitch downward from the valve and terminate at least 6" above the floor drain, making discharge clearly visible.
- The discharge line shall terminate plain, not threaded, with a material serviceable for temperatures of 375^{O}F or greater.
- Do not pipe discharge to any location where freezing could occur.
- No valve may be installed between the relief valve and boiler or in the discharge line. Do not plug or place any obstruction in the discharge line.
- Test the operation of the relief valve after filling and pressurizing the system by lifting the lever. Make sure the valve discharges freely. If the valve fails to operate correctly, immediately replace with a new properly rated relief valve.
- Test relief valve at least once annually to ensure the waterway is clear. If valve does not operate, turn the boiler "off" and call a plumber immediately.
- Take care whenever operating relief valve to avoid scalding injury or property damage.

FAILURE TO COMPLY WITH THE ABOVE GUIDELINES COULD RESULT IN FAILURE OF RELIEF VALVE OPERATION, RESULTING IN POSSIBILITY OF SUBSTANTIAL PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.

C. Backflow Preventer

Use a backflow preventer specifically designed for hydronic boiler installations. This valve should be installed on the cold water fill supply line per local codes.

CAUTION

All piping methods in this manual use primary / secondary connections to the boiler loop. This is to avoid the possibility of inadequate flow through the boiler. For other piping methods, consult your local HTP representative or refer to Applications in this manual.

D. Expansion Tank

Expansion Tank and Make-Up Water

1. Ensure that the expansion tank is sized to correctly handle boiler and system water volume and temperature.

⚠ WARNING

Expansion tanks must be sized according to total system volume. This includes all length of pipe, all fixtures, boilers, etc. Failure to properly size for system expansion could result in wasted time, money, possible property damage, serious injury, or death.

CAUTION

Undersized expansion tanks cause system water to be lost from the relief valve, causing make-up water to be added. Eventual boiler failure can result due to excessive make-up water addition. **SUCH FAILURE IS NOT COVERED BY WARRANTY.**

DO NOT install automatic air vents on closed type expansion tank systems. Air must remain in the system and return to the tank to provide an air cushion. An automatic air vent would cause air to leave the system, resulting in improper operation of the expansion tank.

Model	Heat Exchanger Volume (Gallons)
285	5.4
301	
399	

Table 6 - Heat Exchanger Volume

2. The expansion tank must be located as shown in Applications, this manual, or following recognized design methods. See expansion tank manufacturer's instructions for details.

3. Connect the expansion tank to the air separator only if the separator is on the suction side of the circulator. Always install the system fill connection at the same point as the expansion tank connection to the system.

4. Most chilled water systems are piped using a closed type expansion tank.

Diaphragm (or Bladder) Expansion Tank

Always install an automatic air vent on top of the air separator to remove residual air from the system.

E. Circulators

CAUTION

DO NOT use the boiler circulator in any location other than the ones shown in this manual. The boiler circulator location is selected to ensure adequate flow through the boiler. Failure to comply with this caution could result in unreliable performance and nuisance shutdowns from insufficient flow.

SIZING SPACE HEAT SYSTEM PIPING

Size the piping and components in the space heating system using recognized design methods.

Number of Units and Recommended Common Header Pipe Sizes in Inches			
Number of Units	**2**	**3**	**4**
Pipe Size	3	3	4

Table 7 - Multiple Boiler Manifold Piping - NOTE: Table based on water velocity less than Five (5) feet per second.

F. Hydronic Piping with Circulators, Zone Valves, and Multiple Boilers

The boiler is designed to function in a closed loop hydronic system. The included temperature and pressure gauge allows the user to monitor system pressure and outlet temperature from the boiler. It is important to note that the boiler has a minimal amount of pressure drop that must be calculated when sizing the circulators. Each boiler installation must have an air elimination device that will remove air from the system.

Install the boiler so the gas ignition system components are protected from water (dripping, spraying, etc.). Allow clearance for basic service of the boiler circulator, valves, and other components. Observe minimum 1" clearance around all uninsulated hot water pipes when openings around pipes are not protected by non-combustible materials.

On a boiler installed above radiation level, some states and local codes require a low water cut off device. This is provided standard on the boiler. Check with local codes for additional requirements. If the boiler supplies hot water to heating coils in air handler units, flow control valves or other devices must be installed to prevent gravity circulation of boiler water in the coils during the cooling cycle. Chilled water medium must be piped in parallel with the boiler.

Freeze protection for new or existing systems must use glycol specifically formulated for this purpose. This glycol must include inhibitors that will prevent it from attacking metallic system components. Make certain that the system fluid is checked for the correct glycol concentration and inhibitor level. The system should be tested at least once a year and as recommended by the producer of the glycol solution. Allowance should be made for the expansion of the glycol solution in the system piping. Example: 50% by volume glycol solution expands 4.8% in volume for the temperature increase from 32°F to 180°F, while water expands 3% over the same temperature rise.

CAUTION

Never use dielectric unions or galvanized steel fittings when connecting to a stainless steel storage tank or boiler. Failure to follow this instruction can lead to premature failure of the boiler system. Such failures ARE NOT covered by warranty.

The boiler should not be operated as a potable hot water heater. The boiler should not be used as a direct hot water heating device.

Use at least the MINIMUM pipe size for all appliance loop piping. This is to avoid the possibility of inadequate flow through the appliance. Using less than the required minimum pipe size and piping could result in system problems, property damage, and premature appliance failure. Such problems ARE NOT covered by product warranty.

H. Check / Control Water Chemistry

NOTE: Boiler failure due to improper water chemistry is not covered by warranty.

- **Water pH between 6.5 and 8.5**
- **Hardness between 5 and 12 grains (71.3 and 205 mg/L)**
- **Chloride concentration less than 150 ppm (mg/L)**
- **Total Dissolved Solids (TDS) between 100 and 450 ppm (mg/L)**

***NOTE:** It is recommended to clean the heat exchanger at least once a year to prevent lime scale buildup. To clean the heat exchanger, follow the maintenance procedure in this manual.

Clean system to remove sediment*

1. You must thoroughly flush the system (without boiler connected) to remove sediment. The high-efficiency heat exchanger can be damaged by buildup or corrosion due to sediment.

2. For zoned systems, flush each zone separately through a purge valve. (If purge valves and isolation valves are not already installed, install them to properly clean the system.)

3. Flush system until water runs clean and you are sure piping is free of sediment.

***NOTE:** It is recommended you clean heat exchanger at least once a year to prevent lime scale buildup. Follow the maintenance procedure to clean the heat exchanger in the Maintenance Section of this manual.

Test/replace freeze protection fluid

1. For systems using freeze protection fluids, follow fluid manufacturer's instructions to verify inhibitor level and that other fluid characteristics are satisfactory.

2. Freeze protection fluid must be replaced periodically due to degradation of inhibitors over time. Follow all fluid manufacturer instructions.

I. Plumbing

Piping Components

Heating System Piping

System piping MUST meet the technical pipe requirements listed in Tables 7 and 8. Reducing pipe size can restrict flow rate through the boiler, causing inadvertent short cycling and poor system performance.

Check Valves

Field supplied. Check valves are recommended for installation as shown in Applications.

Isolation Valves

Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the boiler.

Anti-Scald Mixing Valve

Field supplied. An anti-scald mixing valve is recommended when storing domestic hot water above 115°F.

Steel Flanges

Field supplied. Recommended for unit serviceability.

Pressure Relief Valve

Factory supplied on boiler. The pressure relief valve is sized to ASME specifications. Storage tank may require additional relief valves depending on local codes.

CAUTION

This boiler should not be operated as a potable hot water heater. It should not be used as a direct hot water heating device.

Basic steps are listed below that will guide the installation of the boiler.

1. Connect the system return marked "Inlet".
2. Connect the system supply marked "Outlet".
3. Install purge and balance valve or shut off valve and drain on system return to purge air out of each zone.
4. Install a back flow preventer on the cold feed make-up water line.
5. Install a pressure reducing valve on the cold feed make-up water line (15 PSI nominal on the system return). Check temperature and pressure gauge when operating. It should read a minimum pressure of 12 PSI.
6. Install a circulator as shown in piping details (this section). Make sure the circulator is properly sized for the system and friction loss.
7. Install an expansion tank on the system supply. Consult the tank manufacturer's instructions for specific information relating to expansion tank installation. Size the expansion tank for the required system volume and capacity.
8. Install an air elimination device on the system supply.
9. The relief valve is installed at the factory. A pipe discharge line should be installed to discharge 6" above the drain in the event of pressure relief. The pipe size must be the same size as the relief valve outlet. **NEVER BLOCK THE OUTLET OF THE SAFETY RELIEF VALVE.**

Minimum Water Pipe Size	
All Models	**Size**
	1-1/2"

Table 8 - Minimum Pipe Size

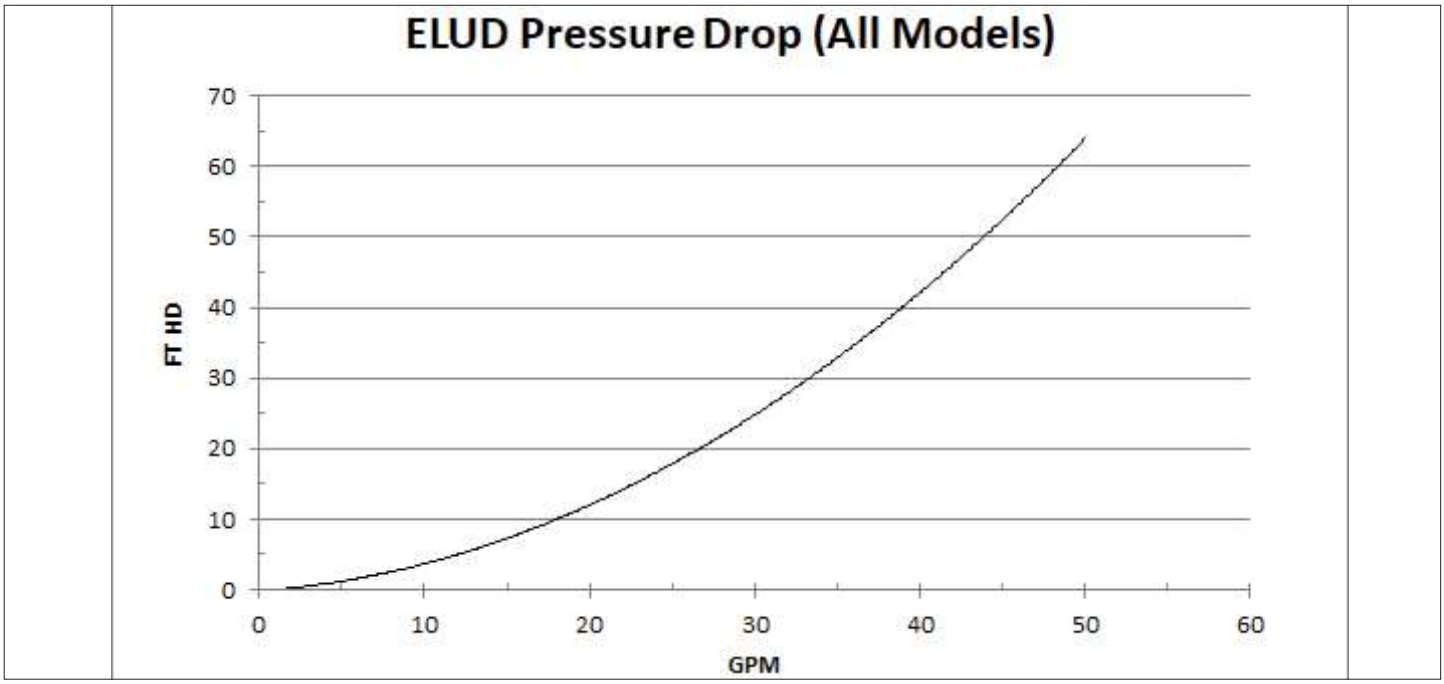


Figure 8 - Boiler Pressure Drop

Model	20°FΔt		25°FΔt		30°FΔt	
	Flow Rate GPM	Ft / Hd	Flow Rate GPM	Ft / Hd	Flow Rate GPM	Ft / Hd
285	28	22	23	15	19	11
301	30	25	24	17	20	12
399	38	38	32	28	27	21

Table 9 - Pressure Drop at Various Temperature Rises

J. Fill and Purge Heating System

- Attach the hose to balance and purge hose connector or drain valve and run hose to nearest drain.
- Close the other side of the balance and purge valve or the shut off valve after the drain.
- Open first zone balance and purge or drain valve to let water flow out the hose. If zone valves are used, open the valves one at a time manually. (NOTE: You should check the valve manufacturer's instructions prior to opening valves manually, so as not to damage the valves.)
- Manually operate fill valve regulator. When water runs out of the hose, you will see a steady stream of water (without bubbles). Close balance and purge valve or drain to stop the water from flowing. Disconnect the hose and connect it to next zone to be purged.
- Repeat this procedure for additional zones (one at a time).

CAUTION

For installation that incorporates standing iron radiation and systems with manual vents at the high points, follow previous section and, starting with the nearest manual air vent, open until water flows out. Then close vent. Repeat procedure, working your way toward the furthest air vent. It may be necessary to install a basket or magnetic strainer in an older system where larger amounts of sediment may be present. Annual cleaning of the strainer may be necessary.

Upon completion, make sure that the fill valve is in the automatic position and each zone balance and purge or shut off is in an open position and zone valves are positioned for automatic operation.

K. Freeze Protection Fluids

CAUTION

Use only inhibited glycol solutions which are specially formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems. Glycol mixtures should not exceed 50%.

1. Glycol in hydronic applications is specially formulated for this purpose, and includes inhibitors that prevent the glycol from attacking metallic system components. Make certain that the system fluid is checked for the correct glycol concentration and inhibitor level.
2. The glycol solution should be tested at least once a year and as recommended by the glycol manufacturer.
3. Anti-freeze solutions expand more than water. For example: A 50% by volume solution expands 4.8% in volume for a temperature increase from 32°F to 180°F, while water increases 3% over the same temperature rise. Allowances must be made for this expansion in the system design.
4. A 30% mixture of glycol will result in a BTU output loss of 15% with a 5% increase in head against the system circulator.
5. A 50% mixture of glycol will result in a BTU output loss of 30% with a 50% increase in head against the system circulator.

CAUTION

It is highly recommended that you carefully follow the glycol manufacturer's recommended concentrations, expansion requirements, and maintenance recommendations (pH additive breakdown, inhibitor reduction, etc.). Carefully figure the additional friction loss in the system as well as the reduction in heat transfer coefficients.

L. Zoning with Zone Valves

1. When zoning with zone valves, connect the boiler to the system as shown in Applications. The primary/secondary piping shown ensures the boiler loop will have sufficient flow. It also avoids applying the high head of the boiler circulator to the zone valves.
2. Connect DHW (domestic hot water) piping to indirect storage water heater as shown in Applications.

M. Zoning with Circulators

1. When using circulator zoning, connect the boiler to the system as shown in Applications. NOTE: The boiler circulator cannot be used for a zone. It must only supply the boiler loop.
2. Install a separate circulator for each zone.
3. Connect DHW (domestic hot water) piping to indirect storage water heater as shown in Applications.

N. Multiple Boilers

1. Connect multiple boilers as shown in Applications.
2. All piping shown is reverse return to assure balanced flow throughout the connected boilers.
3. Each connected boiler must have its own circulator pump to assure adequate flow.
4. Connect DHW (domestic hot water) piping to indirect storage water heater as shown in Applications.
5. The system flow (secondary loop) must be greater than the boiler's primary loop flow.

O. Applications*

CAUTION

In mixed temperature applications, a mixing valve is required for the protection of low temperature loops.

LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	central air seperator		isolation valve		check valve		pressure & temperature valve
	temp/press guage		circulator w/ isolation flanges		union		auto air vent
	expansion tank		pressure reducing valve		strainer		zone load
	backflow preventor		pressure relief valve		zone valve		drain valve

Figure 9 - Piping Symbol Legend

***NOTE:** Systems shown are primary/secondary piping systems. These recommended systems have a primary (boiler) loop, and secondary circuits for heating. The primary loop and secondary circuits have separate circulators. The use of other near boiler piping configurations could result in improper flow rates, leading to inadvertent boiler high limit shutdowns and poor system performance.

NOTE: In piping applications utilizing a single zone, it is recommended that the installer use flow / check valves with weighted seats at or near the appliance to prevent gravity circulation.

FIGURE NOTES:

1. This drawing is meant to demonstrate system piping concept only.
2. A mixing valve is recommended if the DHW temperature is set above the factory setting of 119ºF.
3. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
4. Install a minimum of 6 diameters of straight pipe up and downstream of all closely spaced tees.
5. Piping shown is Primary/ Secondary.
6. The minimum pipe size for connecting an HTP indirect fired water heater is 1".
7. DO NOT down size the boiler heating loop connections.
8. System flow (Secondary Loop) must be greater than the boiler's Primary Loop flow.
9. Installations must comply with all local codes.
10. In Massachusetts, a vacuum relief valve must be installed on the cold water line per 248 CMR.
11. See Multiple Boiler Manifold Piping chart, this manual, when sizing and installing a multiple boiler system.

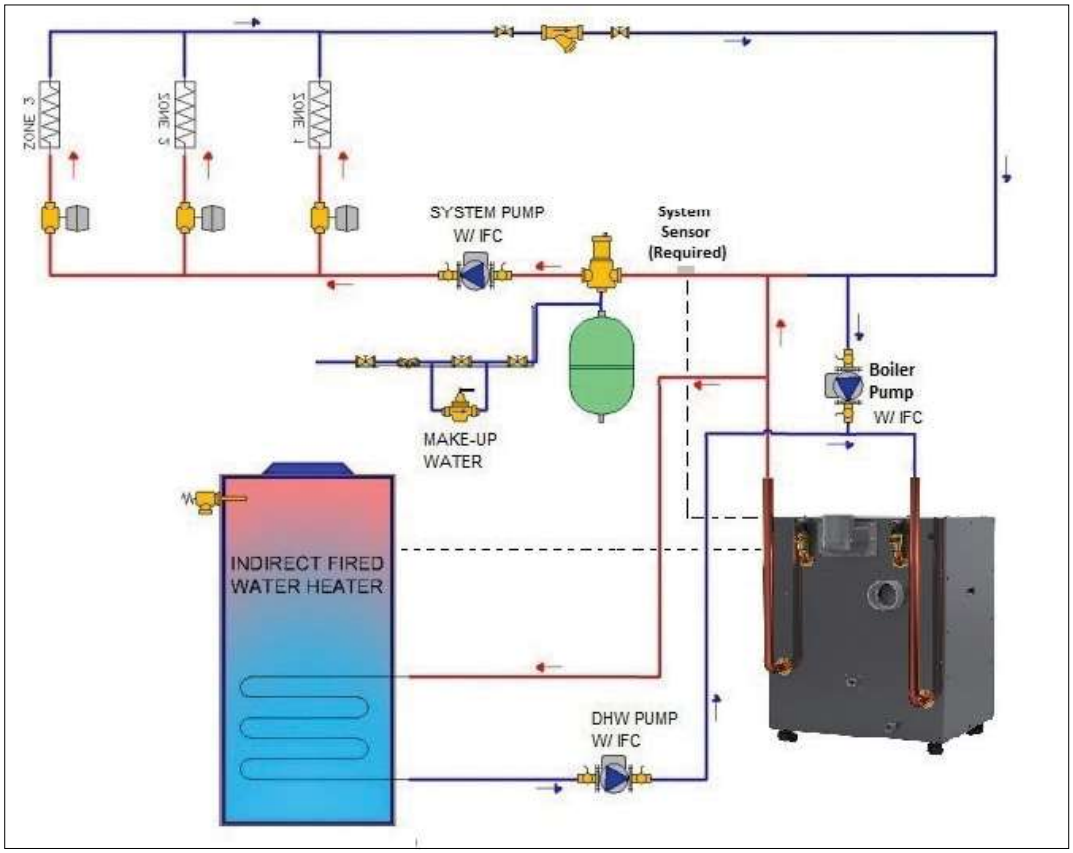


Figure 10 - Single Boiler Space Heating with Indirect Priority and Zone Valves - See Figure Notes.

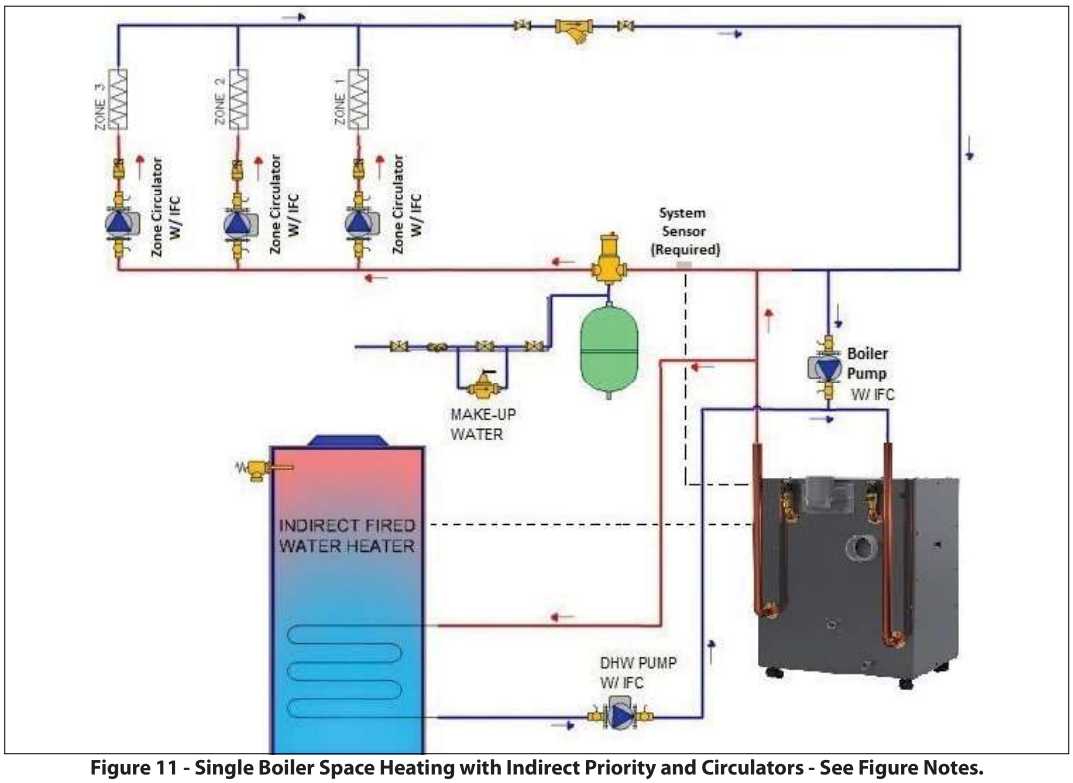


Figure 11 - Single Boiler Space Heating with Indirect Priority and Circulators - See Figure Notes.

⚠ WARNING

An ASSE 1017 thermostatic mixing valve is recommended on all indirect water heaters if the hot water temperature leaving the heater is above 119°F. Failure to do so could result in substantial property damage, serious injury, or death.

⚠ WARNING

The piping will not support the weight of the circulators. Refer to the circulator manufacturer's instructions to properly support the circulator. Failure to comply with these instructions could result in property damage, severe personal injury, or death.

***NOTE:** Systems shown are primary/secondary piping systems. These recommended systems have a primary (boiler) loop, and secondary circuits for heating. The primary loop and secondary circuits have separate circulators. The use of other near boiler piping configurations could result in improper flow rates, leading to inadvertent boiler high limit shutdowns and poor system performance.

NOTE: In piping applications utilizing a single zone, it is recommended that the installer use flow / check valves with weighted seats at or near the appliance to prevent gravity circulation.

FIGURE NOTES:

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4. Install a minimum of 6 diameters of straight pipe up and downstream of all closely spaced tees.
5. Piping shown is Primary/ Secondary.
6. The minimum pipe size for connecting an HTP indirect fired water heater is 1".
7. DO NOT down size the boiler heating loop connections.
8. System flow (Secondary Loop) must be greater than the boiler's Primary Loop flow.
9. Installations must comply with all local codes.
10. In Massachusetts, a vacuum relief valve must be installed on the cold water line per 248 CMR.
11. See Multiple Boiler Manifold Piping chart, this manual, when sizing and installing a multiple boiler system.

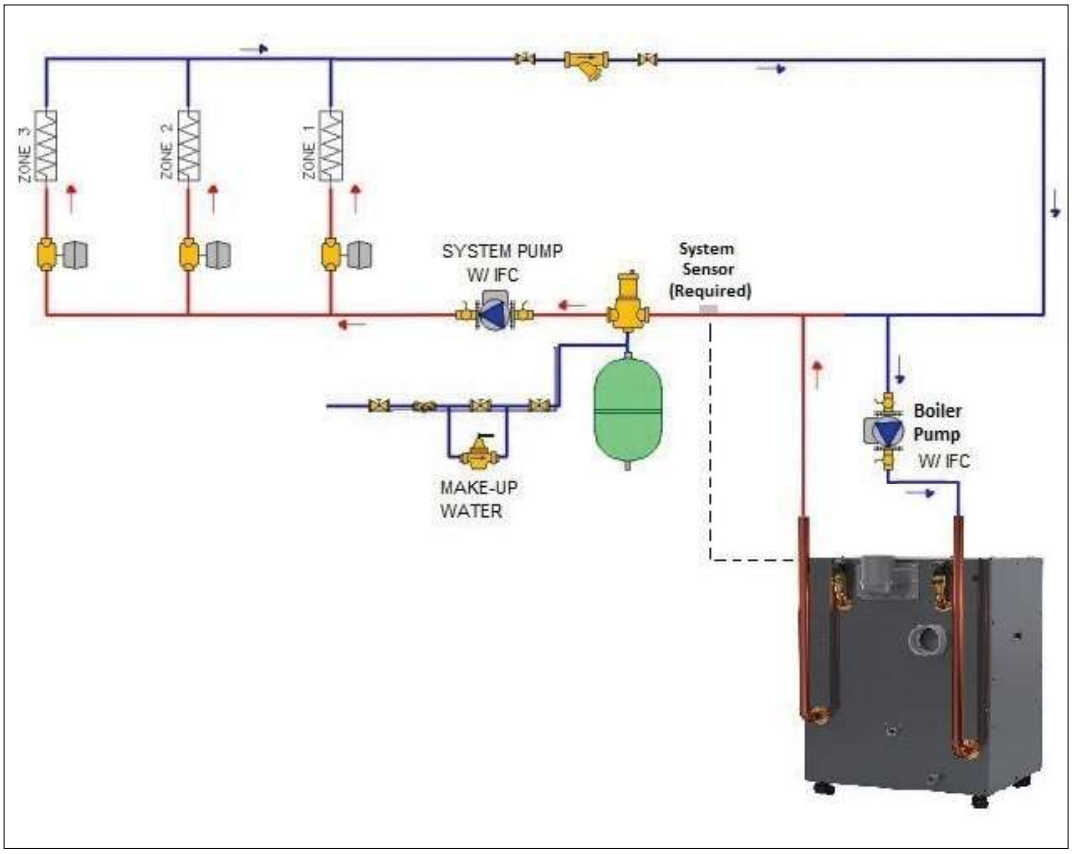


Figure 12 - Single Boiler Space Heating with Zone Valves - See Figure Notes.

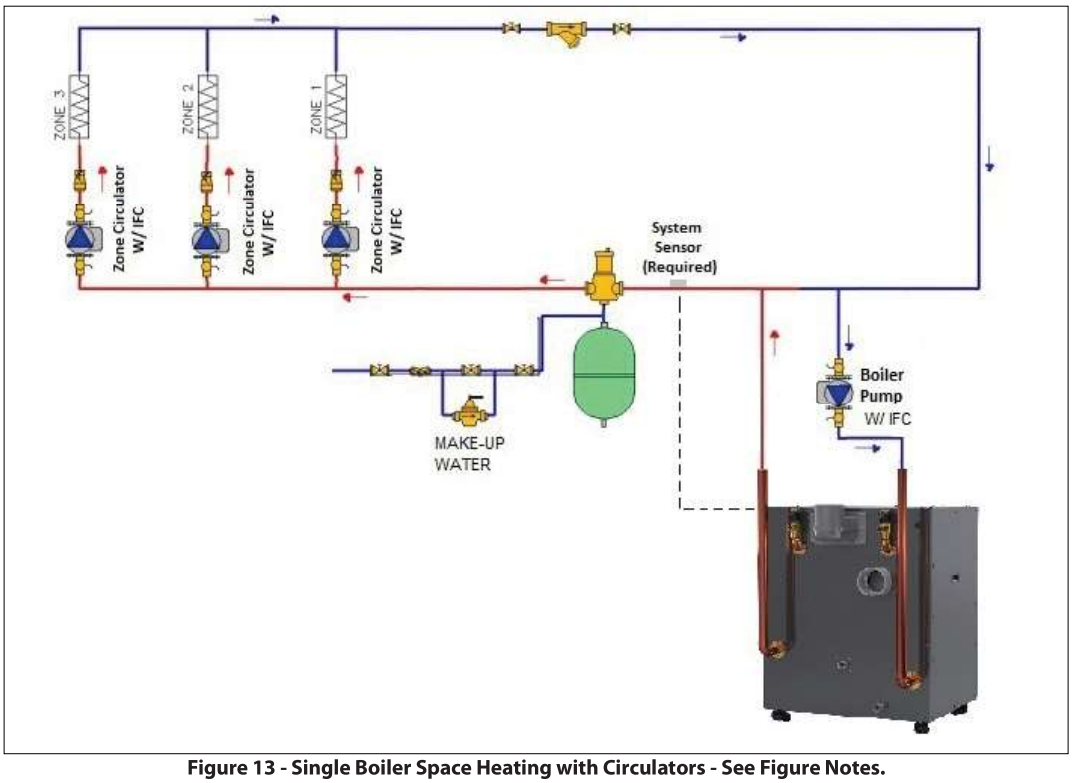


Figure 13 - Single Boiler Space Heating with Circulators - See Figure Notes.

⚠ WARNING

An ASSE 1017 thermostatic mixing valve is recommended on all indirect water heaters if the hot water temperature leaving the heater is above 119°F. Failure to do so could result in substantial property damage, serious injury, or death.

⚠ WARNING

The piping will not support the weight of the circulators. Refer to the circulator manufacturer's instructions to properly support the circulator. Failure to comply with these instructions could result in property damage, severe personal injury, or death.

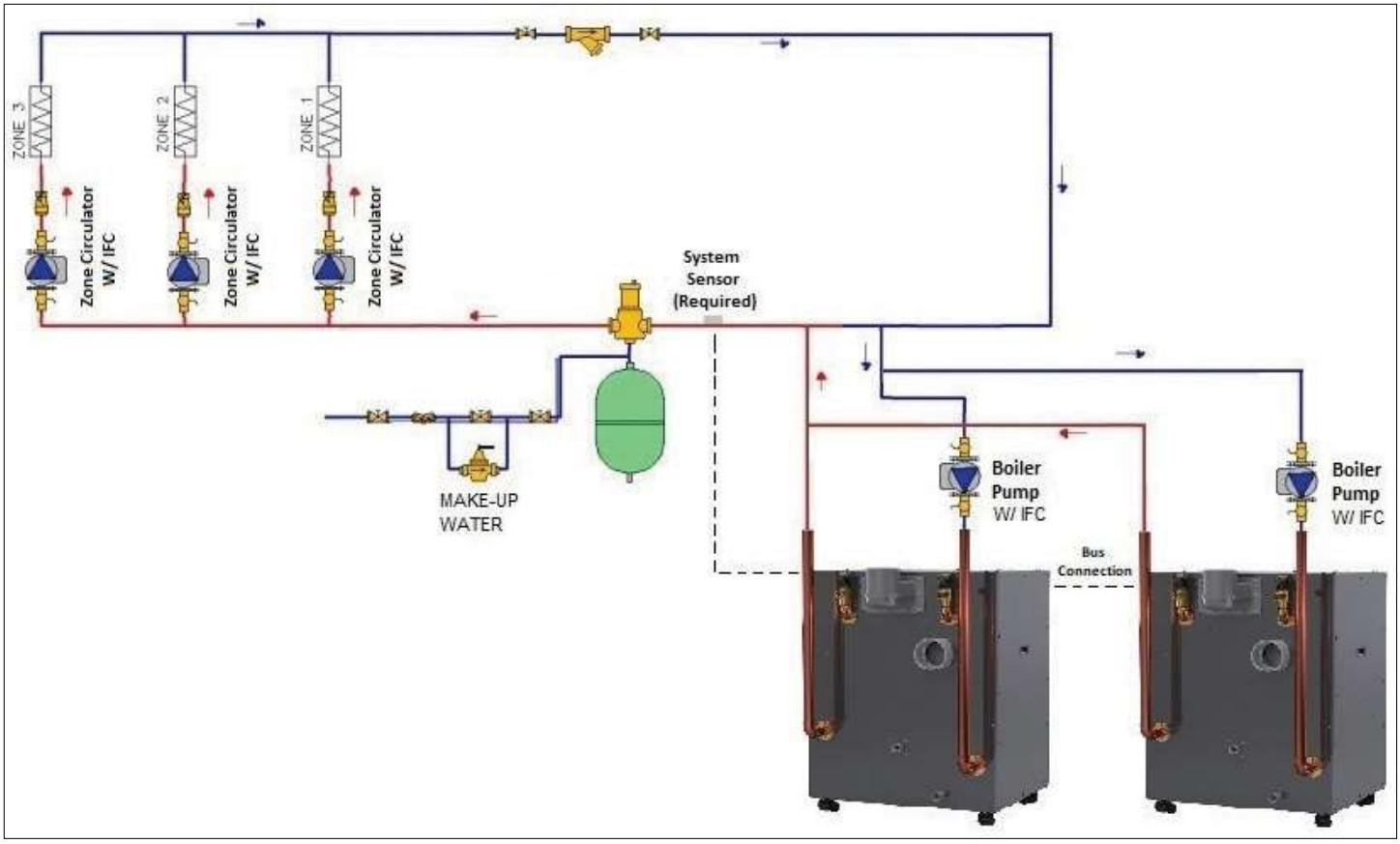


Figure 14 - Cascaded Boilers with Circulators - See Figure Notes.

***NOTE:** Systems shown are primary/secondary piping systems. These recommended systems have a primary (boiler) loop, and secondary circuits for heating. The primary loop and secondary circuits have separate circulators. The use of other near boiler piping configurations could result in improper flow rates, leading to inadvertent boiler high limit shutdowns and poor system performance.

NOTE: In piping applications utilizing a single zone, it is recommended that the installer use flow / check valves with weighted seats at or near the appliance to prevent gravity circulation.

FIGURE NOTES:

1. This drawing is meant to demonstrate system piping concept only.
2. A mixing valve is recommended if the DHW temperature is set above the factory setting of 119ºF.
3. Install a minimum of 12 diameters of straight pipe upstream of all circulators.
4. Install a minimum of 6 diameters of straight pipe up and downstream of all closely spaced tees.
5. Piping shown is Primary/Secondary.
6. The minimum pipe size for connecting an HTP indirect fired water heater is 1".
7. DO NOT down size the boiler heating loop connections.
8. System flow (Secondary Loop) must be greater than the boiler's Primary Loop flow.
9. Installations must comply with all local codes.
10. In Massachusetts, a vacuum relief valve must be installed on the cold water line per 248 CMR.
11. See Multiple Boiler Manifold Piping chart, this manual, when sizing and installing a multiple boiler system.

⚠ WARNING

An ASSE 1017 thermostatic mixing valve is recommended on all indirect water heaters if the hot water temperature leaving the heater is above 119°F. Failure to do so could result in substantial property damage, serious injury, or death.

The piping will not support the weight of the circulators. Refer to the circulator manufacturer's instructions to properly support the circulator. Failure to comply with these instructions could result in property damage, severe personal injury, or death.

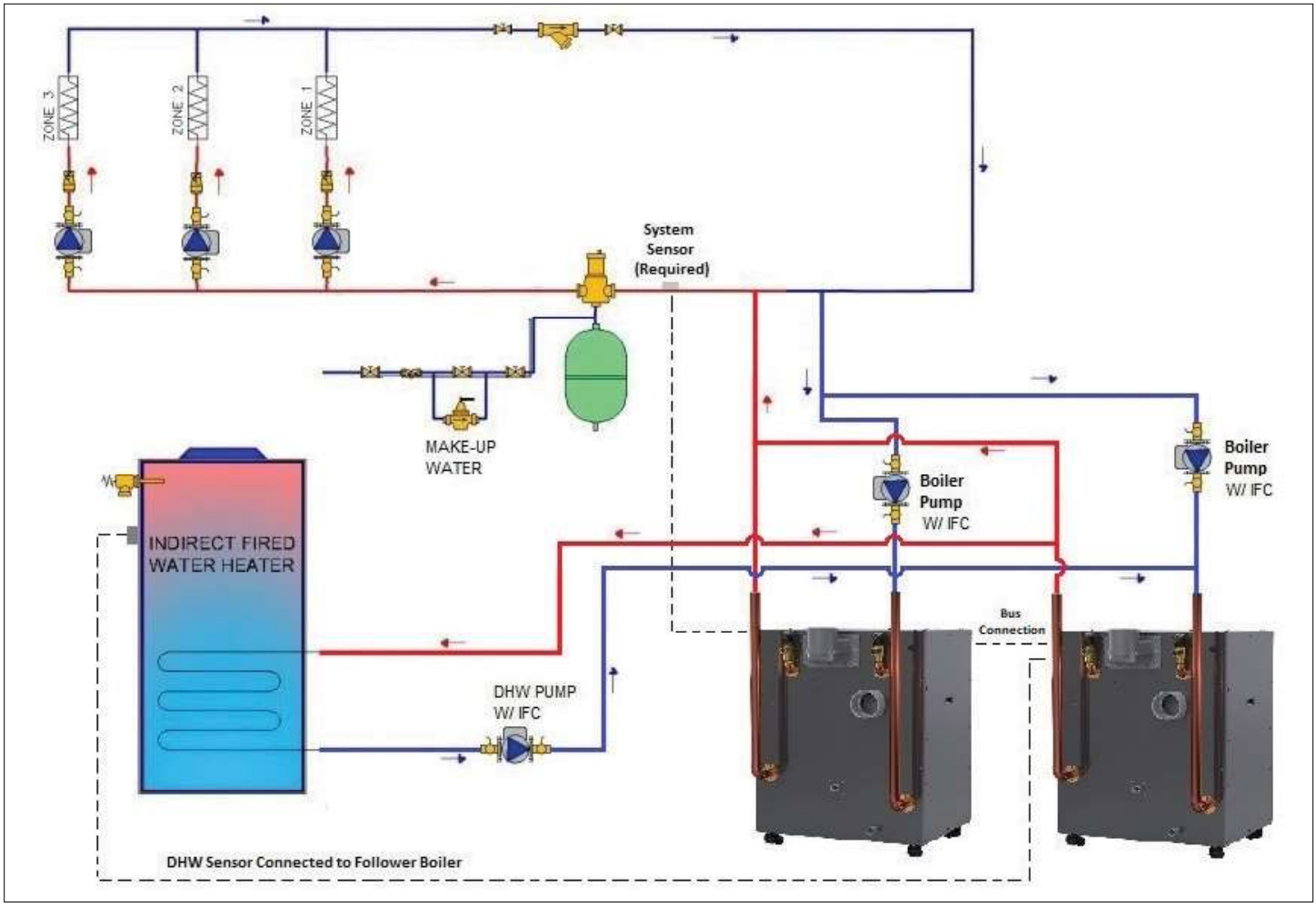


Figure 15 - Cascaded Boilers with Circulators - See Figure Notes.

***NOTE:** Systems shown are primary/secondary piping systems. These recommended systems have a primary (boiler) loop, and secondary circuits for heating. The primary loop and secondary circuits have separate circulators. The use of other near boiler piping configurations could result in improper flow rates, leading to inadvertent boiler high limit shutdowns and poor system performance.

NOTE: In piping applications utilizing a single zone, it is recommended that the installer use flow / check valves with weighted seats at or near the appliance to prevent gravity circulation.

FIGURE NOTES:

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Part 5 - Venting

DANGER

The boiler must be vented as detailed in this section. Ensure exhaust vent and intake piping complies with these instructions regarding vent system. Inspect finished exhaust vent and intake piping thoroughly to ensure all joints are well secured, airtight, and comply with all applicable code requirements, as well as the instructions provided in this manual. Failure to properly install the vent system will result in severe personal injury or death.

A. General

DANGER

This boiler is certified as a "Category IV" appliance and requires a special venting system. The vent system will operate with a positive pressure in the pipe. Exhaust gases must be piped directly outdoors using the vent materials and rules outlined in these instructions. Do not connect vent connectors serving appliances vented by natural draft into any portion of mechanical draft systems operating under positive pressure. Follow the venting instructions carefully. Failure to do so will result in substantial property damage, severe personal injury, or death.

1. Installation should be made in accordance with the regulations of the Authority Having Jurisdiction, local code authorities, and utility companies which pertain to this type of water heating equipment.
2. Install the venting system in accordance with these instructions and with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, CAN/CGA B149, and / or applicable provisions of local building codes.
3. This boiler must be vented with materials, components, and systems listed and approved for Category IV appliances.

DANGER

Exhaust and intake are to be piped separately.

Failure to follow these instructions will result in substantial property damage, severe personal injury, or death.

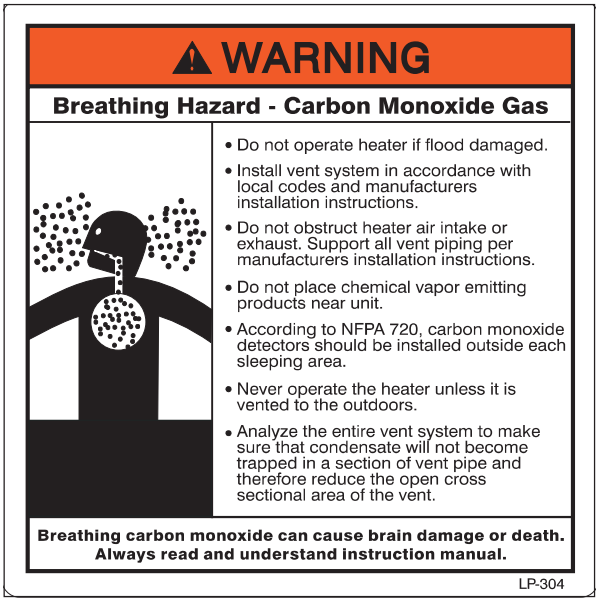
NOTE: To avoid contamination often contained in indoor air, it is best to pipe all intake combustion air directly to the outdoors.
NOTE: Care must be taken to prevent condensate freezing in the exhaust vent pipe system. See local, state, provincial, and national codes for best practices to prevent condensate freezing in the exhaust vent pipe system.

WARNING

Improper seating of vent pipe gaskets can cause eventual gasket failure and exhaust gas leakage. Ensure the exhaust vent pipe is properly beveled and seated before insertion into the flue adapter. Failure to do so could result in property damage, severe personal injury, or death.

Exhaust vent adaptors are not designed as load-bearing devices, and must not be used to support exhaust vent piping. All vent pipes must be properly connected, supported, and the exhaust vent must be pitched a minimum of 1/4" per foot back to the boiler to allow drainage of condensate. Failure to properly support vent piping and follow the information in this statement could result in product damage, severe personal injury, or death.

Vents must be properly supported. Boiler exhaust and intake connections are not designed to carry heavy weight. Vent support brackets must be within 1' of the boiler and the balance at 4' intervals. Boiler must be readily accessible for visual inspection for first 3' from the boiler. Failure to properly support vents could result in property damage, severe personal injury, or death.

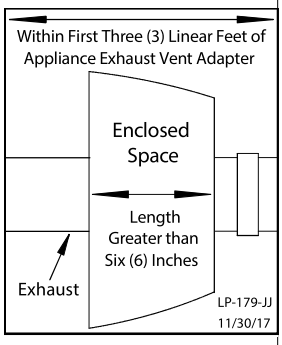


DANGER

Due to the extreme flammability of most glues, cements, solvents, and primers used to join plastic exhaust vent and intake pipes, explosive solvent vapors must be cleared from all vent piping before start-up. Avoid using excess cement or primer, as this may pool in the vent pipes. Vent assemblies should be allowed to cure for a period of at least 8 hours before powering a connected appliance. Failure to follow these instructions will result in substantial property damage, severe personal injury, or death. It is the installers' responsibility to understand the hazards associated with explosive solvents and take the necessary precautions to avoid these risks.

WARNING

- Only Stainless Steel exhaust vent pipe material may be insulated.
- DO NOT insulate the first three (3) linear feet of the exhaust vent run.
- DO NOT insulate PVC, CPVC, or Polypropylene exhaust vent pipe material. Doing so will cause increased vent wall temperatures, which could result in vent pipe failure.
- CPVC, Polypropylene, or Stainless Steel pipe material MUST be used if the first three (3) linear feet of the exhaust vent run passes through an enclosed space greater than 6" in length, such as a wall or ceiling.*



- If CPVC is used to meet these requirements, the balance may be installed with approved PVC pipe.
- If Polypropylene or Stainless Steel is used to meet these requirements, the balance of the vent run MUST be installed with the same material.
- Failure to comply with these requirements could result in property damage, severe personal injury, or death.

*This rule applies when the exhaust vent passes through the enclosed space into another interior space, i.e. through a floor or wall from the mechanical room into another room. This rule DOES NOT apply when the exhaust vent passes through the enclosed space immediately to the exterior of the building.

B. Approved Materials for Exhaust Vent and Intake Pipe

Item	Material	Standards for Installation In:	
		United States	Canada
Pipe and Fittings Approved for Intake ONLY	ABS*	ANSI/ASTM D2661	ANSI/ASTM D2661
Pipe Approved for Intake OR Exhaust Vent	PVC Schedule 40/80	UL-1738 or ANSI/ASTM D1785	UL-1738 or ULC-S636
	PVC-DWV Schedule 40/80	UL-1738 or ANSI/ASTM D2665	
	CPVC Schedule 40/80	UL-1738 or ANSI/ASTM F441	
	Polypropylene	UL-1738 or ULC-S636	
	Stainless Steel AL29-4C	Certified for Category IV and Direct Vent Appliance Venting	
Pipe Fittings	PVC Schedule 40	UL-1738, ANSI/ASTM D2466 or D2665	UL-1738 or ULC-S636
	PVC Schedule 80	UL-1738, ANSI/ASTM D2467 or D2665	
	CPVC Schedule 40	UL-1738 or ANSI/ASTM F438	
	CPVC Schedule 80	UL-1738 or ANSI/ASTM F439	
Pipe Cement	ABS*	ANSI/ASTM D2235	ANSI/ASTM D2235
	PVC	ANSI/ASTM D2564	IPEX System 636 Cements and Primers
	CPVC	ANSI/ASTM F493	
Pipe Primer	PVC / CPVC	ASTM F656	

⚠ DANGER

- The exhaust and intake components installed with this appliance must be used for near appliance piping BEFORE transitioning to the approved materials listed above. DO NOT REMOVE these installed components. Doing so WILL VOID appliance warranty.
- In the US/Canada, PVC vent pipe and fittings SHALL NOT BE USED within the closet or alcove. Only approved CPVC, Polypropylene, or Stainless Steel vent pipe and fittings may be used.
- PVC / CPVC pipe and fittings of the same diameter are considered interchangeable.
- The use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) in exhaust venting systems is prohibited.
- Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.
- When installing AL29-4C vent piping, DO NOT mix AL29-4C piping from different manufacturers unless using adapters specifically designed for the purpose by the manufacturer.
- DO NOT mix components from different venting systems without proper adapters. The vent system could fail, causing leakage of flue products into the living space. Use only the approved pipe and fitting materials, and primer and cement specifically designed for the material used, as listed in the above table.
- A double wall vent or insulated material may be used when using stainless steel vent material in a freezing climate.
- *ABS may be used for air intake applications ONLY.
- Contact the venting material manufacturer if there is any question about the applicability of the proposed venting material.

Failure to follow these directions will result in substantial property damage, severe personal injury, or death.

Table 10 - Approved Materials for Exhaust Vent and Intake Pipe

⚠ WARNING

DO NOT mix components from different venting systems without proper adapters. The vent system could fail, causing leakage of flue products into the living space. Use only the approved pipe and fitting materials, and primer and cement specifically designed for the material used, as listed in the above table. Failure to do so could result in property damage, serious injury, or death.

CAUTION

High heat sources (generating heat 100°F / 37°C or greater, such as boiler flue pipes, space heaters, etc.) may damage plastic components of the boiler as well as plastic vent pipe materials. Such damages ARE NOT covered by warranty. It is recommended to keep a minimum clearance of 8" from high heat sources. Observe heat source manufacturer instructions, as well as local, state, provincial, and national codes, laws, regulations, and ordinances when installing this boiler and related components near high heat sources.

⚠ DANGER

You must not use "B" vent in an exhaust application. "B" vent is for intake applications ONLY. Using "B" vent in an exhaust application will result in serious injury or death.

C. Additional Requirements for Installation in Canada

1. Installations must be made with a vent pipe system certified to ULC-S636.
2. The first three (3) feet of vent pipe from the boiler flue outlet must be readily accessible for visual inspection.
3. The components of the certified vent system must not be interchanged with other vent systems or unlisted pipe / fittings.

⚠ WARNING

It is required to insert exhaust and intake screens into the vent terminations to prevent blockage caused by debris or birds. Failure to keep terminations clear could result in property damage, severe personal injury, or death.

D. Exhaust Vent and Intake Pipe Location

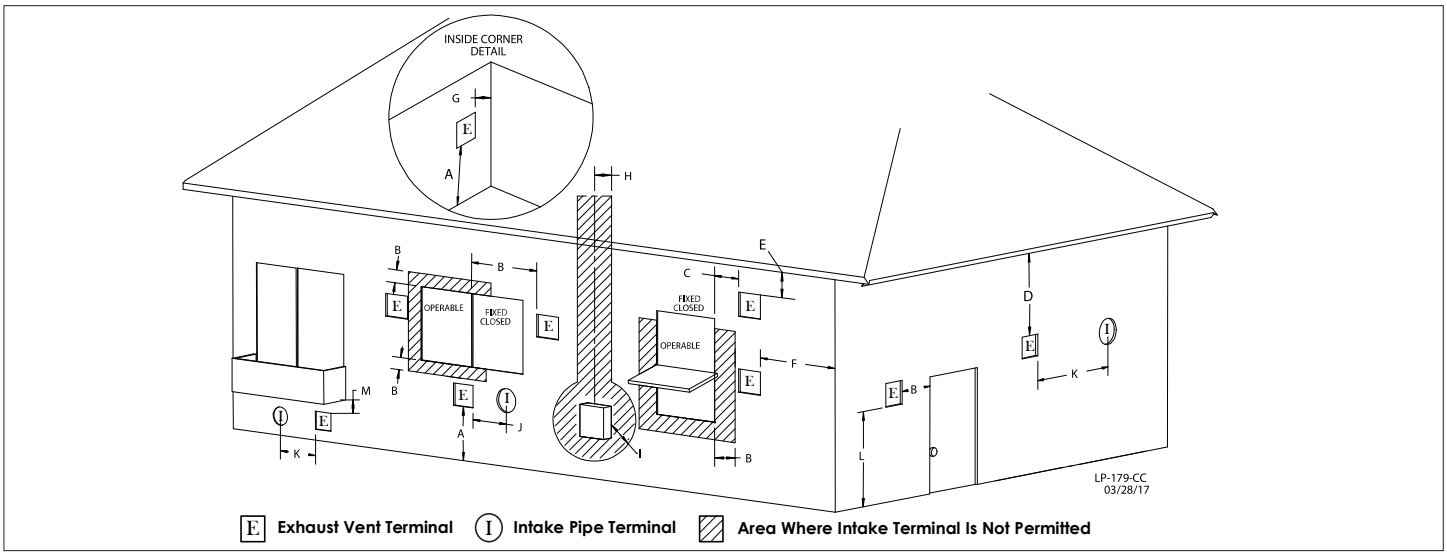


Figure 16 - Exit Terminals for Direct Vent Systems - ANSI Z223.1 / NFPA 54 for US and CAN/CSA B149.1 for Canada

	DESCRIPTION		US	CANADA
A	Clearance above grade, veranda, porch, deck, or balcony		1 foot (30 cm)	
B	Clearance to window or door that may be opened	Direct Vent	1 foot	3 feet (91 cm)
		Power Vent	4 ft below or to side of opening; 1 ft above opening	
C	Clearance to permanently closed window		*	
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance 2 feet (61 cm) from the center line of the terminal		*	
E	Clearance to unventilated soffit		*	
F	Clearance to outside corner		*	
G	Clearance to inside corner		*	
H	Clearance to each side of center line extended above meter / regulator assembly		*	
I	Clearance to service regulator vent outlet		*	Above a regulator within 3 feet (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)
J	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	Direct Vent	1 foot	3 feet (91 cm)
		Power Vent	4 ft below or to side of opening; 1 ft above opening	
K	Clearance to mechanical air supply inlet		3 feet above if within 10 feet horizontally	6 feet (1.83 m)
L	Clearance above paved sidewalk or paved driveway located on public property	Direct Vent	*	7 feet (2.13 m)
		Power Vent	7 feet (2.13 m)	
M	Clearance under veranda, porch deck, or balcony		*	1 foot (30 cm)

Table 11 - Vent Termination Clearances - *NOTE: For clearances not specified in ANSI Z223.1 / NFPA 54 for US and CAN/CSA B149.1 for Canada, please use clearances in accordance with local installation codes and the requirements of the gas supplier.

⚠ WARNING

The building owner is responsible for keeping the exhaust and intake terminations free of snow, ice, or other potential blockages, as well as scheduling routing maintenance. Failure to keep the vent piping terminations clear and properly maintain the heater could result in property damage, severe personal injury, or death.

⚠ WARNING

For each floor containing bedroom(s), a carbon monoxide detector and alarm shall be placed in the living area outside the bedrooms, as well as in the room that houses the heater. Detectors and alarms shall comply with NFPA 720 (latest edition). Failure to comply with these requirements could result in product damage, severe personal injury, or death.

E. Exhaust Vent and Intake Pipe Sizing

1. All models ship with 4" diameter vent pipe exhaust vent and intake air pipe connections.
2. Increasing or decreasing the vent diameter of ANY model boiler IS NOT an option.
3. The total length of the intake air pipe run must not exceed **one hundred and fifty (150) feet in 4" pipe.**
   NOTE: There is no minimum length for the intake air pipe run.
4. **The total length of the exhaust vent pipe run must not be less than ten (10) feet.**
5. **The total length of the exhaust vent pipe run must not exceed one hundred fifty (150) feet in 4" pipe.**

Minimum - Maximum Vent Run Lengths	
Diameter	**4"**
Intake Air Pipe Run	0 - 150 feet
Exhaust Vent Run	10 - 150 feet

Table 12 - Minimum - Maximum Vent Runs

6. The equivalent length of elbows, tees, and other fittings are listed in the Friction Loss Table below.

Friction Loss Equivalent in Piping and Fittings	
Fittings or Piping	**Equivalent Feet**
	4"
90 Degree Elbow*	5'
45 Degree Elbow	3'
Coupling	0'
Air Inlet Tee	0'
One Foot of Straight Pipe	1'
Concentric Kit	3'
V Series Vent Kit	1'
AL29-4C Vent Terminal	1'

Table 13 - *Friction loss for long radius elbow is 1 foot less. NOTE: Consult Polypropylene venting instructions for friction loss and pressure drop equivalents.

Vent Sizing Example

If the exhaust vent run has two 90° elbows, 10 feet of straight pipe and a concentric kit we will calculate:

Exhaust Vent Equivalent Length = (2x5) + 10 + 3 = **23 feet** - Well below the maximum of 150 ft in 4" pipe.

If the intake air pipe run has one 90° elbow, two 45° elbows, and 14 feet of straight pipe:

Intake Air Pipe Equivalent Length = 5 + (2x3) + 14 = **25 feet** - Well below the maximum of 150 ft in 4" pipe.

NOTE: The intake air pipe and exhaust vent do not have to be of equal length. There is no balancing requirement between intake and exhaust.

⚠ WARNING

Failure to install the boiler within the minimum and maximum vent length requirements could result in improper product operation and property damage, serious personal injury, or death.

F. Exhaust Vent and Intake Pipe Installation

⚠ WARNING

All joints of positive pressure vent systems must be sealed completely to prevent leakage of flue products into the living space. Failure to do so could result in property damage, serious injury, or death.

1. Use only solid PVC, CPVC, or stainless steel pipe or a Polypropylene vent system approved for use with Category IV appliances.
ABS pipe material may be used on air intake piping **only**.
2. Work from the boiler to exhaust vent or intake air termination. Do not exceed the lengths given in this manual for the vent or air piping.
3. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends. Chamfer the outside of each pipe end to ensure even cement distribution when joining.
4. When using PVC or CPVC pipe, all joints must be properly cleaned, primed, and cemented. Use only cement and primer approved for use with the pipe material. Cement must conform to ASTM D2564 for PVC and ASTM F493 for CPVC pipe.
NOTE: The use of colored primer is recommended.
NOTE: DO NOT CEMENT POLYPROPYLENE PIPE. Follow manufacturer's instructions for proper installation.
NOTE: Clean and dry the boiler adapters.
DO NOT use primer or cement on the boiler adapters.
   a. Clean all pipe ends and fittings using a clean dry rag. (Moisture will retard curing and dirt or grease will prevent adhesion.)
   b. Dry fit piping to ensure proper fit up before assembling any joint. The pipe should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
   c. Priming and Cementing:
      i. Handle fittings and pipes carefully to prevent contamination of surfaces.
      ii. Apply a liberal even coat of primer to the fitting socket and to the pipe end to approximately 1/2" beyond the socket depth.
      iii. Apply a second primer coat to the fitting socket.
      iv. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket along with an even coat of approved cement to the fitting socket.
      v. Apply a second coat of cement to the pipe.
      vi. While the cement is still wet, insert the pipe into the fitting, if possible twist the pipe a 1/4 turn as you insert it. **NOTE:** If voids are present, sufficient cement was not applied and joint could be defective.
      vii. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.
5. Ensure the vent is located where it will not be exposed to prevailing winds.
6. In all roof venting applications, exhaust discharge must point away from the pitch of the roof.
7. If the exhaust vent is to be terminated in a walled off area (such as a roof with a parapet wall), ensure the exhaust vent terminates a minimum of 10' from nearest wall and extends level with or above the top of the wall. This will ensure flue gas does not get trapped and possibly recirculated into the intake air pipe, which could contaminate the combustion air.
8. To prevent water leakage, install adequate roof flashing where the pipe enters the roof.
9. If it can be avoided do not locate vent directly over public walkways, driveways, or parking lots in climates where freezing conditions are possible. Condensate could drip and freeze, resulting in a slip hazard or damage to vehicles or machinery.
10. Due to potential moisture build-up, sidewall venting may not be the preferred venting option. To save time and cost, carefully consider venting installation and location.

11. Horizontal lengths of exhaust vent must slope back towards the boiler not less than ¼" per foot to allow condensate to drain from the vent pipe.
12. Do not terminate vent where vapors can accumulate and harm people or pets.
13. When it can be avoided, do not terminate vent where vapors can damage shrubs or plants. Such damages are not covered by product warranty.
14. Moisture in the exhaust gas will condense as it leaves the vent terminal. In cold weather this condensate can freeze on the exterior wall, under the eaves, and on surrounding objects, including shrubs. Some discoloration to the exterior of the building is to be expected. However, improper location or installation can result in severe damage to the structure or exterior finish of the building, and increase the opportunity for vent blockages and nuisance shutdowns.
15. In vacant chimney applications, install and seal a rain cap over existing chimney openings.
16. All piping must be fully supported. Use pipe hangers at a minimum of 4 foot intervals to prevent sagging of the pipe where condensate may form.
17. Do not use the boiler to support any piping.
18. Ensure the outdoor exhaust vent and intake pipe terminations are screened to prevent blockage caused by debris or birds.
19. Maximum Snow Level Determination: These installation instructions reference snow levels in establishing a minimum height for the installation of exhaust vent or air intake terminations. Snow levels shall be determined as follows:
   a. The installation location may, by ordinance, designate how snow levels are calculated in that location; or
   b. In the absence of specific ordinances, snow levels shall be calculated from the average monthly maximum depth of snow accumulation as indicated by the National Weather Service's 10 year statistics for the installation location/geographical area.

In addition:

- Total length of vent piping shall not exceed the limits specified in this manual.
- The vent piping for this direct vented appliance is approved for zero clearance to combustible construction.
- The flue products coming from the exhaust vent will create a large plume when the heater is in operation. Avoid venting in areas that will affect neighboring buildings or be considered objectionable.
- DO NOT locate exhaust vent or intake pipe in a parking area where machinery may damage the pipe.
- DO NOT vent near soffit vents, crawl space vents, or other areas where condensate or vapor could create a nuisance or hazard or cause property damage.
- DO NOT vent where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valve, or other equipment.

In the Commonwealth of Massachusetts and as Required by State and Local Codes:

- The vented gas fueled appliance shall not be installed so its combustion, ventilation, or dilution air is obtained from a bedroom or bathroom.
- Signage: Whenever any through-the-wall (horizontal or sidewall) vent is installed less than seven feet above the finished grade, a metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight feet above grade directly in line with the exhaust vent terminal. The sign shall read, in print no less than 0.5 inches in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".
- Marking of Exhaust Vent and Intake Pipe: Piping used for ventilation, make-up, or combustion air intake shall be labeled as follows:
   a. Throughout the entire developed length:
      i. Labels must be placed every ten feet for exposed/visible piping; or
      ii. Labels must be placed every three feet for concealed piping.
   b. At all changes of direction;
   c. On each side of a penetration through a partition, wall or ceiling; and
   d. The labels shall be black lettering that:
      i. Indicates that the piping is used for ventilation, make-up, or combustion air intake, and
      ii. The letters shall be sized equal to a minimum of the pipe diameter. However, for piping with a diameter exceeding two inches, said lettering does not need to be larger than two inches.

G. Applications

1. Direct Vent Installation of Exhaust and Intake

If installing a direct vent option, combustion air must be drawn from the outdoors directly into the boiler intake, and exhaust must terminate outside. There are three basic direct vent options detailed in this manual: 1. Side Wall Venting, 2. Roof Venting, and 3. Unbalanced Venting.
Be sure to locate the boiler such that the exhaust vent and intake pipe can be routed through the building and properly terminated. Different vent terminals can be used to simplify and eliminate multiple penetrations in the building structure (see Optional Equipment in Venting Section). The exhaust vent and intake pipe lengths, routing and termination methods must all comply with the methods and limits given in the Venting section of this manual.
When installing a combustion air intake from outdoors, care must be taken to utilize uncontaminated combustion air. **NOTE:** To prevent combustion air contamination, see Table 3.

Sidewall Venting Options - Direct Vent Installation

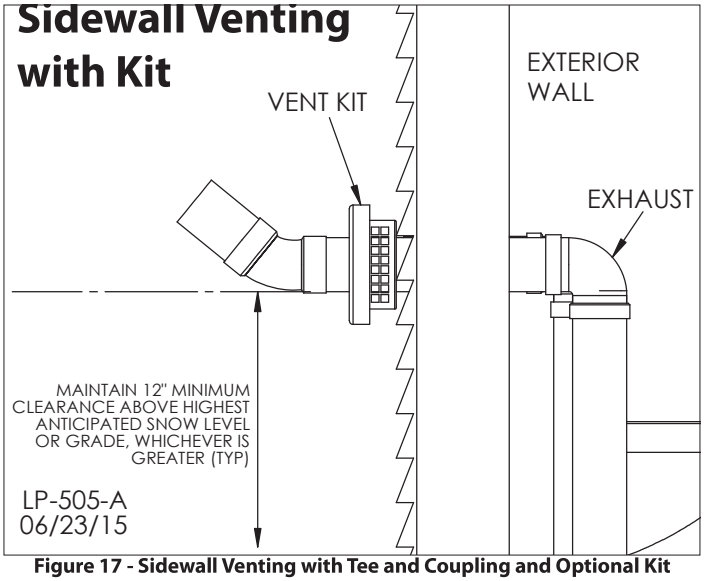


Figure 17 - Sidewall Venting with Tee and Coupling and Optional Kit

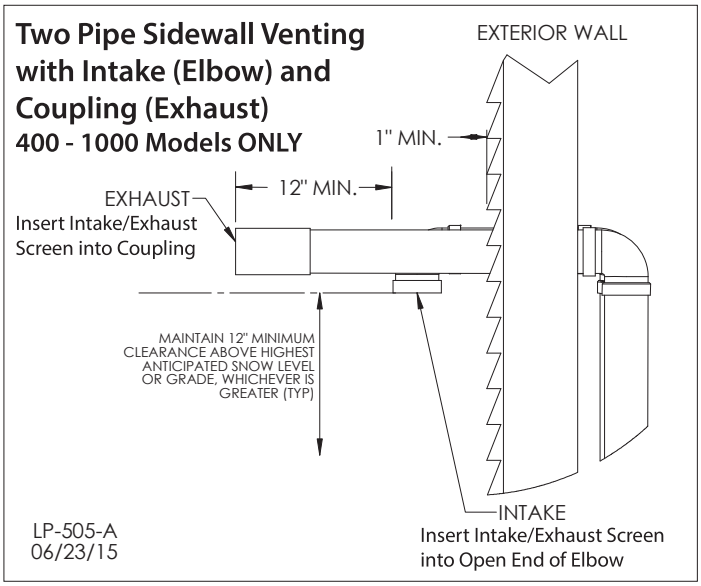


Figure 18 - Sidewall Venting with Elbow and Coupling

NOTE: These drawings are meant to demonstrate system venting only. The installer is responsible for all equipment and detailing required by local codes.

Ensure the terminations are screened to prevent blockage caused by debris or birds.

⚠ WARNING

All vent pipes must be glued, properly supported, and the exhaust pitched a minimum of 1/4" per foot back to the boiler to allow drainage of condensate. When placing support brackets on vent piping, the first bracket must be within 1 foot of the boiler and the balance of 4 foot intervals on the vent pipe. Venting must be readily accessible for visual inspection from the first three feet from the boiler.

Take extra precaution to adequately support the weight of vent pipes terminating through the roof. Failure to properly support roof terminated vent piping could result in property damage, serious personal injury, or death due to flue gas leakage.

An unbalanced vent system can be installed ONLY when the exhaust is in the vertical position. Failure to do so could result in serious personal injury or death.

Snorkel Venting (Two Pipe Sidewall Venting Terminations Beneath an Overhang)

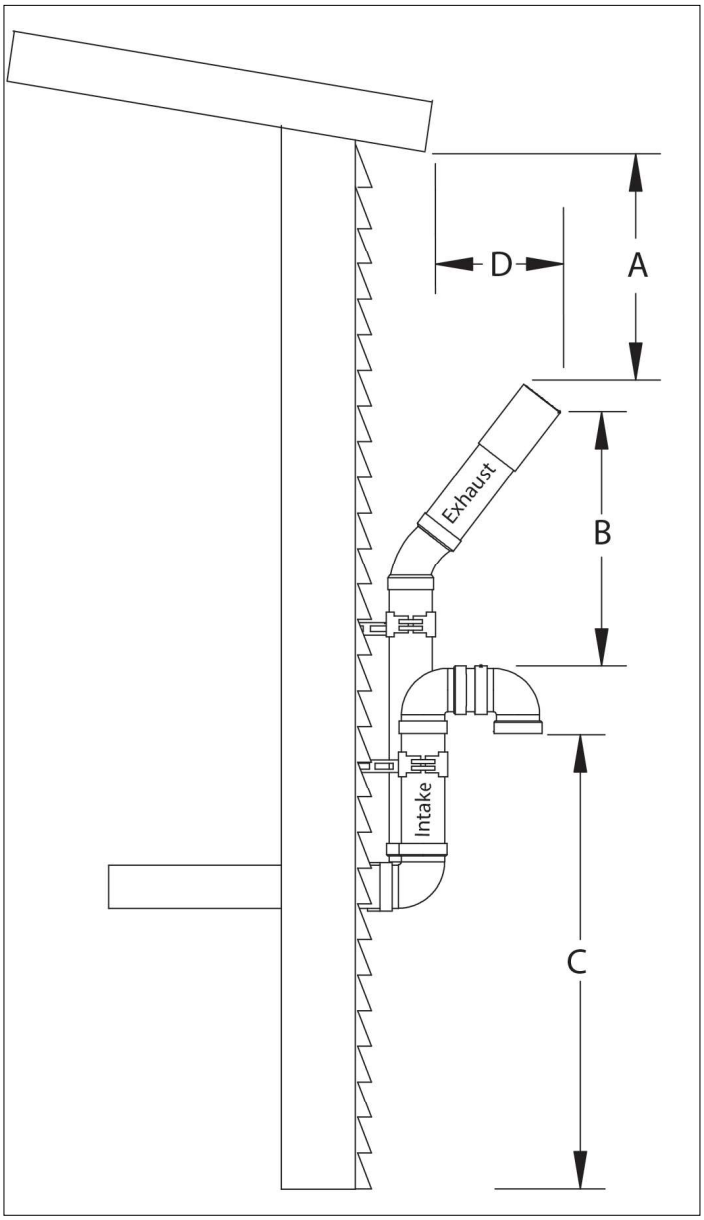


Figure 19 - Two Pipe Sidewall (Horizontal Snorkel) Venting

NOTES:

A. For every 1″ of overhang, the exhaust vent must be located 1″ vertical below the overhang (12″ minimum). Overhang means top of building structure (roof) and not two adjacent walls (corner of building).
B. Maintain minimum separation between exhaust vent and air intake sidewall terminations, as required by local codes.
C. Maintain 12″ minimum clearance above highest anticipated snow level or grade (whichever is greater).
D. The exhaust vent must extend a minimum of 12″ to a maximum of 24″ beyond the building.

NOTE: These drawings are meant to demonstrate system venting only. The installer is responsible for all equipment and detailing required by local codes.

Venting Below Grade

For installations that exit the wall below grade:

1. Excavate the site to a point where the pipes are to exit as shown in Figure 20.
2. Ensure the wall is fully sealed where the pipes penetrate.
3. The exhaust vent / air intake piping MUST be secured to the side of the building above grade, as shown, to provide rigidity.
4. Ensure that the exhaust vent / air intake clearances are maintained.

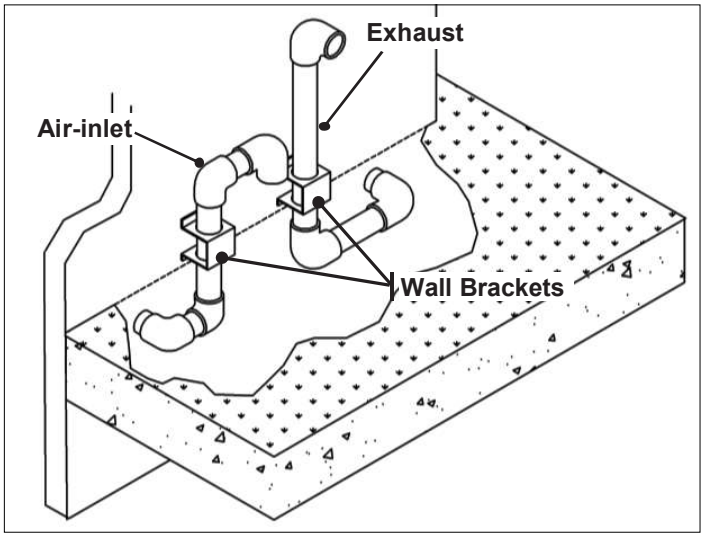


Figure 20 - Venting Below Grade

Outdoor Venting

Vent piping outside the building is permitted under the following conditions:

1. The maximum length outside the building is 20 feet (6.1 m). Note that outdoor length must be included in the overall vent length calculation.
2. All normal termination clearances are maintained.
3. The pipe is supported every 24″ (610 mm).
4. The exhaust and air intake are sloped back to the boiler 1/2″ elevation for every linear foot (13 mm for every linear 305 mm).

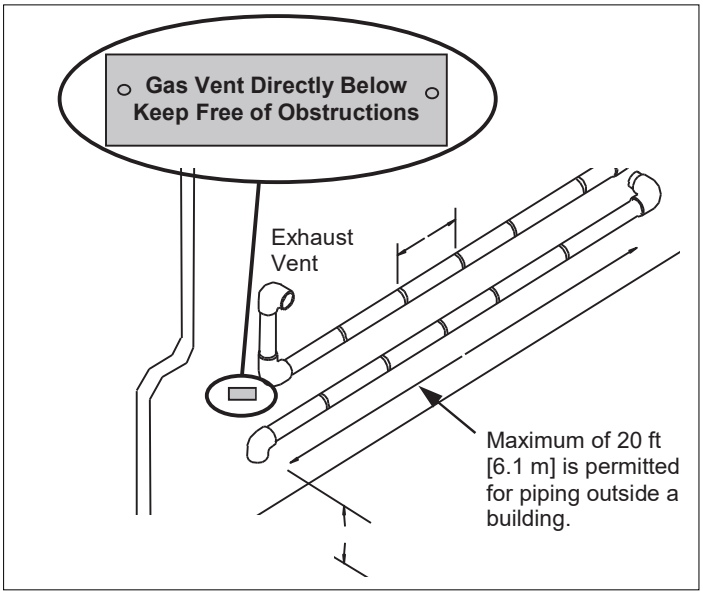


Figure 21 - Outdoor Venting

Roof Venting Options - Direct Vent Installation

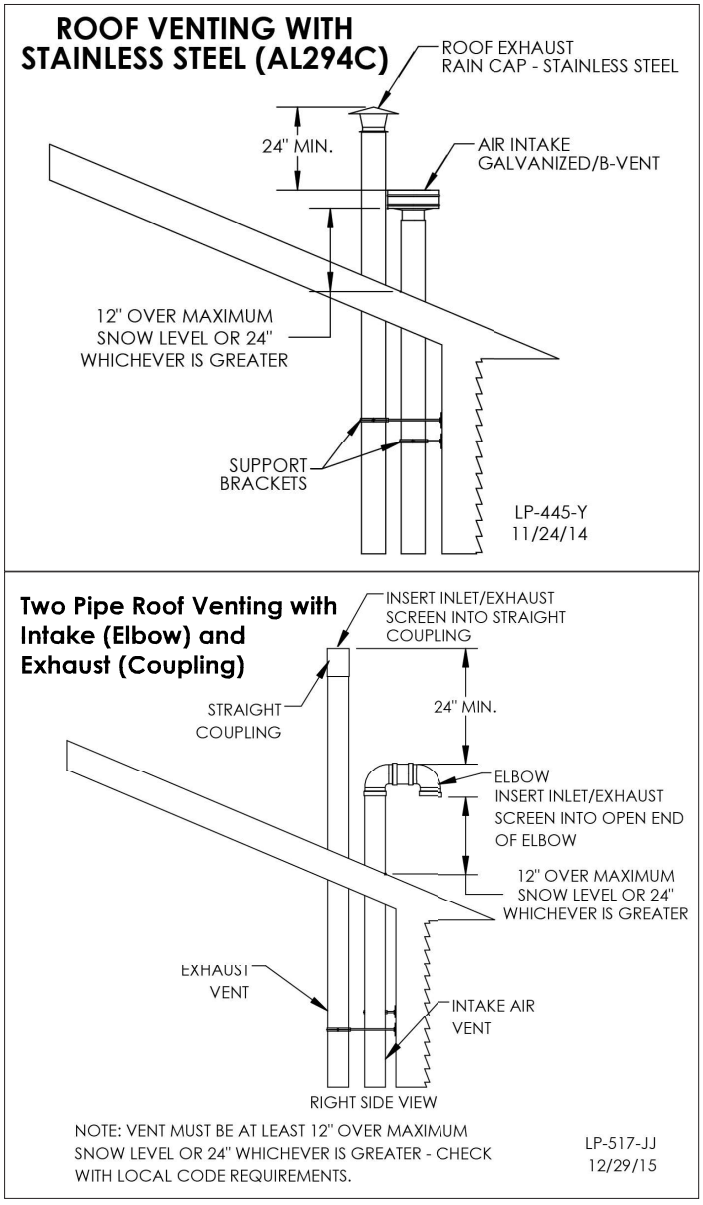


Figure 22 - Roof Venting with Stainless Steel and Tee and Coupling

Unbalanced Venting - Roof Exhaust Termination

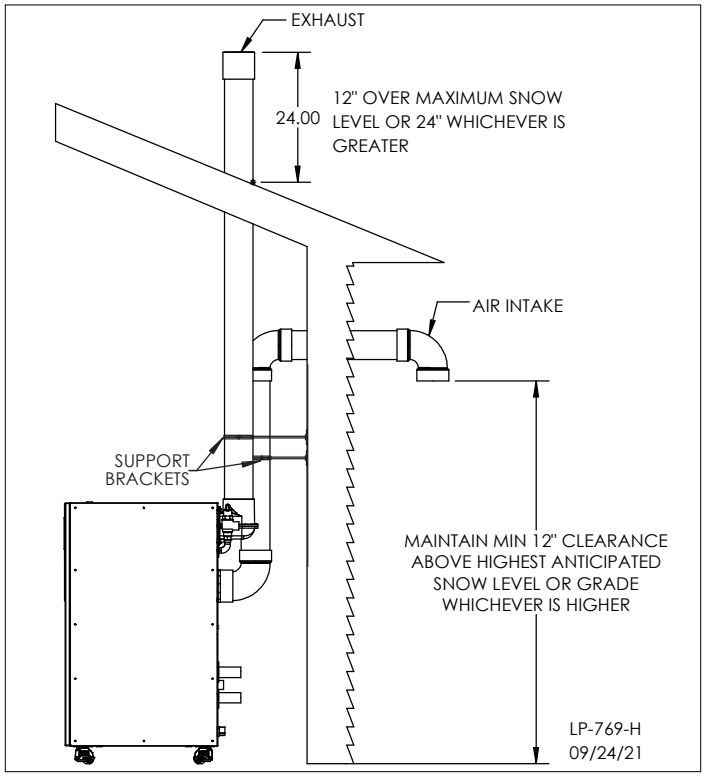


Figure 23 - Unbalanced Venting - Roof Exhaust and Sidewall Intake

NOTE: These drawings are meant to demonstrate system venting only. The installer is responsible for all equipment and detailing required by local codes.

Ensure the terminations are screened to prevent blockage caused by debris or birds.

⚠ WARNING

All vent pipes must be glued, properly supported, and the exhaust pitched a minimum of 1/4" per foot back to the boiler to allow drainage of condensate. When placing support brackets on vent piping, the first bracket must be within 1 foot of the boiler and the balance of 4 foot intervals on the vent pipe. Venting must be readily accessible for visual inspection from the first three feet from the boiler.

Take extra precaution to adequately support the weight of vent pipes terminating through the roof. Failure to properly support roof terminated vent piping could result in property damage, serious personal injury, or death due to flue gas leakage.

An unbalanced vent system can be installed ONLY when the exhaust is in the vertical position. Failure to do so could result in serious personal injury or death.

2. Power Venting, Room and Indoor Combustion Ventilation Requirements

When using an indoor combustion air installation, the mechanical room MUST be provided with properly sized openings, and/or be of sufficient volume to assure adequate combustion air and proper ventilation for all gas fired appliances in the mechanical room to assure adequate combustion air and proper ventilation. The requirements shown here are for the boiler only. Additional gas fired appliances in the mechanical room will require an increase in the net free area and/or volume to supply adequate combustion air for all appliances. This must be done in accordance with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1.

This boiler can be vented using mechanical room air only for combustion. No combustion air openings are needed when the boiler is installed in a space with a volume NO LESS than 50 cubic feet per 1,000 BTU/hr of all installed gas fired appliances and the building MUST NOT BE of "Tight Construction".

TIGHT CONSTRUCTION: A building with less than .4 ACH (air changes per hour). For buildings of "Tight Construction", provide air openings into the building from the outside.

Indoor and outdoor combustion air may be combined by applying a ratio of available volume to required volume times the required outdoor air opening(s) size(s). This must be done in accordance with the National Fuel Gas Code, NFPA 54 / ANSI Z223.1.

1. If air is taken directly from outside the building with no duct, provide two permanent openings to the mechanical room each with a net free area of one square inch per 4000 BTU/hr input. See Figure 24.
2. If combustion and ventilation air is taken from the outdoors using a duct to deliver the air to the mechanical room, each of the two openings should be sized based on a minimum free area of one square inch per 2000 BTU/hr input. See Figure 25.
3. If air is taken from another interior space combined with the mechanical room:
   a. Two spaces on same story: Each of the two openings specified should have a net free area of one square inch for each 1000 BTU/hr input, but not less than 100 square inches.
   b. Two spaces on different stories: One or more openings should have a net free area of two square inches per 1000 BTU/hr.

See Figure 26 for reference.

4. If a single combustion air opening is provided to bring combustion air in directly from the outdoors, the opening must be sized based on a minimum free area of one square inch per 3000 BTU/hr. This opening must be located within 12" of the top of the enclosure. See Figure 27.

Combustion air requirements are based on the latest edition of the National Fuel Gas Code, NFPA 54 / ANSI Z223.1, CGA Standard CAN/CSA B149.1 in Canada. Check all local code requirements for combustion air.

All dimensions based on net free area in square inches. Metal louvers or screens reduce the free area of a combustion air opening a minimum of approximately 25%. Check with louver manufacturers for exact net free area of louvers.

Where two openings are provided, one must be within 12" of the ceiling, and one must be within 12"of the floor of the mechanical room. Each opening must have a net free area as specified in Table 14. Single openings shall commence within 12" of the ceiling. The minimum dimension of air openings should not be less than 3".

⚠ CAUTION

Under no circumstances should the mechanical room ever be under negative pressure. Particular care should be taken where exhaust fans, attic fans, clothes dryers, compressors, air handling units, etc., may take away air from the unit. Failure to follow these instructions could result in property damage or personal injury.

Combustion air supply must be completely free of any flammable vapors that may ignite, or chemical fumes which may be corrosive to the boiler. See Table 3 for a list of combustion air contaminants. These chemicals, when burned, form acids which quickly attack the stainless steel heat exchanger, headers, flue connectors, and the vent system. The result is improper combustion and premature boiler failure. Such failure IS NOT covered under warranty.

EXHAUST FANS: Any fan or appliance which exhausts air from the mechanical room may deplete the combustion air supply and/or cause a downdraft in the venting system. Spillage of flue products from the venting system into an occupied living space can cause a very hazardous condition that must be corrected immediately.

Minimum Recommended Combustion Air Supply to Mechanical Room

Model	Figure 24		Figure 25	
	*Outside Air from 2 Openings Directly from Outdoors[1]		*Outside Air from 2 Ducts Delivered from Outdoors[1]	
	Top Opening, in^2	Bottom Opening, in^2	Top Opening, in^2	Bottom Opening, in^2
285	72	72	143	143
301	76	76	151	151
399	100	100	200	200

Model	Figure 26			Figure 27
	Inside Air from 2 Ducts Delivered from Interior Space[2]			*Outside Air from 1 Opening Directly from Outdoors, in^2 [1]
	Same Story		Different Stories	
	Top Opening, in^2	Bottom Opening, in^2	Top Opening, in^2	
285	285	285	570	95
301	301	301	602	101
399	399	399	798	133

Table 14 - Indoor Combustion Air Sizing

The above requirements are for the boiler only; additional gas fired appliances in the mechanical room will require an increase in the net free area and/or volume to supply adequate combustion air for all appliances.

No combustion air openings are needed when the boiler is installed in a space with a volume NO LESS than 50 cubic feet per 1,000 BTU/hr of all installed gas fired appliances. Buildings MUST NOT be of *"Tight Construction".

[1]Outside air openings shall communicate with the outdoors.

[2]Combined interior space must be 50 cubic feet per 1,000 BTU/hr input. Buildings MUST NOT be of *"Tight Construction".

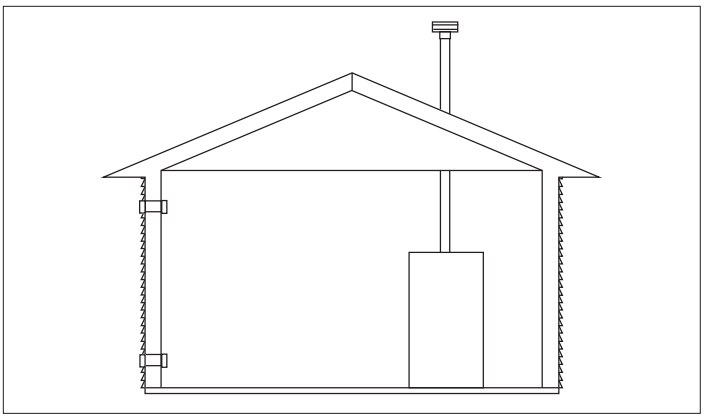


Figure 24 - Combustion Air from Outdoors

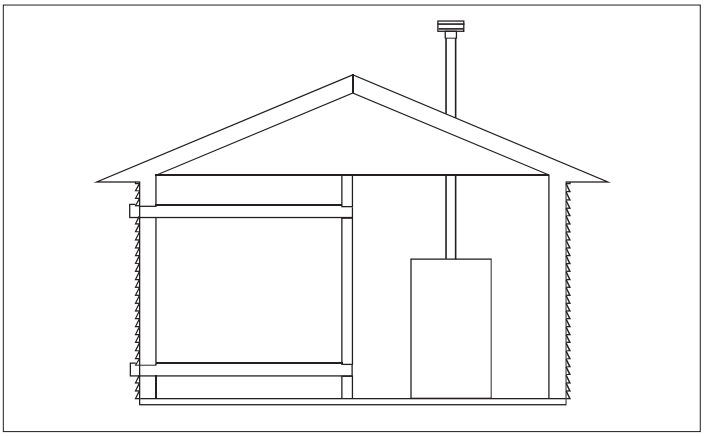


Figure 25 - Combustion Air through Ductwork

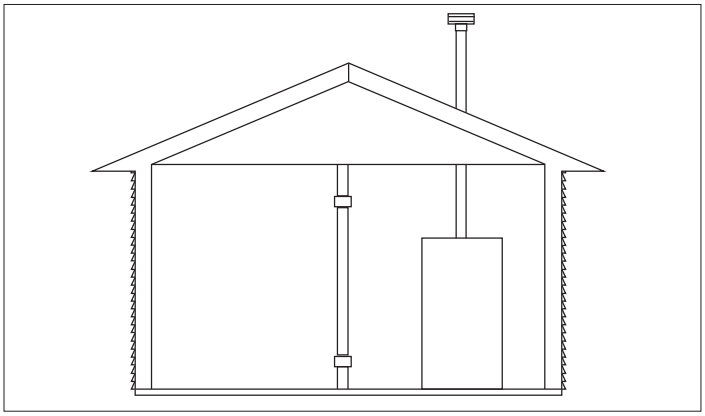


Figure 26 - Combustion Air from Indoors

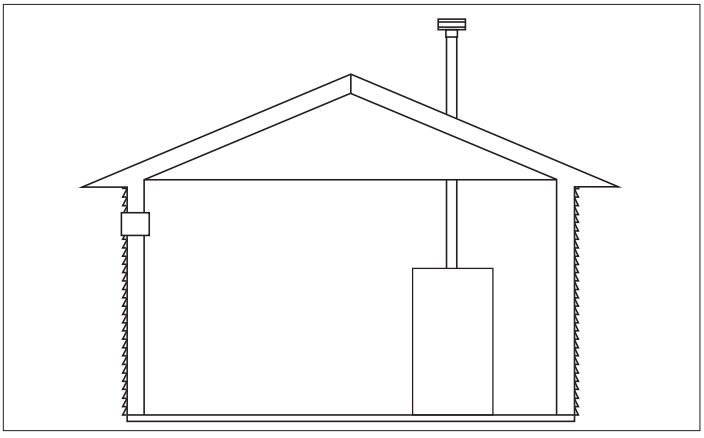
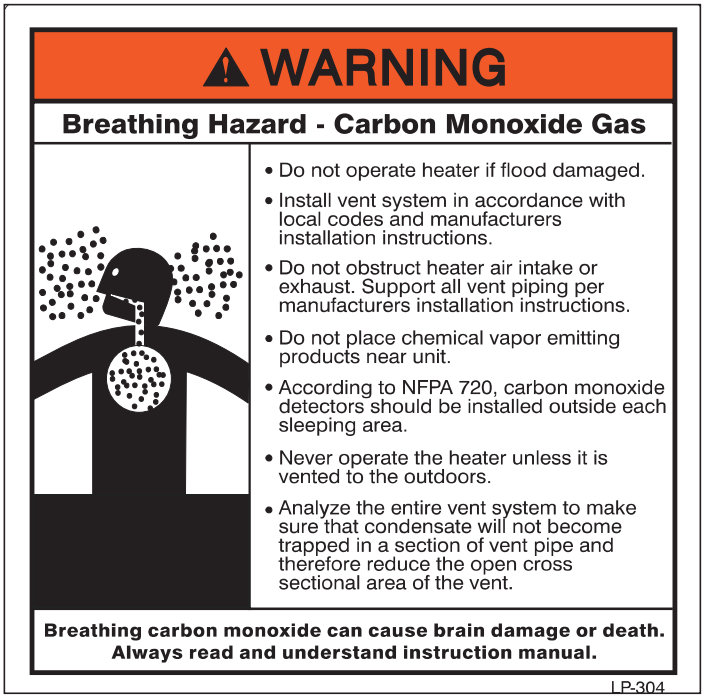


Figure 27 - Combustion Air from Outdoors - Single Opening



Part 6 - Condensate Removal

CAUTION

This condensing high efficiency boiler has a condensate removal system. Condensate is water vapor derived from combustion products, similar to that produced by an automobile when it is initially started. It is very important that the condensate line is sloped down away from the boiler and to a suitable drain.
The condensate line must remain unobstructed. If allowed to freeze in the line or obstructed in any other manner, condensate can exit from the boiler tee, resulting in potential water damage to property.
When installing a condensate pump, select one approved for use with condensing boilers and furnaces. The condensate pump should have an overflow switch to prevent property damage from spillage.
Condensate from the boiler will be slightly acidic (pH from 3.2 to 4.5). Check with your local gas company to determine if combustion condensate disposal is permitted in your area. Install a neutralizing filter if required by local codes.

Is is very important that condensate piping be no smaller than 3/4". Use a tee at the condensate connection with a branch vertically up and open to the atmosphere to prevent a vacuum that could obstruct the flow of condensate from the boiler. To prevent sagging and maintain pitch, condensate piping should be supported with pipe supports.

NOTES:

1. Due to its efficient design, the boiler produces condensate (water) as a normal by-product. This condensate is acidic, with a pH level between 2 and 4.5. This condensate must be drained away from the boiler and disposed in accordance with all local regulations.
2. The condensate line should be as short as possible and must be pitched at least ¼" per foot to properly drain. If this cannot be done, increase the condensate line and place a tee in the line to properly reduce vacuum lock in the drain line. Tees should be placed after the condensate neutralizer (if used).
3. Use corrosion-resistant materials to drain condensate. Use flexible plastic hose or tube, PVC, or CPVC pipe. PVC or CPVC pipe must comply with ASTM D1785, F441, or D2665. Cement must comply with ASTM D2564 for PVC pipe or F493 for CPVC pipe. For Canadian applications, use CSA or ULC certified flexible tube, PVC or CPVC pipe, fittings, and cement.
4. If using flexible tube, place an overflow tee in the tube line to prevent condensate backing up into the boiler if the tube should kink. Ensure the overflow tee is positioned near a drain or in a location that will not damage the surrounding area.
5. Do not reduce the size of the condensate line. The line must at minimum equal the diameter of the line included with the appliance.
6. A frozen condensate line could result in a blocked vent condition. It is very important to protect the condensate line from freezing temperatures or any type of blockage. In installations that may encounter sustained freezing conditions, the use of heat tape is recommended to avoid freezing of the condensate line. Longer condensate runs are more prone to freezing.
7. Support of the condensate line may be necessary to avoid blockage of the condensate flow.
8. Local building codes may require an in-line neutralizer to be installed (not included) to treat the condensate. See Figure 28. If required by local authorities, a condensate filter of lime crystals, marble, or phosphate chips will neutralize slightly acidic condensate (p/n 7350P-611 available from HTP). Follow all the installation instructions included with the neutralizer. If a neutralizer is installed, periodic replacement of the limestone (or neutralizing agent) will be required. The rate of depletion of the limestone varies with usage of the boiler. During the first year of boiler operation, check the neutralizer every few months for depletion.
9. Route the drain line to a nearby floor drain, laundry tub, or condensate pump. If the boiler condensate outlet is lower than the drain, you must use a condensate removal pump (kit p/n 554200 available from HTP).
NOTE: If a nearby laundry tub is used as a disposal for waste water from the washing machine, draining the condensate into this tub allows the soapy water discharge to neutralize the acidic condensate.
10. An error will appear on the boiler display if condensate line is blocked. The boiler will not operate with a blocked condensate line. It is extremely important to have this condition repaired by a qualified service technician.
11. Damages due to frozen or blocked condensate lines or leaks ARE NOT covered by warranty.

NOTE: To clean out condensate trap, see Maintenance section.

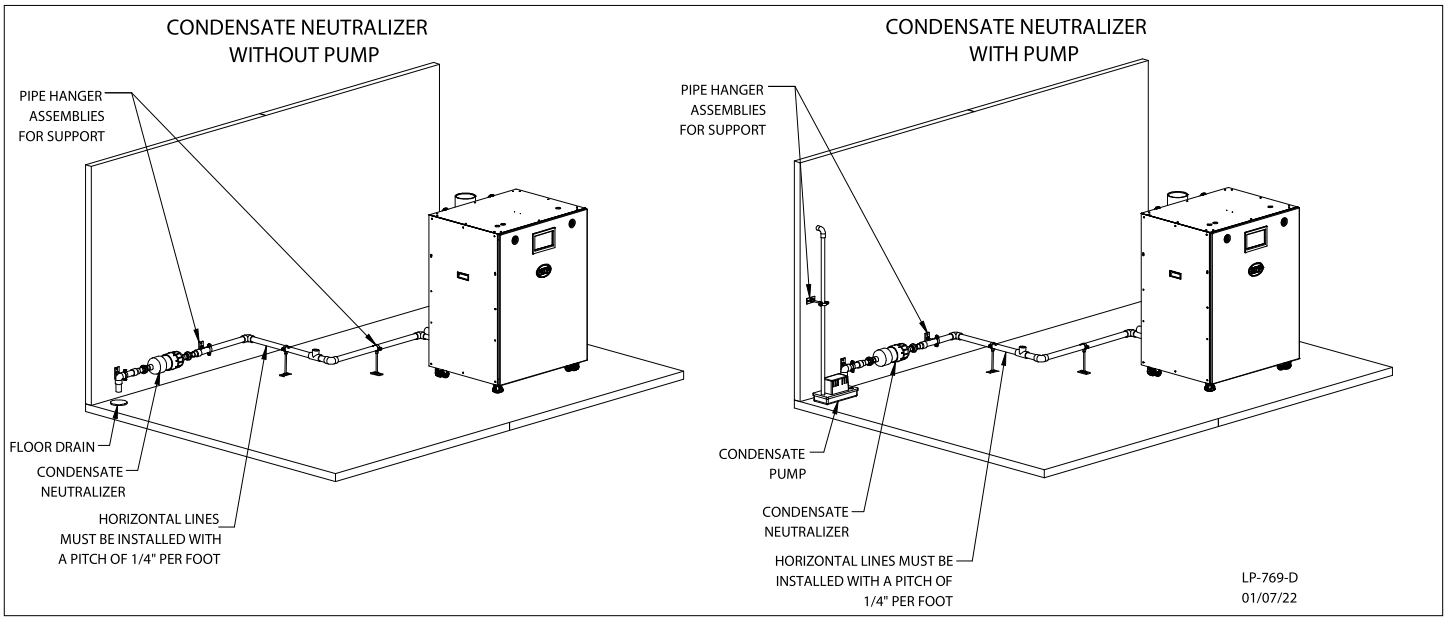


Figure 28 - Condensate Piping

Part 7 - Wiring

⚠ WARNING

Install wiring and electrically ground boiler in accordance with the authority having jurisdiction or, in the absence of such an authority, follow the National Electrical Code, NFPA 70, and/or CSA C22.1 Electrical Code-Part 1 in Canada. Failure to follow all applicable local, state, and national regulations, mandates, and building supply codes for guidelines to install the electrical power supply could result in property damage, serious personal injury, or death.

Jumping out control circuits or components WILL VOID product warranty and can result in property damage, personal injury, or death.

It is of extreme importance that this unit be properly grounded. It is very important that the building system ground is inspected by a qualified electrician prior to making this connection. Electrical power must only be turned on when the boiler is completely filled with cold water. Failure to follow these instructions could result in component or product failure, serious injury, or death.

ELECTRICAL SHOCK HAZARD – To ensure safety, turn off electrical power supply at service entrance panel before making any electrical connections to avoid possible electric shock hazard. Failure to do so could result in property damage, serious personal injury, or death.

⚠ CAUTION

Label all wires prior to disconnecting them when servicing the boiler. Wiring errors can cause improper and dangerous operation. Failure to follow these instructions may result in property damage or personal injury.

CAUTION

Wiring must be NEC Class 1. If original wiring supplied with the boiler must be replaced, use only TEW 105 °C wire or equivalent. Boiler must be electrically grounded as required by the National Electrical Code, ANSI/NFPA 70 - Latest Edition.

A. Installation Must Comply With

1. National Electrical Code and any other national, state, provincial, or local codes or regulations.
2. In Canada, CSA C22.1, Canadian Electrical Code Part 1, and any local codes.

B. Field Wiring

All connections made to the boiler in the field are done inside the electrical junction box located in the front of the boiler. Multiple knockout locations are available to route field wires into and out of the electrical junction box.

The control used in the boiler is capable of directly controlling 2 pumps in standard mode and 3 pumps when configured as a cascade master boiler. An external contactor relay or motor starter is required for each pump.

The Field Connection Boards have separate, clearly marked terminal strips for line voltage and low voltage wiring. Special jacks are provided for trouble-free cascade system wiring using standard CAT3 or CAT5 patch cables.

C. Line Voltage Wiring for Standard Boiler

1. Connect the incoming power wiring to the line voltage terminal strip in the electrical junction box at terminals L (Line), N (Neutral), and G (Ground) (shown in Figure 30).
2. A line voltage fused disconnect switch may be required to be externally mounted and connected according to local wiring codes.
3. Connect the boiler pump relay COIL contacts as shown in Figure 30 to the terminals marked CL (BOILER HOT) and CN (BOILER NEUT).
4. Connect an externally provided 120VAC line to the COMMON terminal of the boiler pump relay.
5. Connect the NO relay contact to the LINE input of the boiler pump.
6. Connect the Neutral of the externally provided 120VAC to the NEUTRAL input of the pump.
7. Connect the Earth Ground of the externally provided 120VAC to the Earth Ground input of the pump.
8. If using DHW, connect the DHW pump relay COIL contacts as shown in Figure 30 to the terminals marked DL (DHW HOT) and DN (DHW NEUT).
9. Connect an externally provided 120VAC LINE to the COMMON terminal of the DHW pump relay.
10. Connect the NO relay contact to the LINE input of the DHW pump.
11. Connect the Neutral of the externally provided 120VAC to the NEUTRAL input of the DHW pump.
12. Connect the Earth Ground of the externally provided 120VAC to the Earth Ground input of the DHW pump.

D. Alarm Connections

The control includes a dry contact alarm output. This is an SPDT circuit, rated at 5 amps at 120 volts. This contact can be used to activate an alarm light or bell or notify a building management system if the boiler goes into a lockout condition. The circuit between the common and ALARM NC terminals is closed during normal operation and the circuit between the common and ALARM NO is open during normal operation. HTP offers an Alarm System Kit (part # 7350P-602).

E. Low Voltage Connections for Standard Boiler

1. All low voltage cables should enter the electrical junction box through the provided knock out holes as shown in Figure 29.
2. Connect all low voltage field devices to the low voltage terminal strips located on the Low Voltage Field Connection Board in the electrical junction box.

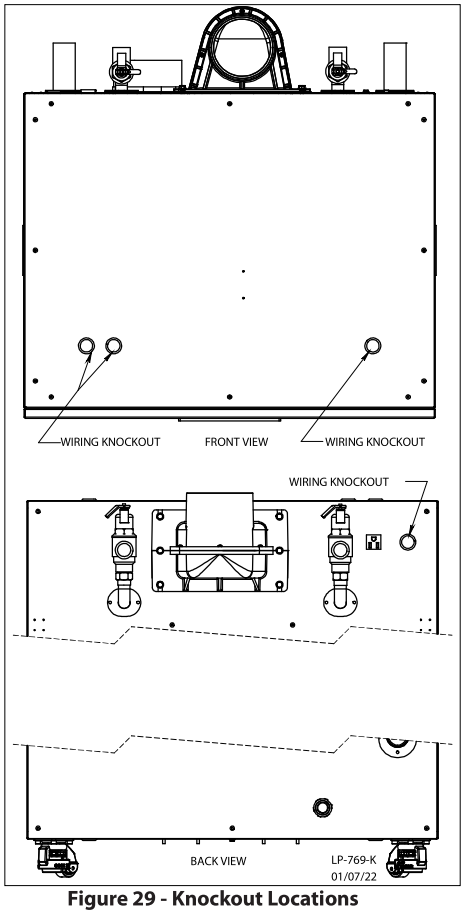


Figure 29 - Knockout Locations

F. Thermostat

1. Connect the room thermostat to the terminals marked TT- and TT+ of the Field Connection Board (shown in Figure 31). Alternately, any dry contact closure across these terminals will cause the boiler to run. Caution should be taken to ensure neither of the terminals becomes connected to ground.
2. Mount the thermostat on an inside wall as centrally as possible to the area being heated, but away from drafts or heat producing devices such as television sets that could influence the ability of the thermostat to measure room temperature.

G. System Sensor

CAUTION

A System Sensor is supplied with the boiler and MUST BE INSTALLED per Figure 31 and the boiler piping diagrams for correct boiler operation. The System Sensor allows the Master module to monitor and compare the secondary heating loop temperature to the desired system setpoint and adjust system power accordingly.
NOTE: Failure to connect this sensor will result in an E03 error.

1. Connect the system sensor to the terminals marked SYS- and SYS+, shown in Figure 31 of the Field Connection Board. Caution should be used to ensure neither of these terminals becomes connected to ground.
2. Use a minimum 22 AWG wire for runs of 100 feet or less and minimum 18 AWG wire for runs of up to 150 feet.
3. Install the sensor on the outlet of the boiler or in the secondary system loop outside of the closely spaced tees. Wrap pipe insulation around the system sensor to improve temperature measurement accuracy and increase overall system efficiency.

H. Outdoor Sensor

NOTE: There is no connection required if an outdoor sensor is not used in this installation.
1. If using an outdoor sensor, connect wires for sensor to the terminals marked OUT- and OUT+, shown in Figure 31 of the Field Connection Board. Caution should be used to ensure neither of these terminals becomes connected to ground.
2. Use a minimum 22 AWG wire for runs of 100 feet or less and minimum 18 AWG wire for runs of up to 150 feet.
3. Mount the outdoor sensor on an exterior surface of the building, preferably on the north side in an area that will not be affected by direct sunlight and will be exposed to varying weather conditions.

I. Indirect Sensor

NOTE: There is no connection required if an indirect water heater is not used in this installation.
1. The boiler will operate an indirect fired water heater with either a thermostat type aquastat installed in the indirect tank, or an HTP 7250P-325 tank sensor. When a tank sensor is used, the control will automatically detect its presence and a demand for heat from the indirect water heater will be generated when the tank temperature falls below the user selected set point by more than the user selected differential. The demand will continue until the sensor measures that the indirect water heater temperature is above the set point.
2. Connect the indirect tank sensor (7250P-325) to the terminals marked DHW- and DHW+, shown in Figure 31 on the Field Connection Board of the Master boiler.

⚠ WARNING

Failure to use the correct sensor may result in tank temperature being either above or below set point, and could result in decreased performance, substantial property damage, or heightened risk of injury or death due to scalds.

Caution should be used to ensure neither of these terminals becomes connected to ground.

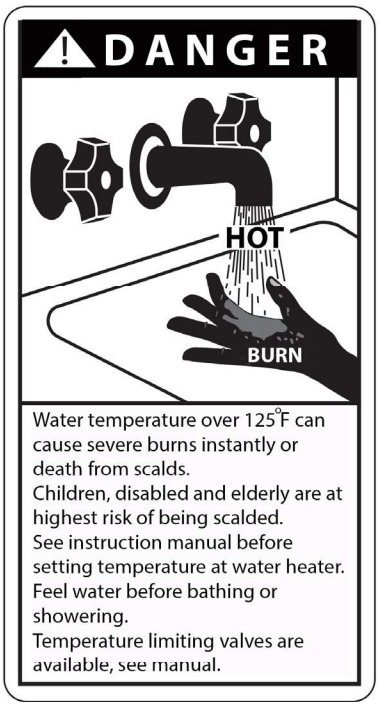
NOTE: If sensor wires are located in an area with sources of potential electromagnetic interference (EMI), the sensor wires should be shielded, or the wires routed in a grounded metal conduit. If using shielded cable, the shielding should be connected to the common ground of the boiler.

J. UL 353 Internal Low Water Cut-Off (Factory Installed)

The supplied internal Low Water Cutoff (LWCO) meets UL 353 requirements to function as a safety, locking out the boiler when water level is inadequate for safe operation. See Service Mode, this manual, for instructions on how to test and reset the Internal LWCO.

K. Wiring of Cascade System Communication Bus

1. A Cascade Bus Termination Strap has been installed on the customer connection board of this boiler. The purpose of this strap is to stabilize communication between multiple boilers and reduce electrical "noise". See Figure 32 for Cascade Bus Termination Strap installation detail.



NOTE: It is important that the termination strap in multiple boilers (cascaded units) be installed as depicted in Figure 32. Leave the strap installed in the right side of J12 on both the Master and final Follower boiler. Remove the strap on intermediate Follower boilers.
2. Use standard CAT3 or CAT5 computer network patch cables to connect the communication bus between each of the boilers. These cables are readily available at any office supply, computer, electronic, department or discount home supply store in varying lengths. If you possess the skills you can also construct custom length cables.
NOTE: Shielded three-conductor cable may be used as an alternate method to connect cascade wiring. Connect the three wires of the shielded cable to the screw terminals labelled BUS A, BUS B, and BUS G. Observe proper polarity across all cascaded units. See Figure 31.
NOTE: All termination straps must be installed as described in Figure 32 to ensure proper cascade operation.
3. It is recommended to use the shortest length cable that will reach between the boilers and create a neat installation. Do not run unprotected cables across the floor where they may become wet or damaged. Avoid running communication cables parallel and close to or against high voltage (120 volt or greater) wiring. HTP recommends that the maximum length of communication bus cables not exceed 200 feet.
4. Route the communication cables through one of the knockouts in the cabinet.
5. Connect the boilers in a daisy chain configuration. It is best to wire the boilers using the shortest wire runs rather than trying to wire them in the order that they are addressed. The communication bus jacks on the customer connection panel are interchangeable so you can use either one or both in any order to connect the cable.
If you have connected the boilers to each other properly, there will be no open communication connection ports.

L. Cascade Master System Pump and Sensor Wiring

1. Connect the system pump relay COIL contacts as shown in Figure 30 to the terminals marked SL (SYSTEM HOT) and SN (SYSTEM NEUT).
2. Connect an externally provided 120VAC line to the COMMON terminal of the system pump relay.
3. Connect the NO relay contact to the LINE input of the system pump.
4. Connect the Neutral of the externally provided 120VAC to the NEUTRAL input of the system pump.
5. Connect the Earth Ground of the externally provided 120VAC to the Earth Ground input of the system pump.
6. Connect the system pipe sensor to the terminals marked SYS- and SYS+. See Figure 31.
7. Connect the outdoor sensor (if used) to the terminals marked OUT- and OUT+.
8. Connect the signal to start the system to the terminals marked TT- and TT+.

NOTE: This signal can come from a room thermostat or a dry contact closure. No power of any voltage should be fed into either of these terminals.

M. Cascade Follower Pump and Sensor Wiring

If the boiler will control the boiler pump:

1. Connect the boiler pump relay COIL contacts as shown in Figure 30 to the terminals marked CL (BOILER HOT) and CN (BOILER NEUT).
2. Connect an externally provided 120VAC line to the COMMON terminal of the boiler pump relay.
3. Connect the NO relay contact to the LINE input of the boiler pump.
4. Connect the Neutral of the externally provided 120VAC to the NEUTRAL input of the pump.
5. Connect the Earth Ground of the externally provided 120VAC to the Earth Ground input of the pump.

If the boiler will be connected directly to an indirect fired water heater:

6. If using DHW, connect the DHW pump relay COIL contacts as shown in Figure 30 to the terminals marked DL (DHW HOT) and DN (DHW NEUT).
7. Connect an externally provided 120VAC LINE to the COMMON terminal of the DHW pump relay.
8. Connect the NO relay contact to the LINE input of the DHW pump.
9. Connect the Neutral of the externally provided 120VAC to the NEUTRAL input of the DHW pump.
10. Connect the Earth Ground of the externally provided 120VAC to the Earth Ground input of the DHW pump.

If the boiler will be connected to an alarm bell or light:

The normally closed alarm contact may be used to turn a device off if the boiler goes into lockout mode. The alarm contacts are rated 5 amps at 120 VAC.

1. To connect an alarm device, connect the power for the device to the common (ALARM Center) terminal. Connect the alarm device hot wire to the NO (ALARM NO) terminal. Connect the neutral or return of the alarm device to the neutral or return of the power for the alarm device. See Figure 30.
2. To connect a device that should be powered off during a boiler lockout condition, follow the same instructions as above and use the NC (ALARM NC) terminal rather than the ALARM NO terminal.

NOTE: In a cascade system, the alarm output of the boiler addressed as #1 will activate if any boiler (including the master) has a lockout condition. The alarm of boilers addressed #2-7 will only activate if a lockout condition occurs on that specific boiler.

N. Variable Speed Pumping

Variable speed pump support is available on the primary boiler / CH loop of all models. This feature controls pump speed via an analog 0-10VDC signal supplied via the 0-10V PUMP+/- connections on the Field Connection Board.

When this feature is in use, an installer selected Delta T is maintained with the Supply and Return sensors, increasing efficiency and providing better system temperature control. When the difference between the Supply and Return temperatures is greater than the desired setting, the pump will increase speed and flow to compensate. Conversely, if the Delta T is less than the desired setting, the pump will decrease speed and flow to compensate.

NOTE: This feature may be used in Primary / Secondary piping arrangements ONLY!

Variable Speed Pumping Wiring:

1. Connect the boiler pump relay COIL contacts as shown in Figure 30 to the terminals marked CL (BOILER HOT) and CN (BOILER NEUT).
2. Connect an externally provided 120VAC line to the COMMON terminal of the boiler pump relay.
3. Connect the NO relay contact to the LINE input of the boiler pump.
4. Connect the Neutral of the externally provided 120VAC to the NEUTRAL input of the pump.
5. Connect the Earth Ground of the externally provided 120VAC to the Earth Ground input of the pump.

NOTE: The connections shown are suitable for a maximum continuous pump draw of 2 amps at 120 volts. If the pump requires 2 amps or less at 120 volts, a relay is not required, and the pump may be wired directly into the CN, CL, and CG terminals on the Customer Connection Board.

6. Connect the 0-10V input wires on the variable speed pump to the 0-10V PUMP connections on the Field Connection Board. Connect the positive pump input wire to 0-10V PUMP+, and the negative wire to 0-10V PUMP-.

NOTE: When making wiring connections, ensure proper polarity or the system will not operate properly.

O. Optional 0-10 Volt Building Control Signal

1. A signal from a building management system may be connected to the boiler to enable remote control. This signal should be a 0-10 volt positive-going DC signal. When this input is enabled using the installer menu, a building control system can be used to control the set point temperature or firing rate of the boiler. The control interprets the 0-10 volt signal as follows; when the signal is between 0 and 1.5 volts, the boiler will be in standby mode, not firing. When the signal rises above 1.5 volts, the boiler will ignite. As the signal continues to rise towards its maximum of 10 volts, the boiler will increase in either set point temperature or firing rate depending on the setting of Function 17 in the Installer Menu. See this manual for details on the setting of Functions 16 and 17 for this option. When the signal drops below 1.3 volts the boiler will stop firing.
2. Connect a building management system or other auxiliary control signal to the terminals marked 0-10V+ and 0-10V– on the Field Connection Board (shown in Figure 31). Caution should be used to ensure that the 0-10V+ connection does not become connected to ground.

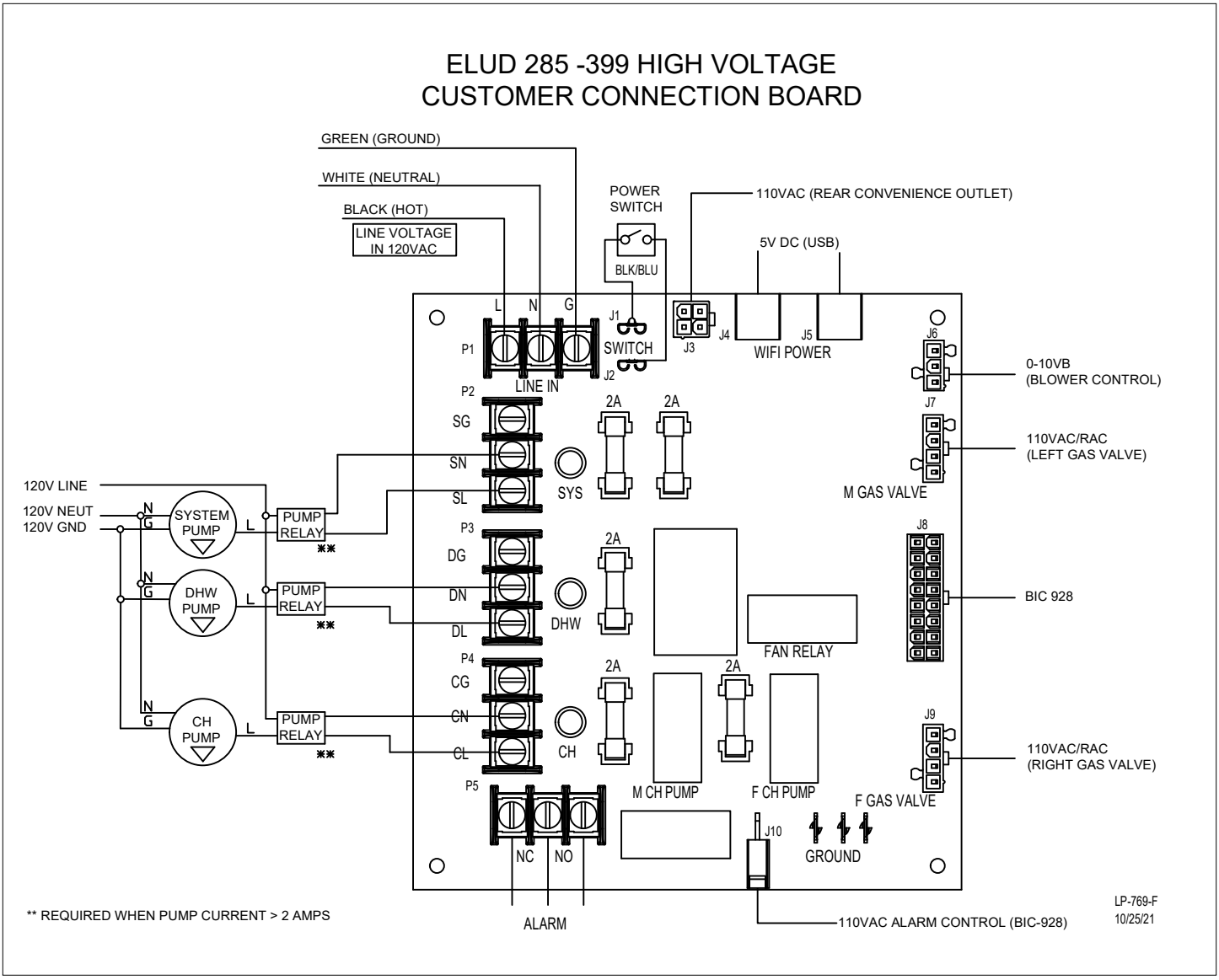


Figure 30 - High Voltage Customer Connection Board

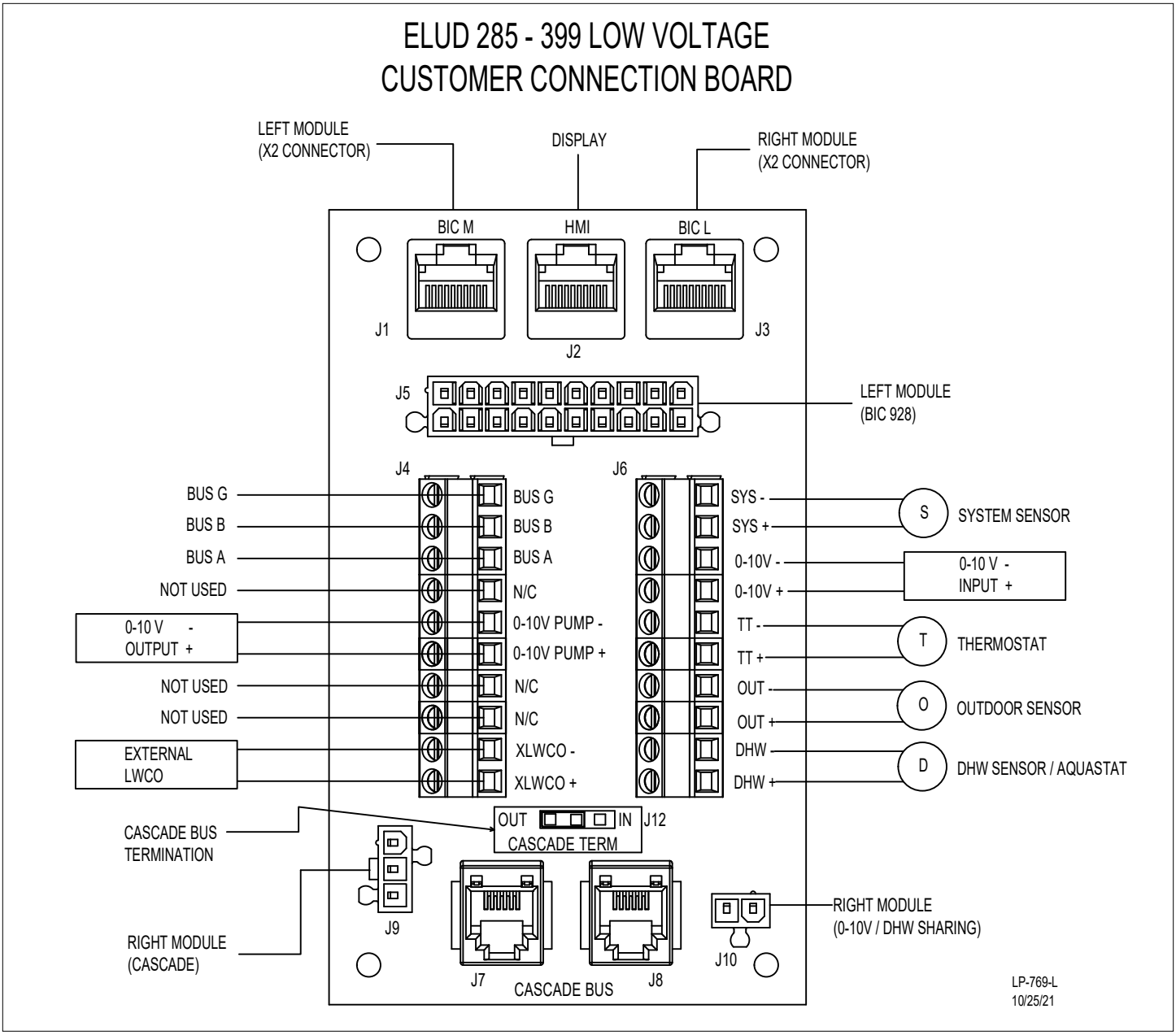


Figure 31 - Low Voltage Customer Connection Board

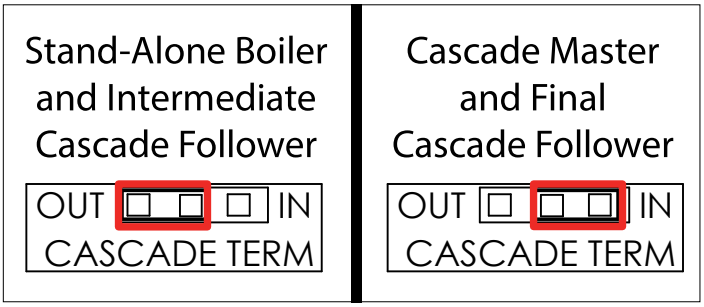


Figure 32 - Cascade Termination Resistor Block - Jumper Location Detail

J12 Position	Boiler Cascade Order			
# of Boilers in Cascade	1	2	3	4
1	IN	N/A	N/A	N/A
2	IN	IN	N/A	N/A
3	IN	OUT	IN	N/A
4	IN	OUT	OUT	IN

Table 15 - Cascade Termination Resistor Block - Jumper Location in Customer Connection Board - NOTE: Boiler ships with Jumper in the IN position

WIRING DIAGRAM
ELUD 285-399
LEFT MODULE

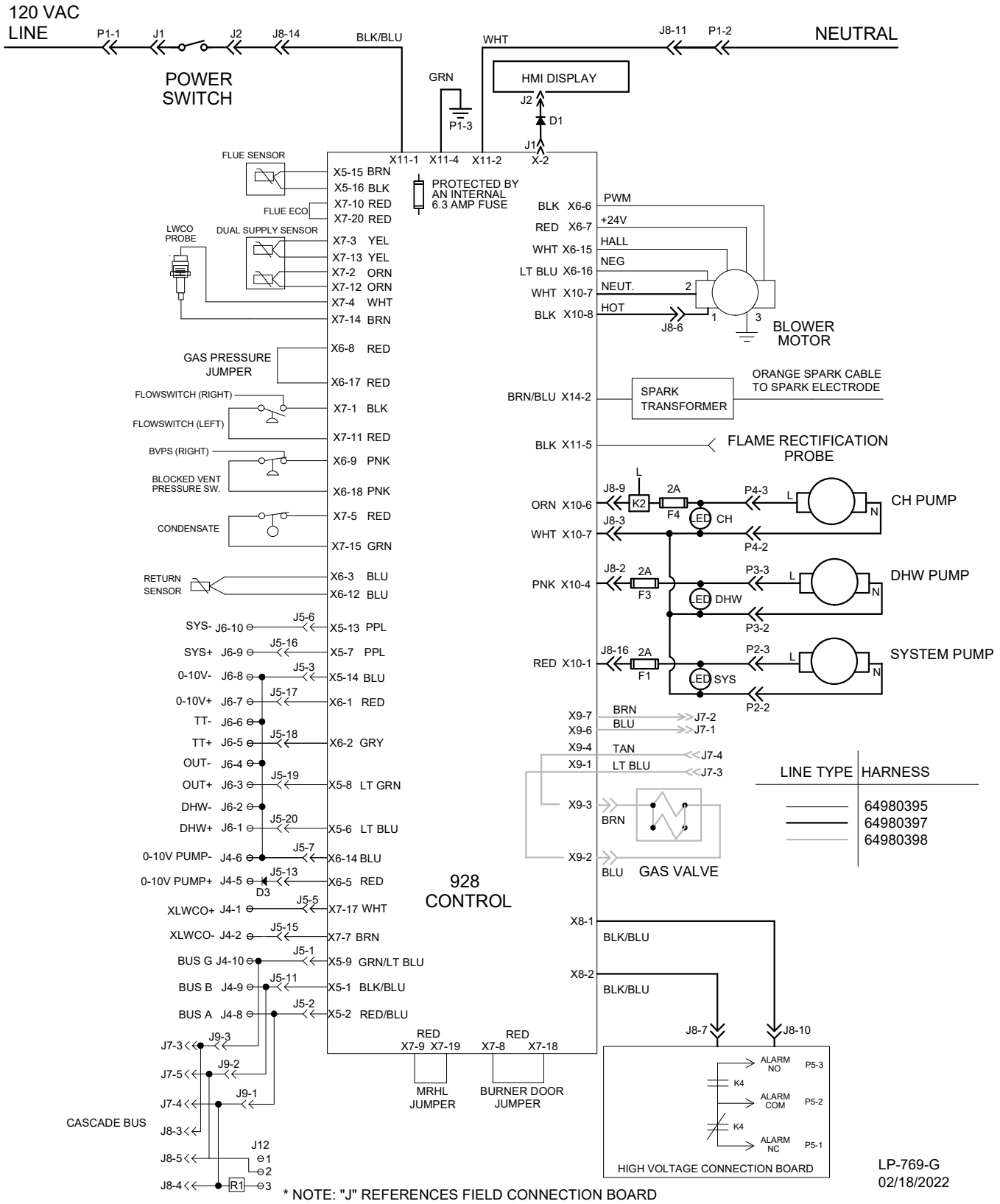
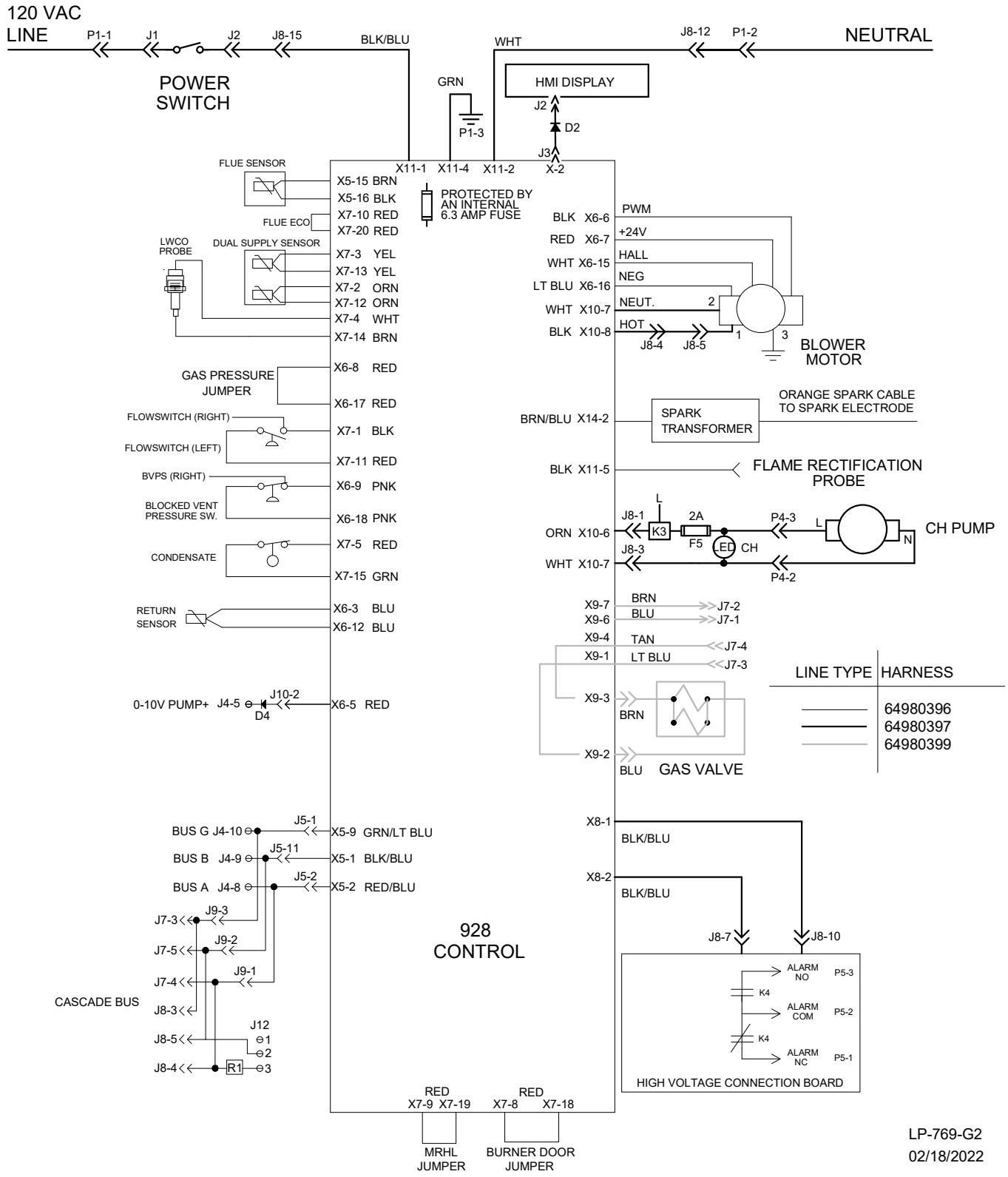


Figure 33 - Internal Connection Diagram - Master

WIRING DIAGRAM
ELUD 285-399
RIGHT MODULE



* NOTE: "J" REFERENCES FIELD CONNECTION BOARD

Figure 34 - Internal Connection Diagram - Follower

Part 8 - Gas Connections

⚠ WARNING

FIRE AND/OR EXPLOSION HAZARD

To avoid serious injury or death, the gas line installation and the gas line inlet pressure test must be done by a licensed professional.

It is very important that the boiler is connected to the type of gas noted on the rating plate. "LP" for liquefied petroleum, propane gas, or "NG" for natural gas. Do not do a gas conversion without an approved gas conversion kit (not included). Prior to turning the gas on, all gas connections must be approved by the local gas supplier or utility, in addition to the governing authority.

Make sure the gas line pressures are within normal limits. Pressures outside normal limits can result in poor performance and hazardous operating conditions, property damage, personal injury, or death.

UL recognized fuel gas detectors are recommended in all enclosed propane and natural gas applications where there is a potential for an explosive mixture of fuel gas to accumulate. The installation of these detectors should be made in accordance with the detector manufacturer's recommendations, and/or local laws. Failure to install fuel gas detectors in these applications could result in fire, explosion, property damage, severe personal injury, or death.

Never use an open flame (match or lighter) to check for gas leaks. Use a soapy solution to test connection.

Do not use Teflon tape on gas line pipe thread. Use a pipe compound rated for use with natural gases. Apply sparingly on male pipe ends, leaving the two end threads bare and flow unobstructed.

Support gas supply piping with hangers, not by the boiler or its accessories. The boiler gas valve and blower will not support the weight of the piping. Make sure the gas piping is protected from physical damage and freezing, where required.

Failure to follow these instructions could result in property damage, gas leakage, fire, explosion, serious personal injury, or death.

⚠ DANGER

Adjustments to the throttle screw or offset may only be made by a qualified gas technician using a calibrated combustion analyzer capable of measuring CO2 and CO. Failure to follow this instruction will result in fire, explosion, property damage, severe personal injury, or death.

Do not do a gas conversion on this boiler without an officially approved conversion kit and instructions supplied by HTP. Failure to use a conversion kit when converting the boiler to fire on Natural or Propane gas will result in extremely dangerous burner operation, leading to fire, explosion, severe personal injury, or death.

The gas supply shall have a minimum of no less than 3.5" water column, a maximum inlet pressure of no greater than 14" water column (350 mm), and ½ pound pressure (3.5 kPa). The entire piping system, gas meter, and regulator must be sized properly to prevent excessive pressure drop (greater than 0.5" WC) as stated in the National Fuel Gas Code. This information is listed on the rating plate.

NOTICE

Do not operate the boiler on Natural Gas or LP gas with average sulfur rates greater than 30 mg/m3. Doing so could result in improper product operation and failure, and WILL VOID the boiler warranty.

The gas connection on the boiler is 3/4" NPT. It is mandatory that this fitting is used for connection to a field fabricated drip leg as shown in the illustration per the National Fuel Gas Code. You must ensure that the entire gas line to the connection at the boiler is no smaller than the unit supplied connection.

Once all inspections have been performed, the piping must be leak tested. If the leak test requirement is a higher test pressure than the maximum inlet pressure, you must isolate the boiler from the gas line. In order to do this, shut the gas off using factory and field-installed gas cocks. This will prevent high pressure. Failure to do so may damage the gas valve. In the event the gas valve is exposed to a pressure greater than ½ PSI, 14" w.c., the gas valve must be replaced. Never use an open flame (match, lighter, etc.) to check gas connections.

A. Gas Piping

1. Run the gas supply line in accordance with all applicable codes.
2. Locate and install manual shutoff valves in accordance with state and local requirements.
3. In Canada, the Manual Shutoff must be identified by the installing contractor.
4. It is important to support gas piping as the unit is not designed to structurally support a large amount of weight.
5. Purge all gas lines thoroughly to avoid start up issues with air in the lines.
6. Sealing compound must be approved for gas connections. Care must be taken when applying compound to prevent blockage or obstruction of gas flow which may affect the operation of the unit.

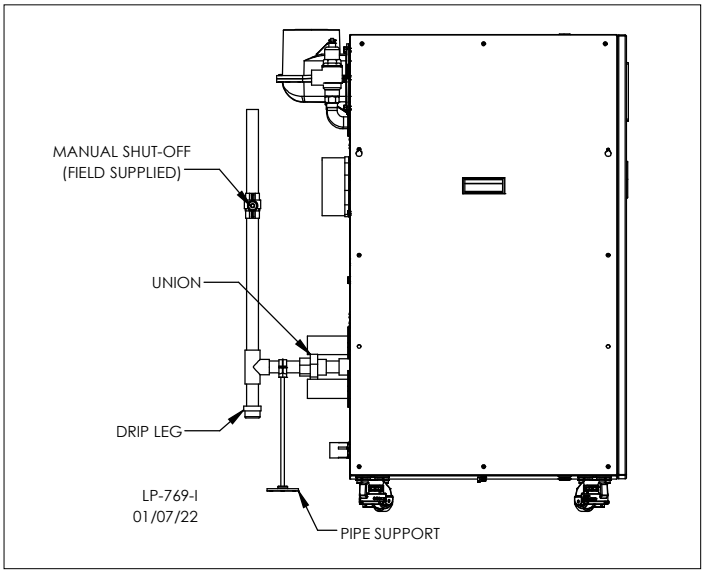


Figure 35 - Gas Connection

CAUTION

Use two wrenches when tightening gas piping at the boiler: One to prevent the boiler gas line from turning. Failure to prevent the boiler gas connection from turning could result in the breaking of tack-welds on the gas pipe plate, damage to the gas line components, substantial property damage, severe personal injury, or death.

CSA or UL listed flexible gas connections can be used when installing the boiler. Flexible gas connections have different capacities and must be sized correctly for the connected boiler firing rates. Consult with the flex line supplier to assure the line size is adequate for the job. Follow local codes for proper installation and service requirements.

B. Gas Table

Refer to Table 16 to size the supply piping to minimize pressure drop between the meter or regulator and unit. Maximum capacity of pipe in cubic feet of gas per hour cannot have a pressure drop greater than .5 w.c.

NOTE: For greater capacities, see NFPA 54, The National Fuel Gas Code.

Natural Gas Supply Piping Capacity Chart - Schedule 40 metallic pipe size in nominal inches														
(0.6 Specific gravity gas; 0.5"WC pressure drop)														
Pipe Size (Inches)	Capacity in Cubic Ft. Hr. by Length of Pipe in Straight Feet													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
3/4	360	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	678	466	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1 1/4	1390	957	768	657	583	528	486	452	424	400	N/A	N/A	N/A	N/A
1 1/2	2090	1430	1150	985	873	791	728	677	635	600	532	482	443	412
2	4020	2760	2220	1900	1680	1520	1400	1300	1220	1160	1020	928	854	794
2 1/2	6400	4400	3530	3020	2680	2430	2230	2080	1950	1840	1630	1480	1360	1270
3	11300	7780	6250	5350	4740	4290	3950	3670	3450	3260	2890	2610	2410	2240
4	23100	15900	12700	10900	9660	8760	8050	7490	7030	6640	5890	5330	4910	4560
5	41800	28700	23000	19700	17500	15800	14600	13600	12700	12000	10600	9650	8880	8260

Table 16 - Gas Supply Piping Size Chart for Boilers - from NFPA 54, The National Fuel Gas Code

C. Additional Precaution for Excess Flow Valve (EFV)

If an excess flow valve (EFV) is in the gas line, check the manufacturer's minimum and maximum flow capacity ratings. An improperly sized EFV will not allow for a full flow of gas to the boiler and will cause the boiler to malfunction. See Figure 36.



Figure 36 - Excess Flow Valve (EFV)

⚠ WARNING

When performing a pressure test on the gas line pipng, be sure the boiler is disconnected or isolated if the test pressure is expected to exceed 1/2 PSI (14" WC), as damage to the gas valve could occur. Such damage could result in fire, property damage, serious personal injury, or death.

D. Checking Gas Pressure at the Boiler for Proper Operation

NOTE: Refer to Figures 37 and 38 when checking gas pressure. Loosen the bolts before checking the gas inlet pressure.

1. The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of the system at test pressures greater than ½ psi (3.5 kPa).
2. The boiler 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 pressures equal to or less than ½ psi (3.5 kPa).

The minimum and maximum inlet gas line pressures must meet the requirements shown in Table 17.

Natural Gas	
Minimum Pressure	3.5"WC
Maximum Pressure	10.5"WC
LP Gas	
Minimum Pressure	8"WC
Maximum Pressure	13"WC

Table 17 - Gas Pressure Requirements

NOTICE

Do not fire (operate) the boiler until all connections have been completed and the heat exchanger is filled with water. Doing so will damage the boiler and void the warranty.

E. Boiler Gas Valve

To check inlet gas pressure:

1. Remove yellow cap from line pressure test point. See Figure 37.
2. Unscrew "P in" screw.
3. Connect the manometer to the test point.
4. Check the inlet gas pressure.
5. Disconnect the manometer from the test point.
6. Tighten the "P in" screw (1 N/m).
7. Check for and repair any gas leaks.
8. Replace the yellow cap.

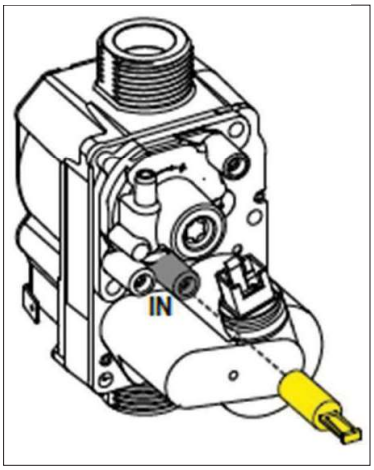


Figure 37 - Remove Yellow Cap

DO NOT REMOVE OR ATTEMPT TO MAKE AN ADJUSTMENT TO SCREWS 2 and 4 WITHOUT A CALIBRATED COMBUSTION ANALYZER. DOING SO COULD RESULT IN FIRE, PROPERTY DAMAGE, SERIOUS PERSONAL INJURY, OR DEATH.

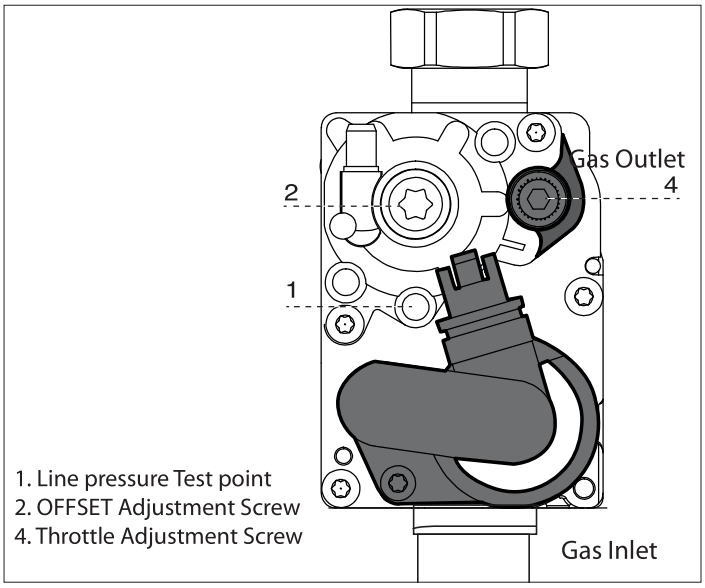


Figure 38 - Gas Valve Detail

Part 9 - Start-Up Preparation

⚠ WARNING

Thoroughly clean and flush any system that has used glycol before installing the boiler. Provide the customer with a material safety data sheet (MSDS) on the fluid used.

A. Check / Control Water Chemistry

CAUTION

Chemical imbalance of the water supply can cause severe damage to your boiler and associated equipment, and may also affect efficiency. You may have to have your water quality professionally analyzed to determine whether you need to install a water softener. It is important that the water chemistry on both the domestic hot water and central heating sides are checked before installing the boiler, as water quality will affect the reliability of the system. Outlined below are those water quality parameters which need to be met in order for the system to operate efficiently for many years. Failure of a heat exchanger due to lime scale build-up on the heating surface, low pH or other imbalance IS NOT covered by the warranty.

To ensure extended service life, it is recommended to test water quality prior to installation. Listed below are some guidelines.

CAUTION

Do not use petroleum-based cleaning or sealing compounds in the boiler system. Damage to elastomer seals and gaskets in the system could occur, resulting in substantial property damage.

Closed loop water must be free of corrosive chemicals, sand, dirt, and other contaminates. It is up to the installer to ensure the water does not contain corrosive chemicals or elements that can damage the heat exchanger.

If you suspect that your water is contaminated in any way, discontinue use of the appliance and contact an authorized technician or licensed professional.

- **Water pH between 6.5 and 8.5**
- **Hardness less than 5 - 12 grains (71.3 - 205 mg/L)**
- **Chloride concentration less than 150 ppm (mg/L)**
- **Total Dissolved Solids (TDS) 100 - 450 ppm (mg/L)**

***NOTE:** It is recommended to clean the heat exchanger at least once a year to prevent lime scale buildup. To clean the heat exchanger, follow the maintenance procedure in this manual.

Clean system to remove sediment*

1. You must thoroughly flush the system (without boiler connected) to remove sediment. The high-efficiency heat exchanger can be damaged by buildup or corrosion due to sediment.
2. For zoned systems, flush each zone separately through a purge valve. (If purge valves and isolation valves are not already installed, install them to properly clean the system.)
3. Flush system until water runs clean and you are sure piping is free of sediment.

***NOTE:** It is recommended you clean heat exchanger at least once a year to prevent lime scale buildup. Follow the maintenance procedure to clean the heat exchanger in the Maintenance Section of this manual.

Test/replace freeze protection fluid

1. For systems using freeze protection fluids, follow fluid manufacturer's instructions to verify inhibitor level and that other fluid characteristics are satisfactory.
2. Freeze protection fluid must be replaced periodically due to degradation of inhibitors over time. Follow all fluid manufacturer instructions.

NOTE: Boiler failure due to improper water chemistry is not covered by warranty.

B. Check for Gas Leaks

⚠ WARNING

Before starting the boiler, and during initial operation, smell near the floor and around the boiler for gas odorant or any unusual odor. Remove boiler front door and smell interior of boiler enclosure. Do not proceed with startup if there is any indication of a gas leak. Repair any leaks at once.

PROPANE ONLY – The propane supplier mixes an odorant with the propane to make its presence detectable. In some instances the odorant can fade, and the gas may no longer have an odor. Before startup (and periodically thereafter), have the propane supplier verify the correct odorant level in the gas.

If you discover any evidence of a gas leak shut down the boiler at once. Find the leak source with a bubble test and repair immediately. Do not start the appliance again until the leak is repaired. Failure to comply could result in substantial property damage, severe personal injury, or death.

C. Freeze Protection (When Used)

⚠ WARNING

NEVER use automotive or standard glycol antifreeze. Do not use ethylene glycol made for hydronic systems. Use only freeze-protection fluids certified by fluid manufacturer as suitable for use with stainless steel boilers, verified in the fluid manufacturer's literature. Thoroughly clean and flush any system that has used glycol before installing the new boiler. Provide the boiler owner with a material safety data sheet (MSDS) on the fluid used.

1. Determine the freeze protection fluid quantity using total system water content following the fluid manufacturer's instructions. Remember to include expansion tank water content.
2. Local codes may require back flow preventer or actual disconnect from city water supply.
3. When using freeze protection fluid with automatic fill, install a water meter to monitor water makeup. Freeze protection fluid concentration may drop if there is a leak, reducing the freeze protection level.

CAUTION

It is highly recommended to carefully follow the glycol manufacturer's recommended concentrations, expansion requirements, and maintenance recommendations (pH additive breakdown, inhibitor reduction, etc.) You must carefully calculate the additional friction loss in the system as well as the reduction in heat transfer coefficients.

D. Fill and Test Water System

⚠ WARNING

Ensure the boiler is full of water before firing the burner. Failure to do so will damage the boiler. Such damage IS NOT covered by warranty, and could result in property damage, severe personal injury, or death.

CAUTION

Connect the condensate discharge pipe before filling and purging the heating circuit.

It is important to purge the system of air to avoid damage to the boiler.

1. Fill the system only after ensuring water chemistry meets the requirements listed in this manual.

2. Close the manual and automatic air vents and boiler drain valve.
3. Fill to the correct system pressure. Correct pressure will vary with each application.
   a. Typical cold water fill pressure for a residential system is 12 psi.
   b. Pressure will rise when boiler is turned on and system water temperature increases. Operating pressure must never exceed the relief valve pressure setting.
4. At initial fill and during boiler startup and testing, check system thoroughly for leaks. Repair all leaks before proceeding further.

CAUTION

Eliminate all system leaks. Continual fresh make-up water will reduce boiler life. Minerals can build up in the heat exchanger, reducing heat transfer, overheating the heat exchanger and causing heat exchanger failure.

5. The system may have residual substances that could affect water chemistry. After the system has been filled and leak tested, verify that water pH and chloride concentrations are acceptable by sample testing.

CAUTION

It is important to purge the system of air to avoid damage to the boiler.

E. Check Thermostat Circuit(s)

1. Disconnect the two external wires connected to the boiler thermostat terminals (low voltage terminal strip).
2. Connect a voltmeter across these two incoming wires with power supplied to the thermostat circuits. Close each thermostat, zone valve and relay in the external circuit one at a time and check the voltmeter reading across the incoming wires.
3. There should NEVER be a voltage reading.
4. If a voltage reading does occur under any condition, check and correct the external wiring. (This is a common problem when using 3-wire zone valves.)
5. Once the external thermostat circuit wiring is checked and corrected if necessary, reconnect the external thermostat circuit wires to the boiler low voltage terminal strip. Allow the boiler to cycle.

F. Condensate Removal

1. The boiler is a high efficiency condensing boiler. Therefore, the unit has a condensate drain. Condensate fluid is nothing more than water vapor, derived from combustion products, similar to that produced by an automobile when it is initially started.
Condensation is slightly acidic (typically with a pH of 3 to 5) and must be piped with the correct materials. Never pipe the condensate using steel, copper, brass or other materials that will be subject to corrosion. Plastic PVC or CPVC pipe are the only approved materials.
A condensate neutralizer, if required by local authorities, can be made up of lime crystals, marble or phosphate chips that will neutralize the condensate. This may be done by the installer or you may purchase a condensate neutralizer from HTP (7350P-611).
2. The boiler is equipped with a female socket weld fitting connection (¾" in) that must be piped to a local drain. It is very important that the condensate line is sloped downward away from the boiler to a suitable inside drain. If the condensate outlet on the appliance is lower than the drain, you must use a condensate removal pump, available from HTP (554200). This pump is equipped with two leads that can be connected to an alarm or another type of warning device to alert the user of a condensate overflow, which, if not corrected, could cause property damage.
3. If a long horizontal run is used, it may be necessary to create a vent in the horizontal run to prevent a vacuum lock in the condensate line.
4. Do not expose the condensate to freezing temperatures.
5. It is very important you support the condensation line to assure proper drainage.

G. Final Checks Before Starting Boiler

1. Read Startup Procedures within this manual for proper steps to start boiler. (See Startup Report to record steps for future reference.)
2. Verify the boiler and system are full of water and all system components are correctly set for operation.

⚠ WARNING

Ensure the boiler is full of water before firing the burner. Failure to do so will damage the boiler. Such damage IS NOT covered by warranty, and could result in property damage, severe personal injury, or death.

3. Fill condensate trap with water.
4. Verify electrical connections are correct and securely attached.
5. Inspect exhaust vent and intake piping for signs of deterioration from corrosion, physical damage or sagging. Verify exhaust vent and intake piping are intact and correctly installed per Venting Section and local codes.

Part 10 - Start-Up Procedure

⚠ WARNING

FOR YOUR OWN SAFETY READ BEFORE OPERATING

1. This boiler does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
2. BEFORE OPERATING: Smell all around the boiler area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

3. WHAT TO DO IF YOU SMELL GAS

- Do not try to light any boiler.
- 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 suppliers' instructions.
- If you cannot reach your gas supplier, call the fire department.
- Turn off the gas shutoff valve (located outside the boiler) so that the handle is crosswise to the gas pipe. If the handle will not turn by hand, don't try to force or repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

4. Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control that has been damaged.
5. The boiler shall be installed so the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during boiler operation and service (circulator replacement, condensate trap, control replacement, etc.)

Failure to follow these instructions could result in property damage, serious personal injury, or death.

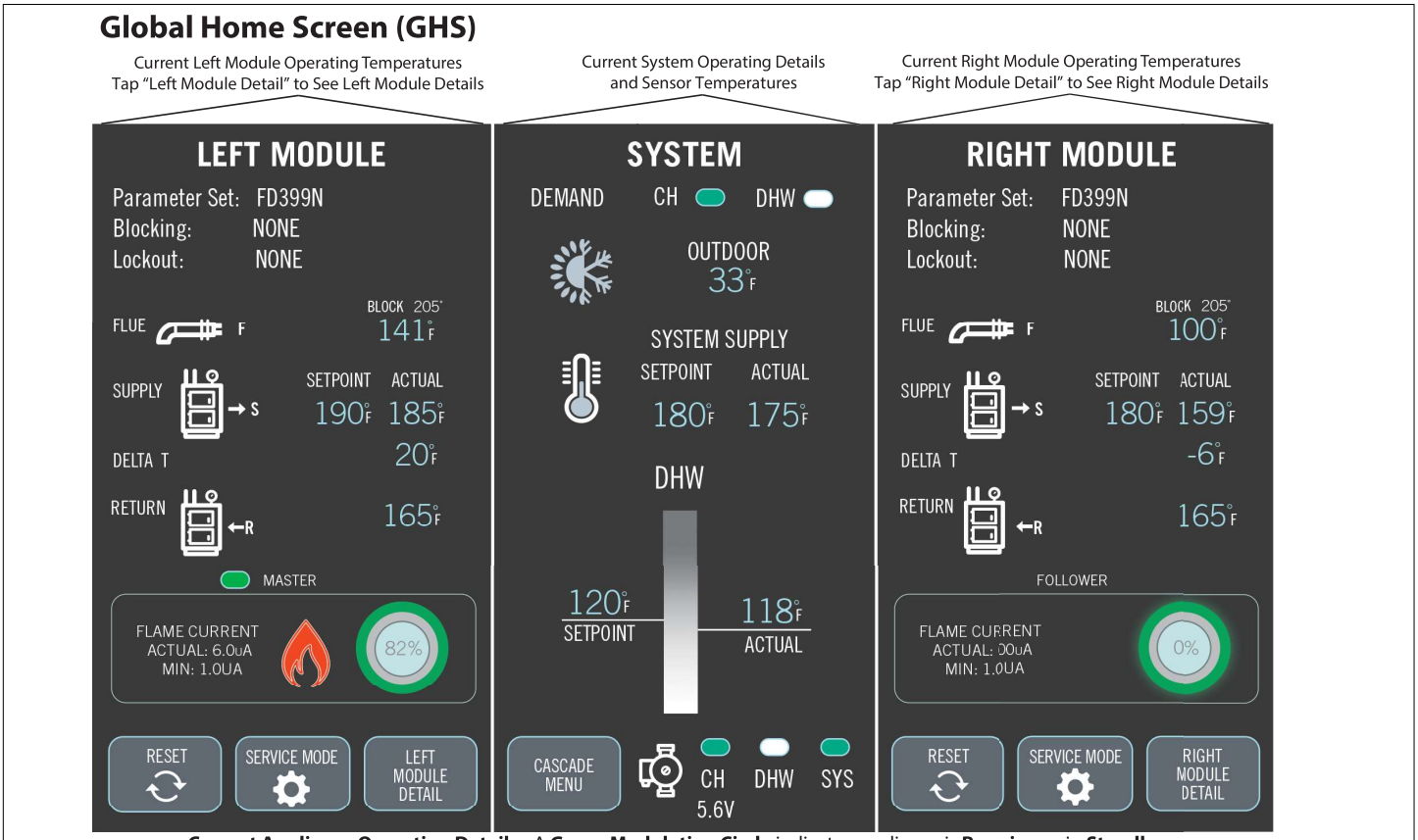
If you discover any evidence of a gas leak, shut down the boiler at once. Find the leak source with a bubble test and repair immediately. Do not start the boiler again until the leak is repaired. Failure to comply could result in substantial property damage, severe personal injury, or death.

A. Control Overview

The control is one of the primary safety devices of the boiler. It monitors the safety sensors of the boiler to assure safe and efficient operation. The control has many features associated with system design. This section addresses programming features, including History, Status, User Settings and Installer Settings, to help in customizing your control. It is important to fully understand control capabilities before customization, as its factory defaults may already fit your system design and not require any adjustment at all.

B. Navigation of the Touch Screen Display

The touch screen allows the installer to quickly navigate between appliance status screens and operating parameters, easing programming and troubleshooting. The display also provides informative messages about the operation of the appliance that are useful to both the installer and user. Many operating parameters can be viewed and adjusted with the display. The Global Home Screen (GHS) is shown below.



Current Appliance Operating Details - A **Green Modulation Circle** indicates appliance is **Running** or in **Standby**; **Yellow** indicates a **Service Notification**; **Orange** indicates a **Blocking Code**; **Red** indicates a **Locking Code**

Figure 39 - Global Home Screen (GHS)

Navigation Bar (Navbar)

The Navigation Bar (Navbar) is visible on all screens except the Global Home Screen (GHS) and features icons that allow the installer / user to move quickly through the appliance control screens. The position of the Navbar is used to indicate the Left and Right Module screens. The Navbar will be on the left on a Left Module screen, and on the right on a Right Module screen. The screens accessed by tapping these icons are described below:

HTP Logo

Tapping the HTP Logo from any screen will return the installer / user to the GHS. The GHS allows the installer / user quick access to appliance internal operating temperatures, external temperature sensor readings, current CH and DHW setpoints and actual temperatures, appliance modulation percentage, operation details, and a Reset key.

Home

NOTE: On the GHS, tap "Left Module Detail" or "Right Module Detail" to access those specific module values.

Tapping Home brings the installer / user to the Boiler Home Screen (BHS), which displays specific module internal operating temperatures, external temperature sensor readings, current CH and DHW setpoints and actual temperatures, appliance modulation percentage, operation details, and a Reset key.

History

The History screens allow the installer / user to view important items from the appliance's history, including serial number, power on hours, ignition attempts, and the ten (10) most recent appliance Blocking and Fault codes.

Status

The Status screens detail the appliance's current operating stats, including fan speed and temperature settings, and input and output settings.

Graphics

The Graphics function allows the installer / user to select and view real time system analytics. This function helps the installer / user fine tune system operation and aids in troubleshooting.

Cascade

Cascade lets the installer / user view cascade system stats, including the current operating status of all the boilers installed in the cascaded system.

User

The User function allows the installer / user to quickly set operating settings such as the boiler setpoint, differential, offset, and DHW settings with easy to use slider bars.

Installer

The Installer Menu is accessed with a password, allowing the installer to customize the installation and offering quick access to set the Outdoor Reset Curve. Pump Service Mode and LWCO Test Mode are also accessed through the Installer function or directly from the GHS through the SERVICE MODE buttons.

NOTE: Installer should only be accessed by a qualifed service technician.

Reset

Tap Reset to clear any lockout code and return the appliance to normal operation.

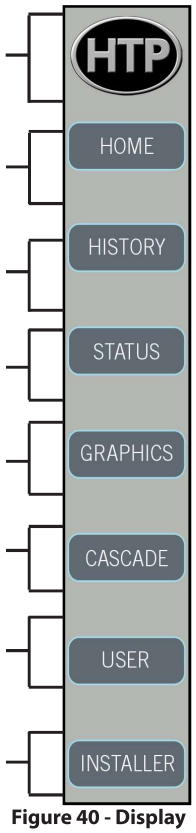


Figure 40 - Display Navigation Bar

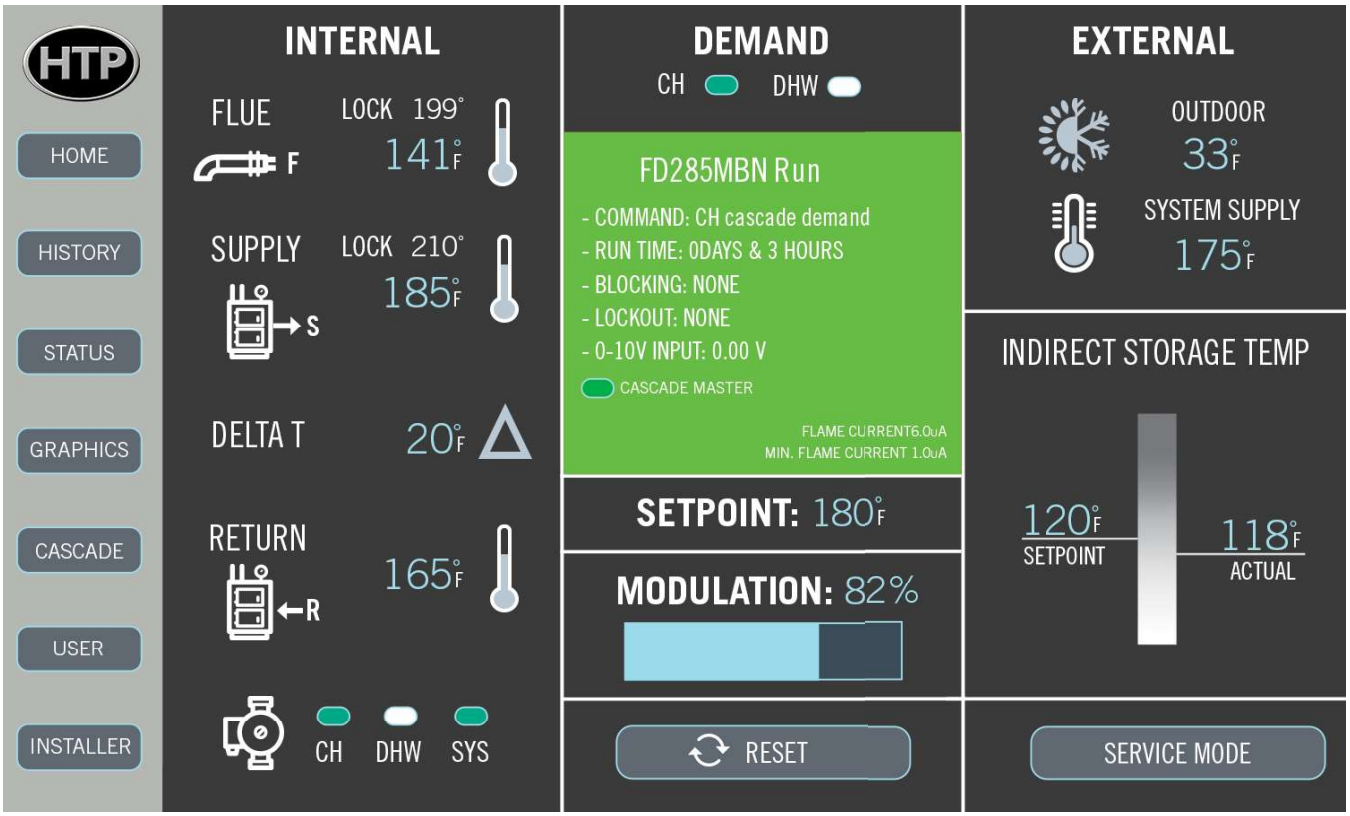


Figure 41 - Left Module Screen - Boiler Home Screen (BHS)

C. Purge Air from the System

To purge air from the system:

a. Connect a hose to the purge valve and route hose to an area where water can drain and be seen.

b. Close the boiler or system isolation valve between the purge valve and fill connection to the system.

c. Close zone isolation valves.

d. Open quick-fill valve on cold water make-up line.

e. Open purge valve.

f. Open the isolation valves one zone at a time. Allow water to run through the zone, pushing out the air. Run water until no noticeable air flow is present. Close the zone isolation valves and proceed with the next zone. Follow this procedure until all zones are purged.

g. Close the quick-fill water valve and purge valve and remove the hose. Open all isolation valves. Watch the system pressure rise to correct cold-fill pressure. It is recommended that you put the pumps into manual operation to assist in purging the circuits.

h. Disconnect the wires that are connected to the THERMOSTAT terminals of the customer connection board. Apply power to the boiler. The display will show the Home Screen.

i. Tap Installer on the display Navigation Bar to open the Installer settings. Then tap NEXT repeatedly to navigate to Service Mode. See Figure 50. When prompted for a password, enter "928".

j. Pump Service Mode allows quick access to run connected pumps and purge air from the lines. Tap the connected pumps On and Off to toggle between running each pump in the system as required to help bleed out all entrapped air. Some good indicators that air is removed include the absence of gurgling noises in the pipes and pump operation becoming very quiet. Tapping Home and returning to the Home Screen will return the boiler to normal operation.

k. After the system has operated for five minutes, eliminate any residual air by using the manual air vents located throughout the system.

l. If purge valves are not installed in the system, open manual air vents in the system one at a time, beginning with the lowest floor. Close vent when water squirts out. Repeat with remaining vents.

m. After purging, refill system to correct pressure.

D. Single Boiler Initial Start-Up and Operation

When power is applied to the boiler, the control first completes a power-up systems check and boots up the display. During this time the combustion fan may run.

After boot up is complete the display will show the Global Home Screen (GHS) and its accompanying data, including firing rate, modulation rate, and current boiler supply temperatures for each module. A green center pane in the Boiler Home Screen (BHS) indicates the boiler is in ready operating condition and either running or in standby, awaiting a demand for heat. In the GHS, the color of the Modulation Circle indicates boiler status. If a fault is detected, the GHS Modulation circle and BHS center pane will display the appropriate blocking code (orange) or lockout code (red).

NOTE: A service notification will result in a BHS center pane that alternates between yellow and orange.

When a demand for heat is received, the control begins the following demand sequence. The boiler first turns on the pump. The control will measure the supply temperature. If it is below the set point temperature minus the ignition differential the control will ignite the burner.

After the burner is lit, the control modulates the firing rate to control the supply water temperature and meet the heat demand. When the thermostat or indirect water heater temperature is met, the control will extinguish the burner and run the combustion fan to purge gasses from the combustion chamber. In addition, the pump will run for a pump post purge interval. The control will then be in standby, waiting to process the next demand for heat.

During this process, the control will extinguish the burner if it senses a dangerous or unsafe condition. If the control determines that a dangerous or unsafe condition has occurred, the control may lock out the boiler and prevent it from igniting until a maintenance person diagnoses the problem, repairs it, and resets the control. In the event that the control goes into lockout, it will show a diagnostic code on the display and close the alarm relay contacts on the CCB to aid in recognition of the condition, diagnosis, and repair.

E. Cascaded System Initial Start-Up and Operation

Operation is slightly different if the boiler is part of a cascaded system. Each boiler control in a cascaded system completes its own power up system check. One of the boilers in the cascade system is designated as the master boiler. After the master boiler completes its power up sequence, it checks the communication bus to see if any other boilers are present. If other boilers are present, the master control determines these follower boiler addresses. The master boiler control will recheck the bus every few seconds as long as it is powered to update the status of the connected boilers. The master boiler control processes all heat demands and dictates which of the follower boilers should light and what firing rate the followers should try to achieve.

When the master boiler receives a demand for heat, it determines which boiler is first in the firing sequence and sends that boiler a command to begin a demand sequence. That boiler will then begin as described above. Once the boiler ignites, the master boiler control will increase the firing rate command to that boiler until the system sensor temperature is at the set point temperature plus the offset, or that boiler is at a high firing rate.

If the command from the master boiler control gets to the high firing rate of the follower boiler, but the system sensor is below the required temperature, the master boiler will tell the next boiler in the firing sequence to begin its demand sequence. The master boiler will then begin to ramp the firing rate command of that boiler.

This process will continue while there is a demand until all boilers in the cascade are at high fire or the desired temperature of the system sensor is reached. If the system sensor temperature reaches set point and offset before all boilers are at high fire, the master control will modulate the cascade command signal to maintain the system sensor at set point until demand is complete (when the system sensor is equal to the set point temperature and the thermostat opens). The master boiler control will extinguish all boilers that may be lit. If the demand decreases, the firing rate command and amount of boilers lit will decrease exactly opposite as described above.

Whenever the master boiler needs to fire a follower, it sends a firing rate command to that boiler. The follower boiler will respond to the command until its supply sensor temperature gets to the supply set point temperature, at which point the individual boiler will modulate on its own so as not to overheat. As a result, it is not uncommon to see the cascade output at maximum but individual boilers firing at less than their maximum firing rate.

F. Lockout Condition - Cascade System

Each boiler in the cascade system is responsible for its own safety functions. If any individual boiler control senses an unsafe condition, it will extinguish the burner and, if necessary, go into a lockout condition. In this way, every boiler in the system has its individual safety controls intact and operational, even if the firing of the boiler is under control of the master boiler. If any boilers are in a lockout condition, including the master boiler in the cascade system, the master control will recognize the lockout condition and skip over the boiler in the firing sequence.

In the event that the system sensor fails, all boilers in the system will ignite simultaneously when there is a demand, and each boiler will individually regulate firing rates to maintain the master set point temperature at the individual supply sensors built into the boiler. If this should happen, and I27 = ON, then the master boiler will display an E03 Blocking code, indicating that the system supply sensor has failed.

G. Cascade System Programming

STOP!!!

NOTE: This sheet applies to Cascade boiler systems only! These instructions do not apply to single boiler systems.

DO NOT connect cascade cables from boiler to boiler UNTIL ALL MODULES ARE ADDRESSED! Failure to follow this instruction will result in improper operation and a failed cascade chain!

NOTE: Each boiler ships factory ready to operate as a Cascade Master. Only boilers designated Followers need to be programmed. The Right Module must be programmed FIRST.

Programming the Second Follower Boiler (Right Module):

1. Make sure there is no demand for heat on the boiler.
2. Apply power to the boiler. Wait for the Global Home Screen (GHS) to display "Master" on the Left Module, and "Follower 1" on the Right Module BEFORE proceeding to the following steps.
3. At the GHS, tap RIGHT MODULE DETAILS, then tap Installer in the Boiler Home Screen (BHS) display Navigation Bar to enter the Installer Menu.
4. Tap NEXT and navigate to Installer #15. Set the Cascade Address to 3.
   NOTE: The Follower Boiler Right Module MUST be addressed with an odd number and CANNOT be addressed 1.
5. Ensure Installer #23, Cascade Mode, is set to ON.
6. Exit the Installer Menu.
7. Tap the HTP logo in the upper left corner of the screen to return to the GHS.

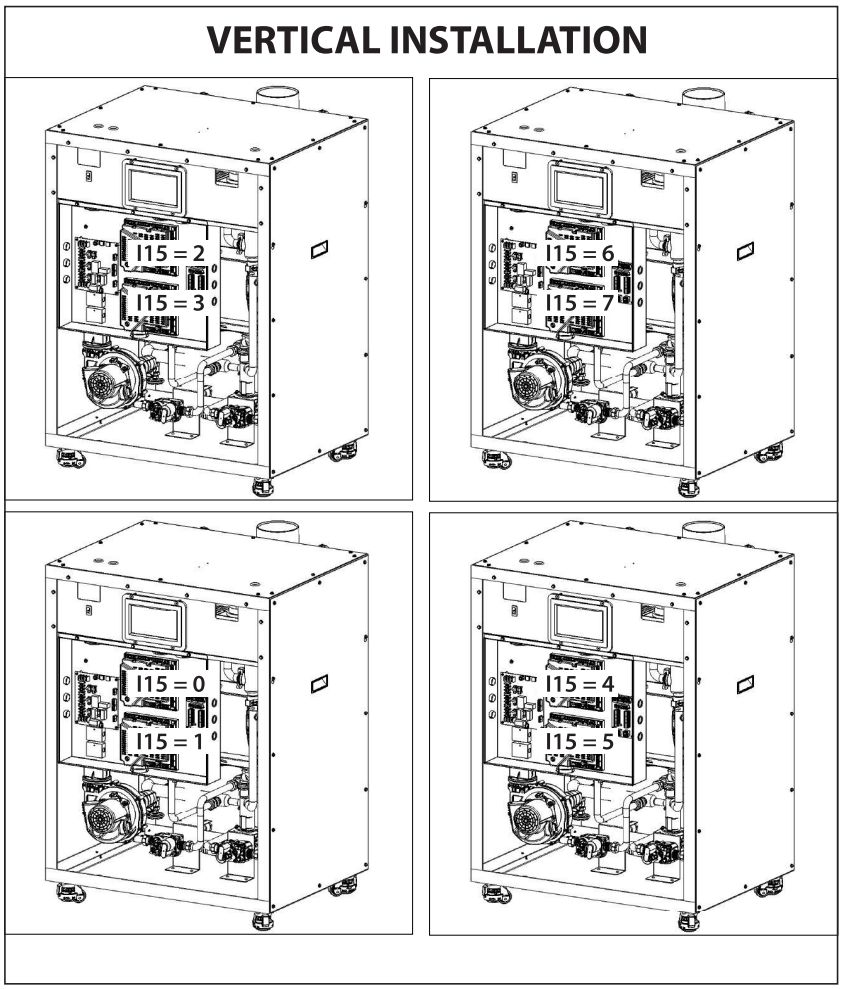
Programming the Second Follower Boiler (Left Module):

1. At the GHS, tap LEFT MODULE DETAILS, then tap Installer in the BHS display Navigation Bar to enter the Installer Menu.
2. Tap NEXT and navigate to Installer #15. Set the Cascade Address to 2.
   NOTE: The Follower Boiler Left Module MUST be addressed with an even number and CANNOT be addressed 0.
3. Ensure Installer #23, Cascade Mode, is set to ON.
4. Exit the Installer Menu.
5. Tap the HTP logo in the upper left corner of the screen to return to the GHS.

Use the above guidelines to program further Follower boilers as necessary. See Figure 42 for further details.
After all boilers are programmed, connect the cascade bus cables from boiler to boiler in a daisy chain configuration, and move the cascade resistor termination jumper(s) as described in Table 15 in this manual.

H. Operating Instructions

Before operating the unit, it is important to verify that the gas line and water lines are connected to the boiler and fully purged. If you smell gas, STOP! Follow the safety instructions listed in the first part of this section. If you do not smell gas, follow the next steps.
1. Turn down the thermostats before applying power to the boiler. If 0–10 volt or other inputs are used, make sure that they are set (<1.5VDC) so there is no call for heat while programming.
NOTE: An input of 1.5V is the minimum input to initiate a call for heat on the boiler.
2. Power on the boiler or boilers if a cascade system is used.
3. Next, check the User settings. Adjustment and factory defaults are outlined within this section. If a cascade system is used, it is important that all the boilers have the same User settings.
4. Next, check the System settings. Adjustments and factory defaults are outlined within this section. If a cascade system is used, it is important that the master boiler is programmed with the correct System settings.
5. Create a demand on the boiler or Master boiler if a cascade system is used. The user can monitor system functions when the boilers are operational.
6. If any boiler fails to start refer to the troubleshooting section in the back of this manual.



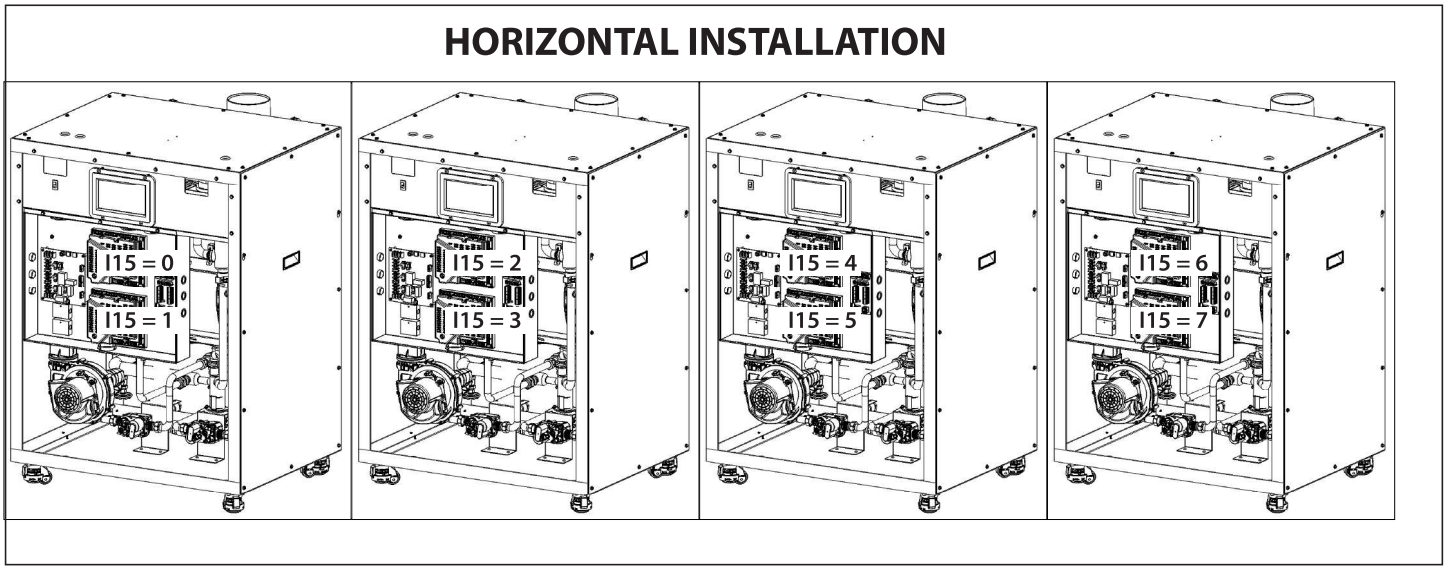


Figure 42 - Cascade Programming Detail

I. Programming User Settings

User Setting Program Access

NOTE: Programming the boiler control is not possible when the boiler is firing. Make sure any input which can create a demand on the boiler, such as the tank thermostat, is turned off so the boiler will remain idle to allow programming.

NOTE: To change User Settings enter Access Code **600** when prompted.

User Setting Program Navigation

Use the touch screen sliders or input prompts to change the Boiler settings. Press **SAVE** to store changes. Press **NEXT** to advance to User Screen 2 - DHW Settings, and **PREVIOUS** to go back a screen. Listed below are the User Settings that can be programmed into the control.

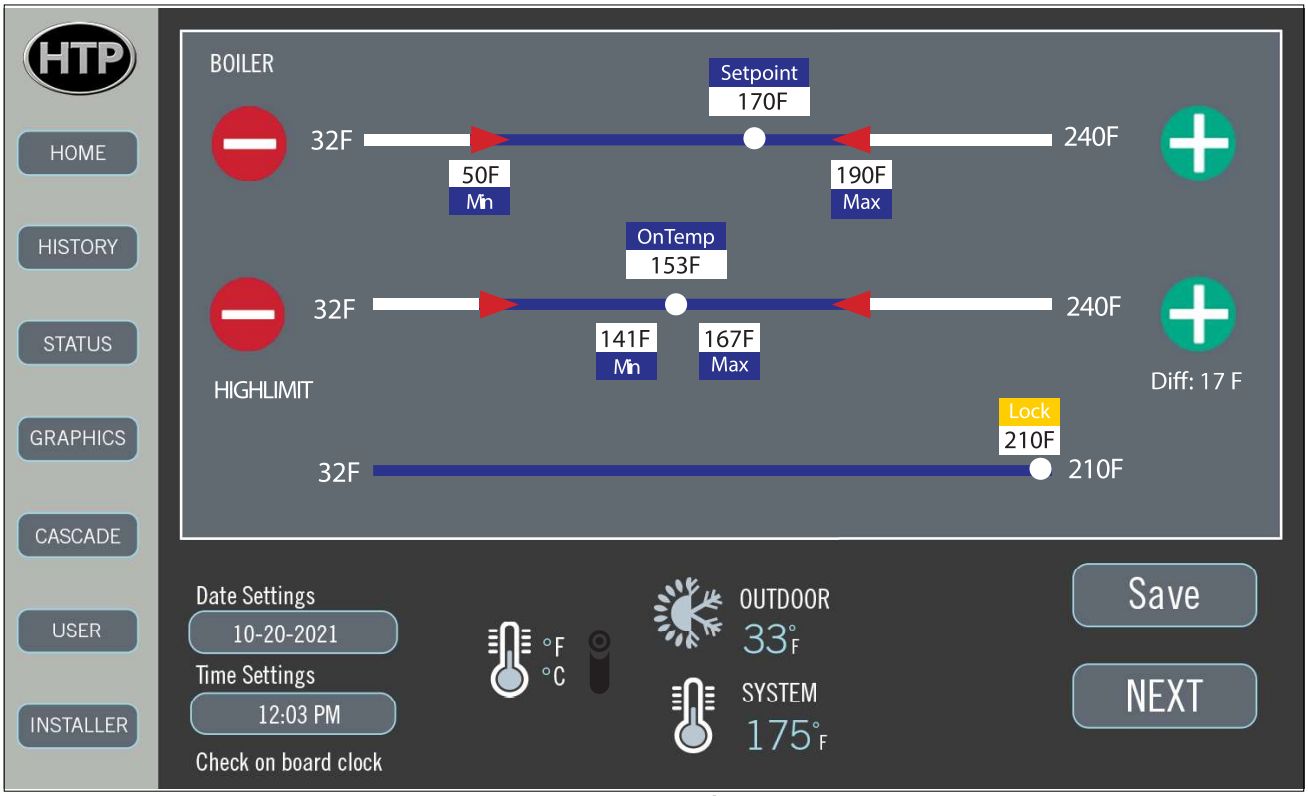


Figure 43 - User Screen 1 - Boiler Settings

Setting	Description
Slider 1 System Setpoint 181 °F	Adjusts the System Setpoint between the Factory programmed limits of 50°F and 190°F (Factory Default 181F). **NOTE:** After changing the setpoint and tapping SAVE, the differential slider will move, maintaining the differential range. When changing the setpoint ensure the differential remains at the desired setting.
Slider 2 System Differential 29 °F	Adjusts the "differential", or the temperature below system setpoint at which the boiler will light (On Temp) during a call for heat. This is user adjustable between Setpoint minus 3 (burner lights at 3F below Setpoint) and Setpoint minus 29F (burner lights at 29F below setpoint). (Factory Default Setpoint minus 29°F). In the example above, a setpoint of 170F and differential of 17F is desired. The setpoint slider is set at 170F. The On Temp slider is set at 153F (170 - 153 = 17). Tap SAVE to save the settings. **NOTE:** The current differential from 3 - 29°F is also displayed in a text box to the right and slightly below the slider.
Slider 3 Central Heat High Limits	Adjusts the high limit based upon the Central Heat Setpoint. This UL-353 compliant feature simplifies testing and increases safety during boiler installation and inspection. This improvement allows the installer to temporarily lower the high limit to a temperature far lower than the normal factory operating limit. For details on how to perform the test see Testing the High Limit, this manual. **NOTE:** High limit temperature cannot be permanently changed. After leaving the User menu the Factory settings will be restored.
Input 1 Date Settings	Allows the user to set the date. See the following page for setting the date.
Input 2 Time Settings	Allows the user to set the time. See the following page for setting the time.
Input 3 Temperature Display C or F	Toggle the switch near the °F or °C to switch temperature measurement from Fahrenheit to Celsius (Default is Fahrenheit).

Table 18 - User Screen 1 Program Navigation

Testing the High Limit

To test the Central Heat High Limit:

1. At the Home Screen, make note of the current boiler supply temperature.
2. Navigate to User Screen 1.
3. Tap on the High Limit slider. You will be prompted to input the Service Mode Access Code, **928**. Click Ok.
4. Slide the High Limit below the current boiler supply temperature, but not below the boiler minimum. Tap Save.
5. Navigate to the Home Screen. The boiler should enter a lockout state and the operating screen will turn red.
6. Tap Reset at the Home Screen to clear the error code. The High Limit will automatically reset to the factory programmed temperature.

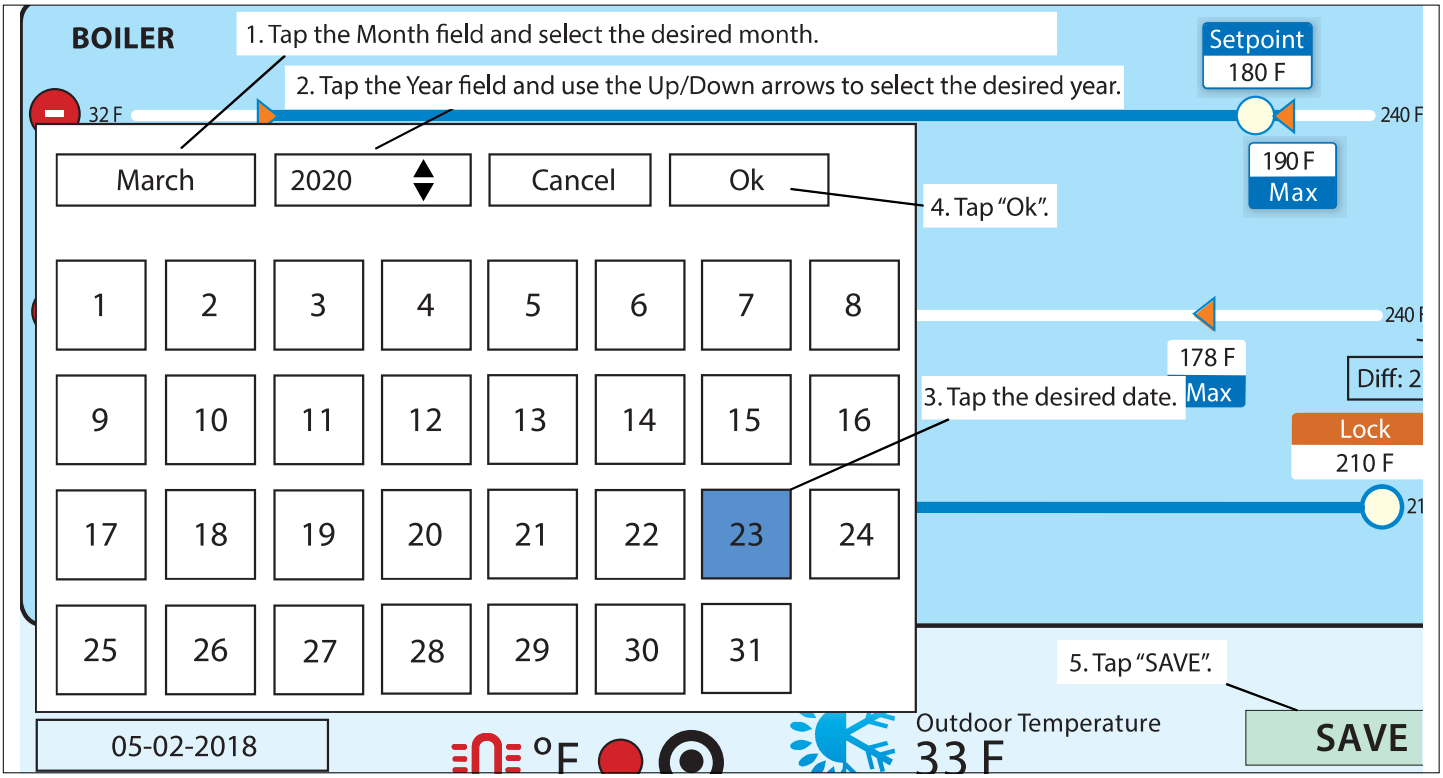


Figure 44 - Setting the Date

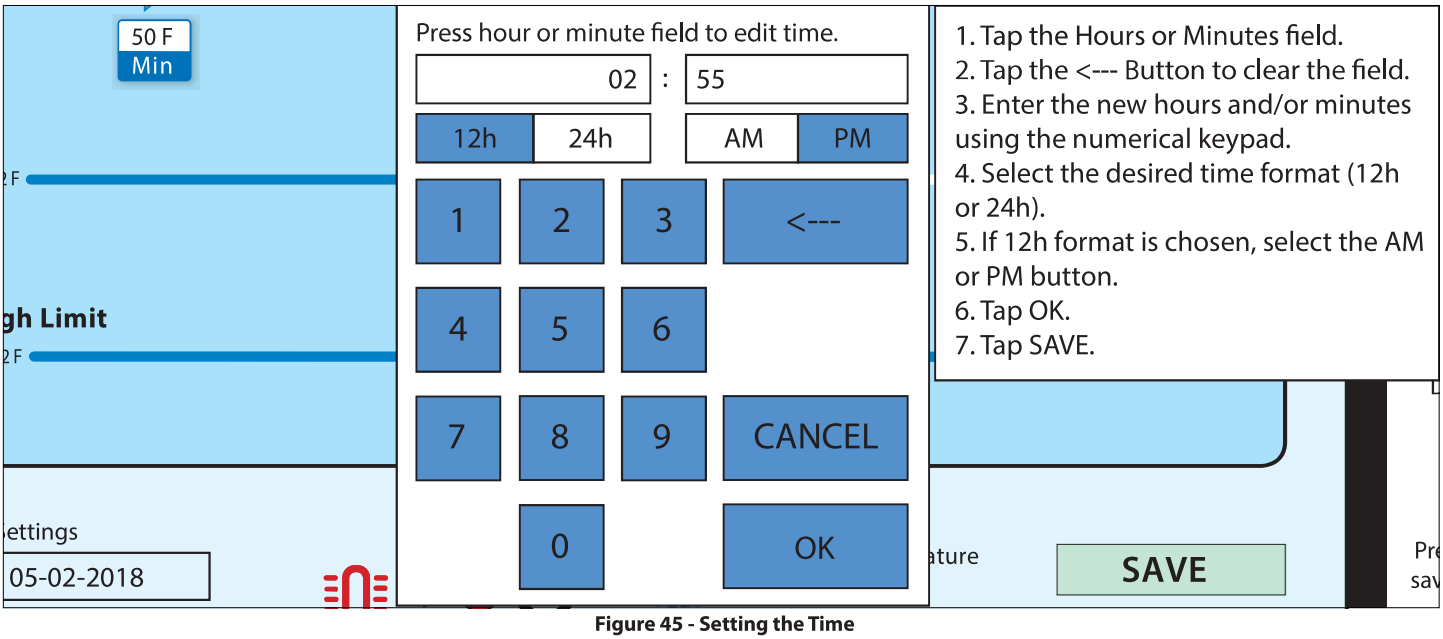


Figure 45 - Setting the Time

NOTE: The DHW Screen below is **only accessible on the left module of each boiler** (including Followers in Cascade).

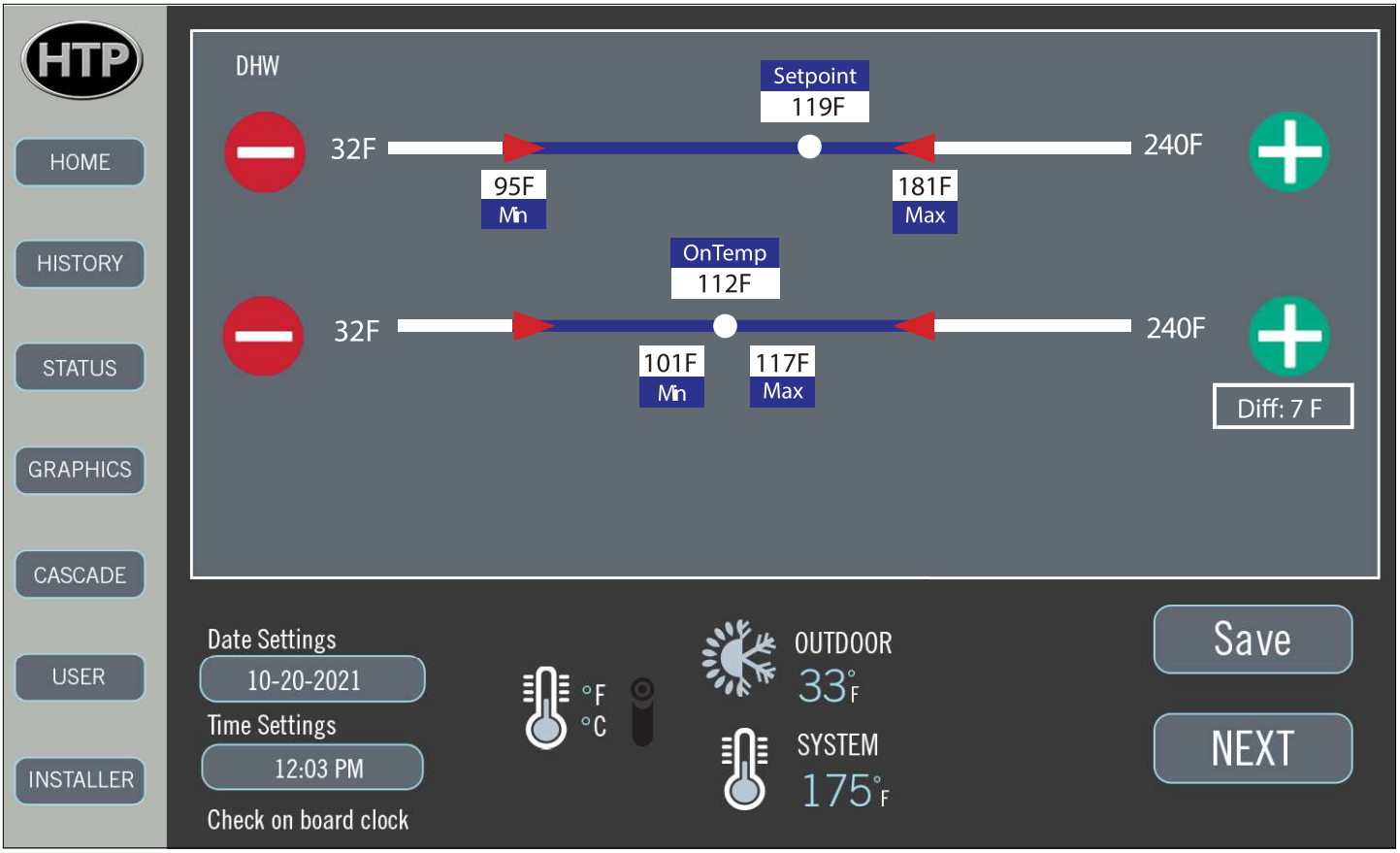


Figure 46 - User Screen 2 - DHW Settings - NOTE: This screen is appears on Left Module BHS ONLY!

Setting	Description
Slider 1 DHW Setpoint 119 °F	Adjusts the DHW indirect tank set point from 95°F to 181°F (Factory Default 119°F). **NOTE:** After changing the setpoint and tapping SAVE, the differential slider will change as well, maintaining the differential range. When changing the setpoint ensure the differential remains at the desired setting.
Slider 2 DHW Differential 18 °F	Adjusts the "differential", or the temperature below setpoint at which the boiler will light (On Temp) during a call for DHW. This is user adjustable between Setpoint minus 2 (burner lights at 2F below Setpoint) and Setpoint minus 18F (burner lights at 18F below setpoint). (Factory Default Setpoint minus 18°F). In the example above, a setpoint of 119F and differential of 7F is desired. The setpoint slider is set at 119F, and then the On Temp slider is set at 112F (119 - 112 = 7). Tap SAVE. **NOTE:** The current differential from 2 - 18°F is displayed in a text box to the right and slightly below the slider.
Input 3 Temperature Display C or F	Toggle the switch near the °F or °C to switch temperature measurement from Fahrenheit to Celsius (Default is Fahrenheit).

Table 19 - User Screen 2 Program Navigation

J. Programming Installer Settings

Installer Setting Program Access

NOTE: Programming the boiler control is not possible when the boiler is firing. Make sure any input which can create a demand on the boiler, such as the tank thermostat, is turned off, so the boiler will remain idle to allow programming.

NOTE: To change Installer Settings enter Access Code **925** when prompted.

Installer Setting Program Navigation

Use the touch screen sliders or input prompts to change the Installer settings. Press **SAVE** to store changes. Press **NEXT** to advance to the next screen, and **PREVIOUS** to go back a screen. The following are the Installer settings that can be programmed into the control.

Installer - Outdoor Reset Curve Screen

The Outdoor Reset Curve Screen provides the installer with a number of sliders to quickly and efficiently set the outdoor reset curve. These settings can also be found in the Installer - Installer Menu. These settings are as follows:

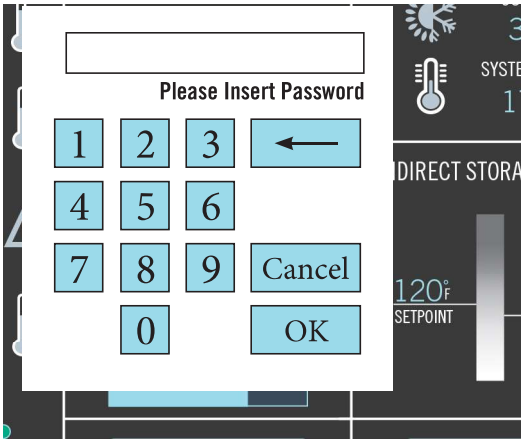


Figure 47 - Insert Password Pop Up Prompt

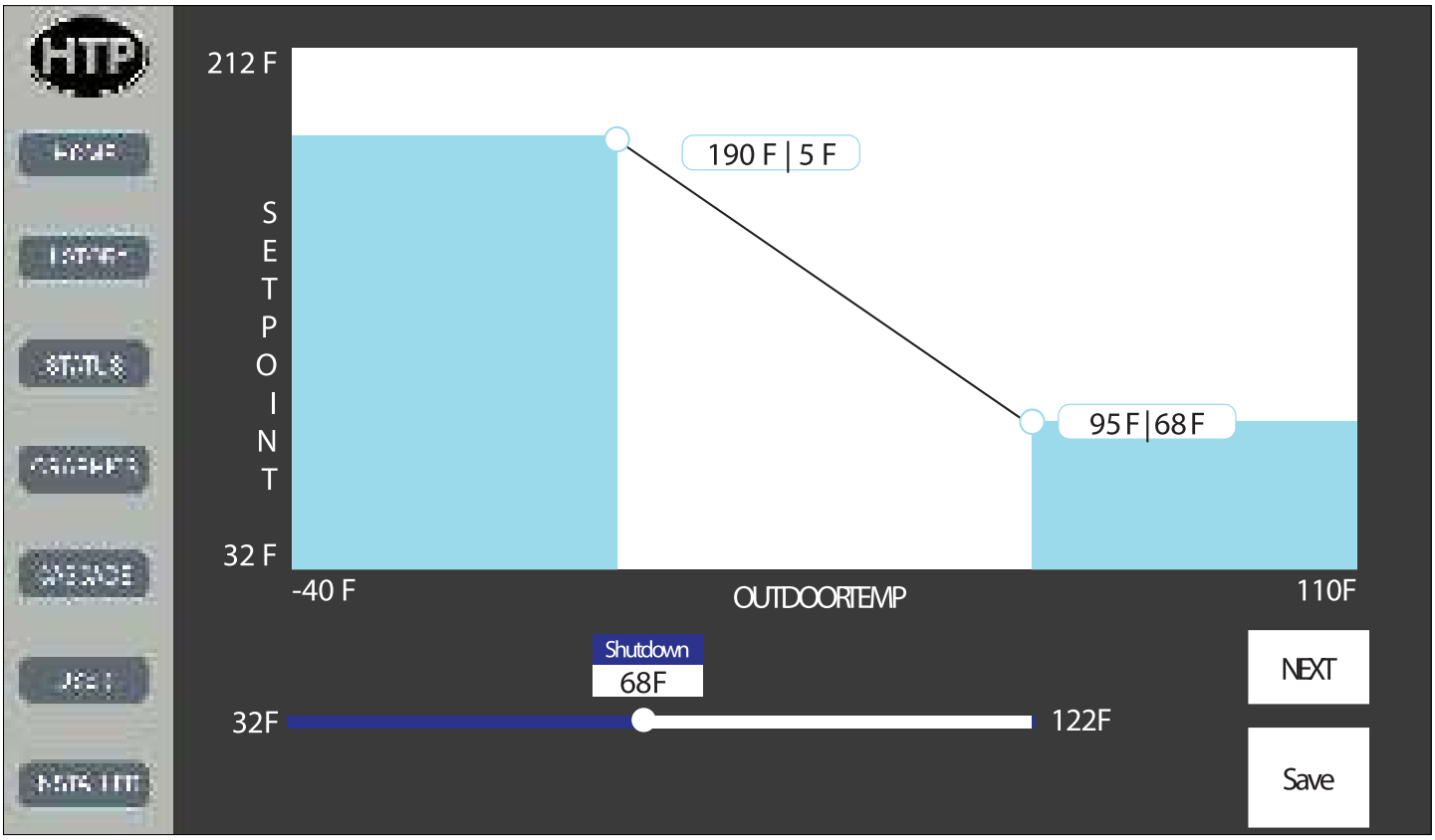


Figure 48 - Installer - Outdoor Reset Curve Screen - NOTE: An Outdoor Sensor Must Be Used When Setting an Outdoor Reset Curve

Setting	Description
Slider 1 Maximum Supply Temp 180 °F and Minimum Outdoor Temp 5 °F	Sets the maximum design supply temperature based on the minimum outdoor design temperature. Default: 180°F (Range: 77°F to 190°F). Sets the minimum outdoor design temperature for the system. Default: 5°F (Range: -42°F to 32°F).
Slider 2 Minimum Supply Temp 95 °F and Max Outdoor Temp 68 °F	Sets the design supply water temperature based on the maximum outdoor design temperature. Default: 95°F (Range: 32°F to 190°F). Sets the maximum outdoor design temperature for the system design. Default: 68°F (Range 32°F to 190°F).
Slider 3 Outdoor Shutdown Temp	Sets the outdoor temperature where the boiler will ignore central heating demands. Default: 68°F (Range 41°F to 122°F).

Table 20 - Installer - Outdoor Reset Curve Screen

Installer - Installer Menu

The Installer Menu provides the installer with a number of settings to customize system operation. These settings are as follows:

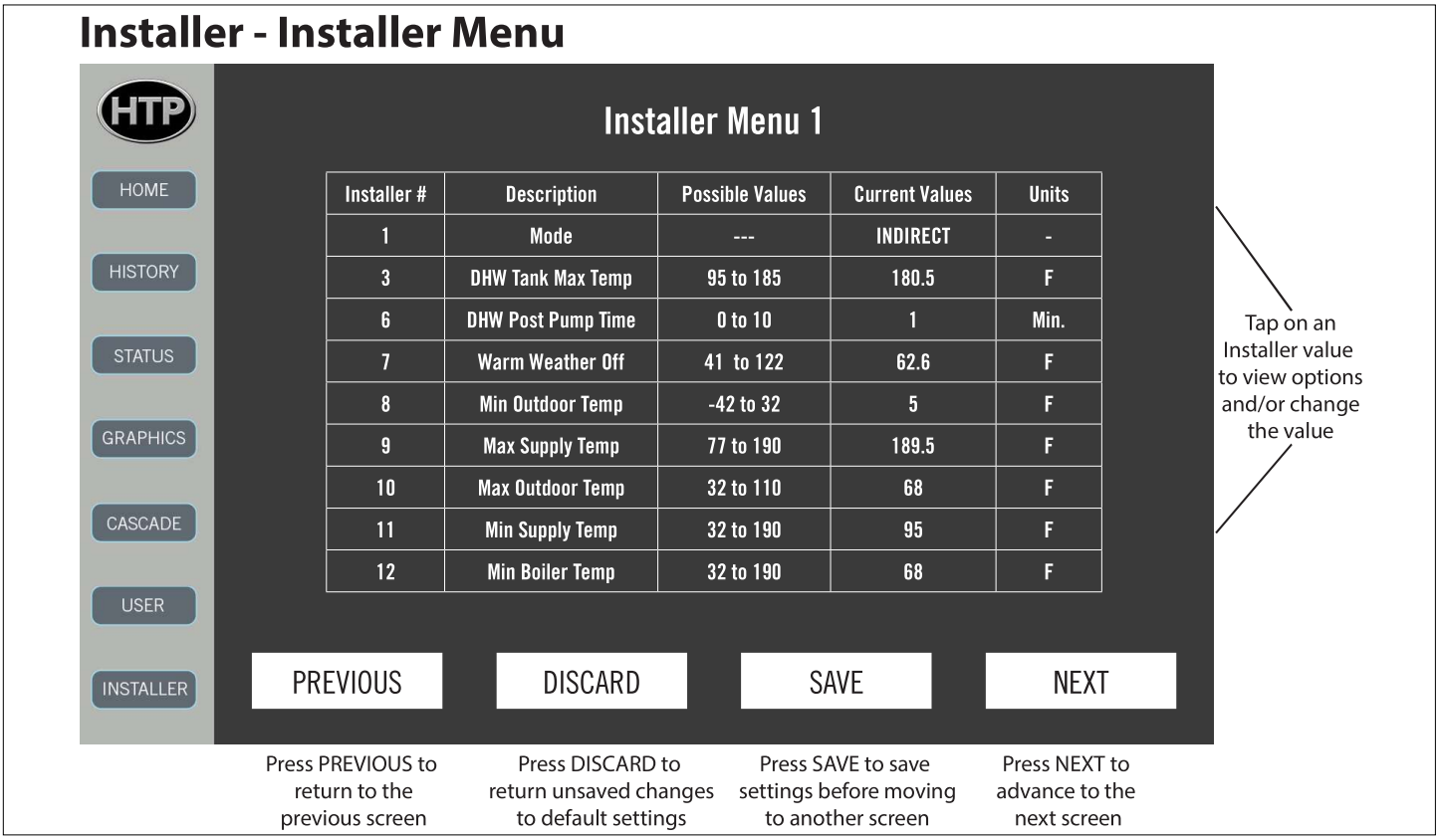


Figure 49 - Installer - Installer Menu Screen

Installer #	Description	**Default** (Range)	Detail
1	**Mode**	**INDIRECT**	This is the Factory Program Mode. INDIRECT indicates that the control is configured correctly. This setting cannot be changed.
3	**DHW Tank Max Temp**	**180°F** (95°F - 185°F)	This is the maximum temperature that can be selected in boiler settings for the DHW tank.
6	**DHW Post Pump Time**	**1 Minute** (0 - 10 Minutes)	The indirect pump has the ability to post purge energy from the boiler to run the pump after the set point has been achieved. Please note that running the pump for a time greater than 5 minutes may cause tank energy to be released back to the heat exchanger.
7	**Warm Weather Shutoff**	**68°F** (41°F - 122°F)	When used with an outdoor sensor, warm weather shut down will disable the boiler if the programmed outdoor temperature is exceeded.
8	**Min Outdoor Temp**	**5°F** (-49°F - 32°F)	Sets the minimum outdoor design temperature for the system.
9	**Max Supply Temp**	**190°F** (77°F - 190°F)	Sets the maximum design system temperature based on the minimum outdoor design temperature.
10	**Max Outdoor Temp**	**68°F** (32°F - 110°F)	Sets the maximum outdoor design temperature for the system design.
11	**Min Supply Temp**	**95°F** (32°F - 190°F)	Sets the design supply water temperature based on the maximum outdoor design temperature.
12	**Min Boiler Temp**	**68°F** (32°F - 190°F)	Sets the design minimum heat curve temperature for central heat. **NOTE: IF INSTALLER 11 IS SET AT <68°F ENSURE THIS VALUE MATCHES IT.**
13	**CH Post Pump Time**	**1 Minute** (0 - 10 Minutes)	Allows the user to set the boiler pump post purge time once the thermostat is satisfied.
14	**DHW Priority**	**30 Minutes** (0 - 60 Minutes)	When I55 is set to OFF, I14 allows the user to set the maximum run time for the indirect fired water heater before switching to meet a central heating call.
15	**Cascade Address**	**0** (0 - 15)	Bus addressing boilers (maximum boilers allowed is four [4] in a cascade system), or eight (8) modules. Master Boiler address is 0 and Follower Boilers are addressed 1 thru 7. NOTE: DO NOT USE ADDRESSES 8 - 15.
16	**Optional Inputs**	**Off** (Off / 0 - 10 Volt)	Allows the user to select optional inputs to control or monitor the system.

Installer #	Description	**Default** (Range)	Detail
17	**0-10 Volt Function**	**Temperature** (Temperature or Fan Speed)	Controls boiler CH setpoint according to the Outdoor Reset Curve. 1.5v will change the setpoint to equal Installer 11, 10v will change the setpoint to Installer 9. If Fan Speed is selected, then 1.5v will cause the boiler to run at low fire (min fan speed) and 10v will cause the boiler to go to high fire (max fan speed).
18	**Step Modulation Mode**	**ON** (OFF or ON)	Allows the user to turn ON step modulation, which regulates burner output in six steps at one minute intervals. Step modulation will start at the last modulation rate of the boiler and work up one minute at a time.
19	**Boiler Supply DHW**	**180°F** (119°F - 190°F)	Allows the user to program the boiler supply water temperature to the indirect heat exchanger during a DHW demand cycle.
20	**Water Safety Input**	**Water Flow** (OFF / Water Pressure / Water Flow)	The user can select various water safety inputs used in the boiler system.
21	**Error Outdoor Sensor**	**OFF** (ON / OFF)	Allows the user to set the control to display a blocking or fault code if an outdoor sensor is open or shorted. NOTE: This does not stop the boiler from running.
22	**Adjust Boiler Output %**	**100%** (50% - 100%)	Adjusts the boiler output down from 100% to 50%. Factory Default: 100%. (Range: 100% – 50%).
23	**Cascade Mode**	**ON** (ON or OFF)	Allows the user to select cascade mode. Select ON to enable Cascade. Select OFF to disable. **NOTE:** DO NOT CHANGE SETTING ON THIS APPLIANCE TO OFF.
24	**Cascade Rotation**	**48 Hours** (0 - 240 Hours)	Sets the number of hours before the first boiler in the cascade firing rotation will be changed. NOTE: If this is set to 0, the firing order of the boilers will not rotate. Factory Default: 48 hours (Range: 0 – 240 hours).
25	**Cascade DHW Mode**	**ENTIRE CASCADE** (ENTIRE CASCADE / DHW ON LOOP / ONLY MASTER / SYS PMP OFF W/DHW)	**NOTE:** In conjunction with I55, this parameter allows you to control pump activity during separate or combined CH and DHW calls. See Pump Matrix below for more information.

Configuration	Demand Type	Resulting Pump Operation			Cascade Master	CH Priority	DHW Cascade Mode
		CH	DHW	SYS	I23	I55	I25
1	TT	ON	OFF	ON	ON	OFF	ENTIRE CASCADE
	DHW	ON	ON	OFF			
	BOTH	ON	ON	OFF			
2	TT	ON	OFF	ON	ON	OFF	ONLY MASTER
	DHW	OFF	ON	OFF			
	BOTH	OFF	ON	ON			
3	TT	ON	OFF	ON	ON	OFF	DHW ON LOOP
	DHW	ON	ON	ON			
	BOTH	ON	ON	ON			
4	TT	ON	OFF	ON	ON	OFF	SYS PMP OFF W/DHW
	DHW	OFF	ON	OFF			
	BOTH	OFF	ON	OFF			
5	TT	ON	OFF	ON	ON	ON	ENTIRE CASCADE
	DHW	ON	ON	OFF			
	BOTH	ON	ON	ON			
6	TT	ON	OFF	ON	ON	ON	ONLY MASTER
	DHW	OFF	ON	OFF			
	BOTH	ON	ON	ON			
7	TT	ON	OFF	ON	ON	ON	DHW ON LOOP
	DHW	ON	ON	ON			
	BOTH	ON	ON	ON			
8	TT	ON	OFF	ON	ON	ON	SYS PMP OFF W/DHW
	DHW	OFF	ON	OFF			
	BOTH	ON	ON	OFF			

Installer #	Description	**Default** (Range)	Detail
26	**System Freeze Protection**	**-58°F** (OFF, -58°F - 104°F)	**NOTE:** This parameter is only active if the boiler is a cascade master. Allows the user to set the freeze protection when a system pump is used. Selection of temperature activates freeze protection.
27	**Error System Sensor**	**ON** (ON / OFF)	Sets the control to display a blocking or fault code if the system sensor is open or shorted. NOTE: This does not stop the boiler (or boilers) from running.
28	**Freeze Protection**	**ON** (ON / OFF)	Allows the user to set freeze protection on the boiler.
29	**DHW Modulation Mode**	**NORMAL MOD** (NORMAL MOD / MINIMUM MOD)	This parameter controls how the boiler modulates for a DHW demand. In NORMAL MOD mode, the boiler will start at and modulate down from high fire when there is a DHW demand. In MINIMUM MOD mode, the boiler will start, then modulate up from low fire when there is a DHW demand. This mode is useful to minimize short cycling when a large boiler and small indirect tank are used together.
30	**Extra Boiler Mode**	**OFF** (OFF / 50% - 100%)	Allows for a non HTP boiler to be controlled when the cascade output has risen above the percent of the cascade firing rate set in this parameter. The extra boiler is controlled by the "repurposed" DHW Pump output of the HTP boiler. Since the DHW Pump output supplies 120VAC, a relay must be added to the pump output. The extra boiler thermostat contacts must then be connected to the NO contacts of the relay. **NOTE:** If this function is used, you CANNOT utilize the HTP boiler for DHW functionality.
31	**System Sensor Mode**	**OFF** (ON / OFF)	Suppresses the 'NO FOLLOWER' display message if the boiler is used as a cascade master boiler with no follower boilers connected. Factory Default: OFF (Range: ON / OFF).
32	**Service Schedule**	**OFF** (OFF / Run Hours / Date)	Selects a service date or time based on the boiler run hours to program the boiler maintenance schedule. Factory Default: OFF (Range: OFF / Run Hours / Date).
33	**Service Schedule Year**	*	If the date function was selected, allows the user to set the year of the next service reminder.
	Service Schedule Hours	*	If the run hour function was selected, allows the user to set the number of run hours before the next service reminder.
34	**Service Schedule Month**	*	If the date function was selected, sets the month of the next service reminder.
35	**Service Schedule Day**	*	If the date function was selected, sets the day of next service reminder.
36	**Telephone**	000-000-0000	Allows the user to input a telephone number that will display when maintenance is required.
37	**Modbus Mode**	**OFF** (ON / OFF)	Enables Modbus/BACnet Mode on the appliance. See Modbus/BACnet Instructions (lp-548) for details. **NOTE: Turning this Mode "ON" without a connected and powered Modbus communication adapter (p/n 7350P-636) will result in improper appliance operation.** Service calls associated with this ARE NOT covered by warranty.

NOTE: Modbus Mode must be enabled on the appliance as outlined above for parameters 38 - 40 to be viewed and changed.

38	**Modbus Address**	**16** (1 - 245)	Sets the Modbus/BACnet address. The address space is comprised of 256 addresses. These are defined as follows: • Address 0 is a broadcast address. The master can send data to address 0 and all followers will process the data. **DO NOT USE ADDRESS 0! IMPROPER OPERATION WILL RESULT!** • Addresses 1 – 247 are free to be assigned to Modbus devices on the bus. Each address can be assigned to only one Modbus device on the bus.
39	**Modbus Speed**	**19200** (9600 / 19200)	The Modbus speed (communication speed) can be set on the control display to either 9600 or 19200 baud. All HTP appliances, as well as any other device on the same bus and the Modbus/BACnet master, must have the same baud rate setting. Select the highest baud rate that offers the most reliable communication performance over the bus.
40	**Modbus / Stop Parity**	**1ST** (1ST / 2ST / EPAR / UPAR)	**NOTE:** This setting only applies to Modbus operation. The BACnet protocol does not utilize parity for communication and this setting will have no effect. The parity/stop bits parameter of the Modbus/BACnet adapter must match the rest of the devices on the bus. Although it is common to set serial devices to use no parity, setting the parity to even or odd may improve communications reliability on all connected devices on the bus.

Installer #	Description	**Default** (Range)	Detail
54	**Boost Enable / Time Step**	**0 min (OFF)** (0 - 255 min)	Boost Time temporarily overrides the Outdoor Reset Curve, bringing the boiler up to the maximum setpoint to satisfy a thermostat call in less time. For example, if 6 minutes is selected (Installer 64, Boost Start Delay), and there has been a thermostat call for 6 minutes, the boiler will override the Outdoor Reset Curve and boost to the next step in temperature (Current Setpoint + I65). If the Enable / Time Step (I54) expires, the Setpoint will increase again by I65. This will continue until the maximum setpoint is reached or the call for heat is satisfied. After the call for heat has been satisfied the setpoint will return to the Outdoor Reset Curve. Factory Default: 0 min (Range: 0-762 min.)
55	**CH During DHW Priority**	**OFF** (ON / OFF)	Controls whether the CH pump will meet a call for heat while also meeting or answering a DHW call. A setting of OFF will not run the CH pump while running the DHW pump; an ON setting will run the CH pump while simultaneously running the DHW pump.
60	**CH dT Setting**	**20ºF** (0 - 47F)	Determines the desired temperature difference between the SUPPLY and RETURN temperatures and the Boiler automatically adjusts the 0-10V pump signal accordingly.
61	**Offstate Pump Voltage**	**0.0** (0.0 - 9.9)	Determines the voltage present in OA1 when the pump is supposed to be OFF.
64	**Boost Start Delay**	**0** (0 - 250)	Time in minutes from TT closure to BOOST activation.
65	**Boost Temp Step**	**10** (0 - 20)	Boost function temperature steps in degrees F
66	**Cascade System**	**E Sys** (100% / E Sys)	Cascade Type / Method
67	**100% Cascade Min Power**	**30** (0 - 100)	Boiler % at which point the last boiler will shut off (100% method ONLY).
68	**Esys Cascade Up Power**	**60** (0 - 100)	Boiler % at which the first boiler will begin to split the load with the other boilers in the cascade chain (E Sys ONLY)
69	**Esys Cascade Down Power**	**20** (0 - 100)	Boiler % at which the last boiler to ignite will drop out of the cascade chain (E Sys ONLY)
70	**Esys Cascade Min Power**	**10** (0 - 100)	Boiler % at which point the last boiler will run until either the demand is satisfied OR the temperature has reached setpoint plus offset (E Sys method ONLY).
71	**Cascade / Supply Setpoint Delta**	**10** (OFF / 0 - 90)	Temperature to be added to the desired System Setpoint in order to determine the boiler Supply Setpoint
72	**CH Cascade System Offset**	**3** (0 - 5)	Value added to the System Setpoint to determine the temperature at which the burner is extinguished during a CH call.
73	**DHW Cascade System Offset**	**3** (0 - 5)	Value added to the System Setpoint to determine the temperature at which the burner is extinguished during a DHW call.
74	**DHW Cascade System Differential**	**7** (1 - 18)	Value subtracted from the System Setpoint to determine the temperature at which the Cascade begins the DHW call.
76	**CH Cascade Supply Differential**	**20** (1 - 30)	Value subtracted from the Supply Setpoint to determine the temperature at which the boiler begins the CH call.

Table 21 - System Setting Program Navigation

K. Resetting the Maintenance Schedule

It is highly recommended to call for service when the Home Screen center pane alternates between YELLOW and ORANGE. On the GHS, the Modulation Circle will also alternate between YELLOW and ORANGE. After service is performed, reset the schedule for the next required service by using the following steps.

Press **Installer.** Tap next until prompted to enter a password. Enter "928". Press MAINTENANCE RESET button in the upper right corner of the Service screen to reset the selected Service Schedule.

NOTE: The Service Screen for a particular module may also be directly accessed by tapping the SERVICE MODE button in the lower right corner of the module's Boiler Home Screen (BHS).

L. Service Mode - Setting and Verifying the Combustion Setting - Testing the Internal LWCO

NOTE: Service Mode can be accessed from the GHS, BHS, or by scrolling through the Installer Settings. Input Access Code **928** when prompted to enter Service Mode.

Service Mode is intended to simplify fan testing, purging air from the water lines, testing the LWCO, and gas adjustment. The following figures and tables include details on use as well as recommended combustion settings by fuel type and boiler fan speeds. Automatic modulation does not take place while the controller is in Service Mode. However, the boilers will modulate down if the program set point is reached while running in Service Mode. It is recommended to enter Service Mode with the largest load possible to create such a heat demand that Service Mode will not be interrupted. To enter Service Mode tap Installer in the display Navigation Bar; then tap NEXT until you reach the Service Mode screens detailed in Figure 50, or use the SERVICE MODE button at the Home Screen.

NOTE: The boiler will automatically exit Service Mode after 20 minutes of operation.

Press the black up ^ and down v arrows to increase and decrease fan speed approximately fifty (50) RPM. Press the red up ^ arrow to go directly to max fan speed and high fire. Press the blue down v arrow to go directly to min fan speed and low fire.

Setting and Verifying the Combustion Setting

Enter Service Mode. At high fire, use a calibrated combustion analyzer to test CO/CO2 measurements. Ensure the measurements meet those detailed in Table 22. If unable to reach these measurements, remove the calibrated combustion analyzer and bring it outdoors into fresh air. When the analyzer reads zero, conduct the test again. If still unable to get the required readings shown in the combustion chart, adjust the throttle screw on the gas valve in ¼ turn increments either in the positive (+) (counter-clockwise to increase fuel or CO2) or negative (-) (clockwise to decrease CO2) direction. When the CO/CO2 measurements meet those in Table 22 at high fire, conduct the test at low fire. Record the combustion measurements in this manual for future reference.

Testing the UL 353 Approved Internal LWCO on All Modules

In Service Mode, locate Internal LWCO Test in the lower right hand corner of the screen. If the screen indicates that the Internal LWCO is READY to test, tap Test. See Figure 50. If the Internal LWCO trips properly, the screen will read LWCO FAULT F21. See Figure 50. Now tap Reset to reset the LWCO and clear the fault.

To leave Service Mode, tap PREVIOUS to stay in the Installer menu or press Home.

Combustion Settings		
Fan Speed	**Natural Gas (NG)**	
	Low	High
Carbon Monoxide (CO) PPM	≤ 175	
Carbon Dioxide (CO_2) %	8.5 - 9.7	
Fan Speed	**Propane (LP)**	
	Low	High
Carbon Monoxide (CO) PPM	≤ 175	
Carbon Dioxide (CO_2) %	9.5 - 10.7	
ATTENTION: The CO2 at minimum gas flow (Low Fan Speed) must not be set higher than the CO2 reading at maximum gas flow (High Fan Speed). It may be set lower by as much as 0.5 to 1.0%. **For Example: If CO2 at Max. = 9.2%, CO2 at Min. = 8.2-8.7%**		

Table 22 - Combustion Settings - All Models

⚠ WARNING

Adjustments to the throttle screw or offset may only be made by a qualified gas technician using a calibrated combustion analyzer capable of measuring CO2 and CO. Failure to follow this instruction could result in fire, explosion, property damage, severe personal injury, or death.

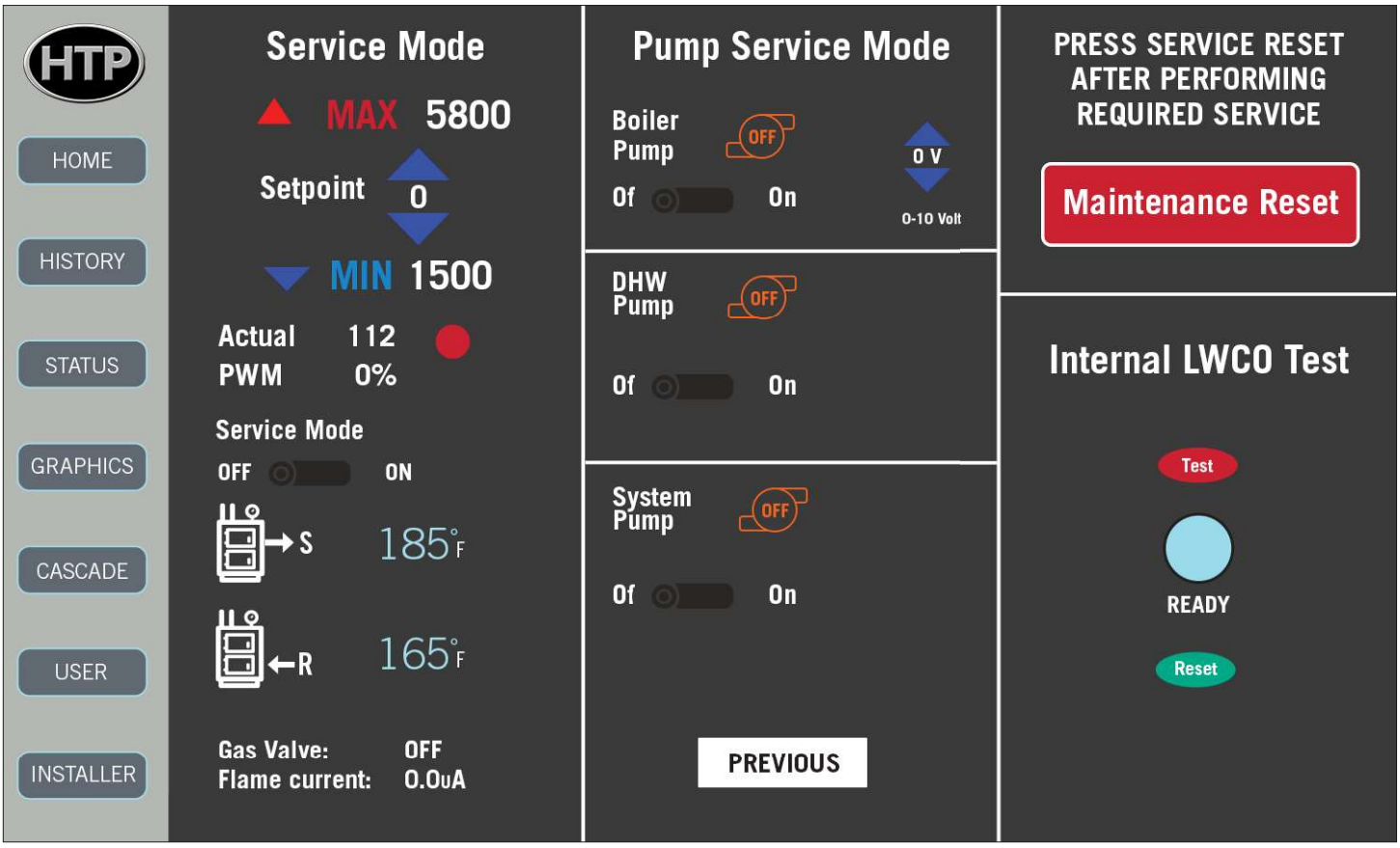


Figure 50 - Installer - Service Mode Screen

Part 11 - Installation Checklist

Light Off Activities		Date Completed:	
1. Fill the Heating System	Check all piping and gas connections. Verify all are tight.		
	Pressurize system (12 - 15 psi).	PSI	
	Add water to prime condensate cup.		
	Verify near boiler piping is properly supported.		
	Percentage of glycol in system (0 - 50%)		
2. Check Gas Pipe	Leak test using locally approved methods (consult jurisdictional code book).		
	Check incoming gas pressure.	Static WC	
	Check the "drop" on light off (less than 1" WC).	Dynamic WC	
3. Check Combustion	Check and adjust (if necessary) carbon dioxide content.	%CO2 High Fire	%CO2 Low Fire
	Check and adjust (if necessary) carbon monoxide content.	ppm CO High Fire	ppm CO Low Fire
4. Check Electrical Connections	Ensure all electrical connections of line voltage (pumps, etc.) and low voltage circuits (system sensor, outdoor sensor, etc.) are properly wired.		
5. Verify System Operation	Turn up thermostat to verify wiring connections.		
6. Record Ionization Current	Check uA reading in the status menu (see Start-Up section, this manual).	uA High Fire	uA Low Fire
7. System Setting	Verify system settings.	CH Setpoint	CH Differential
8. Indirect Water Heater	Verify safety and operation of the indirect water heater. Record settings.	DHW Setpoint	DHW Differential
Notes:			

Table 23 - Installation Checklist

Part 12 - Boiler Monitoring

A. Status Screens

The boiler control has the ability to display system status. To access the Status screens, tap Status in the display Navigation Bar. Tap NEXT or PREVIOUS to swap between the screens. Tap Home in the display Navigation Bar to exit the Status screens.

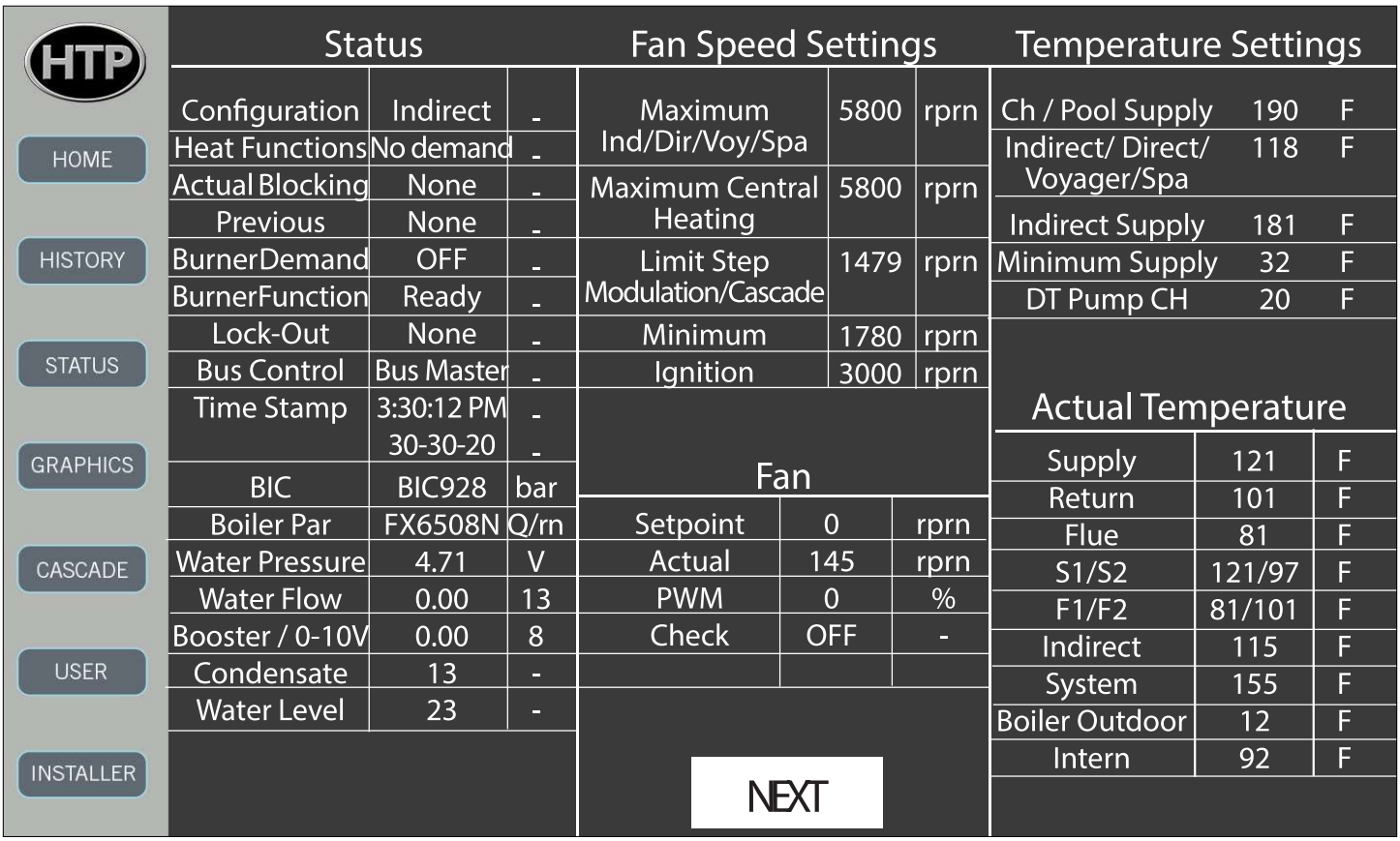


Figure 51 - Status Screen 1

Status Table	
Display	**Description**
Configuration	This is the factory setting of the appliance. It should always read "Indirect".
Heat Functions	Lets the user know if the appliance is servicing a demand for heat. In this example, there is no demand.
Actual Blocking	This would display a blocking code if the appliance was currently in a blocking state.
Previous	Displays most recent blocking code. In this example, "None" was the most recent.
Burner Demand	Will display a demand on the burner. In this example there is currently no demand.
Burner Function	Displays the current burner state. Burner is in stand-by in this example.
Lock-Out	Displays the Error Code if the appliance is in lockout.
Bus Control	This displays the bus state of the appliance. The appliance in this example is the bus master.
Time Stamp	Displays the time and date.
Control Model	Refers to the control model. "BIC928" in this example.
Parameter Set	Refers to the parameter set programmed into the appliance.
0-10V	Displays the voltage on the optional input. This voltage is only relevant if an external 0-10 volt signal is being used to control the boiler.
Condensate	0 indicates an empty condensate trap. A number above 50 triggers a Condensate Full Lockout.
Water Level	Displays the "electrical resistance" between the LWCO probe, through the water, to ground. A value of 80 and above indicates a lack of water in the appliance (open circuit). A perfect connection to ground would indicate a level of 0.

Table 24 - Status Screen 1 - Status Table

Fan Speed Settings	
Display	**Description**
Maximum DHW	These settings describe the appliance fan speed settings. These settings are for reference only. Fan Speed Settings are programmed into the control at the factory and cannot be changed in the field.
Maximum Central Heating	
Limit Step Modulation / Cascade	
Minimum	
Ignition	

Table 25 - Status Screen 1 - Fan Speed Settings

Fan Table	
Display	**Description**
Setpoint	This is the current setpoint of the fan as determined by the control.
Actual	This displays the actual fan RPMs.
PWM	This is the current percentage of power being applied to the fan.
Check	Will display "OK" if fan speed is within operating limits.

Table 26 - Status Screen 1 - Fan Table

Temperature Settings Table	
Display	**Description**
Central Heat Supply (CH)	Current CH Setpoint
Indirect (DHW)	Current DHW Setpoint
Indirect Supply	Maximum temperature that the boiler can supply to the indirect DHW HX input.
Minimum Supply	Minimum temperature that the boiler can supply to the indirect DHW HX input.
DT Pump CH	Current dT setting in degrees when a o-10V delta T pump is connected to P9-6 and P9-6 on the low voltage connection board.

Table 27 - Status Screen 1 - Temperature Settings Table

Actual Temperatures Table	
Display	**Description**
Supply	Shows the highest of the two actual supply temperatures measured by the dual supply sensors.
Return	Shows the actual return temperature measured by the return sensor.
Flue	Displays the current boiler flue temperature measured by the flue sensor.
Supply 1 / Supply 2	Shows the actual temperatures measured at the appliance by the dual supply sensor (Supply 1 = Sensing element A in the dual sensor body and Supply 2 = Sensing element B).
Flue 1	Shows the actual temperature measured at the appliance by the flue sensor (Flue 1 = Sensing element A in the flue sensor body).
Indirect	Displays the actual temperature measured by the tank or return sensor. If a mechanical aquastat is used in place of the recommended sensor, it will display "N/C" if the aquastat is open because the DHW tank is at setpoint. If the aquastat is closed it will display ON.
System	This screen displays the system sensor reading. If there is no system sensor this will display "N/C".
Boiler Outdoor	The current outdoor temperature is displayed. If there is no outdoor sensor connected to the boiler, this line will display "N/C" in place of the temperature. If the outdoor sensor is shorted, this line will display "ON" in place of the temperature.
Internal	Ambient board temperature of BIC928 control, as measured by the on-board Comfort Microprocessor.

Table 28 - Status Screen 1 - Actual Temperatures Table

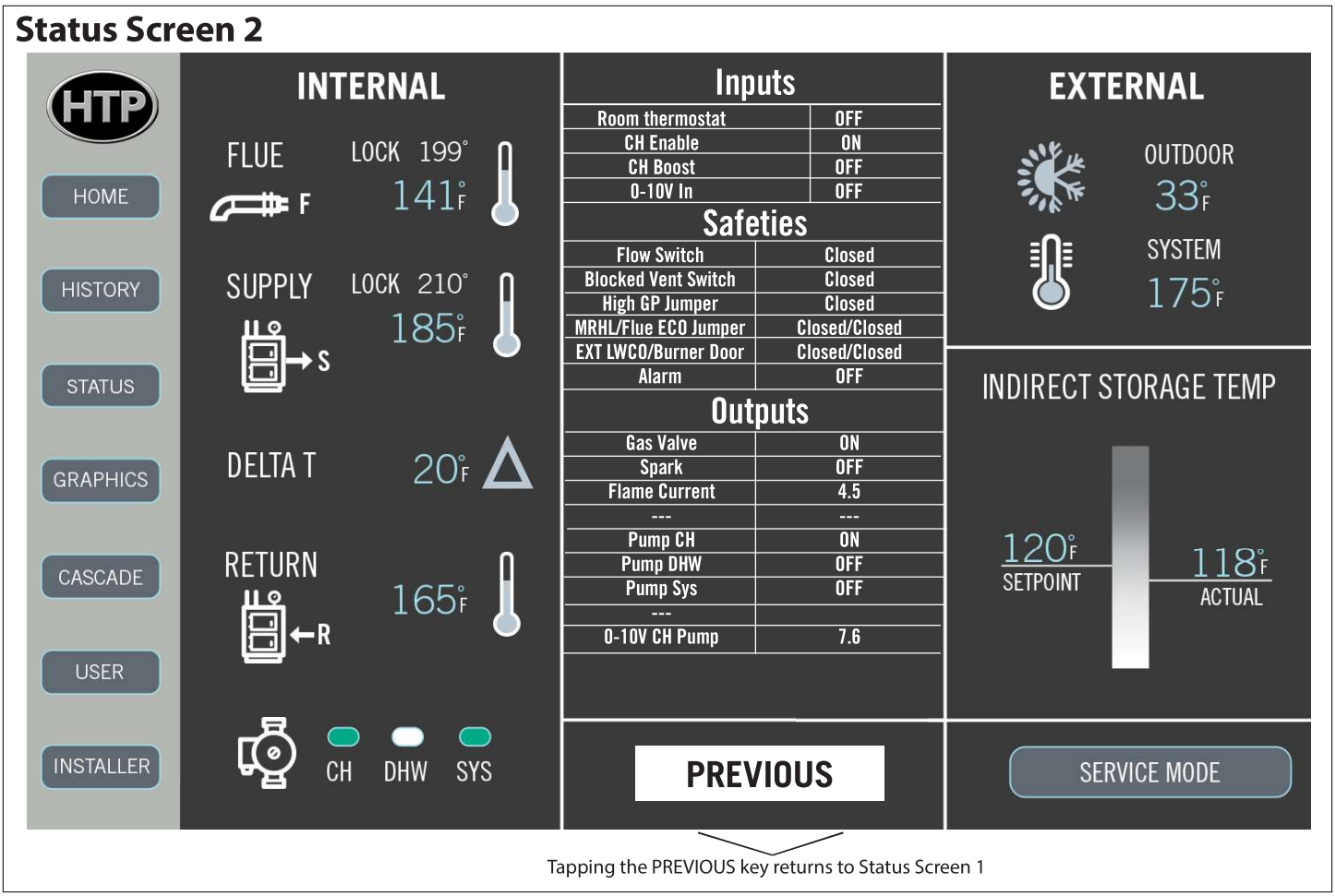


Figure 52 - Status Screen 2 - NOTE: For Reference Use ONLY.

Status Screen 2 - Internal

Internal describes the current temperature readings read by the flue, supply, and return sensors, as well as the Delta T setting and the flue and supply lockout temperatures.

Inputs Table	
Display	**Description**
Room Thermostat	Displays whether the room thermostat is on or off.
CH Enable	Displays whether CH Enable is on or off.
CH Boost	Displays On or Off if CH Boost is engaged.
0-10V In	Displays whether 0-10V Input is on or off. Displays ON if 0-10V is enabled.

Table 29 - Status Screen 2 - Inputs

			HMI Status Screen 2 - Safeties (Normal Operation Displays "Closed")					
Open Signal	**I/O**	**928 Pins**	**Flow Switch**	**Blocked Vent Switch**	**High GP Jumper**	**MRHL / Flue ECO Jumper**	**EXT LWCO/Burner Door Jumper**	**Alarm**
Flow Switch	ID8	X7-1, X7-11	***Open***	Closed	Closed	Closed/Closed	Closed/Closed	Closed
Blocked Vent Switch	ID5	X6-9, X6-18	Closed	***Open***	Closed	Closed/Closed	Closed/Closed	Closed
High GP Jumper	ID6	X6-8, X6-17	Closed	Closed	***Open***	Closed/Closed	Closed/Closed	Closed
MRHL / Flue ECO Jumper	ID3	X7-9, X7-19	Closed	Closed	Closed	***Open/Open***	Closed/Closed	Closed
Flue temp limit* - NOTE: *The Flue ECO has been replaced with a jumper in the LV harness.	ID1	X7-10, X7-20	Closed	Closed	Closed	Closed/***Open***	Closed/Closed	Closed
EXT LWCO / Burner Door Jumper	ID14	X7-7, X7-17	Closed	Closed	Closed	***Open/Open***	***Open/Open***	Closed
Burner Door ECO	ID2	X7-8, X7-18	Closed	Closed	Closed	***Open/Open***	Closed/***Open***	Closed

Table 30 - Status Screen 2 - Safeties

Outputs Table	
Display	**Description**
Gas Valve	Displays whether the gas valve is on or off.
Spark	Displays whether the spark is on or off.
Flame Current	Displays the current flame ionization current.
---	---
Pump CH	Displays whether the CH Pump is on or off.
Pump DHW	Displays whether the DHW Pump is on or off.
Pump Sys	Displays whether the Pump Sys is on or off.
---	---
0-10V CH Pump	Displays the 0-10V pump output voltage.

Table 31 - Status Screen 2 - Outputs

Status Screen 2 - External

External describes the current outdoor temperature and system temperature readings, as well as DHW Temperature setpoint and actual DHW temperature.

B. History Screens

The boiler control also has the ability to review its current history. To access the History screens, tap History in the display BHS Navigation Bar. Tap NEXT or PREVIOUS to swap between the screens. Tap Home in the display Navigation Bar to exit the History screens and return to the BHS.

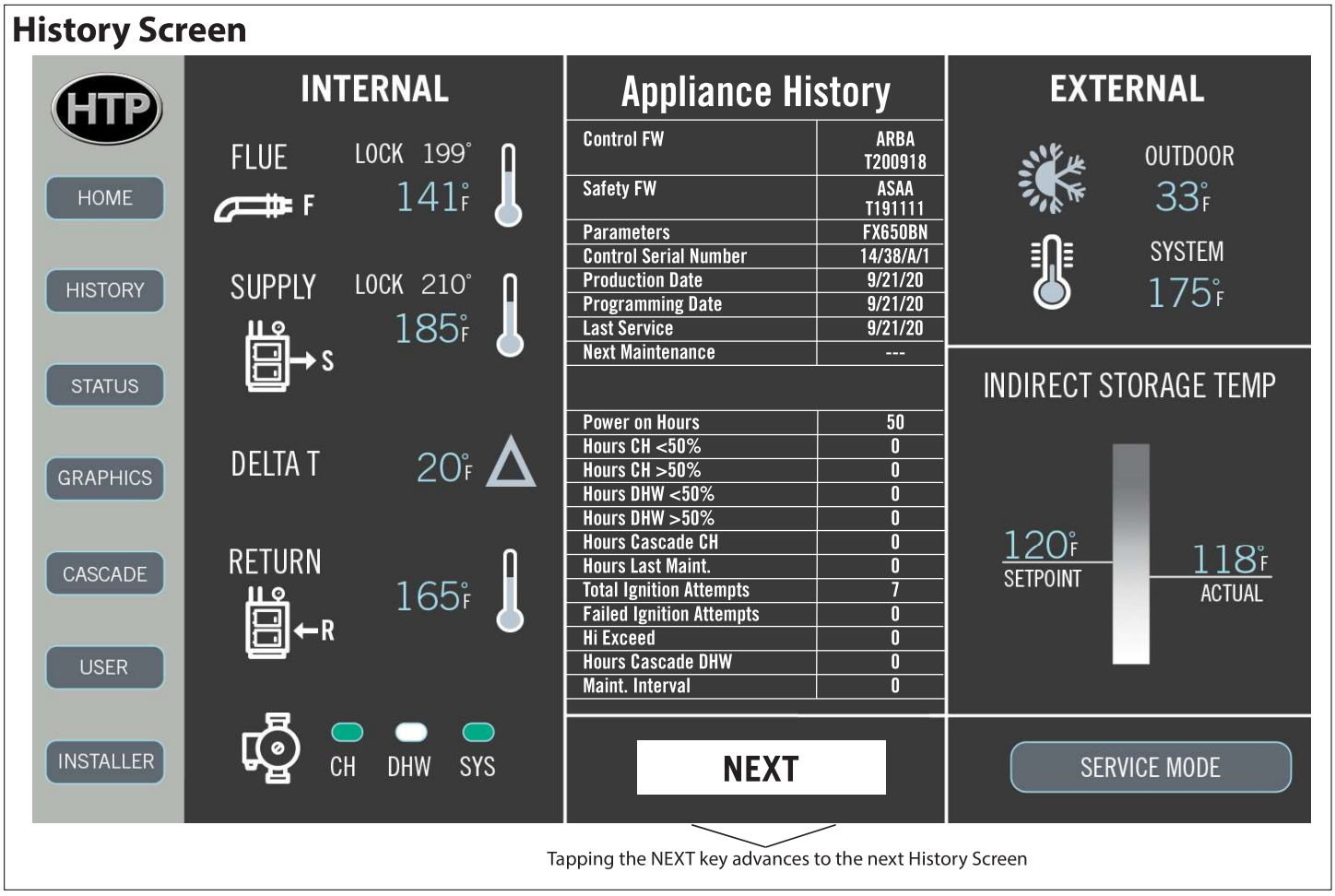


Figure 53 - History Open Screen

History Screen - Internal and External

The History Open Screen displays the current Internal and External temperatures. These are the same as those displayed and described in the Status section.

Appliance History Table	
Display	**Description**
Control	Displays control details, including the Comfort and Safety firmware revisions programmed into the control.
Parameters	Displays the programmed appliance model number parameter set.
Serial Number	Displays the appliance serial number.
Production Date	Displays the appliance production date.
Programming Date	Displays when the appliance was last programmed.
Last Service Date	Displays when the appliance was last serviced.
Next Maintenance	Displays the next appliance service date.
Power On Hours	Displays the total appliance power on hours.
Hours CH < 50%	Displays the total hours that the appliance has met a CH demand at below 50% power.
Hours CH > 50%	Displays the total hours that the appliance has met a CH demand at greater than 50% power.
Hours DHW < 50%	Displays the total hours that the appliance has met a DHW demand at below 50% power.
Hours DHW > 50%	Displays the total hours that the appliance has met a DHW demand at greater than 50% power.
Hours Cascade CH	Displays the total hours that the appliance has met a Cascade CH demand.
Hours Last Maint	Displays the total hours since the last time the appliance was maintained.
Total Ignition Attempts	Displays the total appliance ignition attempts.
Failed Ignition Attempts	Displays the total appliance ignition failures.
Hi Exceed	Displays the number of times the high limit has been exceeded.
Hours Cascade DHW	Displays the total hours that the appliance has met a Cascade DHW demand.
Maint Interval	Displays the interval time for the time until the next Maintenance notice.

Table 32 - History Screen - Appliance History Table

History Screen - Faults Screen

Tap NEXT at the History Screen to display the ten (10) most recent lock-out faults along with the date and time when they occurred. There is a list of fault codes as well as their total amount of occurences. Internal temperatures are also provided for troubleshooting purposes.

History Screen - Blocks Screen

Tap Show Blocks at the History Faults Screen to display the ten (10) most recent blocking codes along with the date and time when they occurred. There is a list of fault codes as well as their total amount of occurences. Internal temperatures are also provided in the left pane for troubleshooting purposes. Tap Show Faults to return to the History Faults Screen. Tap PREVIOUS to return to the History Screen.

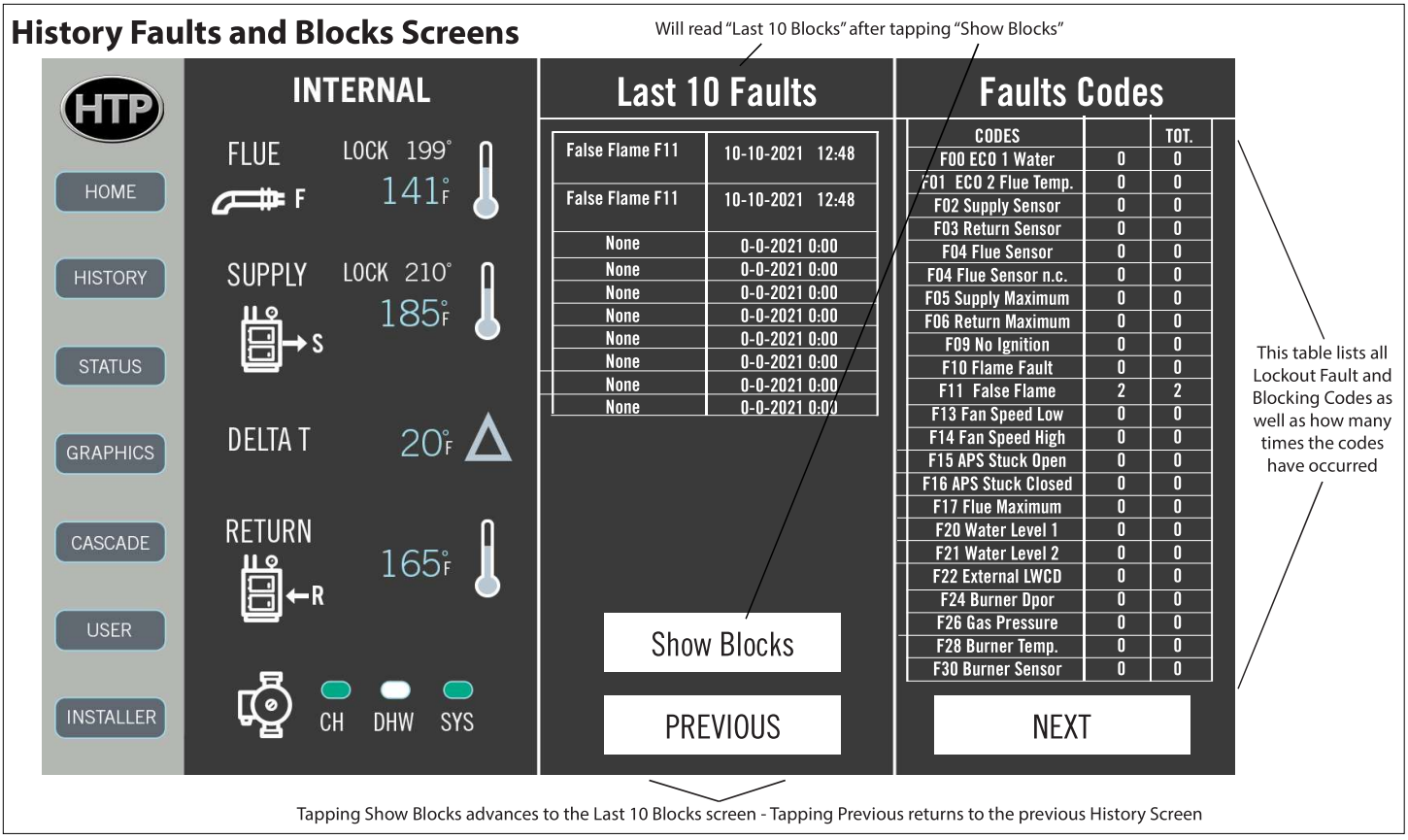


Figure 54 - History Faults and Blocks Screens

C. Graphics Screen

Tap Graphics in the display Navigation Bar to open the Graphics function. The Graphics function allows the installer / user to select, record, and view real time system analytics. This function helps the installer / user fine tune system operation and aids in troubleshooting. Tap on the signals below the screen to enable tracking.

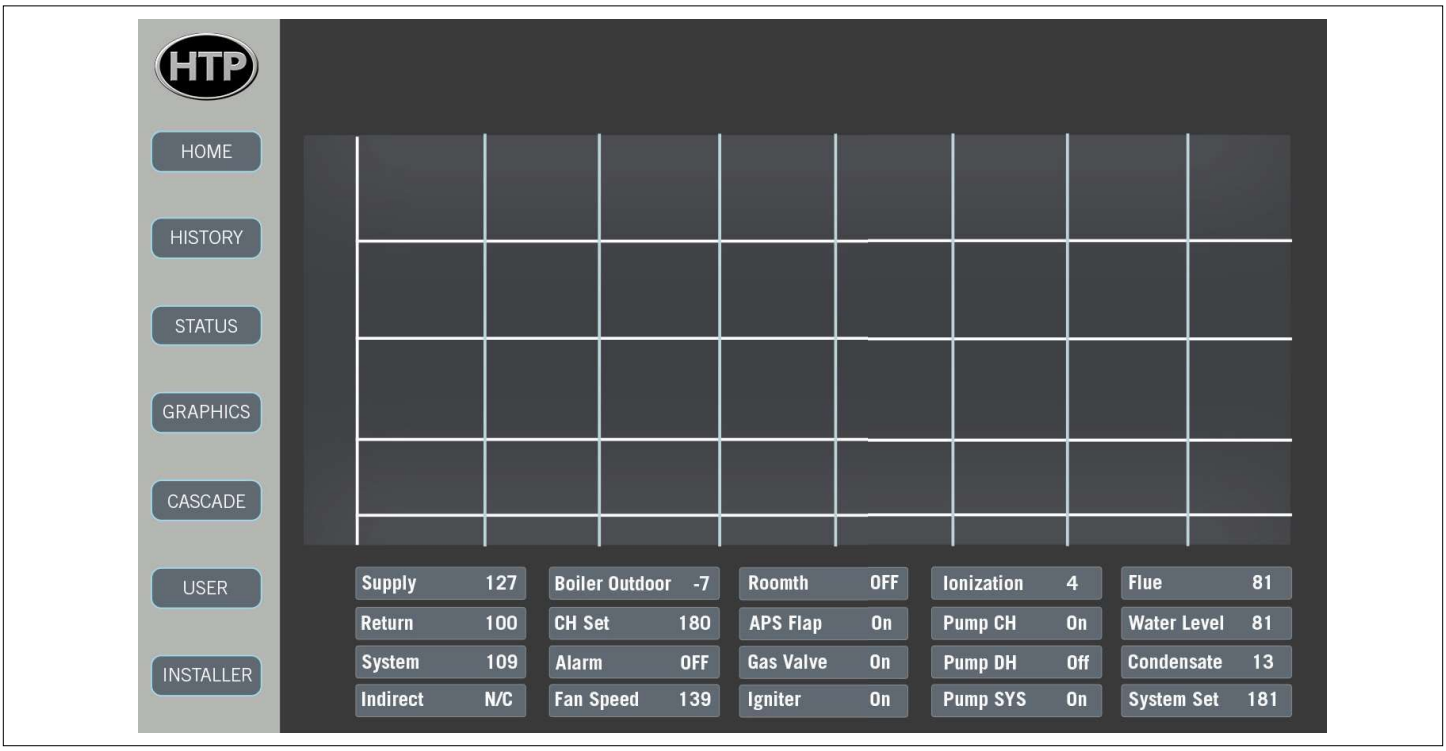


Figure 55 - Graphics Screen

D. Cascade Screen

To access Cascade system status and settings, tap Cascade in the display Navigation Bar. Tap NEXT or PREVIOUS to swap between the screens.
NOTE: If the boiler is not in Cascade mode, all indicators (ie pumps) will be disabled, and Outdoor temperature and System temperature will be displayed as N/C.

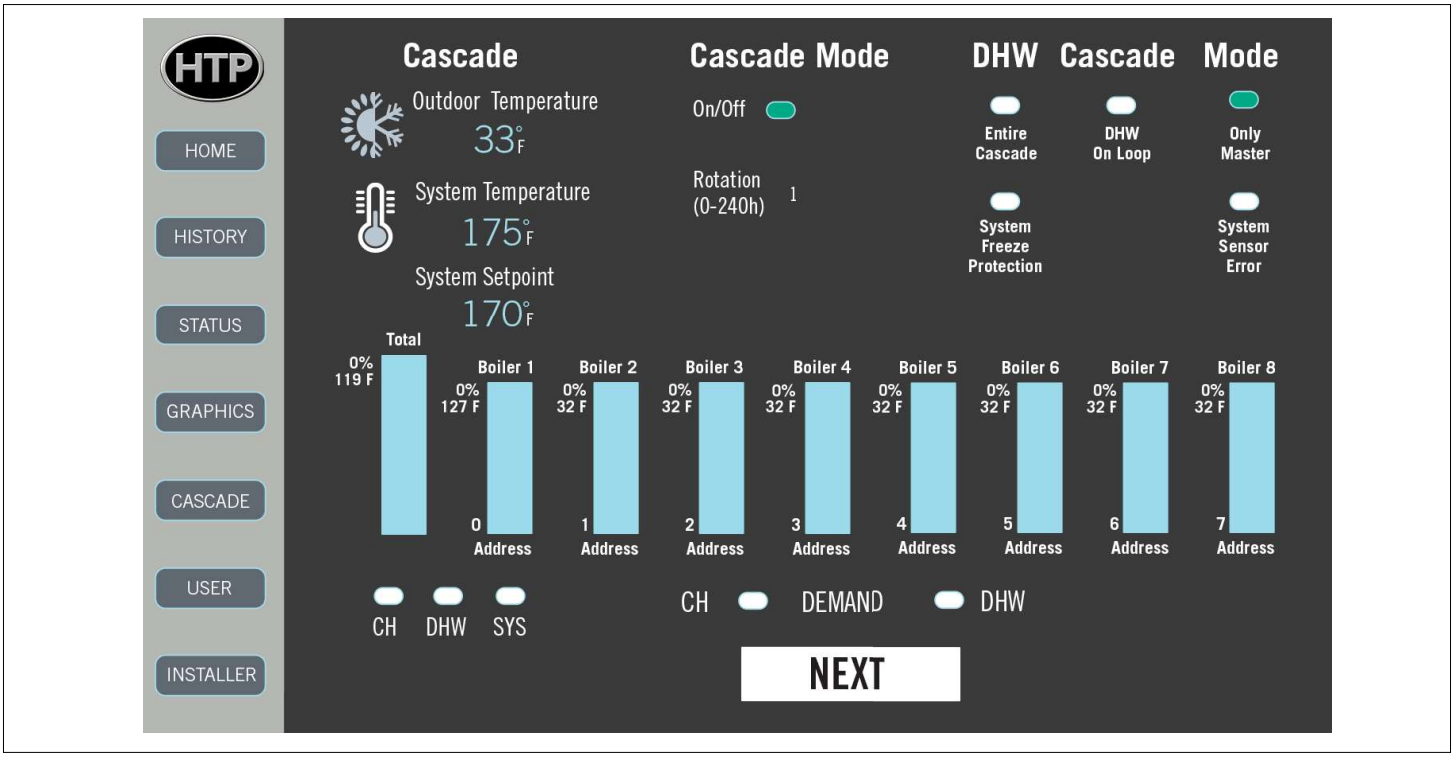


Figure 56 - Cascade Screen 1

Cascade Screen 1

Cascade Screen 1 shows the current system supply and outdoor temperature readings, states whether Cascade Mode is On or Off, as well as whether DHW Cascade Mode is On or Off and the enabled DHW Cascade Mode setting. System Freeze Protection enable and System Sensor code are shown here. The Cascade Mode rotation hours are shown here. The operating percentages of connected appliances is shown towards the

bottom of the screen, along with whether the SYS, DHW, or CH pumps are enabled and whether the system is meeting a CH or DHW demand. The above screen shows a single boiler system. One boiler is operating at 60% of total modulation capacity.

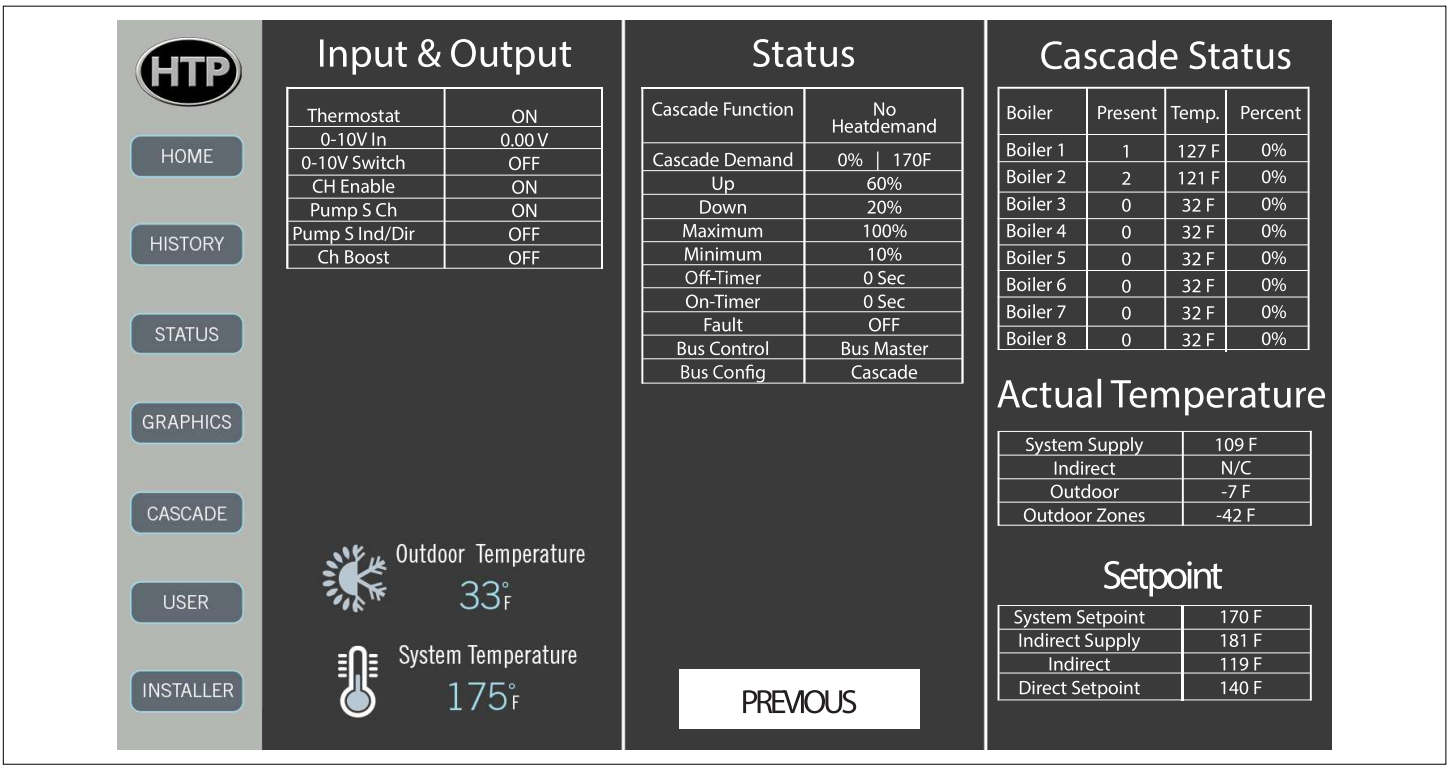


Figure 57 - Cascade Screen 2

Cascade Screen 2

Cascade Screen 2 replicates many items that can be found on other display screens, including the current Outdoor and System temperatures and Actual Temperature readings. The Cascade Status table offers a text representation of the visual and textual Cascade Status from Cascade Screen 1.

Input and Output Table	
Display	**Description**
Thermostat	*Displays whether the room thermostat is on or off.
0-10V In	Displays current 0-10V voltage input.
0-10V Switch	Displays whether 0-10V is On or Off.
CH Enable	Displays whether CH Enable is on or off.
Pump S CH	Displays whether CH Pump is on or off.
Pump S Ind/dir	Displays whether DHW Pump is on or off.
CH Boost	Displays whether CH Boost is engaged.

Table 34 - Cascade Screen 2 - Input and Output Table - *Will only display if not in Cascade Mode

Status Table	
Display	**Description**
Cascade Function	This indicates whether the cascade function is turned on.
Cascade Demand	Displays the entire percentage of cascaded system demand. Ex: 3 boiler system at max power equals 300%.
Up	Power level at which the first boiler will switch on the next boiler (Default = 60% [Esys] or 100% [100%]).
Down	Power level at which the last boiler to ignite will switch off (Default = 20% [Esys] or 100% [100%]).
Maximum	Maximum power allowed per boiler (Default = 100%).
Minimum	Minimum power allowed per boiler. Below this setting the boiler will switch off (Default = 10% [Esys] or 30% [100%]).
Off-Timer	Timer to prevent switching off the next boiler (Default = 0 sec).
On-Timer	Timer to prevent switching on next boiler (Default = 0 sec).
Fault	Indicates ON when boiler is in an Alarm state, OFF when the Alarm is cleared.
Bus Control	This displays the bus state of the appliance. The appliance in this example is the bus master.
Bus Config	This displays the bus configuration of the appliance. The appliance in this example is standalone.

Table 33 - Cascade Screen 2 - Status Table

Part 13 - Troubleshooting

NOTE: If any sensor detects an abnormal condition or an internal component fails during the operation of the boiler, the display may show an blocking or fault message and code.
IMPORTANT: If you see blocking or fault codes on your display readout, call a technician immediately. The message may indicate a more serious problem will occur soon.

A. Blocking

A Blocking message and code may be the result of a condition that must be manually corrected or by a temporary condition that will resolve itself.
The boiler control will be operable. The center pane of the Home Screen will be **Orange** and the "**Blocking**" message will display. When the condition is corrected or corrects itself the display will revert to its normal readout and operation. Be sure to observe the operation of the unit for a period of time to ensure correct operation and no reoccurrence of the code.
The controller will display a blocking code and message when a blocking condition occurs. These codes, descriptions, and recommended corrective actions are described in Section C.

B. Fault (Lockout)

A Fault (Lockout) message and code is the result of a condition that the control has evaluated as not safe to restart the boiler. In this case, the boiler control will be locked out. The center pane of the Home Screen will be **Red** and the "**Lockout**" message will display. The alarm output will also activate. Most fault conditions cause the CH pump to run in an attempt to cool the boiler.
The controller will display a fault code and message when a lock-out condition occurs. These fault codes, descriptions, and recommended corrective actions are described in Section C.
After the fault condition has been repaired by a qualified technician press and hold RESET on the display for more than 1 second to clear the fault and resume operation. Be sure to observe the operation of the unit for a period of time to assure correct operation and no reoccurrence of fault message.

⚠ WARNING

If overheating occurs or the gas supply fails to shut off, do not turn off electrical power to the circulating pump. This may aggravate the problem and increase the likelihood of boiler damage. Instead, shut off the gas supply to the boiler at the gas service valve. Failure to do so may result in property damage, personal injury, or death.

When servicing or replacing components that are in direct contact with boiler water, be certain that:

- There is no pressure in the boiler. (Pull the release on the relief valve. Do not depend on the pressure gauge reading.
- The boiler water is not hot.
- The electrical power is disconnected.
- The gas is shut off.

Failure to make these checks could result in substantial property damage, serious personal injury, or death.

DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN SUBMERGED IN WATER. Immediately call a qualified service technician. The appliance MUST BE replaced if it has been submerged. Attempting to operate an appliance that has been submerged could create numerous harmful conditions, such as a potential gas leakage causing a fire and/or explosion, or the release of mold, bacteria, or other harmful particulates into the air. Operating a previously submerged appliance could result in property damage, severe personal injury, or death.
NOTE: Appliance damage due to flood or submersion is considered an Act of God, and IS NOT covered under product warranty.

⚠ CAUTION

Label all wires prior to disconnecting them when servicing the boiler. Wiring errors can cause improper and dangerous operation. Failure to follow these instructions may result in property damage or personal injury.

NOTE: If system return temperatures are maintained below the dew point, condensation will form on the boiler cabinet and cause some components to rust.

C. User Interface Display

Lockout Codes

Code	Message	Description	Possible Remedy
F00	**ECO 1 Water**	F00 indicates the water in the boiler has overheated. The boiler will not restart until it cools sufficiently and a technician determines and repairs the cause of overheating and pushes **RESET** on the display. This is a serious safety issue as indicated by the illuminated red light and the word LOCKOUT flashing on the display. During this lockout fault, the pump will be on in an effort to cool the boiler down.	1. Check circulator pump operation. 2. If the circulator pump is running, ensure there is water in the system and that the water is moving through the system as intended. Ensure that all correct ball valves and or zone valves are open or closed as intended. 3. Observe the temperature/pressure gauge. If the water is not too hot and this message is displayed, check the wiring to the water ECO sensor and repair if necessary. If the wiring is ok and this code is still present and the water is not excessively hot, replace the dual supply sensor.
E03	**Sys Supply Sensor**	E03 indicates a problem with the system sensor circuit. The circuit could be open or shorted. Possible reasons for this error are: 1. There is no system sensor connected to the Master Boiler. 2. The system sensor is faulty. 3. There is a short circuit in the system sensor wiring; possibly from a staple placed through the wire, or damage to the wire causing both conductors to touch. 4. The system sensor wiring is open due to defect or damage.	Disconnect the system sensor from the wiring and measure its resistance. Compare the measured resistance to the table in this manual to see if it corresponds to the temperature of the sensor. If the resistance does not agree with the table, replace the sensor. If the sensor is OK, disconnect the sensor wiring from both the boiler control and the sensor and check continuity between those two ends using an ohmmeter. Repair or replace as necessary. If this error is present, the boilers in the cascaded group will run and ignite simultaneously when there is a heat demand. Each boiler will modulate to maintain set point temperature on its own supply sensor. This code automatically resets when repair is complete. This code will not display if system setting function ERROR SYSTEM SENS is set to OFF.

Code	Message	Description	Possible Remedy
F01	**Flue Temp / Wat Lvl F01**	Indicates possible low voltage harness error.	1. Use an ohmmeter to check the jumper between X7-10 and X7-20 at the BIC928 control end of the Low Voltage Harness. 2. If there is no continuity, check the jumper wire and terminations for loose or broken connections.
F02	**Lockout: Supply Sensor Open F02**	The dual supply sensor contains two sensing elements within a single body. F02 indicates that one or both halves of the supply temperature sensor has failed OR the difference between the dual sensor readings is greater than 18°F. This is a serious safety issue and the boiler will not restart until the sensor is replaced by a technician and he pushes the **RESET** button on the display. This situation is indicated by the red center pane of the Home screen and the displayed phrase Lockout: Supply Sensor Open F02. During this lockout fault, the CH pump will be on.	1. Navigate to the Status Menu and observe the values of Supply1 and Supply 2 in the Actual Temperatures table. If one value is either an abnormal value or N/C, locate the orange and yellow pairs of wires at the Supply Sensor end of the Low Voltage harness. Switch the positions of the Yellow and Orange pairs in the adapter, and go back to the Status values. If the abnormal or N/C values switched positions, then inspect the wiring for loose or corroded connections. If the abnormal or N/C value does not change places, then replace the wires and proceed to the next step. 2. Check the electrical connections to each half of the thermistor on the outlet manifold. Verify 3.3 VDC by checking in Molex connector. If there is not 3.3 VDC, check the harness. If harness and sensors are OK, replace control. **NOTE:** The boiler will reset automatically. Verify thermistor resistance values of each half of the dual sensor by referencing chart in this manual. 3. Replace thermistor if necessary.
F03	**Lockout: Return Sensor Open F03**	F03 indicates the return temperature sensor of the boiler has failed in the OPEN state (no continuity). The boiler will not restart until a technician replaces the sensor and pushes **RESET** on the display. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: Return Sensor Open F03. During this lockout fault, the CH pump will be on.	1. Check circulator pump operation. 2. Ensure adequate flow through the boiler by accessing the status menu and determining there is less than a 50°F rise from the return thermistor to the supply thermistor. 3. Troubleshoot thermistor by following the steps in F02.
F04	**Lockout: Flue Sensor Open F04**	F04 indicates that the flue temperature sensor of the boiler has failed in the OPEN state (no continuity). The boiler will not restart until a technician replaces the sensor and pushes **RESET** on the display. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: Flue Sensor Open F04 Interrupted. During this lockout fault, the CH pump will be on.	Inspect the flue sensor for physical damage or corrosion and replace it if necessary. Check the electrical connection to the flue sensor and repair as necessary. Measure the resistance of the sensor and refer to the sensor resistance table in this manual. The temperature on the chart should be close to the temperature in the flue. If not, replace the flue sensor.
F04	**Lockout: Flue Sensor Shorted F04**	F04 indicates that the flue temperature sensor of the boiler has failed in the SHORTED state (zero ohms resistance). The boiler will not restart until a technician replaces the sensor and pushes **RESET** on the display. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: Flue Sensor Open F04 Interrupted. During this lockout fault, the CH pump will be on.	Inspect the flue sensor for physical damage or corrosion and replace it if necessary. Check the electrical connection to the flue sensor and repair as necessary. Measure the resistance of the sensor and refer to the sensor resistance table in this manual. The temperature on the chart should be close to the temperature in the flue. If not, replace the flue sensor.
F05	**Blocking: HIGH Supply Temp** **OR** **Lockout: Supply High F05**	F05 indicates the boiler supply temperature is excessive. If the center pane of the Home screen is orange, and the displayed phrase Blocking: High Supply Temp, the supply temperature of the boiler is at or above 199°F. The message will clear automatically when the temperature drops below 194°F. When accompanied by the red center pane of the Home screen and the displayed phrase Lockout: Supply High F05, this code indicates the supply sensor temperature has exceeded 210°F and a serious safety issue exists. The boiler will not restart until a technician determines and repairs the cause of excessive temperature and pushes **RESET** on the display. During the time that this fault is displayed, the CH pump will be on.	1. Check circulator pump operation. 2. Ensure adequate flow through the boiler by accessing the status menu and determining there is less than a 50°F rise from the return thermistor to the supply thermistor. 3. Check the direction of flow off the boiler circulator. (See Piping Details in this manual.) 4. Troubleshoot the dual supply thermistor by following steps in F02.

Code	Message	Description	Possible Remedy
F06	**Blocking: HIGH Return Temp** **OR** **Lockout: Return Temp High F06**	This display indicates that the boiler return temperature is excessive. If the center pane of the Home screen is orange and the displayed phrase Blocking: High Return Temp, the supply temperature of the boiler is at or above 199°F. The message will clear automatically when the temperature drops below 194°F. This code indicates that the return sensor temperature has exceeded 210°F and a serious safety issue exists when accompanied by the red center pane of the Home screen and displayed phrase Lockout: Return Temp High F06. The boiler will not restart until a technician determines and repairs the cause of excessive temperature and pushes **RESET** on the display. During the time that this message or lockout fault is displayed, the CH pump will be on.	1. Check circulator pump operation. 2. Ensure adequate flow through the boiler by accessing the status menu and determining there is less than a 50°F rise from the return thermistor to the supply thermistor. 3. Check the direction of flow on boiler circulator. (See Piping Details in this manual.) 4. Troubleshoot thermistor by following steps in F02.
F09	**Lockout: No Flame on Ignition F09**	The boiler tried to ignite four times during one heat call and failed. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: No Flame on Ignition F09. The boiler will reset automatically after an hour. The boiler may also be restarted after a technician determines and repairs the cause of ignition failure and pushes **RESET** on the display. During this lockout fault, the CH pump will remain on.	1. Watch the igniter through the observation window. 2. If there is no spark, check the spark electrode for the proper 1/4" gap between the burner. 3. Remove any corrosion from the spark electrode. 4. If there is a spark but no flame, check the gas supply to the boiler. 5. If there is a flame, check the flame current. 6. Check any flue blockage or condensate blocks. 7. Replace the ignitor.
F10	**Lockout: Flame Loss F10**	The flame was lost 3 times while the boiler was firing during one (1) demand call. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: Flame Loss F10. The boiler will reset automatically after an hour. The boiler may also be restarted after a technician determines and repairs the cause of ignition failure and pushes **RESET** on the display. During this lockout fault, the CH pump will be on.	1. Monitor gas pressure to the unit while in operation. 2. Assure the flame is stable when lit. 3. Check if the display readout changes from "GAS VALVE ON" to "RUN" within a few seconds of boiler ignition. 4. Check the FLAME signal on the display. It should be above 1.2uA when the boiler is firing. 5. If the signal reads less than 1.2uA, clean the spark probe. 6. If the problem persists and the 'FLAME" signal is still less than 2.5uA, replace the spark igniter probe. 7. The flame signal should be steady after the boiler has been firing for 1 minute and is normally at 5.0 to 9.0. If the flame signal is not steady, disassemble the burner door and check the burner and its sealing gaskets.
F11	**Lockout: False Flame F11**	There is flame during a call for heat, but prior to the ignition sequence. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: False Flame F11 in Standby/Purge. The boiler will not restart until a technician determines and repairs the cause and pushes **RESET** on the display. During this lockout fault, the pump will be on.	1. Look into heat exchanger sight glass. If there is flame, turn the gas off to the unit at the service valve and replace the gas valve. 2. If the flame signal on the status menu is greater than 1.2uA when the burner is not lit, replace the flame probe. 3. If the flame signal is not present after turning off the gas supply, check the gas valve electrical connection. 4. Check for condensate backup. Repair condensate system as necessary. If condensate has partially filled the combustion chamber, the refractory wall may be damaged and should be replaced. 5. Turn the gas on at the service valve after corrective action is taken. 6. If the refractory wall falls against the flame probe, it may conduct the signal to ground, giving a false reading.
F13	**Lockout: Fan Speed Error F13**	The fan is not running at the speed determined by the control. Fan speed has been more than 30% slower than the commanded speed for more than 10 seconds. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: Fan Speed Error F13. This boiler will not restart until a technician determines and repairs the cause and pushes **RESET** on the display. During this lockout fault, the pump will be on.	1. Check the combustion fan wiring. 2. Measure DC voltage from the red fan wire (POS) to the light blue wire (ground) while it is connected to the fan. It should be 24V +/- 1v volts. If it is lower than 23 volts, check for excessive external loads connected to the boiler sensor terminals 3. Disconnect the 5 pin plug from the fan and check the voltage on the red wire again. If it is now 24 volts, replace the fan. If it is still below 23 volts replace the boiler control board.

Code	Message	Description	Possible Remedy
F14	**Lockout: Fan Speed High F14**	The fan is not running at the speed determined by the control. Fan speed has been more than 30% faster than the commanded speed for more than 10 seconds. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: Fan Speed High F14. This boiler will not restart until a technician determines and repairs the cause and pushes **RESET** on the display. During this lockout fault, the pump will be on.	1. Check the combustion fan wiring. 2. Measure DC voltage from the red fan wire (POS) to the light blue wire (ground) while it is connected to the fan. It should be 24V +/- 1v volts. If it is lower than 23 volts, check for excessive external loads connected to the boiler sensor terminals 3. Disconnect the 5 pin plug from the fan and check the voltage on the red wire again. If it is now 24 volts, replace the fan. If it is still below 23 volts replace the boiler control board.
F20	**Lockout: Condensate Full F20**	The condensate trap is full. This is a serious safety issue as indicated by the red center pane of the Home screen and the phrase Lockout: Condensate Full F20. The boiler will not restart until a technician determines and repairs the cause and pushes **RESET** on the display. During this lockout fault, the pump will be off.	1. Check condensate lines for obstructions. 2. Check float switch in condensate reservoir. 3. Check wiring from condensate reservoir to 928 control and repair as necessary.
F21	**Lockout: LWCO Fault F21**	This fault indicates the water level in the boiler is low. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: LWCO Fault F21.	1. Check boiler feed water system to be sure it is supplying make-up water to the boiler system. 2. Ensure all air is bled from the system. 3. Check for leaks in the boiler and system piping and repair as necessary. 4. Inspect low water cutoff probe and wiring for damage and repair and replace as necessary.
F22	**Lockout: External LWCO F22**	This code is generated when the External Low Water Cutoff is installed and the water level in the boiler is low. This is a serious safety issue as indicated by the red center pane of the Home screen and the displayed phrase Lockout: External LWCO F22. When this code is displayed, the boiler will not respond to a demand for heat. The pump icons on the lower left corner of the display indicate the status of the pumps. The pump will remain on when this code is displayed.	IF EXT LWCO is installed: 1. Check boiler feed water system. Ensure it is supplying make-up water to the boiler system. 2. Be sure all air is bled from the system. 3. Check for leaks in the boiler and system piping and repair as necessary. 4. Inspect low water cutoff wiring for damage and repair as necessary. 5. Ensure EXT LWCO has power applied to the power input terminals. 6. Press Reset button on LWCO. If code reoccurs, replace EXT LWCO. IF EXT LWCO is NOT installed: Inspect the jumper from terminals 20 and 21 on the Field Connection Board for damage or loose connections.
F24	**Lockout: Burner Door F24**	Burner Door Switch does not apply to this product. There is a jumper in the Low Voltage harness that is used in the place of an actual sensor.	1. Use an ohmmeter to check the jumper between X7-8 and X7-18 at the BIC928 control end of the Low Voltage Harness. 2. If there is no continuity, check the jumper wires and terminations for loose or broken connections.
F26	**Lockout: Gas Pressure F26**	Gas Valve Pressure Switch does not apply to this product. There is a jumper in the Low Voltage harness that is used in the place of an actual sensor.	1. Use an ohmmeter to check the Gas Pressure jumper between X6-8 and X6-17 at the BIC928 control end of the Low Voltage Harness. 2. If there is no continuity, check the jumper wires and terminations for loose or broken connections.
F31	**Program Error**	There was a code while programming the control and the memory is corrupt. The boiler control will not function in this state and the pump will be off as indicated on the bottom line. This code only occurs if a technician is programming the control and the programming function fails. The only way to recover from this code is to reprogram the control. If this code occurs at any time other than when a technician is servicing the boiler, the control has failed and must be replaced by a qualified technician.	The control must be reprogrammed. If programming does not solve the problem, the control must be replaced.
F41	**Lockout: Condensate Internal Fault F41**	This code indicates there is an internal fault in the circuit within the control connected to the condensate switch.	1. Inspect the ground wires for damage or loose connections. 2. Inspect the condensate wiring for damage and repair as necessary. 3. Ensure no high voltage wires are routed in parallel with the condensate low voltage wiring. 4. Replace control.
F42	**Lockout: LWCO Internal Fault F42**	This code indicates there is an internal fault in the LWCO circuit.	1. Inspect the ground wires for damage or loose connections. 2. Inspect the LWCO wiring for damage and repair as necessary. 3. Ensure no high voltage wires are routed in parallel with the LWCO low voltage wiring. 4. Replace control.

Code	Message	Description	Possible Remedy
F43	**Lockout: AD Safety Fault F43**	The temperature of either the flue or supply sensors has risen nine degrees in 100 milliseconds and not returned to normal within 1 second.	This is usually a result of loose or corroded connections in either the Supply, Return, or Flue Sensor wiring. Ensure the connections to the flue and supply sensors are intact. If wires are intact, check sensor resistance. If the problem persists or the sensors are out of normal resistance range, replace the sensors.
	Outdoor Sensor	On the GHS, the Modulation Circle will be Orange, but Blocking code indicates None. If you navigate to the BHS, the Center pane will be Orange, and the text "Outdoor Sensor" will be displayed. This indicates an issue with the outdoor sensor. It is shorted, damaged, or disconnected from the boiler.	1. Check outdoor sensor connections and wiring. Ensure the sensor and wiring are intact and that the sensor is connected to the boiler. 2. Check the outdoor sensor resistance with an ohmmeter. See table in this manual for correct outdoor sensor resistance. 3. Replace the outdoor sensor.
The following blocking codes will block operation until the control determines the situation safe for boiler operation.			
	Blocking: Water Flow	This indicates there is demand but the flow switch is not activated.	1. Ensure boiler contains water and all valves are open. 2. Check the boiler circulator and ensure it is in good operating condition (operating, wiring intact, etc.). 3. Inspect the wiring to the flow switch for damage and repair as necessary. 4. Disconnect one wire from the flow switch and test for continuity across the switch while flow is confirmed to be present. 5. Remove flow switch and inspect switch paddle for proper operation.
E07	**Blocking: HIGH Flue Temp**	This display indicates that the flue sensor temperature is above 204°F. When this code is displayed, the boiler will not respond to a demand for heat. When the flue temperature decreases below 194°F, the display will return to normal and allow the boiler to respond to a heat demand. The bottom line indicates the status of the pump. The pump will remain on when this code is displayed.	Check the flue for obstructions or any sign of damage, especially signs of excessive heat. Repair as necessary. Run the boiler and check the flue temperature with an external thermometer. If the flue temperature on the thermometer does not agree with the flue temperature displayed in the status menu, inspect the wiring to the flue temperature sensor in the boiler and repair as necessary. If the wiring is intact, replace the flue sensor. If the flue temperature is excessive on the status menu and the test thermometer reads the same, check and adjust combustion controls on the boiler.
	Blocking: Regulation Temp	This condition is part of the normal operation of the boiler, and indicates there is either a CH or DHW demand on the boiler, the pump is powered on, and the supply sensor temperature is too high for the boiler to ignite. This occurs because the water temperature measured by the supply sensor is higher than the Setpoint – CH diff setting.	This message will stay present until the water temperature measured by the supply sensor is less than the tank temperature – CH diff setting.
	Blocking: Max Flue Pressure	Blocking: Blocked Vent indicates excessive flue pressure. This code resets automatically after the high pressure condition is resolved.	1. Assure the flue is not blocked. 2. Check the switch wiring by applying a jumper in place of the switch. If the code clears with the jumper in place, REPLACE the flue switch and connect the wires to the new switch BEFORE running boiler.

Table 35 - Boiler Blocking and Fault Codes

Troubleshooting a Non-Responsive Display Screen

1. Clean the screen with a soft, damp towel and test for response.
2. If there is no response, ensure there is no debris trapped around the edges of the display/bezel junction.
3. Ensure the gasket is installed correctly and not protruding onto the active touch surface.
4. Power the boiler off and on. On power up, if the display goes into the calibration procedure it thinks it is being touched. If the display does not enter the calibration procedure, skip to step 6.
5. If the display enters calibration without being touched, contact Tech Support for assistance.
6. Power the boiler off. Rest your stylus on the HMI and power the boiler on.
7. Touch the 3 green dots with your stylus. After the HMI is up check the display for responses.

Display Screen Calibration

1. Turn the power switch off at the boiler.
2. While touching the screen with one finger, turn the power back on. The screen will go into calibration mode.
3. Follow the instructions on the screen to complete calibration.

Outdoor Sensor (7250P-319)		System Sensor (7250P-324) Return Sensor (7100P-004) Indirect Sensor (7350P-325)	Supply Sensor (7700P-073) Flue Temp. Sensor (7550P-147)
Temperature (°F)	Resistance (ohms)	Temperature (°F)	Resistance (ohms)
-22	171800	32	32624
-13	129800	41	25381
-4	98930	50	19897
5	76020	59	15711
14	58880	68	12493
23	45950	77	10000
32	36130	86	8056
41	28600	95	6530
50	22800	104	5324
59	18300	113	4365
68	14770	122	3599
77	12000	131	2982
86	9804	140	2483
95	8054	149	2079
104	6652	158	1748
113	5522	167	1476
		176	1252
		185	1066
		194	912
		203	782
		212	674

Table 36 - Sensor Temperature Resistance

Part 14 - Maintenance

⚠ DANGER

The boiler must be inspected and serviced annually, preferably at the start of the heating season, by a qualified service technician. In addition, the maintenance and care of the boiler as outlined in this manual must be performed by the user/owner to assure maximum efficiency and reliability. Follow the maintenance procedures given throughout this manual. Failure to perform the service and maintenance or follow the directions in this manual could damage the boiler or system components, resulting in substantial property damage, severe personal injury, or death.

A. Procedures

Periodic maintenance should be performed once a year by a qualified service technician to ensure that all the equipment is operating safely and efficiently. The owner should make necessary arrangements with a qualified heating contractor for periodic maintenance of the boiler. The installer must also inform the owner that a lack of proper care and maintenance of the boiler may result in a hazardous condition.

B. Maintenance That May be Performed by the User

Check the Surrounding Area

⚠ DANGER

To prevent the potential of substantial property damage, severe personal injury, or death, eliminate all the materials listed in Table 3 from the area surrounding the boiler and the vicinity of the combustion air intake. If contaminants are found:

- Remove products immediately from area.
- If contaminants have been there for an extended period, call a qualified service technician to inspect the boiler for possible damage from acid corrosion.

If products cannot be removed, immediately call a qualified service technician to re-pipe the combustion air intake piping away from the contaminated areas.

Ensure the Cabinet is Closed When the Boiler is Operating

The boiler cabinet must be closed when the boiler is operating.

Combustible/Flammable Materials

Do not store combustible materials, gasoline, or other flammable vapors or liquids near the boiler. If found, remove these materials immediately.

Air Contaminants

If allowed to contaminate combustion air, products containing chlorine or fluorine will produce acidic condensate that will cause significant damage to the boiler. Read the list of potential contaminants and areas likely to have these contaminants in Table 3. If any of these contaminants are in the room where the boiler is located, or combustion air is taken from one of the areas listed, the contaminants must be removed immediately or the intake pipe must be relocated to another area.

Check the Power Source

Make sure the power cord and the main power line are properly connected to the manual switch box inside the boiler.

Check the Status of the Control Panel

Observe the Control Panel to ensure the boiler is powered on and to check for any error codes. Clear any debris from the panel.

Check CH Pressure Gauge

Ensure the pressure reading on the CH gauge does not exceed 30 psig. Higher pressure readings may indicate a problem with the expansion tank. Immediately contact a qualified service technician to inspect the boiler and system.

Check Exhaust Vent and Intake Pipe Terminations

Verify that the boiler exhaust vent and intake pipe terminations are clean and free of obstructions. Remove any debris from the exhaust vent or intake pipe openings. If removing the debris does not allow the boiler to operate correctly, contact your qualified service technician to inspect the boiler and the vent system.

Check Exhaust Vent and Intake Piping

Visually inspect the exhaust vent for any signs of blockage, leakage, or deterioration of the piping. Inspect the exhaust vent bracing. Ensure bracing is undamaged and in good condition. Notify a qualified service technician immediately if any problems are found.

⚠ WARNING

Failure to inspect the venting system and have it repaired by a qualified service technician can result in vent system failure, causing severe personal injury or death.

Check Pressure Relief Valve

1. Visually inspect the primary pressure relief valve and discharge pipe for signs of weeping or leakage.
2. If the pressure relief valve often weeps, the expansion tank may not be operating properly. Immediately contact a qualified service technician to inspect the boiler and system.

C. Maintenance Only to be Performed by a Qualified Service Technician

Operate Pressure Relief Valve

1. Before proceeding, verify that the relief valve outlet has been piped to a safe place of discharge, avoiding any possibility of scalding from hot water.
2. Shut power off to the boiler. To avoid scalding, wait for boiler to cool before operating the relief valve.

⚠ WARNING

To avoid water damage or scalding due to relief valve operation, a discharge line must be connected to the valve outlet and directed to a safe place of disposal. This discharge line must be installed by a qualified service technician in accordance with the boiler installation manual. The discharge line must be terminated so as to eliminate possibility of severe burns or property damage should the valve discharge.

3. Lift the relief valve lever. If water flows freely, release the lever and allow the valve to seat. Watch the end of the relief valve discharge pipe to ensure that the valve does not weep after the line has had time to drain. If the valve weeps, lift the lever again to attempt to clean the valve seat. If the valve does not properly seat and continues to weep, contact a qualified service technician to inspect the valve and system.
4. If water does not flow from the valve when you completely lift the lever, the valve or discharge line may be blocked. Immediately shut the boiler down per instructions on page 2 and call a qualified service technician to inspect the valve and system.
5. If relief valve seats properly, restore power to the boiler. Observe operation for five minutes and ensure it operates properly.

Check the Condensate Drain System

1. While the boiler is running, check the discharge end of the condensate drain tubing. Ensure no flue gas is leaking from the condensate drain tubing by holding your fingers near the opening.
2. If you notice flue gas leaking from the opening, this indicates a dry condensate drain trap. If problem persists, contact a qualified service technician to inspect the boiler and condensate line and refill the condensate trap.
3. If applicable, check the condensate neutralizer and ensure it is full of condensate neutralizing marble chips.

Removing the Cabinet Covers and Inspecting the Boiler

Before carrying out any work on the boiler, switch off the power supply at the external power switch and circuit breaker. Close the external gas shutoff.

⚠ DANGER

Ensure power and gas to the appliance are shut off before performing the following operations. Failure to do so will result in substantial property damage, severe personal injury, or death.

See Figure 58 to access the interior of the boiler:

1. Use a flat head screwdriver or a coin to turn the two (2) latches on the front cover. See (a) below. Then tilt the front cover forward and lift the cover from the cabinet.
2. The control panel and boiler internal components are now exposed. See (b) below.

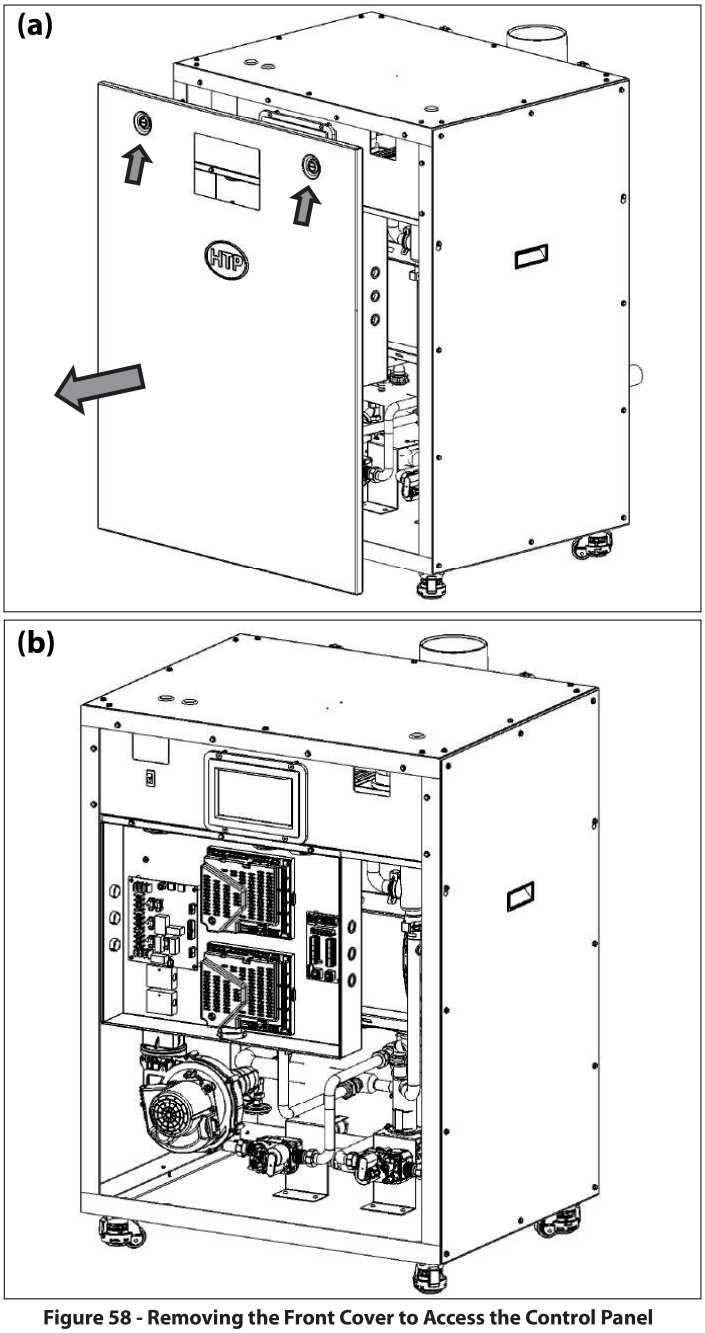


Figure 58 - Removing the Front Cover to Access the Control Panel

3. To access the combustion modules, use a 5/16" hex driver to remove the twelve (12) bolts from each side cover - twenty four (24) bolts total. When removing the final screw, support the panel by the handle and lift from the boiler. See Figure 59 (a) below.
4. Now the combustion modules can be accessed. See (b) below.

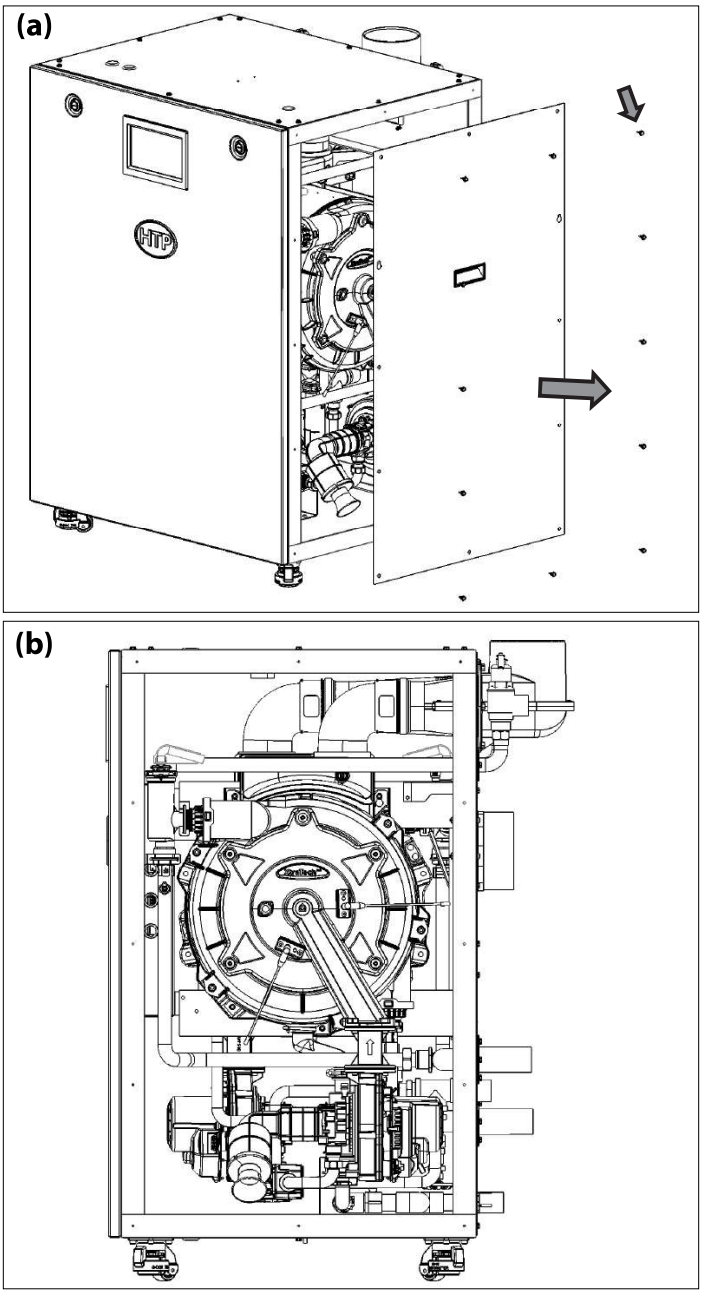


Figure 59 - Removing the Side Cover to Access the Combustion Module

Check Water and Gas Piping

1. Remove the boiler covers and perform a gas leak inspection following Operating Instructions on page 2 of this manual. If gas odor or leak is detected, follow procedures on page 2. Call a qualified service technician.
2. Visually inspect for leaks around the boiler water connections and around the heat exchanger. Visually inspect the external system piping, circulators, and system components and fittings. Immediately call a qualified service technician to repair any leaks.

⚠ WARNING

Have leaks fixed at once by a qualified service technician. Failure to comply could result in substantial property damage, severe personal injury, or death.

Before Starting Maintenance:

1. Ensure the power and gas remain off.
2. Close the valves of the heating and hot water circuits.
3. Remove the cabinet covers as shown in Figures 58-59.
4. If necessary, drain the appliance of water.

Draining Procedure

To drain the heating system:

1. Ensure the boiler power and gas remain off.
2. Open the system drain valve and collect the escaping water in a container.
3. Drain the water from the lowest points of the system (where applicable).

If the system is to be inactive in areas where the room temperature may fall below 0°C during winter, it is recommended that anti-freeze liquid be added to the heating system in order to avoid the need for repeated draining. Ensure the antifreeze used is compatible with the stainless steel boiler heat exchanger.

⚠ WARNING

NEVER use any toxic chemical, including automotive, standard glycol antifreeze, or ethylene glycol made for hydronic (non-potable) systems. These chemicals can attack gaskets and seals in water systems, are poisonous if consumed, and can cause personal injury or death.

It is recommended to use antifreeze which contains PROPYLENE GLYCOLS as these inhibit corrosion. Use the quantities and formulation suggested by the antifreeze manufacturer to protect against freezing in your region and prevent scaling and corrosion.

Regularly check the pH level of the water/anti-freeze mix in the boiler circuit and replace it when the value measured is lower than the limit prescribed by the manufacturer.

DO NOT MIX DIFFERENT TYPES OF ANTI-FREEZE.

The manufacturer will not be held liable for any damage caused by the appliance or the system due to the use of inappropriate antifreeze substances or additives.

Draining the DHW System and Indirect Water Heater

To drain the DHW System or Indirect Water Heater follow the DHW component manufacturer's instructions.

⚠ WARNING

Water drained from the boiler could be scalding hot. Wait for the boiler to cool before draining water, and take precautions when draining water. Failure to do so could result in property damage, personal injury, or death.

Allowing the boiler to operate with a dirty combustion chamber will hurt operation. Failure to clean the heat exchanger as needed by the installation location could result in boiler failure, property damage, personal injury, or death. Such product failures ARE NOT covered under warranty.

⚠ WARNING

The combustion chamber insulation in this product contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)."

- Avoid breathing dust and contact with skin and eyes.
- Use a NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on job site conditions. Current NIOSH recommendations can be found on the NIOSH website: http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
- Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent dust.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

Cleaning the Heat Exchanger Combustion Chambers

NOTE: The boiler has two (2) combustion chambers. This procedure will need to be carried out on each.

*Before beginning this procedure, have on hand the following items:

- a nylon or other non-metallic brush
- an FDA approved liquid lime scale remover in a spray bottle
- gloves and eye protection

1. Remove the silencer clip. See Figure 60 (a) below.
2. Remove the silencer by pulling it away from the blower. See (b) below.

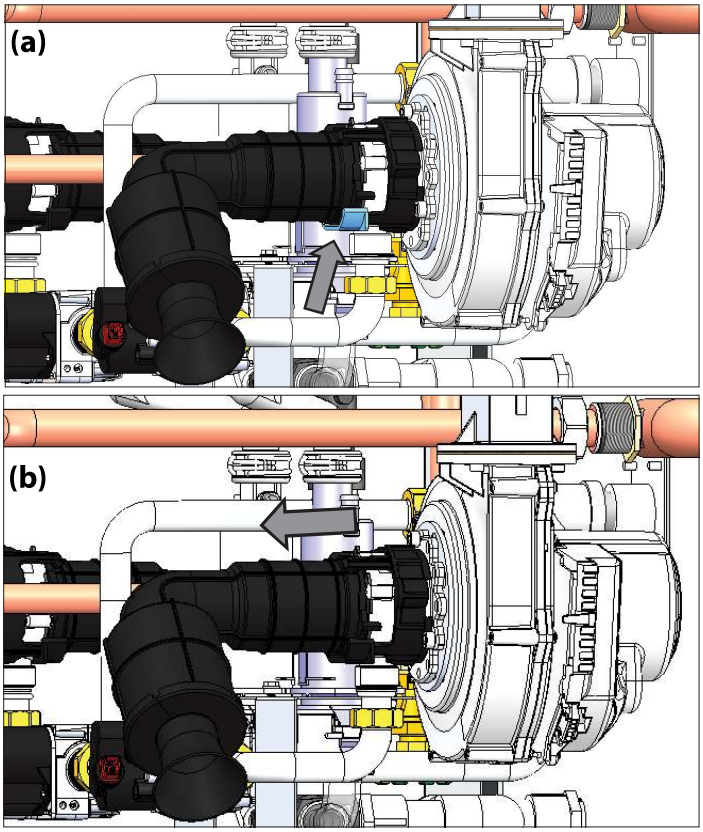


Figure 60 - a - Remove the Silencer Clip, b - Remove the Silencer

3. Unscrew the two (2) nuts and remove the gas pipe.

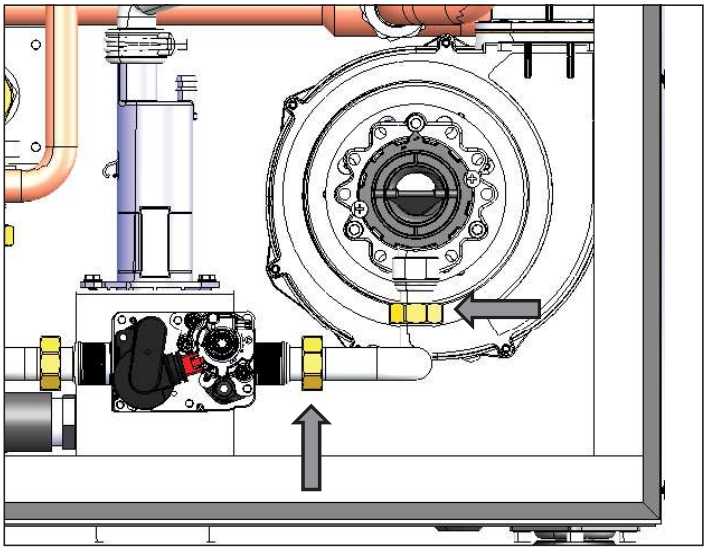


Figure 61 - Remove the Gas Pipe

4. Remove the gas diaphragm (if present).
5. Disconnect the electrical connections from the electrodes, igniter, and blower.
6. Unscrew the five (5) 10mm nuts on the burner door. See Figure 62.

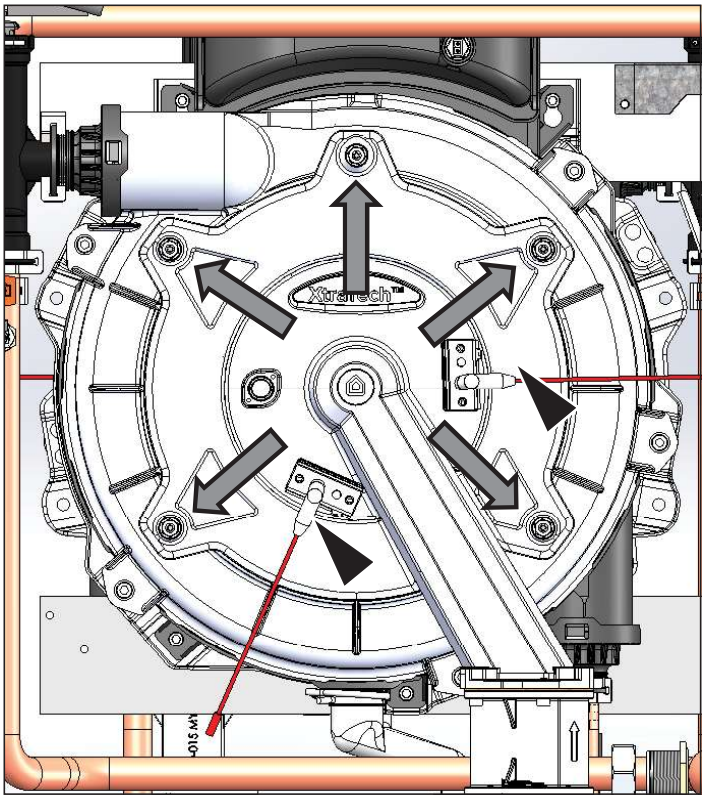


Figure 62 - Remove the Blower and Electrodes

7. Remove the combustion assembly.

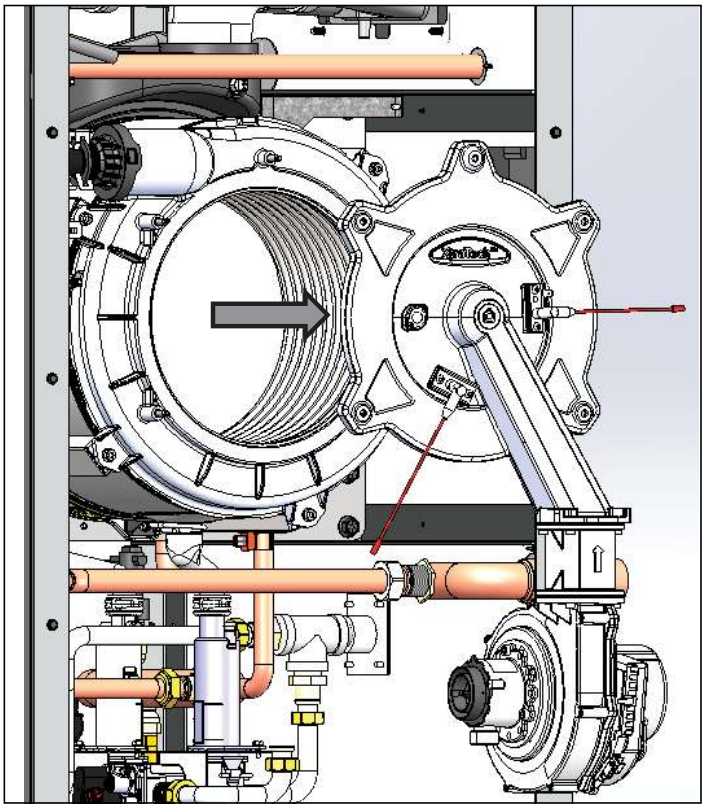


Figure 63 - Remove the Combustion Assembly

8. Disconnect the condensate hose from the condensate trap, not the heat exchanger.
9. Check the back wall insulation and replace if necessary.

⚠ WARNING

Protect the back wall insulation from water before performing any cleaning. Failure to do so could result in damage to the insulation, improper boiler operation, personal injury, or death.

10. Protect the back wall insulation. Then clean the combustion chamber by spraying water into the combustion assembly and monitor the flow through the combustion system. Liquid should flow freely through each tube. If there is an obstruction, use a nylon bristle brush and increase the flow on the tube to clean the blockage out.

NOTE: The solution will flow out of the heat exchanger through the condensate connection. Take precautions to collect the solution and prevent it from damaging the surrounding area or boiler components.

⚠ WARNING

Do not use solvents to clean any of the boiler components. The components could be damaged, resulting in unreliable or unsafe boiler operation, substantial property damage, severe personal injury, or death.

Checking the Burners

While the combustion assembly is removed from the heat exchanger, inspect the burner. Proceed as follows:

1. Unscrew the four (4) T20 Torx screws securing the two electrodes to the burner plate. See Figure 64.

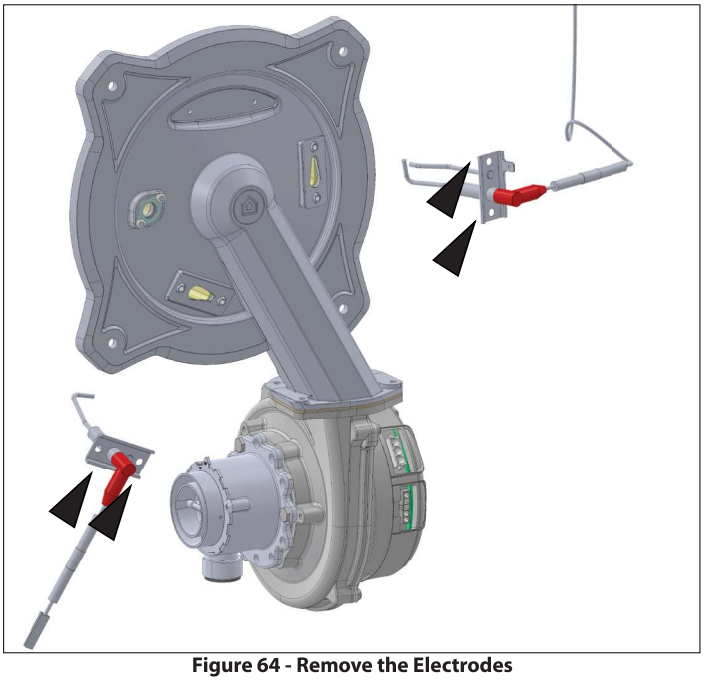


Figure 64 - Remove the Electrodes

2. Remove the ceramic fiber.
3. Remove the four screws and pull the burner toward you.

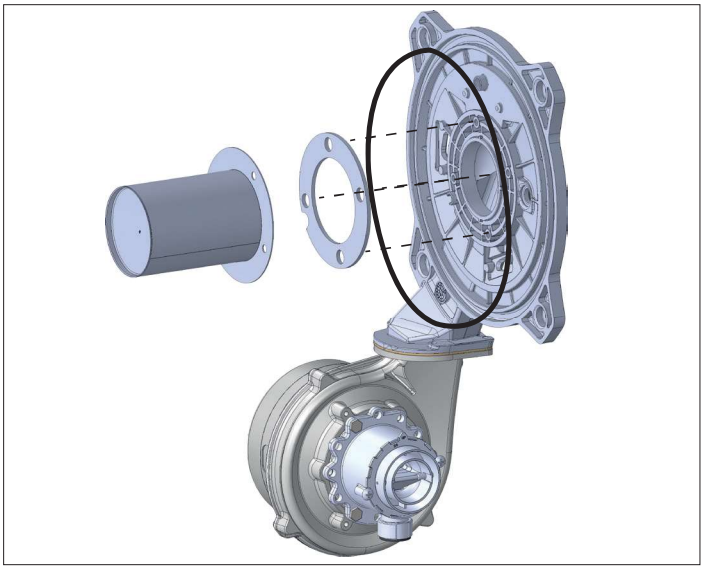


Figure 65 - Disassembled Burner Assembly

4. Verify and replace the other gaskets if they are damaged or showing signs of deterioration.
5. Make sure the burner is not damaged. Replace if necessary.

NOTE: Whenever replacing the burner, ALWAYS replace the burner gasket.

6. Reassemble the burner assembly.
7. Ensure the combustion assembly sealing ring is not damaged. Replace if necessary.

⚠ DANGER

Failure to replace a damaged sealing ring will result in exhaust gas leaks, substantial property damage, severe personal injury, or death.

NOTE: Ensure this procedure is repeated on both combustion assemblies.

8. After maintenance is complete, reinstall the combustion assembly. Reinstall the two removed electrodes with the four (4) removed screws.
9. Reassemble the combustion assembly and tighten the five (5) nuts.
10. Reconnect the gas line. Replace the sealing ring.
11. Reconnect the electrode electrical connections.
12. Reinstall the silencer.
13. Ensure all components are tightened properly.
14. Restore power and gas to the boiler. Restart the boiler. Check for leaks in the combustion system. Observe operation for 5 to 10 minutes.

If boiler is operating properly, condensate is flowing normally, and no gas leaks are detected, combustion coil cleaning is complete.

Clean the Condensate Traps

NOTE: The boiler has two (2) condensate traps. This procedure will need to be carried out on each.

1. Remove the front cover from the boiler cabinet following the instructions in this manual.
2. Remove the hoses from each condensate trap. Make note of where these hoses attach for reinstallation. See Figure 66.

⚠ WARNING

Take care when removing the hoses and condensate traps as condensate may escape. Failure to do so could result in property damage due to leaks, personal injury, or death.

3. Remove the two (2) screws from each condensate trap bracket - four (4) screws total. Take care not to lose these screws and set aside for reinstallation.
4. Loosen the clips securing the hoses to the condensate traps.
5. Remove the condensate traps.

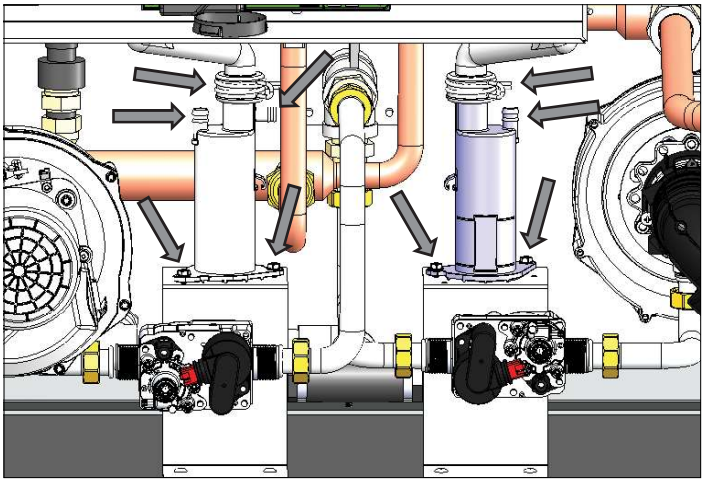


Figure 66 - Remove the Condensate Traps

6. Remove the siphon cap retaining clip. Then remove the siphon cap by depressing the two (2) lateral hinges (use a tool if necessary).
7. Remove the cone and the ball.
8. Clean each part.
9. When the condensate traps are sufficiently clean, reassemble and reinstall on the boiler in the reverse order.

NOTE: Ensure all parts shown in Figure 67 are installed with the boiler. If any parts are missing DO NOT operate the boiler. Replace the entire condensate trap assembly.

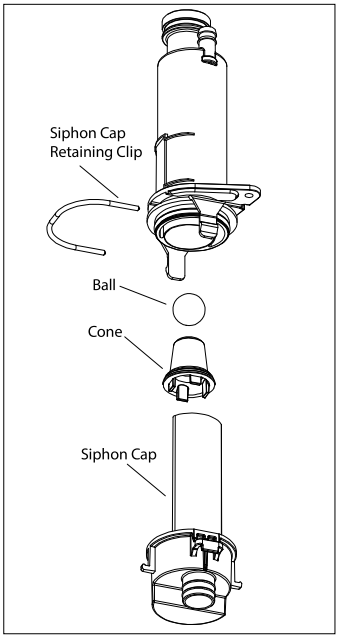


Figure 67 - Clean the Condensate Trap

⚠ WARNING

Do not install the condensate assembly if a component is lost or missing. Replace the entire assembly. Failure to follow this warning could result in property damage, serious personal injury, or death.

10. If a condensate neutralizer kit is installed, check the assembly when cleaning the condensate trap, and replenish the limestone chips if necessary. When replacing the limestone chips, take care to ensure chips are no smaller than ½" to avoid blockage in condensate piping.
11. Check condensate piping for sagging and/or leakage. Repair any sags or leaks before restoring power to the boiler.
12. If the boiler has a condensate pump, ensure the pump operates properly before considering maintenance complete.

D. Replacing Components

At any point in time over the boiler's service life it may be necessary to replace boiler components. If the boiler displays an error message, determine its cause and possible remedies.

If the remedy is replacement of a component, ensure:

1. That the boiler is powered OFF. Press the ON/OFF button to turn the boiler off. Then turn the main electrical power to the boiler off at the circuit breaker.
2. The boiler electrical connection is connected properly. A loose electrical connection could be the root cause of problems.
3. The front and side covers have been removed.
4. The main shutoff gas valve is closed.
5. All water valves to and from the boiler (supply, return, inlet, outlet) are closed.
6. If necessary, the water has been drained from the boiler and/or appropriate circuit.
7. No water can get into the display / control panel.

Replacing a Burner

1. Remove the cabinet covers following the instructions described in **Removing the Cabinet Covers and Inspecting the Boiler.**
2. Remove the combustion assembly as described in **Cleaning the Heat Exchanger Combustion Chambers.**
3. Remove, inspect, and replace the burner as described in **Checking the Burners.**
4. Replace all damaged seals that are damaged or showing signs of wear.

⚠ DANGER

Failure to replace a damaged sealing ring will result in exhaust gas leaks, substantial property damage, severe personal injury, or death.

5. Proceed in the reverse order to reinstall the components.

Replacing a Fan

1. Remove the silencer and gas line as described in Cleaning the Heat Exchanger Combustion Chambers.
2. Loosen the three [3] screws to release the Mixer (1) from the fan (5). Ensure the O-Ring (4) is not damaged or deteriorating. See Figure 68.

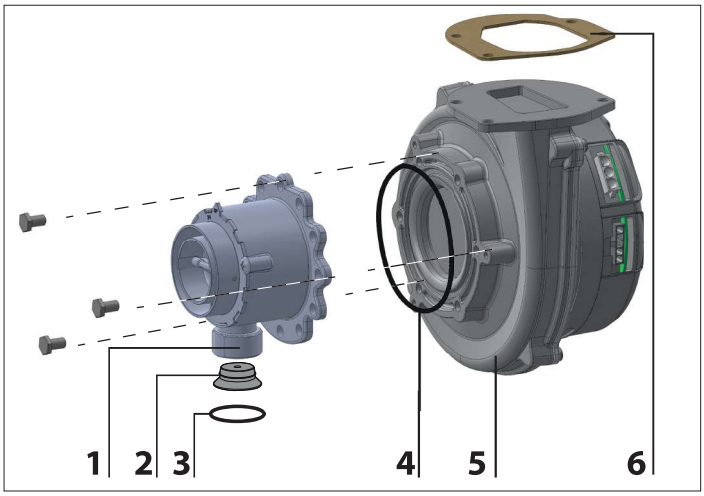


Figure 68 - Removed Fan, Mixer, and Components

Legend:

1 - Mixer (when converting to Propane, install the Mixer included in the Natural Gas to Propane Conversion Kit)
2 - Gas Diaphragm if applicable (Models converted to Propane require a Gas Diaphragm - see Natural Gas to Propane Conversion Instructions)
3 - Gas Seal
4 - O-Ring
5 - Fan
6- Fan to Air Inlet Channel Gasket

3. Loosen the three [3] screws to release the fan from the heat exchanger.

⚠ DANGER

Ensure that the correct gas diaphragm and mixer are used for the correct fuel type for the boiler - Natural Gas or Propane. See Conversion Kit Instructions. Failure to do so will result in substantial property damage, severe personal injury, or death.

4. Reassemble the mixer and fan assembly in the reverse order. Ensure the O-Ring (4) is installed between the mixer and fan.
5. Reinstall the fan and combustion assembly components as described in Cleaning the Heat Exchanger Combustion Chamber. Ensure the gasket (6) is assembled between the fan and air inlet channel.

⚠ DANGER

Failure to replace damaged or deteriorating gaskets or O-Rings will result in exhaust gas leaks, substantial property damage, severe personal injury, or death.

Replacing a Heat Exchanger

1. Drain the boiler and remove the combustion assembly as described in **Cleaning the Heat Exchanger Combustion Chambers.**
2. Remove the exhaust vent adapter retaining screws on the rear of the cabinet.
3. Remove the two (2) screws securing the CH relief valve pipe assembly to the rear of the boiler. See Figure 69.
4. Remove the three clips on the automatic air purging device (a), then remove the CH relief valve pipe (b) from the rear of the boiler.
5. Disconnect the bottom of the heating supply pipe (c) from the hydraulic group, then from the automatic air purging device (a).

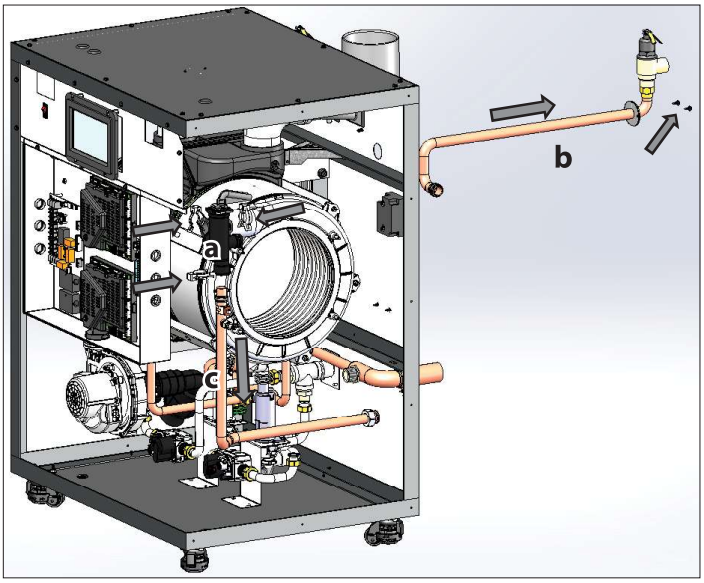


Figure 69 - Remove the CH Pressure Relief Valve and CH Outlet Pipe

6. Remove the automatic air purging device (a) from the heat exchanger.
7. Disconnect return pipe (d) by removing clip from the heat exchanger, then loosen the clip (e) securing the condensate channel to the heat exchanger. Disconnect the condensate channel from the boiler. See Figure 70.

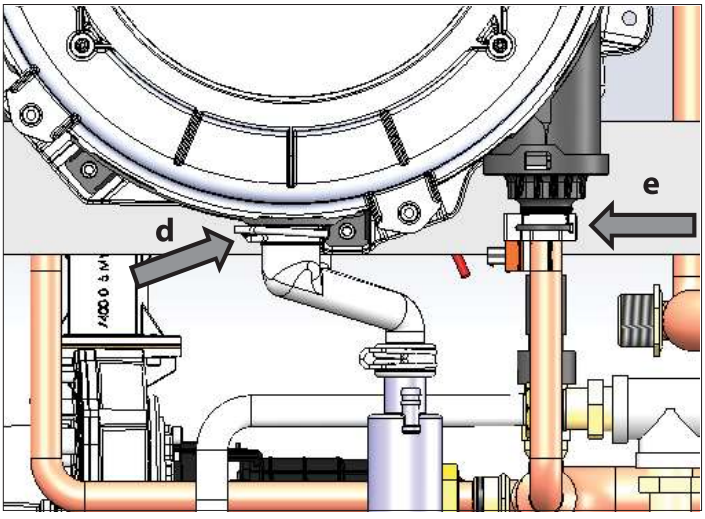


Figure 70 - Remove the Condensate Pipe and CH Return Pipe

8. Remove the two (2) lower 4mm fixing screws and loosen the two (2) upper 4mm fixing screws on the heat exchanger. See Figure 71 (a) below. Then remove the heat exchanger by lifting up off the keyholes and pulling towards you. See Figure 71 (b).
9. Proceed in the reverse order to install the new heat exchanger.

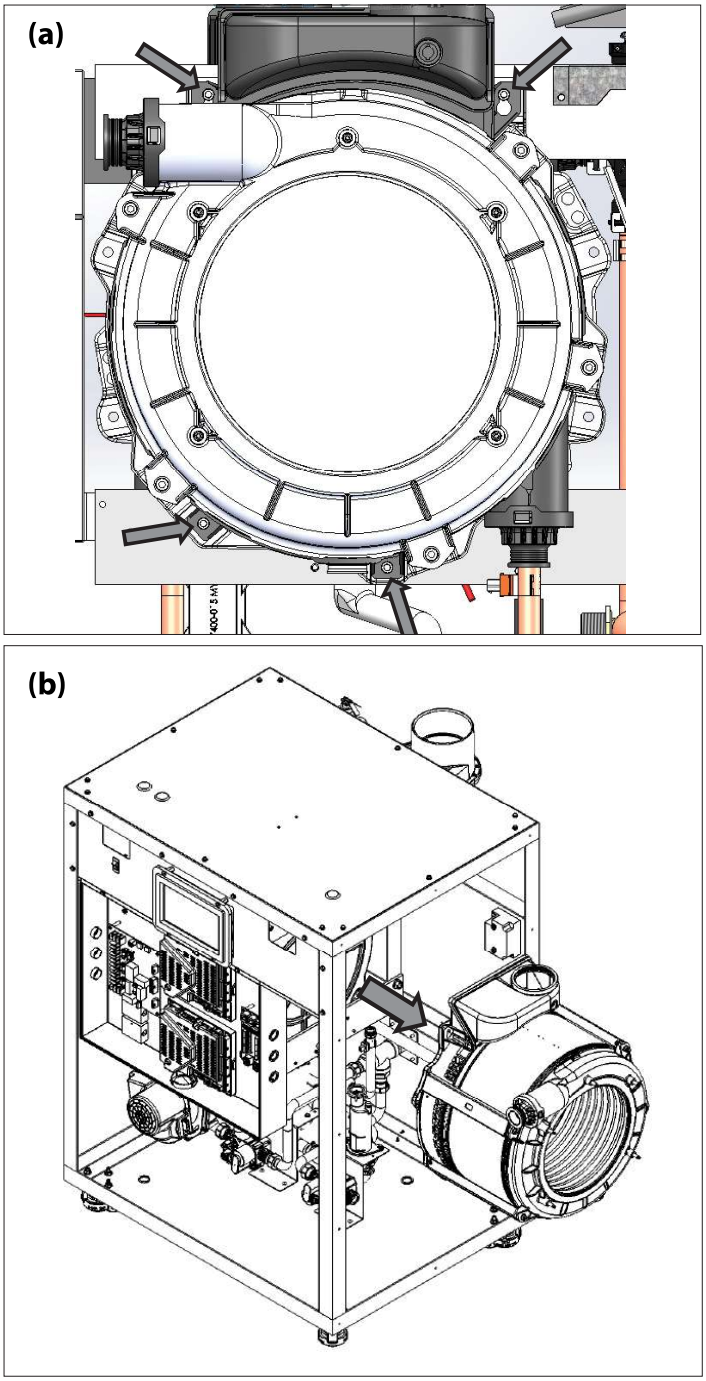


Figure 71 - Remove the Heat Exchanger

Replacing a Gas Valve

1. First remove the gas pipe as described in **Cleaning the Heat Exchanger Combustion Chambers. See Figure 61.**
2. Remove the electrical connection from the gas valve.
3. Remove the nut before the inlet of the gas valve. See Figure 72.
4. Remove the gas valve.
5. Reinstall the new gas valve in reverse order.
6. **BE SURE TO USE NEW SEALING RINGS.**
7. Ensure there are no gas leaks.

⚠ DANGER

Failure to replace the sealing rings will result in gas leaks, and could cause an explosion or fire, substantial property damage, severe personal injury, or death.

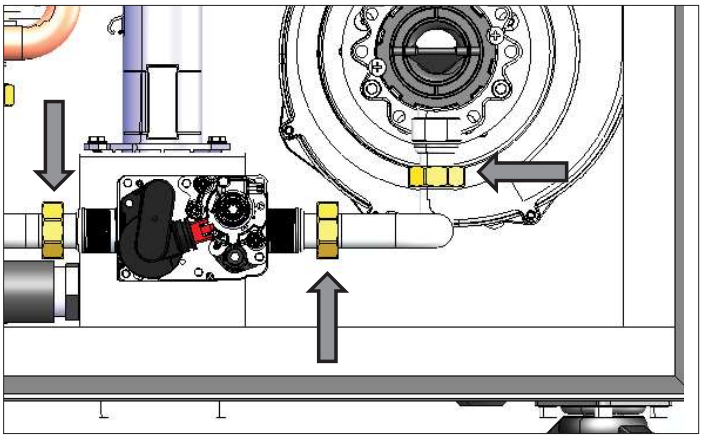


Figure 72 - Remove the Gas Valve

Replace a Control Board (See Cascade Quick Start Document for Details)

NOTE: This boiler features two (2) control boards, one for each module. Ensure you are replacing the correct control board. When replacing a control board, take note of programming settings. For example, if replacing a Follower / Follower control board, you will have to ensure the boiler is ready to operate as a cascade boiler and input the correct cascade address.

1. Ensure the boiler is POWERED OFF before proceeding with the following steps. Remove the boiler front cover. See Figure 73.
2. Disconnect the electrical connections from the control board to be replaced.

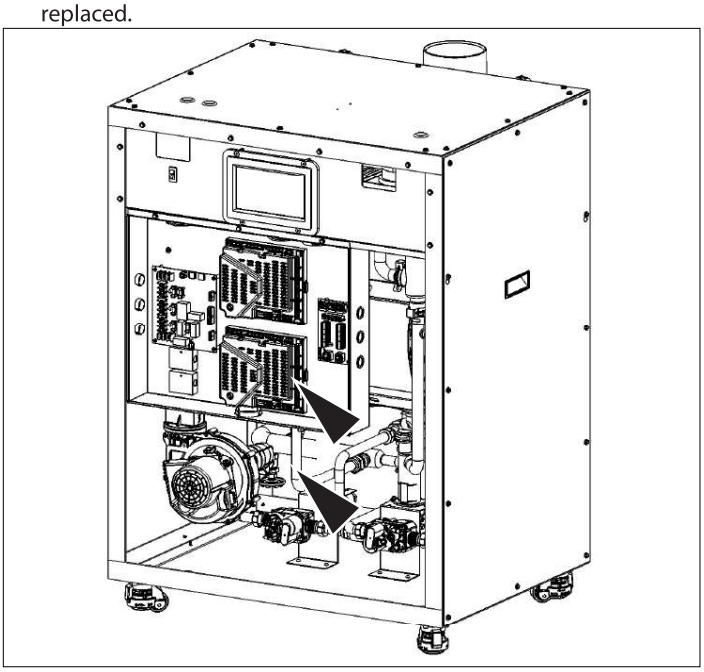


Figure 73 - Boiler Control Boards

3. Remove the five (5) 6-32 Phillips screws from the control board and remove it.
4. Proceed in reverse order to install the new control board.

E. After Maintenance is Complete

Functional Test

After maintenance is complete, ensure the CH circuit is filled and purged with a pressure of 12 psi. Ensure the DHW circuit is filled and purged if necessary.

1. Power the boiler on.
2. If necessary, purge air again from the CH and DHW circuits.
3. Check the boiler and system settings and components. Ensure all adjustments are working properly.
4. Ensure the exhaust pipe is connected properly.
5. Reinstall the boiler front cover.
6. If necessary, set the maintenance interval.

Inform the User

1. Inform the user of any changes / adjustments / replacements in the system.
2. Ensure the user understands how the system works.
3. Hand the instructions to the user. Ensure the instructions will be kept close to the unit.
4. Have the user perform these regular tasks:
   - Check the system water pressure regularly.
   - If necessary, restore pressure and vent the system.
   - Set the setpoints and control systems to ensure correct and economical control of the system.
   - Have the system serviced in accordance with regulations at regular intervals.
   - NEVER attempt to service the boiler or adjust the combustion system.

Part 15 - Maintenance Report

CAUTION

In unusually dirty or dusty conditions, care must be taken to keep boiler cabinet door in place at all times. Failure to do so VOIDS WARRANTY!

⚠ WARNING

Allowing the boiler to operate with a dirty combustion chamber will hurt operation. Failure to clean the heat exchanger as needed by the installation location could result in boiler failure, property damage, personal injury, or death. Such product failures ARE NOT covered under warranty.

The combustion chamber insulation in this product contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)."

- Avoid breathing dust and contact with skin and eyes.
- Use a NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on job site conditions. Current NIOSH recommendations can be found on the NIOSH website: http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website.
- Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent dust.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid.

- Eye: Irrigate immediately.
- Breathing: Fresh air.

The boiler requires minimal periodic maintenance under normal conditions. However, in unusually dirty or dusty conditions, periodic vacuuming of the cover to maintain visibility of the display and indicators is recommended.

Periodic maintenance should be performed once a year by a qualified service technician to ensure that all the equipment is operating safely and efficiently. The owner should make necessary arrangements with a qualified heating contractor for periodic maintenance of the boiler. Installer must also inform the owner that the lack of proper care and maintenance of the boiler may result in a hazardous condition.

INSPECTION ACTIVITIES		DATE LAST COMPLETED			
PIPING		1st YEAR	2nd YEAR	3rd YEAR	4th YEAR*
Near boiler piping	Check boiler and system piping for any sign of leakage. Leaking pipes could cause property damage. Make sure all piping is properly supported. See User's Information manual for instructions.				
Vent	Check condition of all vent pipes and joints. Ensure all vent piping is properly supported. Check for obstructions at exhaust and intake termination points.				
Gas	Check Gas piping, test for leaks and signs of aging. Make sure all pipes are properly supported.				
SYSTEM					
Visual	Do a full visual inspection of all system components.				
Functional	Test all functions of the system (central heat, water heating, Safeties)				
Temperatures	Verify safe settings on boiler or Anti-Scald Valve				
Temperatures	Verify programmed temperature settings				
ELECTRICAL					
Connections	Check wire connections. Make sure they are tight.				
Smoke and CO detector	Verify devices are installed and working properly. Change batteries if necessary.				
Circuit Breakers	Ensure the circuit breaker is clearly labeled. Exercise circuit breaker.				
Switch and Plug	Verify ON/OFF switch and convenience plug are both functional				
CHAMBER/BURNER					
Combustion Chamber	Check burner tube and combustion chamber coils. Clean according to maintenance section of manual. Vacuum combustion chamber.				
Spark Electrode	Clean. Set gap at 1/8".				
CONDENSATE					
Condensate Trap	Clean debris from the condensate trap. Fill with clean water.				
Neutralizer	Check condensate neutralizer. Replace if necessary.				
Condensate hose	Disconnect condensate hose. Clean out dirt and re-install. (**NOTE:** Verify the flow of condensate, making sure that the hose is properly connected during final inspection.)				
GAS					
Pressure	Measure incoming gas pressure (3.5 to 10.5" W.C. NG, 8 to 13" W.C. LP)				
Pressure Drop	Measure drop in pressure on light off (no more than 1" W.C.)				
Check for leaks	Check gas piping for leaks. Verify that all are properly supported.				
COMBUSTION					
CO/CO2 Levels	Check CO and CO2 levels in Exhaust. Record at high and low fire.				
SAFETIES					
ECO (Energy Cut Out)	Check continuity on flue temperature sensor. Replace the flue gas temperature sensor if corroded. Check continuity on Water ECO. Check position and sensor resistance. Ensure air pressure switch is properly connected (electrical connections and silicone pipe).				
FINAL INSPECTION					
Check list	Verify that you have completed entire check list. WARNING: FAILURE TO DO SO COULD RESULT IN SERIOUS INJURY OR DEATH.				
Homeowner	Review what you have done with the homeowner.				
TECH SIGN OFF					

Table 37 - *Continue annual maintenance beyond the 4th year as required.

Part 16 - Shutdown

A. Shutdown Procedure

If the burner is not operating, disconnect the electrical supply.
If the burner is operating, lower the set point value to 70ºF and wait for the burner to shut off. Continue to wait for the combustion blower to stop, so all latent combustion gases are purged from the system. This should take a maximum of 40 to 90 seconds.
NOTE: If the boiler is to be shut down for an extended period of time in freezing conditions, it is recommended to drain the heating system of water. When water freezes it expands, which could degrade the heating system components or cause the heat exchanger to leak.

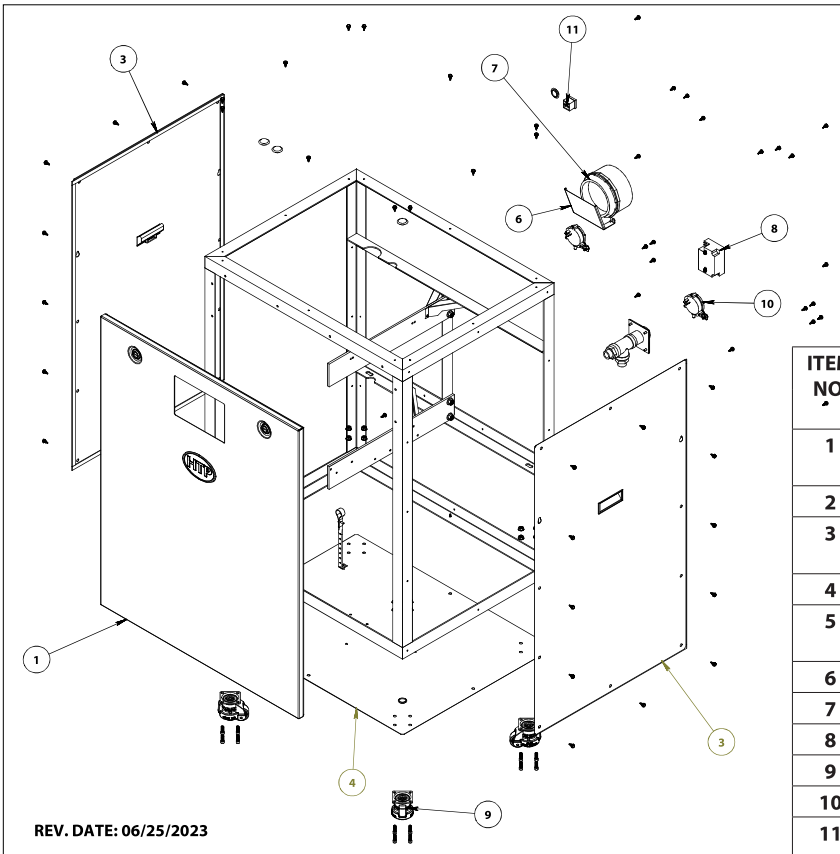
CAUTION

Freeze related damages are not covered by product warranty.

B. Failure to Operate

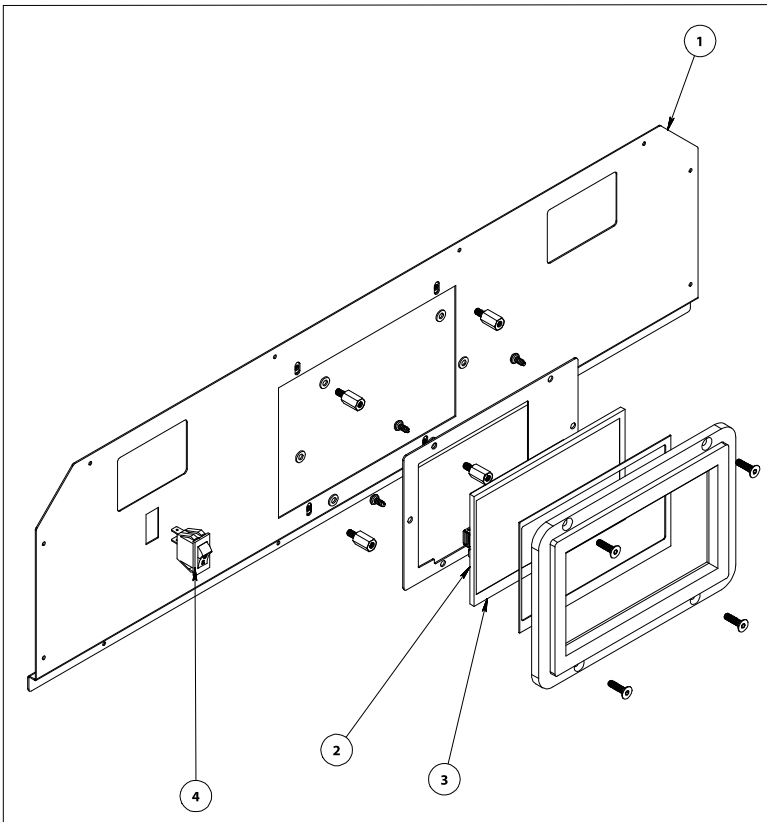
Should the burner fail to light, the control will perform two more ignition trials prior to entering a lockout state. Note that each subsequent ignition trial will not occur immediately. After a failed ignition trial, the blower must run for approximately 10 seconds to purge the system. Therefore, a time period of approximately 40 to 90 seconds will expire between each ignition trial.
If the burner lights during any one of these three ignition trails, normal operation will resume. If the burner lights, but goes off in about 4 seconds, check the polarity of the wiring. See electrical connection section.
If the burner does not light after the third ignition trial, the control will enter a lockout state. This lockout state indicates that a problem exists with the boiler, the controls, or the gas supply. Under such circumstances, a qualified service technician should be contacted immediately to properly service the boiler and correct the problem. If a technician is not available, pressing and holding RESET on the display for more than 1 second will remove the lockout state so additional trials for ignition can be performed. The unit will try to re-light once every 6 minutes.

Part 17 - Replacement Parts



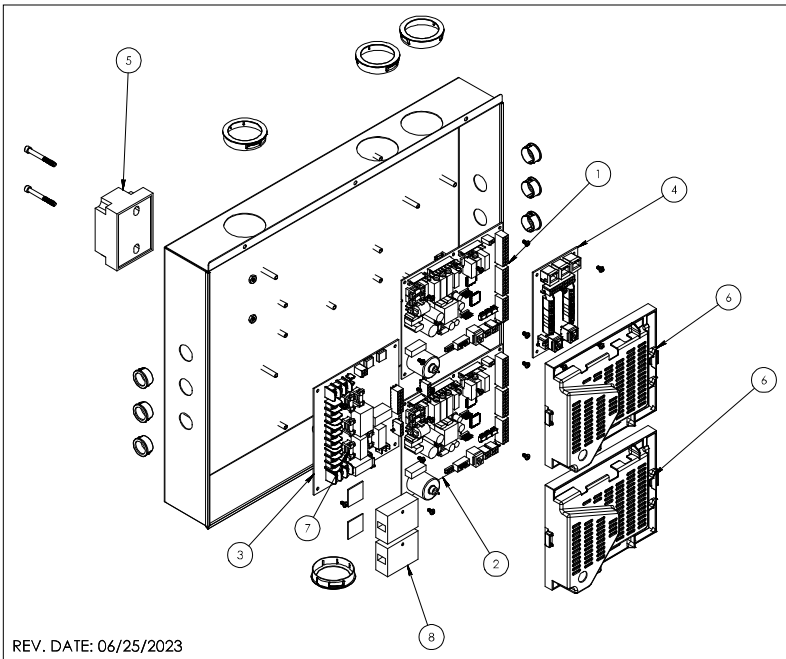
ITEM NO.	PART NUMBER			DESCRIPTION
	ELUD-285	ELUD-301	ELUD-399	
1	64980350			FRONT DOOR ASSEMBLY
2	64980351			TOP PANEL
3	64980352			SIDE DOOR ASSEMBLY
4	64980353			BOTTOM PANEL
5	64980354			REAR PANEL ASSEMBLY
6	64980355			AIR INLET SHIELD
7	64980356			INTAKE ADAPTER
8	64980357			SPARK GENERATOR
9	7550P-219			SWIVEL CASTER
10	64980007			PRESSURE SWITCH
11	7500P-037			CONVENIENCE OUTLET

Figure 74 - Cabinet Replacement Parts



ITEM NO.	PART NUMBER			DESCRIPTION
	ELUD-285	ELUD-301	ELUD-399	
1	64980378			DISPLAY PANEL ASSEMBLY
2	64980379			7"TOUCH DISPLAY
3	64980380			DISPLAY RIBBON
4	7500P-087			POWER SWITCH

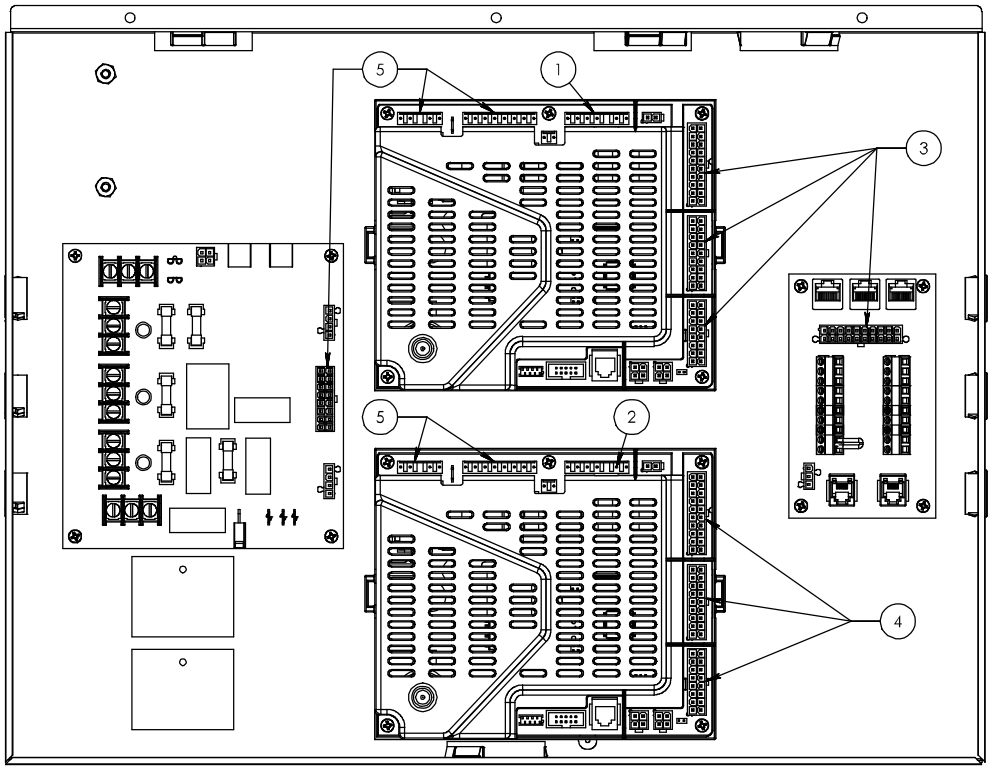
Figure 75 - Display Replacement Parts



REV. DATE: 06/25/2023

ITEM NO.	PART NUMBER			DESCRIPTION
	ELUD-285	ELUD-301	ELUD-399	
1	64980382	64980386	64980390	MASTER MODULE CONTROL NG
	64980384	64980388	64980393	MASTER MODULE CONTROL LP
2	64980383	64980387	64980391	FOLLOWER MODULE CONTROL NG
	64980385	64980389	64980392	FOLLOWER MODULE CONTROL LP
3	64980376			HIGH VOLTAGE BOARD
4	64980377			LOW VOLTAGE BOARD
5	64980357			SPARK GENERATOR
6	7540P-323			CONTROL COVER
7	6300P-037			FUSES
8	7550P-998			WIFI DONGLE

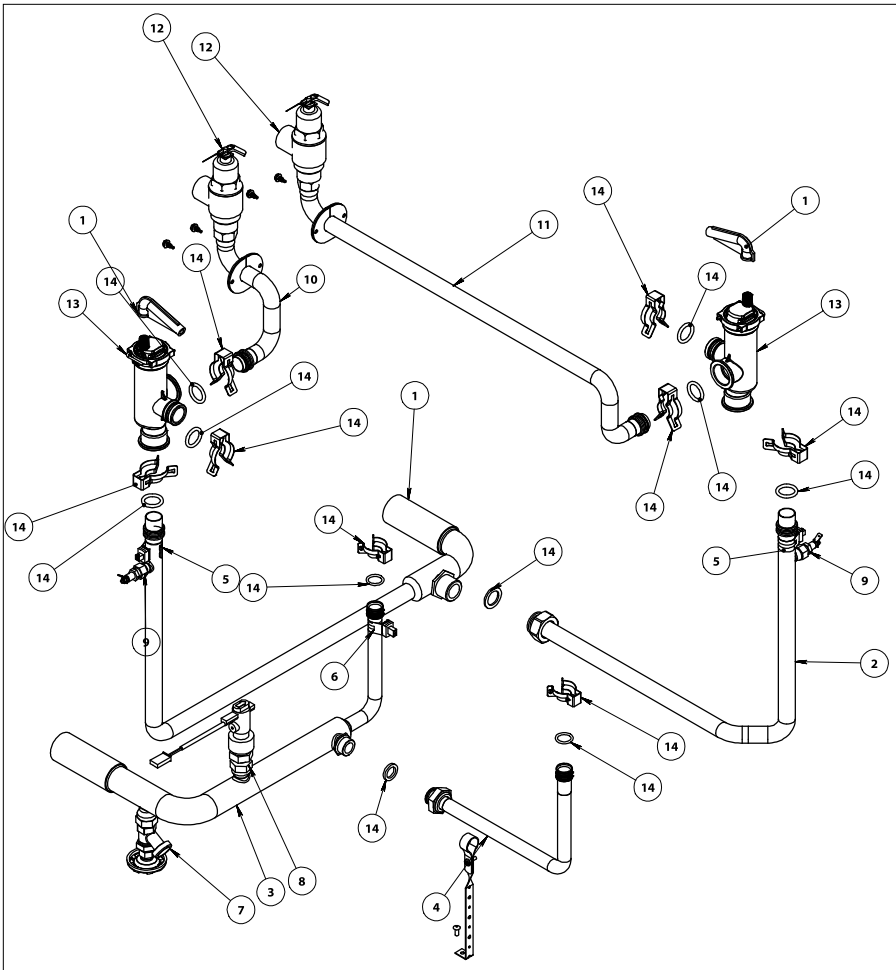
Figure 76 - Control Box Replacement Parts



REV. DATE: 06/25/2023

ITEM NO.	PART NUMBER			DESCRIPTION
	ELUD-285	ELUD-301	ELUD-399	
1	64980398			GAS VALVE HARNESS MASTER ELUD 285/399
2	64980399			GAS VALVE HARNESS FOLLOWER ELUD 285/399
3	64980395			LOW VOLTAGE HARNESS MASTER ELUD 285/399
4	64980396			LOW VOLTAGE HARNESS FOLLOWER ELUD 285/399
5	64980397			HIGH VOLTAGE HARNESS ELUD 285/399
6	64980409		N/A	ADAPTER HARNESS FOR 285/301 ELUD FAN

Figure 77 - Control Box Replacement Parts



ITEM NO.	PART NUMBER ELUD-285 ELUD-301 ELUD-399	DESCRIPTION
1	64980358	WATER SUPPLY HEADER (LEFT HX)
2	64980359	WATER SUPPLY RIGHT
3	64980360	WATER RETURN HEADER (RIGHT HX)
4	64980361	WATER RETURN LEFT
5	64980362	NTC CLIP SENSOR SUPPLY
6	64980363	NTC CLIP SENSOR RETURN
7	7350P-277	DRAIN VALVE
8	64980364	FLOW SWITCH
9	7350P-089	LOW WATER CUT OFF
10	64980342	PIPE (PRESSURE RELIEF) LEFT
11	64980346	PIPE (PRESSURE RELIEF) RIGHT
12	7550P-218	PRESSURE RELIEF VALVE
13	64980147	FLOW OUT DEAERATOR ASSEMBLY
14*	64980365	WATER PIPE SEALS & CLIPS KIT

*#14 INCLUDES ALL O-RINGS,GASKETS, AND CLIPS FOR WATER PIPING

Figure 78 - Water Piping Replacement Parts

ITEM NO.	PART NUMBER ELUD-285	ELUD-301	ELUD-399	DESCRIPTION
1	64980372		64980370	GAS PIPE VALVE INLET LEFT MODULE
2	64980373		64980371	GAS PIPE VALVE INLET RIGHT MODULE
3*	64980374			GAS PIPE GASKET KIT (8 PIECES)
4	64980375			GAS BULKHEAD ASSEMBLY
5	7400P-023			GAS PIPE VALVE OUTLET LEFT MODULE
6	7400P-024			GAS PIPE VALVE OUTLET RIGHT MODULE
7	64980381			GAS VALVE

*#3 COMES WITH ALL GASKETS FOR GAS PIPING CONNECTIONS

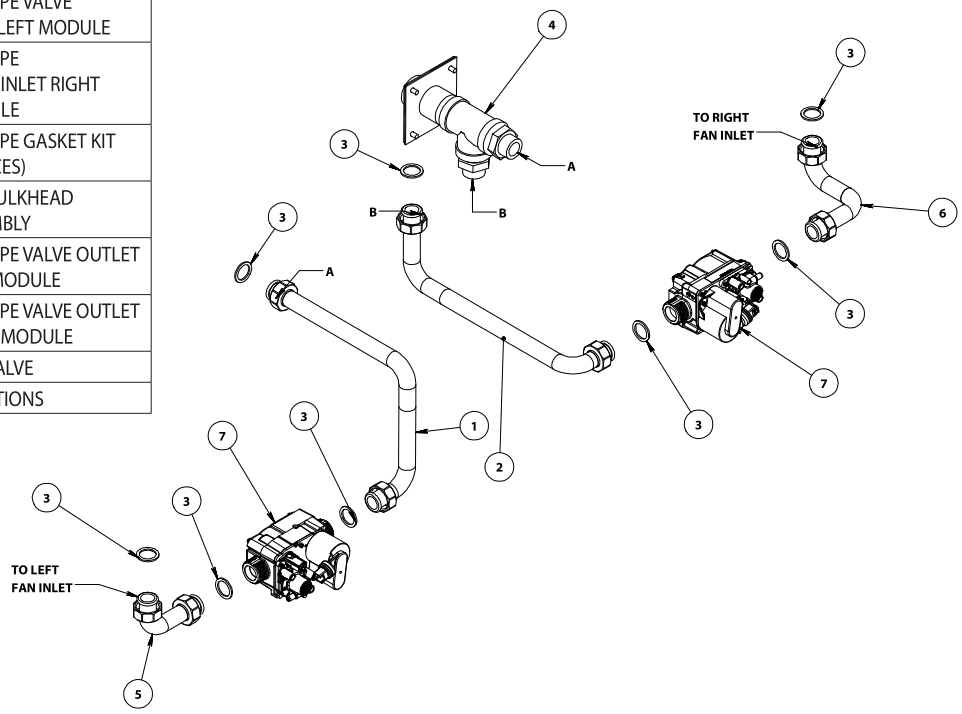
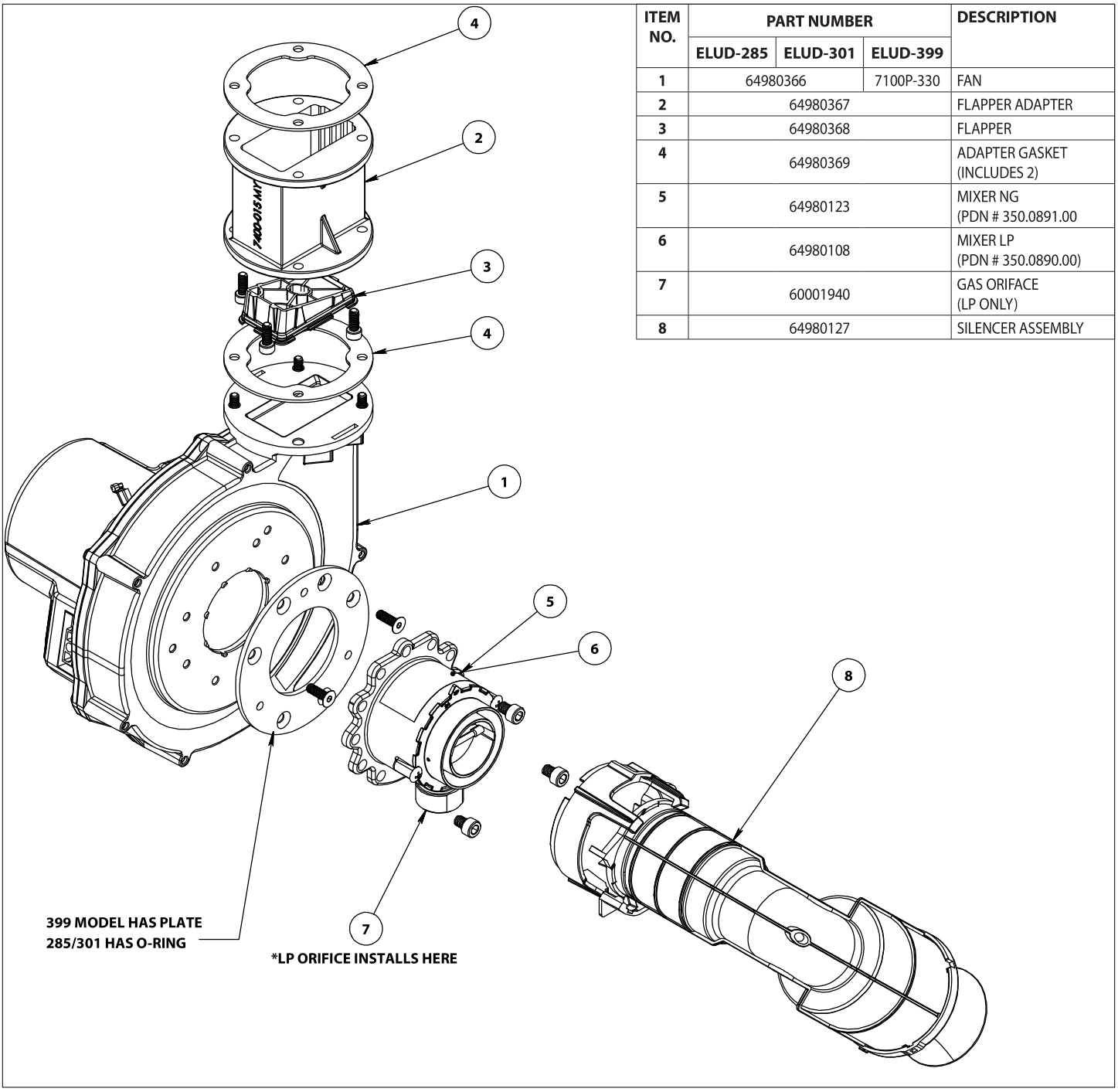
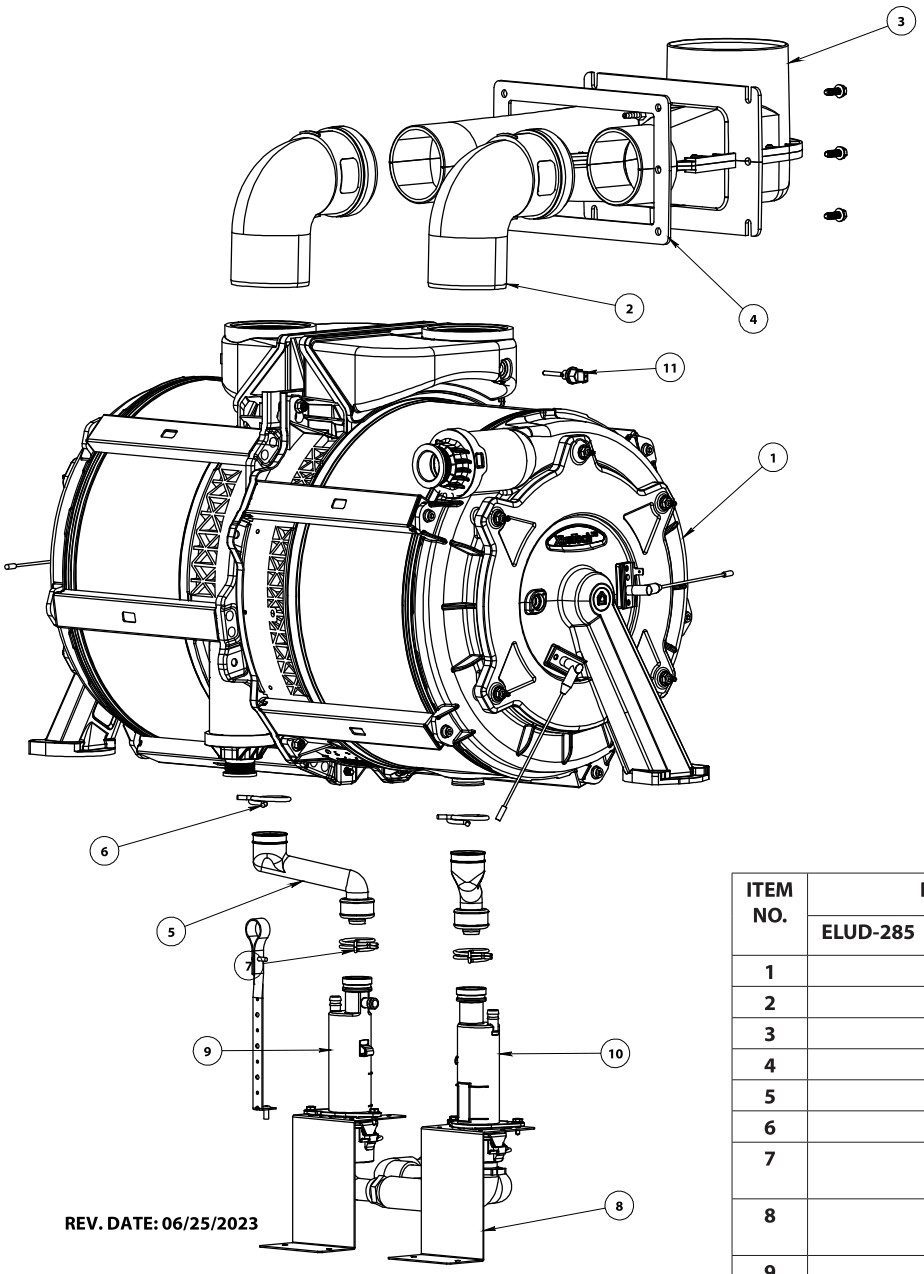


Figure 79 - Gas Piping Replacement Parts



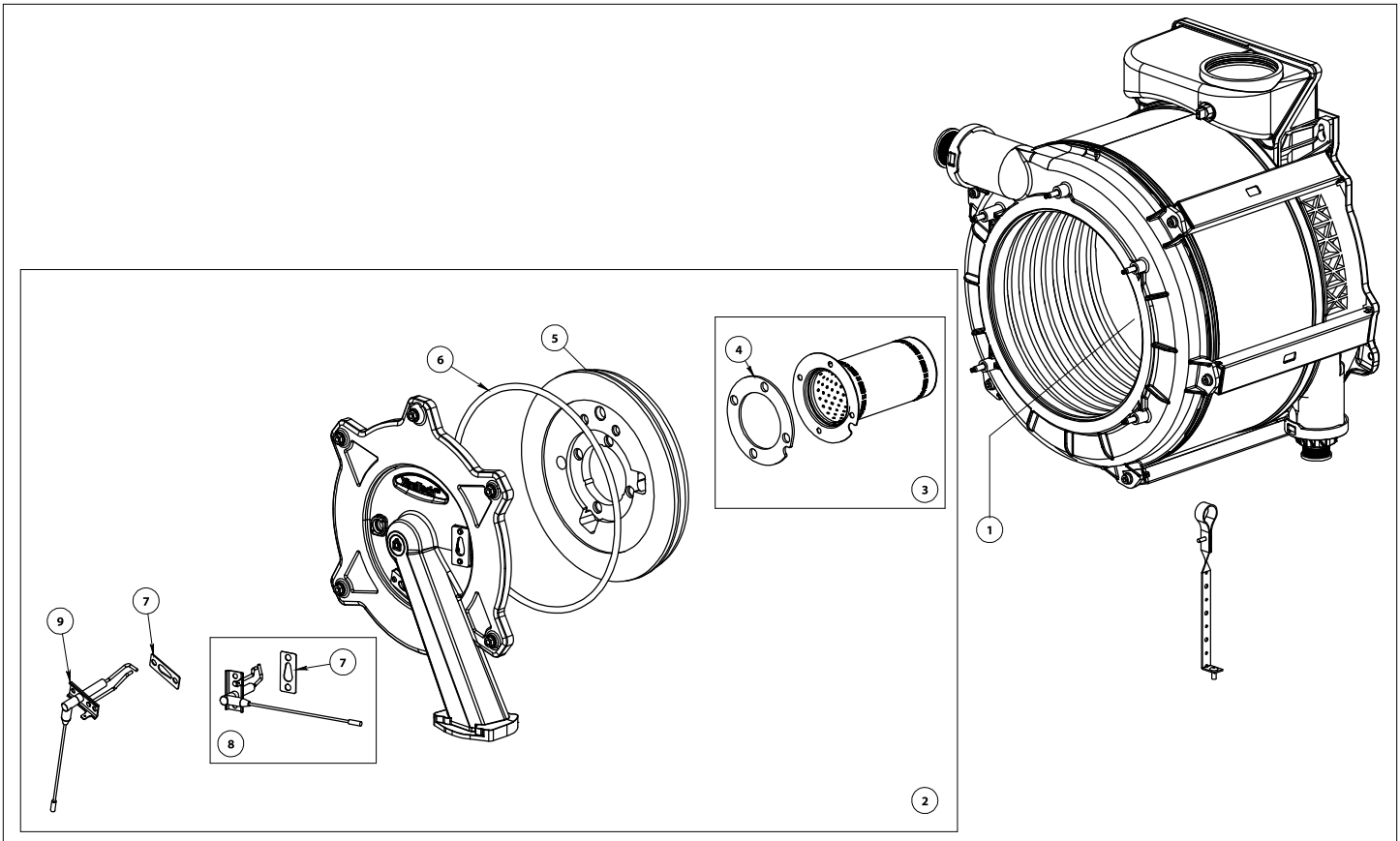
ITEM NO.	PART NUMBER			DESCRIPTION
	ELUD-285	ELUD-301	ELUD-399	
1	64980366		7100P-330	FAN
2	64980367			FLAPPER ADAPTER
3	64980368			FLAPPER
4	64980369			ADAPTER GASKET (INCLUDES 2)
5	64980123			MIXER NG (PDN # 350.0891.00
6	64980108			MIXER LP (PDN # 350.0890.00)
7	60001940			GAS ORIFACE (LP ONLY)
8	64980127			SILENCER ASSEMBLY

Figure 80 - Blower Replacement Parts



ITEM NO.	PART NUMBER			DESCRIPTION
	ELUD-285	ELUD-301	ELUD-399	
1	64980087			HEAT EXCHANGER (60KW)
2	64980349			EXHAUST ELBOWS
3	64980347			EXHAUST V ENT ADAPTER
4	64980348			VENT ADAPTER GASKET
5	64980178			CONDENSATE HOSE
6	64980243			HOSE CLAMP (HX)
7	60000533			HOSE CLAMP (CONDENSATE)
8	64980309			CONDENSATE DRAIN ASSEMBLY
9	64980193			CONDENSATE TRAP LEFT
10	65117391			CONDENSATE TRAP RIGHT
11	65118667			FLUE SENSOR

Figure 81 - Water Piping Replacement Parts



REV. DATE: 06/25/2023

ITEM NO.	PART NUMBER			DESCRIPTION
	ELUD-285	ELUD-301	ELUD-399	
1	64980128			INSULATION (REAR)
2	64980112			FULL DOOR ASSEMBLY
3	64980118			BURNER (W. GASKET)
4	65116521			GASKET (BURNER)
5	64980114			INSULATION (BURNER DOOR)
6	64980113			DOOR GASKET
7	64980262			GASKET (ELECTRODE)
8	64980787			IGNITION ELECTRODE (W. GASKET)
9	64980115			FLAME PROBE

Figure 82 - Water Piping Replacement Parts

Limited Warranty

Ten year warranty to assure your complete satisfaction.

HTP warrants this boiler and its components to be free from defects in material and workmanship according to the following terms, conditions, and time periods. UNLESS OTHERWISE NOTED THESE WARRANTIES COMMENCE ON THE DATE OF INSTALLATION. This limited warranty is only available to the **original consumer purchaser** (herinafter "Owner") of this boiler, and is non-transferable.

Coverage	Coverage Period	Coverage Rate	Components Covered	Additional Terms and Conditions
Basic	Year 1	100%	All Components	Basic Coverage applies to boiler installations not registered at https://htp.secure.force.com/warrantywizard/ within six (6) months of installation and commences on the date of manufacture.
	Years 1 - 5	100%	Pressure Vessel Only	
Extended	Year 1	100%	All Components	Extended Coverage applies to boiler installations registered at http://www.htproducts.com/Warranty-Wizard.html within six (6) months of installation and commences on the date of installation.
	Years 1 - 5	100%	Pressure Vessel Only	
	Years 6 - 10	20%	Pressure Vessel Only	

Basic Coverage Explanation

Installations Not Registered Online within Six (6) Months of Installation

A. During the first year after the date of manufacture, HTP warrants that it will repair or replace, at its option and at 100% coverage, any defective or malfunctioning component of the boiler that is found to have failed due to manufacturer's defect.

B. During the first five years after the date of manufacture, HTP warrants that it will repair or replace, at its option and at 100% coverage, any defective or malfunctioning pressure vessel that is found to have failed due to manufacturer's defect.

Extended Coverage Explanation

Installations Registered Online within Six (6) Months of Installation

A. During the first year after the date of installation, HTP warrants that it will repair or replace, at its option and at 100% coverage, any defective or malfunctioning component of the boiler that is found to have failed due to manufacturer's defect.

B. During the first five years after the date of installation, HTP warrants that it will repair or replace, at its option and at 100% coverage, any defective or malfunctioning pressure vessel that is found to have failed due to manufacturer's defect.

C. During the sixth through tenth year after the date of installation, should a defect or malfunction result in a leakage of water from the pressure vessel due to defective material or workmanship, malfunction, or failure to comply with the above warranty, with such defect or malfunction having been verified by an authorized HTP representative, HTP will repair or replace, at its option and at a reduced 20% coverage, the defective or malfunctioning pressure vessel.

Coverage Terms and Conditions

1. This warranty applies only to the components (including the pressure vessel) of the boiler, and does not apply to any boiler installation.
2. Replacement components will be of the nearest comparable model available at the time of replacement.
3. Replacement components (other than the pressure vessel) will be warranted for ninety (90) days. A replacement pressure vessel will be warranted for the unexpired portion of the applicable warranty period of the original pressure vessel.
4. In the event of a leakage of water from a replacement pressure vessel due to defective material or workmanship, malfunction, or failure to comply with the above warranty, HTP reserves the right to refund to the Owner the published wholesale price available at the date of manufacture of the original pressure vessel, at the applicable coverage rate detailed in the Basic or Extended Coverage sections above.
5. If government regulations, industry certification, or similar standards require the replacement component(s) to have features not found in the defective component(s), the Owner will be charged the difference in price represented by those required features. If the Owner pays the price difference for those required features and/or to upgrade the size and/or other features available on new replacement component(s), the Owner will also receive a complete new limited warranty for that replacement component(s).
6. This warranty extends only to boilers utilized in heating applications that have been properly installed by qualified professionals based upon the manufacturer's installation instructions.
7. It is expressly agreed between HTP and the Owner that repair, replacement, or refund are the exclusive remedies of the Owner.

Owner Responsibilities

The Owner or Qualified Installer / Service Technician must:

1. Have a relief valve bearing the listing marks of the American Society of Mechanical Engineers (ASME) installed with the boiler assembly in accordance with federal, state, and local codes.
2. Maintain the boiler in accordance with the maintenance procedure listed in the manufacturer's provided instructions. Preventive maintenance can help avoid any unnecessary breakdown of the boiler and keep it running at optimum efficiency.
3. Maintain all related system components in good operating condition.
4. Check all condensate lines to confirm that all condensate drains properly from the boiler.
5. Use the boiler with a properly sized and installed thermal expansion tank.
6. Use the boiler at water pressures not exceeding the working pressure shown on the rating plate.
7. Keep the boiler free of damaging scale deposits.
8. Make provisions so if the boiler or any component or connection thereto should leak, the resulting flow of water will not cause damage to the area in which it is installed.

Warranty Exclusions

This limited warranty will not cover:

1. Any boiler purchased from an unauthorized dealer.
2. Any boiler not installed by a qualified heating installer/service technician, or installations that do not conform to ANSI, CSA, and/or UL standards, as well as any applicable national or local building codes.
3. Service trips to teach the Owner how to install, use, maintain, or bring the boiler installation into compliance with local building codes and regulations.
4. The workmanship of any installer. The manufacturer disclaims and does not assume any liability of any nature caused by improper installation, repair, or maintenance.
5. Electricity or fuel costs, or increased or unrealized savings for same, for any reason whatsoever.
6. Any water damage arising, directly or indirectly, from any defect in the boiler or component(s) or from its use.
7. Any incidental, consequential, special, or contingent damages or expenses arising, directly or indirectly, from any defect in the boiler or the use of the boiler.
8. Failure to locate the boiler in an area where leakage of the boiler or water line connections and the relief valve will not result in damage to the area adjacent to the boiler or lower floors of the structure, as well as failure to install the boiler with properly designed containment measures.
9. Any failed components of the system not manufactured by HTP as part of the boiler.
10. Boilers repaired or altered without the prior written approval of HTP.
11. Damages, malfunctions, or failures resulting from failure to install the boiler in accordance with applicable building codes/ordinances or good plumbing and electrical trade practices.
12. Damages, malfunctions, or failures resulting from improper installation, failure to operate the boiler at firing rates or pressures not exceeding those on the rating plate, or failure to operate and maintain the boiler in accordance with the manufacturer's provided instructions.
13. Failure to operate the boiler with a properly sized and installed thermal expansion tank.
14. Failure or performance problems caused by improper sizing of the boiler, expansion device, piping, or the gas supply line, the venting connection, combustion air openings, electric service voltage, wiring or fusing.

15. Damages, malfunctions, or failures caused by improper conversion from natural gas to LP gas or LP gas to natural gas.
16. Damages, malfunctions, or failures caused by operating the boiler on Natural Gas or LP gas with average sulfur rates greater than 30 mg/m^3.
17. Damages, malfunctions, or failures caused by operating the boiler with modified, altered, or unapproved components, or any component / attachment not supplied by HTP.
18. Damages, malfunctions, or failures caused by abuse, accident, fire, flood, freeze, lightning, electrochemical reaction, acts of God and the like.
19. Failures (leaks) caused by operating the boiler in a corrosive or contaminated atmosphere.
20. Damages, malfunctions, or failures caused by operating an empty or partially empty boiler ("dry firing"), or failures caused by operating the boiler when it is not supplied with water, free to circulate at all times.
21. Any damage or failure of the boiler due to the accumulation of solid materials or lime deposits.
22. Any damage or failure resulting from improper water chemistry. See installation manual for full water chemistry requirements.
23. Any damages, malfunctions, or failures resulting from the use of dielectric unions.
24. Boilers replaced for cosmetic reasons.
25. Components of the boiler that are not defective, but must be replaced during the warranty period as a result of reasonable wear and tear.
26. Components of the boiler that are subject to warranties, if any, given by their manufacturers; HTP does not adopt these warranties.
27. Damages, malfunctions, or failures resulting from the use of any attachment(s) not supplied by HTP.
28. Boilers installed outside the fifty states (and the District of Columbia) of the United States of America and Canada.
29. Boilers moved from the original installation location.
30. Boilers that have had their rating labels removed.

Extended Limited Warranty Registration

To register for the Extended Limited Warranty, complete the registration form located on the HTP website at https://htp.secure.force.com/warrantywizard/within six (6) months of installation. The form must be completed in full with owner name, email address, and phone number, the address where the unit is installed and installation date, and unit model and serial numbers. Proof of purchase is required, and may be an invoice for the product, or a bill from an installing contractor that clearly documents the installation of the unit. To be valid, proof of purchase must also include the unit serial number. Proof of purchase may be typed or hand written. Submit the proof of purchase to HTP via the directions provided on the website.

NOTE: When registration is complete, retain proof of the Extended Limited Warranty registration. Proof of Extended Limited Warranty registration must be presented when making a warranty claim in order for the Extended Limited Warranty to be valid.

Procedures for Warranty Service Requests

1. Any claim for warranty assistance must be made immediately upon finding the issue. Contact your installing contractor or service provider. DO NOT CALL HTP. If your contractor or qualfied service technician requires further help, they will contact HTP directly.

NOTE: HTP cannot provide technical assistance unless you are a licensed and trained qualified service technician.

2. If the contractor or qualified service technician determines that the issue may be covered by warranty, consult the HTP Warranty Wizard (http://www.htproducts.com/Warranty-Wizard.html) to check warranty eligibility. You may also contact HTP Technical Support at 1-800-323-9651 for questions or assistance. Warranty coverage requires review and approval of the issue with HTP Technical Support or through the Warranty Wizard prior to a full unit replacement. Any claim for warranty reimbursement will be rejected if prior approval from HTP is not obtained in advance of a full unit replacement. Final determination will be made as part of the warranty claim process.

3. When submitting a warranty claim the following items are required:

- **a. Proof of purchase or installation of the product –** Typically a copy of the invoice from the installing contractor, the receipt of the purchase of the product, or an original certificate of occupancy for a new home.
- **b. Clear pictures (or video) of the following:**
  - i. Serial number tag (sticker)
  - ii. The product
  - iii. The product issue / failure whenever possible
  - iv. A picture of the piping near the product
  - v. For gas fired products, a picture of the venting, including how it exits the building

All claims will be reviewed by HTP within three (3) business days. If additional information is required and requested by the HTP Claims Department you will have thirty (30) days to provide it. When all requested information is provided HTP will respond within three (3) business days. The claim will be automatically closed if requested information is not provided within thirty (30) days. Claims will not be reopened without HTP Warranty Supervisor approval.

During the claims process a product that must be replaced will be given a designation of either a) field scrap, or b) return to HTP. If the product must be returned to HTP, the returned product must arrive at HTP within thirty (30) days of the date of our request to return the product. After receipt of the returned product HTP may require as many as thirty (30) additional days for product testing.

NOTE: Any components or heaters returned to HTP for warranty analysis will become the property of HTP and will not be returned, even if credit is denied.

4. HTP will replace or credit components under warranty only. Credits are issued to the authorized wholesaler at their cost, so do not purchase replacement component(s) from suppliers with hopes of receiving 100% credit.
5. Take care to maintain records of all regular maintenance and combustion efficiency test results (showing appropriate adjustment settings), as these will be required for any warranty claim.
6. If you have questions about the coverage of this warranty, please contact HTP at the following address or phone number: HTP, 272 Duchaine Blvd., New Bedford, MA, 02745, Attention: Warranty Service Department, 1(800) 323-9651.

Service, Labor, and Shipping Costs

Except when specifically prohibited by the applicable state law, the Owner, and not the Manufacturer, shall be liable for and shall pay for all charges for labor or other expenses incurred in the removal, repair, or replacement of any component(s) claimed to be defective or any expense incurred to remedy any defect in the product. Such charges include, but are not necessarily limited to:

1. All freight, shipping, handling, and delivery costs of forwarding replacement component(s) to the owner.
2. All costs necessary or incidental in removing the defective component(s) and installing replacement component(s).
3. All administrative fees incurred by the Owner, as well as material required to complete, and/or permits required for, installation of replacement component(s), and
4. All costs necessary or incidental in returning the defective component(s) to a location designated by the manufacturer.

LIMITATIONS OF THIS HTP WARRANTY AND REMEDIES

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE GIVEN AND ACCEPTED TO THE FURTHEST EXTENT UNDER APPLICABLE LAW IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ANY OBLIGATION, LIABILITY, RIGHT, CLAIM OR REMEDY IN CONTRACT OR TORT, WHETHER OR NOT ARISING FROM HTP'S NEGLIGENCE, ACTUAL OR IMPUTED. THE REMEDIES OF THE OWNER SHALL BE LIMITED TO THOSE PROVIDED HEREIN TO THE EXCLUSION OF ANY OTHER REMEDIES INCLUDING WITHOUT LIMITATION, INCIDENTAL OR CONSEQUENTIAL DAMAGES, SAID INCIDENTAL AND CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO, PROPERTY DAMAGE, LOST PROFIT OR DAMAGES ALLEGED TO HAVE BEEN CAUSED BY ANY FAILURE OF HTP TO MEET ANY OBLIGATION UNDER THIS AGREEMENT INCLUDING THE OBLIGATION TO REPAIR AND REPLACE SET FORTH ABOVE. NO AGREEMENT VARYING OR EXTENDING THE FOREGOING WARRANTIES, REMEDIES OR THIS LIMITATION WILL BE BINDING UPON HTP. UNLESS IN WRITING AND SIGNED BY A DULY AUTHORIZED OFFICER OF HTP. THE WARRANTIES STATED HEREIN ARE NOT TRANSFERABLE AND SHALL BE FOR THE BENEFIT OF THE ORIGINAL OWNER ONLY.

NO OTHER EXPRESS WARRANTIES

This warranty gives the Owner specific legal rights. The Owner may also have other rights that vary from state to state. Some states do not allow the exclusion or limitation of incidental or consequential damages so this limitation or exclusion may not apply to the Owner.

These are the only written warranties applicable to this boiler manufactured and sold by HTP. HTP neither assumes nor authorizes anyone to assume for it any other obligation or liability in connection with said boilers.

HTP reserves the right to change specifications or discontinue models without notice.

Maintenance Notes

Customer Installation Record Form	
The following form should be completed by the qualified installer / service technician for you to keep as a record of the installation in case of a warranty claim. After reading the important notes at the bottom of the page, please also sign this document.	
Customer's Name	
Date of Installation	
Installation Address	
Product Name / Serial Number(s)	
Comments	
Installer's Code / Name	
Installers Phone Number	
Signed by Installer	
Signed by Customer	
Installation Notes	

IMPORTANT

Customer: Please only sign after the qualified installer / service technician has fully reviewed the installation, safety, proper operation, and maintenance of the system. If the system has any problems please call the qualified installer / service technician. If you are unable to make contact, please call your sales representative.

Distributor / Dealer: Please insert contact details.